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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D.C. 20523

PROJECT PAPER

THAILAND

Northeast Rainfed Agricultural Development

(493-0308)

September 1981

UNCLASSIFIED

THAILAND  
NORTHEAST RAINFED AGRICULTURAL DEVELOPMENT  
PROJECT PAPER

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- V Technical Feasibility Analyses for Agricultural Technology (See Supplemental Analyses for analyses listed below)
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- A. Extension Support
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- E. Soil and Land
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- G. Demonstrations and Research
- H. Resources Inventory
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Abbreviations, Terms and Equivalents

AIT	=	Asian Institute of Technology
AID	=	Agency for International Development
ALRO	=	Office of Land Reform for Agriculture
ARD	=	Office of Accelerated Rural Development
"Aw"	=	Tropical Savana Climate
BAAC	=	Bank for Agriculture and Agricultural Cooperatives
CDD	=	Community Development Department
CD	=	Community Development (Worker)
CDSS	=	Country Development Strategy Statement
CoF	=	Contact Farmer (Farmers' representatives who have been selected in each village and on whom the extension agents will concentrate their effort in transferring practical agro-technology.)
CDP	=	Changwat Development Program
CP	=	Conditions Precedent
DCP	=	Department of Cooperatives Promotion
DLD	=	Department of Land Development
DOA	=	Department of Agriculture
DOAE	=	Department of Agricultural Extension
DOF	=	Department of Fisheries
DOLD	=	Department of Livestock Development
DTEC	=	Department of Technical and Economic Cooperation
DAE	=	Division of Agricultural Economics (Now OAE)
DEO	=	Amphoe or District Extension Office
EEC	=	European Economic Community
EC	=	Electrical Conductivity
FAO	=	Food and Agriculture Organization of the United Nations
FY	=	Fiscal Year
FX	=	Foreign Exchange Cost

HH	=	Household
IBRD	=	International Bank for Reconstruction and Development
IRR	=	Internal Rate of Return
KKU	=	Khon Kaen University
LSD	=	Land Settlements Division
LC	=	Local Cost
MOAC	=	Ministry of Agriculture and Cooperatives
MOF	=	Marketing Organization for Farmers
MT	=	Metric Ton
NE	=	Northeast
NERAD	=	Northeast Rainfed Agricultural Development Project
NEROA	=	Northeast Regional Office of Agriculture
NESDB	=	National Economic and Social Development Board
NIDA	=	National Institute of Development Administration
NVD	=	New Village Development Program
OAE	=	Office of Agricultural Economics
PWD	=	Public Welfare Department
PD	=	Projects Division
PID	=	Project Identification Document
POL	=	Petroleum, Oil and Lubricants
RID	=	Royal Irrigation Department
RFD	=	Royal Forest Department
ROA	=	Regional Office of Agriculture
RTG	=	Royal Thai Government
REGP	=	Rural Employment Generation Program
RD	=	Rice Division
SMS	=	Subject Matter Specialists
SpF	=	Specialist Farmer
TEA	=	Tambon Extension Agent

UK = University of Kentucky  
UNDP = United Nations Development Program  
USAID = United States Agency for International Development

Terms

Changwat = Province  
Amphoe = District  
Tambon = Sub-District (the level above village and below Amphoe)  
Muban = Village

Currency Equivalents

U.S.\$ 1 = Baht (฿) 20  
Baht (฿) 1 = U.S.\$ 0.05

Area Equivalents

1 rai = 0.16 hectares (1,600 m<sup>2</sup>)  
1 hectare = 6.25 rai

Project Design Credits

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 Dr. Prawit Nilsuvannakul, NIDA

II. NERAD Project Design Committee (MOAC): The following MOAC personnel participated in numerous project development activities and furnished support for the Project Design Team.

- |     |                                      |  |
|-----|--------------------------------------|--|
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| 9.  | Mr. Kitti Jatanilapan                | Northeast Regional Office of Livestock Development, DOLD |
| 10. | Mr. Sawad Dulyapat                   | Watershed Conservation Division, RFD                     |
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| 12. | Mr. Chaleo Changprai                 | Soil Survey Division, DLD                                |
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17.	Mr. Pramuan Setarat	Rice Section, Crop Promotion Division, DOAE
18.	Mr. Prawat Supaprawat	Agricultural Cooperatives Division, CPD
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20.	Dr. Prasoot Sithisruang	Rice Division, DOA
21.	Dr. Vijai Nopharmornbodi	Field Crop Division, DOA
22.	Mr. Wichit Himmakorn	Foreign Loan Section, ALRO
23.	Mr. Porn Tanvanich	Research & Planning Division, ALRO
24.	Mr. Surathep Kowangoon	Land Reform Management Division, ALRO
25.	Dr. Supote Dechates	Agricultural Economics Research Division, OAE

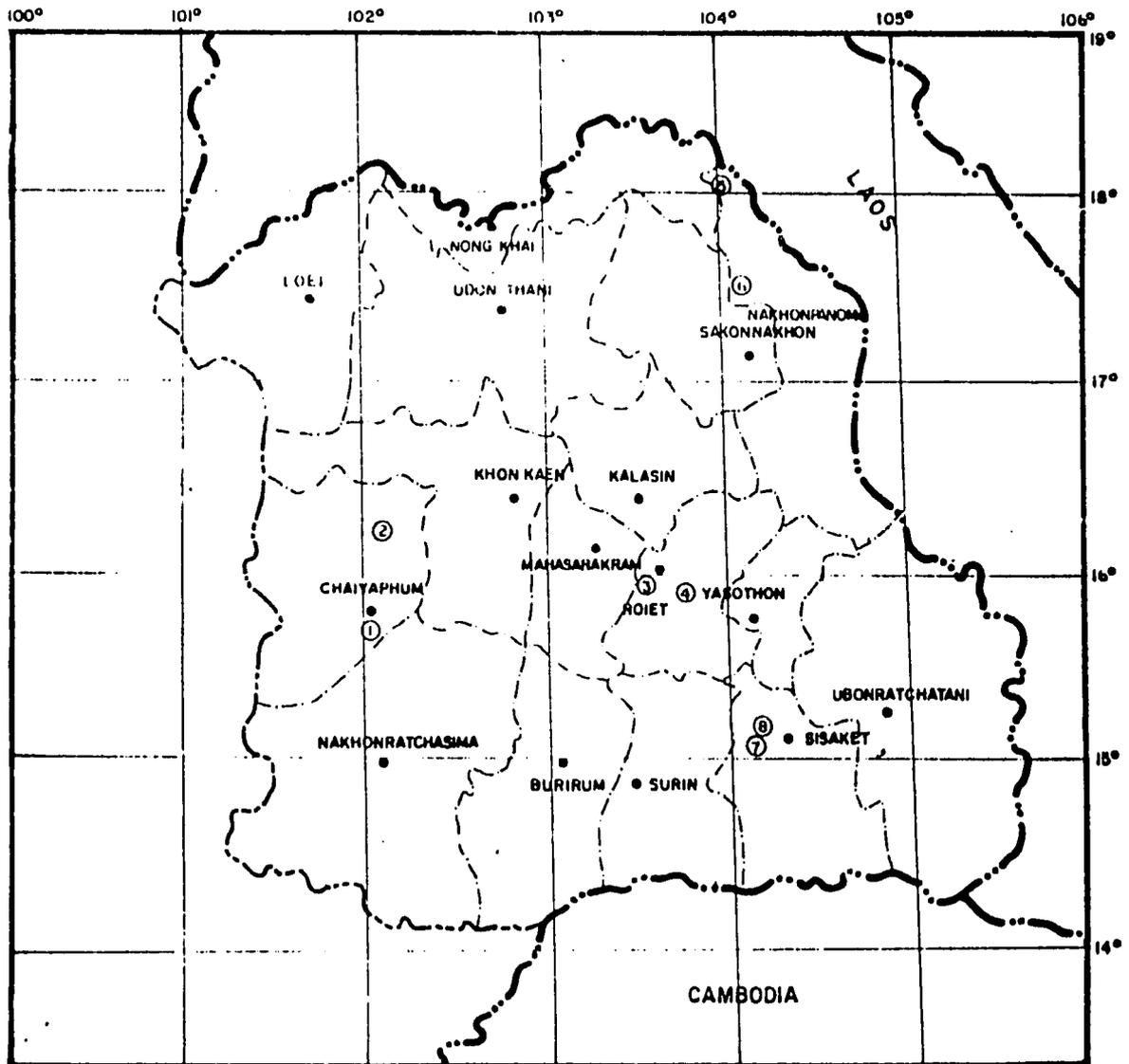
III. The development and design of this project has been greatly facilitated by the consistent support offered by Mr. Kangwan Devahastin, Deputy Undersecretary of State, Ministry of Agriculture & Cooperatives.

IV. Publications : Background publications developed in preparation for NERAD Project Design.

- Northeast Rainfed Agricultural Development Project: an Opportunity Framework, by University of Wisconsin Team and Staff Committee of the RTG (1979)
- Survey Report on Rainfed Agricultural Projects in Northeast Thailand, (4 volumes) by NEROA, MOAC (1980)
  - Volume 1 : The Main Report
  - Volume 2 : Compilation of Research and Development Project on Rainfed Agriculture in the Northeast
  - Volume 3 : Statistics; Data Related to Agriculture in the Northeast
  - Volume 4 : Northeast Water Resource Development Projects
- Northeast Rainfed Agricultural Development Project Site Survey Report by MOAC Technical Specialists,

NEROA, MOAC (1981)

Village Level Study of Northeast Rainfed Agricultural  
Development Project, by Damrong Thandee, Department of  
Sociology & Anthropology, Faculty of Humanities,  
Ramkhamhaeng University (1981)



CONVENTIONAL SYMBOLS

- ② Tambon
- Changwat
- International boundary
- Region boundary
- Changwat boundary

No	Sub District ( Tambon )	District ( Amphce )	Province ( Changwat )
1	Lohan	Chatturat	Chaiyaphum
2	Kwang Chon	Phu Khleo	Chaiyaphum
3	Nong Khaew	Muang	Roi Et
4	Na Muang	Salaphum	Roi Et
5	Na Thom	Ban Phaeng	Nakhon Phanom
6	Na Ngua	No Wa	Nakhon Phanom
7	Tae	Utumphonphisai	Si Saket
8	Taket	Utumphonphisai	Si Saket

Figure 1. Location of Project sites in the North East Thailand

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON D C 20523

PROJECT AUTHORIZATION

THAILAND

Northeast Rainfed  
Agricultural Development  
Project No. 493-0308

Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended (the "FAA"), I hereby authorize the Northeast Rainfed Agricultural Development Project (the "Project") for Thailand (the "Cooperating Country"), involving planned obligations of not to exceed Six Million Three Hundred Thousand United States Dollars (\$6,300,000) in loan funds (the "Loan") and Three Million Seven Hundred Thousand United States Dollars (\$3,700,000) in grant funds (the "Grant") over a five-year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

The Project will establish in representative tambons of Northeast Thailand a replicable agricultural development program for increasing farm productivity and farm income, particularly among lower income farmers in the rainfed agricultural zones. It will be necessary in such rainfed areas to adopt a multi-intervention approach, including planning, research and demonstration, appropriate and varied farming practices, extension, and development of available water resources. A.I.D. funds will assist principally in providing technical assistance, training for farmers and extension personnel; intensified Cooperating Country support in the target areas; required construction and equipment purchases; and water resources development, land/soil modifications, surveys, mapping, research and demonstrations.

The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Payment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D., in United States Dollars, interest from the date of first disbursement of the Loan at the rate of (i) two

percent (2%) per annum during the first ten (10) years, and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Except for ocean shipping, goods and services financed by A.I.D. under the project shall have their source and origin in the Cooperating Country or the United States for grant funds and in the Cooperating Country or countries included in A.I.D. Geographic Code 941 for loan funds, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the loan shall, except as A.I.D. may otherwise agree in writing, be financed on flag vessels of the United States, the Cooperating Country and other countries in Code 941. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the U.S. unless otherwise agreed in writing.

c. Conditions and Covenants

Except as A.I.D. may otherwise agree in writing, the A.I.D. assistance will be subject to the following conditions and covenants:

1. Conditions Precedent

Prior to any disbursement of loan funds other than for administration and technological support, the Cooperating Country shall

- a. execute an acceptable contract for consulting services;
- b. establish a satisfactory implementation and training plan with cost estimates;
- c. provide evidence that organization arrangements required for effective implementation of the Project have been made; and
- d. provide area development plans for tambons participating in the Project.

2. Covenants

a. The Cooperating Country shall agree to furnish to A.I.D., prior to commencement of each construction activity for which reimbursement will be sought from A.I.D., detailed plans and cost estimates for the construction activity in form and substance satisfactory to A.I.D.

b. The Cooperating Country shall agree that the procurement and use of pesticides for purposes of the Project shall comply with A.I.D.'s environmental procedures regarding the procurement and use of pesticides.

d. Waivers

Based upon the justification set forth in the Project Paper,  
I hereby:

(1) Approve a source/origin/componentry waiver from Code 000 (U.S. only) to Code 935 (Free World) of the A.I.D. Geographic Code Book for the procurement of 16 light motorcycles assembled in the Cooperating Country;

(2) Find that special circumstances exist to waive and do hereby waive, the requirements of Section 636(i) of the Act;

(3) Certify that the exclusion of procurement mentioned above will seriously impede attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program; and

(4) Approve a waiver of competition and approve procurement from American Motors Corporation of right-hand drive vehicles required for the Project.

Signature *Joseph C. Wheeler*  
Joseph C. Wheeler  
Acting Administrator  
August 27, 1981  
Date

Clearances

Jon D. Holstine, AA/ASIA  
Larry Smucker, A/AA/PPC  
John R. Bolton, GC

Initial  
*JH*  
*LS*  
*KB*

Date  
8/14/81  
8/26/81  
8-19-81

<b>AGENCY FOR INTERNATIONAL DEVELOPMENT</b> <b>PROJECT DATA SHEET</b>	<b>1. TRANSACTION CODE</b> <input type="checkbox"/> A = Add <input type="checkbox"/> C = Change <input type="checkbox"/> D = Delete	Amendment Number _____	<b>DOCUMENT CODE</b> 3
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<b>2. COUNTRY/ENTITY</b> Thailand	<b>3. PROJECT NUMBER</b> 493-0308
--------------------------------------	--------------------------------------

<b>4. BUREAU/OFFICE</b> Asia <span style="float: right;">04</span>	<b>5. PROJECT TITLE (maximum 40 characters)</b> N.E. Rainfed Agricultural Development
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<b>6. PROJECT ASSISTANCE COMPLETION DATE (PACD)</b> MM DD YY 07 31 88	<b>7. ESTIMATED DATE OF OBLIGATION</b> (Under 'B.' below, enter 1, 2, 3, or 4) A. Initial FY 81 B. Quarter 4 C. Final FY 83
---	---

**8. COSTS (\$000 OR EQUIVALENT \$1 = 20 baht )**

A. FUNDING SOURCE	FIRST FY 81			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	1,200	6,300	7,500	3,400	6,600	10,000
(Grant)	( 1,000 )	( 200 )	( 1,200 )	( 3,200 )	( 500 )	( 3,700 )
(Loan)	( 200 )	( 6,100 )	( 6,300 )	( 200 )	( 6,100 )	( 6,300 )
Other U.S.						
1.						
2.						
Host Country		435	435	-	6,000	6,000
Other Donor(s)						
<b>TOTALS</b>	1,200	6,735	7,935	3,400	12,600	16,000

**9. SCHEDULE OF AID FUNDING (\$000)**

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) FN	213B	210	210	-	-	1,200	6,300	3,700	6,300
(2)									
(3)									
(4)									
<b>TOTALS</b>						1,200	6,300	3,700	6,300

<b>10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)</b>	<b>11. SECONDARY PURPOSE CODES</b>
--	------------------------------------

<b>12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)</b>
A. Code _____ B. Amount _____

**13. PROJECT PURPOSE (maximum 480 characters).**

Establish in 8 representative tambons of NE Thailand a replicable agricultural development program for increasing farm productivity and farm incomes particularly among lower income farmers in rainfed agricultural zones.

<b>14. SCHEDULED EVALUATIONS</b> Interim MM YY MM YY Final MM YY 0 3 8 5 0 6 8 8	<b>15. SOURCE/ORIGIN OF GOODS AND SERVICES</b> <input checked="" type="checkbox"/> 000 <input checked="" type="checkbox"/> 941 <input checked="" type="checkbox"/> Local <input type="checkbox"/> Other (Specify) _____
--	--

**16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a \_\_\_\_\_ page PP Amendment.)**

<b>17. APPROVED BY</b>	Signature Donald D. Cohen	<b>18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION</b>
	Title Director, USAID/Thailand	
	Date Signed MM DD YY 6 10 81	MM DD YY 

## I. Addendum to Project Paper

### A. Organizational and Implementational Addenda

#### II.B.2.e Replicability - p. 21

Once technologies are tested and verified within the selected tambons, they can be immediately diffused to the other tambons within those seven amphoes. This can be readily accomplished within the existing institutional framework since the Kaset amphoe is intimately involved in the project as a Assistant Field Manager and as a member the Tambon Agricultural Development Committee. (of the discussion in the addendum on district level organizational arrangements). Thus, he can diffuse these technologies to the other tambons within his domain of responsibility accordingly a total of approximately 60 tambons will be receiving technology directly from the NERAD system. In addition through the mechanisms described above, a much border deffusion throughout the northeast is anticipated during project life.

#### IV.A. Summary Administrative Analysis - p. 75

After careful study of the project by various departments of the MOAC and their concurrency plus the invaluable contributions by NIDA, it was determined that its comprehensive nature requires the organizational structure described herein. The yearly operational reviews will assess its continuing viability, and adjustments will be duly recommended.

#### IV.A.1.e Organizational Arrangements Tambon Level - p.78

The kaset amphoe will also become a member of the Tambon Agricultural Development Committee. This will strengthen the institutional arrangements in two ways. First, the Committee will have immediate access to higher levels of Extension through the kaset amphoe. And secondly, the replication of proven technologies can be facilitated to other tambons within his jurisdiction.

#### IV.A.1.d. Organizational Arrangements District Level - p.78

The assistant field managers will be the kaset amphoes from the relevant amphoes. This organizational Arrangement will tie the supervision of the TEA into the regular operating system yet provide flexibility enough for easy access to the NERAD Project subject matter specialists.

IV. B. 5. Tambon Implementation Procedure - p. 86

Activities to be undertaken at the tambon level will begin in all eight tambons at the same time. However, activities will be placed within, rather than between, tambons in order to assure that local communities and project personnel are not burdened with an excessive number of activities at the same time.

IV.C.1. General Evaluation Arrangements - p. 90

The yearly operational evaluations will determine the strengths and weaknesses of the project to date. Short comings in material, technical, or administrative support will be identified and rectified immediately. Technological successes can be duly recorded and feedback into the project. Evaluations of professional performance of personnel will be made and passed on to the Civil Service Commission.

B. Farming Systems and Demonstration/Research Addenda.

Throughout the development and design of the NERAD Project it has been recognized that soil and water regimes and native vegetation are important factors in the mixed subsistence/cash income of farm families in rainfed areas of the Northeast. Soil and water regimes are basic determinants of the potential crop production capacity of these areas. Farm families depend on native vegetation directly for its fuel, fodder, native and other products, and indirectly for its influence on the soil and water regimes of the area. Currently, fuelwood and animal feed are becoming serious limitations in some areas and causing serious deforestation in most of the remaining areas, while overall deforestation and overgrazing are having a substantial negative effect on watersheds of the Northeast, including increased rainfall runoff and soil erosion and decreased year-round streamflow.

Based upon recommendations coming out of the MOAC review of the NERAD Project Paper, the public lands demonstration component will be enlarged to include a program to more directly address some of these problems in Project areas. These components are directly in line with the farming systems strategy of the NERAD Project, will complement other project activities dealing with livestock and water resources, and will further strengthen this MOAC effort to rationally and systematically assist rural communities in rainfed areas meet their needs. These components will not increase the number of implementing agencies or alter the project administrative structure, nor will they increase the overall funding requested from AID. Although Project component details are still being worked out by the Royal Forestry Department (RFD), the following is a general description of the activities which will be available for implementation in NERAD Project tambons, based upon the tambon plans developed during project implementation:

II.B.4.d.(1)(b) - p. 28 1. Other Farming Systems:

Village Woodlots - Activities to meet the fuelwood and other forest product needs of villages in NERAD Project tambons will become available, beginning in year 3 of Project implementation. The implementation and management of these activities will be based upon the experience the Royal Forestry Department is gaining in the RTG-USAID Renewable Non-conventional Energy Project. The first woodlots to be established under that project are in Si-Sa-Ket Province, near to NERAD Project Tae and Taked tambons; other sites in the Northeast will be selected for additional woodlots to begin next planting season. RFD will have over two years of woodlot establishment and management experience in these areas before any activities would begin under NERAD. Village woodlots under the NERAD Project will cover a total of approximately 5,000 rai, and will be of three different types:

a. Forest Reserve Land. - In tambons with ready access to Forest Reserve lands (e.g. Kwang Jon, Na Thom, and Na Ngua), the RFD will make land available under official land use tenure arrangement:

being worked out in the Renewable Non-conventional Energy Project, to be planted, managed, and harvested by villagers for their own use, with planting materials and technical assistance from the RFD and the extension systems in NERAD tambons.

b. Public Land. - In tambons with public lands under local jurisdiction where the communities wish to establish woodlots, planting materials and technical assistance will be provided by the RFD and the extension systems in NERAD tambons.

c. Private Land. - For individuals who wish to establish woodlot plantings on their own lands, technical assistance and a reasonable amount of planting materials will be provided by RFD and the extension systems in NERAD tambons. Selection of species and planting and management techniques will be determined by local decisions based upon the advice and recommendations of Project staff and MOAC personnel participating in the Project.

II.B.4.d(4) (a) - p.33(insert in place of last sentence in 1st paragraph)

## 2. Demonstrations and Research:

a. Range Management Demonstration - In tambons with access to reserved Forest land, the RFD will establish and manage rangelands in suitable nearby areas of the Forest Reserve for the use of villagers within Project tambons, in order to decrease the grazing pressure on other Forest Reserve areas. Assistance will be provided by Project Livestock Specialists. Such activities have been conducted on a pilot basis under the Mae Sa Project in North Thailand, but these will be the first demonstrations in the Northeast. Allocation of grazing rights will give emphasis to families with limited private land available for grazing. The RFD will also give assistance to Project Livestock Specialists in establishing fodder/fuelwood demonstrations on public lands where local communities determine that this would be the most desirable use of the land. Total range lands will cover approximately 1,600 rai of land.

b. Watershed Management Demonstration. - Based on the land resource survey and analysis of the Department of Land Development and the decisions of local communities, the RFD will offer assistance in the utilization of vegetative methods for improved watershed management in NERAD Project tambons. These methods would include revegetation of approximately 1,500 rai of erodible soils not suitable for crop production, embankment structures associated with small water resources, and other suitable areas, in order to decrease soil erosion and silting of water resources, decrease evaporation from water resources, and increase water infiltration and groundwater recharge.

## PART I - RECOMMENDATIONS, SUMMARY, ISSUES AND FINDINGS

### A. Recommendations

It is recommended that a grant of \$3.7 million of FAA Section 103 funds be authorized for this Project and Loan of \$6.3 million of FAA Section 103 funds be authorized in FY 1981. Loan terms are to be 40 years including 10 years grace, 2% during grace, 3% thereafter.

The following waivers are requested.

1. 636I waiver to procure sixteen locally manufactured light motorcycles.
2. A proprietary procurement waiver for four AMC CJ8 jeeps.

(These waivers are discussed in Part III D.)

### B. Summary Description

This seven year Project will address the needs of the rural poor in Northeast Thailand by establishing in 8 tambons a replicable, area-based agricultural technology development program for increasing productivity and farm incomes in rainfed agricultural zones. Total expected direct beneficiaries are 65,000 persons.

By the end of the Project, the RTG should have adopted an effective, low-cost systematic process for analyzing and resolving the key technical constraints to agricultural production in rainfed areas and be prepared to extend the system beyond the 8 tambons. Components of the process will include the refinement, demonstration and extension of improved farming practices (subsistence/cash-crop cultural technologies, water utilization, animal husbandry) appropriate to rainfed areas; improvement of the extension system and its linkage to research; improvement of the land-water resource base, and the establishment of an interactive means of matching RTG technology development and programs and resources with farmer's needs and problems.

C. Issues

1. General Issues

Issues in the PID approval cable (State 305713 - see Annex I) included concern for limiting the geographic area of implementation, desire to simplify the Project and reduce initial funding level, need for clearly articulating the implementation responsibilities at each administrative level, need to specify linkages to other projects in the Northeast, desire for area specific development plans and site selection criteria, concern for adequate monitoring arrangements and grant/loan split, and need to focus on negative environmental concerns (if any). Each of these issues has been addressed in Parts II-IV of the PP. One of the most difficult issues, the Project's complexity, is discussed below.

2. The Complexity Implicit in the Area Based Methodology

The value of the area-based approach is that it organizes complementary inputs and services to overcome interlocking constraints to development in a manner best-suited to local conditions and potential. It deliberately avoids the oversimplification of promoting one set of cropping practices or one technical "formula" for the widely varying agro-ecological conditions of Northeast Thailand. Accordingly, by design, NERAD provides for a wide variety of possible interventions from which local decision-makers can select. The Project is concerned with both the process of local selection and adaptation of agricultural technologies and the development/application of technologies that will work under a variety of rainfed agricultural situations. There is a price to pay for this necessary diversity and flexibility, and that is added complexity.

During the design process, the design team was well aware that while a multi-component, flexible farming systems type approach is perhaps the most appropriate way to address agricultural problems in rainfed areas, it can be difficult to implement if measures are not taken to ameliorate the inherent complexity of the approach.

NERAD attempts to deal with the implications of complexity through a variety of mechanisms:

BEST AVAILABLE DOCUMENT

a. Simplification of Technical Approach

It is not intended that all of the proposed technical interventions be introduced in all of the participating tambons and villages, although some "core activities" will be carried out in all Project tambons. These are modification of cropping systems, more effective extension support, and supplemental water resource development. Within these categories, a few appropriate technologies will be selected in any given area according to local conditions and needs. The objectives of this core set are to increase rice yields and diversify the cropping system to achieve more productive land use.

Other interventions such as farming systems modifications, soil/land modifications, operations research, marketing support, etc. are considered supporting activities in the sense that they can, in certain situations, contribute greatly to increased production and income. Yet they will not have the same potential in all areas and, in some, may not even be practical. Therefore only a few activities in this supporting group will be selected for any given tambon or village, with farmers' interest a prime consideration.

It should be noted that none of the proposed interventions represent radically new technologies or practices. Many are within the usual scope of activities of government service programs in at least some locations in the Northeast. For example, the Thai-IRRI rice research project has developed a wide variety of rainfed rice varieties, but these have been tested only at the province level. What the Project generally attempts to do is to provide a more effective, coordinated approach to planning and carrying out various interventions so that they are mutually supporting and effectively sited and managed. This in turn should provide better social, financial and economic returns than might otherwise be expected.

b. Minimize Potential Administrative Constraints

NERAD will be implemented totally within the organizational structure of the Ministry of Agriculture and Cooperatives (MOAC). This will greatly reduce the need for inter-ministerial coordination which has been a source of problems in the past. Interdepartmental coordination will be facilitated by field management and control through the Northeast Regional Office of Agriculture under the direct

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control of the Under-Secretary of MOAC. NERCA's capability to coordinate the Project is being strengthened through additional staff and consultant assistance, and its authority is being increased by providing it the key planning, budgeting, and Project support role. Each Project activity will be implemented by existing line departments that have regular responsibility for the activity. No "new" agencies are being formed although apparent weaknesses in departments' staffing levels, outreach capabilities and levels of expertise are being addressed under the Project. Training (and in some cases, pay) will also be provided directly to representatives of beneficiary groups so that they may help supplement efforts of the technical agencies. Finally, the consultant team is expected to be available to assist Project management early in the first year of implementation, since the collaborative assistance arrangement with the University of Kentucky will enable expedited procurement of assistance. This early availability of consultant assistance should help to reduce management bottlenecks before they become severe.

c. Other Provisions to Assure a "Manageable Project"

The Project's target area has been reduced from the PID's six districts composed of 30,000 farm families to eight sub-districts (tambons) with less than 10,000 farm families. The Project provides for a seven year implementation period to include one year for necessary recruitment, procurement, organization and survey/design work (as opposed to the six-year implementation period proposed in the PID). AID/Thailand will devote more staff time to monitoring this Project than any other in its portfolio (one full-time direct hire American plus one and one-half local direct hires and a project committee). Two ex-Peace Corps Volunteers (or similar technicians) will be recruited under the Project to help monitor field implementation and provide liaison between RTG field personnel, consultants and AID personnel. These provisions are discussed in more detail elsewhere in this PP.

In addition to the above, throughout the Project, attention will be given to seeking out the most appropriate targets of opportunity for accelerated development within the target tambons. Thus should any technological innovations emerge early in the Project as particularly promising, it is planned to increase the focus of available

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resources and staff time on those areas. This concern for selectively limiting emphasis in the Project to those interventions that are most attractive economically and socially will serve to target the Project more narrowly as it matures, and further simplify the implementation process. Care will be taken that this process is not premature, however, so that potential interventions are not dropped without a fair trial.

It is expected that the above mechanisms will help to assure that the Project is manageable and that implementation proceeds reasonably according to schedule.

D. Summary Findings

This Project is considered socially and technically sound and administratively feasible. Cost estimates are reasonable and realistic. No significant negative environmental effects are expected. The Project meets all applicable statutory criteria per Annex X.

PART II - DETAILED PROJECT DESCRIPTION

A. Background

1. Problem Definition

Northeast Thailand contains about one-third of the land area and population of the nation. Although half of the region's 17 million hectares are devoted to farmland, less than five percent of this farmland is presently irrigated and only 20 percent is potentially irrigable from reliable water sources. Most of the more than two million rural households in the Northeast must accordingly depend primarily on the erratic rainfall of the region to provide necessary crop and livestock water. This dependence on the unreliable rains often results in crop loss due to flooding or drought.

Besides an undependable water supply farmers in the Northeast must also contend with generally sandy, low fertility soils that have low water holding capacity. In view of these limitations it is not surprising that Northeast Thailand has the lowest per capita income of any region of Thailand (ranging from \$75-\$130 annually), and that half of

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## NERAD PROJECT - SELECTED CHARACTERISTICS\*

Geographic Locations Sub District - Province	Number of Villages	Number of Households Total Pop.	Average Net Household Farm Income Total Income (\$) (Including income-in-kind)	Average Family Rainfed Paddy Total Land Holding (Ha)	Three Most Important Perceived Needs (% of Responses) For Gov't Inter- vention
1. Taket - Si Sa Ket	12	<u>530</u> 3,428	<u>615</u> 850	<u>3.3</u> 3.4	Electricity (35%) Credit (24%) Water (23%)
2. Tae - Si Sa Ket	6	<u>335</u> 2,165	<u>665</u> 900	<u>3.2</u> 3.4	Water (64%) Ag. Tech. (15%) Roads (13%)
3. Na Thom - Nakhon Phanom	9	<u>845</u> 5,257	<u>565</u> 690	<u>4.5</u> 6.1	Ag. Tech. (24%) Roads (28%) Water (16%)
4. Na Ngua - Nakhon Phanom	12	<u>1,107</u> 7,731	<u>470</u> 670	<u>5.5</u> 6.7	Water (87%) Ag. Tech. (5%)
5. Lahat - Chaiyaphum	11	<u>1,617</u> 11,183	<u>540</u> 805	<u>3.6</u> 5.3	Water (31%) Fertilizer (24%) Credit (12%)
6. Kwang Chon - Chaiyaphum	16	<u>2,564</u> 17,886	<u>685</u> 810	<u>4.5</u> 5.3	Water (47%) Electricity (20%) Fertilizer (9%)
7. Nong Kaew - Roi Et	21	<u>1,539</u> 8,950	<u>925</u> 1,220	<u>3.9</u> 4.1	Water (36%) Ag. Tech. (13%) Electricity (11%)
8. Na Muang - Roi Et	14	<u>1,207</u> 8,260	<u>700</u> 960	<u>3.5</u> 3.8	Water (63%) Ag. Tech. (16%) Electricity (5%)
Total for Project	101	<u>9,744</u> 64,860	<u>665</u> 875	<u>4.0</u> 4.8	Water (48%) Electricity (11%) Ag. Tech. (10%)
Estimates for rural Northeast**	20,000	<u>2,395,000</u> 14,315,000	<u>611</u> 1,015	<u>3.7</u> 5.1	-
Estimates for Whole Northeast**	-	<u>2,830,000</u> 16,700,000	<u>560</u> 1,165	-	-

\* Data from NERAD Socio-economic Survey (MOAC/USAID) for crop year 1979-1980.

\*\* Based on NSC 1975/76 Socio-economic Survey (NE Report pp. 34, 41, 42) updated to 1979-80 through following assumptions: income x 1.3, population x 1.1. Land-holding data from World Bank Report 2059-TH, 1978, p. 35.

the roughly fourteen million Thais living in "absolute poverty" (below \$120 annually) are located in this region. Figure 11-1 shows other selected socio-economic characteristics of the Northeast and the eight Project areas.

Northeast Thai farmers have responded to their difficult conditions by placing priority on production of the rice needed for their subsistence. Cash crops are not generally given the same degree of attention as the rice crop and opportunities for other enterprises may be ignored if they appear to compete or conflict with traditional rice farming practices. For a discussion on present agricultural practices employed by the Northeast farmer refer to Annex IV.

Suboptimal research and extension support also constrain development in the region. Rainfed agricultural research for Northeast Thailand, although it has been expanded in the past 10 to 15 years, still has not provided results that clearly indicate the optimum rainfed cropping systems. Furthermore, the results of this research are not necessarily usable everywhere and one cannot be sure that farmers' incomes will increase if they adopt the new practices under their specific farming conditions. This deficiency is a result of several factors: (1) farming systems are diverse in the Northeast and environmental factors vary widely from place to place; (2) most research has been discipline or commodity oriented and does not address the full range of elements in farming systems; (3) research results are often not relevant to farmer's needs since they have not been subject to the adaptive, integrative, trial-and-error type of research that farmers and agri-business firms do in agriculturally more developed countries.

Problems with the agricultural extension service operations also impede information flows between the research organizations and the farmers. The current department of Agricultural Extension (DOAE) plan for placing an extension agent (TEA) in each tambon in Thailand is relatively new and is still being implemented. The program is currently experiencing the problems one would expect in such a large and rapidly expanding undertaking, namely a shortage of well-trained personnel which results in many inexperienced people trying to implement a program they may not fully understand. Various administration characteristics further constrain TEA performance. For example, TEAs generally do

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not live in the tambon, they have no office in the tambon, no storage space for extension materials, seeds, fertilizers, tools or other demonstration materials and often no satisfactory place for meetings, etc. Many do not have transportation. Even with significant donor support from the IBRD and others in recent years, these problems appear mainly due to chronic funding shortages in the extension program.

Other constraints that affect agricultural development in the Northeast include various problems farmers have in obtaining and/or properly utilizing necessary inputs (credit, appropriate fertilizers, good seed) as well as obtaining information on market prices and demand generally. These constraints vary in their importance, however, depending on such factors as cropping/farming practices of farmers, and their access to land, dependable information and input services.

## 2. RTG Response to the Problems

The RTG recognizes most of the above problems and has taken steps to address them. The National Agricultural Extension project which is being carried out with support from AID and the World Bank represents a massive attempt to develop extension support at the tambon level with an interim national goal of one extension agent per 1,000 farm families. The World Bank and the Department of Agriculture of MOAC are also beginning implementation of a National Research Improvement Project which will greatly strengthen the crop production research activities of the Department. A cropping systems institute which will be established under the Research Project will be especially supportive of the NERAD Project, and other interventions aimed at improving the DOA's organization, staffing, and adaptive research for rainfed agriculture will complement NERAD's emphasis on strengthening research-extension linkages.

The UNDP is funding a three year project which will assist the Department of Agriculture in developing a research program directed at the improvement of rainfed crop production technologies, including cropping systems work and the sharing of rainfed cropping research results with other researchers in South and Southeast Asia. This project is focused on the development of a long-term research program, and not the extension of technology to farmers, beyond multi-location on-farm testing.

UN/FAO is supporting an on-going workshop program on rainfed crop research and development.

In recent years considerable research has been conducted by the Department of Agriculture on specific crops grown within rainfed areas around the country, including rice, kenaf, jute, cassava, peanut, cotton, soybeans, corn, sesame, mungbean, castorbean, mulberry, and various vegetable and fruit tree crops. The Department of Livestock Promotion has investigated buffalo and cattle breeding, disease control, and nutrition, in addition to screening a variety of forage crops and management practices for their suitability in some areas. The Department of Fisheries has screened a number of fish species for their suitability in various types and scales of production. Likewise, Khon Kaen University, Kasetsart University, and other academic institutions as well as NEROA have contributed research on various particular crops, forages, and animal species.

A substantial amount of this research has been conducted on various research stations around the provinces of the Northeast region, and some trials have been conducted on village community lands and individual farms. Experience and insights into implementation problems have also been gained through the various farmer assistance programs of the DOAE, DOLD, DOF, DOA, and NEROA. Although much still remains to be done, in the aggregate this work has resulted in a considerable body of knowledge regarding species and cultivar selection and production practices for a number of the agricultural commodities produced in rainfed areas. Most of this work, however, has not yet been locally verified under the full range of ecological and socio-economic conditions characteristic of rainfed areas of the Northeast Region.

Other efforts contributing to agricultural development of the Northeast include the Department of Land Development's programs to survey and classify the soil resources of the region and pilot programs to develop soil and water resource conservation and improvement practices. The Royal Forest Department also has a variety of activities aimed at developing suitable management techniques for the Forest Reserve areas of the region, but implementation has been difficult due largely to the pressure exerted on these areas by villagers seeking firewood, charcoal, and additional land for crop cultivation. So current activities include pilot efforts for the development of village and farm-level woodlots.

Khon Kaen University, with assistance from the Ford Foundation, has been analyzing rainfed cropping systems and seeking improvements for five years. Current efforts include expansion of the interdisciplinary nature of their work by strengthening the economic and social science aspects of their program.

The World Bank is also supporting a rainfed agriculture development pilot project as one component of their Northern Agricultural Development Project. The project will include activities primarily based on ICRISAT-developed models. This approach is characterized by relatively capital intensive land shaping activities, and many of the implementation problems generally associated with this approach, e.g. need for large scale land consolidation, are being addressed by conducting this activity entirely within an RTG Land Reform Area.

EEC has provided grant assistance for a crop diversification project in Northeast Thailand which will explore some cropping alternatives to cassava, and will look for methods to promote productivity/income increases in rainfed areas.

Other important efforts currently underway in the Northeast by the RTG and donor community include the following:

RTG Land Settlements Division (LSD) of the Public Welfare Department has a program to promote agricultural productivity in Land Settlements, the vast majority of which are in rainfed areas. AID is supporting these efforts through a Land Settlements Project (No. 493-0289) directed at improving land utilization in 8 settlements of the Northeast Thailand, and a Sericulture Settlements Project (No. 493-0271) aimed at introducing modern sericulture technology to the Settlements; and the Netherlands, Germany, and IBRD also have projects to assist in the LSD program. These efforts are all limited to the 56 areas administered by the LSD.

Decentralized Development Efforts have been carried out in recent years mostly through the Changwat Development Program (CDP), the New Village Development Program (NVDP)--which is also assisted by the Japanese OECF--and the Rural Employment Generation Program (REGP). These are on-going programs that involve the subdistrict (tambon), and village level organizations in planning and

carrying out infrastructure projects primarily--roads, bridges, water resources. More than \$20 million was allocated in FY 80 under these three programs to the four provinces in which NERAD will be implemented. A recent review of these programs conducted for USAID by the Thai National Institute of Development Administration indicated, however, that all of them were constrained by questionable site selections, inadequate technical support, overly detailed guidance from central (National) committees, and insufficient preparation time for sub-projects.

### 3. Adequacy of Response

Each of the above programs is directed at increasing agricultural incomes in rural areas and each has at least a partial rainfed component. No project to date, however, has attempted to develop a coordinated response to the major perceived farm-level production constraints to agricultural development in rainfed areas. A coordinated area-based development approach--that addresses locally perceived needs, through a highly interactive process of technology trials, extension, institutional development and human resource development--is proposed in the NERAD Project. This approach will be implemented by mobilizing the range of available MOAC research and development resources in the identification and alleviation of key overall farming system production constraints in specific areas selected to represent the major range of variation in rainfed agricultural production zones of the Northeast. A replicable project of this nature should fill an important gap in the various approaches to development in the Northeast and could very well point toward the most appropriate way to facilitate development in this region.

## B. Detailed Description

### 1. Development Process

The NERAD Project will initiate a process which will ameliorate the major agricultural production constraints in rainfed areas as discussed in the background of this PP (low soil fertility, extreme rainfall variability, low productivity of farming systems, poor linkages between research--extension--farmer). This process is composed of five components:

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- a) Providing a suitable process framework for matching farmers' needs to government resources and capabilities.
- b) Establishing a research and demonstration program responsive to farmers' needs for continuous development and refinement of rainfed farming systems.
- c) Assisting farmers to adopt farming practices suitable to land, climate, and socio-economic conditions in their areas ("farming practices" can relate to cultural practices for crops, water utilization, animal husbandry, fisheries, sericulture, land development and soil conservation as appropriate).
- d) Providing adequate extension and other agricultural services to farmers to support the utilization of the improved practices.
- e) Assisting in the development of available water resources for supplemental agricultural and domestic uses

These outputs will be established through AID-supported interventions of technical assistance, training for farmers and extension personnel, temporarily intensified RTG technical support in the target areas, equipment purchases/construction of facilities to improve extension and research efforts, funding for water resources development and land/soil modifications, and funding for surveys, mapping, data gathering, research efforts and demonstrations necessary for the above operations.

## 2. Strategy

The general strategy of this Project is to demonstrate the feasibility and establish the replicability of the above process for improving the economic well being of farmers in rainfed areas of Thailand so that the RTG will be in a position to continue the process on a larger scale.

In Thailand, as in many other countries, agricultural research and technology development and area development projects have long focused on increasing production in irrigated areas, where the environment for crop production can be reliably modified through the controlled application of water and high levels of plant nutrient and

plant protection inputs. A new approach is required for agricultural development of rainfed areas, however, since farming practices must be introduced which are adapted to the local natural environment.

The complexity of selecting and adapting the various technological options available is obvious, but the RTG feels it must attempt to develop an approach to rainfed agricultural development which can overcome these obstacles if it is to fulfill what it perceives to be a pressing mandate--to raise income and improve the standard of living in poor rural areas. The Fifth Five Year Plan (1982-1987) outline stresses the need for priority allocation of public sector resources and services to low income areas and groups, thus continuing and expanding the equity initiatives of the last plan. In furthering its role in the implementation of this plan, the MOAC is particularly interested in a development process which can reach a broad range of low-income farm families in rainfed areas and make efficient use of available resources without a massive input of capital or personnel. The NERAD Project attempts to develop an approach for dealing with this situation in a systematic manner, and is intended to serve as the initial phase of a major program to improve rainfed farming throughout the Northeast Region.

The strategy of the NERAD Project has five basic organizing concepts which systematize the approach to this large and complex problem:

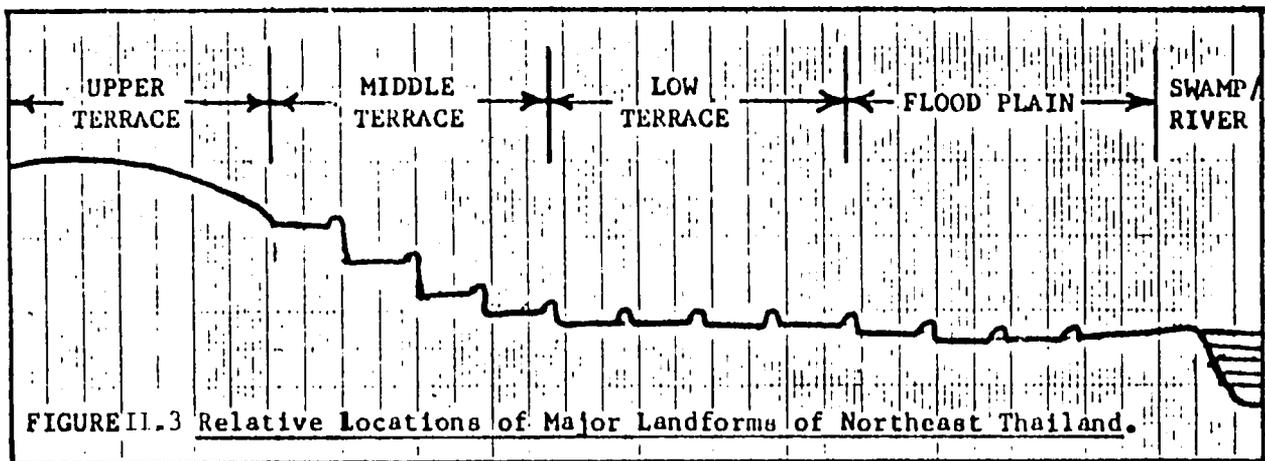
a. Selection of a small sample of tambons representative of the diversity of agro-ecological and agro-economic conditions in the Northeast Region. The Project will be limited to only eight of Northeast Thailand's 1,076 tambons, located in four of the Region's 16 provinces. These eight tambons, however, were selected both to represent the major range of agro-ecological and agro-economic variation present in the Northeast, and to serve as dispersed demonstrations of the potential of rainfed farming system development. Tambons vary in many general agronomic and socio-economic characteristics, several of which are presented in Figure II-2 (see Annexes IV, V and VII for more detail).

FIGURE II-2 Important Regional Variation Sampled by Project Tambons

PROVINCE:	Si Sa Ket	Nkn. Phanom	Chaiyaphum	Roi Et				
TAMBON:	Taket	Tae	Na Thom	Na Ngua	Lahan	Kwang -jon	Nong Kaew	Muang
ANNUAL RAINFALL (mm):								
- .10 Probability Rainfall Less Than	475	475	762	762	427	213	639	588
- .50 Probability Rainfall Less Than	1,072	1,072	1,530	1,530	924	580	1,214	1,156
WATER RESOURCE POTENTIAL:								
Identified Small-Scale sites for:								
- Natural Swamp Rehabilitation	6	5	5	2	0	10	28	9
- Submergable Water Structures	0	0	3	0	10	0	0	0
- Embankment Water Structures	0	0	14	27	5	5	0	4
Shallow Well Potential	med	med	low	low	none	high	high	high
FARM LAND USE:								
Total Farm Size (ha)	3.45	3.36	6.10	6.65	5.30	5.30	4.07	3.76
Percent of Area with Full Title	100	93	69	79	90	76	100	61
Percent of Area in Rainfed Paddy	95	96	74	83	67	84	95	92
- Percent of Paddy Planted (1979)	95	94	86	82	62	76	94	90
- Percent of Paddy Harvested (1979)	87	84	62	65	35	64	90	81
- Percent Glutinous Rice Planted	18	24	92	93	5	85	86	73
Rice Yield (tons/ha. planted)	1.3	1.3	0.9	0.6	0.7	1.4	1.3	1.4
- Percent of Rice Sold	30	41	18	22	11	33	32	34
Percent of Area in Cash Crops	10	8	4	3	21	11	17	5
FARM LOCATION:								
Approximate distance (km) to								
-all-weather road	1.0	3.9	16.1	4.2	0.2	1.8	0.7	2.2
-provincial capital city	15	20	125	90*	30	80	15	40
-Bangkok	555	550	780	680*	300	420	525	550

\*Sakon Nakhon is 40 km. away and is therefore the closest provincial city and shortest route to Bangkok.

b. Utilization of landform characteristics to guide the research, development, and extension of suitable agricultural technology. The ecological microvariability exhibited within the various subregional zones and administrative areas of the Northeast Region, including Project tambons, correlates most closely with geomorphological landforms. These landforms may be classified into flood plains, low terraces, middle terraces, and upper terraces, according to how they are situated in the undulating to rolling topography of the Region, as depicted in the following diagram (Fig II-3):



Each of these landforms has its own set of soil and water regime characteristics, including water holding capacity, drainage, fertility, erodability, etc. Under rainfed conditions these characteristics will determine such variables as general cropping patterns, optimal planting dates and crop duration, and eventually crop production.

The agronomic suitability of a particular agricultural practice can thus best be predicted by classifying the local area where it was developed and the area where it may be potentially applicable according to the general climatic characteristics and the specific landform on which the site is located (see Annex V). Therefore, the NERAD Project will use climatic and landform characteristics as the basis for systematizing project activities and categorizing potential sites for activity replication. Project planning has thus far made a general assessment of the mix of landforms present in each Project tambon (see Figure II-4)

based on reconnaissance-level soil and topographical maps and site visits, but detailed soil, contour, and land capability maps will be prepared for each Project tambon during initial stages of project implementation.

FIGURE II-4 - Landscape Characteristics of Project Tambons

PROVINCE:	Si Sa Ket	Nkn	Phanom	Chaiyaphum	Roi Et			
TAMBON:	Laket	Tae	Na Thom	Na Ngua	Lahan	Kwang Jon	Nong Kaew	Na Muang
TOTAL LAND AREA (ha)	2,000	992	10,800	10,240	7,520	12,240	6,560	6,240
% Flooded Land	0	0	40	0	18	0	0	0
% Paddy Land	100	100	14	75	42	65	93	75
% Upland/Forest	0	0	46	25	40	35	7	25
CULTIVATED AREA (ha)	1,300	800	3,500	4,900	6,000	10,000	4,500	3,200
% on Flood Plain	0	0	30	0	20	0	0	9
% on Low Terrace	100	100	31	61	25	53	89	63
% on Middle Terrace	0	0	21	33	27	34	10	25
% on Upper Terrace	0	0	18	6	28	13	1	3

Thus by providing an intensive effort to refine and implement new agricultural technology and agricultural development methodologies suitable for the various conditions represented in these few tambons, the Project will be developing a basis for future larger programs applicable over a broad range of the environmental conditions encountered by rainfed agriculture in the Northeast Region. In addition, it will systematically test individual technological innovations which may be disseminated through more informal channels.

c. Attention to the range of farming activities currently engaged in by farmers and suitable for further development. Most rainfed agriculture in the Northeast is characterized by primary attention to the basic subsistence rice crop. Although other farming activities have a secondary priority, they are usually significant in terms of family cash income, nutrition, draft power, fuel, and potential for development, especially if rice production can be stabilized

FIGURE II-5 Major Farming Characteristics of Project Tambons

PROVINCE:	Si Sa Ket		Nkn. Phanom		Chaiyaphum		Roi Et	
TAMBON:	Taket	Tae	Na Thom	Na Thom	Lahan	Kwang -jon	Nong Kaew	Na Muang
<b>HOUSEHOLD LAND RESOURCES:</b>								
Total Farm Size (ha)	3.45	3.36	6.10	6.65	5.30	5.30	4.07	3.76
-Percent Rainfed Paddy	95	96	74	83	67	84	95	92
-Percent Upland Fields	ns	ns	17	6	26	13	1	3
<b>HOUSEHOLD LAND UTILIZATION: (1979-80)</b>								
Percent Area Planted								
-During Wet Season	91	91	66	68	53	72	90	82
-During Dry Season	9	8	1	2	10	3	17	5
-To Rice	90	91	63	67	42	64	90	82
-To Cash Crops	10	8	4	3	21	11	17	5
Percent Households								
Growing								
-Cassava	0	0	10	4	24	1	0	6
-Kenaf	0	0	13	3	12	34	4	1
-Watermelon	83	30	1	8	1	0	42	2
-Beans	27	0	0	2	1	0	0	1
-Maize	0	0	0	0	1	7	0	0
-Other Cash Crops	4	1	1	3	12	2	3	38
<b>OTHER FARMING ACTIVITIES:</b>								
Household Livestock Owned (approx. total value - US\$)								
	750	600	1,100	1,300	1,100	650	600	700
Percent Households Having Availability Problem With								
-Place to Fish	89	78	40	20	10	56	32	50
-Firewood/Charcoal	68	90	37	7	79	46	62	63
<b>HOUSEHOLD INCOME SOURCES:</b>								
Total Net Income* Sources (US\$)	848	902	688	671	807	808	1,222	959
Major Income Sources (US\$):								
-Net Rice Income**	480	497	384	399	200	542	611	557
-Net Cash Crop Income	112	93	92	26	253	80	243	72
-Net Animal Income	44	51	118	82	109	102	102	106
-Net Off-Farm Income	201	165	82	150	188	84	189	174

\*includes value of subsistence rice, other sources of income and deductions for rent, interest, and misc. work expenses.  
\*\*includes value of subsistence rice.

and intensified on the soils best suited for rice production. (See Annexes IV and V. Farm families in rainfed areas of Northeast Thailand have generally developed a mixed farming strategy over a period of many years, which usually includes cropping, livestock, fishery, and forest product components.

The particular agricultural production practices chosen to supplement rice production vary from area to area and family to family depending on the land, environmental, socio-economic, and technological resources at the disposal of a farm family. When sufficient constraints to this production system occur they have turned to non-farm and off-farm employment. Figure II-5 gives mean tambon values for several major activities important in Project areas.

Past efforts to increase the production from cash crops, livestock, or other farming activities in rainfed areas have often met with limited success, frequently due to various farming system production constraints which were overlooked in the development of the proposed improvements. For example, potential cash crops with seasonal labor requirements conflicting with rice production, or attempts to establish permanent pastures in areas from which farmers at least in some years expect a crop. The same problem has occurred in many developing countries where small farms have developed traditional mixed farming systems to cope with difficult conditions and limited resources.

Although a number of technological options are available, there is no one technological "miracle" in sight for the rainfed farms of Northeast Thailand. Enough technology has been developed and enough is known about the potential for development of various farming activities, however, that it can be reasonably expected that through careful analysis, refinement, and field testing of technological innovations, incremental improvements in various of their farming practices can, in the aggregate, amount to a substantial increase in overall agricultural productivity and income. Each area, however, will have its own set of activities with the most development potential.

As discussed in paragraphs a) and b), above, the environmental parameters of the farm resource base can be classified according to climatic and landform characteristics. These are the environmental constraints within which the various farming systems must operate, and additional constraints within these areas are determined by socio-economic factors. It is the intent of the NERAD

Project to fully utilize existing technologies potentially beneficial to farmers by using what has been termed "operational research"\* to analyze the various farming systems in the selected tambons and their production constraints. The Project will determine what constraints can be addressed by refining currently promising technology to fit into local farming systems, and assist farmers in applying the refined technology to implement changes which will increase farm productivity and farm income. Successful applications of technology will serve as a basis for replication in other areas with similar conditions, while researchable questions and problems which are identified but beyond the scope of this Project, will be referred to appropriate agencies and institutions for further long-term or more basic research. This unified approach to transformational farming system development is widely viewed as the best possible prospect for improvement of farm income in rainfed areas of Northeast Thailand.

d. Strengthening of local institutions and human resources to deal with local problems. Ultimately it is the people of the local communities who must assess and implement any modification to their present farming practices. Local leaders and officials will be assisted in assessing local agricultural constraints and potential methods for addressing those constraints, and in formulating development plans which will match local needs with RTG resources and capabilities. MOAC agency personnel will gain experience in coordinating their activities to assist in solving area-specific problems. Research field trials, demonstrations, and extension trials will be conducted in cooperation with extension agents, Contact and Specialist Farmers, and farm families, so that they can learn about both the range of crop types and farming practices currently available and the methodologies for assessing their viability under local conditions. Training will be offered in skills necessary to implement locally-formulated plans. One important innovation of the Project is to develop a trained cadre of Specialist Farmers, which will put special skills in place at the village and

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\*Amphol Senanarong, "Development and Transfer of Technology for Rainfed Crop Production in Thailand". In ICRISAT, (1980) Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer

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tambon level to supplement the efforts of extension agents and Contact Farmers without requiring a major increase in RTG staffing levels. (The Contact and Specialist Farmer Concept are described in Parts II B-4 and III C-3.) These temporary intensive efforts of the Project will all seek to help farm families, local leaders, and local officials in solving their specific set of problems, thereby reducing the need for permanent intensive future activities and providing important support for the tambon extension agents. Such activities will also help to close the gaps between agricultural research, extension, and farmers' needs and circumstances, by establishing a feedback system based on interaction between these groups. This will, in turn, provide a mechanism for a more efficient utilization of research and development resources available to the agencies of the MOAC.

e. Attention to the replication potential of all Project activities. The cores of the Project will be the refinement and extension of farming system improvements appropriate to the various conditions of the Northeast by identifying and addressing key area-specific constraints in several different types of areas. Ultimately, the Project aims at a cost-effective system for increasing farm productivity which may be widely replicated. Replication of Project activities will involve both (1) the application of the same area-specific problem solving approach to other areas, including the organization of local farmer activities, government interventions, and supporting services; and (2) diffusion of proven agricultural technology to other areas with similar agro-ecological and agro-economic conditions.

Admittedly, the unit costs of this Project are substantial--roughly \$250 per intended beneficiary. Unit costs of this magnitude are to be expected in a project which proposes to finance multiple, complementary functions and requires expenditures over a seven-year period. The ability of the RTG to replicate the Project, however, will depend upon reducing unit costs over time. This lowering of unit costs should occur because of several factors: (1) The need for consultant assistance and associated overhead costs will greatly decrease or be eliminated once a group of RTG managers and technicians have gained experience in the areabased approach to rainfed agricultural development under NERAD. (2) Successful technologies will spread to other areas of the Northeast both through the regular extension program and through informal transfer processes such as the copying of successful practices observed in NERAD areas.

(3) There will be a reduction of special "project-related" costs involving supplemental water resource development as programs to provide basic water needs to poor rural villages become generalized throughout the Northeast. Project replication could then introduce the overall project approach to tambons and villages that are already endowed with ponds, wells, etc.

Apart from the facilitating effect of reduced unit costs, the Project will consciously promote replication through several means: (1) The emphasis on collecting detailed information on soils, rainfall, etc. will provide a solid basis for understanding the environment under which certain technology produces benefits and, concomitantly, for selecting areas suitable for introduction of the same technology. (2) Project funds will finance activities to identify and disseminate knowledge about techniques which appear useful, including: special studies, technical reports, workshops, field days, newsletters, radio programs, and a periodically updated handbook of operational methodologies. (3) Use of the existing extension structure and involvement of other officials at amphoe and province levels will mean that information about successful innovations will immediately get into the hands of government officials in the best position to promote these innovations elsewhere within their jurisdiction.

Other aspects of the Project which promote replication include its direct association with the four provincial agricultural development committees and existing regional/national committees, and its training/seminar components which will introduce a wide range of RTG officials (as well as local merchants) to the Project who have responsibilities/interests in areas outside of the 8 tambons.

### 3. Tactics

It needs to be emphasized that these five organizing concepts are to be used in the establishment of an agricultural development process in Project tambons. Considerable flexibility will be required in the implementation of this type of Project in order to assure the suitability of Project activities to local circumstances. Therefore, rather than develop even illustrative detailed tambon implementation plans which would have a tendency to pre-empt the cooperative resolution of local problems, NERAD Project design activities have focused on defining the range of

local resources (see Annexes II, IV, and VII), the range of available promising technology (see Annex V), and a system and procedures for implementing Project activities (see Annexes V, VII, and VIII).

The first year of Project implementation will be primarily concerned with refining knowledge of available resources and technology, establishing the organizational and administrative system, and beginning the project implementation process. At the Project tambon level, the first stage of this process will involve villagers, local leaders and officials and Project personnel in the development of tambon-specific plans. Initial plans will focus on (a) the location and nature of first-stage demonstrations of the most promising cropping systems improvements to address locally-perceived needs, (b) the extension of one or two broadly-applicable improvements which would gain local confidence by giving quick highly-visible results, such as native poultry improvement, and (c) site selection for water resource activities which require substantial lead time for planning and construction. Plans approved by the Project Director will be required before the implementation of related activities. As Project implementation proceeds and the amount of knowledge and experience regarding local problems grows, plans will be revised. Once activities are successfully implemented or determined to be impractical, new activities will begin to address additional local problems. Special attention will be given to keeping the number of implementation activities in a given tambon to a manageable level, both in terms of Project administration and the time and effort required by farmers to evaluate the merits of proposed farming improvements, and receive any required training.

Thus, Project tactics include both "top-down" and "bottom-up" approaches. The provision of information about possibilities through field research, demonstrations and other extension methods will proceed from the top down in more or less the conventional manner but at an accelerated pace and with a more integrated approach by the agricultural technicians involved in this effort. This effort will present to the rural areas a variety of potential practices which might be adopted. A decision on some practices, for example to use fertilizer, can be made by an individual farmer. In other cases the decision will need to be made on a village or group basis: for example, to develop a village woodlot or to develop a small water reservoir. Group adoption

may also be necessary in some cases in order to achieve economies of scale in provision of adequate technical resources, development of markets, etc. The decision to implement a particular activity will, however, be made at the lowest feasible level and only be subject to review at higher levels for technical feasibility, conformance with overall policy and constraints of project or other funding if such are involved.

The top-down technical support activities and the bottom-up decision making activities overlap at the village level. At this level farmers interact with extension, technical support and local government personnel in the examination of farming systems and in conducting research and demonstration activities, in village level educational programs, and in decision making meetings. This interaction is considered to be the vital process in the Project. It is, after all, farmers who develop farming systems. The researchers and other agricultural technicians whose job it is to provide the technical resources for farming system improvement therefore need to develop these resources in conjunction with farmers. It is also the farmers either individually or collectively who must make the changes which will bring about increased productivity and income. For them to make sound decisions they must have knowledge of the possibilities based either on their own experience or on sources they trust. Village level interaction of farmers and technicians will provide opportunities for both increasing the farmers' knowledge and developing their trust in the knowledge of the technician, as well as increasing the technicians' understanding of problems faced by farmers. Farmers' decisions to adopt changes in practices or enterprises may also require support in the form of infrastructure development, training, and initial technical and financial support to reduce the perceived risk, and these are provided for in the Project.

#### 4. Logical Framework Narrative

##### a. Sector Goal

This Project contributes to a goal of the Royal Thai Government to raise the level of living of the farm population in Northeast Thailand. The goal is consistent with the FY 81 and FY 82 USAID Thailand CDSS which focus on agricultural development particularly in the Northeast region.

Movement towards the goal can be measured by government statistical publications and will also be monitored by surveys conducted in connection with this Project and by other surveys routinely conducted by RTG agencies. Achievement of this goal depends on continued RTG policies for and support of special developmental activities in the Northeast.

It is assumed that farmers in the Project areas desire to increase their level of living through increasing agricultural productivity and income. It is also assumed that lower income farmers are willing and able to take advantage of improved economic opportunities. MOAC has on-going and planned programs to improve extension and research. It is assumed that these activities will continue as planned and accordingly provide an increasing level of support for project activities. AID/Thailand has no reason to doubt any of these assumptions. The assumptions relating to achievement of the goal also apply to achievement of the Project purpose.

b. Project Purpose

The purpose of this Project is to establish in 8 representative tambons of Northeast Thailand a replicable agricultural development program for increasing farm productivity and farm income particularly among lower income farmers in rainfed agricultural zones. It is expected that the Project will enhance farm family income both through increasing net cash income and through increasing the amounts and kinds of home consumed products. The increased consumption of farm products by farmers may be a result of greater consumption of staples but will more likely result from increased consumption of products such as poultry, fruit, and vegetables.

c. End of Project Status

It is expected that the Project will reduce the percentage of farm families in the Project tambons with incomes below the poverty level (as defined by the World Bank) from the current level of approximately 55 per cent of the approximately 10,000 families based on the NERAD household survey, to 40 per cent during the life of the Project. This represents a reduction of 25 per cent in the number of poor. Average village incomes are below the national average, and real increases in farm incomes in the target

tambons will tend to reduce this disparity. Achievement of this objective by the end of Project assumes that the distribution of income will become no worse than it is currently.

The Project will monitor and evaluate the impact of Project activities on the various local income groups, and a special investigation will be conducted to further define the causes of poverty in project areas. It is expected that the Project's management, research and extension techniques for conducting agricultural development on an area basis will be replicated by the Ministry of Agriculture outside the Project tambons and that such plans will be under consideration by the end of this Project. It is planned that by the end of the Project the agricultural development program in the Project tambons will be sustained by the regular agricultural agencies. It is not expected that the rate of introduction of new initiatives in the Project areas will be maintained after withdrawal of Project support, but that the system will be capable of both maintaining the end-of-project status and improving it through new initiatives.

By the end of the Project the area-based farming systems development program will have produced useful results for the Project areas and be capable of both further extension of more productive technology to other similar areas and applying similar techniques to the site specific problems of other areas. Conversely, those activities in the Project that do not meet expectations should at least generate a useful number of "lessons learned" that will help in deciding further directions for development.

End-of-project status will be verified by RTG agricultural statistics, by comparison of preimplementation and end-of-project survey results and by Project reports, site visits and evaluations.

d. Outputs/Inputs

The difficulties of making more than marginal improvements in rainfed agriculture in the Northeast suggests the development of site specific technologies to encompass a variety of farm enterprise possibilities. The diverse and inhospitable environment clearly benefits from provision of a comprehensive series of inter-related Project

outputs. However, within the various output components listed below, the improvement of farming practices through the adoption of appropriate cropping systems and related farming systems is the core of the Project. These are strongly supported by the farming systems research and extension components. The development of water resources is justified on the basis of its felt need by Northeastern region farmers and this component will serve as an important facilitative mechanism for farmer participation and will interact with the cropping/farming systems components by providing supplemental water. The technology development process does not require that the variety of activities described within each of these components be undertaken simultaneously. Rather, these activities reflect the number of possibilities presently thought appropriate to rainfed agriculture that can gradually, over Project life, be introduced. Given the predominance of rice production in the area, clearly the cropping systems and farming systems activities will be the first to be emphasized. Based upon the Tambon Plans to be developed the first year, and to be annually updated, the other modifications listed in these sections will be gradually phased into the Project.

(1) Farming practices Suitable to Land, Climatic and Socio-Economic Conditions Adopted

Suitable farming practices will be demonstrated and extended for subsistence/cash crop cultural technologies, water utilization, animal husbandry, fish production, fruit and tree crop plant production, sericulture, and land/soil management as appropriate to felt needs and environmental and socio-economic conditions in each tambon.

a) Cropping Systems

Proposed cropping systems modifications are based on the concept of developing practices suitable to the existing land forms--flood plain, low, middle and high terrace--which correlate generally with soil types and water supply. Thirteen specific types of modifications are suggested to stabilize subsistence rice production and increase cash crop production, including rice in some areas. (See Technical Analysis for details). Implementation of these and other modifications which may be developed as the Project progresses will be supported by a sequential process of field research (where necessary), demonstration

trials and extension trials utilizing extension and technical support personnel and farmer-specialists trained under the Project.

(b) Other Farming Systems Modifications

In addition to cropping systems modification, the Project has identified five other farming systems modifications for Project implementation. Household Poultry Improvement will provide interested villagers with one week of training plus improved male birds and initial supplies in order to introduce disease control measures, improved feeding practices and an improved genetic base to the ubiquitous household poultry enterprise. By controlling disease (up to 90% mortality of young chickens) and providing some additional nutrients, productivity can be greatly increased without changing the basic nature of the production method nor the market preference enjoyed by birds produced in this manner. It is expected that these improvements can result in an annual increase of more than 275,000 birds and more than 55,000 dozen eggs by the end of the Project. This represents an increase of 275 per cent over the approximately 100,000 birds currently being raised in Project tambons.

By addressing disease and parasite problems, the Larger Animal Improvement activity can greatly reduce the 30-40% mortality of young animals and prevent epidemics. Improvement in feed supply from seeding pasture areas with legumes and from the greater amount and quality of residues resulting from the cropping systems modifications will provide feed for the larger number of animals. Farmer specialists and tambon agents will accordingly be trained under the Project to assist veterinary officers in vaccinating animals and dispensing and utilizing drugs and hamata seed (for forage). An increase of 500 head of large animals per year or about a two and one-half per cent annual increase is expected by the end of the Project under this activity,

Fish Production Improvement will utilize both Project constructed and existing reservoirs. Activities include training for farmers, stocking, fertilization and planned harvesting. For stocking young fry will be used where predators can be controlled. Otherwise fingerlings will be used. Fish production increases are targetted at more than 200 tons per year based on input and water resource availabilities under the Project. Current

fish production is estimated at about 80 tons/per year. Individual farmers having access to a suitable location will be encouraged to produce fingerlings for use in the Project or for marketing.

Sericulture is widely practiced in most Project areas although the silk produced is mostly consumed at home. Production of native silk can be greatly increased by improved silkworm production practices and especially by increasing the supply of mulberry leaves through improved cultural practices. Introduction of newly developed hybrid silkworms having the fiber characteristics and hardness of native silkworms but with higher productivity may be phased into the later stages of the activity depending on local demand.

The limitation on fruit and tree crop production resulting from lack of planting stock of more productive species or varieties will be addressed through the Fruit and Tree Crop Nursery activity. Farmers having interest and a suitable location will be assisted in starting a fruit and tree crop nursery enterprise. Training and some initial stocks and supplies will be provided. Project plans provide for up to 200,000 seedlings per year to meet farmers' needs.

The above farming systems modifications will be facilitated by farmer specialist training, support of some initial costs through village grants or other appropriate means, and provision of technical support by the Project staff and technicians of the appropriate agency of MOAC. Criteria for selecting any of the farming system components for a particular area will be based on technical feasibility as determined by MOAC technicians, interest and support of local officials and sufficient interest by villagers to indicate that the activity will succeed. Activities which are expected to be of wide interest such as the poultry and large animal project will be phased among villagers in order to spread the technical support and training requirements.

(2) Adequate Extension and Other Agricultural Support Services Being Provided and Utilized in Target Areas

These activities have been selected to strengthen the overall agricultural research-extension

system in its implementation of activities in areas with rainfed agricultural conditions. The Tambon Extension Agent (TEA) is the key agricultural official in the tambon, but he needs training and support and the cooperation of trained villagers to function effectively.

(a) Extension Support

The IBRD sponsored "Train and Visit" program was aimed at improving extension and was a start in the right direction. This Project supplements and intensifies the T & V approach through improving TEA's access to technical resources, giving him/her more information and training support, upgrading the contact farmers TEAs work with to specialist Farmers, and giving TEAs more help through additional staffing and better facilities. Intensification of present MOAC delivery systems will include provision for assigning tambon extension officers at the ratio of 1 to 500 farm families, or double the current targets for each tambon. In each tambon, a house, office, and storage facility and, where necessary, a meeting place will be constructed. Transportation and a minimal level of tools with which to work will be provided. Additional training related to project activities will be given to tambon agents so that they understand the basis for all project activities in their tambon and are able to provide day-to-day instruction and support. Furthermore a concerted effort will be made to channel all Project activities in each tambon through the TEA. He will be involved in all Project activities and care will be taken under the Project to have this official considered by the villagers as the person most responsible for Project activities in the village.

Provision will also be made for Department of Agricultural Extension (DOAE) support from the district, province and regional levels. Training for these officials will be provided and a mobile training unit will be stationed at the regional level to be dispatched for concentrated training programs in the Project tambons. The Project will also finance inputs for radio programs, printed materials and other audio-visual components as appropriate.

Additional training for extension and other personnel are included for 24 tambon agents, 4 field managers and 4 assistant field managers, 7 district extension officials and 12 subject matter specialists.

One key element of the Project aimed at increasing the effectiveness and reducing the workload of the TEA is the development of a cadre of Specialist Farmers. This component provides for the selection of respected farmers (by their peer groups) for intensive training at NEROA in the various farming practices advocated under the Project, with each farmer being trained in only one or two practices that he/she is most interested in. Specialist Farmers will be compensated for their time spent in assisting with demonstrations, livestock vaccinations etc. except where they may earn a direct return from the community from their participation (e.g. through the native chicken component). It is expected that Specialist Farmers will be instrumental in supplementing the efforts of TEAs and strengthening the outreach capability of the Project. Short training courses will also be conducted by technical specialists in the villages for other farmers.

Project targets related to villager training are as follows: about 500 villagers trained in specialized programs of one week or more, 10,000 villagers trained in tambon or village level programs, radio agricultural programs regularly broadcast in Project areas, and publications regularly distributed in Project areas.

(b) Other Support Services

These activities will provide a knowledge base for Project activities and a basis for predicting the appropriateness of Project results in other areas in Northeast Thailand. Land Use Planning activities will provide a detailed soil survey, one-meter interval contour maps, land suitability maps and land tenure information. The soil testing service will provide for a survey of fertility and a continuing soil testing service for project activities. Simple weather station equipment and training (By the RTG Meteorology Dept.) will provide for an accurate record of weather conditions during project implementation. These activities, especially the maps and soil fertility survey, are essential for Project implementation. Also these activities, especially the weather data, will provide a logical basis for predicting both the long term applicability of Project results and their replicability in other areas.

(3) Economic Development of Available Water Resources for Supplemental Agricultural and Domestic Uses

Water is both a primary limiting factor and a dominant felt need in Project areas. Activities are directed at rational economic exploitation of small-scale water resources available in each area of each tambon according to its hydrological, agronomic and socio-economic potential. Local participation will be sought in final site selection, construction and management. The involvement of local leaders and officials in this process will help them improve the effectiveness of future water resource development efforts.

The Site Survey Team and Project Design Team found that there are a number of technically feasible activities for increasing water availability for household livestock, fisheries, off-season crops and rice bed nurseries. Estimates of numbers of feasible small-scale structures were made. The Project is budgeted to provide for construction of the structures which are the most cost effective and most desired by local beneficiaries. Project staff will assist local government officials in preparing requests for support from non-Project sources for additional structures if there is strong demand for more. Budgeted activities include Swamp Rehabilitation for 25 locations to increase the capacity and utility of water-retaining natural depressions, 20 Embankment Structures\* to retain runoff, 13 Submerged Dikes to retain receding seasonal flood water, 11 Water Filter Systems to allow fish production as well as household use in certain existing water improvements and up to 1,500 Shallow Wells which include only wells which are deep enough to require liners (the only item to be supplied by the Project for shallow wells). A relatively small amount of money (\$150,000) also is budgeted as a contingency for other water resource modifications such as pit ponds, weirs, improvement of existing structures, minor flood control structures, farm ponds, etc. which may be found to be highly desirable during the detailed planning stage of implementation. Section III C-8 of this PP describes the water resource components in some detail.

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\*Water retention structures budgeted are all of a small enough scale to fall within the DLD Small-Scale Water Resources Development Program being implemented in other areas of the country.

(4) Research and Demonstration Program  
for Continuous Refinement of Rainfed  
Farming Systems

Activities are to be selected to support the Project with farming system analysis and development of technology which can resolve current problems and expand the range of opportunities available to farmers to increase overall agricultural income. This integrative, area-based research is currently very limited, it but is very important for both short and long term development of rainfed agriculture. In addition to providing practical information for Project implementation activities, this activity will provide experience in the farming systems research approach which will assist individual MOAC agencies in their other activities. The DOA, for example, will use this experience in the development of their approach to cropping and farming systems research under the new National Agricultural Research Improvement Project.

(a) Research/Demonstrations

There are elements of research and/or demonstration in most of the foregoing activities. In addition some other research/demonstration activities are planned. Fertility Evaluation Research Trials have the objective of both assessing the fertility status of the Project area soils and providing a basis for fertilizer recommendations on prevailing crops. Shallow Well Research will investigate techniques for improving the yield of shallow wells thereby reducing the numbers needed and enhancing the feasibility of mechanical pumping of water from these wells. Minimum Tillage Research will investigate the possibilities of incorporating no-tillage or minimum tillage practices into the farming system. The importance of these practices lies in the fact that greatly reducing tillage is probably the only method by which the organic matter content of Northeast Thailand soils can be permanently and significantly increased. A Saline Soil Demonstration on approximately 400 ha. of affected land will demonstrate proposed methods for both reducing salt accumulation in the soil and reducing the consequences of such accumulation, including investigations of salt-tolerant plants which could provide economically viable alternative uses of areas already seriously affected by salinity. Location and nature of research activities will be based on the judgment of technical support staff. Implementation of demonstration activities will be

based on their technical feasibility as determined by the support staff, on the interest of local officials, on the interest of involved villagers and on their willingness and ability to develop a program for the continued use and maintenance of the activity. Public Land Use Demonstrations on approximately 10 areas will demonstrate the use and management of public lands for wood and/or forage production.

(b) Soil and Land Modification Demonstrations

These activities are designed to demonstrate the value of improving soil productivity and conditions. Terracing has the primary objective of reducing erosion through slowing water runoff thereby reducing losses of soil fertility components. Sites for terracing will be selected on the basis of need and technical feasibility as determined by MOAC technicians, interest and support of local officials and collective agreement by the land owners concerned to maintain the terraces. Land shaping has the objectives of increasing cultivatable area and providing for better use and control of rain water. Criteria for implementation is the same as for terracing. Composting is designed to encourage the recycling of waste materials in a way that will produce highly visible results. It will reduce somewhat the need for chemical fertilizers or for purchasing manure which is a common practice for vegetable and tobacco production. Individual farmers can make the decision to implement composting but priority for Project encouragement of this activity will be placed on villages in which a number of farmers have an interest and the availability of compostable wastes is high. Demonstrations are planned for about 200 km of terracing and 176 hectares of land shaping. Composting will be demonstrated by encouraging 50 families in each tambon per year to make and utilize 2 tons of compost each year. The Project will subsidize compost production (\$10 per ton).

The Project also provides for further replication of the land shaping activity if demonstrations in years 2 and 3 result in large demand for this activity. DLD plans to budget for up to 100 hectares of land shaping per year during years 4-7 provided farmers will pay about 75 per cent of the costs. AID participation and funding are expected to be limited to the demonstration activities during the first 3 years. However, AID also expects to finance technical assistance (e.g. an agricultural engineer)

and technologies to help determine if costs of this activity can be reduced through appropriate technology, and this assistance may continue beyond the first three years.

(c) Farming Systems Research will utilize the Project's multidisciplinary technical support staff for an integrated research effort to analyse current farming systems in Project tambons, identify and prioritize key constraints for their development and conduct an applied research program to develop technological innovations to overcome those constraints. Should important constraints be identified which are beyond the scope of this Project's mandate or budget to address, they will be referred to the appropriate RTG agencies as recommendations for more basic or longer-term research. Workshop and publications will be used to seek input from the broad range of Thai researchers whose work relates to these activities, and to disseminate the research approach and findings of their efforts.

(d) Economic Studies Support

The Project will provide for economic feasibility studies, market studies, and resource development evaluation and planning in support of Project activities. Technical support for group action in production marketing or input purchasing will be provided where needed. Project implementation decisions will be initially made at the village or tambon level. It is therefore essential that the Project staff be able to provide economic analysis as well as other technical support.

(5) An Agricultural Development Process That Will Fit Government Resources and Farmer Needs According to Both RTG and Farmer Resources and Capabilities

Local government and agricultural research and extension officials need to have a better understanding of local farming systems, agronomic factors, farmer culture, farmers' felt needs and of the agricultural knowledge and wisdom of farmers. Farmers need to have a better understanding of the technical resources available to them and of how to most effectively utilize these resources. These needs will be met by involving local government officials, agricultural research and extension agents and farmers in a highly interactive process of agricultural development, provision of agriculture infrastructure where needed, and agricultural research.

The Project will develop an administrative system appropriate to an area-based agricultural development program which can provide a basis for planning and implementing further programs. (See Administrative Analysis for more complete discussion). This will include:

- (a) National and provincial level planning sub-committees
- (b) Administrative and technical support at the Northeast Regional Office of Agriculture to provide integrated planning and coordinated implementation.
- (c) A field manager in each Project province to expedite Project implementation and support local officials.

Local Organization is particularly important to an area-based project's success. The Project accordingly aims at assuring the full understanding, cooperation, and participation of villagers in Project activities so that they will feel a strong sense of involvement and Project "ownership" and will want to continue activities after the conclusion of the Project. The Tambon Council, TEA, Contact Farmer and Specialist Farmer are key figures in these activities, in addition to the CD worker, teacher, and the chief district official. The Project will also seek the involvement of local private sector agricultural interests in the informative extension components of the Project in order to assure consistency in what is transmitted to the farmer. The Project will emphasize the strengthening of these existing institutions as the best means for reducing complexity and in order to provide a readily understandable, replicable process.

Social Support Activities are designed to increase the sense of community participation in the Project. A large number of village meetings are planned for informational and decision making purposes. The involvement of the tambon council in developmental plans and meetings of community leaders, both public and private, are included as a means of marshalling support for the Project. A newsletter will be distributed to all participating farmers and

officials. Existing farmer cooperatives in the Project tambons will be studied, evaluated, and assisted by a farmer institution specialist provided by the Department of Cooperative Promotion.

(6) Inputs

Inputs are generally noted above for each output component. The Project will finance several training activities, including short training courses of a few days each for about 16,000 villagers in agricultural subject areas of interest; intensive one to three week specialized training courses for approximately 500 villagers; and supplemental training for TEA's, field managers, district officials and subject matter specialists. In addition, a number of meetings and seminars will be financed for Project staff working groups and for villagers, in order to introduce them to the Project concept and activities. Approximately fifteen meetings between civil officials, farmers and merchants are also planned to discuss and arrange for marketing needs under the Project.

Land Use Planning activities will be financed under the Project, including detailed soil surveys, contour maps, topo maps and a land tenure survey for the approximately 60,000 hectares in the eight tambons. Soil testing will also be financed for approximately 8,000 samples.

Wages and Per Diem (where appropriate) will be provided for Farmer Specialists, weather recorders, farmer record keepers, and engineering staff.

Other inputs include necessary tools and agricultural inputs for the research demonstration and extension activities, and equipment and supplies for the administration of the Project and for each of the output components. The Project will finance tractors/vehicles for the land development component and regional project support, motorcycles for TEAs and the engineering support component, and construction/furnishing of tambon extension facilities, Specialist Farmers' storage rooms, and the regional administrative facility.

Construction/improvement of water resources infrastructure is a Project input, and operating expenditures

for maintenance, utilities, POL, office supplies, and personnel support (salaries/housing/per diem) are also Project inputs.

Finally, technical assistance, research activities and evaluation are to be financed under the Project. All of the above inputs are quantified and costed in Annex IX of this PP. Generally, AID is financing all of the costs for the above inputs except for local support of foreign consultants, most operational costs such as RTG salaries, office supplies, POL, utilities maintenance for offices, purchase of two wheel drive vehicles and 50 percent of the cost for water resources improvement. Part III-D shows the financial arrangements and cost sharing breakdown for elements of each output package. Details for the technical assistance input are further discussed below.

#### (7) Technical Assistance

Technical assistance needed to carry out the Project includes both an expatriate team and Thai consultants employed locally. The expatriate team includes four long-term positions, chief of party (4.8 years), agronomist (4 years), agricultural economist (4 years) and training specialist (2 years). The team will be procured through the University of Kentucky under Title XII collaborative assistance procedures. The primary function of the long-term expatriate staff will be to assist the MOAC Project Director in developing the Project based on coordinated implementation by the various MOAC agencies involved. The chief of party will serve as counterpart to the Project Director and will assist him in preparing the necessary plans, management information system, reports, etc., required to manage, monitor and evaluate Project activities. The agronomist and agricultural economist will serve as the backup for the technical support staff charged with implementing the crop and other farming systems modifications in this Project. One or more members of the long-term expatriate team will be expected to have experience in conducting the type of integrative, problem-solving research necessary for implementation of the farming systems research component of the Project. The training specialist will assist in developing the Project training programs.

Forty three months of short-term expatriate staff include specialists in such areas as soils, minimum tillage, forage production and utilization, fisheries, animal nutrition, plant protection, animal disease, forestry

and training. These individuals will assist in developing and/or implementing the program components in their respective fields. The expatriate staff will be heavily involved in planning and conducting the farming systems research.

Thai specialists, including persons skilled in disciplines such as administration and management, financial management, agricultural engineering, cropping systems, non-formal training and social science, will be employed to provide additional expertise which is needed for Project implementation. A total of 124 person-months is budgeted but it is expected that some individuals will be employed on a part-time basis in order to have their expertise available over a longer period of time. The expected scheduling of the technical assistance is shown in Figure II-2

Besides the technical assistance described above, the services of two agricultural technicians experienced in Thailand and fluent in the language will be sought as liaison officers between the RTG, AID and expatriate team. This expertise, which has proven invaluable in the AID-financed Anti-Malaria Project, may be available at minimum cost from ex-Peace Corps Volunteers.

FIGURE II-2

TECHNICAL ASSISTANCE SCHEDULE

	<u>YEAR</u>							<u>Total</u>	
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>		
Long Term, per year	2.5	4	3.4	3	2	-	-	14.8	p/y
Short Term, per month	5	12	10	12	4	-	-	43	p/m
Local Hire, per month	20	36	28	28	12	-	-	124	p/m
Support Staff, per yr.	7	7	7	7	7	-	-	35	p/y
On Campus, per year	1	1	1	1	1	-	-	5	p/y
Liaison Officers, per year	1	2	2	2	1	-	-	8	p/y

PART III - PROJECT ANALYSES SUMMARIES

A. Economic Analysis Summary

1. Economic and Financial Returns

The overall economic internal rate of return for the project is estimated at 18%, ranging from a high of 19% for cropping systems, to a low of 17% for the other farming systems component (see Figure III-A-1 below). The IRR is relatively insensitive to changes in project and household input costs but moderately sensitive to changes in output yield. Thus a 20% increase in Project costs reduces the overall IRR from 18 to 16%. The corresponding figures for a 20% increase in participating household costs, including investment costs, and a 20% reduction in output yield are 16% and 12% respectively. Since the yield estimates used in the analysis are conservative, such a yield decrease is unlikely.

Figure III-A-1 - IRR, Sensitivity Analysis and Financial Returns to Participating Households

ECONOMIC INTERNAL RATE OF RETURN

Project Component	Basic	20% Increase In Input Costs		20% Decrease In Output Yield	Benefit Cost Ratio to Farmers*
		Project	Farm/HH		
Cropping Systems	19	18	17	12	2.1
Water Resources	18	16	16	12	2.4
Other Systems	17	14	14	10	1.9:1
<u>Combined</u>	18	16	16	12	2.1:1

\*Discounted at 14%.

Figure III-A-1 also indicates that the Project should be attractive to farmers: the financial benefit-cost ratio to participating farmers is estimated at 2.1:1 for the overall Project. (See Annex VI-2 for benefit-cost streams.)

Annex VI-2 shows that the overall Project should begin to provide net positive returns to participating farmers during the third Project year. Positive net returns to the farmer are expected during the second Project year for the cropping systems component and water resources component due to their low cost to the farmer during early Project implementation. Under the farming systems component, farmers in the large animal improvement activity are expected to purchase more animals to take advantage of improved pastures, and farmers engaged in sericulture will need to invest in mulberry trees and rearing room trays. These costs account for most of the early expenses to the farmer for this component and lead to a negative net return to the farming systems component during Project years two and three. However, the early returns to the farmer shown in this analysis are probably quite conservative, since the analysis assumes that all farming systems activities will begin at approximately the same time. It is quite likely that the large animal production and sericulture activities will begin later in the Project than the more rapid impact interventions such as the native chicken activity, and this would provide a favorable net return earlier than shown.

The largest incremental costs that farmers will incur will be for chemical fertilizers. Estimated consumption will grow rapidly beginning in the third year of the Project, reaching about 1,400 tons by year 7. The estimated growth in hired labor costs will also be substantial, amounting to about one-half of the growth in fertilizer costs. In addition to reducing underemployment in Project area households, the Project will provide employment for an estimated 400 man-years of labor by year 7.

Participating households bear less than half the total cost during the first 7 years, their net farm income will have increased by an estimated \$22 million (in 1980/81 prices) by year 7, a 36% increase over net farm income in 1979/80. As noted in Part II, this represents a 25 percent reduction in the number of poor in the Project tambons, given an even distribution of benefits.

## 2. Prices

Late 1980 - early 1981 prices are the base year prices used in the analysis. Relative prices are assumed to remain constant over the economic life of the Project. For most farm inputs and outputs in the Project area, actual

farmgate prices are the best possible estimates of economic costs/benefits. Non-glutinous rice is the major exception since there are significant export duties levied on this commodity. For the remaining farm inputs and outputs in the Project area, markets are relatively free and competitive. Taxes and subsidies are small enough that an effort to take these into account has at most only a very marginal impact on internal rates of return. Hired labor is valued at the market rate and Government employees at their pay scale, including supplementary benefits. This may slightly overstate the economic cost of unskilled labor, but only marginally so. During much of the year, there is substantial under employment of Project area farm households. Because of this, no economic costs were assigned to the estimated increase in household labor that the Project will entail, including household labor for the maintenance of Project constructed facilities such as submerged dams. This assumption may not be strictly valid since the Project will increase the demand for farm labor and more opportunities will exist for local employment. Under these conditions, temporarily idle household members which would not seek employment outside the area might seek local employment. Also, the increased demand for household labor may result in some household members foregoing some employment off the farm, in order to meet the increased labor requirements on the farm. The fact that the marginal opportunity cost of the increased household labor requirement may be greater than zero would introduce negligible bias in the analysis, however.

On the basis of the advice/recommendation of personnel in the Research Department of the Bank of Thailand, foreign exchange was priced at the current exchange rate. To the extent that the Baht is overvalued, this would increase the relative (baht) prices of both imports and exports. It would seem that this (successive decomposition of all input and output prices into import, export and domestic) would affect the IRR but little. If anything, the overall IRR would probably be somewhat higher since a large proportion of output would be valued at border prices (adjusted for transportation, processing, other costs, farm to port) and since the sensitivity analysis indicated that the IRR was relatively insensitive to cost increases but rather sensitive to a change in output yields or output prices, yields held constant.

Glutinous rice is typically produced for home consumption; that produced for the market is ordinarily non-glutinous since the market price of the latter is generally higher than the former and yields and production cost of local varieties are roughly the same. There is a very limited export market for glutinous rice; very little is exported and none imported. Furthermore, the domestic elasticity of substitution between glutinous and non-glutinous is reported to be very low. Consequently glutinous rice is priced at its domestic farmgate price. Also, since the production growth trend is zero for glutinous rice and all growth in output has been due to growth in output of non-glutinous, it is assumed that all the increase in paddy production due to the Project is non-glutinous.

The economic price for paddy was derived by taking the average f.o.b. export price (\$355 or ₱7,280/MT) and working back to the farmgate, (excluding all taxes) to obtain the value added between farmgate and port. Based on prices that farmers were actually receiving in February 1981, the paddy prices used (see annex for prices used), both economic and financial, are very conservative. The remaining prices are estimates of farmgate prices and are realistic. The net return to household labor and land for vegetable production could be substantially higher than the approximately ₱900/ra: used. It could also be substantially lower. We believe the net returns used for vegetable/truck crops is as realistic an estimate as is possible.

It was assumed that per ra: crop yields would be constant without the Project. Historical data show yields generally being flat or drifting downward.

### 3. Farm Budget

Farm budgets without and with the Project are shown in the Annex. Over 85% of the cropped area was in rice in 1979,80. With the Project, this will be reduced some but rice will continue to be by far the dominant crop. The area planted to mung beans and other similar short duration crops is projected to increase substantially in both absolute and relative terms and over the longer run. The cropped area in mung beans is projected to be about equal to cassava. This would reflect a continuation of a national trend, since the area in mung beans has been consistently growing at a relatively rapid pace over the past decade or so. The projected area under vegetables/truck

crops will almost double and will make a significant contribution to net farm income. Net farm income generated by livestock will also increase significantly.

## B. Social Analysis Summary

### 1. Beneficiaries

Beneficiaries of this Project are some 65,000 persons living in eight tambons (about 100 villages) of four Northeastern Provinces. Ethnically they are predominantly Lao-Isan (Northeastern Thai) but can speak central Thai language, nearly all having had at least four years schooling in the Thai educational system. The majority (89%) can read and write central Thai as well. Average family size is 6.3, about average for the rural Northeast. Occupationally, beneficiaries are overwhelmingly (85%) rainfed agriculturalists (no irrigated land), and virtually all of them plant rice as their main crop. Average holding is 30 rai (4.8 ha) (25 rai rainfed paddy land, 3 upland, 1 misc., 1 non-cultivable). The average household plants 22 rai in the wet season (20.5 in rice, 1.5 in cash crops) and 2 rai in cash crops in the dry season. Average household income is B17,500 (\$875), about half of which is from rice (including amount consumed at home), the rest is mainly from off-farm wages and cash crops. Family planning is practiced by over 40% of the households. Only 5% of household heads have education beyond the 4th level, but over 90% of the households have a radio. The vast majority of villages are not yet electrified, but most households are within 3 or 4 kilometers of an all-weather road. Formal organizations exist within the villages (temple, school and development committees, farmers' organizations and co-ops) and over 40% of the household heads belong to at least one of these formal groups. Many households have also participated at one time or another in "development" efforts, often under the "tambon council" fund program, building village roads, repairing bridges, etc.

### 2. Poverty

Poverty within the Project areas is typical of rural Northeast Thailand where a majority of Thailand's poor reside. Over 50% are below the World Bank "absolute poverty" line (updated to \$120 per capita for 1979-80 crop year). There is considerable variation in the per cent of poor on a

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tambon and province basis. Nong Kaew in Roi Et province, the wealthiest tambon, has only 26% below the poverty line, whereas Na Ngua in Nakhon Phanom is the poorest tambon and has 75% of its population below the poverty line. Variation among villages can account for perhaps half of these poor in a few tambons, but the majority of poor cannot be located by identifying the "poorer villages" in the tambons. They are located within apparently "medium" and "better-off" villages where they may be less noticeable amid their more fortunate neighbors. Income distribution in the Project tambons is rather differentiated, somewhat more than World Bank estimates (0.4 vs. 0.3 Gini co-eff.), but considerable variation exists on a tambon basis (0.48 in Lahan, 0.28 in Tae). Intra-village calculations are not available, but analysis shows that much of income differentiation must be occurring within villages (see Social Analysis Annex).

### 3. Social and Environmental Feasibility

This Project is considered socio-culturally feasible. Survey evidence and anthropological interviewing indicate the Project is to address real needs, as perceived by villagers themselves, by means of strategies and actions which have precedent local communities and are seen as appropriate and useful by the villagers themselves. Intended changes are incremental and realistic and well-fitted to the villagers' present state of knowledge, manpower and organization. Communication planning is comprehensive (contact agents and mobile units, trial farmers, demonstration plots, radio programs and newsletters) and mechanisms have been designed to foster participation, appropriateness of development actions, and sense of ownership (cost-sharing, incremental staging, variety of possible options to choose from, etc.).

Effects of this Project on the poor, on women, on environment, on population, fertility and migration, and spread, have all been considered. Spread effects are likely to be substantial due to several special characteristics of the Project: Use of the existing extension structure, scattered Project areas (which represent major agro-ecological types), involvement of local merchants, use of radio, and coordinated monitoring and evaluation. Effects on population, fertility and migration can at least be said to be neutral, but may be quite positive depending on the success of the Project. Of particular importance is potential effect on migration: To the extent that rainfed agriculture can

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provide more attractive returns, rural to urban migration from the Northeast should decrease, although it is unlikely to be reversed. The Project's effects on rural women are likely to be mildly positive; that is they are expected to benefit at least as much as men in most Project activities and may benefit relatively more than men in a few of them, such as silk production and animal husbandry.

Effects of the Project on the poor and on the physical environment cannot be adequately assessed at this point in the Project cycle and it is recommended that these be more fully assessed throughout the Project. This methodology is necessary in that the types, location and mix of water resource components is not yet known and assessment must be done on the ground, in more detail than can adequately be addressed at the Project Paper stage. Pesticide type and usage is also not predictable at present and thus its analysis must follow the same procedure. Socio-cultural effects of terracing and paddy contouring is also a concern. Since existing models (precedent) are available, they should be carefully studied in evolving the detailed planning. The Project should finance the services of a social scientist who will be available on an as needed basis to monitor and assess socio-cultural concerns. His/her expertise will be of great value in many components of the Project, particularly since the emphasis on farming systems will need to take account of the socio-cultural factors that are important variables in such systems.

### C. Technical Feasibility Summary

#### 1. Agricultural Technology

The current farming strategy of Northeast farmers involves a number of interrelated activities, with an emphasis on particular activities which changes with the seasons (See Annex V for an illustrative description of current farming practices). Therefore, the approach taken by this Project in developing and introducing changes in rainfed agricultural technology is based upon consideration of whole farm enterprises of farm families living in Project tambons. Since this approach requires the utilization of concepts and terminology which are relatively new, the following definitions are offered to clarify the technical discussions in this Project Paper and its annexes:

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A farming system (or farm system or whole-farm system) is not simply a collection of crops and animals to which one can apply this input or that and expect immediate results. Rather, it is a complicated interwoven mesh of soils, plants, animals, implements, workers, other inputs and environmental influences with the strands held and manipulated by a person called the farmer who, given his preferences and aspirations, attempts to develop output from the inputs and technology available to him. It is the farmer's unique understanding of his immediate environment, both natural and socio-economic, that results in his farming system.

Farming systems may be broken down into component activities or sub-systems. Since the subsistence rice-based crop production aspects of farm production generally are of central importance in rainfed areas of Northeast Thailand, the NERAD Project has classified its agricultural technology activities according to whether they involve (a) cropping systems modifications, or (b) other farming system modifications.

For NERAD purposes, cropping systems modifications refer to those technological innovations which directly affect any of the set or annual crop systems making up the cropping activities of a farm system. An annual crop system comprises all components required for the production of a particular annual crop and the interrelationships between them and the environment. These components include all the necessary physical and biological factors, as well as technology, labor, and management.

For NERAD purposes, other farming system modifications include technological innovations directly affecting non-cropping system components of the farming system, including a farm's livestock system, fishery system, tree crop system, forest production system, or sericulture system.

The modifications of farming practices suggested in this Project are based on the best information available to the design team from research results, demonstration trials, pilot projects, etc. Proposed modifications are discussed in some detail in Annex V and the supplemental Annexes.

Proposed cropping systems modifications include:

- Deep water rice in areas subject to regular flooding of a nature suitable for the characteristics of available cultivars;
- Planting of short-duration field crops (e.g. mungbean, sesame) during May-June in areas subject to heavy flooding in September.
- Improved production of vegetables or other high-value crops during the dry-season in areas with supplemental water supplies.
- Planting of drought-tolerant crops of short to medium duration in areas with sufficient residual soil moisture but no supplemental water supply (e.g. low input requirements: mungbean, sesame, peanut; higher input and higher value: watermelon).
- Sowing of legume crops requiring little care in rice fields prior to or immediately following rice harvest for home consumption, and high-protein forage for domestic animals in areas with sufficient residual soil moisture.
- Planting of currently available high-yielding, fertilizer-responsive rice cultivars in areas where there is a high probability of sufficient water and no flooding.  
  
Planting of a short-duration crop (e.g. mungbean) which can be harvested prior to rice transplanting in areas where rice is usually not transplanted before August.
- Utilization of direct-seeding techniques and drought-tolerant cultivars for rice in areas subjected to mid-season drought stress.
- Planting of a sequence of two short-duration crops (e.g. sesame-mungbean, or monocropping of a long-duration crop (e.g. peanut, jute) in areas which remain fallow in 2 to 3 years out of five years due to insufficient water for paddy production.

- Planting of new high-yielding cultivars of cassava (Rayong 1) and kenaf (TSH 30) and improved management practices in areas where those crops are currently grown.
- Intercropping of cassava with a short to medium duration legume crop (e.g. peanut) or cassava-legume rotations in cassava growing areas which need soil conservation measures.

Other farming systems modifications include:

- Improvement of disease control and nutrition of household poultry.
- Improvement of disease and parasite control and nutrition of large domestic livestock.
- An agricultural component for increased fish production.
- Improvement of sericulture practices for increased mulberry and silk production.
- Nursery production of trees for fruit, fodder, and fuel-wood production.
- Demonstration or improved management of public lands for animal feed and fuelwood production.

All of the proposed practices are either currently being applied in various areas of the country or have shown considerable promise based on research station and/or village work conducted by departments of the MOAC or local universities. They have demonstrated their feasibility under certain conditions.

It is recognized, however, that due to the highly site specific nature of rainfed agriculture, additional refinement during implementation may be necessary. The opportunity for refinement is built into the Project in several complementary ways:

- Detailed planning during the first year by MOAC personnel assigned to the project, local government officials, villagers and Project consultants.
- A phased sequence of field research-- demonstration trials--extension trials-- adoption for the cropping systems modifications.
- A phased implementation schedule for other components which will allow for refinement as initiation moves from one group of villages to the next group.
- A research and demonstration trial component for activities which are considered promising and potentially of great importance but for which there is not sufficient information to suggest adoption.
- A planning cycle which will allow for modification of implementation plans to accommodate results obtained from research and/or experience.

The modifications suggested in the Project are to be technologically suitable for Northeast Thailand. They have been selected to conform to soil, climate, and geomorphological land forms (flood plains, low-middle-high terraces) found in Project areas. They do not require expensive equipment although some simple hand/buffalo equipment is suggested. They do not require massive increases in labor supply (labor intensive activities are proposed for small scale introduction only.) Many of the activities proposed have already been adopted by some farmers (although not necessarily in the Project area). All of the above evidence indicates that the modifications proposed do not represent too great a technological jump for Northeast Thailand farmers. Furthermore, the benefit/cost of the Project interventions to the farmer (at 2.1:1) should provide a very satisfactory incentive to adopt them.

## 2. Farming Systems Research

The preceding discussion and others in this Project Paper have indicated that current farming practices in Northeast Thailand involve a considerable range of interrelated activities and that if overall rainfed farm income is to be increased significantly a number of these activities will need to be improved. NERAD proposes a careful assessment of farming systems in project areas in order to identify key constraints and solve local problems to the extent that available technology and resources allow. The Project also proposes some applied, systematic research to be directed at solving important local problems related to the interactions of various farming practices, which can also serve as a basis for future agricultural research and development activities of the MOAC and its various departments. In conducting such activities it is suggested that the Project use the methodologies of the rapidly expanding field known as Farming Systems Research. This type of research (including training) has been defined\* as that which (a) is conducted with a recognition of and focus towards the interdependencies and interrelationships that exist among elements of the farm system, and between these elements and the farm environment; and (b) is aimed at enhancing the efficacy of farming systems through the better focusing of agricultural research so as to facilitate the generation and testing of improved technology. Requirements for this type of systems approach include: (a) team effort across disciplines; (b) clear delineation of the system of interest (e.g. the farm system); (c) perception of objectives of the system itself (e.g. security of income) and of higher-level systems (e.g. social and economic objectives at national and regional levels); (d) anticipation of technical and economic restrictions from within the system itself (e.g. labor supply) and from the system's environment (e.g. cultural or credit constraints to new technology).

As discussed in Annex V, although there is a substantial and growing interest in this type of approach for agricultural research in Thailand, particularly for rainfed areas, there is no one agency within the MOAC which

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\*Farming Systems Research at the International Agricultural Research Centers, published by the Technical Advisory Committee of the CGIAR; (1978).

could be easily identified as the logical location for such research to be conducted. This is due to the division of responsibilities within the MOAC, which is along traditional functional and agricultural commodity lines. Although the Department of Agriculture has recently established a Cropping Systems Division to begin to investigate the interrelationships between various cropping activities, there is still no way to integrate other elements such as livestock, fisheries, and community forestry. Agricultural extension, economic analysis, cooperative organization, land reform and other aspects are also the domain of individual departments.

The MOAC has proposed that the Project follow some of the recommendations of the recently-approved NIDA report on the roles and functions of the Regional Agricultural Offices by locating the NERAD Project Management Office at NEROA, which is the Northeast regional unit of the Office of the Under-Secretary of MOAC. Other than a few key Project staff, however, Project implementation will be performed by personnel of appropriate line agencies who will be assigned from  $\frac{1}{2}$  to full time to NERAD activities.

The farming system assessments and the systematic refinement and implementation of agricultural technology improvements proposed by the Project in order to solve key local problems are sure to identify problems with various available technologies and gaps in current knowledge (see Annex V). The Project will address these problems in one of two ways: (1) For those problems which can be addressed by short-term applied research, the multi-disciplinary staff of the NERAD Project, representing the various MOAC departments and supplemented by local and expatriate consultants, will perform the necessary applied research in Project tambons, or at NEROA or local department facilities if necessary. Selection and monitoring of these activities will be performed by the Project management and technical staff, who will meet regularly to develop and evaluate the progress of this program. (2) Those problems which require longer-term or more basic research will be clearly identified and referred to the appropriate agency of the MOAC for solution as part of their on-going research programs.

These activities will help in the solution of two basic problems: (1) It will provide the multi-disciplinary team necessary to assess farming system constraints and refine technology for solving rainfed agricultural problems in Project tambons. (2) It will provide scientists and

technicians from the various agencies of the MOAC with an opportunity to participate in a highly interactive research and development process aimed at the inter-disciplinary resolution of area-specific problems at sites representing the major range of variation present in the Northeast region. Thus, not only will all relevant agencies be able to contribute their knowledge to this problem-solving process but the various agencies will all benefit by learning more about how their activities interact with the activities of other agencies and the range of problems of individual farmers in the Northeast.

Personnel required for this activity will be provided as technical specialists from the various MOAC departments assigned to the Project staff, with necessary additional services available from local or expatriate consultants. The multi-disciplinary research facilities and equipment of NERCA are available for supporting NERAD activities, and various departments and divisions have additional facilities and equipment located within Project provinces. The Project will have funds to provide additional necessary equipment and supplies, in addition to per diem and travel expenses of personnel.

### 3. Extension

The Department of Agricultural Extension of MOAC is in the midst of an expansion program aimed at providing at least one tambon level agent for each 1,000 farm families. The intent is to more directly provide available technology to farm families in order for the tambon extension agent (TEA) to be effective with this large number of farm families, a training and visit system and a system of contact farmers (Co.F) is being used. The TEA receives training and suggestions for program activities one day each two weeks. He visits his area on a regular schedule during the other days. During his visits his primary contacts are the Co.F. There is one Co.F for each ten farm families in each village. Each Co.F is, in turn, responsible for instructing and informing ten farmers in his area.

While TEA's now have considerable responsibilities, this Project with its heavy emphasis on demonstration and extension trials, village meetings and village and tambon level planning, will greatly increase the responsibilities of the tambon level extension officials. To compensate for this, the Project will provide 14 additional

TEA's for the 8 Project tambons. These supplemental TEAs will provide the necessary man power for carrying out the activities added by the project and continuation of the presently scheduled level of Train and Visit activities. At the same time all TEA's in project tambons will obtain, through formal training and through working with technical support staff, a greatly improved technical background and, through working in the village and tambon planning process, practical training in developmental methodology. This should result in a core of well-trained officials who could be instrumental in future developmental projects of the DOAE. In addition, Specialist Farmers will be chosen among Co.F and other respected villagers for intensive short-term training at NEROA or other suitable training sites. These farmers will thus be better suited to assisting TEAs than the untrained Co.F, and in most cases will be paid to help, giving them an incentive for cooperation.

The Project reliance on the use of these minimally trained and generally inexperienced officials (by U.S. standards) represents a calculated risk. The odds are mitigated by providing extensive training and a considerable amount of technical support through the Project. With these mitigating circumstances the risk appears justified. Experience has shown that relatively poorly trained technicians, if properly motivated and supplied with administrative and technical support, often perform nearly as well as more highly trained individual. Further, the use of officials with this level of training is required if the Project is to be considered replicable on a wider scale.

#### 4. Availability of Inputs

The Project requires little or no inputs that are not now available in the region. While there will be considerable intensification of input use in the Project area the total area involved is not large enough to affect national requirements significantly except possibly for certain varieties of seed or planting stock.

a. Fertilizer. Fertilizer was found to be readily available in all Project provinces except Nakhon Phanom. The low supply in this area is probably a reflection of low demand and would probably be solved if the private dealers and government organizations involved in fertilizer distribution received reasonable assurance of a market. The Project will provide organizational support for

group purchasing activities by farmers if needed. Some changes in the usage of fertilizers which are available may be needed for obtaining the highest possible fertilizer efficiency, but exactly what changes are needed cannot be specified until more complete information on soils and appropriate cropping patterns is developed early in the Project. In discussions, fertilizer dealers indicated that they could supply whatever is needed given sufficient lead time. It is expected that the district level meetings planned under the Project between tambon leaders, merchants and district officials should help assure selection of appropriate inputs and their availability.

b. Credit. The Project is not designed to require massive infusions of credit, although some additional credit for fertilizers and for increased production of dry-season high-value crops will be needed. Discussions with BAAC and private banks indicated that credit availability would likely be adequate, and the Project will facilitate organization of farmers for group credit arrangements when necessary. The general approach of the Project will minimize the need for credit since it stresses incremental adoption of suggested practices. This provides for either financing of inputs out of previous profits or for providing a sound basis for obtaining credit. Also farmers will receive training from TEAs in the proper use of input credit as a part of the Project. Credit availability is further discussed in Annex VI (Economic Studies).

c. Livestock Inputs (Vaccines, Feed). Vaccines for large animals are available only through the MOAC's Department of Livestock Development. The large animal vaccines to be administered under this Project are not new and they are in good supply, so the relatively modest increase under the Project in their use in only 05% of the villages of the Northeast can be easily absorbed by the DOLD. In the past, it has not been lack of vaccine that has constrained its use but the distribution administration of the vaccine, and that problem is being addressed by the Project through the specialist farmers and training components. Vaccine for chickens is available from DOLD and the local markets and should not be a constraint under the Project. Sources of feed will be supplemented for chickens and other livestock through the hamata seed distribution component. Moreover, the Specialist Farmer in each village concerned with the native poultry component of the Project will receive training in poultry nutrition and sources of supplemental feeding materials.

d. Seed Stock. Farmers often mention their lack of access to improved seeds as an important constraint to using them. The Project will address this constraint for rice and field crops by linking up with the several MOAC programs for supplying high quality seeds. Where necessary and feasible, seed stocks will be increased at the village level by farmers trained in the basics of seed multiplication. Seeds of high value crops for dry season planting may be more of a problem but the crops envisioned at this time are already grown in the Northeast and have established sources of supply. When a crop new to an area is introduced, the Project will supply seeds for initial demonstration or extension trials. Later the Project will schedule meetings with merchants and arrange for group purchases until local sources of supply are established. The project implementation sequence of research trial, demonstration trial and extension trial combined with farmer training in seed multiplication will avoid the necessity for large scale provision of seeds from sources outside of the Tambon in all cases where seed can be safely multiplied by farmers. To supplement this approach it is also planned that this Project element be closely coordinated with the proposed Seeds II Project which is partially aimed at increasing the availability of suitable vegetable seeds.

e. Fish stock required under the Project can be supplied by the Fisheries Department but it may not be able to supply sufficient fingerlings on a timely basis for all locations where these will be needed. Provision accordingly is being made under the Project for training and assisting farmers in the production of fingerlings from fish seed. Similar training programs for farmers have been conducted periodically in the past by provincial fisheries station personnel and these are therefore not expected to be a problem to develop under the Project. Furthermore, although fish seed production is generally earmarked each year from the seven Northeastern provincial fisheries stations, all stations generally exceed their quotas (in FY 80 by 5% to 111%); thus permitting allocations to other priority demands. New projects which could increase hatchery supplies dramatically are under consideration by OECF, and this subject may also be addressed under the proposed Fish Ponds II Project scheduled for FY 82. Even if RTG supplies are inadequate to meet this Project's demand, however, there is some indication (e.g. in the Auburn University pre-design study of VFP II done in November, 1980) that fish seed not provided by DOF could be provided by the private sector.

which is gradually increasing its capability to produce fish seed in the Northeast.

f. Improved Mulberry Seedlings are probably not available in sufficient quantities from the four sericulture experiment stations serving the 8 tambons for the amount of improved plantings planned. However, the Project includes a component for training and assisting villagers in the establishment of nurseries for production of improved fruit and tree crops including rootrot resistant mulberry cultivars. In areas where silk production is important, it is expected that farmers will want to concentrate initially on mulberry production, and they will be encouraged to do so. Sericulture training will also include training in mulberry grafting techniques and proper cultivation. Technical recommendations obtained from the comprehensive evaluations of the Sericulture Project will be incorporated where appropriate.

g. Household poultry improvement provides for a small (approximately 5,000 male birds over the life of the Project) introduction of improved stock. These birds are readily available and can, if necessary, be produced using the facilities of NEROA.

h. Pesticide Use. While pesticides are not widely used in Project areas except for dry-season high-value crops, the design team found that when they are used they are often misused. The use of one insecticide for all purposes or the use of an insecticides when a fungicide is needed is not uncommon. Proper precautions for the safety of the applicator, other farm workers or consumers are not generally known. Improvement of farmer knowledge about proper pesticide use is viewed accordingly as an important component of the Project. In addition, the Project should result in increased use of pesticides, especially in three types of cropping system changes:

(1) Emphasis on high-yield rice production on the more favorable rice lands may increase pesticide use on rice.

(2) Emphasis on increased legumes and grain crops will increase pesticide use because pesticides are often required for seasonable production.

(3. Emphasis on increased production of high-value dry-season crops will increase pesticide use because pesticide use is essential for most of these crops.

The Project proposes to supply inputs for demonstration and extension trials in the Project areas and appropriate pesticides will need to be included in the input packages in some cases. Hence USAID regulations concerning pesticide use must be observed. The Project proposes a maximum total of more than 2,300 demonstration trials covering approximately 380 hectares and 5,400 extension trials covering 1,300 hectares or a total of 1,680 hectares. It is estimated that approximately 20% of these trials covering approximately 12% of the area or a total of 200 hectares will need to be treated with pesticides. Demonstration trials will begin in year three of the project and extension trials in year four. These will be preceded by research activities in year two. Pesticides to be used will be selected by MOAC technical support staff and contractor staff in conjunction with a short-term plant protection specialist to be furnished by DS/AGR (AID/W). This planning will take place during the middle to latter part of the year so that selected pesticide can be tested during the year two research. Pesticides not registered by EPA will be used in demonstration and extension trials only if data is available or can be obtained which conclusively proves that they are more efficacious and equally or less hazardous than EPA registered pesticides. (Note: This component was planned with reference to AID/W advice contained in STATE 032150.)

##### 5. Training

The Project has a large component of farmer training both at locations away from the tambon and within the tambon. Training within the tambon will be provided by regular DOAE personnel, DOAE personnel added by the Project and other Project personnel. Facilities and equipment provided by the Project include a tambon meeting place, audio visual equipment, a mobile training unit, radio broadcasts, and publications. Training outside of the tambon for Project personnel and for specialist farmers will utilize MOAC facilities at NEROA and, where more appropriate, at other MOAC stations or locations in the Northeast. Discussions with MOAC officials indicated that these training center and dormitory facilities and personnel could be made available providing that the training costs (travel and per diem, training materials and other supplies) were provided by the Project.

The Project will require a considerable effort in the development of training curricula and materials. To help assure the manpower for this effort, the Project provides for new MOAC positions of equipment specialist and artist. The technical assistance component provides for an expatriate training specialist (2-year term) and for a local consultant in non-formal education.

#### 6. Marketing

Marketing of inputs and produce is primarily a private sector activity in Thailand. Most evidence indicates that the private sector marketing apparatus in rural areas is both efficient and competitive (e.g. 1980 Chulalongkorn University Marketing Study; 1980 IBRD Agricultural Development Strategy Review). However, there are also indications that monopsonistic marketing practices exist in localized areas (e.g. AID NESSI Project Social Analysis Survey), and that marketing of some perishable crops and newly introduced crops is likely to be a problem in at least some areas unless special care is given to strengthening marketing linkages to the private sector.

Besides private merchants, there are a number of cooperatives that engage in marketing of supplies and farm products, but as of 1980, only about 15% of the farm population was served by cooperatives and most of these were not full-service cooperative but only dealt with selected marketing and/or other functions.

National pricing and export policies do affect the market prices of present and potential crops, but Project activities are generally directed towards improvement in production of products for well-developed national marketing systems and for which little marketing assistance will be required under the Project. With regard to rice, the RTG recently increased the support price of paddy by 25% and early evidence suggests that the increase has been very favorably received by farmers and that the Government is serious in implementing it. Purchasing, storage is being done through the private sector rice millers. Expanded production of dry-season, high-value crops in the Project areas will, however, need to be carefully coordinated with market availability and/or development. At present farmers have no reasonably satisfactory way of estimating the market/price situation at harvest time for these crops. This is an especially acute constraint for highly perishable crops.

It should be noted that under rainfed conditions marketing considerations are not likely to be as critical as for irrigated agriculture since yield/area potentials are not the same. However, the Project has several components directed at addressing potential marketing constraints and these include (a) marketing surveys (for perishable commodities), (b) marketing newsletter for farmers and Project personnel, (c) linkages with the private sector at the district level through Project sponsored meetings with merchants to discuss input needs and marketing requirements, (d) radio programming on market issues, (e) the Cooperatives Development Department of MOAC will provide a professional to the Project to help identify constraints of existing local cooperatives and help resolve them. In addition, should certain supplemental services such as transportation of goods be required to facilitate initial marketing efforts on special cases, the Project can consider assisting these from contingency funds.

#### 7. Road Improvement

In order to limit interventions to only those considered essential to the Project Purpose, no road improvement work is planned under the Project. This decision was based on several factors: (a) several active RTG programs (including the Employment Generation Program, New Village Development Program, and Provincial Development Program) are concentrating on infrastructure projects such as improving farm to market roads, and tentative plans under these programs already call for road improvement in several of this Project's tambons, including Nathom and Tae where road improvement is most needed; (b) The populations of all of the target tambons (excepting Na Thom) are on the average within the generally accepted zone of influence (4 km.) of an all weather road; (c) the NERAD socioeconomic survey indicated that people's desire for the RTG to improve roads in the 8 tambons was relatively low less than 5% of people requesting assistance, except for Na Thom and Tae, where 28% and 13% of the populace wished to have roads improved, respectively; (d) Every tambon and village has adequate access to markets during the dry season when marketing requirements would most increase under the Project; (e) Road maintenance is generally poor for farm access roads. This problem would affect any improvements done under the Project since maintenance funds for these small, earthen roads simply do not exist, and traffic volume does not justify upgrading these roads to low-maintenance type roads.

Despite the exclusion of roads from Project funding, however, should lack of good roads develop to be a significant constraint to the Project Purpose every effort will be made to encourage the RTG to improve any problem roads within other ongoing development programs. If all else fails, contingency funds may be considered for minimum essential road improvement work. A covenant to the Project Agreement will be negotiated to help assure priority attention to roads whenever necessary.

8. Engineering Feasibility

a. Engineering Arrangements

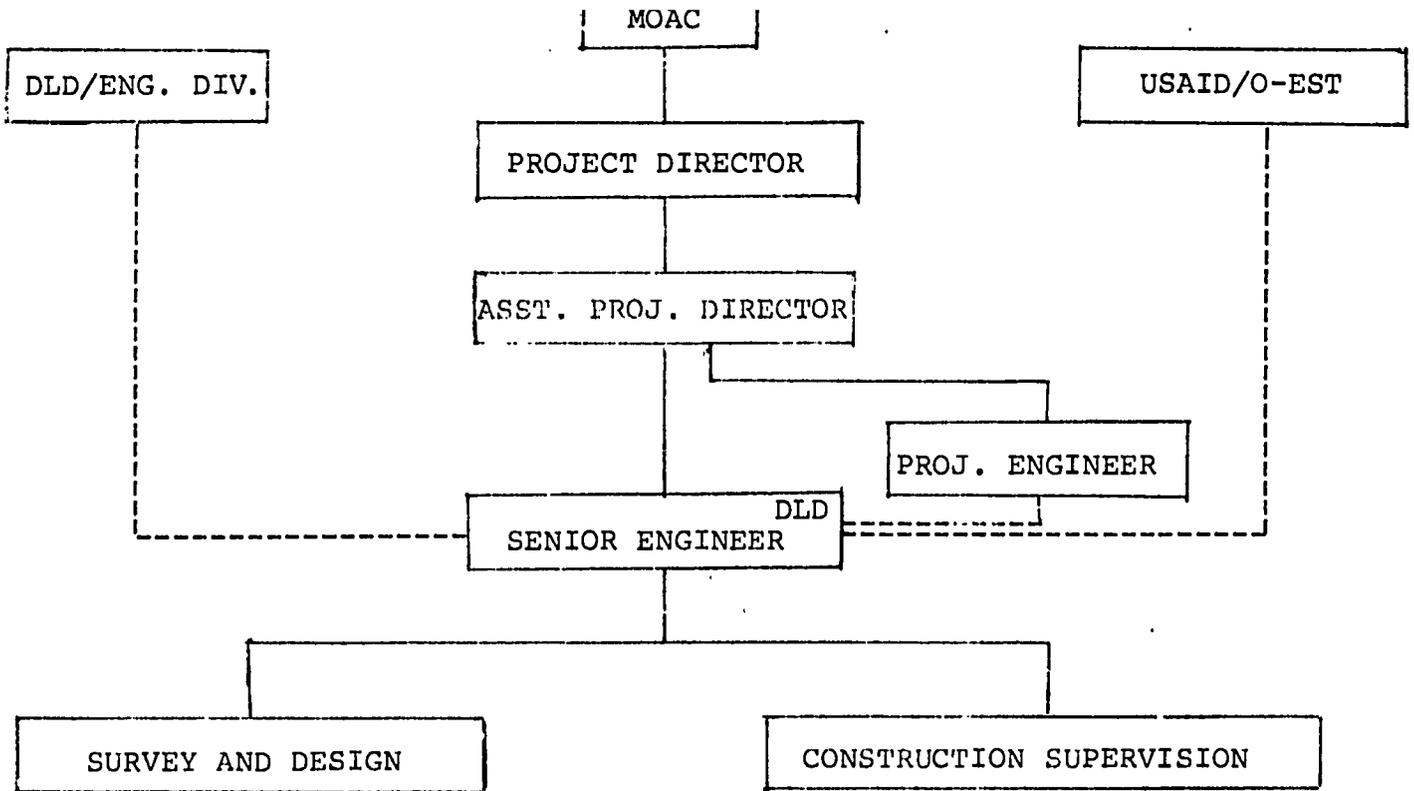
Project components requiring engineering design and supervision input are the water resource modifications, land modifications and facilities construction. For all of these elements it was decided that a single agency, the Department of Land Development (DLD) of MOAC, should assume responsibility for construction activities in order to provide unified control. DLD has wide experience in these areas and last year (1980) constructed 367 water improvements (221 by force account and 146 by contract). DLD is also the designated RTG agency for land shaping and small scale water resource activities.

DLD plans to provide a survey and design team to the Project beginning in year one, and to follow up with designation of a construction supervision team and two additional inspectors beginning year two when construction activities are scheduled to begin. To coordinate the work and provide liaison with the Project, DLD will assign an experienced, senior engineer full-time to the Project who will be stationed in the Northeast. All other technical expertise will be hired especially for the Project to assure their full-time commitment. (Figure III-C shows Organization Chart.)

As in other recent AID projects, all construction services for the water resource activities will be contracted from local, experienced contractors which are in good supply in the Northeast. It is planned that land shaping and terracing will be done by DLD force account because of the need to work closely with farmers on this component.

The above arrangement represents an improvement over existing procedures. Up to now DLD has not stationed engineers in the field but has relied on temporary

FIGURE III-C - ORGANIZATION CHART  
FOR CONSTRUCTION ACTIVITIES



———— line of supervision  
----- line of coordination/liaison

support from Bangkok. This Project will thus result in an important first step toward decentralizing DLD's engineering services in accordance with RTG policy and the real need for field expertise. DLD accordingly plans to observe this innovation closely for possible further replication elsewhere in the country.

b. Technical Feasibility Concerns

For a project of this nature, comprising a number of small-scale infrastructure components whose final locations and specifications cannot reasonably be determined until implementary organizations are in place, it is not possible in the PP to provide designs for every sub-project. This will be done on a rolling basis during Project implementation. The PP's approach to engineering feasibility has accordingly been (1) to determine feasible sites for interventions, (2) to determine average costs for each construction component based on current unit costs in the areas and utilizing standard RTG construction specifications, and (3) develop a sound approach and organizational basis for implementation.

The following is a brief description of what is entailed in designing/constructing the various water resource elements of the Project. Figure III C-1 and III C-2 give illustrative examples of each water resource component.

(1) Pond Rehabilitation. In the Northeast certain inundated areas which are not free draining, have over a long period of time filled in with silty material or clay which forms an impervious blanket. This blanket seals the pond bottom so that seasonal run-off waters are held in the pond. Too often the ponds are of insufficient depth to serve the agricultural and other needs of local farmers. In rehabilitating these ponds a study must be made to determine how much the pond can be deepened without breaking through the blanket and allowing the water to return to the ground water system. Depending on the run-off area, it is often possible to put in a minor dike formed of the excavation materials to give additional storage capacity. Generally speaking, however, the rehabilitation work is to remove material from the bottom of the pond to increase the depth of the impounded water and temporarily decrease the weed growth. Pond rehabilitation is not difficult, however the engineering study must be carefully done to ensure construction work will not imperil the existing resource.

(2) Embankment Structure (Dike). This is a storage pond which is formed by taking advantage of natural slopes which direct run-off waters to the pond area, and constructing a dike to hold those run-off flows for latter dry season use. A study must be made to determine that the proposed pond bottom is relatively impervious. This being the case it is sometimes possible to utilize a combination of digging materials from the proposed pond bottom and using these materials to form a homogeneous embankment. Often, however, the materials are not structurally sound and materials must be imported to construct the dike. A close estimate of cost can be developed when the haul distance is known. If impervious soils are expensive to bring to site a zoned embankment can be designed where the expensive impervious soils are only utilized in the central section of the dike. The run-off area must be calculated so the spillway may be designed to discharge excess flood run-off and prevent breaching of the dike. For this and numerous other reasons, each site requires a thorough engineering study. Each project has to be individually designed based on site conditions including soils, and potential run-off during heavy rainy seasons.

(3) Submerged Embankment (Dikes). These projects are constructed in areas which are periodically deeply flooded. The concept is to build a dike to retain water in selected areas after flood waters recede. The structure, which is under water during floods, must be carefully designed for similar reasons to those noted in (2) above, but design must also take into account the pressure which develops as waters recede from one side of the embankment as the flood waters diminish. The rate of the drop in elevation determines the pore pressure which develops, and the embankment must be designed to withstand these forces. High forces could require very expensive construction and may preclude economic viability of a project. However, if the water recedes slowly, a less expensive structure can be successful. Here again, each project requires a complete engineering study.

(4) Filter Systems and Wells

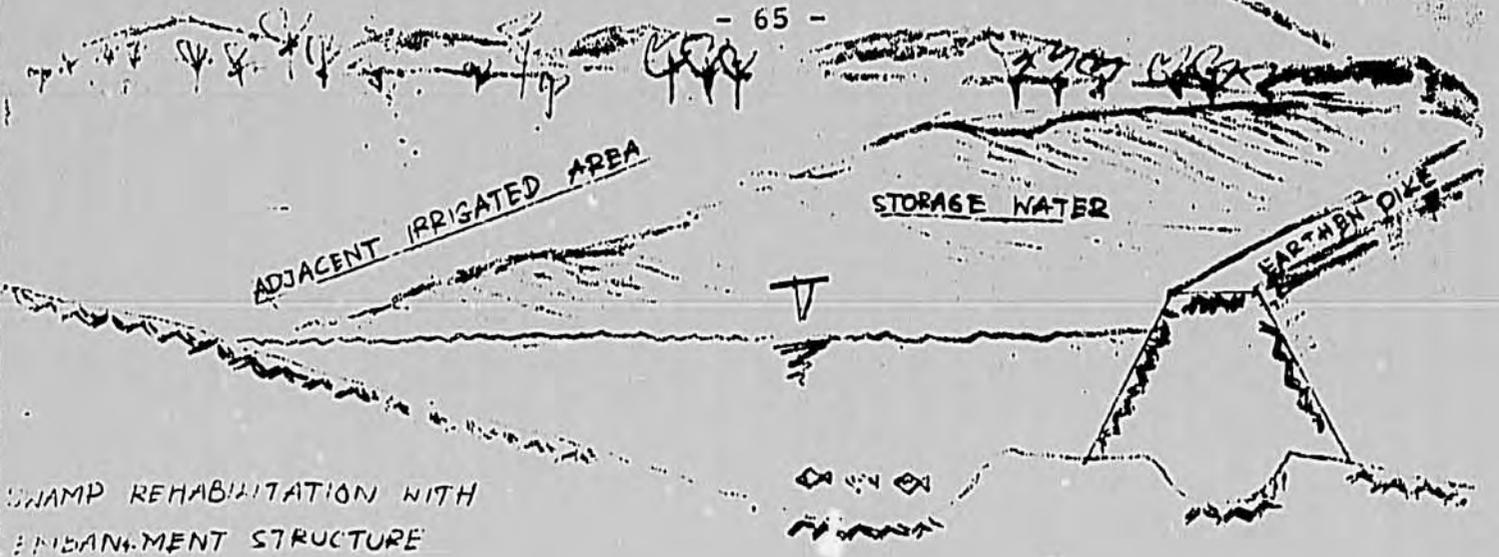
Filter systems will be generally composed of a filter box arrangement of sand/gravel/charcoal connected to an inlet pipe and outlet pipe to a storage well. These systems are easily constructed by local villagers with some minor technical assistance from the technical engineering staff. Likewise shallow wells are

commonly constructed by the farmers themselves and the Project will only assist in helping them determine good locations and will provide concrete rings to prevent cave-ins of the wells.

The engineering cost estimates for design of the universe of projects now proposed are considered adequate to assure that necessary engineering will be applied to each and every project. (See Annex IX for cost estimates and supplemental Annex V-J for derivations). The provision of services also assure that adequate supervision will be provided to insure that the construction is of the quality specified.

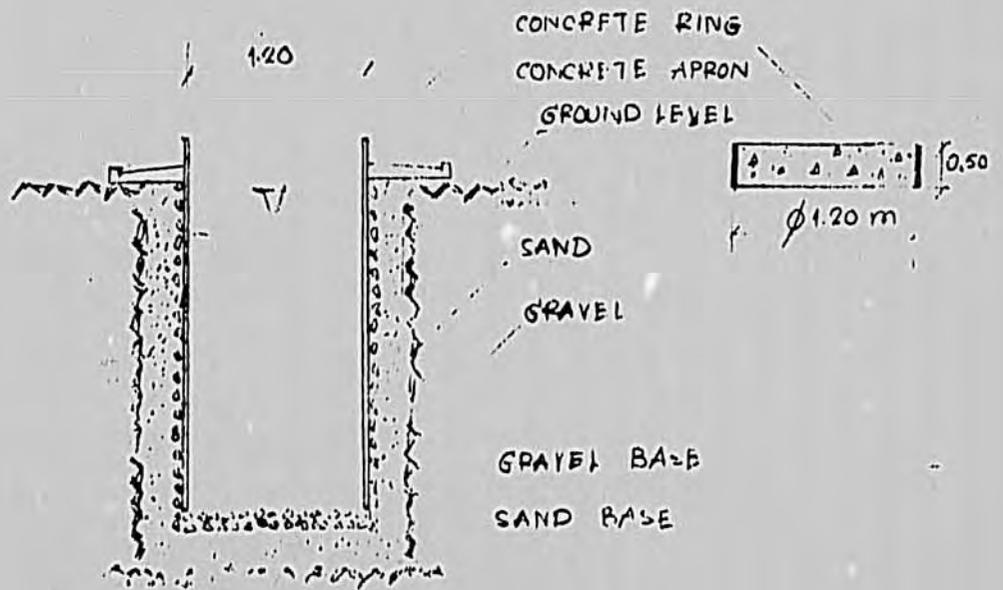
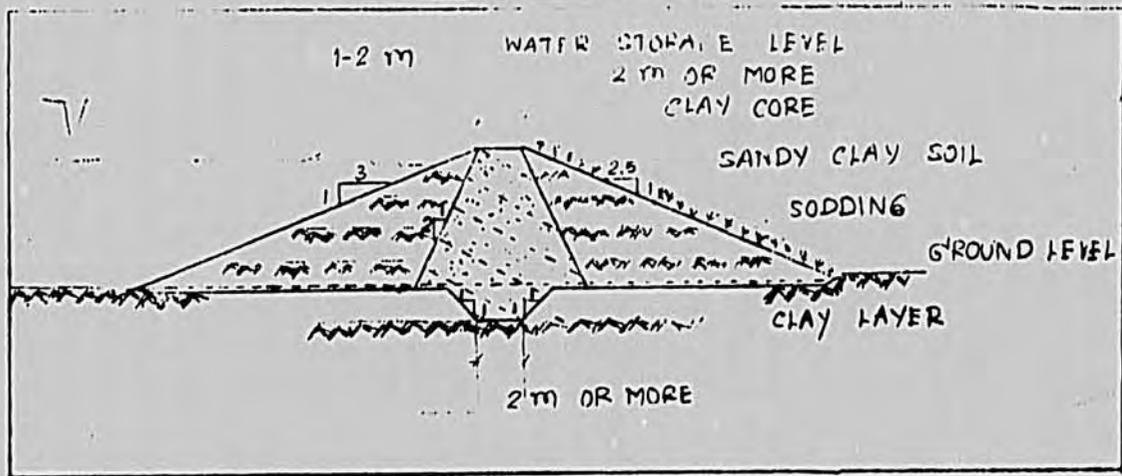
Local contractors are available in the Northeast to accomplish the construction work. They are capable of quality work as long as provision is made for competent engineering quality control. This, as noted above, is built into the Project plans. The cost of construction of "average" water impoundment is included in Annex V-J and this provides a reasonable basis for the cost estimates for this Project. Data includes construction costs of the Fish Ponds I Project; an on-going USAID/Thailand Project. Data also includes cost experience drawn from various construction agencies of the RTG including the recent experience of DLD in the Northeast. Costs for wells and water filter systems are detailed in Annex V-J.

The above procedures and estimates are considered adequate to satisfy FAA Section 611 requirements on this type of development project. Construction plans and specifications will be available as decisions are made as to where each of the impoundments are to be constructed, and as the site-by-site studies are carried out during the life of the Project. (Supplementary Annex V-J provides additional detail on engineering feasibility concerns).



SWAMP REHABILITATION WITH EMBANKMENT STRUCTURE

ILLUSTRATIVE EARTHEN DAM



FILTERED SHALLOW WELL

BEST AVAILABLE DOCUMENT

LARGE FLOODED AREA

SUBMERGED DIKE

BEST AVAILABLE DOCUMENT

FLOODED WATER RECEDES

FLOODED WATER LEVEL

WATER LEVEL STORAGE

SUBMERGED DIKE

STORAGE WATER

EMBANKMENT DAM

INTAKE

CULVERT

PIPER

PIPER

PIPER

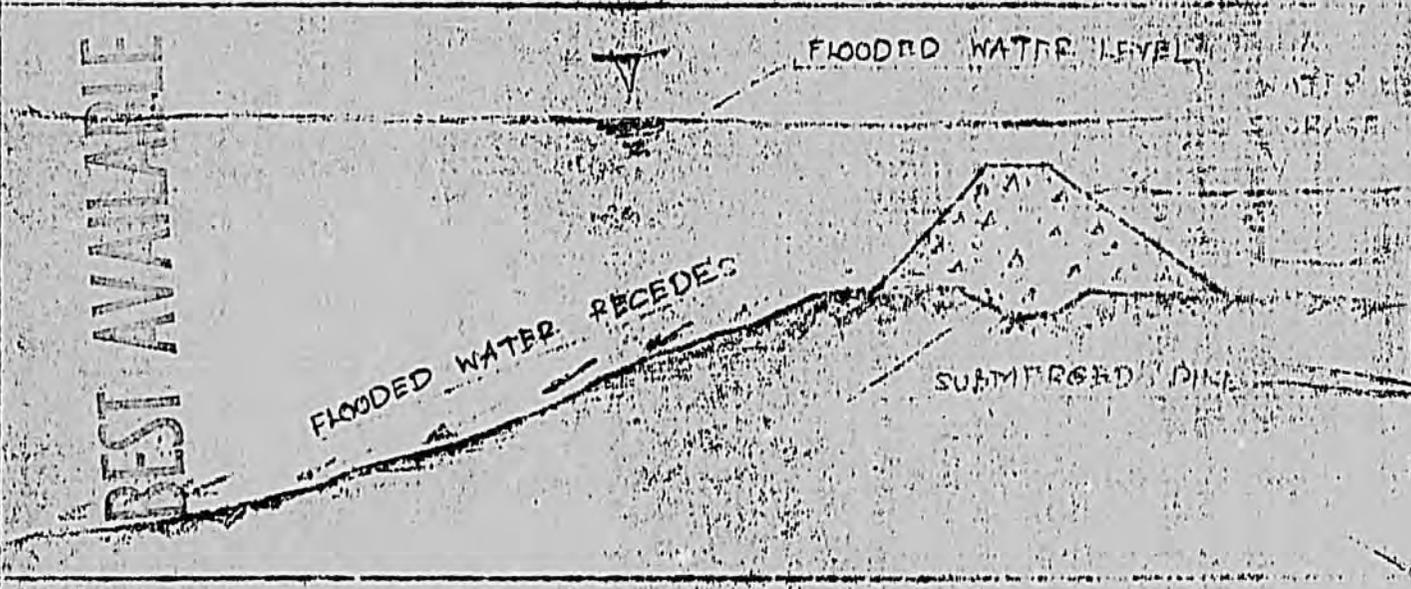
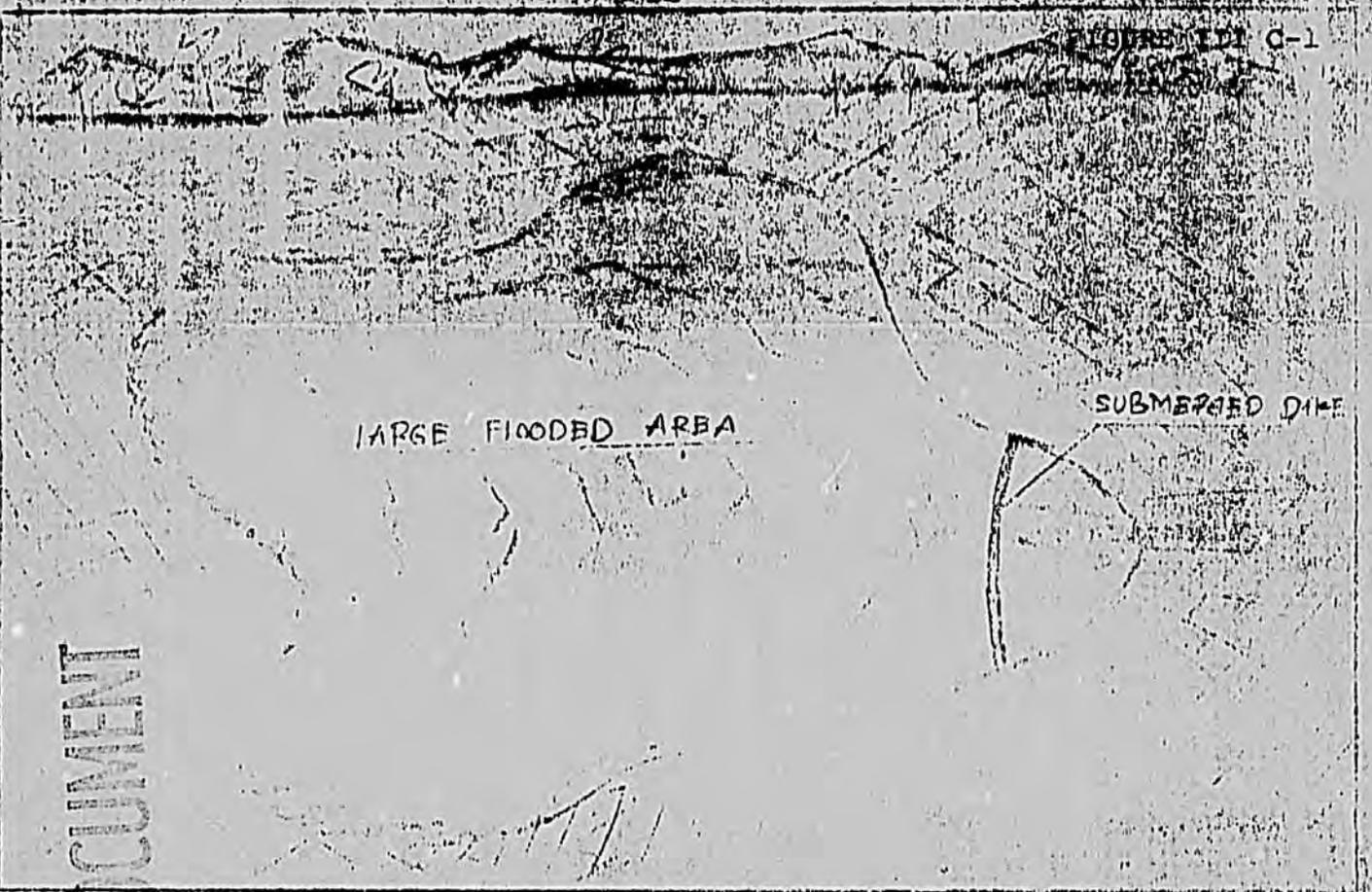
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D. Financial Plan and Arrangements

1. General

The total life of project cost for NERAD is \$16.0 million. This total does not include costs for land or labor contributed by villagers for the various subcomponents nor does it include a cost for many RTG personnel who will be indirectly associated with the Project in their regular jobs. Despite these omissions, the expected Thai contribution to the Project, at \$6.0 million, represents about 40 percent of total costs. It is proposed that AID provide a loan of \$6.3 million and a grant of \$3.7 million to finance the remaining costs of the Project.

2. Financial Contributions

a. AID Contribution

Figure III-E-1 shows the Project components divided into their respective input packages and proposed funding sources, and Figure III-D-2 shows the summary annual budget. AID's contribution is attributed to foreign exchange costs (i.e., expatriate consultants and U.S. vehicles), local capital costs (construction and associated engineering services, equipment purchases), and other interventions that represent important innovations under the Project (some survey and planning activities, training, farmer rewards, farmer seminars/excursions, composts subsidies, new agricultural support services, demonstrations and research, economic studies support). The AID assistance will also be used to provide necessary funds for per diem and travel for RTG support personnel and to provide production inputs, and will be used to hire local consultants to support the Project.

AID grant funds are proposed for the technical assistance component, U.S. vehicles, demonstration/research activities, economic studies support, evaluation activities. These activities are proposed for grant funding because they either do not have easily quantifiable benefits, tend to be high risk or high cost components, or (in the case of vehicles) will be restricted to U.S. source/origin.

b. RTG Contribution

The RTG is financing all local support costs for consultants, all operational costs (office supplies, POL, utilities, maintenance, etc.), and is defraying all costs for salaries of Project personnel (excepting engineering services and consultants). In addition it is planned that the RTG will contribute 50 percent of the costs of water resource development and will purchase all two-wheel drive vehicles under the Project in order to allow purchase of locally assembled pick-up trucks, which are the RTG's vehicles of choice. All identifiable local taxes and fees applicable to AID financed goods and services will be either exempted by the RTG or paid from the RTG contingency fund.

c. Cost Sharing

Cost sharing inputs from the farmers are not shown in the financial plan. Farmers are expected to provide all inputs except cement rings for wells, and to provide free labor for demonstrations and extension projects where they will reap the benefits. The water resource development components offer other possibilities for farmer cost sharing, including (for example) provision of labor for weeding swamps, planting grass on embankments for stabilization and contributions of community land when necessary. These will be investigated during early Project implementation. A Condition Precedent to construction activities calls for plans for the cost sharing arrangements for this Project activity, and these will be periodically reviewed during Project implementation. For water resource development sub-projects, at a minimum the local beneficiaries will be expected to provide funds/labor necessary for routine maintenance. Costs for soil and local improvements from Project years 4-7 (except for compost demonstration) will be shared between the RTG and farmers on an expected 25%/75% basis, but all costs are shown in the RTG budget column for these years.

d. Evaluation Cost

Due to the five year statutory limitation on disbursement for grant funds, the evaluation scheduled for year 7 under the Project cannot be funded with the FY 81 or 82 grant, and PDS funds will be sought for the Project's final evaluation. This cost is not shown in the budget. Evaluation costs shown in Figures III-D-1 and 2 are based on up to four mini evaluations/studies to be conducted in years 1, 2, 3, 5, 6 and an in-depth evaluation scheduled for year 4.

C. Revised Budget

Figure III-D-1  
NERAD Financial Plan  
By Project Component and Category of Assistance

(\$1,000's)

Project Component	AID Loan		AID Grant		RTG Agencies		Total
	FX	LC	FX	LC	MOAC	DTEC	
a. <u>Technical Assistance/Liaison</u>	-	-	2,310	-	-	925	3,235
b. <u>Admin/Technical Support</u>							
(1) Compensation/Travel	15	420	-	-	790	-	1,225
(2) Operating Expenses	-	-	-	-	465	-	465
(3) Equipment	35	100	-	-	-	-	135
(4) Vehicles	-	-	40	-	125	-	165
(5) Construction & Furnishings	-	225	-	-	-	-	125
Sub-Total	50	745	40	-	1,380	-	2,115
c. <u>Cropping Systems</u>							
(1) Farmer Training	-	65	-	-	-	-	65
(2) Production Inputs	-	420	-	-	-	-	420
(3) Seminars/Excursions	-	10	-	-	-	-	10
(4) Wages/Travel	-	290	-	-	-	-	290
(5) Technician Support	-	45	-	-	120	-	165
(6) Storage Room Construction	-	70	-	-	-	-	70
(7) Rewards	-	10	-	-	-	-	10
Sub-Total	-	910	-	-	120	-	1,030
d. <u>Farming Systems</u>							
(1) Farmer Training	-	45	-	-	15	-	35
(2) Production Inputs	-	415	-	-	90	-	355
(3) Seminars/Excursions	-	15	-	-	-	-	15
(4) Wages/Travel	-	80	-	-	80	-	60
(5) Technician Support	-	65	-	-	85	-	130
Sub-Total	-	625	-	-	270	-	895
e. <u>Soil/Land Modification</u>							
(1) Compensation/Travel	-	15	-	-	50	-	65
(2) Operating Expenses	-	-	-	-	210	-	210
(3) Tractor/Vehicles	110	-	-	-	10	-	120
(4) Compost Subsidy	-	-	-	40	-	-	40
Sub-Total	110	15	-	40	270	-	435
f. <u>Extension Support</u>							
(1) Training	-	105	-	-	-	-	105
(2) Compensation/Travel (TEAs & Support Staff)	-	135	-	-	160	-	295
(3) Operating Expenses	-	-	-	-	190	-	190
(4) Equipment	-	45	-	-	-	-	45
(5) Motorcycles	-	15	-	-	-	-	15
(6) Construction & Furnishings	-	250	-	-	-	-	250
Sub-Total	-	550	-	-	350	-	900

C. Revised Budget

Project Component	AID Loan		AID Grant		RTG Agencies		Total
	FX	LC	FX	LC	MOAC	DTEC	
(\$1,000's)							
<u>Other Agricultural Support Services</u>							
(1) Market Meetings	-	45	-	-	-	-	45
(2) Newsletter	-	220	-	-	-	-	220
(3) Weather Data	-	80	-	-	-	-	80
(4) Soil Survey - Land Use Planning	-	75	-	-	-	-	75
(5) Soil Testing	-	25	-	-	-	-	25
Sub-Total	-	445	-	-	-	-	445
<u>Water Resources Development</u>							
(1) Engineering Support	-	250	-	-	-	-	250
(2) Swamp Rehabilitation	-	370	-	-	370	-	740
(3) Embankment Structures	-	300	-	-	300	-	600
(4) Submerged Embankments	-	100	-	-	95	-	195
(5) Water Filter Systems	-	-	-	-	5	-	5
(6) Shallow Wells	-	70	-	-	70	-	140
(7) Other Improvements	-	75	-	-	75	-	150
Sub-Total	-	1,165	-	-	915	-	2,080
<u>Demonstration and Research</u>							
(1) Compensation/Travel	-	-	-	35	15	-	50
(2) Supplies/Equipment	-	-	-	115	-	-	115
(3) Wages/Travel	-	-	-	105	-	-	105
(4) Construction	-	-	-	10	-	-	10
Sub-Total	-	-	-	265	15	-	280
<u>J. Economic Studies Support</u>							
(1) Studies	-	-	-	100	45	-	145
(2) Supplies/Printing	-	-	-	25	-	-	25
(3) Wages	-	-	-	95	-	-	95
Sub-Total	-	-	-	220	45	-	265
<u>k. Evaluation/Monitoring</u>							
(1) Consultants	-	-	100	50	-	50	200
(2) Compensation/Travel	-	110	-	-	135	-	245
(3) Supplies/Equipment	-	15	-	-	-	-	15
Sub-Total	-	125	100	50	135	50	460
Sub-Total All Components	160	4,580	2,410	575	3,500	940	12,220
Contingency		285		30	350	100	765
Inflation 10%	1,275		685		1,155	205	3,315
Grand Total	6,300		3,700		4,900	1,300	16,300

c. Revised Budget

(\$1,000's)

	Year							Total
	1	2	3	4	5	6	7	
<b>A. <u>Grant</u></b>								
1. Technical Assistance	420	535	500	365	290	-	-	2,110
2. Liaison Officer	25	50	50	50	25	-	-	200
3. Demonstration/Research (including compost subsidy)	5	20	80	85	90	40	-	320
4. Economic Studies	20	40	40	40	40	40	-	220
5. Evaluations	10	10	10	100	10	10	-	150
6. Vehicles	40	-	-	-	-	-	-	40
<b>Grant Sub-Total</b>	<b>520</b>	<b>655</b>	<b>680</b>	<b>640</b>	<b>455</b>	<b>90</b>	<b>-</b>	<b>3,040</b>
<b>B. <u>DTEC Counterpart</u></b>								
Consultant Support	155	230	195	215	145	-	-	940
<b>C. <u>Loan</u></b>								
1. Admin. Support	320	120	85	65	75	70	60	795
2. Cropping Systems	10	155	180	150	140	140	135	910
3. Farming Systems	15	50	150	135	90	95	90	625
4. Soil/Land	-	115	10	-	-	-	-	125
5. Extension Support	40	340	45	50	35	25	15	550
6. Other Ag. Services	170	45	45	45	45	45	50	445
7. Water Resources	85	395	480	185	20	-	-	1,165
8. Monitoring	10	15	20	20	20	20	20	125
<b>Loan Sub-Total</b>	<b>650</b>	<b>1,235</b>	<b>1,015</b>	<b>650</b>	<b>425</b>	<b>395</b>	<b>370</b>	<b>4,740</b>
<b>D. <u>MOAC</u></b>								
1. Admin. Support	225	190	195	195	195	190	190	1,380
2. Cropping Systems	10	20	20	20	20	20	10	120
3. Farming Systems	5	10	10	35	70	70	70	270
4. Soil/Land	-	50	45	50	50	40	35	270
5. Extension Support	10	50	60	60	60	60	50	350
6. Other Ag. Support	-	-	-	-	-	-	-	-
7. Water Resources	5	315	420	155	20	-	-	915
8. Demon/Research	3	3	3	2	2	2	-	15
9. Econ. Studies	7	7	7	8	8	8	-	45
10. Monitoring	15	20	20	20	20	20	20	135
<b>Sub-Total MOAC</b>	<b>280</b>	<b>665</b>	<b>780</b>	<b>525</b>	<b>385</b>	<b>350</b>	<b>315</b>	<b>3,500</b>
<b>Total All Components</b>	<b>1,605</b>	<b>2,785</b>	<b>2,670</b>	<b>2,050</b>	<b>1,470</b>	<b>895</b>	<b>745</b>	<b>12,220</b>
Contingency	100	180	140	110	100	75	60	765
Inflation 10%	-	280	560	680	680	545	570	3,315
<b>Grand Total</b>	<b>1,705</b>	<b>3,245</b>	<b>3,370</b>	<b>2,840</b>	<b>2,250</b>	<b>1,515</b>	<b>1,375</b>	<b>16,300</b>

### 3. Cost Components

All costs shown in Figure III-D-1 were based on 1980 prices and are considered reasonable and firm. Annex IX contains more detailed breakdowns of each category. A 10 percent inflation factor was added for each year of the Project. A 10 percent contingency was also added to all funding categories except for the grant, which only has a 3 percent contingency since adequate flexibility already exists within the technical assistance budget to meet possible contingencies

### 4. Financial Arrangements and Procurement Plan

#### a. Technical Assistance

The RTG through DTEC expects to contract with the University of Kentucky to provide all the necessary expatriate technical assistance (except for evaluation services and liaison officers) under the Project. Since U.K. has already been contracted by AID under collaborative assistance arrangements for Project design work, no difficulties are expected in obtaining an early contract. AID will provide a direct letter of commitment to U.K. to finance the foreign exchange costs of services and associated supporting equipment estimated to cost \$2.19 million dollars over a five year period for 14.8 person years of long term assistance and 43 person months of short-term assistance.

Local technical assistance, estimated to cost \$100,000 for about 124 person months, and the services of technical liaison officers (\$320,000 for 8 person years), also will be procured through DTEC under a separate contract. AID expects to finance these costs through either a direct payment or cost reimbursement arrangement. Local support costs for the above services will be financed by DTEC.

#### b. Equipment/Vehicles

It is planned that all loan-financed equipment will be purchased through a procurement agent for the MOAC. This arrangement will facilitate the procurement process which has often been delayed in the past due to the unfamiliarity of many MOAC agencies with international

procurement procedures. Total cost for loan-financed equipment needed under the Project is about \$305,000.

The RTG does not exempt taxes or duties on loan-financed imports so arrangements will be made to have MOAC reimburse local importers for all identifiable taxes on imported equipment. MOAC can directly pay customs and other fees for off-shore suppliers who do not have local agents.

Procurement of U.S. vehicles has been a chronic problem in Thailand since no suitable two-wheel drive utility vehicles manufactured in the U.S. are available. RTG agencies accordingly prefer to use small Japanese right-hand drive pickup or jeep type vehicles that are partially manufactured in Thailand and that have a strong dealer network and readily available spare parts and maintenance throughout the country. To avoid the need to import unsuitable U.S. vehicles, the sixteen pick-ups and one minibus proposed under the Project will be procured by the RTG using their own resources.

Four jeeps will also be procured under the grant and these are proposed to be AMC CJ-8 vehicles under proprietary procurement arrangements. AMC jeeps have been established under several earlier projects (e.g. Hill Area Education and Northeast Small-Scale Education) as the only suitable four-wheel drive U.S. utility vehicle for use in Thailand because of their availability with right hand drive and the availability of spare parts/servicing in rural areas. It is planned that DTEC will procure these four jeeps through purchase orders using AID direct letters of commitment.

Fourteen small motorcycles will be purchased with loan funds to support extension workers and two will be purchased for engineering support. Since these small (less than 200 cc) motorcycles are not available in the U.S., a 636 1 waiver is requested to allow purchase of locally manufactured machines.

c. Other Local Costs

Most other local costs financed by the AID assistance are planned to be funded through a reimbursement system as follows:

(1) AID and the RTG will agree on appropriate maximum costs for each input package, and these will be documented in Project Implementation Letters.

(2) The RTG will finance all costs initially and then seek reimbursement from AID of actual costs up to agreed maximums. (For water resource improvements, only half of these costs will be reimbursed by AID).

(3) AID will reimburse the RTG through a direct payment.

During the first year of implementation AID will consider advancing funds for certain components, but it is expected that during subsequent years the MOAC will be able to budget adequate funds to directly pay for most local cost components. In some cases, i.e. for local studies or other services it may be simpler and more effective to directly disburse funds under the AID assistance, and in these instances direct payment procedures will be utilized where appropriate.

d. Budget Arrangements

It is expected that this Project will follow the lead of the FY 80 Mae Chaem Project and utilize an integrated budget procedure to program RTG funds. A single NERAD budget will be approved each year for the Project rather than several independent participating agency budgets as has been the case in the past. This will allow for easier review and approval through the RTG budget process and will also provide for better control since the MOAC's Office of the Under-Secretary will be responsible for both the planning, implementation and budgeting process. It is also expected that the Northeast Regional Office of Agriculture (NEROA) will serve as a channel for at least some of the funds under the Project (See Part IV for institutional arrangements).

e. Disbursement Procedures.

Prior to the disbursement of funds for project activities in each tambon, a tambon area development plan must be approved by the MOAC NERAD Committee and submitted to USAID to provide evidence of adequate planning and proper selection. This plan will be developed by the Tambon Agricultural Development Committee (TADC), approved by the Provincial NERAD Sub-Committee, and forwarded to the Project Director's office at NEROA. Before forwarding plans to the MOAC NERAD Committee, the Project Director will utilize the technical staff assigned to NEROA to determine the technical, engineering, and economic feasibility of the plans. Plans submitted to the MOAC NERAD Committee will have the Project Director's endorsement regarding suitability and feasibility.

The TADC will periodically revise and update tambon plans in light of the progress and experience gained in project implementation. Minor changes in the plans can be approved by the Project Director, but subsequent annual plans and major revisions must go through the same approval process as the initial plan. NERAD Project Field Managers and other Project staff will be made available to assist the TADC in the development of these plans.

Upon notification that activities within the approved tambon plan have been completed, AID will disburse up to the maximum amount agreed to in that plan. For all engineering work USAID will certify satisfactory completion prior to reimbursement; for all agricultural works USAID will depend on periodic monitoring by the Project Officer, the Technical Assistance Team, and the Liaison Officers to provide information regarding satisfactory completion. Also, a Management Information System which will provide a regular flow of information on Project activities will be established to provide both the Project Director and USAID with information for monitoring the progress and completion of Project activities. (A consultant is being recruited during the summer of 1981 to devise a Management Information System for NERAD and other projects in the Mission).

## PART IV - IMPLEMENTATION PLAN AND ARRANGEMENTS

### A. Summary Administrative Analysis and Proposed Project Organization and Procedural Arrangements

As mentioned earlier in this PP, the activities to be undertaken under the NERAD scheme fall into the purview and responsibilities of several departments of the Thai Ministry of Agriculture and Cooperatives (MOAC). Normally, even being in the same ministry, these agencies operate quite independently, which tends to reduce their effectiveness when working toward the common objective of improving the well-being of the poor farmers. Success in introduction of integrated projects to increase government capability to serve the farmers is still limited and not satisfactory mainly because old attitudes and working methods still prevail. Other problem areas (discussed further in Annex VIII) with current administration of many agricultural development activities include (1) planning and implementation of development activities by separate agencies independent of each other with little or no cooperative effort on related activities, (2) separate departmental budget allocations for activities rather than integrated budgeting by projects, (3) insufficient supervision of activities in the field, (4) centralized decision making, with little delegation to the field, (5) few incentives to reward performance.

To improve the administrative system it is now the policy of the Thai Government to decentralize planning and implementation to the regions, thus increasing the probability of addressing effectively the needs and problems of particular areas.

In recognition of this policy and the problems it responds to, the proposal for the organization and procedural arrangements for NERAD will have an area-based focus on efforts to coordinate and to decentralize agricultural development activities. Existing units will be utilized as much as possible in order to avoid duplication and unnecessary waste.

#### 1. Organizational Arrangements

There are five levels of organizational arrangements which are needed in this project, i.e. at the national, regional, provincial, district and tambon levels.

a. National Level

The organization which will be responsible for the elaboration of main policies and project coordination at the departmental level will be a Committee on Northeast Rainfed Agricultural Development. This will be a high level inter-departmental committee. It is expected that the Deputy Under-Secretary of State of the MOAC will be Chairman, the Director of the Projects Division will be Secretary, and the NERAD Project Director will be Assistant Secretary. The main NERAD policies will be issued by the MOAC's Agricultural Policy and Development Planning Committee. The Committee on Northeast Rainfed Agricultural Development will review the Project plan, and the accompanying budget requests. It will issue the regulations regarding the major methods of operations, the personnel as well as the financial procedures to be used in the NERAD project, as far as these need to be done at the inter-departmental level. It will also have the responsibility to assist the Project management solve inter-agency problems or other problems which have to be dealt with at national level. It will help to coordinate with other ministry committees, and will review the performance of the Project on an annual basis.

b. Regional Level

The Project Management Center will be set up at the Northeast Regional Office of Agriculture. The NEROA is the Northeast regional field office of the Office of the Under-Secretary of State of MOAC, a central body where activities of various MOAC departments are integrated. The NEROA has long been considered by the MOAC as the focal point for this Project and the management of this institution has assigned high priority to NERAD.

The Project Management Center will consist of a Project Director, his assistant and a number of technical and administrative staff (See Figure IV-2). The Project Management Center will administer the allocation of Project vehicle support, and will process documentation and reimburse travel and per diem expenses of all personnel involved with Project implementation.

The Project Director will have the responsibility to plan, coordinate and monitor the implementation of the NERAD Project. The signature of the Project Director, or the Assistant Director or field managers acting as his

delegated representative, will be required for the disbursement of Project funds, in order to maintain a unified Project financial management and accounting system. The Project Director, his assistant and all the administrative staff should be full-time, while the technical specialists are one-half to full-timers or are hired on a contractual basis. The Project Director or his assistant will meet regularly with the technical specialists to administer the farming systems research program and review technical aspects of Project implementation.

The Project Director will report to the national NERAD Committee, who will assist the Project Director in matters as deemed necessary in order to facilitate the implementation of the Project. He will review the performance of the Project on a regular basis. He will also review the performance of the Project staff.

c. Provincial Level

At each of the four provinces which will be covered by the NERAD Project, a provincial sub-committee on NERAD implementation and coordination will be set up, with the governor or his designate acting as a chairman, and representatives of participating agencies as members. The field manager, who will be employed by the NERAD Project, will be the committee secretary, and the prime mover of Project implementation in the province. An officer of the provincial planning office is expected to be assistant secretary. This is to facilitate coordination between the NERAD Project and the provincial development plan and committee.

This NERAD provincial committee will first provide necessary data for planning to the Project Director and will prepare the provincial NERAD operations plan accordingly. Endorsement of department representatives will be made by each respective department. Review of progress and problems occurring during implementation will be addressed first by this committee. The field manager will also advise the provincial administration regarding preliminary planning activities which they can begin in preparation for implementation of an expanded NERAD program in other rambons of their province as RTG funding becomes available.

d. District Level

The field manager will report to the Project Director, and will be responsible for supervision of the implementation of the Project at the two sites in each province. He will have an office and one or two deputies, and will provide administrative support to facilitate operations of participating personnel in order that work will progress according to specific area plans and time schedules. The latter will be prepared jointly among the implementation personnel, local leaders, and the farmers. He will assist the district DOAE office in coordinating activities with other MOAC field units in the area, and he will keep the Chief District Officer informed about Project activities, progress, and problems, and assist him in organizing district-level meetings between Project tambon leaders, district officials, and local merchants. He will also serve as technical backstopping role for tambon level personnel through advice and managing the provision of Project technical support and training services, including transportation and per diem.

e. Tambon Level

Tambon Extension Agents (TEA) will provide project leadership at the tambon but will initially be strongly supported by the field manager. The primary vehicle for tambon planning will be the Tambon Agricultural Development Committee established by the Tambon Council. It will consist of Tambon Council members, and the existing tambon-level advisory personnel: the TEA, the tambon Community Development Department (CDD) worker, teachers and village Contact Farmer (Co.F) leaders. Decision making at the tambon level will be the responsibility of the Tambon Council. At the village level the village meeting will serve as both the planning and decision making organization with the village development committee serving as the "executive board" for the village meeting.

Management at the tambon level utilizes existing organizations and mechanism that have been regularly used for village level activities. It accordingly will not impose any new, untried structures that may be resisted or further strain local administrators with unnecessary organizing duties. On the contrary, it will assist the Tambon Council in carrying out its duties more effectively, an approach strongly supported by the RTC at all levels.

NERAD PROJECT FUNCTION DISTRIBUTION

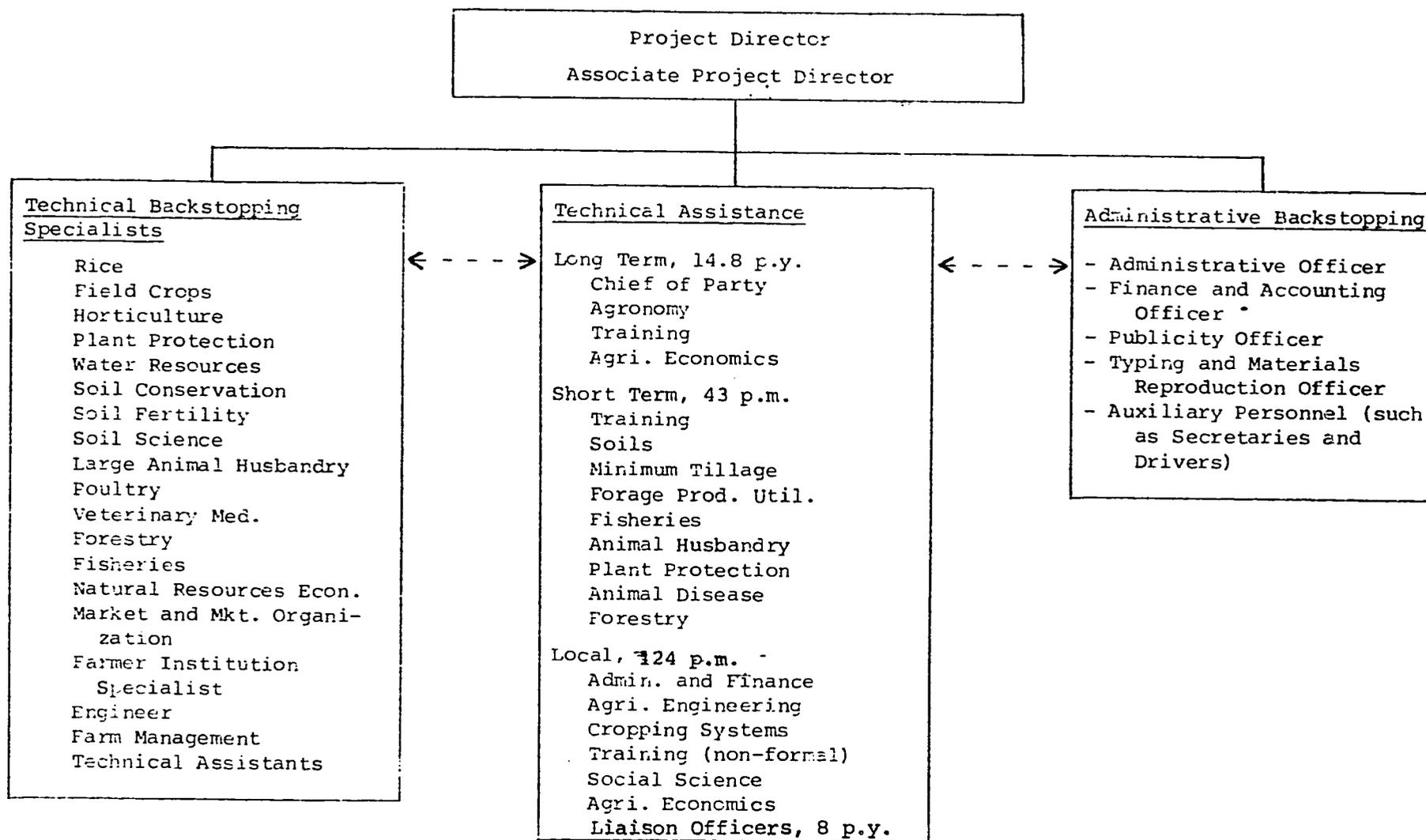
<u>Name of Organization</u>	<u>Primary Responsibilities</u>
1. Department of Land Development	1. Soil and land modifications 2. Land use surveys 3. Water resource modifications 4. Shallow well research 5. Saline soils demonstration (with forestry) 6. Weather Data
2. Royal Forest Department	1. Public Land Development (with Livestock) 2. Fruit and Tree Crop Nursery (with Agriculture) 3. Saline Soils (with Land Development)
3. Northeast Regional Office of Agriculture	1. Administration and Management 2. Social Support (with Cooperative Promotion) 3. Technical Support laboratories 4. Farming Systems Research (joint with Agriculture, Livestock, Forestry, Fisheries and Land Development) <b>OAEI</b>
4. Office of Agriculture Economics	1. Agricultural Economics Support (with Cooperative Promotion) 2. Evaluation (with USAID)
5. Department of Agriculture	1. Cropping System Modifications 2. Sericulture 3. Fertility Field Evaluations 4. Minimum Tillage Research 5. Fruit and Tree Crop Nursery (with forestry)
6. Department of Agricultural Extension	1. Extension support activities
7. Department of Livestock Development	1. Household poultry improvement 2. Large animal project 3. Public Land Development (with forestry)
8. Department of Fisheries	1. Fisheries Development
9. Department of Cooperative Promotion	1. Social support (with NEROA) 2. Agricultural Economics Support (with OAE)



NERAD PROJECT MANAGEMENT

FIGURE IV-3

TEAM AT REGIONAL OFFICE



## 2. Procedural Arrangements

In order to efficiently carry out the Project, certain procedures will be followed. Some of the important ones are identified below:

### a. New Working Relationship

In an area project like this, it is unavoidable that dual supervision has to be used. There will be one more line of work-authority than usually is the case. Although such authority will be quite limited it will be well defined in order to eliminate confusion concerning lines of authority. Briefly:

(1) The Project Director will see that the provincial committee's work proceeds according to the operations plan. He is entitled to request clarification and contribution from the provincial committee or extend his assistance as he sees fit.

(2) The field manager, as secretary of the provincial committee, will liaison with the Chief District Officers and coordinate the area operations personnel working in Project tambons and manage Project support and technical backstopping services, based on the operations plan and will report problems to the provincial committee for correction. Personnel of individual MOAC departments will keep the field manager informed about their plans and activities in Project tambons.

(3) The provincial committee will exert some authority over participating officers operating within the province who represent their functional departments. The departments must abide by the common operations plan, which they have jointly agreed upon.

### b. Personnel Selection and Recruitment

A committee on Project personnel selection and recruitment will be set up by the Northeast Regional Office of Agriculture, with major guidelines given and approved by the Committee on Northeast Rainfed Agricultural Development. Appropriate personnel will be screened and selected to suit particular positions. Personnel assigned to Project provinces will be nominated by the Project Director and appointed by the Provincial Governor.

c. Esprit de Corps

Special attention has to be made to develop the esprit de corps of all the Project contributors. A feeling of equality and pride to participate in this Project should be promoted and maintained throughout the Project life. This has to be done by conscious design, and by using various techniques of group dynamics. Special workshops will be held to assure a common direction and share important experience among Project personnel.

d. Working Group Method

If there is need for extended deliberation on any subject, such as setting of policy guidelines, operation plan, implementation techniques, operations guidelines, or conditions of work, a task force or work group should be set up for a certain period of time. This is to avoid the need for long-standing committees, each with few activities to do, and to limit numbers only to those with qualifications appropriate for a particular mission.

e. Planning-Programming-Budgeting System

In order to best address coordination problems met in the past, packaged project planning and unified budget preparation, request and approval should be used. This will be followed by a series of operations plans. The operations plans should be prepared in progressively greater detail, respectively, by the Project Director, the provincial implementation and coordination committee, and the field manager. The operations plan will relate activities to be undertaken with the supporting resources and the time available. Budget requests of participating departments to implement plans will be submitted to the Project Director, who will submit the unified budget request each fiscal year.

B. Implementation Plan

It should be noted from the outset that because this Project is designed for bottom-up decision making and because these decisions will differ among villages and tambons and cannot be made in advance of activities designed to enable villagers and lower level officials to make informed decisions, a precise schedule of implementation events cannot be made. Nonetheless, implementation plans for planned activities which are based on assumed levels of

Interest and capabilities for adoption are given in the Annexes. This section discusses the implementation plans generally and lists the more significant steps.

1. Preimplementation steps include approval of the Project Paper and Agreement, nomination of the Project Director and preliminary negotiations with the technical assistance contractor. Since it is anticipated that the University of Kentucky will be the contractor under the collaborative assistance procedure, no competitive procurement procedures are anticipated for expatriate consultant assistance. In order to expedite demonstration and extension activities some of the necessary soil and land use survey work may be conducted as a pre-implementation activity, and this will be pursued upon AID/W approval of the PP.

2. First year implementation will involve:

- a. Negotiation of contract for technical assistance and appointment of scheduled individuals.
- b. Appointment of project management, technical support staff--field managers and assistant field managers, and training of these staff.
- c. Development of a preliminary general tactical plan.
- d. Drafting of a handbook of basic procedures, then review and revision of this document.
- e. Conduct village and tambon meetings to inform villagers and local officials about potential Project activities and obtain suggestions for initial Project activities.
- f. Select initial specific village/tambon activities and specialist farmers in collaboration with Tambon Council, Contact Farmers, TEA, cooperative and occupational group leaders and villagers.
- g. Develop preliminary plans and begin examination of existing farming systems and farmers constraints generally observed in order to develop appropriate technological interventions most needed.

- h. Collaboratively develop specific program plans for the first two years, including assignment of specific department/agency responsibilities.
- i. Recruit and train 4 additional TEA.
- j. Select and/or design equipment, supplies and buildings and let contract.
- k. Survey tambon land resources, soils, and markets.
- l. Recruit technical field assistants and other personnel.
- m. Plan and initiate research field trials.
- n. Site selection and design of water and land resource modification structures.
- o. Evaluation of progress and procedures and revision of plans accordingly.

The first year implementation steps are crucial to the success of the Project. The considerable time expected for assembling and training Project staff, detailed planning of initial Project activities, development of Project operational plans and assignment of responsibilities to MOAC agencies, is a result of three factors. The first, which has already been mentioned, is the Project commitment to bottom-up planning. The second is the fact that when the need for adequate start-up time is ignored a project invariably fails behind schedule. The third involves the Project's commitment to integrated planning and cooperative implementation. Cooperative implementation requires integrated planning by the individuals who will be responsible for the implementation. The process of initially training project personnel followed by project planning by these same individuals can substantially enhance the possibilities for truly cooperative implementation. It is also essential that the mapping activities and site selection and engineering for initial soil and water structures be done and that field research be started at or near the beginning of the second project year. These activities along with village involvement in planning activities will provide a firm basis for village commitment to the Project, and show beneficiaries that concrete benefits will be forthcoming at an early stage of implementation.

### 3. Second and Succeeding Years

The second year will see the start up of most Project activities on a phased basis. The ten remaining TEA will be recruited and trained as will any other personnel not recruited and/or trained in year 1. In addition to the activities shown in the PP annexes, years 2-7 will involve a cycle of activities including reporting of progress and forward detailed planning (revision of current year plan and development of next year detailed plan and budget requirement). Evaluations will also be conducted in accordance with the evaluation plan of this PP. A major evaluation will be conducted early in year 4. This comprehensive evaluation will examine the validity of the initial Project strategy and tactics, evaluate the Project performance, suggest minor or major changes felt to be essential for achievement of the Project Purpose.

### 4. General Implementation Schedule

A general implementation schedule is attached as Figure IV-4. This schedule shows the approximate start-up and completion times of major Project components and indicates expected levels of effort during the Project. Activities expected to continue after formal termination of the Project are so indicated.

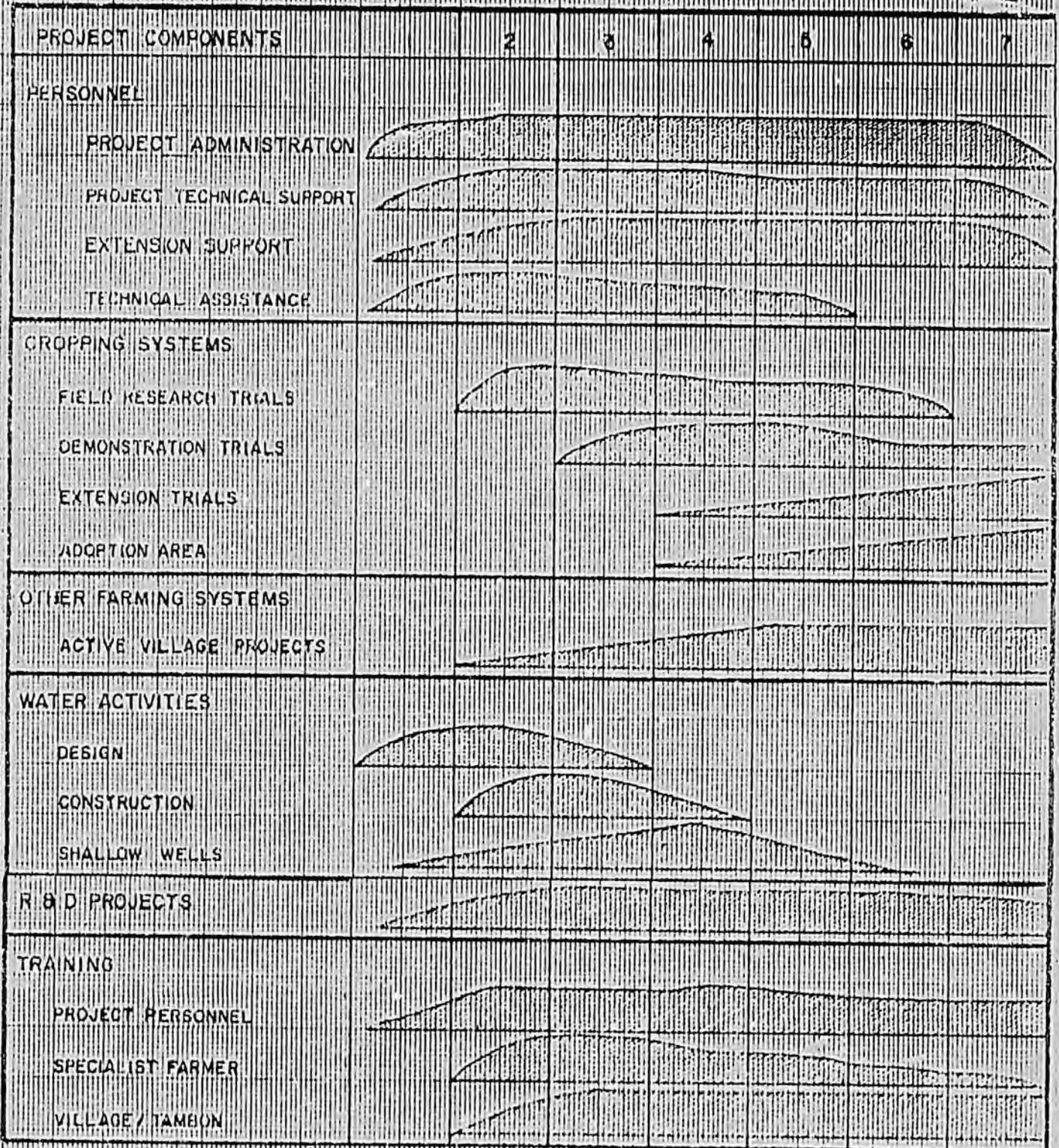
### 5. Illustrative Tambon Implementation Procedure

Although detailed Project implementation plans must be developed as a part of Project implementation, an illustrative example of the procedure which might be followed in a Project tambon could be described as follows:

The first Project activities to be conducted in a Project tambon would include a detailed orientation of the goals and procedures of the Project for the Tambon Council, with individual village headmen then conducting orientation meetings in their individual villages. Explanatory materials would be provided by the Project staff. The Project field manager would then work with the Tambon Council and tambon agricultural extension agents to establish the Tambon Agricultural Development Committee (TADC).

The first task of the TADC would be to give approval for the initiation of Project tambon assessment activities, including detailed soil and land use surveys

FIG. IV-4 SUMMARY IMPLEMENTATION SCHEDULE SHOWING LEVEL OF EFFORT BY PROJECT YEARS



and initiation of the current farming systems assessment activities. A site would also be selected for the tambon extension office and meeting facility. Next, the TADC will develop, in consultation with villagers through village-level meetings, the initial agricultural development plan for tambon activities, based on local priorities for particular crops and other farming activities and information provided by the Project through the field manager, the TEA and other Project support staff as required, including policy guidance and the types and amounts of resources available. The plan will include the selection of a small number of initial demonstration and extension trial activities and the identification of sites and proposed management organization for any small water resource structures. For example, the TADC might decide that local priorities would be to learn more about improved rice varieties for low terrace soils and field crops which could follow rice utilizing residual soil moisture. They might also identify a natural swamp for rehabilitation and make arrangements for how the improved resource would be managed and allocated. The selection for initial extension activities might be household poultry improvement. This plan would then be submitted through the field manager to the provincial committee and the Project Director for review and approval, subject to any required feasibility analyses.

The Project staff at NEROA will assemble all tambon plans and submit them for satisfaction of conditions precedent to major tambon implementation activities, including additional information establishing technical, economic, and administrative feasibility. The Project technical staff can then plan their support activities accordingly. As soon as the initial plan is approved, activities would begin, including the selection and training of appropriate Specialist Farmers, and the selection of sites for the initial rice and field crops after rice demonstration trials.

Prior to the implementation of construction activities, including the swamp rehabilitation activities, necessary analysis, planning and design work will be conducted by the Project engineering staff. Plans for the swamp rehabilitation would also indicate what the proposed use of the water would be, so arrangements would also be made for supporting demonstration trials as soon as the construction is completed. The household poultry improvement extension program could begin as soon as

Specialist farmers are trained, and demonstration trials on rice would begin with the first rainy season, while the field crops after rice demonstration trials would begin after rice harvest.

The TADC will meet regularly to review the progress of Project implementation activities and update and revise tambon plans as more information and experience is gained. Information will be provided to the TADC through the reporting and explanation by Project staff of land resource surveys, farming systems assessments, and demonstration and applied research trials; through technical, marketing, and other information provided by the Project; through meetings with local officials and merchants on the feasibility of various activities; and through information provided by villagers in periodic village meetings. The Project field manager will assist the TADC in these activities and assure that the Chief District Officer, provincial committee, and Project management Center are kept advised regarding tambon plans and activities.

As initial Project implementation activities in the tambon are successful in getting local farmers to understand improved practices and their potential for improved income, additional activities will be selected by the TADC for inclusion in the tambon program. Additional activities up to agreed funding level would not require approval beyond the Project Director, however, major amendments would be approved through the same process as the original plan. The field manager will pay special attention to tambon activities to see that they are not becoming too complex so that they overburden either the ability of local farmers to digest the new information, or the ability of the Project to supply adequate support. In order to help him in this assessment, personnel of the various departments involved with Project implementation will keep him advised of their activities within the tambon. The field manager will report progress and problems to both the provincial committee and the Project Director.

### C. Evaluation Plan and Monitoring Arrangements

Continual close monitoring and careful evaluation of NERAD project activities and impact are central concerns. These concerns are particularly important for this Project, since it is conceived as the first phase of implementation of what will be (if it produces sufficient results) a regional program for the development of rainfed agriculture. MOAC has, therefore, indicated a desire to take a strong lead in Project evaluation.

#### 1. General Evaluation Arrangements

It will be the duty of the Project Management Staff, in collaboration with the Agricultural Project Evaluation Division of the Office of Agricultural Economics, to evaluate Project progress in carrying out Project plans. The Agricultural Projects Evaluation Division of the Office of Agricultural Economics will report on Project progress and problems to the MOAC Agricultural Policy and Planning Committee. Data will also be collected by the Research Division of the Office of Agricultural Economics and will be provided to the NERAD Project Management Staff to assist in the monitoring of Project progress. The Project Management Staff will provide relevant data to the Planning Divisions of the various Departments involved in Project activities. In-depth RTG-USAID evaluations of Project activities to include external consultant assistance are expected to be conducted in year 4 and year 7 of Project implementation. However, these dates are tentative and will depend on the needs of the Project and the RTG/AID.

#### 2. Evaluation Data Sources

##### a. Baseline Data

A substantial amount of data has already been collected in a socio-economic survey of 15% of the households of the 8 project tambons conducted by the Research Division of the Office of Agricultural Economics. During the early stages of project implementation, as detailed Project plans are developed, any additional data needs identified will be met by the collection of additional baseline data by the Office of Agricultural Economics.

In addition, baseline data will be collected in 3 additional tambons similar, but not adjacent to Project

tambons, where no NERAD Project activities will take place. Only data deemed essential, based on analysis of the initial NERAD socio-economic survey, need be collected in these additional tambons. These tambons will be re-surveyed with the NERAD tambons in years 4 and 7 to serve as an indication of what development would have occurred within Project tambons in the absence of the NERAD Project.

b. Routine Monitoring and Evaluation

In line with current MOAC policy, progress reports will be prepared 3 times per year by the Project Management Staff, in collaboration with the Agricultural Projects Evaluation Division of the Office of Agricultural Economics, based on information provided by MOAC personnel participating in Project implementation. These reports will indicate progress toward implementation targets during the reporting period and problems encountered. A reporting format will be developed by the Project Management Staff and the Office of Agricultural Economics during the initial six months of Project implementation. Copies of the reports will be provided to USAID.

Also associated with Project monitoring activities will be regular compilation of Project-generated data on climatological characteristics, market prices, test-demonstration plot yields, farm management records, and other data generated by the farming systems research component of the Project. Data will be provided by the Office of Agricultural Economics regarding Bangkok prices of relevant farm commodities and inputs, and changes in the Consumer Price Index.

A yearly assessment of these data will be made by the Project Management Staff Economist, with copies provided to the MOAC and USAID.

c. Mini-Evaluations and Studies

Since this is an innovative project with important implications for the future, several "mini-evaluations" are planned which will help clarify and develop means of attacking the problems of working in the Northeast rainfed context. This would build a base of knowledge for this Project as well as follow-on projects.

In the first year for example, it might be useful to document the process of village and tambon

meetings--one or two Thai university anthropologists could study this process and perhaps answer questions as to what types of participation occurred, how effective were officials who organized meetings, what communication problems were involved, how did this process effect village "commitment" etc. This type of study could help improve the design of future projects which might use the "bottom-up" mode.

Another "mini-study" which might prove useful would be a look at the "collaborative planning process" which is to be implemented in the first year. This would provide insights into the process which occurs between the provided TA and recipient. It is also expected that several "mini-evaluations" will be conducted on marketing elements. During the first year of the Project, for example, a marketing survey is planned to identify any constraints for marketing fresh vegetables and fruits particularly.

In general, short term 30-60 days mini-evaluations during various phases of Project implementation would provide valuable feedback into the Project system in between the in-depth evaluations.

Studies would be contracted to local Thai Universities and other sources of technical expertise. Four studies could be conducted annually at \$2,500 each during year 1, 2, 3, 5 and 6.

d. In-Depth Evaluations

Two joint RTG-USAID special evaluations will be conducted, including an in-depth assessment of both progress toward Project implementation targets and progress toward achievement of the Project Purpose. To assist in this evaluation, early in the 4th and 7th years a household socio-economic survey of Project tambons and the three non-Project tambons is planned where baseline data was gathered. This survey will include selected basic data of the baseline survey plus additional data deemed important as a result of Project investigations and implementation efforts. Compilations of the routine monitoring data will be provided to the special evaluation team. The special evaluations will also include interviews and investigations aimed at determining the effectiveness of the Project management system as a model for implementation of integrated agricultural development activities, and the effectiveness of the farming systems research activities as a model for future research

of this nature. An effort will also be made to estimate, at least qualitatively spread effects of the Project in other areas, including utilization of materials, program strategies and technologies developed within Project areas.

### 3. AID Monitoring Arrangements

The NERAD Project will be intensively monitored by the AID/Thailand Mission because of its relative importance to both the RTG and AID strategies which emphasize rainfed agricultural development in the Northeast. It is planned that a U.S. direct hire agricultural officer and a local-hire assistant project officer will be stationed in the Northeast at Khon Kaen to monitor the Project, and facilities have already been obtained for this purpose.

It is expected that about 75 percent of these officers' time will be devoted to NERAD, at least during the early years of the Project. AID/Thailand is confident that by stationing two officers in Khon Kaen, which is only about 20 minutes drive from Tha Phra, and by making NERAD their major responsibility, the Thai Mission's field monitoring capability will be sufficiently enhanced to fulfill the requirements of this Project. In addition, one assistant project officer assigned in Bangkok will be assigned half-time to the Project, and a project committee in Bangkok will help monitor the Project. The membership will include a financial analyst, capital projects officer, agriculture economist, social scientist, engineer and program officer.

### D. Negotiating Status, Conditions Precedent, Covenants,

The following CP's and covenants are anticipated in the Agreements. The RTG prefers separate Loan and Grant Agreements because of the bifurcated approval process and separate jurisdictions for grants (DTEC) and loans (Ministry of Finance). There is substantive agreement of CPs and covenants for both documents and no significant delay is expected for executing both Agreements whenever the Project is authorized.

#### 1. Grant Agreement

##### Initial CPs

Designation of Grantee Representatives.

2. Loan Agreement

a. Initial CPs (60 days)

- (1) Designation of Borrower's Authorized Representative.
- (2) Designation of Project Director

b. Secondary CPs for All Loan-Funded Project Activities Other than Administration and Technological Support. (120 days)

- (1) Consultant Team Contract.
- (2) General Implementation and Training Plan specifying approach to phasing of activities and tambons under the Project and giving general time frames and cost estimates.
- (3) Organizational Arrangements including membership and role of the Committee on Northeast Rainfed Agricultural Development.

c. CPs for Project Activities Within Any Tambon

Except for personnel placement and related support activities, meetings/seminars, staff training, surveys and information services, in a tambon, the Government shall furnish to AID in form and substance satisfactory to AID, an area development plan for the tambon showing the expected activities, their criteria for selection, cost estimates and expected social as well as economic impacts, their locations and implementation scheduling, and including the organizational and staffing requirements for the activities with assurances these will be satisfied.

d. CP for Construction Activities

Prior to the commencement of any construction activities for which reimbursement will be sought, the Government shall furnish to AID in form and substance satisfactory to AID detailed plans and firm cost estimates including cost sharing arrangements of the construction to be carried out. Such plans shall include inter alia evidence that a detailed engineering survey has been done for water resource construction sites, that environmental

implications of water resource and land shaping activities have been adequately considered in the design of these activities, and that adequate arrangements have been made for supervision of construction.

e. CP for Pesticide Use

Prior to the commencement of any research trials or demonstrations requiring the use of pesticides, the Government shall furnish to AID in form and substance satisfactory to AID, a pesticide use plan for the proposed activity evidencing adequate safeguards for protecting the environment.

f. Covenant for Pesticides

Pesticides not registered by the U.S. Environmental Protection Agency (EPA) will be used in demonstration and extension trials only if it can be proven that they are more efficacious and equally or less hazardous than EPA registered pesticides.

g. Covenant for Road Improvement

The Government will improve at no cost to the Project on a priority basis any roads that appear to be significant constraints to meeting Project objectives.

h. Covenant for Evaluation and Reporting

The Government agrees to develop an evaluation plan and project reporting system, adequate to meet the needs of the Project, during the first six months of Project Implementation.

NERAD

ANNEXES

- i-v Addenda to Annexes
- I. PID Approval Cable (State 305713)
- II. Analytical Methodology
- III. Logical Framework
- IV. Description of Project Areas
- V. Detailed Project Technical Analyses
- VI. Economic Analysis - Costs and Benefits (Detailed Narrative and Calculations Contained in Supplement to PP)
- VII. Social Soundness Analysis (Contained in Supplement to PP)
- VIII. Administrative Analysis (Contained in Supplement to PP)
- IX. Detailed Financial Data
- X. Statutory Checklist
- XI. Borrower/Grantee Application for Assistance

II. Addendum to Annexes

Annex IX - 7, ln. 8 Housing Allowance Gudget.

The housing allowance should be made for Technical Specialists for other Departments to participate in NERAD Project. This will be gudgeted for C-5 or C-6 officials at a rate of ₧1,500/month (\$75/month). These fund can be taken out of contingency funds.

Annex IX- 10 Construction Budget Office Building

The amount originally budgeted for cost of building construction should be increased from \$100,000 to \$200,000 with the cost of furnishings remaining at \$25,000 for a total of \$225,000. The schedule should be changed from project year 4 to project year 1 which, discounting for inflation, would amount to an additional \$55,290 to be taken from contingency funds.

Annex IX - 2 Technical Assistance Budget

Expatriate

<u>Long Term</u>	13.8 years
Chief of Party	4.8 years
Agriculturist	4.0 years
Training Specialist	2.0 years
Agriculture Economist	3.0 years

Annex IV - 15 Other Farming Systems Improvement Budget

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Total</u>
Previous total	16.7	63.1	102.05	108.1	98.75	103.95	102.7	595.35
Village Woodlots	-	-	60	60	60	60	60	300
New Total	16.7	63.1	162.05	168.1	158.75	163.95	162.7	895.35

Annex IX - 29 Demonstration and Research Budget

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Total</u>
Previous Total *	3.	12	20	15	15	15	-	80
Range Management	-	-	20	30	30	20	-	100
Watershed Management	-	-	30	30	40	-	-	100
New Total	3	12	70	75	85	35	-	280

\* Public Land Use Demonstration deleted.

### III. GUIDELINES FOR LONG TERM TECHNICAL ASSISTANCE POSITIONS

#### GENERAL REQUIREMENTS AND EXPECTATIONS

All long-term team members should have interest and experience in interdisciplinary problem-solving research and/or extension. It is absolutely necessary that either the agronomist or the agricultural economist (or both) should have farming/cropping systems applied research experience. Ph.Ds for all team members are preferable. All team members will be expected to accomplish the following:

1. Identify, assist in recruitment, and work with short term personnel in technical assistance whether they come from UK, other SECD institutions, or Thai institutions, whenever supplementary assistance is necessary.
2. General willingness to spend considerable time in the field with the various levels of personnel.
3. Be willing to make an attempt to learn Thai language and customs.

#### CHIEF OF PARTY

The Chief of Party should have at least five years of applied research and/or extension experience in any field related to farming systems. This person should have some previous experience in administration. Additionally, it is necessary for the COP to have experience of at least two years in an LDC, preferably Thailand. The COP will be expected to accomplish the following:

1. Coordinate and advise project personnel in the implementation of the overall project including revision of annual plan of monitoring, evaluation, etc.
2. Administer the team technical assistance effort.
3. Advise the MUAC Project Director, Project Manager, and USAID concerning project technical assistance.
4. Conduct research and/or extension in his area of expertise on farming systems.

### TRAINING

The long-term training specialist should have at least five years experience in using various communications/media modes and methods in training extension agents, farmer, leaders and other trainers, etc. It would be preferable for this specialist to have previous Thai experience. This person will be expected to accomplish the following.

1. Advise the general program of training required in the Project Paper for project staff members, extension agents, farmers, community leaders, and trainers.
2. Provide technical assistance in the use of various media modes for the above mentioned groups.
3. Assist in the preparation of training materials.
4. Assist other specialist in training matters.

### AGRICULTURALIST

The long-term agriculturalist should have at least five years experience in crop production and soils research and extension. This person should be interested in and have knowledge of the biology of the farming system. Some international experience is strongly preferred. This agriculturalist will be expected to accomplish the following:

1. To advise RTG concerning the general biological component of the technical assistance program.
2. Assist and coordinate in the development of a cropping systems applied research methodology which would include but not be limited to:
  - a. analysis of current farming system practices;
  - b. identify and analyze specific research needs for crop, livestock, forestry, and fisheries development;
  - c. identify and analyze specific research needs of the integration of the above mentioned into cropping and farming systems.

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The long-term training specialist should have at least five years experience in using various communications/media modes and methods in training extension agents, farmer, leaders and other trainers, etc. It would be preferable for this specialist to have previous Thai experience. This person will be expected to accomplish the following.

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3. Assist in the preparation of training materials.
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  - a. analysis of current farming system practices;
  - b. identify and analyze specific research needs for crop, livestock, forestry, and fisheries development;
  - c. identify and analyze specific research needs of the integration of the above mentioned into cropping and farming systems.

DUTIES OF CAMPUS COORDINATOR

A campus coordinator will be responsible for:

1. Recruitment and selection of team members; correspondence with COP concerning needs and potential suitability of candidates; arrangement for orientation on campus, assistance in arranging travel, shipments, storage and other requirements for travel to post.
2. Routine on campus back stopping of team members, including pay, evaluations and other personnel matters.
3. Support of project interests/activities on campus, including: a) access to library and other information sources; b) collection and shipment of relevant reports, reference materials and catalog; c) finding and contacting individuals in the U.S. who may have needed information; d) solicitation of informal assistance to feed team by other faculty members.
4. Liaison with all university units in relation to project activities; periodic briefing of relevant administrators; sponsoring seminars and speakers on Thai agriculture and/or project activities; creating a climate of wide university involvement in the project.
5. Provide back-up for financial reporting and assist in preparation as needed.
6. Assist in project planning, project review and project reporting.



# TELEGRAM

NNEX I-1

AMERICAN EMBASSY BANGKOK

PROV: 493-308

**ACTION**

USAID-5

AMB

CHARGE

DCM

ADCM

POL

SA

ECON

DAO

ICA

PA

USAID

JUSMAG

DEA

CONS

VOA

NCU

COMBAT

AGR

EL

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ADM

B&M

CPO

GSO

MED

PER

SY

NCOIC

FADPC

BRDCO

GAO

TSO

CEG-C

CEG-R

LAS

REF

FBIS

FOUCH

APD

CPU

CHMAI

SONG

UDORN

CHURN

TCU

10/CS

## UNCLASSIFIED

Classification

STATE 305713

LNNNVV MJA624EHK50  
RR RUMJGB  
DE RUEHC #5713 13302321  
ZNR UUUUU ZZH  
R 262125Z NOV 79  
FM SECSTATE WASHDC  
TO AMEMBASSY BANGKOK 1970, 1971

Date Received

Nov 27 6 45 AM '79

27 NOV 1979

BT  
UNCLAY (STATE 305713)

AIDAC

E.O. 12065: N/A

TAGS:

SUBJECT: NORTHEAST RAINFED AGRICULTURAL DEVELOPMENT  
(493-0308)

REFS: A) BANGKOK 41553, B) STATE 262290

**DISTRIBUTION**

ACT	INFO
D	<input checked="" type="checkbox"/>
EXO	<input checked="" type="checkbox"/>
O/FIN	<input checked="" type="checkbox"/>
O/PPD	<input checked="" type="checkbox"/>
O/IST	<input type="checkbox"/>
O/RIUD	<input type="checkbox"/>
<input checked="" type="checkbox"/> O/RD	<input type="checkbox"/>
O/HPN	<input type="checkbox"/>
O/HRT	<input type="checkbox"/>
TRG	<input type="checkbox"/>
EMB	<input type="checkbox"/>
C&R	<input checked="" type="checkbox"/>

1. AT ASIA PROJECT ADVISORY COMMITTEE (APAC) REVIEW OF SUBJECT PID, ISSUES OUTLINED REF B AND MISSION RESPONSES, REF A, WERE DISCUSSED WITH MISSION REPRESENTATIVES IN ATTENDANCE.

2. THE APAC APPROVED THE SUBJECT PID FOR DEVELOPMENT OF A PP FOR FY 81 FUNDING, ASSUMING SATISFACTORY RESOLUTION OF THE ISSUES OUTLINED IN PARA 3 BELOW AND WITH THE INJUNCTION THAT USAID LIMIT PROPOSED ACTIVITIES UNDER NERAD I TO FEWER THAN SIX DISTRICTS (IN THREE PROVINCES) AND THAT THE PP ADDRESS THE ISSUE OF THE SCOPE OF PROPOSED NERAD ACTIVITIES AND THE MANNER IN WHICH REPLICATION IS PROPOSED. APPROVAL AUTHORITY FOR THE PP WILL REMAIN WITH AID/W.

3. THE FOLLOWING ISSUES WERE IDENTIFIED BY THE APAC AS NEEDING FURTHER CONSIDERATION:

...(A) AREA DEVELOPMENT STRATEGY: WHILE THE DESIRABILITY OF ADDRESSING MULTIPLE PROBLEMS ASSOCIATED WITH INCREASING AGRICULTURAL PRODUCTIVITY IN THE NORTHEAST SIMULTANEOUSLY IS WELL DOCUMENTED BY THE PID, THE APAC QUESTIONED THE WORKABILITY OF THE AREA DEVELOPMENT APPROACH AS PROPOSED, ESPECIALLY WITH MORE THAN ONE AGRICULTURAL TECHNOLOGY PACKAGE. ACCORDINGLY, THE APAC DISCUSSED ALTERNATIVES FOR SIMPLIFYING THE PROJECT WITH A VIEW TOWARD REDUCING THE RISK OF FAILURE, GIVEN A HISTORY IN THAILAND OF DIFFICULTY IN GETTING A MULTIPLICITY OF LINE MINISTRIES, DEPARTMENTS, AND DEVELOPMENT AGENCIES TO WORK TOGETHER PRODUCTIVELY. OPTIONS SUCH AS GEOGRAPHIC LIMITATIONS AND LIMITING THE NUMBER OF ACTIVITIES TO BE INCORPORATED IN THE PROJECT, AS WELL AS PHASING AND/OR TRANCHING, WERE EXPLORED. THE APAC RECOMMENDED THAT USAID SHOULD LIMIT GEOGRAPHICAL COVERAGE

ALLY COULD BE INCLUDED IF DEEMED ESSENTIAL TO ACHIEVEMENT OF PROJECT PURPOSE. FURTHERMORE, THE APAC URGED THAT, IN CONNECTION WITH REDUCING GEOGRAPHICAL COVERAGE, USAID GIVE SERIOUS CONSIDERATION TO REDUCING OVERALL FINANCING WITH A VIEW TOWARD SUBSEQUENT DEVELOPMENT OF A NERAD II PROJECT UNDER WHICH AID-SUPPORTED ACTIVITIES COULD BE GEOGRAPHICALLY EXPANDED AND/OR INTENSIFIED. ON THE LATTER POINT, MISSION REPRESENTATIVES SPOKE FOR INTENSIFICATION WHILE THE APAC FAVORED REPLICATION.

... (B) ADMINISTRATIVE ARRANGEMENTS: THE APAC NOTED THAT THE OBJECTIVE OF DECENTRALIZING MANAGEMENT DECISIONMAKING AND IMPLEMENTATION WILL ATTACH A GREAT DEAL OF IMPORTANCE TO THE PROPOSED DISTRICT LEVEL COMMITTEES AND THE ROLE OF THE PHRA. THEREFORE, DURING PP PREPARATION, A CLEAR UNDERSTANDING OF THE RESPONSIBILITIES OF THE VARIOUS ENTITIES WITHIN THE ADMINISTRATIVE HIERARCHY SHOULD BE DEVELOPED AND NEGOTIATED WITH THE RTG. IN ORDER TO ASSURE AN EFFECTIVE ADMINISTRATIVE SYSTEM, CP'S SHOULD BE INCLUDED IN THE PP WHICH CLEARLY ARTICULATE IMPLEMENTATION RESPONSIBILITIES AT EACH LEVEL. SINCE THE PROJECT ALSO SEEKS TO DECENTRALIZE BUDGETARY RESPONSIBILITIES, BUDGETARY CONTROL ISSUES SHOULD BE INCLUDED IN THE CP'S.

... (C) COORDINATION: THE PP SHOULD BE EXPLICIT REGARDING THE RELATIONSHIP AND LINKAGES OF THE SUBJECT PROJECT TO THE PROPOSED PLANNING AND PROVINCIAL DEVELOPMENT AND VILLAGE FISH PONDS II ACTIVITIES, AS WELL AS ONGOING AND FY 80 PROJECTS IN THE NORTHEAST. THE INTER-RELATIONSHIPS OF THE VARIOUS IMPLEMENTING ORGANIZATIONS AND AGENCIES

SHOULD BE SPELLED OUT. THE RELATIONSHIP OF THE PROPOSED PROJECT TO ACTIVITIES UNDERTAKEN BY OTHER DONORS SHOULD ALSO BE FULLY DOCUMENTED, ESPECIALLY IN THE CASE OF ACTIVITIES, SUCH AS THE WORLD BANK-SUPPORTED RAINFED AGRICULTURAL RESEARCH PROJECT, WHICH ARE VIEWED AS INPUTS TO THE SUBJECT PROJECT.

... (D) DISTRICT-SPECIFIC DEVELOPMENT PLANS: THE APAC EXPRESSED CONCERN THAT THE PP BE AS EXPLICIT AS POSSIBLE ABOUT THE MIX, EXTENT AND MAGNITUDE OF ACTIVITIES PLANNED IN EACH DISTRICT. DESPITE AN EVIDENT NEED FOR FLEXIBILITY IF THE PLANNING/MANAGEMENT ROLES OF THE NEW DISTRICT COMMITTEES ARE TO BE ENHANCED, THE PP SHOULD AT A MINIMUM INCLUDE ILLUSTRATIVE DISTRICT DEVELOPMENT PLANS. IF IT IS NOT POSSIBLE TO DEVELOP DETAILED PLANS AT THE TIME OF PP PREPARATION, CP'S REGARDING THE NECESSITY FOR SUCH PLANS PRIOR TO ACTUAL DEVELOPMENT ACTIVITIES GETTING UNDERWAY SHOULD BE GIVEN SERIOUS CONSIDERATION.

... (E) SITE SELECTION CRITERIA: WHILE BOTH LOW PROVINCIAL INCOME AND LOW CURRENT LEVELS OF FOREIGN DONOR ASSISTANCE ARE REASONABLE CRITERIA FOR USE IN SELECTING PARTICIPATING PROVINCES/DISTRICTS, OTHER CRITERIA WHICH WOULD FACILITATE THE SELECTION OF PROVINCES/DISTRICTS WHERE THERE IS A GOOD CHANCE OF SUCCESS SHOULD BE ADDED. SUCH CRITERIA MIGHT INCLUDE CONSIDERATION OF SOIL CONDITIONS OR RAINFALL PATTERNS CONDUCTIVE TO IMPROVEMENTS IN RAINFED AGRICULTURAL PRODUCTION.

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HOWEVER, THERE IS UNLIKELY TO BE A SIGNIFICANT INCREASE IN USDH STAFF, AND THE RELATIVELY SMALL SIZE OF USAID'S AGRICULTURAL STAFF WILL MAKE RELIANCE UPON STAFF-INTENSIVE ACCOUNTING/MONITORING TECHNIQUES IMPOSSIBLE OR AT BEST DIFFICULT. THEREFORE, THE PP SHOULD INCLUDE A DETAILED DISCUSSION OF HOW THE PROJECT WILL BE MONITORED INCLUDING ARRANGEMENTS FOR THE FLOW OF FUVDS.

...(G) ENVIRONMENTAL ASSESSMENT: THE APAC DISAGREED WITH A POSITIVE DETERMINATION BASED ON STATEMENT IN THE IEE THAT THERE WOULD BE NO SIGNIFICANT NEGATIVE ENVIRONMENTAL CONSEQUENCES RESULTING FROM THE PROPOSED PROJECT. (SEE PARA 1.E. OF SEPTEL ON VILLAGE FISH PONDS II APAC FOR RATIONALE.) THEREFORE, RATHER THAN SEEK APPROVAL OF THE IEE INCLUDED IN THE PID, THE APAC WOULD PREFER THAT THE POTENTIAL IMPACTS OF THE PROJECT BE RE-EVALUATED AND THAT AN IEE THAT FOCUSES ON POTENTIAL ADVERSE IMPACTS, IF ANY,

BE RESUBMITTED RECOMMENDING A LIMITED SCOPE EA ADDRESSED ONLY TO THOSE ADVERSE IMPACTS, IF ANY.

...(H) FUNDING: IT WAS NOTED THAT THE ABS LEVEL FOR THE SUBJECT PROJECT WAS DOLS 9.5 MILLION INCLUDING A GRANT ELEMENT OF DOLS 2.5 MILLION RATHER THAN THE DOLS 3.7 MILLION PROPOSED IN THE PID. THE APAC REGARDED THE PID'S GRANT/LOAN SPLIT AND LIFE-OF-PROJECT FUNDING AS ONLY ILLUSTRATIVE. GIVEN THE EXPECTED PAUCITY OF GRANT AVAILABILITY AND THAILAND'S RELATIVELY AFFLUENT STATUS WITHIN THE REGION, THE APAC EXPECTS USAID TO RESTRICT ITS REQUEST FOR GRANT FUNDS TO THE MINIMUM NEEDED FOR THE PROJECT. CONSISTENT WITH PRACTICES ELSEWHERE IN THE REGION, USAID SHOULD ENDEAVOR TO SHIFT SOME COMPONENTS (E.G. TRAINING) TO LOAN FUNDING. VANCE

PROJECT FORMULATION PROCESS AND ANALYTICAL METHODOLOGY  
USED IN PREPARING THE NERAD PROJECT PAPER

The process which has resulted in the preparation of this Project Paper has had two features which deserve further explanation. First, the project formulation process entailed a great deal of collaboration, not only among the MOAC, and consultants, but also between the various agencies within the MOAC itself. Secondly, the analytical methodology used in providing the information base upon which the project was designed employed several innovative procedures. This annex offers a brief discussion of each of these features.

A. COLLABORATIVE PROJECT FORMULATION

Various MOAC and other Thai research and development personnel began several years ago to see the need to develop an agricultural research and development program which would address the concerns of the majority of farmers in Northeast Thailand who live outside of areas which have potential for year-round irrigation. The national Workshop on Rainfed Agriculture supported by the FAO held in December 1978-January 1979 began to help the MOAC develop more concrete ideas on the direction such a program might take. In June-July of 1979 USAID financed a pre-feasibility study by a team from the University of Wisconsin and a committee of technical specialists from several departments of the MOAC, which resulted in the publication Northeast Rainfed Agricultural Development: An Opportunity Framework. This document and an additional series of meetings of MOAC technical specialists was used to develop the NERAD PID.

After the approval of the NERAD PID the MOAC, under the leadership of Deputy Undersecretary of State Kangwan Devahastin, appointed a series of working groups with representatives from all relevant MOAC departments to perform all the tasks necessary to develop the project:

- Under the leadership of NEROA a multi-disciplinary, multi-departmental working group conducted a USAID-funded study of projects in the Northeast which related to rainfed agriculture, during October-December 1979. This resulted in the four volume publication Survey Report on Rainfed Agricultural Projects in Northeast Thailand, which provided information regarding relevant research and development projects of the various RTG agencies operating in the Northeast, including problems, obstacles,

suggestions for rainfed agricultural development, statistics and data related to agriculture, geographical characteristics and climatic conditions, and general farming systems in the region.

- Another multi-agency MOAC working group of technicians was appointed to formulate Project site selection criteria, identify potential sites, conduct a reconnaissance survey of potential sites, and make final site selection.

- This multi-departmental process continued with the determination of the skills required for project design and the formulation of terms of reference for the Design Team.

- The MOAC NERAD Project Design Committee was then appointed, including representatives of all concerned departments, chaired by NEROA, with the Projects Division furnishing the vice-chairman and OAE the secretary. Representatives of NEROA and OAE travelled to the U.S. to participate in the selection of the U.S. members of the Design Team through the Title XII Collaborative Assistance process, and the Committee furnished suggestions for Thai consultants.

- Again, all concerned departments furnished technical specialists for an MOAC technical team which visited all selected Project tambons to collect background information and formulate recommendations for NERAD activities, to be used as background for the Project Design Team. OAE also conducted a household socio-economic survey (see section B, below), which included suggestions on data needs from specialists of various departments.

- Finally, the MOAC NERAD Project Design Committee furnished the support necessary for the NERAD Project Design Team to conduct its investigations and design work, including visit support, data from previous departmental research and development efforts, policy guidance, etc

As this list of activities indicate, the development and design of the NERAD Project has been a milestone in the collaborative multi-departmental development of an important agricultural development project. Throughout this process all departments have been very cooperative and responsive to Project design needs. It is this type of cooperation which demonstrates both the concern of the various MOAC departments regarding rainfed agricultural research and development, and the potential of a project such as NERAD.

B. ANALYTICAL METHODOLOGY

In preparing the design of this Project, the RTG and USAID adopted a methodology that has provided more information, in a shorter period of time, than has previously been available for most USAID project design work. Time from initial conceptualization of tambon-level information needs to completion of project paper was eight months, the last two to three of which involved the actual design. Primary sources of information were (1) Recent studies of rainfed agriculture in the Northeast by MOAC (see section A, above); (2) Village-level surveying by an anthropological team from Ramkhamhaeng University; (3) Household surveying by the Office of Agricultural Economics; and (4) Site visitation and survey work by both a team of MOAC technical specialists, and the Design Team of Thai and U.S. consultants.

The components of the information base fitted together in the following manner. The Northeast rainfed agriculture studies (see section A, above) were used to provide much of the general data about rainfed farming in the Northeast and to guide and frame the design process. Village-level surveying by an anthropological team was used as a rapid and inexpensive means to provide a great deal of information about specific tambons to be considered as potential project sites. Usefulness of this type of surveying is in site selection and to provide a description of each site that would give the design team a great deal of needed advanced knowledge. We found that this method provided accurate information at the village level (born out by the more time-consuming and expensive household surveying) and was an invaluable aid to the Design Team, allowing them to be much better informed before they began to work and prior to their own site visits. The report by technical specialists from various departments of the MOAC on their observational survey of NERAD sites was also used to provide much of the general information about the primary needs for agricultural development, problems and recommendations for each particular tambon. From this informational base, the design team then conducted site visits and gathered further on-the-ground information necessary to the actual planning, in addition to information from conversations with RTG officials from various agencies and information provided by them. While all this was occurring, the Office of Agricultural Economics had surveyed the sites at the household level and household data was coded, edited and summary descriptive results prepared with the aid of computer facilities (U.S. RAMC in Bangkok), using SPSS. Results of this survey were available as the design team prepared to write up the design and the statistics provided were used throughout the project paper. Further

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ANNEX II-4

computer analysis, beyond summary description, was also requested by the design team and provided by RAMC with USAID staff technical assistance. The data from this household survey is considered some of the best, most recent household data available on the Northeast and will undergo further analysis for USAID and RTG programmatic concerns, and will serve as baseline data for the Project.

110 (10-70)  
SUPPLEMENT 1

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL  
FORM WHICH CAN BE USED AS AN AID  
TO ORGANIZING DATA FOR THE PDR  
REPORT. IT NEED NOT BE RETAINED  
OR SUBMITTED.)

Title of Project: \_\_\_\_\_  
From FY: \_\_\_\_\_ to FY: \_\_\_\_\_  
Total U.S. Funding: \_\_\_\_\_  
Date Prepared: \_\_\_\_\_

Project Title & Number: NORTHEAST RAINED AGRICULTURAL DEVELOPMENT

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: The broader objective to which the project contributes: (A-1)</p> <p>Increased economic well-being of poorer Northeast Thailand farm families.</p>	<p>Measures of Goal Achievement: (A-2)</p> <ol style="list-style-type: none"> <li>1. Increased real income per farm family in Northeast relative to changes in the nation.</li> <li>2. Increased availability of public and private agricultural services located in rural areas.</li> </ol>	<p>RFC statistical publications and reports.</p>	<p>Assumptions for achieving goal targets: (A-4)</p> <ol style="list-style-type: none"> <li>1. Continued political stability in Thailand.</li> <li>2. Relatively stable price structures.</li> <li>3. Lower income farmers willing and able to take advantage of better economic opportunities.</li> </ol>
<p>Project Purpose: (B-1)</p> <p>Establish in 8 representative Tambons of Northeast Thailand a replicable agricultural development program for increasing farm productivity and farm income particularly among lower income farmers in rainfed agricultural zones.</p>	<p>Conditions that will indicate purpose has been achieved: End of project status: (B-2)</p> <ol style="list-style-type: none"> <li>1. Increase in quantity and/or quality of farm output consumed by villagers.</li> <li>2. Increase in cash agricultural income by farmers.</li> <li>3. Reduced percentage of farm families below the poverty level.</li> <li>4. Self sustaining agricultural development programs in the target sub-districts operated by regular agricultural agencies at end of project.</li> <li>5. Management system and other project techniques for integrated agricultural development on an area basis planned for application in other areas.</li> <li>6. On-going area based farming system research program development with active components relating to at least 3 major weaknesses in Northeast Thailand farming system.</li> </ol>	<p>(B-3)</p> <ol style="list-style-type: none"> <li>1. Project surveys.</li> <li>2. RFC agricultural statistics.</li> <li>3. Project reports</li> <li>4. Site visits, and evaluations.</li> </ol>	<p>Assumptions for achieving purpose: (B-4)</p> <ol style="list-style-type: none"> <li>1. Farmers desire an increase standard of living through increasing agricultural productivity and income.</li> <li>2. Lower income farmers are willing and able to take advantage of improved opportunities.</li> <li>3. MWR extension and research programming will continue to be improved in accordance with present plans.</li> <li>4. See Goal Level Assumptions.</li> </ol>
<p>Outputs: (C-1)</p> <ol style="list-style-type: none"> <li>1. Farming practices suitable to land, climatic, and socio-economic conditions adopted.</li> <li>2. Adequate extension and other agriculture support services being provided and utilized in target areas.</li> <li>3. Economic development of available water resources for supplemental agricultural and domestic uses.</li> <li>4. Research and demonstration program for continuous refinement of rainfed farming systems.</li> <li>5. Agricultural development process fitting farmer needs and government resources and capabilities:             <ol style="list-style-type: none"> <li>(a) Suitable administrative system procedure for an area development project;</li> <li>(b) village/Tambon program for community action.</li> </ol> </li> </ol>	<p>Magnitude of Outputs: (C-2)</p> <ol style="list-style-type: none"> <li>1. Recommended practices adopted in each tambon for subsistence/cash crop cultural technologies water utilization, animal husbandry, fisheries, horticulture, land development and soil conservation.</li> <li>2. 493 farmer specialists, 24 tambon extension agents, 4 field managers and 4 assistants, 7 district officials, and 12 subject matter specialists trained and in place; 8 tambon extension facilities constructed; extension radio support program; 1 mobile unit equipped and operating; publications regularly distributed in project areas; detailed soil and land maps prepared; simple weather stations serving each tambon established and operating.</li> <li>3. 58 water structures, 1500 shallow wells and 11 filter systems in place.</li> <li>4. Demonstrations of saline soil amelioration and of public land use for wood/forage established. Active research program underway targeted on analysis of project area farming systems and resolution of key problems and production constraints.</li> <li>5. Establishment of an interactive and replicable process in each project tambon for matching government resources and farmer needs in agricultural development.             <ol style="list-style-type: none"> <li>a. Project management system operating in accordance with principles and concepts outlined in project paper.</li> <li>b. Villages and tambons organized to make informed decisions on needs for project activities and have capacity to plan and implement these activities.</li> </ol> </li> </ol>	<p>(C-3)</p> <ol style="list-style-type: none"> <li>1. Evaluations/reviews.</li> <li>2. Project reports.</li> <li>3. RFC records.</li> <li>4. Site visits.</li> </ol>	<p>Assumptions for achieving outputs: (C-4)</p> <ol style="list-style-type: none"> <li>1. Recommended farming practices acceptable and desired by farmers.</li> <li>2. Suitable land made available for interventions.</li> <li>3. Rainfall patterns do not deviate markedly from expectations.</li> <li>4. Necessary farm inputs and infrastructure not addressed by project are adequately available in project areas.</li> <li>5. Village and district governments as well as RFC line agencies cooperate fully with project staff.</li> </ol>
<p>Inputs: (D-1)</p> <ol style="list-style-type: none"> <li>1. Personnel.</li> <li>2. Supplies and equipment.</li> <li>3. Training.</li> <li>4. Technical Assistance.</li> <li>5. Administrative/Management.</li> <li>6. Construction of facilities</li> <li>7. Funds for meetings, transport subsidy, seminars, per diem/lodging.</li> <li>8. Plant seed/fish seed/animal seed.</li> <li>9. Surveys, demonstrations, research.</li> <li>10. Evaluation/monitoring.</li> </ol>	<p>Implementation Target (Type and Quantity) (D-2)</p> <p>(See Financial Plan and Annexes)</p>	<p>(D-3)</p> <p>Project reports, evaluations, site visits.</p>	<p>Assumptions for providing inputs: (D-4)</p> <ol style="list-style-type: none"> <li>1. Adequate numbers of qualified personnel available.</li> <li>2. Integrated planning and budgeting adopted.</li> <li>3. All agricultural inputs freely available.</li> <li>4. Marketing/credit not a constraint.</li> </ol>

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DESCRIPTION OF PROJECT AREAS  
NERAD PROJECT TAMBONS

In selecting tambons of the Northeast as sites for the NERAD project, the MOAC has made an effort to select areas representing the broad range of variation in agro-ecological and agro-economic conditions found in the region (see figure 1). The four provinces selected for the project are each in different MOAC Agro-Economic zones of the Northeast: Nakhon Phanom in zone 1; Roi Et in zone 3; Si Sa Ket in zone 4; and Chaiyaphum in zone 5. This selection also distributes the site around the region as a means of facilitate future expansion of successful project activities over wide areas of the Northeast. The following is a brief discussion of each project site, including figures which show the climatic factors and physical characteristics of the land resources, followed by tables of tambon level data from the socio-economic survey conducted in the project tambons by the Office of Agricultural Economics. Further description of project tambon characteristics may be found in the Social Analysis (Annex VII) and Economic Analysis (Annex VI) of the Project Paper, and in two publications prepared as background material for the project design:

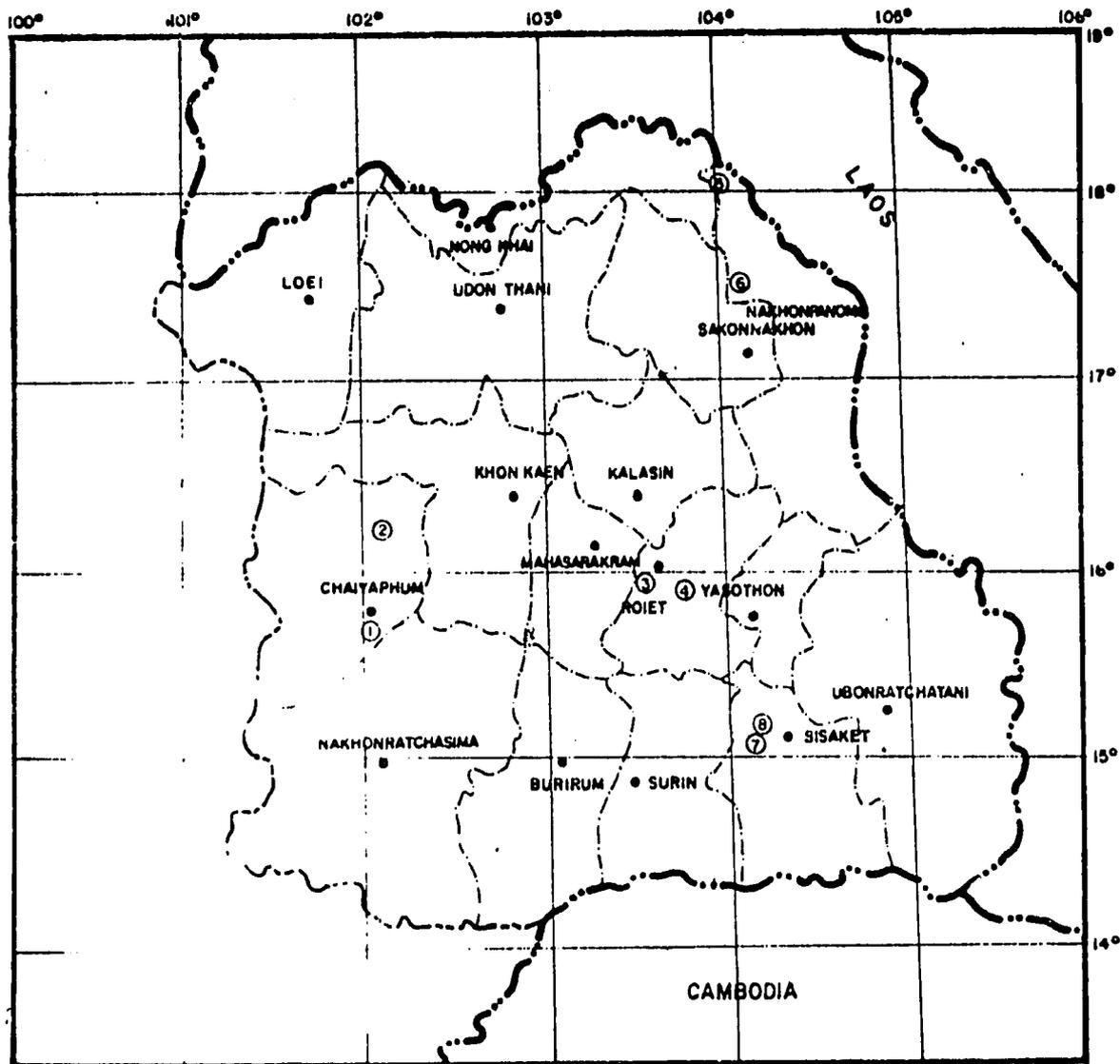
- Village Level Study for the NERAD Project, by Damrong Thandee, Department of Sociology & Anthropology, Ramkhamhaeng University (1980)
- NERAD Site Survey Report by MOAC Technical Specialists, Northeast Regional Office of Agriculture, Office of the Undersecretary, MOAC (1980) Soil and Land Classification symbols are explained in Figures 2<sup>0</sup> and 2

1. Chaiyaphum Province

This province is located in Agro-Economic Zone 5, the lowest rainfall area of the Northeast (See Figure 2).

a. Tambon Lahan. This tambon is located in the southern portion of the province, and the all-weather road running through the tambon provides relatively convenient communication and transportation to both the provincial city and to Nakhon Ratchasima, the major regional marketing center for goods being transported between Bangkok and the Northeast Region. The tambon is divided roughly in half by the main road (Figure 3). To the northwest of the road is a large lowland area (Figure 4) dominated by Lahan Lake, the largest water resource of the area, which occupies up to about 5,700 hectares during

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CONVENTIONAL SYMBOLS

- ② Tambon
- Changwat
- International boundary
- Region boundary
- Changwat boundary

No	Sub District ( Tambon )	District ( Amphoe )	Province ( Changwat )
1	Lahan	Chatturat	Chaiyaphum
2	Kwang Chon	Phu Khiep	Chaiyaphum
3	Nong Khoew	Muang	Roi Et
4	Na Muang	Salaphum	Roi Et
5	No Thom	Ban Phoeng	Nakhon Phanom
6	Ma Ngua	Na Wa	Nakhon Phanom
7	Tae	Utumphonphisai	Si Saket
8	Taket	Utumphonphisai	Si Saket

Figure 1. Location of Project sites in the North East Thailand

the flooding season and is used for fishing and some lotus growing. Some paddy areas mostly non-glutinous rice surround this swamp, and vegetable production occurs, along with a limited amount of off-season rice production on the land exposed by the receding flood waters. Some salinity problems are encountered here, especially in the southern portion of the swamp area. The area southwest of the road has extensive upland areas, much of which used to be planted to kenaf. Since 1975 most of it has been planted to cassava which is processed in a large processing facility in Ban Lahan which also has tractors available for hire. Considerable rainy season production of vegetables also occurs some of these upland areas, which along with the off-season production is marketed in Nakhon Ratchasima. Production practices and cultivars are mostly traditional, and improper use of pesticides is evident. Good paddy land is quite limited in this tambon, and number of families in the villages along the main road are landless. Significant number of cattle are grazed primarily in upland areas and along the road. Socio-economic stratification is quite pronounced in this tambon.

b. Tambon Kwangjon

This tambon is located in the northern portion of the province, and is the largest Project tambon, both in term of area and population. The land of the tambon is undulating (Figures 5 and 6) and is bordered on the west by mountains which are within RTG Forest Reserves. Crop production is primarily subsistence glutinous rice in lowland areas, with low-yield kenaf dominating the upland areas. Cassava production is limited due to tuber damage caused by flooding in most years. Some maize is grown in the tambon, and is also being planted by some villagers with limited land on the adjacent mountain within the Forest Reserve area. Cash inputs for crop production are quite low and traditional cultivars and practices are dominant. Small-scale water resources are scattered around the tambon but mostly dry out in the dry season. Crop failure due to erratic rainfall is frequent. Substantial numbers of livestock are also produced. A number of farmers rent paddy from absentee landlords, often on a sharecropping basis. Sale of "green" crops is common.

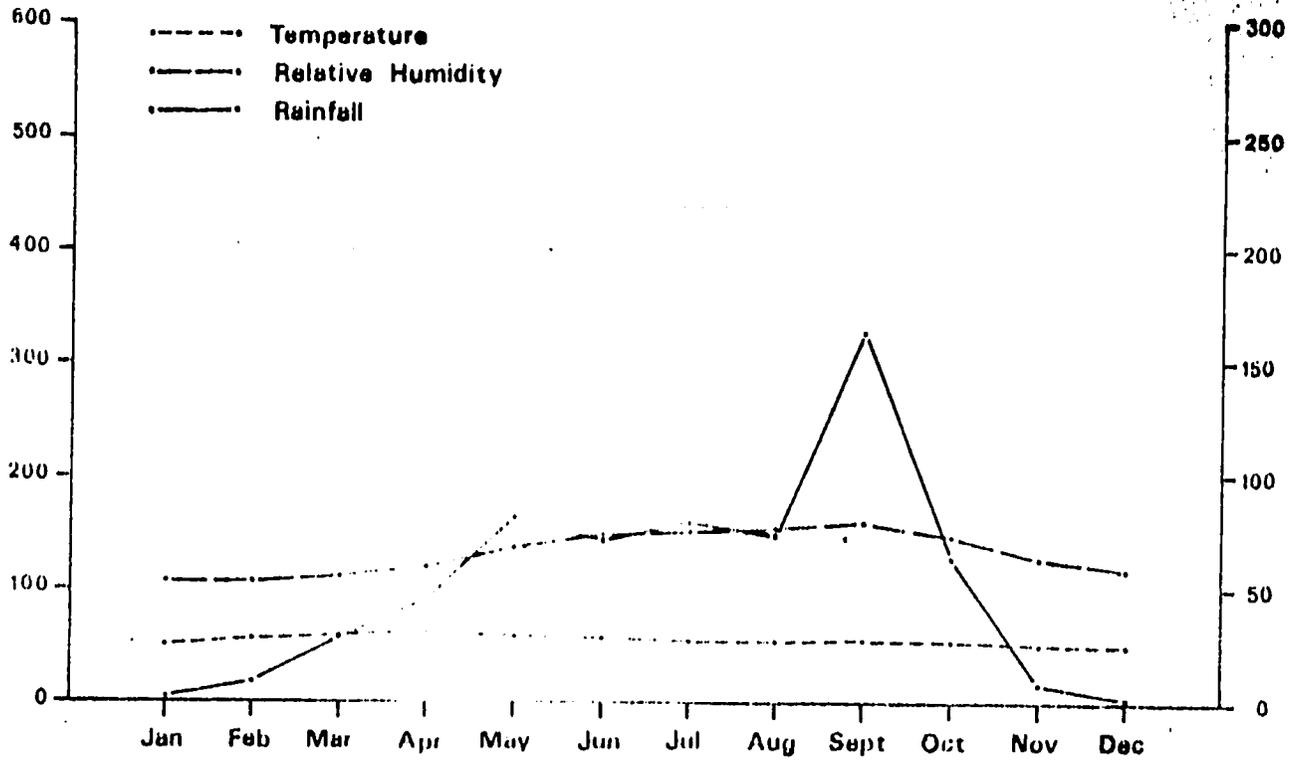
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**FIGURE 2 AVERAGE CLIMATIC FACTORS : Charyaphum**

**ANNEX IV**

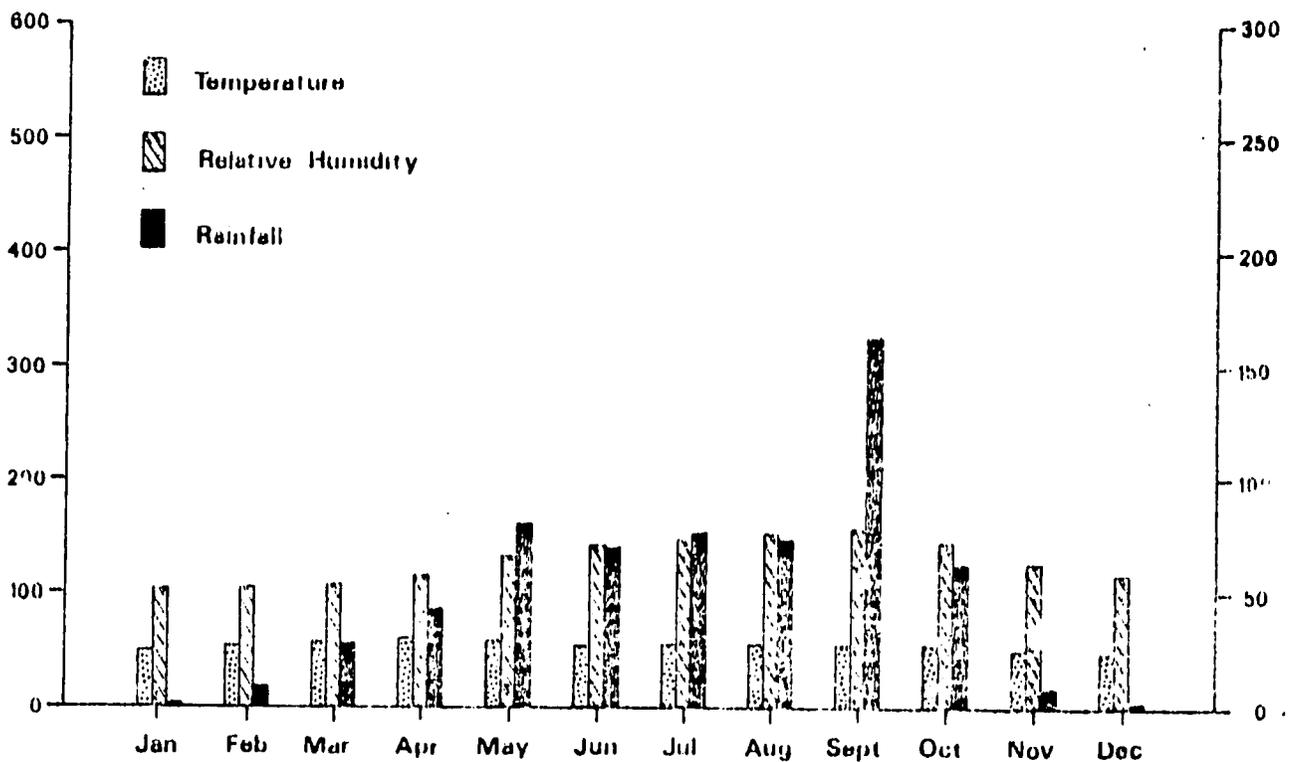
Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)



Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)

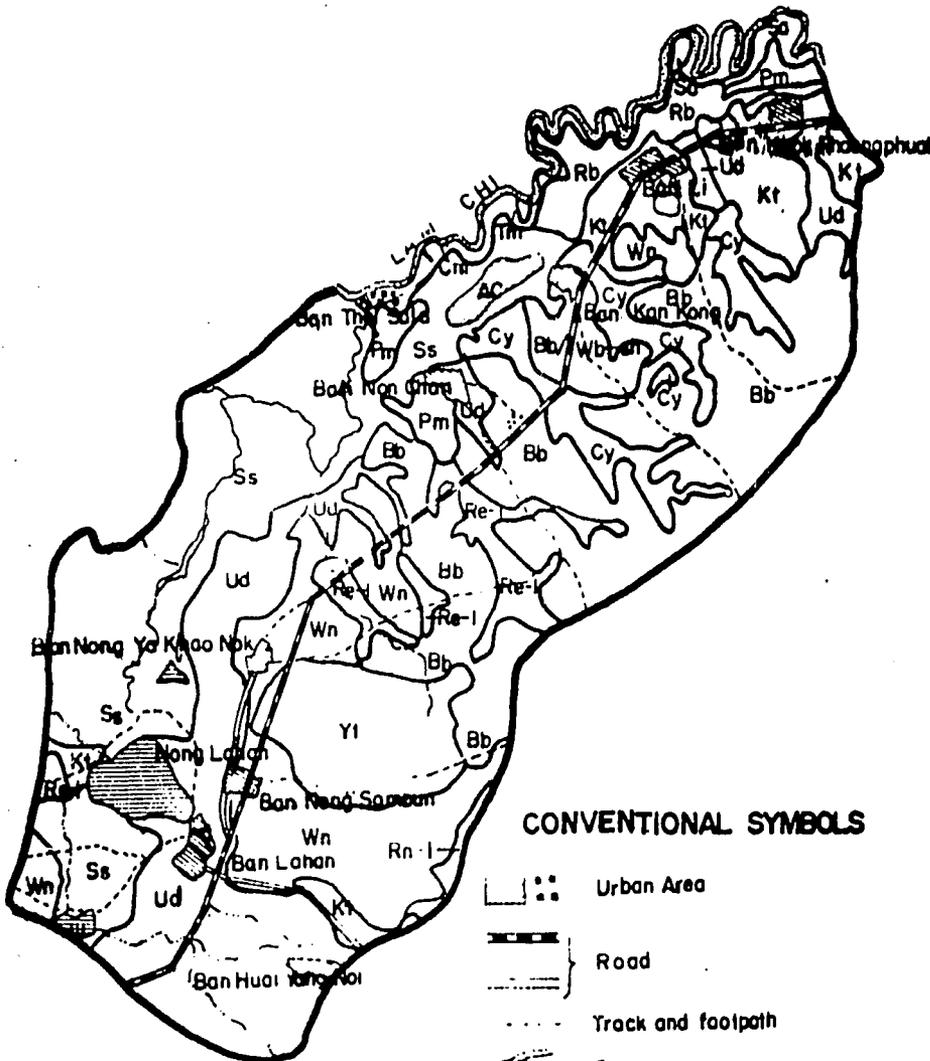


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FIGURE 3

# RECONNAISSANCE SOIL MAP OF TAMBON LAHAN

Amphoe Chatturat Changwat Chaiyaphum



### LEGEND

- AC Alluvial Complex
- Cm Chiang Mai series
- Tm Tho Muang series
- Sa Sanphaya series
- Pm Phimai series
- Rb Patchaburi series
- Ss Si Sangkhram series
- Cy Chaiyaphum series
- Ud Udon series
- Re-l Roi Et series, loamy variant
- Rn-l Renu series, loamy variant
- Kt Karat series
- Wn Warin series
- Wn-sh Warin series shallow phase
- Yt Yasothon series
- Bb Borabu series

### CONVENTIONAL SYMBOLS

- Urban Area
  - Road
  - Track and footpath
  - River
  - Stream and creek
  - Pond
  - Tambon boundary
  - Soil boundary
- { Long. 101° 54' - 102° 00' E }  
 { Lat. 15.34' - 15.42' N }

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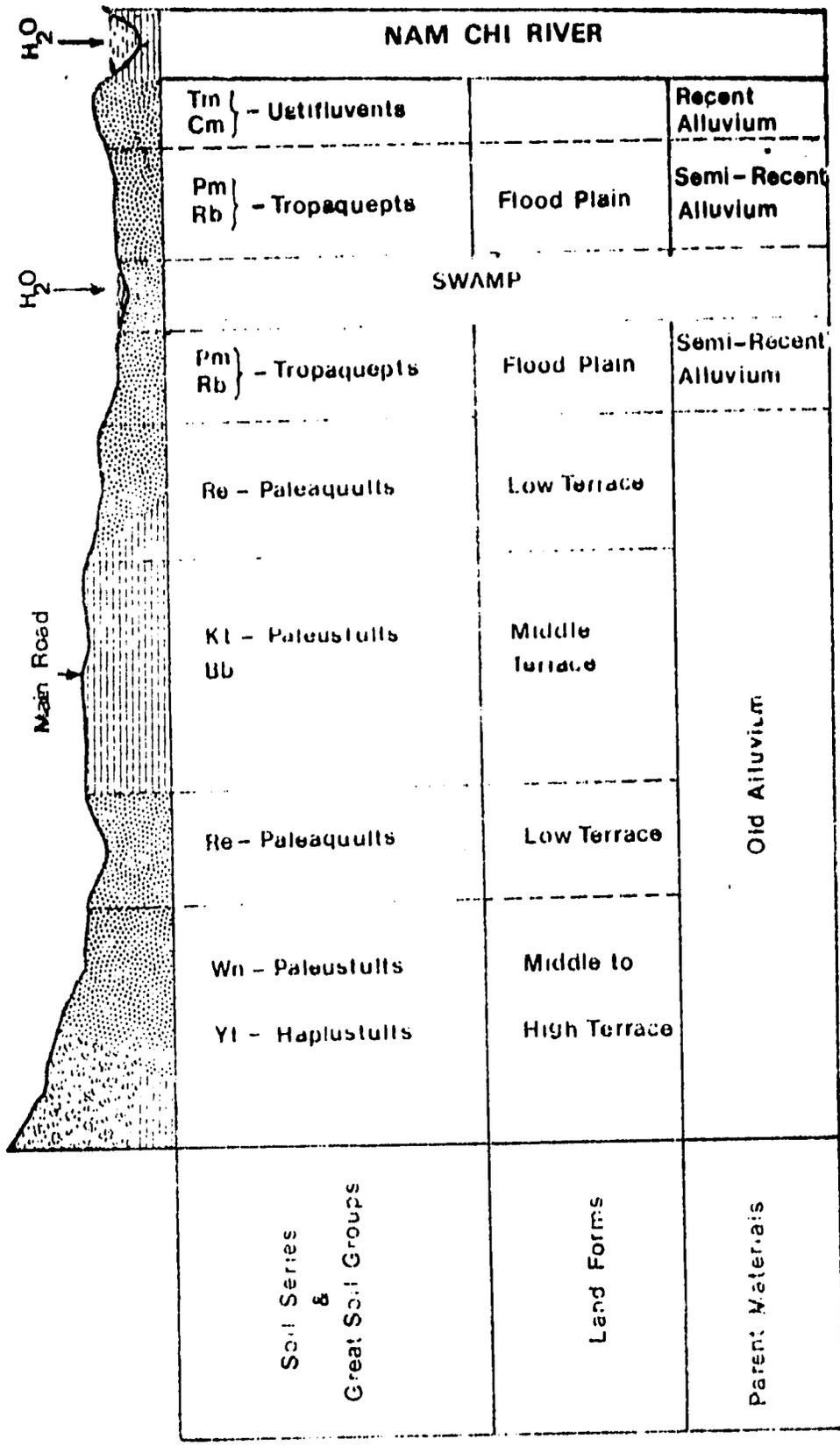


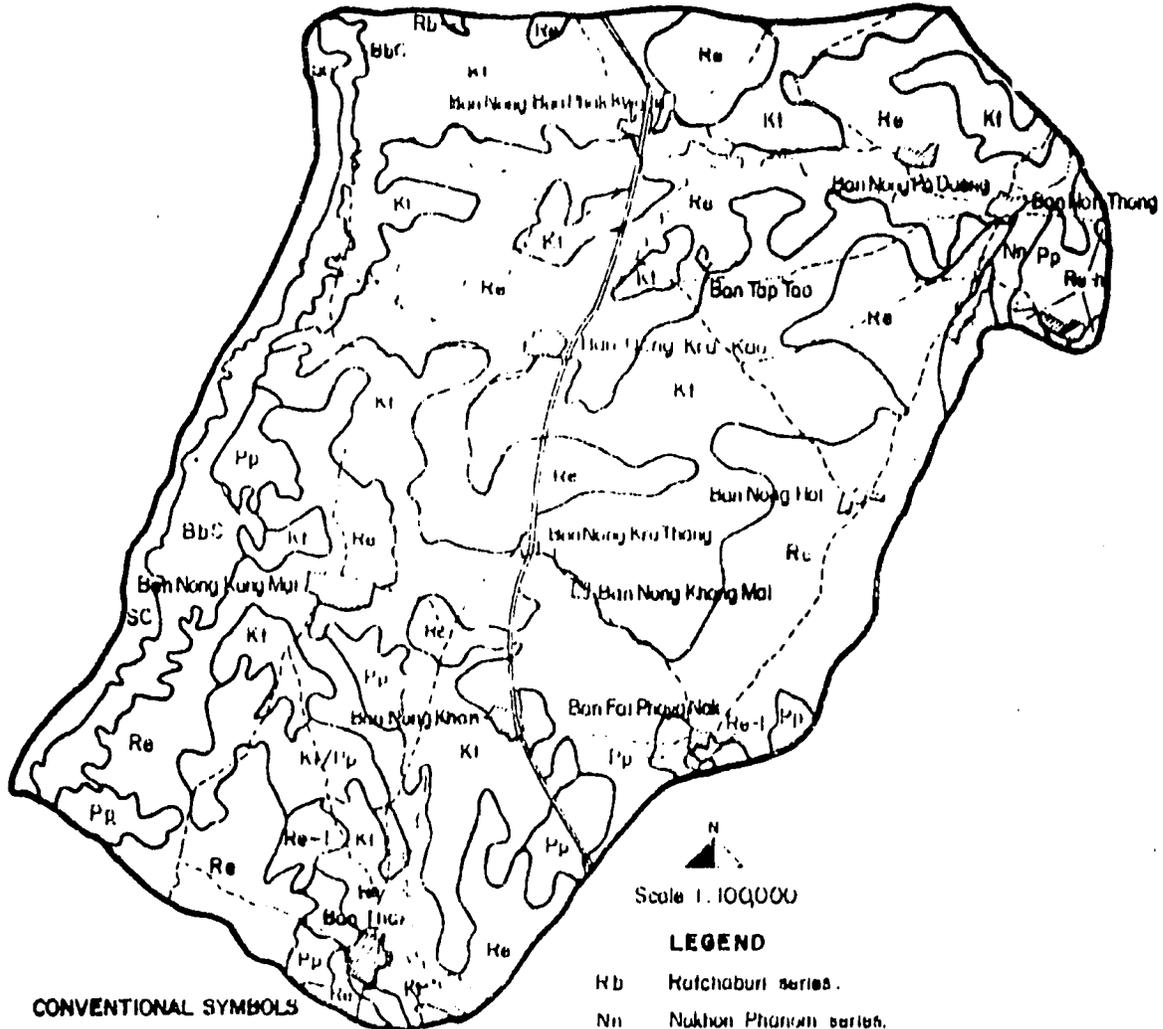
FIGURE 4 Schematic Cross Section of Tambon Lahan, Amphoe Chaturat, Chaiyaphum Province.

DOI

FIGURE 5

RECONNAISSANCE SOIL MAP OF TAMBON KWANG JON

Amploe Phu Khiao, Changwat Chalyaphum

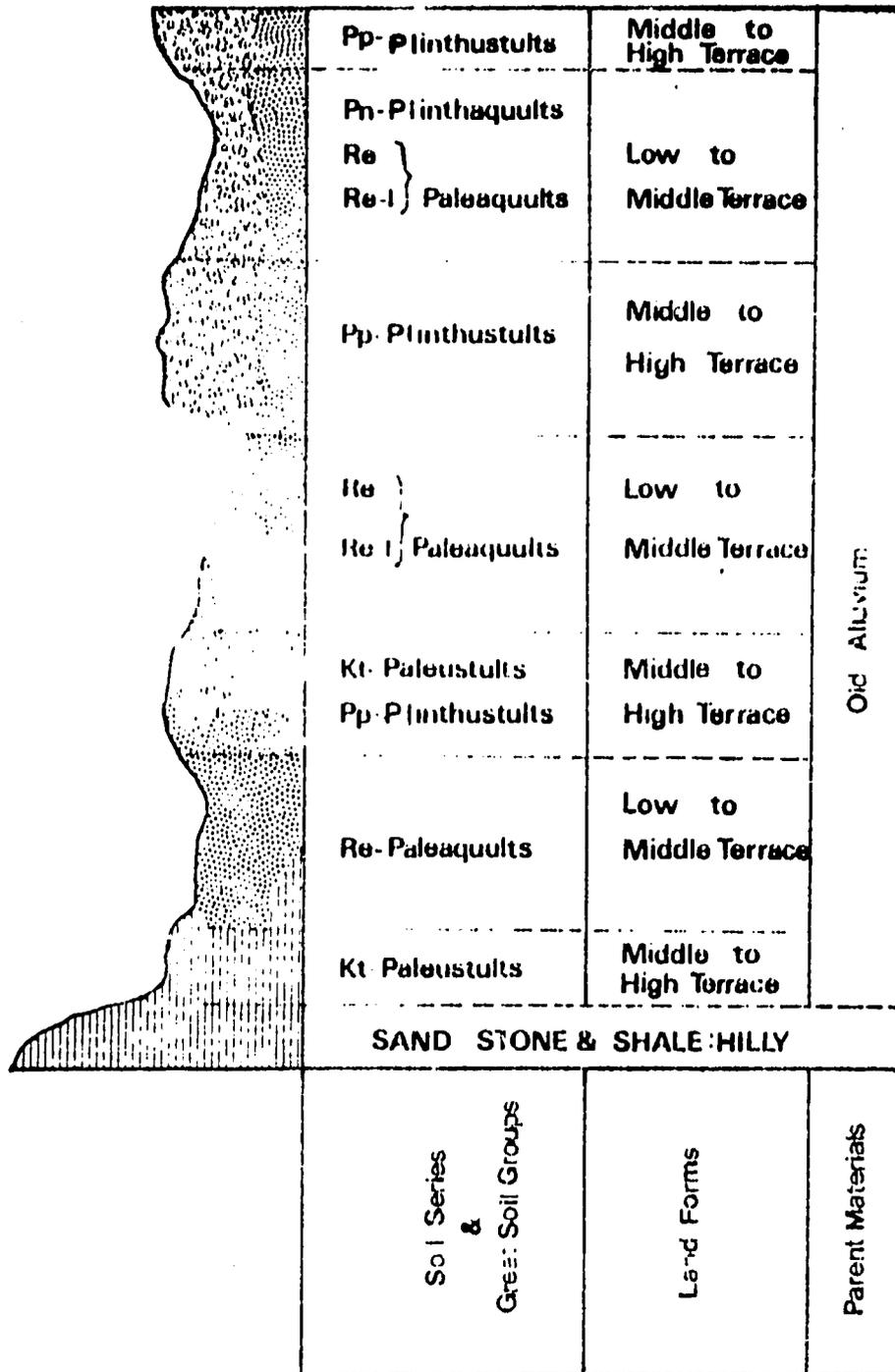


CONVENTIONAL SYMBOLS

- Urban Area
- Road
- Track and Footpath
- Stream and Creek
- Furd
- Tambon boundary { Long 102°08'-102°17'E }  
{ Lat 16°11' 16°19' N }
- Soil boundary

LEGEND

- Rb Ratchaburi series.
- Nn Nakhon Phanom series.
- Re Roi Et series.
- Ru-1 Roi Et series, loamy variant.
- Re-h Roi Et series, high phase.
- Ki Korat series.
- Pp Phra Phisai series.
- Ki/Pp Korat Phra Phisai association
- BbC Burabu Complex.



**FIGURE 6** Schematic Cross Section of Tambon Kwang Jon,  
Amphoe Phu Khioe, Chaiyaphum Province

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## 2. Roi Et Province

This province is located in Agro-Economic Zone 3, a major rice-producing area of the Region. Rainfall is generally greater than in Chaiyaphum (Figure 7).

### a. Tambon Nong Kaew

This tambon is primarily lowland rice area (Figures 8 and 9), with only a limited amount of upland area, and is located near to the provincial capital city. Rice production is dominated by glutinous local cultivars, but a substantial portion is sold. Some kenaf is grown, mostly in paddy fields before rice, and vegetable and livestock production is substantial. Small areas of tobacco, sesame, and jute are also grown, sometimes with supplementary water from swamps or shallow wells. The dominant cash crop of the tambon is watermelon, which is grown in small plots by many farmers in the paddy fields after rice. Areas to be planted to watermelon are usually planted to a short-season local glutinous rice variety, which allows the watermelon to be planted before the main rice harvest begins. Watermelon is marketed through merchants who contract with farmers for their crop and come to the village to pick it up. This is the wealthiest tambon of the Project sites, with relatively few families in the lowest income groups. Farmers appear industrious, but traditional cultivars and practices are still dominant.

### b. Tambon Na Muang

This tambon is in the eastern portion of the province, on the west side of the Chi River. Although the land area is primarily paddy, middle terrace upland fields occupy more of the area than in Nong Kaew (Figures 10 and 11). Glutinous rice production utilizing local cultivars is predominant, but improved glutinous cultivars and nonglutinous cultivars are also planted. Rice sales is second only to Nong Kaew. Flooding occurs along the Chi River, but water could be pumped from the river for some dry season rice production. Cassava, tobacco, and some kenaf, peanut, and watermelon are grown as cash crops. Some swamps and shallow wells are used for growing vegetables after rice, but commercial production is quite limited except along the Chi River Bank. Some public area is available for livestock grazing. The district town of Selaphum serves as the market for agricultural products and the source of agricultural inputs, but with the crops other than tobacco traditional practices are still predominant and inputs such as fertilizer are often of the wrong type or applied incorrectly.

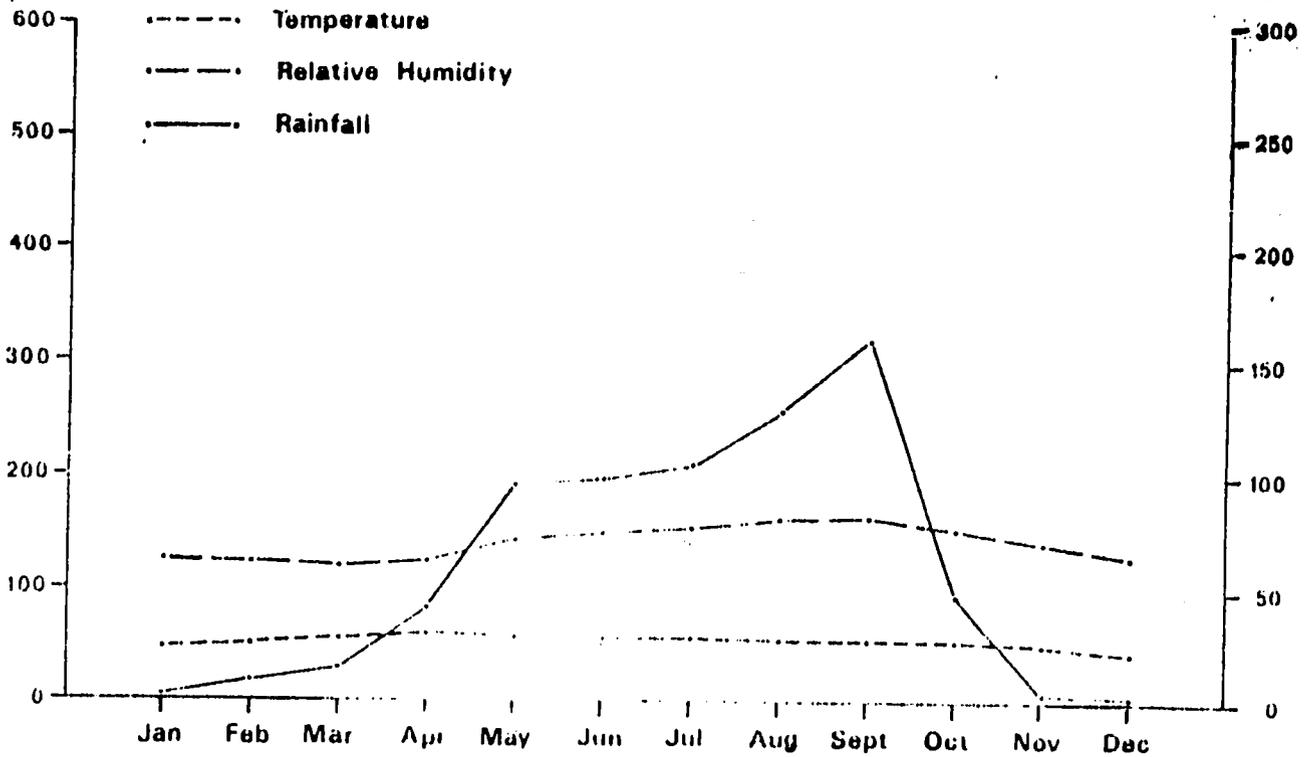
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**FIGURE 7 AVERAGE CLIMATIC FACTORS : Roi Et**

**ANNEX IV-10**

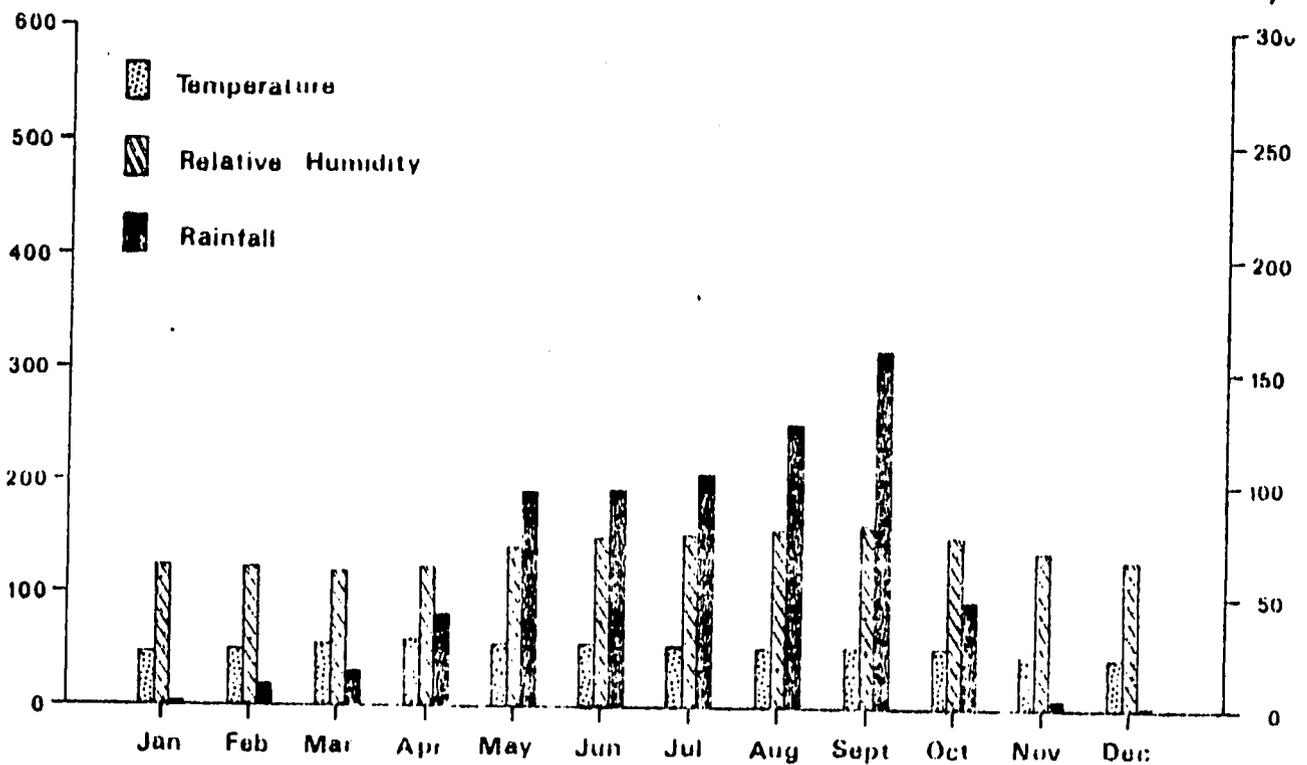
Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)



Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)

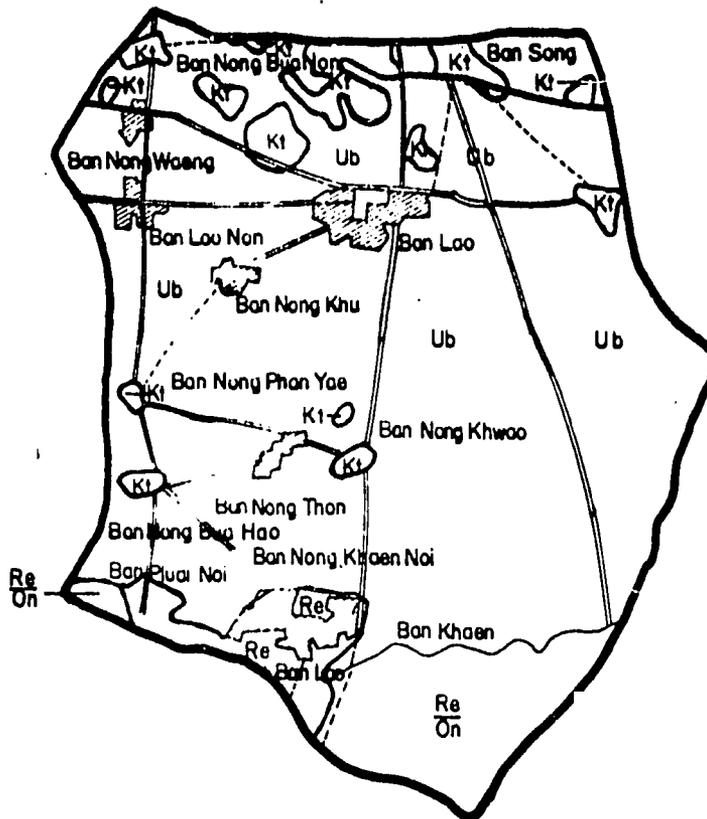


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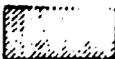
FIGURE 2

# RECONNAISSANCE SOIL MAP OF TAMBON NONG KHAEW

Amphoe Muang Changwat Roi Et



CONVENTIONAL SYMBOLS

-  Village
-  Road
-  Track and Footpath
-  Tambon boundary
-  Soil boundary

Long . 103°38' - 103°42' E  
 Lat . 15°51' - 15°58' N



SCALE 1 : 100,000

LEGEND

- Kt Korat Series
- Ub Ubon Series
- Re Rai Et Series
- $\frac{Re}{On}$  Roi Et-On association

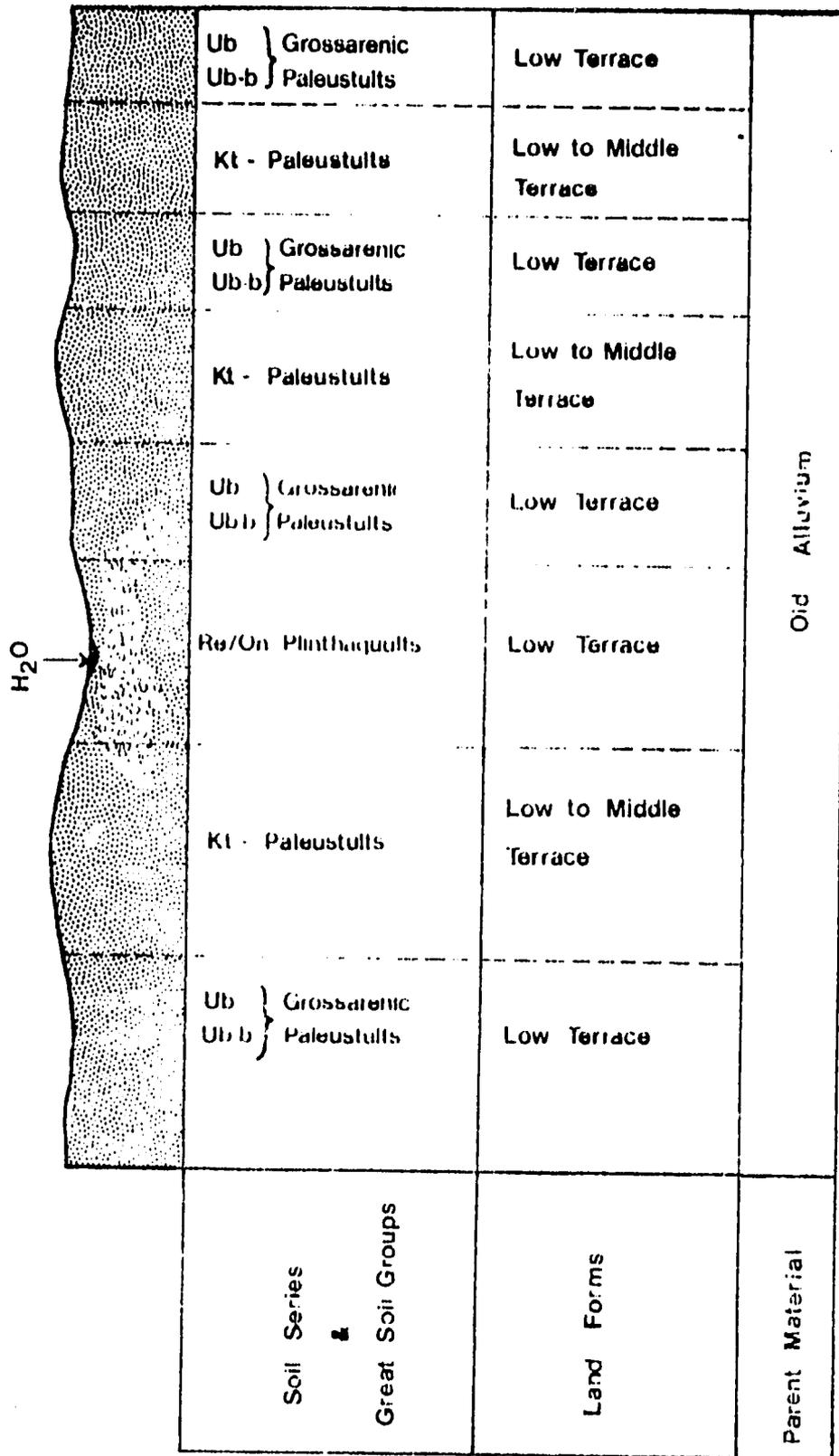
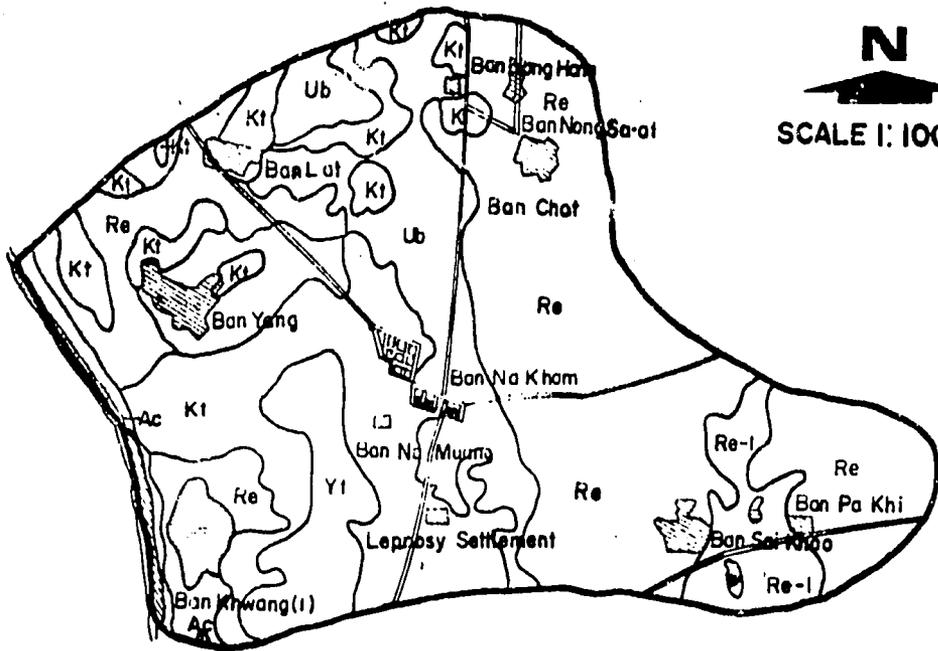


FIGURE 9 Schematic Cross Section of Tambon Nong Kaew, Amphoe Muang, Roi-Et Province.

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RECONNAISSANCE SOIL MAP OF TAMBON NA MUANG

Amphoe Selaphum Changwat Roi Et



SCALE 1: 100,000

CONVENTIONAL SYMBOLS

 Urban Area

 Road

 River

 Pond

 Tambon boundary { Long 103°57'-104°00' E  
Lat. 16°02'-16°07' N }

 Soil boundary

LEGEND

Yt : Yasolhon series

Kt Korat series

Ub Uban series

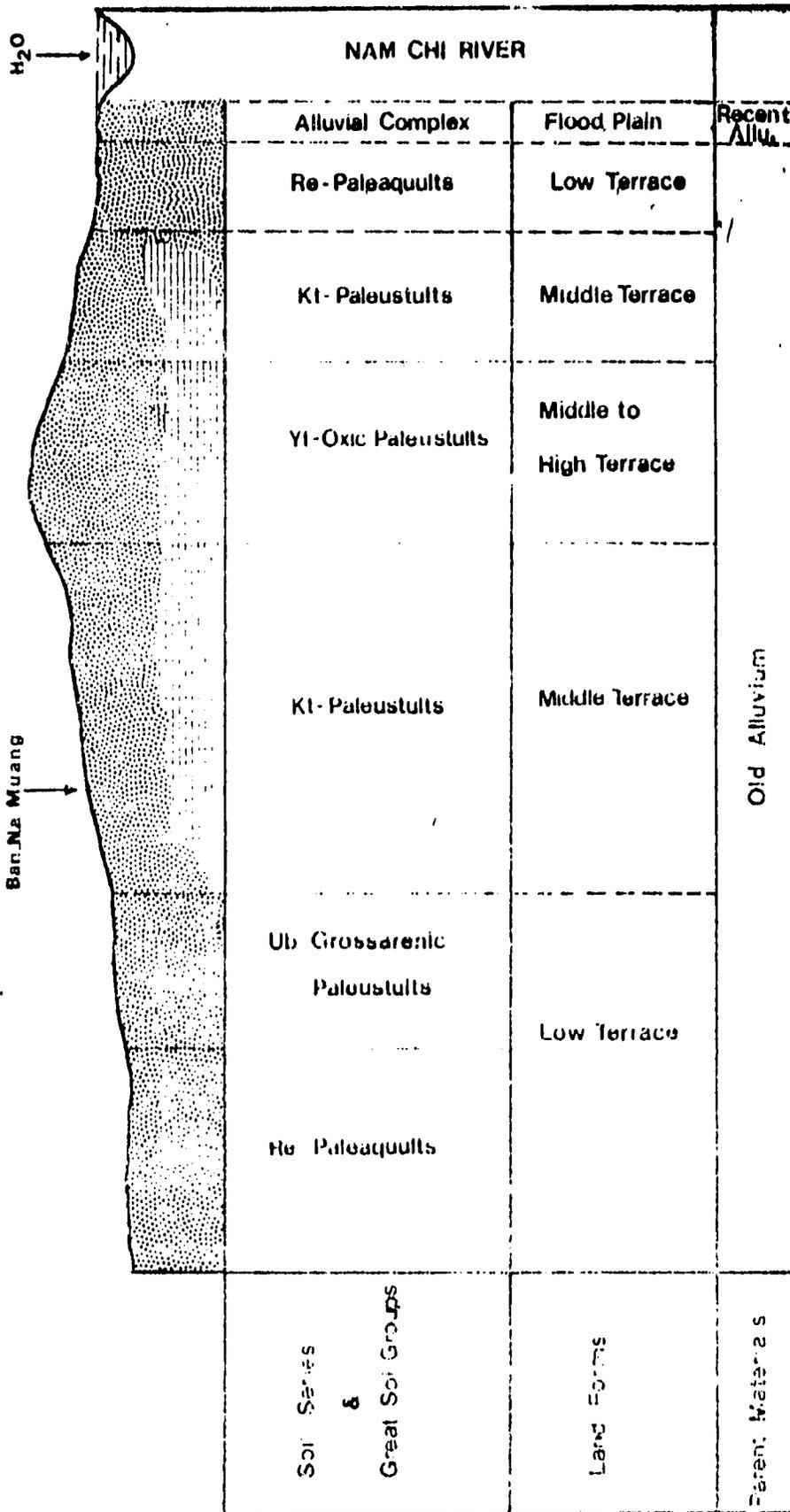
Re Roi Et series

AC Alluvial Complex

Re-l Roi Et series loamy variant

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FIGURE 13 Schematic Cross Section of Tambon Na Muang, Amphoe Selaphum Roi - Et Province.



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### 3. Nakhon Phanom Province

This province is located in Agro-Economic Zone 1, in the northeastern corner of the Region, where rainfall is earlier and heavier (Figure 12) than other parts of the Northeast, and where the distance to Bangkok is the greatest.

#### a. Tambon Na Thom

This tambon is located in the northwestern portion of the province and is the most inaccessible of the Project tambons, particularly during the rainy season. Topographical features divide the tambon into two distinct areas (Figures 13 and 14). The southern portion of the tambon is flood plain and low terrace soils, which are heavily influenced by the Songkram River. During the rainy season severe flooding occurs in this area, seriously limiting the amount of glutinous rice which is cultivated on these potentially good rice soils, and many villagers turn to commercial fishing. Some off-season rice is grown by pumping water from water resources which remain after the flood waters recede. Some fish are also sold from the public ponds and swamps in the northern portion of the tambon, but here the area is mostly upland fields resulting from the clearing of the dry dipterocarp forest. Cassava, kenaf, and livestock production dominate the upland portion of the tambon, and water is scarce during the dry season. A considerable number of fruit trees are grown around the houses. Very little cash inputs are used for any crops, and modern practices are rarely observed.

#### b. Tambon Na Ngua

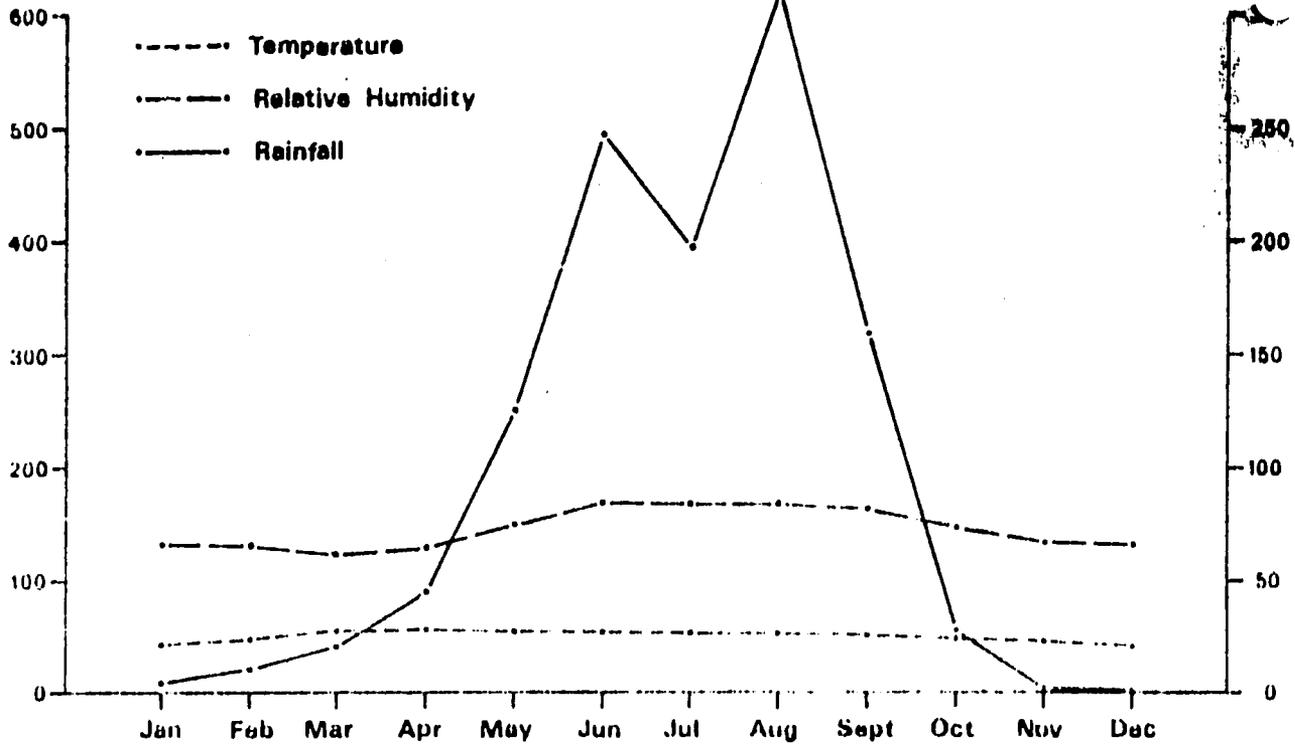
Although somewhat less remote, this tambon resembles Tambon Na Thom in that it is divided into upper and lower areas (Figures 15 and 16). The lower area borders the Oon River, resulting in some flooding during the rainy season. Bamboo shoots along the river are exploited for both home consumption and commercial production. These lower, primarily middle terrace areas are used for glutinous rice production, but yields are the lowest of any of the Project tambons. Fish production from small ponds and swamps is enough for some commercial sales. The upper terrace fields are being cleared from dry dipterocarp forests for cultivation of cassava, Thai kenaf, and some peanuts and watermelon. Livestock production using traditional breeds of cattle and buffalo is also widely practiced. Water is very scarce in these areas during the dry season, but some vegetables are grown around swamps and shallow wells and are marketed in Sakon Nakhon. As in Tambon Na Thom, very little cash inputs are used for any crop, and modern production practices are rare.

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FIGURE 12 AVERAGE CLIMATIC FACTORS : Nakhon Phanom

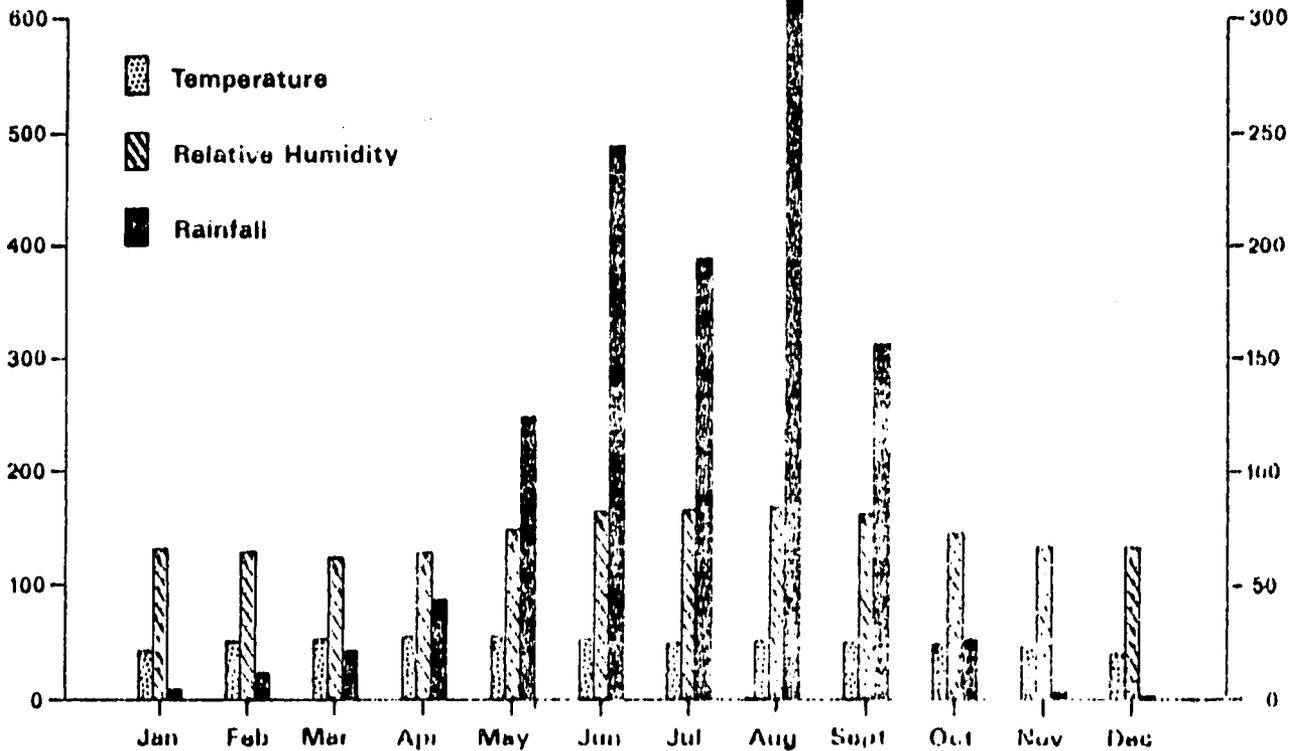
Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)



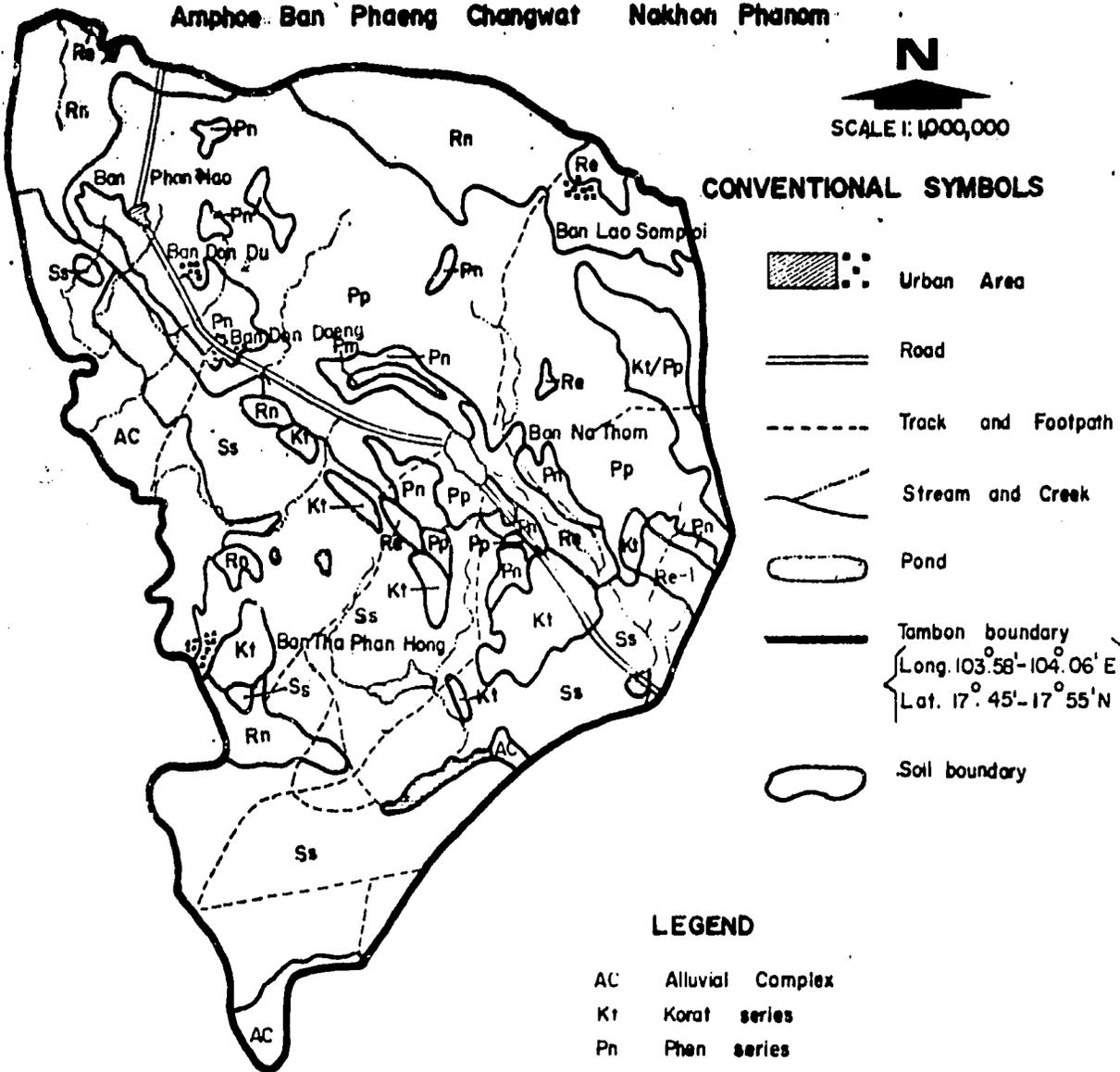
Rainfall (mm.)

Temperature (°C)  
Relative Humidity (%)



**FIGURE 113 RECONNAISSANCE SOIL MAP OF TAMBON NATHOM**

Amphoe Ban Phaeng Changwat Nakhon Phanom



**CONVENTIONAL SYMBOLS**

- Urban Area
- Road
- Track and Footpath
- Stream and Creek
- Pond
- Tambon boundary
- Soil boundary

N

SCALE 1: 1,000,000

Long. 103° 58' - 104° 06' E  
 Lat. 17° 45' - 17° 55' N

**LEGEND**

- AC Alluvial Complex
- Kt Korat series
- Pn Phan series
- Pp Phon Phisai series
- Re Roi Et series
- Re-1 Roi Et series loamy phase
- Rn Renu series
- Ss Si Songkhram series
- Kt/Pp Korat and Phon Phisai association

FIGURE 14 Schematic Cross Section of Tambor Na Thom, Amphoe Ban Phaeng, Nakhon Phanom Province.

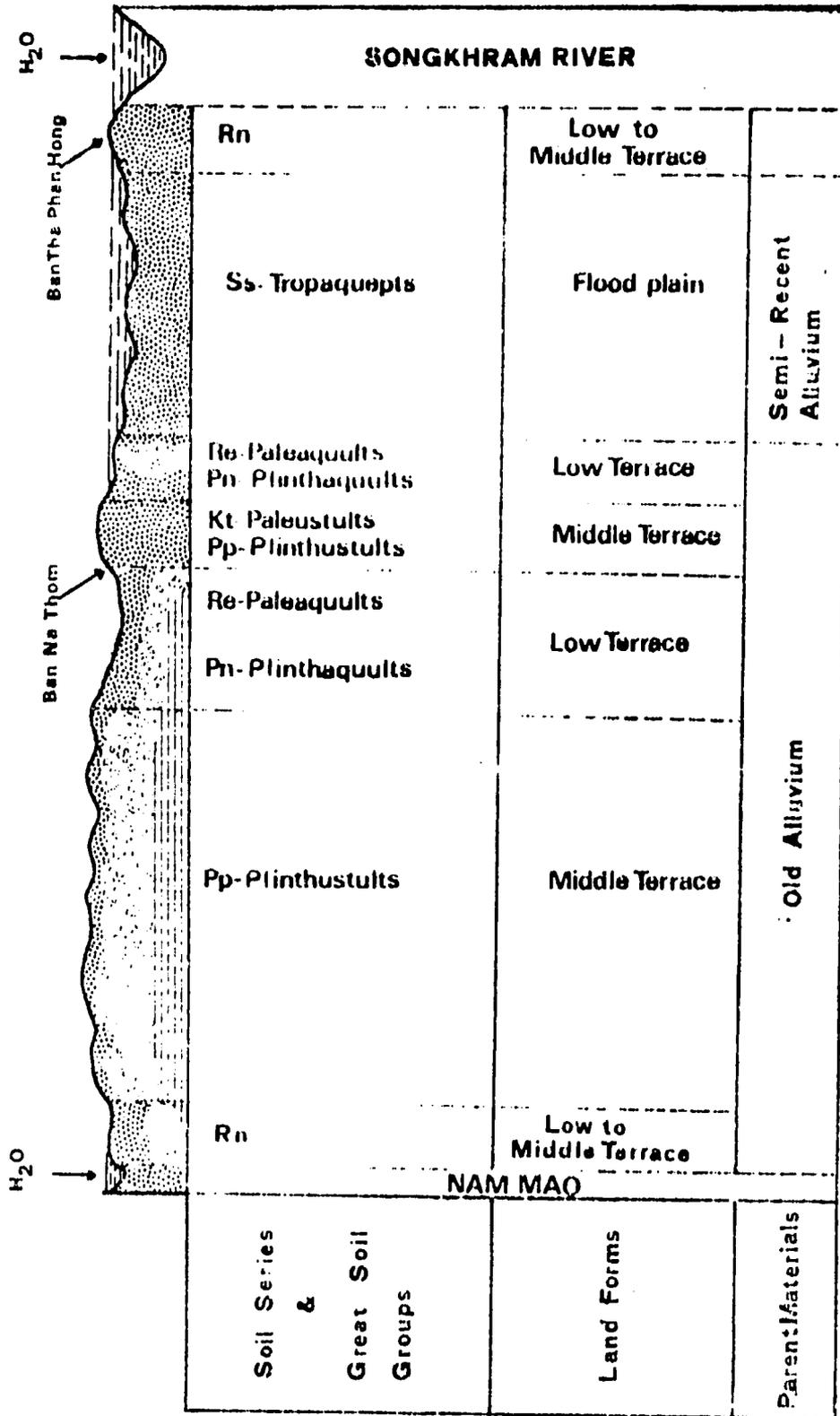
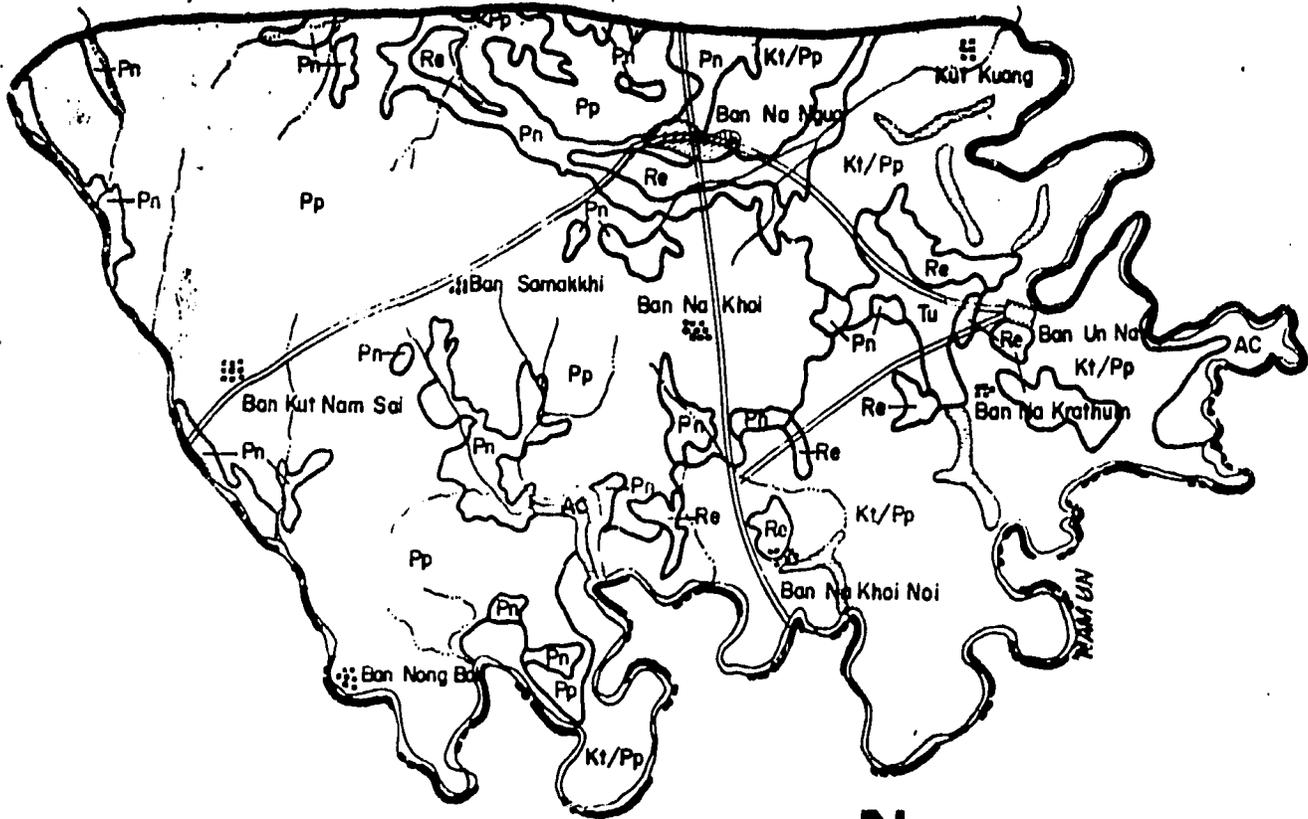


FIGURE 15

RECONNAISSANCE SOIL MAP OF TAMBON NA NGUA

Amphoe Na Wa Changwat Nakhon Phanom



CONVENTIONAL SYMBOLS

- Urban Area
  - Road
  - Stream and Creek
  - Pond
  - Changwat boundary
  - Tambon boundary
  - Soil boundary
- (Long. 104° 02' - 104° 12' E  
Lat. 17° 22' - 17° 28' N)

N  
  
 SCALE 1: 100,000

LEGEND

- AC Alluvial Complex
- Pn Phen series
- Pp Phon Phisai
- Re Eoi Et series
- Tu Tha Uthen series
- Kt/Pp Korat and Phon Phisai association

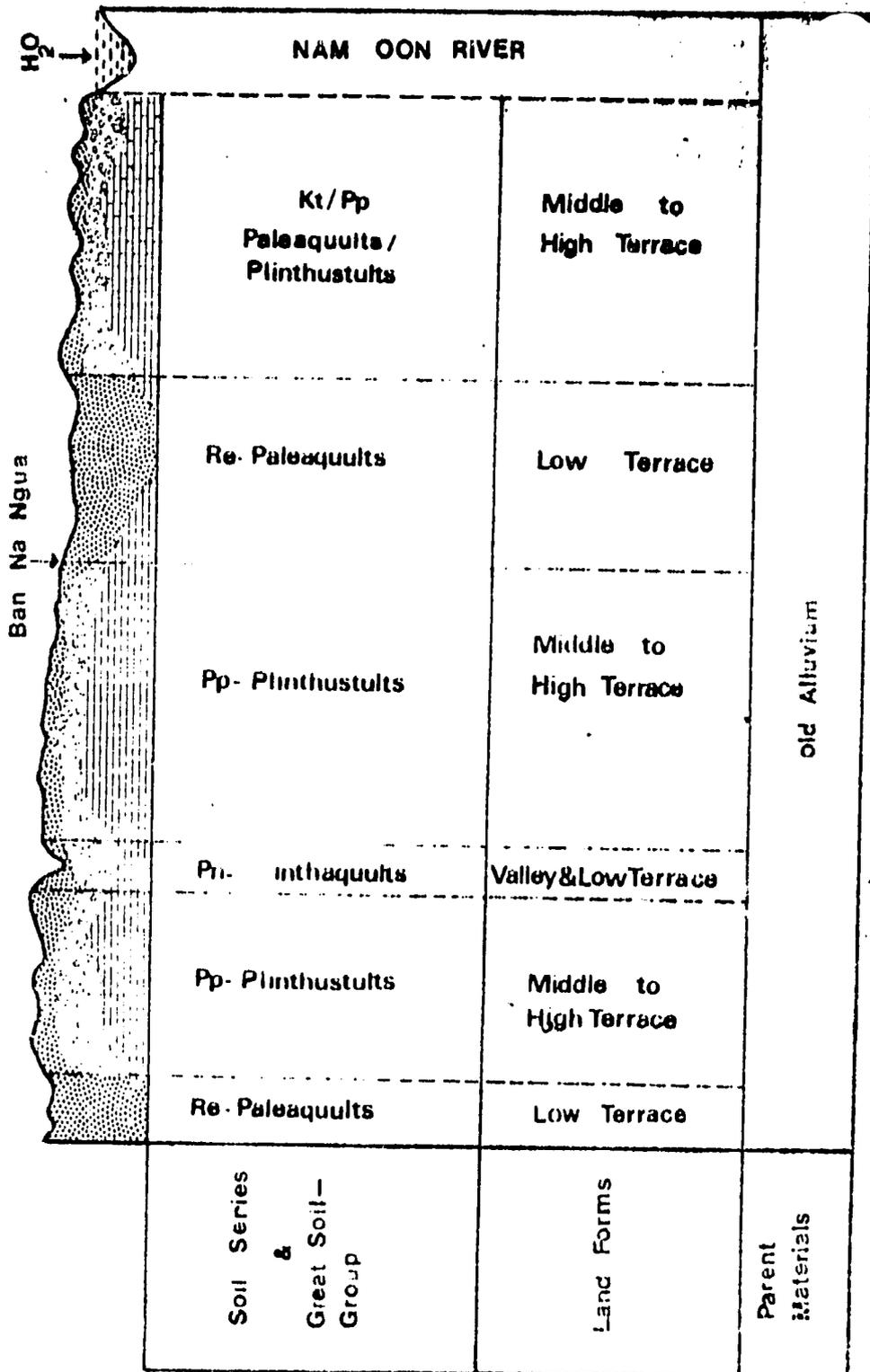


FIGURE 16 Schematic Cross Section of Tambon Na Ngua, Amphoe Na Wa,

Nakhon Phanom Province.

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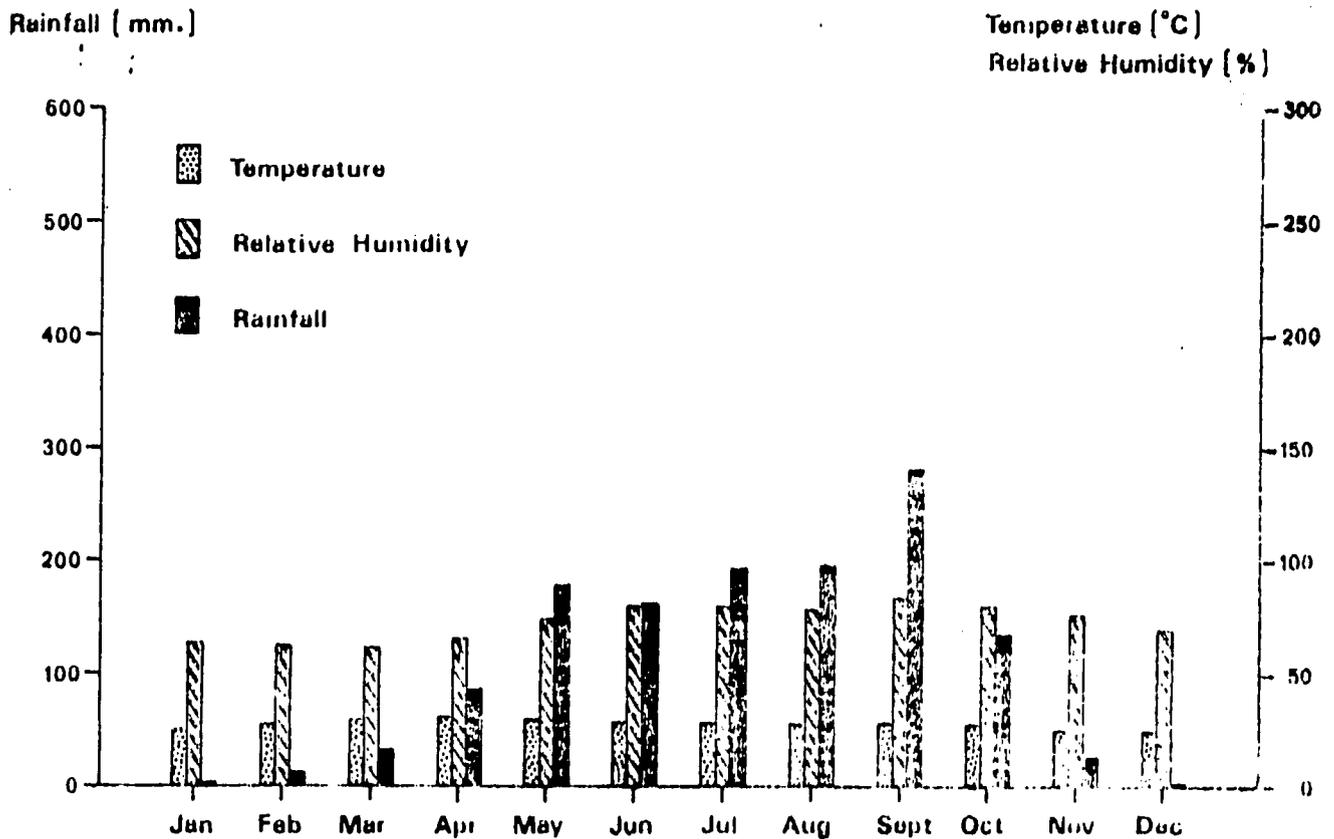
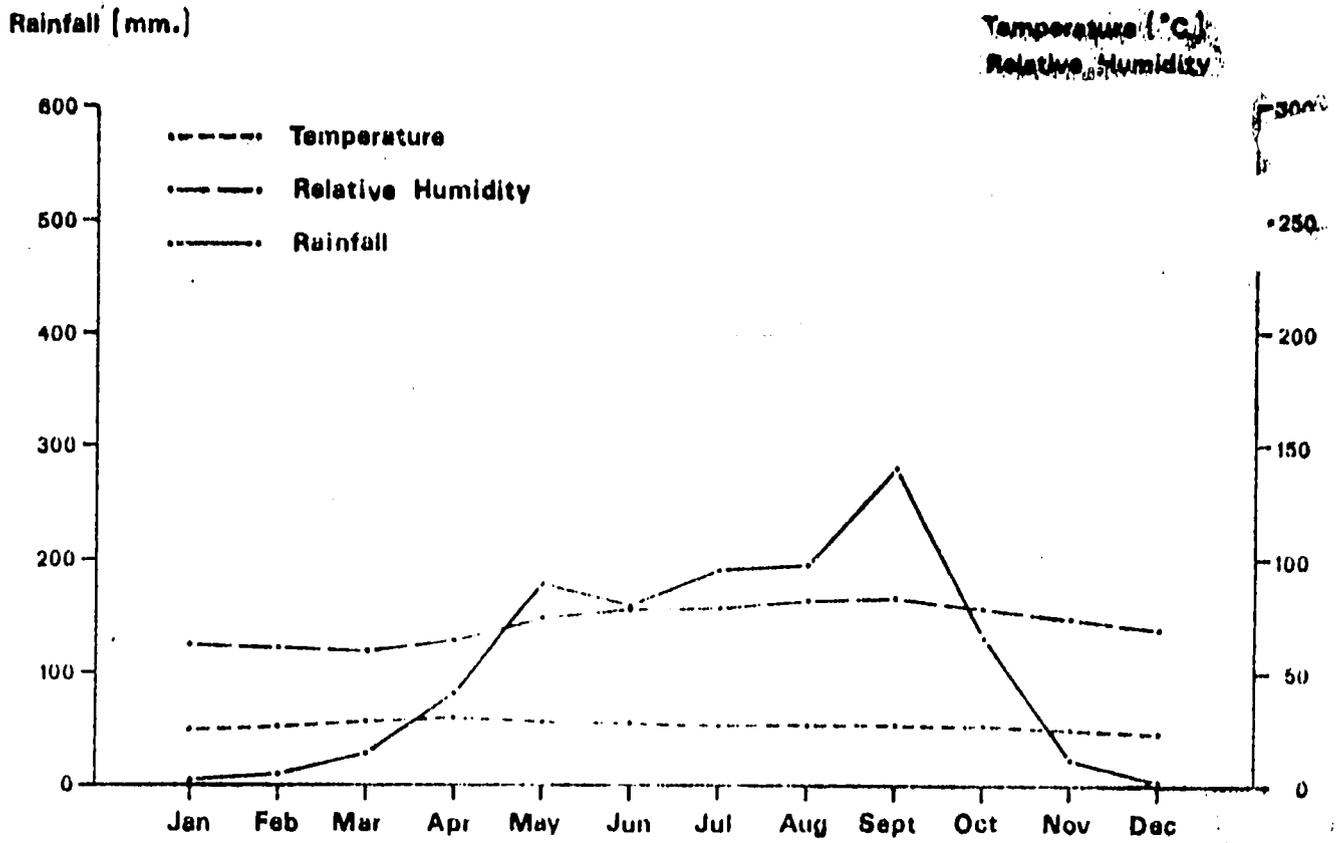
4. Si Sa Ket Province

This is one of the southern tier of provinces of the Northeast, located in Agro-Economic Zone 4. Rainfall data from Surin Province, the closest weather station to Si Sa Ket is shown in Figure 17.

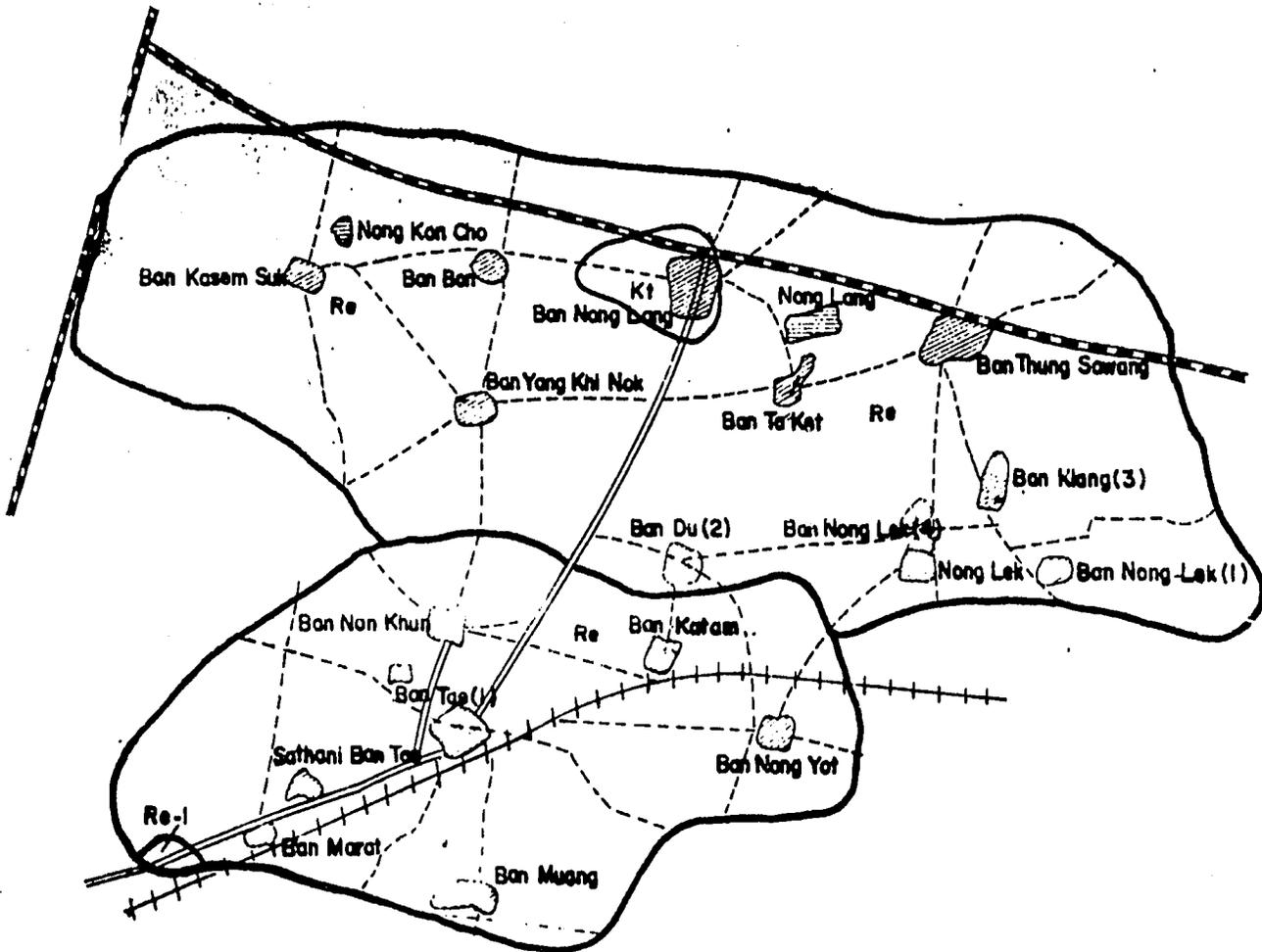
Tambons Tae and Taket

These are two small contiguous tambons, located in the same district, near to the provincial capital. They are both virtually 100% paddy fields (Figures 18 and 19) and have rather similar characteristics. Non-glutinous rice production is dominant, using relatively high levels of cash inputs, especially fertilizer. Although virtually no cassava or kenaf is grown and livestock production is limited by available grazing land, substantial amounts of watermelon (particularly in Taket) and a variety of vegetables are grown after rice harvest, using water from swamps and shallow wells which tap the fairly shallow water table in this area. Manure, chemical fertilizer, and some pesticides are used on these crops, but most are still local cultivars, fertilizers and pesticides are often used incorrectly, and traditional management practices are still widely used. Sericulture is also an important activity in these tambons and both raw filament and finished cloth is sold.

**FIGURE 17 AVERAGE CLIMATIC FACTORS : Surin (closest to S.I. Sta. No. 100) ANNEX IV-2**



Reconnaissance Soil Map of Tambon Taket and Toe  
 Amphoe Uthumphon Phisai Changwat Saket



CONVENTIONAL SYMBOLS

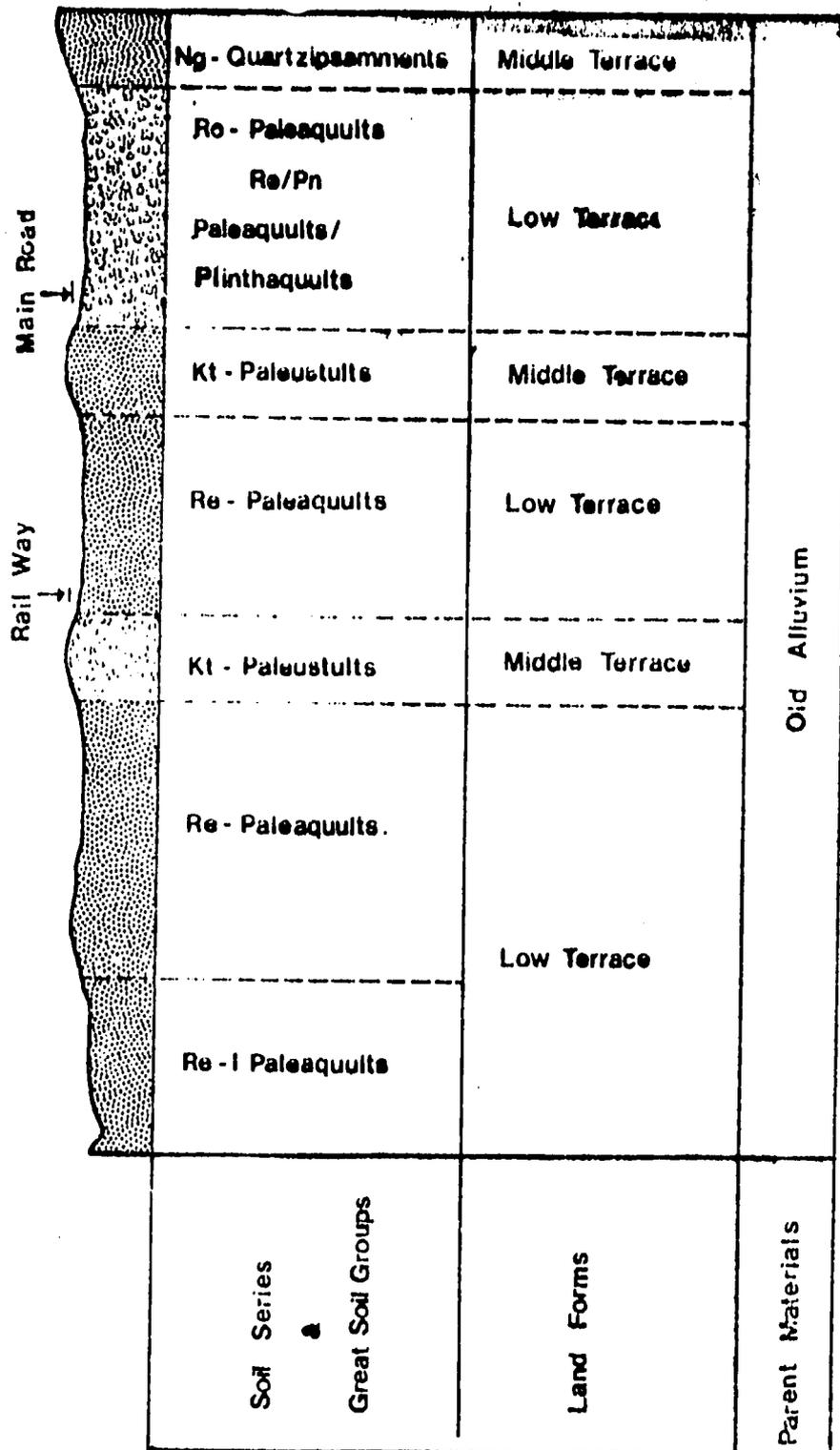
-  Urban Area
-  Road
-  Road
-  Track and Footpath
-  Pond
-  Tambon boundary
-  Soil boundary
-  Railroad

N  
  
 SCALE 1:50,000

LEGEND

- Re = Roi Et series
- Re-1 = Roi Et series, loamy phase
- Kt = Korat series

{ Long. 104°08'-104°14' E  
 { Lat 15°06' -15°10' N



**FIGURE 19** Schematic Cross Section of Tambon Taket and Tambon Tas,  
Amphoe Uthumphon Phisai, Si Sa Ket Province.

Figure 20 - Soil and Land Capability Classification

Tambon	Soil Classification		Land Capability	
	Soil Series	Great Soil Groups	Upland Crop	Paddy
Lahan	Ac.	Ustifluvents	U - II f.	P - II f.
	Cm.	Typic Ustifluvents	U - II f.	P - II f.
	Tm.	Typic Ustifluvents	U - II f.	P - II f.
	Sa.	Typic Ustifluvents	U - III d.	P - II f.
	Rb.	Aeric Tropaquepts	U - IV fd.	P - II f.
	Pm.	Vertic Tropaquepts	U - IV fd.	P - II f.
	Ss.	Vertic Tropaquepts	U - V f.	P - II f.
	Re-1.	Aeric Paleaquults	U - III d.	P - III s.
	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Ud.	Aeric Halaquepts	U - VI x.	P - IV x.
	Cy	Epiaquic Ustropepts	U - III d.	P - III m.
	Rn-1.	Aeric Paleaquults	U - III s.	P - IV t.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
	Wn.	Oxic Paleustults	U - III s.	P - V ts.
	Wn-sh.	Oxic Paleustults	U - III s.	P - V ts.
	Yt.	Oxic Paleustults	U - III ts.	P - V ts.
Bb.	Aquic Plinthustults	U - VI es.	P - V ts.	
Kwang Chon	Re-1.	Aeric Paleaquults	U - III d.	P - III s.
	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Re-h.	Aeric Paleaquults	U - IV ds.	P - IV s.
	Nn.	Aeric Plinthic Paleaquults	U - III ds.	P - III s.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
	Pp.	Typic Plinthustults	U - VI ts.	P - V t.
	BbC.	Aquic Plinthustults	U - VI es.	P - V t.
Nong Kaew	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Ub.	Aquic Dystropepts	U - IV sd.	P - IV sm.
	On.	Plinthaquults	U - III ds.	P - III s.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
Na Muang	Ac.	Ustifluvents	U - II f.	P - II f.
	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Re-1.	Aeric Paleaquults	U - III ds.	P - III s.
	Ub.	Aquic Quartzipsamments	U - II sd.	P - IV sm.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
	Yt.	Oxic Paleustults	U - III ts.	P - V t.
Tae	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Re-1.	Aeric Paleaquults	U - III ds.	P - III s.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.

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ANNEX IV-26

Tambon	Soil Classification		Land Capability	
	Soil Series	Great Soil Groups	Upland Crop	Paddy
Taket	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Re-1.	Aeric Paleaquults	U - III ds.	P - III s.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
Na Thom	Ac.	Ustifluvents	U - II f.	P - II f.
	Ss.	Vertic Tropaquepts	U - II f.	P - II f.
	Re-1.	Aeric Paleaquults	U - III d.	P - III s.
	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Pn.	Aeric Plinthaquults	U - IV ds.	P - IV t.
	Rn.	Aeric Paleaquults	U - III s.	P - IV t.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
	Pp.	Typic Plinthustults	U - IV tsm.	P - V t.
Na Ngua	Ac.	Ustifluvents	U - II f.	P - II f.
	Re.	Aeric Paleaquults	U - III ds.	P - III s.
	Pn.	Aeric Plinthaquults	U - IV ds.	P - IV t.
	Tu.	Entic Tropaquods	U - IV sm.	P - V t.
	Kt.	Oxic Paleustults	U - III sm.	P - V t.
	Pp.	Typic Plinthustults	U - IV tsm.	P - V t.

Figure 21. Key to Land Classification Symbols.

Upland Crops

Soils are grouped in eight classes to show capability for upland crops. Classes U-I through U-IV are suitable for cultivated upland crops, with increasing degrees of limitation. Soils placed in classes U-V through U-VIII are generally not suited for cultivated crops. Those placed in classes U-V, U-VI and U-VII can, however, be used for grassland, woodlands or tree crops. Soils and land types placed in classes U-VIII do not produce economic returns in agriculture or forestry.

Class U-I - Soils very well suited for upland crops, having no significant limitations that restrict their use. They are suited for growing a wide range of crops.

Class U-II - Soils well suited for upland crops, having slight limitations that restrict their use.

Class U-III - Soils moderately suited for upland crops, having moderate limitations that reduce the choice of crops and/or require special management.

Class U-IV - Soils poorly suited for upland crops, having severe limitations that restrict the choice of crops and/or require very careful management.

Class U-V - Soils having little or no erosion hazard, but having other limitations that are serious and restrictive, making them unsuited for upland crops.

Class U-VI - Soils having severe limitations that make them generally unsuited for cultivation and for their use as pasture, woodlands, wildlife food and cover and water supply.

Class U-VII - Soils having very severe limitations that make them unsuited for cultivated crops and for their use as pasture, woodlands, wildlife food and cover, water supply and recreation.

Class U-VIII - Soils and land types having limitations that preclude their use for commercial agriculture and for their use as recreation, wildlife food and cover and water supply.

Paddy (wetland) Rice

Five soil suitability groups for paddy (wetland) rice have been recognized. Groups P-I through P-V are suitable for rice, with increasing limitations from P-I to P-V. Soils and land types placed in group P-V are not suited for paddy rice.

Group P-I - Soils very well suited for paddy land, having no significant limitations for rice production. There is sufficient water available from rainfall and/or irrigation for at least one high yielding crop of rice in most years.

Group P-II - Soils well suited for paddy land, having slight limitations that restrict their use for rice production.

Group P-III - Soils moderately suited for paddy land, having moderate limitations that restrict their use for rice production and/or require special management.

Group P-IV - Soils poorly suited for paddy land, having severe limitations that restrict their use for rice production and/or require very special management.

Group P-V - Soils generally not suited for paddy land, having very severe limitations that preclude their use for rice production with ordinary methods.

Kind of Limitations for Subclasses and Subgroups

Capability classes and suitability groups are subdivided according to the kinds of limitations. There are eight kinds of limitations, that either apply to both the land capability classes and paddy suitability groups or to only classes or groups. They are designated by the following symbols.

- a - erosion  
Soils with an erosion hazard or past erosion damage.
- b - soil limitation in the root zone.  
Soils with problems such as shallowness, unfavourable texture, stoniness or low fertility that is difficult to correct.
- c - lack of moisture for plant growth.  
Soils on which plant growth is severely reduced by lack of moisture due to insufficient rainfall.
- d - unfavourable topography  
Soils whose relative position or relief (macro or micro) limits use for crops and paddy in particular.
- f - flooding  
Soils that are susceptible to flash floods or in the case of upland crops, prolonged deep flooding, or both, which limit the type or limit choice of crops.
- g - imposed drainage  
Soils whose use for upland crops is limited by excess water due to high water table, slow permeability or slow surface drainage or a combination of all three.
- s - salinity or alkalinity  
Soils for which the major limitation is salinity or alkalinity.
- e - soil acidity  
Soils for which extreme acidity difficult to correct is the major limitation for crop production.

The dominant kind of limitation for use determines the assignment of the mapping units to capability subclasses and paddy suitability subgroups. The same kind of limitation may occur in different classes or groups according to the intensity of that limitation.

BEST AVAILABLE DOCUMENT

Ten Days, Fifteen Days and Monthly Precipitation Data in mm of Project Areas Based on Record Length of 22 years.

(Nearest) District-Level Rainfall Data for Tambon Taket and Tae, Amphoe Uthumphon Phisai, Si Sa Ket Province.

Month	10 Days Precipitation					15 Days Precipitation					Monthly Precipitation				
	Probability Smaller than					Probability Smaller than					Probability Smaller than				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	1.1	2.2	3.7
Mar	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.8	1.6	1.6	3.6	6.0	8.8	12.4
Apr	0.1	0.1	0.3	0.5	1.2	0.4	1.0	2.0	3.3	5.1	10.7	17.8	24.3	30.7	37.8
May	2.2	3.7	5.2	6.8	8.5	4.8	9.0	13.8	18.0	24.3	44.8	65.7	86.6	104.6	125.5
Jun	1.1	3.0	4.9	7.5	10.5	12.3	20.4	26.5	33.7	41.8	94.9	117.3	136.1	158.3	183.7
Jul	1.0	2.3	4.0	6.0	3.3	11.1	19.2	24.6	31.7	38.1	92.0	117.8	138.0	159.2	176.6
Aug	1.8	4.0	6.7	9.8	13.3	9.3	16.9	23.7	31.3	39.8	56.4	116.6	144.7	172.7	198.6
Sep	3.3	7.3	11.9	17.2	23.1	17.4	23.2	40.2	49.6	61.7	117.1	153.4	179.3	205.2	233.6
Oct	0.1	0.2	0.5	1.2	2.5	0.2	0.6	1.6	3.1	5.5	25.8	42.0	58.1	72.6	88.8
Nov	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.8	2.7	9.4	1.3	3.3	5.3	7.9	11.2
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(Nearest) District-Level Rainfall Data for Tambon Na Thom, Amphoe Ban Phaeng and Tambon Na Ngua, Amphoe Na Wa, Nakhon Phanom Province.

Month	10 Days Precipitation					15 Days Precipitation					Monthly Precipitation				
	Probability Smaller than					Probability Smaller than					Probability Smaller than				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.0	2.0	4.1
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.7	0.2	0.7	1.3	2.5	4.0
Mar	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.7	1.2	2.0	8.1	14.0	19.2	24.3	30.2
Apr	0.1	0.2	0.5	1.0	2.0	1.0	2.5	4.4	6.4	9.0	27.0	38.0	49.9	58.7	70.8
May	1.2	2.3	4.3	6.2	9.0	9.9	15.1	19.6	24.2	29.5	96.8	113.8	137.0	156.2	177.5
Jun	3.3	15.3	21.2	27.1	33.9	35.1	50.9	62.9	76.3	91.0	143.4	194.8	225.7	261.4	296.2
Jul	5.5	11.2	15.4	20.1	25.2	29.0	40.8	50.8	59.9	69.9	158.5	193.4	222.5	249.6	274.3
Aug	10.2	18.6	25.1	33.4	41.8	33.3	51.3	69.2	87.2	107.7	157.2	227.5	275.7	323.9	366.1
Sep	2.9	5.3	3.2	11.1	15.0	15.4	27.4	36.9	46.5	57.5	158.9	186.1	213.8	237.7	264.9
Oct	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	1.1	2.1	6.5	12.2	19.7	28.1	37.5
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.5	2.9
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.6	0.6



District-Level Rainfall Data for Tambon Nong Kaew, Amphoe Muang, Roi Et Province.

Month	10 Days Precipitation					15 Days Precipitation					Monthly Precipitation				
	Probability Smaller than					Probability Smaller than					Probability Smaller than				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.3	0.4
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	2.1	3.0	5.0
Mar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	2.1	5.0	7.8	10.5	14.0
Apr	0.2	0.5	0.9	1.4	2.2	0.2	0.6	1.0	1.5	2.3	2.1	5.0	7.8	10.5	14.0
May	1.5	2.9	5.0	7.8	10.5	1.5	2.9	4.5	7.2	10.5	24.7	35.4	45.3	54.3	64.3
Jun	2.5	4.0	6.4	9.9	13.3	3.3	4.9	7.1	10.5	13.3	75.9	99.9	117.5	138.1	158.7
Jul	3.1	4.1	5.4	7.1	9.9	13.3	18.1	23.0	29.1	34.0	115.0	132.5	149.5	165.5	181.5
Aug	5.0	6.4	8.3	10.5	13.3	15.1	22.0	28.4	35.2	41.9	115.0	132.5	149.5	165.5	181.5
Sep	8.0	10.5	13.3	16.6	20.0	22.9	31.3	40.3	51.5	61.5	114.5	149.9	179.1	204.9	231.9
Oct	0.0	0.0	0.0	0.0	0.0	38.4	51.0	51.5	71.3	71.3	170.1	201.9	231.4	258.5	288.5
Nov	0.0	0.0	0.0	0.0	0.0	1.0	1.7	2.9	4.4	4.4	21.3	31.7	43.4	55.0	65.5
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.2	2.4	4.0
						0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.5	0.7

District-Level Rainfall Data for Tambon Na Muang, Amphoe Selaphum, Roi Et Province.

Month	10 Days Precipitation					15 Days Precipitation					Monthly Precipitation				
	Probability Smaller than					Probability Smaller than					Probability Smaller than				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.7	1.5	3.4
Feb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.6	3.0	5.1
Mar	0.2	0.3	0.4	0.5	0.6	0.1	0.3	0.7	1.6	3.7	1.5	3.6	6.5	9.4	14.5
Apr	0.1	0.3	0.7	1.4	2.2	0.2	0.7	1.5	2.7	4.4	15.5	25.0	33.9	42.7	52.3
May	2.0	4.0	6.4	8.7	12.3	7.1	12.5	17.8	24.0	30.3	107.4	126.9	146.3	165.8	188.0
Jun	1.6	3.5	6.0	8.5	11.7	7.0	13.7	20.6	26.5	34.3	87.1	111.3	133.3	155.4	177.4
Jul	1.0	2.1	3.7	5.6	7.9	11.1	18.2	23.8	30.1	37.2	97.0	119.8	139.6	157.8	174.6
Aug	4.3	3.0	12.2	16.5	21.8	18.1	27.1	33.4	41.5	48.7	138.6	164.7	190.9	214.7	238.5
Sep	3.8	7.3	10.4	13.9	17.6	15.6	25.7	35.7	46.9	58.0	128.8	166.1	196.4	224.4	252.4
Oct	0.0	0.1	0.3	0.5	1.1	0.2	0.6	1.0	1.6	2.5	11.2	19.0	28.0	36.9	47.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.4	2.8
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source : Rainfall and Evaporation Analysis of Thailand by Dr. Apichart Anukularmphai, Division of Agriculture and Food Engineering, The Asian Institute of Technology, August 1980.

5. Tambon-Level Data Summary

Figure 22 shows tambon income structures, and Figure 23 gives tambon-level mean data for a number of important characteristics related to rainfed agricultural production in Project tambons. In interpreting this data, however, it should be kept in mind that intra-tambon and even intra-village variation is often very substantial. Some discussion of this variation is offered in the Social Analysis (Annex VII).

Figure 22. Income Structures of NERAD Project Tambons.

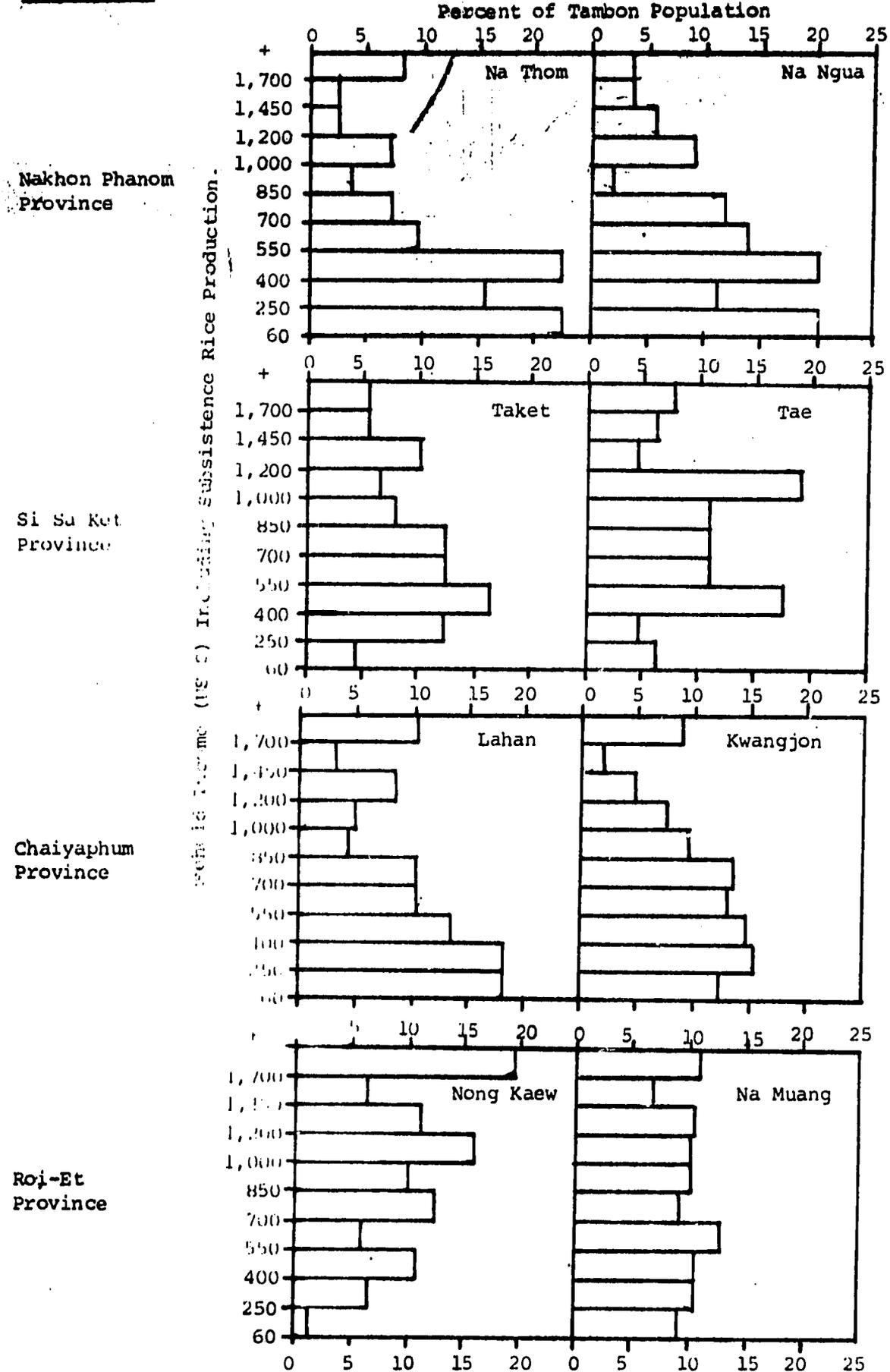


Figure 23. Tambon Level Data Summary

Province	Si Sa Ket		Nakhon-Phanom		Chaiyaphum		Roi-Et	
Amphoe	Uthumphon-Phisai		Ban Phaeng	Na Wa	Chat-turat	Phu-khieo	Muang Nong	Selaphum Na
Tambon	Taket	Tae	Na Thom	Na Ngua	Lahan	Kwang Jon	Kaew	Muang
Sample Size & %	91(17%)	67(20%)	89(11%)	116(10%)	187(12%)	337(13%)	178(12%)	193(15%)

Tambon Resources

No. of Villages	12	6	9	12	11	16	21	14
No. of Families	530	335	845	1107	1617	2564	1539	1207
Population	3428	2165	5257	7731	11183	17886	8950	8260
Total land area (ha)	2000	992	10800	10240	7520	19760	6560	6240
% Paddy Land	100	100	14	75	42	65	92.5	75
% Flooded Land	-	-	40	-	18	-	-	-
% Upland	-	-	-	-	40	35	7.5	25
% Upland/Forest	-	-	46	25	-	-	-	-

Household Land Resources (ha)

Total land size	3.45	3.36	6.10	6.65	5.30	5.30	4.07	3.76
Total land owned	3.45	3.12	4.18	5.25	4.78	4.03	4.06	2.30
Total cultivated land	3.30	3.25	5.82	6.07	5.20	5.20	3.93	3.60
- rainfed paddy	3.28	3.24	4.53	5.52	3.56	4.47	3.88	3.46
- irrigated paddy	0	0	0	0	0.03	0	0	0
- upland fields	n.s.	n.s.	1.02	0.37	1.37	0.68	0.03	0.11
- orchard land	0.02	n.s.	n.s.	0.03	0.12	0	n.s.	n.s.
- garden land	0	n.s.	0	0	0.14	0	n.s.	n.s.
- other	0	0	0.26	0.15	n.s.	0.04	n.s.	0.02
Total uncultivated land	0.15	0.11	0.28	0.58	0.09	0.10	0.14	0.16
Land subject to flooding	0	0.10	1.89	0.44	0.65	0.04	0.04	0.22
Km. to all-weather road	1.00	3.90	16.10	4.20	0.20	1.80	0.70	2.20

Farm Land Utilization (ha)

Total Area Planted in the Wet Season	3.15	3.05	4.05	4.55	2.83	3.80	3.65	3.07
Total Area Planted in the Dry Season	0.31	0.27	0.09	0.13	0.52	0.17	0.69	0.24
Cultivated Land Cropping Index	1.05	1.02	0.71	0.77	0.64	0.76	1.10	0.92

ANNEX IV-34

Province	Si Sa Ket		Nakhon-Phanom		Chaiyaphum		Roi-Et	
Amphoe	Uthumphon-Phisai		Ban Phaeng	Na Wa	Chat-turat	Phu-khiao	Muang	Selaphum
Tambon	Taket	Tae	Na Thom	Na Nqua	Lahan	Kwang Jon	Nong Kaew	Na Muang
Sample Size & %	91(17%)	67(20%)	89(11%)	116(10%)	187(12%)	337(13%)	178(12%)	193(15%)

Household Labor Resources (No.)

Household Size	5.8	6.6	6.5	7.1	5.8	6.1	6.0	6.8
Potential Farm Labor Force	4.0	4.4	4.1	4.5	4.1	4.1	4.0	4.8
Actual Farm Labor Force	3.8	4.0	3.8	4.1	3.7	3.8	3.6	4.6
No. of Days Off-Farm Labor	66	82	41	72	65	40	65	91

Rice Cultivation

Area of Rice Planted (ha)	3.13	3.05	3.90	4.51	2.22	3.40	3.64	3.13
Area of Rice Harvested (ha)	2.86	2.73	2.82	3.57	1.25	2.88	3.49	2.81
Rice Yield/Area Planted (t/ha)	1.30	1.31	0.87	0.65	0.68	1.44	1.35	1.39
Rice Yield/Area Harvested (t/ha)	1.42	1.46	1.20	0.82	1.21	1.70	1.41	1.55
Type of Rice Planted:								
% glutinous local cv.	18.25	24.25	91.88	92.13	4.92	85.16	85.66	72.59
% glutinous RTG cv.	0	0	0	0.53	0	0	0	7.88
% non-glutinous local cv.	79.97	70.66	1.84	0.37	69.15	6.65	11.87	12.46
% non-glutinous RTG cv.	0	4.79	0	0	8.53	0	0.15	3.35
Inputs/Area Planted (\$/ha)								
- fertilizer	28.35	24.62	1.76	5.32	1.73	3.84	12.25	12.36
- hired labor	9.94	8.16	5.82	2.76	9.26	6.31	4.25	7.11
- hired equipment	0.09	0.00	0.76	0.09	5.51	0.68	0.23	0.27
- other	2.17	0.65	0.69	0.40	2.10	4.94	2.55	0.82

Cash Crop Cultivation

Area planted to cash crop (ha)	0.33	0.27	0.24	0.17	1.13	0.57	0.70	0.18
Inputs/Area Planted (\$/ha)								
- fertilizer	85.44	85.96	0.58	11.76	15.32	2.06	75.79	38.84
- hired labor	1.50	2.20	14.86	4.18	34.21	14.16	3.87	6.78
- hired equipment	0.00	0.00	0.79	0.00	22.10	1.59	0.16	0.00
- other	26.32	18.54	3.62	7.04	17.26	4.59	18.33	15.95

ANNEX IV-35

Province	Si Sa Ket		Nakhon-Phanom		Chaiyaphum		Roi-Et	
	Uthumphon-		Ban	Na	Chat-	Phu-	Muang	Selaphum
	Phisai		Phaeng	Wa	turat	khieo		
Amphoe	Taket	Tae	Na	Na	Lahan	Kwang	Nong	Na
Tambon			Thom	Nqua		Jon	Kaew	Muang
Sample Size & %	91(17%)	67(20%)	89(11%)	116(10%)	187(2%)	337(13%)	178(12%)	193(15%)
Percentage of								
Households growing:								
- Cassava	none	none	10.11	4.31	23.53	0.89	none	5.70
- Kenaf	none	none	13.48	2.59	12.30	34.12	4.49	0.52
- Water Melon	83.52	29.85	1.12	7.76	0.53	none	41.57	1.55
- Beans	27.47	-	-	1.72	1.07	-	-	1.04
- Corn	-	-	-	-	0.53	6.82	-	-
- Other	4.39	1.49	1.12	2.58	11.76	1.78	3.37	37.82
App. value of livestock owned (\$)	747.50	597.50	1091.25	1275.25	1076.25	645.00	598.75	702.50
App. value of livestock purchased (last year)	133.75	67.50	117.50	233.75	115.00	128.75	281.25	491.25
App. value of livestock sold (last year)	166.98	119.05	229.41	245.11	220.16	197.82	333.22	497.42
<u>Household Credit Utilization</u>								
Amount Borrowed in Past Year (\$)	67.57	53.74	59.83	80.78	141.80	107.21	140.31	105.60
<u>Household Income (\$)</u>								
*Total Net Income	848.45	902.00	688.10	671.20	807.30	808.00	1222.50	959.40
*Net Income/capita	167.75	136.55	109.40	104.80	150.95	147.35	214.75	151.00
Off-Farm Income	200.60	165.30	81.65	149.55	188.00	83.70	189.45	174.10
Net Home Industry Income	13.25	8.05	2.15	6.85	11.35	0.85	8.40	4.10
Miscellaneous Net Income	39.75	66.85	44.95	52.20	65.40	37.35	99.15	82.65
*Total Agricultural Income	612.80	662.95	565.30	467.60	542.30	684.64	925.65	699.55
Net Rice Income	480.65	497.00	384.30	398.80	200.05	541.80	610.80	557.00
Net Cashcrop Income	112.35	92.65	91.65	25.90	252.55	80.25	243.10	72.40
Net Animal Income	44.00	50.90	117.75	81.90	108.70	101.75	101.80	105.55

\* These figures include deductions for rent, interest, and miscellaneous work expenses.

ANNEX IV-36

Province	Si Sa Ket		Nakhon-Phanom		Chaiyaphum		Roi-Et	
	Uthumphon- Phisai	Taket	Ban Phaeng	Na Wa	Chat- turat	Phu- khieo	Muang	Selaphum
Amphoe		Tae	Na	Na	Lahan	Kwang	Nong	Na
Tambon			Thom	Nqua		Jon	Kaew	Muang
Sample Size & %	91(17%)	67(20%)	89(11%)	116(10%)	187(12%)	337(13%)	178(12%)	193(15%)

Usual Source of Assistance for Agricultural Problems (Percent)

No help	41.8	29.9	57.3	48.3	72.7	39.8	36.5	18.7
Headman	28.6	13.4	15.7	23.3	12.8	44.8	18.0	21.8
Kamnan	2.2	-	7.9	5.2	1.1	5.9	2.8	-6
Tambon Extension Agent	8.8	34.3	1.1	2.6	0.5	-	14.0	36.8
Community Development Worker	1.1	-	-	-	-	-	-	-
Amphoe Office	17.6	20.9	16.9	12.9	9.6	8.3	22.5	20.2
Teacher	-	-	-	-	-	-	-	-
Merchant	-	-	-	2.6	-	0.3	2.8	-
Other	-	1.5	1.1	5.2	3.2	0.9	3.4	-

RTG Assistance Most Desired by Villagers (% of responses)

Water Availability	23.1	64.3	15.7	87.1	30.7	47.2	36.0	62.7
Electricity	35.2	1.5	1.1	1.7	2.2	19.7	11.2	5.2
New Agri. Technology	0	14.9	33.7	5.2	6.5	1.8	12.9	16.1
Fertilizer	7.7	3.0	4.5	2.6	24.2	8.7	3.9	2.6
Roads	2.2	13.4	28.1	0.9	4.8	8.1	5.1	-4.1
Credit	24.2	0	0	0	12.4	1.8	5.1	0
New Crops	0	0	2.2	0	1.6	3.0	7.9	3.6
Crop Disease Control	5.5	0	3.4	0.9	3.8	1.8	3.4	0.5
More Agric. Land	0	0	0	0	0.5	4.5	0.6	3.1
Village Development	0	1.5	2.2	0	2.2	0.6	5.6	0
Education	0	0	0	0	0	0	1.1	0
Medical Help	0	0	1.1	0	0.5	0	0.6	0

Note: Data from NERAD Socio-Economic Survey conducted by Office of Agricultural Economics, MOAC and PPD/USAID/Thailand.

V. Technical Feasibility Analysis Agricultural Technology  
(See Supplemental Annexes for more detailed analysis)

a. Background - Current Farming Practices

Although local variation is frequent, the general farming strategy in Northeast Thailand follows these seasonal activities: A great number of individual farms have both upland and paddy fields, so prior to the onset of the rainy season much of the upland areas are planted to cassava or kenaf. As soon as rainfall permits, rice seedling nurseries are prepared and seeded. When seedlings are available, water is sufficient, and paddies have been prepared by plowing with buffalo, the rice transplanting process begins on the lowest-lying lands available that do not have a high probability of crop failure due to flooding. As the rains continue to increase, transplanting moves out of the flood plains and low terraces into the middle terraces to the extent that the rainfall of that season allows. Much of the land reported as fallow is being held in reserve for rice should rainfall be sufficient, especially since in wet years considerable areas of lower paddy are flooded out. After rice is transplanted labor demands for rice production decrease, and other farming activities are given primary emphasis, including additional cassava or other garden or cash crops, livestock which must graze only on land not planted to crops, fishing, sericulture, etc. The second labor demand peak for rice production comes during the harvest season, during which priority is again given to the primary subsistence crop. Especially during both peak labor periods for rice, problems related to the increasing scarcity of livestock grazing land and fuelwood are becoming serious problems in many areas. After a paddy field is harvested it is usually grazed by livestock, but in a few areas some farmers are beginning to plant small areas of paddy fields to a second crop which can produce a crop from residual soil moisture, sometimes supplemented by a hand-dug shallow well. Some farmers also plant low-lying flooded land to rice or cash crops after the flood waters recede. Kenaf is usually harvested and retting begun just before rice harvest, and continued after rice harvest unless water becomes too scarce. During the dry season, cropping activities other than cassava harvest are limited by water availability, and primary emphasis shifts again to other farming activities such as fishing, woodcutting, construction, and handicrafts. Livestock also require tending during this period, since the quantity and quality of available feed and water decreases through the dry season, resulting in weight loss and poor nutrition status of draft animals which must perform their hardest work at the end of the dry season.

b. Cropping System Modifications

The present cropping systems utilized under rainfed conditions in the Northeast can be described as primarily the monocropping of rice, cassava and kenaf during the rainy season. Rice is the basic subsistence crop and occupies more than two-thirds of the crop acreage. Local varieties of cassava and kenaf occupy the major portion of upland areas where soils are generally infertile. Corn is grown on more fertile soils, but they constitute only a very small percentage of upland areas. Peanut is the major food legume grown in the Northeast, while smaller acreages are planted with mungbean. Areas devoted to some other crops are also significant. As discussed in the Strategy section, predominant cropping patterns of a particular area generally correspond to subregional agro-ecological and agro-economic zonation, and the local geomorphological landforms.

Proposed cropping system modifications are, therefore, presented according to the landforms on which they are potentially applicable, subject to local verification in each of the subregional zones represented by the sample of NERAD tambons. Landform characteristics of Project tambons are shown in Figure V-1.

Flood Plains. The major crop in this area is traditional long-season cultivars of rice, grown without additional fertilization. The yields are sometimes reduced to near zero due to flash flooding. To eliminate this problem, the Project will introduce some newly-released deep water rice cultivars such as RD 17 and 19. After the rainy season, some farmers grow off-season rice or high-value vegetable crops with supplementary irrigation from swamps, rivers or shallow wells. On the other hand, in some areas water resources are not readily available for supplementary irrigation, but soil moisture is adequate to support full growth of short to medium duration crops. In these areas farmers will be introduced to marketable drought-tolerant or short-duration flooded crops such as peanuts, mungbeans, or sesame after rice harvesting.

Low Terraces. These areas are also dominated by rice production, and soil moisture is usually available throughout the growing stage of rice, even with the occurrence of a drought. Therefore, high-yielding rice cultivars which are responsive to fertilization will be introduced by subsidizing production inputs for conducting extension trials utilizing this type of technology. In years when the rainy season begins late, a nursery seed bed will be prepared early by supplementary irrigation from pit ponds or swamps which have been rehabilitated by the Project at selected locations in some tambons. Many areas on low terraces have prolonged residual soil moisture, and can therefore be planted

with drought-tolerant crops such as watermelon, peanuts, mungbeans, or sesame to increase utilization of potentially productive land which is vacant after rice harvest. Also, mungbeans, cowpeas, or forage legumes can be planted into rice straw prior to rice harvesting in order to provide forage for livestock, or for pods if soil moisture is adequate.

Middle Terraces. Low rice yields and frequent rice crop failure due to erratic rainfall are found in these areas, which relate to the poor water holding capacity and low inherent fertility of the prevailing sandy soils. In order to reduce the problem of low rice yields, farmers will be introduced to rice direct-seeding techniques. Drought-tolerant rice cultivars will be tested under on-farm conditions before release to farmers. All rice cultivation practices promoted on middle terraces, however, should include a moderate amount of nitrogen fertilizer. Middle terrace areas which remain uncropped in 2 to 3 years out of five due to insufficient water for paddy production can be transformed into relatively more productive utilization by planting them to field crops. This can be done by planting either a monocrop of long duration (e.g. peanut, kenaf, or cassava), or a sequential cropping of two short duration crops (e.g. sesame-mungbean).

High Terraces. Drought-tolerant crops, predominantly cassava and kenaf, currently occupy this landscape. Due to present uncertainties and possible future limitations in the marketing of these crops, alternative crops (peanuts, mungbeans, sesame and cashew or other fruit or tree crops) will be tested and demonstrated in these areas in order to provide examples of potential crop diversification and risk avoidance in the event of a market failure of one particular crop. The remaining cassava and kenaf will be further improved through the introduction of new high-yielding cultivars such as Rayong 1 cassava and TSH 30 kenaf. Farmers will also be encouraged to apply some fertilizers and use improved cultivation techniques with these crops. For cassava growers, other short to medium duration legumes (e.g. peanut) will be introduced for intercropping during the early rainy season between the rows of relatively slow-growing cassava. This will help to conserve soil fertility and reduce soil erosion, in addition to increasing net income per unit area planted to cassava.

Proposed cropping system modifications are summarized in Figure V-2. The potential for implementation of these modifications can be seen by comparing Figure V-3, which indicates estimated areas of current crops in Project tambons, with Figure V-4, which gives rough estimates of areas utilizing NERAD cropping systems modifications 20 years after the beginning of Project implementation.

c. Other Farming System Modifications

As discussed in the Strategy section, farming practices both in the Northeast generally and in Project tambons, currently include activities other than annual crop production which are important in terms of both overall farm income and overall labor utilization. A number of these activities also have considerable potential for a significant contribution to increase farm income through the utilization of improved technology. It is widely believed that only through the examination of the overall farming system and implementation of improvements which address key constraints throughout this system, will farm families in rainfed areas of the Northeast be able to generate enough income to begin to approach nation-wide averages. Therefore, NERAD will also have a program to improve the productivity of farm activities other than annual cropping, on a selective and phased basis both between and within Project tambons, as appropriate.

The farm livestock system almost always includes at least 1 to 3 buffalo which provide farm draft power, and a small flock of native chickens for meat and eggs. A smaller percentage of farms also have some cattle, hogs, and/or ducks or other types of poultry, depending on feed and water availability, capital, etc.

Primary limitations for the production of large animals (buffalo and cattle) currently include disease, parasites, and feed availability. Disease and parasites currently result in a 30 to 40% mortality of young animals in addition to occasional epidemic losses, and the number of livestock officers are inadequate to address the problem. The Project, therefore, will provide for better access to disease and parasite control services by providing training for tambon extension agents and farmer specialists, who will assist veterinary officers in vaccinations, dispensing drugs for parasite control, etc. The Project will address the feed availability constraint through increased crop residue output under the cropping systems modification component, and through providing training for extension agents and specialist farmers in the use of seeding techniques for Hamata (*Stylosanthes Hamata*) and other forage legumes on unused lands and/or in public areas. Selected villages will also have demonstrations of public land management for forage and fuelwood production.

Household poultry production is greatly limited by epidemic diseases (generally 90% mortality of young native chickens), in addition to problems related to nutrition, inbreeding depression, and parasites. Since native poultry are an important source of protein for family consumption (second only to fish) and also have a ready market and a consumer preference over commercial breeds, NERAD will introduce improved

techniques which have been demonstrated to be viable in village pilot projects conducted by the research staff of NEROA. Selected villagers (approx. 1 per village) will receive training in vaccination techniques, poultry health, nutrition, and upgrading of poultry flocks through the introduction of improved breeder males. Low-cost vaccinations (free to the farmer during initial stages) are introduced first, resulting in rapid and dramatic decreases in young bird mortality, followed by the introduction of other improved management techniques as farmer interest grows. This activity is expected to be popular and will be phased into tambon activities beginning early in implementation to stimulate farmer interest in overall NERAD Project activities.

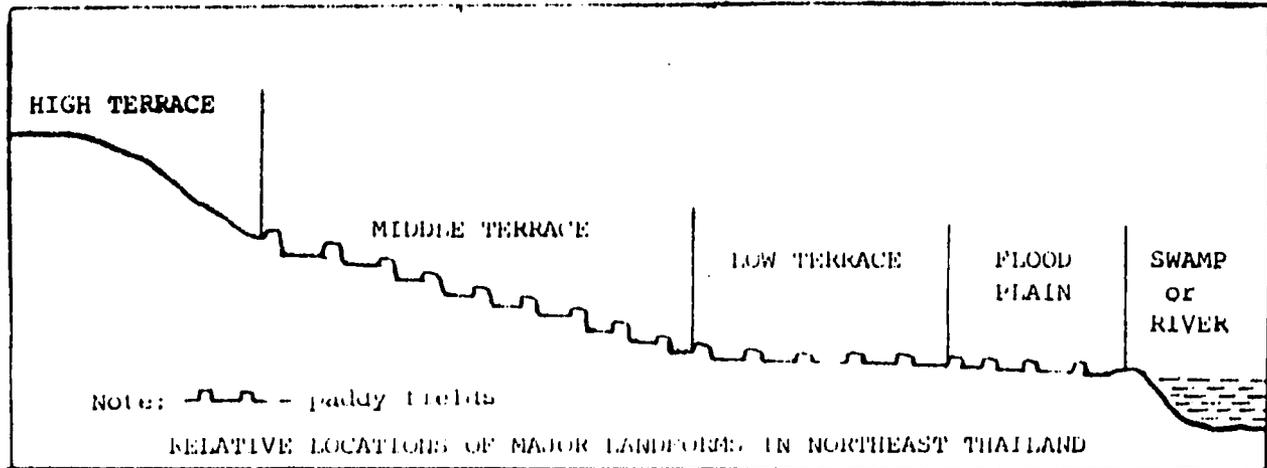
The farm fishery system currently involves capture of native populations of fish from virtually all available rivers, swamps, ponds, etc. Fishing is an important activity and source of protein for family consumption, and along with rice production enjoys special standing in Thai culture. The present low level of productivity is a result of reliance on natural stocking in most cases, in addition to essentially no management other than controlled fishing in some reservoirs. A substantial amount of research and a number of pilot activities have indicated that fish production in these water resources can be substantially improved through stocking and management techniques. Therefore, the Project will include training for specialist farmers in stocking, fertilization, planned harvesting, and other techniques such as cage production in suitable locations, according to local interest in improving fish production in either existing or newly-constructed water resources. Young fry will be used to stock facilities where predators can be controlled. In other facilities an appropriate size of fingerlings will be used. Individual farmers having access to a suitable water resource will be encouraged to produce fingerlings for use in the Project or for marketing. It is estimated that 50% of the 107 ha. of Project water resources and 130 ha. of existing water resources can be used for improved fish production.

The farm tree crop system currently involves the planting of a few trees of each of several types around the house or other parts of their land holdings. Trees observed in Project tambons include mango, annona, banana, papaya, jackfruit, guava, coconut, tamarind, kapok, leucaena, mulberry, and bamboo. Farmers utilize native varieties grown from seed and traditional cultivation practices which do not include pruning, spraying, or fertilizer application, due to their lack of knowledge regarding propagation and management techniques and the lack of a local source of improved plant propagation material. The farm forest product system currently includes primarily the gathering of wood for firewood,

charcoal, construction, or other uses; use of forest lands for grazing livestock; and the gathering of wild plant products such as food and cooking and medicinal herbs. These activities depend on the type and availability of forest areas and the availability and cost of substitutes. In Project areas these lands are usually either public land or part of the official RTG Forest Reserves. The Project will address key constraints of these systems, in addition to the sericulture system discussed below, by offering training for farmer specialists in nursery stock production, including seedling production, grafting and budding of planting stock, and other propagation, planting and management techniques. Initial planting stock, supplies, and assistance in establishing a nursery facility will also be provided. Training in tree crop management will also be available for areas where farmers are interested, and during the first few years the Project will purchase some of the planting materials produced by specialist farmers for use in demonstration plantings. A few research/demonstrations will be established (see section 4. a., below) in selected villages, concerning management of public lands for forage and fuelwood production. Project staff will also attempt to identify appropriate underutilized land for planting of fast-growing trees such as leucaena, acacia, and eucalyptus, including areas around swamps, ponds, schools, temples, or along borders or rice field bunds in order to meet current and future needs for fuelwood where sufficient local interest can be generated.

The farm sericulture system currently involves the longstanding Northeast Thailand tradition of silk production, which is still practiced by many farm families. In Project areas, sericulture is widely practiced for both home use and commercial production in two tambons, while some families in the other tambons practice sericulture, primarily for home use. Most farmers still use native varieties of both mulberry and silkworms, and traditional or incorrect production techniques which usually result in low levels of silk production. Recent efforts to stimulate silk production in other areas of the Northeast have identified mulberry production as a particularly important constraint, due to root rot disease and poor management techniques. The NERAD Project will address key constraints to sericulture production in areas where villagers have a strong desire to increase silk production and have sufficient land available for mulberry plots, by providing training in improved sericulture techniques and mulberry cultural practices. Root rot-resistant mulberry planting material will be provided and increased by the tree nursery efforts discussed above. Assistance will also be available for constructing improved simple silkworm rearing facilities, and if local demand is sufficient introduction of a newly developed hybrid silkworm having the fiber characteristics and hardiness of native silkworms, but with substantially improved productivity, will be phased into the later stages of the activity.

Figure V-1 Land Form Characteristics



Estimated Area<sup>1/</sup> (rai) of Arable Land Located on Different Types of Landscapes in the Eight Selected Tambons

Tambon	Landscape				Total Arable Land
	Flood Plain	Low Terrace	Middle Terrace	High Terrace	
Taker	-	8,100	-	-	8,100
Tae	-	5,100	-	-	5,100
Na Thom	6,500	6,700	4,700	4,000	21,900
Na Ngua	-	18,500	10,100	1,900	30,500
Lahan	7,400	9,500	10,100	10,400	37,400
Kwang Chon	-	33,000	21,000	8,200	62,200
Nong Kaew	-	25,200	2,800	200	28,200
Na Muang	1,800	12,700	5,100	600	20,200
Total	15,700	118,800	37,800	25,300	213,600

<sup>1/</sup> Estimated from Tambon baseline survey.

BEST AVAILABLE DOCUMENT

Figure V-2 Calendar of Modified Cropping Systems

CROPPING PATTERNS	MONTH												TYPES OF * LANDSCAPES		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb		Mar	Apr
1. Deep water rice															FP
2. Short duration crop before flooding															FP
3. Improved vegetables and high value crop															FP, LT
4. Less-care legume after rice															FP, LT, MT
5. High yielding rice varieties															MT
6. Field crop after rice															MT
7. Short duration crop before transplanted rice															MT
8. Direct seeded rice															MT
9. Drought tolerant rice															MT
10. Double cropping of field crops															MT, HT
11. Monocropping of field crops (e.g., peanut)															MT, HT
12. Intercropping of cassava with legume															HT
13. Improved cassava															HT
Improved kenaf															HT

\* FP = Flood plain, LT = Low terrace, MT = Middle terrace, HT = High terrace

CALENDAR OF MODIFIED CROPPING SYSTEMS

Figure V-3 Estimated Area<sup>1/</sup> (rai) Planted to Major Crops in Eight Selected Tambons

Tambon	Rice	Cassava	Kenaf	Vegetables + High Value Crop + Other Field Crops	Total
Taket	8,100	-	-	800	8,900
Tae	5,100	-	-	400	5,500
Na Thom	18,000	2,400	1,700	900	23,000 ..
Na Ngua	28,600	1,600	300	1,000	31,500
Lahan	27,000	8,100	2,400	8,700	46,200
Kwang Chon	54,000	700	7,500	7,000	69,200
Nong Kaew	28,000	-	200	5,000	33,200
Na Muang	20,000	600	-	1,000	21,600
Total	188,800	13,400	12,100	24,800	239,100

<sup>1/</sup> The Design Team found no published statistics on agricultural land use at the tambon level. The above estimates for rice were based on extrapolation of average household rice planting reported by farmers in the household survey. Reported data were reduced by 25% which was suggested as the normal degree of overestimation by farmers. Area in other crops was estimated primarily from observation, from calculations of survey data.

Figure V-4 Area (rai) Expected to Be Planted with Modified Cropping Systems by Year 20

Patterns	Tambon								Total
	Taket	Tae	Na Thom	Na Ngua	Lahan	Kwang Chon	Nong Kaew	Na Muang	
1. Deep water rice	-	-	2,600	-	3,000	-	-	700	6,300
2. Short duration crop before flooding	-	-	700	-	700	-	-	200	1,600
3. Improved prodn. of vegetable/ high value crop	700	300	1,500	1,500	700	2,800	2,800	600	10,900
4. Less-care legume after rice	800	500	1,300	1,900	1,700	3,300	2,500	1,500	13,500
5. High yielding rice varieties	4,000	2,500	3,400	9,300	4,700	16,400	12,600	6,300	59,200
6. Field crop after rice	1,600	1,000	2,600	3,700	3,400	6,500	5,000	2,900	26,700
7. Short duration field crop before transplanting rice	-	-	900	2,000	2,000	4,200	600	1,000	10,700
8. Direct seeded rice	-	-	1,900	4,100	4,000	8,400	1,100	2,100	21,600
9. Drought tolerant rice	-	-	1,400	3,000	3,000	6,300	900	1,500	16,100
10. Double cropping of field crops	-	-	1,300	1,800	3,100	4,400	500	900	12,000
11. Monocropping of field crop (peanuts)	-	-	1,300	1,800	3,100	4,400	500	900	12,000
12. Intercropping of cassava & legume	-	-	700	500	2,400	200	-	200	4,000
13. Improved cassava	-	-	1,000	600	3,200	300	-	200	5,300
Improved kenaf/ jute	-	-	1,200	200	1,700	5,300	-	-	8,400
<b>Total</b>	<b>7,100</b>	<b>4,300</b>	<b>21,800</b>	<b>30,400</b>	<b>36,700</b>	<b>62,500</b>	<b>26,500</b>	<b>19,000</b>	<b>208,300</b>

## ANNEX VI

Estimates of Incremental Economic Costs & Benefits by  
Sub-project and Project and Internal Rates of Return  
 (£ Million)

Project Year	Cropping Systems				Water Resources				Farming Systems				Project			
	Costs		Benefits a/		Costs		Benefits		Costs		Benefits		Costs		Benefits	
	Project	HH	Total	Net	Proj.	HH	Total	Net	Proj.	HH	Total	Net	Proj.	HH	Total	Net
1	19.78	0.00	0.00	-19.78	3.74	0.04	0.00	-3.78	5.88	0.03	0.00	-5.85	29.40	0.07	0.00	-29.47
2	33.19	0.00	0.33	-32.86	17.41	0.51	0.92	-17.00	9.70	4.98	1.37	-13.31	60.30	5.49	2.62	-63.17
3	26.30	2.01	5.35	-22.96	20.70	1.67	4.23	-18.14	8.20	5.70	4.26	-9.64	55.20	9.38	13.84	-50.74
4	26.78	5.05	13.08	-18.75	9.19	3.53	9.01	-3.71	8.63	6.25	7.46	-7.42	44.60	14.83	29.55	-29.88
5	20.47	8.16	22.00	-6.63	2.60	5.89	14.89	6.40	6.73	6.75	11.36	-2.12	29.80	20.80	48.25	-2.35
6	12.35	11.27	31.58	7.96	1.22	7.44	18.60	9.94	4.43	8.26	14.31	1.62	18.00	26.97	64.49	19.52
7	10.31	14.38	42.30	17.61	1.00	7.89	19.59	10.70	3.89	6.55	17.07	6.63	15.20	28.82	88.96	34.94
8	-	18.42	40.22	21.80	-	8.20	19.63	11.43	-	7.60	19.37	11.77	-	34.22	39.22	45.00
9	-	22.46	49.01	26.55	-	8.20	19.63	11.43	-	7.75	20.42	12.67	-	38.41	89.06	50.65
10	-	26.50	57.80	31.30	-	8.20	19.63	11.43	-	7.90	20.72	12.82	-	42.60	98.15	55.55
11	-	30.54	66.59	36.05	-	8.20	19.63	11.43	-	8.04	21.02	12.98	-	46.78	107.24	60.46
12	-	34.58	75.38	40.80	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	51.02	116.33	65.31
13	-	38.62	84.17	45.55	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	55.06	125.12	70.06
14	-	42.66	92.96	50.30	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	59.10	133.91	74.81
15	-	46.70	101.75	55.05	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	63.14	142.70	79.56
16	-	50.74	110.54	59.80	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	67.18	151.49	84.31
17	-	54.78	119.33	64.55	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	71.22	160.28	89.06
18	-	58.82	128.12	69.30	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	75.26	169.07	93.81
19	-	62.86	136.91	74.05	-	8.20	19.63	11.43	-	8.24	21.32	13.08	-	79.30	177.86	98.56
20	-	64.93	141.51	76.58	-3.80	8.20	19.63	15.23	-	6.07	21.32	19.15	-3.80	67.06	182.46	119.20
IRR				19				18				17				18

a/ Includes estimates of value of output from extension trials, field experiments and demonstration plots.  
 Project evaluation costs are not included.

Econ. Sensitivity Analysis for Total Project

<u>Case 1</u>	20%	↑	,, EIRR = 16 ∴	not sensitive to the increase in project cost.
<u>Case 2</u>	20%	↑	, EIRR = 16 ∴	not sensitive to the increase in farm costs.
<u>Case 3</u>	20%	↓	, EIRR = 12 ∴	is rather sensitive to the decrease in farm productivity.

Estimates of Household Incremental Financial Costs & Benefits  
by Sub-project and for Project and Benefit-cost Ratios\*

Project Year	Cropping Systems			Water Resources			Farming Systems			Total Project		
	Costs	Benefits <sup>a/</sup>		Costs	Benefits		Costs	Benefits		Costs	Benefits	
		Total	Net		Total	Net		Total	Net		Total	Net
1	0.00	0.00	0.00	0.04	0.00	-0.04	0.03	0.00	-0.03	0.07	0.00	-0.07
2	0.00	0.33	0.33	0.51	0.92	0.41	4.98	1.37	-3.61	5.49	2.62	-2.87
3	2.01	4.78	2.77	1.67	4.21	2.54	5.70	4.26	-1.44	9.38	13.25	3.87
4	5.05	12.12	7.07	3.53	8.95	5.42	6.25	7.46	1.21	14.83	28.53	13.90
5	8.16	19.98	11.82	5.89	14.77	8.88	6.75	11.36	4.61	20.80	46.11	25.31
6	11.27	28.28	17.01	7.44	18.44	11.00	8.26	14.31	6.05	26.97	61.03	34.06
7	14.38	37.22	22.84	7.89	19.42	11.53	6.55	17.07	10.52	28.82	73.71	44.89
8	18.42	36.25	17.83	8.20	19.46	11.26	7.60	19.37	11.77	34.22	75.08	40.26
9	22.46	44.25	21.79	8.20	19.46	11.26	7.75	20.42	12.67	38.41	84.13	45.72
10	26.50	52.26	25.76	8.20	19.46	11.26	7.90	20.72	12.82	42.60	92.44	49.84
11	30.54	60.26	29.72	8.20	19.46	11.26	8.04	21.02	12.98	46.78	100.74	53.96
12	34.58	68.26	33.68	8.20	19.46	11.26	8.24	21.32	13.08	51.02	109.04	58.02
13	38.62	76.26	37.64	8.20	19.46	11.26	8.24	21.32	13.08	55.06	117.04	61.98
14	42.66	84.26	41.60	8.20	19.46	11.26	8.24	21.32	13.08	59.10	125.04	65.94
15	46.70	92.26	45.56	8.20	19.46	11.26	8.24	21.32	13.08	63.14	133.04	69.90
16	50.74	100.26	49.52	8.20	19.46	11.26	8.24	21.32	13.08	67.18	141.04	73.86
17	54.78	108.26	53.48	8.20	19.46	11.26	8.24	21.32	13.08	71.22	149.04	77.82
18	58.82	116.26	57.44	8.20	19.46	11.26	8.24	21.32	13.08	75.26	157.04	81.78
19	62.86	124.26	61.40	8.20	19.46	11.26	8.24	21.32	13.08	79.30	165.04	85.74
20	64.93	128.58	63.65	8.20	19.46	11.26	6.07	21.32	13.08	67.06	169.36	87.99
B/C		2.1			2.4			1.9			2.1	

\* Cost and income streams discounted at 14%

<sup>a/</sup> Includes estimated benefits from field experiments, demonstrations and extension trials. Gross output  
 ₧1,000/rai.

Annex VII

Social Soundness Analysis

See Analysis Supplement

Annex VIII

Administrative Analysis and Arrangements

See Analysis Supplement

DETAILED FINANCIAL TABLES

A.	Technical Assistance Budget	IX-2
B.	Administration and Technical Support Budget	IX-5
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D.	Other Farming System Improvements Budget	IX-15
E.	Estimated Budget for Soil and Land Improvement Demonstrations	IX-18
F.	Agricultural Extension Support	IX-22
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I.	Demonstration and Research Budget	IX-29
J.	Economic Studies Support	IX-30
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A. Technical Assistance BudgetNERAD ProjectExpatriateLong Term

14.8 years

Chief of Party	4.8 years
Agronomist	4.0 years
Training Specialist	2.0 years
Agricultural Economist	4.0 years

Short Term

43 months

Training Specialist	6 months
Soils	6 months
Minimum Tillage	6 months
Forage Prod./Util.	6 months
Fisheries	3 months
Animal Nutrition	4 months
Plant Protection	6 months
Animal Disease	3 months
Forestry	3 months

Local

124 months

Administration & Mgt.	6 months
Finance	8 months
Agricultural Engineering	30 months
Cropping Systems	14 months
Training (non-formal)	18 months
Social Scientist	48 months

Expatriate Team (Short-Term)

Cost estimate per person month (short-term), estimates based on average  
2 month tour

Grant

Salary	\$3,500
Fringe 17%	600
Workmen's comp. 8.75%	320
Post differential 20% 2 weeks/2	<u>180</u>
Sub-total	4,600
Overhead 18%	<u>830</u>
Total - grant	5,430 - use \$5,400

Support

Travel international $\frac{2,700}{2}$	\$1,350
Travel in-country $\text{¥}500 \times 4$	100
Per diem in-country	<u>2,620</u>
Total - Support:	\$4,070 - use \$4,100

Expatriate Team (Long-Term)

Cost estimate per person year (long-term)

Grant

Salary	\$42,000
Fringe 17%	7,140
Post differential 20%	8,400
Workmen's Comp. 8.75%	4,410
Transportation	
Household effects $\frac{3,800}{2}$	1,900
Auto $\frac{2,000}{2}$	1,000
Storage household effects	900
Sub-total	65,750
Overhead 18%	<u>11,840</u>
Total - grant	\$77,590 - use \$78,000

Support:

Educational allowance	\$6,000
Travel $4 \times \frac{2,700}{2}$	5,400
Educational travel $1 \times \frac{2,700}{2}$	1,350
R&R $4 \times \frac{300}{2}$	600
Housing $\text{¥}18,000 \text{ pm}$	10,800
Temp. p.d. $(10 \times \$73 + 20 \times \$29) \times 4 \div 2$	2,620
In-country transportation $20 \times 500$	500
In-country p.d. $(30 \times \$73) + (60 \times \$29)$	5,240
International travel $2 \times 1000$	2,000
International per diem $20 \times 75$	1,500
Language training	<u>2,000</u>
Total - Support	\$36,210 - use \$36,000

Local Hire Liaison Officers (ex PCVs)  
(8 person years)Grant

Salary, International Travel, Workmen's Compensation (per year)	\$25,000
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Support

Housing, Per Diem, Local Travel, local secretary	\$15,000
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Technical Assistance Support EquipmentOffice

Typewriter	3 @1,000	\$ 3,000
Copier	1 @5,000	5,000
Calculator	5 @200	1,000

Household

Refrigerator	4@800	3,200
Dryer	4@800	3,200
Stove	4@700	2,800
Air-conditioner	2@600	7,200
Worker	4@700	2,800
Driver	4@700	2,800

Total		\$71,000
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On-Campus Expenses

Salaries		
Campus coordinator	1	\$20,000
Secretary/booker	1	6,000
Fringe		4,420
Communications		1,200
Supplies and printing		3,000
Travel, U.S.		600
Per diem, U.S.		800
Travel, international		2,600
Per diem, international		1,500
Recruitment, medical, visa, etc.		2,500
Minor procurement of commodities		1,000
Overhead 25%		10,605
Total		\$53,010

Technical Assistance - In-country Support (Expatriate team & local experts)

Personnel	Annual Cost	
	\$000	¥000
Secretary 2@¥8,000/mo	9.6	192
Driver 3@¥4,000/mo	7.2	144
Translator-interpreter 2@¥10,000/mo.	12.0	240
Total	28.0	576

B. Administration and Technical Support BudgetPersonnel Costs

(\$'000 at 1:120)

Descriptions	Year							Total
	1	2	3	4	5	6	7	
<u>Salaries</u>								
1. Project Director, C-7 official, @ ₪9,500/month	4.3	5.7	5.7	5.7	5.7	5.7	5.7	38.5
2. Associate Project Director, C-6 or C-7 official, @ ₪8,000/month	3.6	4.8	4.8	4.8	4.8	4.8	4.8	32.4
3. Field Managers (four persons), C-6 officials, @ ₪7,000/month	8.4	16.8	16.8	16.8	16.8	16.8	16.8	109.2
4. Assistant Field Managers (four persons), *C-5 officials, @ ₪6,000/month	7.2	14.4	14.4	14.4	14.4	14.4	14.4	93.6
5. Technical Back-Stop Specialists (eight), C-6 officials, @ ₪7,000/month, average 1/3 time first year, 2/3 time 2, 3, 4 years, and 1/2 time 5, 6 and 7 years	11.2	22.4	22.4	22.4	16.8	16.8	16.8	128.8
6. Technical Back-Stop Specialists (eight), C-5 officials, @ ₪6,000/month, average 1/3 time first year, 2/3 time 2, 3, 4 years, and 1/2 time 5, 6 and 7 years	9.6	19.2	19.2	19.2	14.4	14.4	14.4	110.4
7. Administrative Officer, C-4, @ ₪5,000/month	2.25	3.0	3.0	3.0	3.0	3.0	3.0	20.25
8. Finance Officer/Accountant, C-4, @ ₪4,500/month	2.05	2.7	2.7	2.7	2.7	2.7	2.7	18.25
9. Publicity Officer, C-4 officer, @ ₪4,500/month	1.35	2.7	2.7	2.7	2.7	2.7	2.7	17.55
10. Typists (six persons), C-3, @ ₪3,000/month	5.4	10.8	10.8	10.8	10.8	10.8	10.8	70.2
11. Drivers (three persons) at Phra, @ ₪2,500/month	2.25	4.5	4.5	4.5	4.5	4.5	4.5	29.25
12. Drivers at the field level (four persons), @ ₪2,000/month	2.4	4.8	4.8	4.8	4.8	4.8	4.8	31.2
<b>Sub-Total</b>	<b>60.0</b>	<b>111.8</b>	<b>111.8</b>	<b>111.8</b>	<b>101.4</b>	<b>101.4</b>	<b>101.4</b>	<b>699.6</b>

## ANNEX IX-6

(\$'000 at 1:฿20)

Description:	Year							Total
	1	2	3	4	5	6	7	
<b>Meeting Allowance</b>								
1. NERAD working group Bangkok, 80 meetings/ man @ ฿150/man	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.2
2. Project Director's working groups, 180 meetings/man @ ฿150/man	1.35	1.35	1.35	1.35	1.35	1.35	1.35	9.45
3. Provincial sub-committees, (four provinces) 180 meetings/man per province, @ ฿150/man	5.4	5.4	5.4	5.4	5.4	5.4	5.4	37.8
4. Other working groups at provincial level (four provinces), 150 meetings/ man @ ฿150/man	4.5	4.5	4.5	4.5	4.5	4.5	4.5	31.5
5. Chairman of all the meetings, 100 meetings @ ฿187.50 per meeting	0.95	0.95	0.95	0.95	0.95	0.95	0.95	6.65
<b>Sub-Total</b>	<b>12.8</b>	<b>12.8</b>	<b>12.8</b>	<b>12.8</b>	<b>12.8</b>	<b>12.8</b>	<b>12.8</b>	<b>89.6</b>
<b>Grand Total</b>	<b>72.8</b>	<b>124.6</b>	<b>124.6</b>	<b>124.6</b>	<b>114.2</b>	<b>114.2</b>	<b>114.2</b>	<b>789.2</b>

\*The salaries of the Assistant Field Managers are on the payrolls of the respective provincial agricultural extension offices.

Administration and Technical Support BudgetPer Diem, Lodging and Housing Allowance

(\$'000 at 1:120)

Description	Year							Total
	1	2	3	4	5	6	7	
1. Project Director and Associate Project Director @ \$300/day for 120 days/year	0.9	1.8	1.8	1.8	1.8	1.8	1.8	11.7
2. Subject matter specialists @ \$250/day for 800 days/year	5.0	10.0	10.0	10.0	10.0	10.0	10.0	65.0
3. Field managers, four persons @ \$250/day for 180 days/year	4.5	9.0	9.0	9.0	9.0	9.0	9.0	58.5
4. Assistant field managers, four persons @ \$250/day for 120 days	3.0	6.0	6.0	6.0	6.0	6.0	6.0	39.0
5. Committee members @ \$250/day for 120 days	1.5	1.5	1.5	1.5	1.5	1.5	1.5	10.5
6. Drivers @ \$150/day for 800 days	3.0	6.0	6.0	6.0	6.0	6.0	6.0	39.0
7. International travel	1.2	2.4	2.4	1.2	1.2	1.2	-	9.6
8. Housing Allowance - Field Managers, C-6 officials (four persons) @ \$1,500/month*	1.8	3.6	3.6	3.6	3.6	3.6	3.6	23.4
<b>Total</b>	<b>20.9</b>	<b>40.3</b>	<b>40.3</b>	<b>39.1</b>	<b>39.1</b>	<b>39.1</b>	<b>37.9</b>	<b>256.7</b>

\* Housing facilities will be provided for project director, associate project director, and Thai subject-matter specialists at Tha Phra, while junior officers (including assistant field managers) will be recruited locally, and thus are not entitled to housing allowance from the government.

Administration and Technical Support BudgetTransportation

(\$'000 at 1:120)

Description	Year							Total
	1	2	3	4	5	6	7	
<u>In Country</u>								
Air, train and bus fares	10.0	15.0	20.0	15.0	15.0	15.0	15.0	105.0
Transportation of things	2.5	5.0	10.0	10.0	10.0	10.0	10.0	57.5
Sub-Total	12.5	20.0	30.0	25.0	25.0	25.0	25.0	162.5
<u>International</u>								
Air fares for regional seminars, etc.	1.6	3.2	3.2	1.6	1.6	1.6	-	12.8
Total	14.1	23.2	33.2	26.6	26.6	26.6	25.0	175.3

Administration and Technical Support BudgetOperating Expenditures

(\$'000 at 1:120)

Descriptions	Year							Total
	1	2	3	4	5	6	7	
1. Expendable office supplies	5.0	5.0	5.0	5.0	5.0	5.0	5.0	35.0
2. Supplementary water, electricity and other charges at Tha Phra Office @ \$250/month	1.5	3.0	3.0	3.0	3.0	3.0	3.0	19.5
3. Supplementary water, electricity and other charges at each field manager office (four) @ \$50/month	1.2	2.4	2.4	2.4	2.4	2.4	2.4	15.6
4. Gasoline, lubrication and oil for 20 project vehicles, estimated at 320 litres/month/vehicle @ \$0.5/litre	19.2	38.4	38.4	38.4	38.4	38.4	38.4	249.6
5. Maintenance, repair and parts, estimated at \$40/month/vehicle for years 2-4 and \$80/month for years 5-7	-	9.6	9.6	9.6	19.2	19.2	19.2	86.4
6. Maintenance and repairs of office and equipment	-	2.5	2.5	2.5	2.5	2.5	2.5	15.0
7. Lab supplies	3.75	5.0	10.0	7.5	7.5	5.0	5.0	43.75
<b>Total</b>	<b>30.65</b>	<b>65.9</b>	<b>70.9</b>	<b>68.4</b>	<b>78.0</b>	<b>75.5</b>	<b>75.5</b>	<b>464.85</b>

Administration and Technical Support BudgetConstruction - Office Building

(\$'000 at 1:B20)

Description	Year							Total
	1	2	3	4	5	6	7	
1. Cost of construction of one office building at Tha Phra NEROA	---	---	---	100	---	---	---	100
2. Cost of furnishing the above building	---	---	---	---	25	---	---	25
Total	---	---	---	100	25	---	---	125

Administration and Technical Support BudgetEquipment

(\$'000 at 1:120)

Description	Year							Total
	1	2	3	4	5	6	7	
<u>Vehicle</u>								
Four Jeeps @ \$10,000	40	-	-	-	-	-	-	40
15-Seat Microbus, one @ \$13,000	13	-	-	-	-	-	-	13
Pick-ups, 15, 1,500-1,600 cc. @ \$7,500	112	-	-	-	-	-	-	112
<b>Sub-Total</b>	<b>165</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>165</b>
<u>Office</u>								
Typewriter, English/Thai, electric, three @ \$1,730	5.19	-	-	-	-	-	-	5.19
Typewriter, Thai, ordinary, five @ \$825	4.125	-	-	-	-	-	-	4.125
Stencil machine, five @ \$1,250	6.25	-	-	-	-	-	-	6.25
Calculator, machine, five @ \$100	0.5	-	-	-	-	-	-	0.5
Desks and chairs, 20 sets @ \$100	2	-	-	-	-	-	-	2
Filing cabinets, 20 sets @ \$75	1.5	-	-	-	-	-	-	1.5
Electric Fans, 20 sets @ \$62.5	1.25	-	-	-	-	-	-	1.25
Radio-transmitter sets stationed at project manager's and field managers' offices (5 stations)	10	-	-	-	-	-	-	10
Safe, one @ \$500	0.5	-	-	-	-	-	-	0.5
Copier @ \$3,900	3.9	-	-	-	-	-	-	3.9
Research equipment	25	50	10	-	10	5	-	100
<b>Sub-Total</b>	<b>60.125</b>	<b>50</b>	<b>10</b>	<b>-</b>	<b>10</b>	<b>5</b>	<b>-</b>	<b>135.125</b>
<u>Others</u>	-	2.5	-	-	-	-	-	2.5
<b>Sub-Total</b>	<b>-</b>	<b>2.5</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2.5</b>
<b>Grand Total</b>	<b>225.2</b>	<b>52.5</b>	<b>10</b>	<b>-</b>	<b>10</b>	<b>5</b>	<b>-</b>	<b>302.7</b>

C. Estimated Budget for Improved Cropping Systems

(\$'000 at 1:120)

Activity	Year							Total
	1	2	3	4	5	6	7	
1. Specialist Farmers								
TEA	-	-	-	.55	.45	.45	.45	1.9
1.1 Training	-	10.05	10.05	-	-	-	-	20.10
1.2 Field Excursion S.F.	-	-	-	1.75	1.75	1.75	1.75	7
1.3 Transportation Within Tambon	-	1.75	3.5	3.5	3.5	3.5	3.5	19.25
1.4 Wages	-	15.1	30.2	30.2	30.2	30.2	30.2	166.10
1.5 Farm Tools								
Cost	-	5.8	5.8	-	-	-	-	11.60
Maintenance	-	.3	.6	.6	.6	.6	.6	3.3
1.6 Storage Room	-	36.8	36.8	-	-	-	-	69.60
Total	-	67.80	86.95	36.60	36.50	36.50	36.50	298.85
2. Technical Assistance								
2.1 Training	.5	-	-	-	-	-	-	.5
2.2 Field Excursion	.7	-	.7	-	.7	-	-	2.1
2.3 Travel and Per Diem	2.4	7.8	7.8	7.8	7.8	7.8	7.8	49.20
Salary	9.6	19.2	19.2	19.2	19.2	19.2	9.6	115.2
Total	13.20	27	27.70	27.0	27.70	27	17.40	167.0
3. Tambon Training Programs								
Total	-	-	-	3.75	7.45	11.2	18.6	41
4. Research Field Experi- ments								
4.1 Travel and Per Diem for Technical and Expert Personnel.	5.3	21.15	21.15	18.5	15.85	13.2	-	95.15

C. Estimated Budget for Improved Cropping Systems

(\$'000 at 1:120)

Activity	Year							Total
	1	2	3	4	5	6	7	
4.2 Graduate Assistants								
4.2.1 Travel and Per Diem	-	-	1.7	1.7	1.7	-	-	5.10
4.2.2 Allowance	-	-	3.6	3.6	3.6	-	-	10.80
4.2.3 Thesis Preparation	-	-	.6	.6	.6	-	-	1.80
4.3 Land Rent	-	8.3	7.05	5.5	5.2	3.95	-	30.0
4.4 Farm Tools								
Cost	-	9.6	-	-	-	-	-	9.6
Maintenance	-	.5	.5	.5	.5	.5	-	2.5
4.5 Fencing	-	19.95	-	-	-	-	-	19.95
4.6 Production Inputs								
4.6.1 Labor	-	12.9	11.05	8.4	8.15	5.95	-	46.45
4.6.2 Chemicals & Supplies	-	8.05	7.1	5.4	5.2	3.9	-	29.65
<b>Total</b>	<b>5.3</b>	<b>80.45</b>	<b>52.75</b>	<b>44.2</b>	<b>40.8</b>	<b>27.5</b>	<b>-</b>	<b>251.00</b>
5. Demonstration Trials								
5.1 Production Inputs								
5.1.1 Labor	-	-	5.6	11.2	11.2	8.5	8.5	45.0
5.1.2 Chemicals & Supplies	-	-	5.35	10.7	10.7	8	8	42.75
5.2 Fencing	-	-	17.8	17.8	-	-	-	35.60
<b>Total</b>	<b>-</b>	<b>-</b>	<b>28.75</b>	<b>39.7</b>	<b>21.9</b>	<b>16.5</b>	<b>16.5</b>	<b>123.35</b>
6. Extension Trials								
6.1 Farm Tools								
Cost	-	-	-	11	7.6	12.6	16.2	47.40
Maintenance	-	-	-	.55	.95	1.6	2.4	5.50
6.2 Rewards	-	-	-	.8	1.6	2.4	4	8.80
6.3 Production inputs	-	-	-	3.45	13.55	22.8	34	78.80
<b>Total</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>20.8</b>	<b>23.7</b>	<b>39.4</b>	<b>56.6</b>	<b>140.50</b>

C. Estimated Budget for Improved Cropping Systems

(\$'000 at 1:120)

Activity	Year							Total
	1	2	3	4	5	6	7	
7. Seed Production								
7.1 Production Inputs	-	-	7.7	-	-	-	-	7.7
Total	-	-	7.7	-	-	-	-	7.7
GRAND TOTAL (BAHT)	370	3,505	4,037	3,441	3,161	3,162	2,912	20,588
GRAND TOTAL (\$000)	19	175	202	172	158	158	147	1,029

## D. Other Farming System Improvements Budget

(\$'000 at 1:฿20)

Description	Year							Total
	1	2	3	4	5	6	7	
Native Chicken	5.6	10.15	13.4	12.2	5	3	1.75	51.1
Large Animal Improvement	-	23.25	30.5	40.75	54.15	61.35	61.35	271.35
Fish Production	11.1	21.2	33.7	33.7	29.4	29.4	29.4	187.9
Sericulture	-	5.3	18.25	18.25	9	9	9	68.8
Fruit and Tree Nursery	-	3.2	6.2	3.2	1.2	1.2	1.2	16.2
<b>Total</b>	<b>16.7</b>	<b>63.1</b>	<b>102.05</b>	<b>108.1</b>	<b>98.75</b>	<b>103.95</b>	<b>102.7</b>	<b>595.35</b>

## Native Chicken Budget

(\$'000 at 1:฿20)

Description	Year							Total
	1	2	3	4	5	6	7	
*Farmer Specialist Training (101 persons)	-	1	2.4	1.2	1.25	-	-	5.85
Supplies (vaccines needles & cooler)	2.5	2.5	5	5	2.5	2.5	1.25	21.25
† Educational Materials	2.5	2.5	2.5	2.5	-	-	-	10
Male Birds (5000 birds)	-	2.25	2.25	2.25	.75	-	-	7.5
Village Meetings #260 @ 500 baht	.6	1.9	1.25	1.25	.5	.5	.5	6.5
<b>Total</b>	<b>5.6</b>	<b>10.15</b>	<b>13.4</b>	<b>12.2</b>	<b>5</b>	<b>3</b>	<b>1.75</b>	<b>51.1</b>

\*Village Volunteers, no wages

## Fruit and Tree Nursery Budget

(\$'000 at 1:K20)

Description	Year							Total
	1	2	3	4	5	6	7	
Farmer Specialist Training	-	1.2	1.2	1.2	1.2	1.2	1.2	7.2
Supplies (seedlings & Equip.)	-	2	5	2	-	-	-	9
<b>Total</b>	-	3.2	6.2	3.2	1.2	1.2	1.2	16.2

## Sericulture Budget

(\$'000 at 1:K20)

	Year							Total
	1	2	3	4	5	6	7	
Farmer Specialist Training (74 Villagers)	-	-	4.45	4.45	-	-	-	8.9
Rearing Rooms	-	-	1.85	1.85	-	-	-	3.7
Supplies	-	-	3.7	3.7	3.7	3.7	3.7	18.5
Mulberry Plants	-	-	2.95	2.95	-	-	-	5.9
Salary for one technician	-	2.5	2.5	2.5	2.5	2.5	2.5	15
Travel for one technician	-	1	1	1	1	1	1	6
Per diem for one technician	-	.8	.8	.8	.8	.8	.8	4.8
Village Meetings	-	1	1	1	1	1	1	6
<b>Total</b>	-	5.3	18.25	18.25	9	9	9	68.8

## Large Animal Improvement Budget

(\$'000 at 1:K20)

Description	Year							Total
	1	2	3	4	5	6	7	
Farmer Specialist Training	-	3	-	-	3.05	-	-	6.05
Supplies, Vaccines and Medicine	-	10.25	20.5	30.75	41	51.25	51.25	205
Seed (forage)	-	3.75	3.75	3.75	3.75	3.75	3.75	22.5
Wages, Farmer Specialists for assisting in activities (hourly wage)	-	6.25	6.25	6.25	6.35	6.35	6.35	37.8
Total	-	23.25	30.5	40.75	54.15	61.35	61.35	271.35

## Fish Production Budget

(\$'000 at 1:K20)

Description	Year							Total
	1	2	3	4	5	6	7	
Salaries for three technicians	1.5	9	9	9	9	9	9	55.5
Wages for farmer specialists	-	-	3.9	3.9	3.9	3.9	3.9	19.5
Supplies (fry & manure)	-	7.5	10	10	7.5	7.5	7.5	50
Per Diem	1	2	5	5	5	5	5	28
Travel	.5	1.5	4	4	4	4	4	22
Farmer Specialist Training	-	1.2	1.8	1.8	-	-	-	4.8
Equipment	8.1	-	-	-	-	-	-	3.1
Total	11.1	21.2	33.7	33.7	29.4	29.4	29.4	187.9





2. Land Terracing

(US\$1 = B20)

	<u>Area Per Year (Rai)</u>							Total
	1	2	3	4	5	6	7	
<u>Tambon</u>								
Lahan	-	30	20	-	-	-	-	50
Kwang Chon	-	-	-	-	-	-	-	-
Nong Kaew	-	-	-	-	-	-	-	-
Na Muang	-	30	-	-	-	-	-	30
Na Thom	-	-	10	20	25	-	-	55
Na Ngua	-	-	10	20	20	20	-	70
Takot	-	-	-	-	-	-	-	-
Tae	-	-	-	-	-	-	-	-
	-	60	40	40	45	20	-	205
<u>Cost Per Year (US\$)</u>								
<u>Equipment</u>								
1 C Farm Tractor	-	27,500	-	-	-	-	-	27,500
<u>Salary</u>								
- 1C Driver		879	879	879	879	879	-	4,395
<u>Per Diem and Lodging</u>								
- 1C Driver (90 B/day x 240 days/ year)		1,080	1,080	1,080	1,080	1,080	-	5,400
<u>POL</u>								
- Farm Tractor		7,680	7,680	7,680	7,680	7,680	-	38,400
<u>Others</u>								
- Miscellaneous		250	250	250	250	250	-	1,250
- Travelling Allowance								
<b>TOTAL</b>	-	37,389	9,889	9,889	9,889	9,889	-	76,945

3. Compost Demonstration

(US\$1 = B20)

	Year							Total
	1	2	3	4	5	6	7	
<u>Compost Subsidy</u>								
- Collection residual material @ B100/ton.	-	4	4	4	4	4	4	20
- Material (manure and fertilizer) @ B100/ton.	-	4	4	4	4	4	4	20
<b>TOTAL</b>	-	8	8	8	8	8	8	40

F. Agricultural Extension Support

	Quantity	@ (US\$)	Total (US\$)	
<u>1. Training</u>				
<u>1.1 TEA Subject Training</u>				
1.1.1	Trainer's per diem	12/yr	\$ 320	\$23,040
1.1.2	TEA per diem	12/yr	455	32,760
1.1.3	Transport	12/yr	100	7,200
1.1.4	Supplies	12/yr	100	7,200
Total				\$70,200
<u>1.2 TEA Induction Training</u>				
1.2.1	Trainers per diem	3 courses	1,800	5,400
1.2.2	TEA per diem	3 courses	2,200	6,600
1.2.3	Travel	3 courses	210	630
1.2.4	Supplies	3 courses	100	300
Total				\$12,930
<u>1.3 Amphoe Officer Training</u>				
1.3.1	Trainer per diem	4 courses	340	3,360
1.3.2	Amphoe Officer per diem	4 courses	1,345	5,380
1.3.3	Transportation	4 courses	115	460
1.3.4	Supplies	4 courses	100	400
Total				\$ 9,600
<u>1.4 Other Training (SMS &amp; Field Managers)</u>				
1.4.1	Trainer per diem	4 courses	840	3,360
1.4.2	Trainer per diem	4 courses	2,015	8,606
1.4.3	Transport	4 courses	170	680
1.4.4	Supplies	4 courses	125	500
Total				\$12,600
TOTAL				<u>\$105,330</u>

## F. Agricultural Extension Support Budget

	Quantity	@ (US\$)	Total (US\$)
<b>2. Farmer Education</b>			
2.1 <u>Tambon Building</u>	8 buildings	\$ 25,000	\$200,000
2.1.1 Land and Site (Tambon Contribution)			42,000
2.1.2 Annual Maintenance of Building			10,000
2.1.3 Furnishing the Building	1 set	10,000	<u>10,000</u>
			\$252,000
<b>2.2 Personnel</b>			
2.2.1 TEA Salary			140,000
2.2.2 Equipment Specialist			9,750
2.2.3 Artist			9,750
			<u>\$159,500</u>
<b>2.3 Equipment Cost</b>			
2.3.1 Motorcycles for TEA	14 sets	1,000	14,000
2.3.2 Equipment in Each Tambon			
2.3.2.1 Viewing Screen	11 sets	125	1,375
2.3.2.2 35 mm Camera	9 sets	625	5,625
2.3.2.3 Slide Projector	9 sets	625	5,625
2.3.2.4 Generator	10 sets	937.5	9,375
2.3.2.5 Overhead Projector	9 sets	500	4,500
2.3.2.6 Desks and Chairs	14 sets	75	1,050
2.3.2.7 Chairs (Visitor)	14 sets	75	1,050
2.3.2.8 Small Sprayer	10 sets	50	500
			<u>\$29,100</u>
2.3.3 Equipment for Field Manager			
2.3.3.1 Desks (including chairs)	4 sets	118.75	475
2.3.3.2 File Cabinets	8 sets	81.25	650
2.3.3.3 Office Chairs	8 sets	25	200
			<u>\$1,325</u>
2.3.4 <u>Equipment for Radio Programmer</u>			
2.3.4.1 Omni-Direction Microphone	2 sets	150	300
2.3.4.2 Uni-Direction Microphone	2 sets	150	300
2.3.4.3 Microphone Stands	2 sets	25	50
2.3.4.4 Cassette Tape Desk	1 set	500	500
2.3.4.5 Reel to Reel Stereo Tape Recorder	2 sets	750	1,500
2.3.4.6 Turn Table	1 set	750	300

	Quantity	Unit (US\$)	Total (US\$)
2.3.4.7 Cassett Tape Recorder	2 sets	\$ 150	\$ 300
2.3.4.8 AM/FM Portable Radio including tape recorder.	1 set	200	200
2.3.4.9 Stereohed phone	1 set	100	100
2.3.4.10 Bulk tape eraser	1 set	50	50
2.3.4.11 Pre-Amplifier Mixer Console	1 set	1,500	1,500
2.3.4.12 Typewriter	1 set	4,000	4,000
2.3.4.13 lettering	2 sets	150	300
2.3.4.14 Desk for Secretary (includes chair)	2 sets	75	150
			<u>\$10,000</u>
<b>2.3.5 <u>Equipment for Mobile Unit</u></b>			
2.3.5.1 Generator	1 set	750	750
2.3.5.2 Cassette Player/Recorder	1 set	175	175
2.3.5.3 Slide Projector	1 set	500	500
2.3.5.4 Amplifier	1 set	350	350
2.3.5.5 Radio AM/FM/SW	1 set	150	150
2.3.5.6 Microphones	2 sets	75	150
2.3.5.7 Horn Speakers	2 sets	125	250
2.3.5.8 Set of lights	1 set	100	100
2.3.5.9 Cables Connection Set	1 set	200	200
2.3.5.10 Projection	1 set	100	100
2.3.5.11 Projection (Daylight)	1 set	100	100
2.3.5.12 Cassettes	15 sets	16,665	250
2.3.5.13 Tool Set	1 set	50	50
2.3.5.14 Set Spare Part	1 set	150	150
2.3.5.15 Projection Table	1 set	150	150
2.3.5.16 Padded Cabinets	1 set	250	250
2.3.5.17 Movie Camer (8 mm)	1 set	400	400
2.3.5.18 Movie Projector (8 mm)	1 set	750	750
2.3.5.19 35 mm. Camera	1 set	500	500
			<u>\$ 5,335</u>
<b>2.4 <u>Cost of Supplies and Maintenance</u></b>			
2.4.1 TEA			<u>\$74,100</u>
2.4.2 Other			

	Quantity	@ (US\$)	Total (US\$)
2.4.2.1 Supplies			\$ 21,000
2.4.2.1 Supplies			\$ 21,000
2.4.2.3 Radio Programming			83,541
2.4.2.4 Mobile Unit Vehicle			12,600
			<u>\$117,141</u>
<b>2.5 <u>Cost of Travel</u></b>			
2.5.1 TEA (in tambon) (฿1,125/mo/TEA)			122,700
2.5.2 Radio Programmer (per diem)			2,400
2.5.3 Mobile Unit Personnel (per diem)			9,360
			<u>\$134,460</u>
			<u><u>\$796,961</u></u>

## G. Other Agricultural Support - Social Support Services

(\$'000 at 1:820)

Description	Quantity	Per Unit	Year							Total		
			1	2	3	4	5	6	7			
1. Regular meetings between civil officials, merchants, and farmers												
Official - per diem for 3	15 meeting, 7 amphur	\$2.50 meeting	1.05	0.7	0.7	0.7	0.7	0.7	0.7	0.7	50	Per diem for 3 officials \$2.50 for one meeting per amphur.
Member - per diem and travelling expenses			30	6	4	4	4	4	4	4	30	50 persons x \$5/person x 8 Tambons x 15 meetings
Merchant member - per diem and travelling expenses			1.2	.8	.8	.8	.8	.8	.8	.8	6	10 persons x \$2.5/person x 8 Tambons x 30 meetings
Supplies			.1	.1	.1	.1	.1	.1	.1	.1	.7	
Total			8.35	5.6	5.6	5.6	5.6	5.6	5.6	5.6	41.95	
2. Circulation of Newsletter												
Newsletters	840,000	.25	30	30	30	30	30	30	30	30	210	10,000 persons x \$0.25/person x 12 months x 7 years
Stamps	840,000	.01	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.4	10,000 persons x \$0.01/person x 12 months x 7 years
Total			31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	218.4	
Grand Total			39.55	36.8	36.8	36.8	36.8	36.8	36.8	36.8	260.35	

## G. Other Agricultural Support - Resource Inventory

(\$'000 at 1:100,000)

Description	Year							Total
	1	2	3	4	5	6	7	
Weather Data	49.075	4.2	5.875	5.85	5.8	5.8	5.8	82.4
Soil Survey and Land Use Planning	72.45	-	-	-	-	-	-	72.45
Soil Testing	3.275	3.55	3.925	2.9	3.45	3.65	4.2	24.95
Total	124.8	7.75	9.8	8.75	9.25	9.45	10.0	179.8



1. Demonstration and Research Budget

(\$'000 at 1:B20)

Description	Year							Total
	1	2	3	4	5	6	7	
Salaries for Supervisors and Project Specialists	3.0	2.0	2.0	2.0	2.0	2.0		13.0
Soil Fertility Field Evaluation	-	3.7	3.7	3.7	3.7	3.8		19.0
Shallow-Well Improvement	-	5.5	4.5	-	-	-		10.0
Minimum Tillage	-	-	1.0	1.0	1.0	-		3.0
Saline Soil Amelioration	-	-	8.5	8.5	8.5	8.5		35.0
Public Land Use Demonstration	1.5	10.3	9.5	7.85	7.0	7.85		45.0
Farming Systems Research* Soil and Land Demonstrations**	-	-	-	-	-	-		-
<b>TOTAL</b>	<b>5</b>	<b>22</b>	<b>30</b>	<b>23</b>	<b>22</b>	<b>22</b>		<b>125</b>

\*Budgeted in Administration and Technical Support.

\*\*Budgeted in Soil and Land Annex.

J. Economic StudiesSupport

\$ 000 at 1:20

	Year							Total
	1	2	3	4	5	6	7	
<u>Salaries</u> 2 PC 3, 2 PC 5-6	7	7	7	8	8	8		45
<u>Farmer Record</u> <u>Keeping Fees</u> (30 farmers/Tambon) B100/mo	16	16	16	16	16	16		96
<u>Supplies/Materials</u> <u>Printing</u>	4	4	4	4	4	4		24
<u>Studies</u>	-	20	20	20	20	20		100
<b>Total</b>	27	47	47	48	48	48		265

K. Evaluation/Monitoring

\$ 000 U.S. Dollars

	Year							
	1	2	3	4	5	6	7	Total
<u>Evaluation</u>								
Mini Evaluations (4 studies yr. x \$2,500)	10	10	10	-	10	10	-	50
In Depth Evaluation (10 person months)				100				100
Consultant Support				50				50
Sub-Total	10	10	10	150	10	10	-	200
<u>Monitoring</u>								
Wages	15	20	20	20	20	20	20	135
Travel - Per Diem	5	13	18	18	18	18	18	108
Equipment/Supplies	5	2	2	2	2	2	2	17
Sub-Total	25	35	40	40	40	40	40	260
Total	35	45	50	190	50	50	40	460

## CHECKLIST OF STATUTORY CRITERIA

## COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in consistent patterns of gross violations of internationally recognized human rights?
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?
3. FAA Sec. 690(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?
4. FAA Sec. 690(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?

A. GENERAL CRITERIA FOR COUNTRY

This project is designed specifically to benefit the farmers of Northeast Thailand.

The Government is taking such steps.

Yes.

RTG not so liable.

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5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? No.
6. FAA Sec. 620(d), 620(f); FY 79, App. Act Sec. 103, 114, 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola? No.
7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? No.
8. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? No.
9. FAA Sec. 620(j). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility, or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? The investment guaranty program is in effect.

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10. FAA Sec. 620(o): Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters,
- N/A
- a. has any deduction required by Fishermen's Protective Act been made?
- b. has complete denial of assistance been considered by AID Administrator?
11. FAA Sec. 620(q): FY 79 App. Act Sec. 603.
- a. Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country?
- No.
- b. Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?
- No.
12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This
- Yes, as reported in annual report on implementation of Sec.620(s).

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report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

13. FAA Sec. 620(l). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? No.
14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, into account by the AID Administrator in determining the current AID Operational Year Budget? Not in arrears
15. FAA Sec. 620A; FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of terrorism? No.
16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? No.
17. FAA Sec. 699, 6.0. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified

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arrangements or safeguards?  
 Has it detonated a nuclear  
 device after August 3, 1977,  
 although not a "nuclear-  
 weapon state" under the  
 non-proliferation treaty?

No.

B. FUNDING CRITERIA FOR COUNTRY

FUNDING CRITERIA FOR COUNTRY

1. Development Assistance  
 Country Criteria

- a. FAA Sec. 102(b)(4).  
 Have criteria been  
 established and  
 taken into account  
 to assess commitment  
 and progress of coun-  
 try in effectively  
 involving the poor in  
 development on such  
 indexes as: (1) in-  
 crease in agricultural  
 productivity through  
 small farm labor in-  
 tensive agriculture  
 (2) reduced infant  
 mortality, (3) control  
 of population growth,  
 (4) equality of income  
 distribution, (5) re-  
 duction of unemploy-  
 ment, and (6) increased  
 literacy?

Yes, See FY 1981 CDSS.

- b. FAA Sec. 104(d). If  
 appropriate is this de-  
 velopment activity de-  
 signed to build motiva-  
 tion for smaller families  
 through modification of  
 economic and social con-  
 ditions supportive of the  
 desire for large families  
 in programs such as edu-  
 cation in and out of  
 school, nutrition, dis-  
 ease control, maternal  
 and child health ser-  
 vices, agricultural pro-  
 duction, rural develop-  
 ment, and assistance to

This activity is not specifically  
 designed to address these issues.

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urban poor? Are problems of malnutrition, disease, and rapid population growth addressed by coordinated assistance?

2. Economic Support Fund  
Country Criteria

- a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights? N/A
- b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has the President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests? N/A
- c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A
- d. IT '90 App. Act Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? N/A

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- e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978?

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and Related Land Resources dated October 25, 1973?

5. FAA Sec. 611(c). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?
6. FAA Sec. 209. Is project susceptible of execution as part of a regional or multilateral project? If so why is project not so executed? Information, and conclusion whether assistance will encourage regional development programs.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

The project is not a capital assistance project.

No. However, Project represents new approach which may encourage multilateral replication in the future.

No significant effect expected.

No so designed.

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9. FAA Sec. 612(b); Sec 636(h).  
Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the United States are utilized to meet the cost of contractual and other services.

The Royal Thai Government contribution will exceed 25%.

10. FAA Sec. 612(d). Does the United States own excess foreign currency and, if so, what arrangements have been made for its release?

There are no US owned local currencies available for this Project.

11. FAA Sec. 601(c). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes.

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting production commences, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance

Project Criteria

a. FAA Sec. 107(b); 111; 113; 281 (c). Extent to which activities will: (i) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive

FUNDING CRITERIA FOR PROJECT

Project is aimed at meeting felt needs of rural poor and will utilize the services of a Title XII institution.

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production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (ii) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life, and otherwise encourage democratic private and local governmental institutions; (iii) support the self-help efforts of developing countries; (iv) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (v) utilize and encourage regional cooperation by developing countries?

Benefits are expected to be self sustaining once improved technologies are adopted by beneficiaries. Farmer groups/cooperatives will be utilized to help manage local aspects of project.

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b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph: e.g., 1, 2, etc.,--which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source).

(1)(103) for agriculture, rural development or nutrition; if so extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;

(2)(104) for population planning under 104(b) or health under 104(c); N/A if so, extent to which activity emphasizes low-cost, integrated delivery systems for

The Project purpose is to establish a program to increase farm productivity and incomes among low income farmers.

health, nutrition, and family planning for the poorest people with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics, and health posts, commercial distribution systems and other modes of community research;

(3)(105) for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

N/A

(4)(106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

N/A

(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(ii) to help alleviate energy problem;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for program of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

(5)(107) Is appropriate effort

N/A

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placed on use of appropriate technology?

c. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived under Sec. 124(d) for a "relatively least-developed" country)?

Yes.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing or is recipient country "relatively least developed?"

N/A

e. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

The Project is consistent with the RTG's own development plans and is based on satisfying felt needs of the rural poor.

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

Yes, agricultural productivity should be improved.

2. Development Assistance Project Criteria (Loans Only)

Repayment prospects are excellent.

(a) FAA Sec. 122(b). Information and conclusion on capacity

of the country to repay the loan, including reasonableness of repayment prospects.

- (b) FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

3. Project Criteria Solely for Economic Support Fund

- (a) FAA Sec. 531(a). Will this assistance support or promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?

N/A

- (b) FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?

N/A

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CHECKLIST OF STATUTORY CRITERIASTANDARD ITEM CHECKLISTA. PROCUREMENT

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegations from him?
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?
6. FAA Sec. 603. Compliance with requirement in Sec. 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.

A. PROCUREMENT

Yes.

Yes.

Yes.

N/A

Yes.

Agreement will contain such provision.

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7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

Yes.

N/A

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S. flag carriers will be utilized to the extent such service is available?

Yes.

9. FY 79 App. Act Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States?

Yes.

B. CONSTRUCTION

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?

Not a capital project.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

Yes.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million?

N/A

B. CONSTRUCTION

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C. OTHER RESTRICTIONS

1. FAA Sec. 122(e). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?
3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the U.S.?
4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S. or guaranty of such transaction?
5. Will arrangements preclude use of financing:
  - a. FAA Sec. 104(i). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization?
  - b. FAA Sec. 620(g). To compensate owner for expropriated nationalized property?
  - c. FAA Sec. 660. To finance police training or other law enforcement assistance, except for narcotics programs?

Yes.

N/A

Yes.

Yes.

Yes.

Yes.

Yes.

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- d. FAA Sec. 662. For CIA activities? Yes.
- e. FY79 App. Act Sec. 104. To pay pensions, etc., for military personnel? Yes.
- f. FY79 App. Act Sec. 106. To pay UN assessments? Yes.
- g. FY79 App. Act Sec. 107. To carry out provisions of FAA Sec 209(d) and 251(h)? (Transfer to multilateral organizations for lending.) Yes.
- h. FY79 App. Act Sec. 112. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields? Yes.
- i. FY79 App. Act Sec. 601. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? Yes.

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PROJ: 498-308

a/ARD



MINISTRY OF AGRICULTURE AND COOPERATIVES  
Rajadamnern Ave., Bangkok  
THAILAND

exk

Received

11 JUN 1981

ACT	INFO
D	<input checked="" type="checkbox"/>
EXO	<input checked="" type="checkbox"/>
O/FIN	<input checked="" type="checkbox"/>
O/PPD	<input checked="" type="checkbox"/>
O/EST	<input type="checkbox"/>
O/RHUD	<input checked="" type="checkbox"/>
O/RD	<input checked="" type="checkbox"/>
O/HPN	<input type="checkbox"/>
O/MRI	<input type="checkbox"/>
TRG	<input type="checkbox"/>
EMB	<input type="checkbox"/>
C&R	<input checked="" type="checkbox"/>

June 11, 1981

No. AC 0205/1316

Mr. Donald D. Cohen, Director  
U.S. Agency for International Development  
2948 Soi Somprasong 3  
Bangkok

Dear Mr. Cohen:

For more than a year officers of the Departments of the Ministry of Agriculture and Cooperatives have worked closely with consultant teams and USAID to prepare a project concerned with improvement of rainfed farming in Northeast Thailand.

As a result of this collaborative effort, a development project titled "Northeast Rainfed Agricultural Development" has been prepared. As you know, this project is aimed at increasing the income of poor farmers by carrying out a program of intensification of farming systems in 8 tamboons. Components of the project include the refinement, demonstration and extension of improved farming practices; improved soil and water management; and integration of animal husbandry, fishery and forestry into farming systems. It is planned to meet the expressed needs of farmers for MOAC services.

Having recently completed the joint project technical review, we are requesting that USAID provide concessional assistance to support this project in the amount of US\$ 10 million. Of this amount US\$ 3.7 million in grant funds and US\$ 6.3 million in loan funds are estimated to be required. The total project cost is estimated to be US\$ 16 million in local currency and foreign exchange including an RTG contribution of US\$ 6 million.

As you are aware, before entering into any grant or loan agreements, the project and its financing must receive final approval by the Cabinet upon recommendation of the National Economic and Social Development Board and the Department of Technical and Economic Cooperation. Also, several issues raised in the technical review must be resolved and I understand my colleagues are currently meeting with yours with this in mind.

We trust that both USAID's and the RTG's project approval processes will be completed in time to sign the agreements before the end of this fiscal year.

ACTION TO:	
DUE DATE:	6-18-81
ACTION TAKEN:	
INITIAL:	
DATE:	6/12

Sincerely yours,

Chalerng Thamrong - Nawasawat  
Under - Secretary of State  
for Agriculture and Cooperatives