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*****************************************************************
*4930312                THAILAND                                 *
*                       NORTHEAST SMALL SCALE IRRIGATION         *
*                       FY80 TO FY86                             *
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PROJECT SUMMARY DESCRIPTION

Grant and loan are provided to the Royal Thai Government (RTG) to develop a replicable system for increasing distribution of water needed for crop production in the Northeast from existing tanks (reservoirs). RTG sector agencies will implement the project with U.S. long-term technical assistance.

The delivery systems of seven of the region's 200 tanks will be rehabilitated. This will include the design and construction of effective on-farm distribution systems (farm ditches and structures), as well as the topographical surveys, soils classification, and land preparation needed for system design and utilization. Main and lateral canals will be improved or extended upon consultant recommendation; and lining, culverts, drainage, inlets, turnouts, and checks will be provided to ensure better water control. In some cases, tank embankments will be rehabilitated to ensure their safety. A laterite-surfaced roadway will be constructed along main and lateral canals to provide operation and maintenance access roads. On-the-job training will be provided to personnel from the Department of Agri ltural Extension (DOAE) and the Royal Irrigation Department (RID) working onsite.

Improved methods for managing and maintaining water delivery systems will be tested, and 14 DOAE extension agents will be trained to assist farmers and farmer user associations in this regard. Farmer field trips to successful irrigation projects, approximately two per site, will also be financed.

To increase coverage of farm families by DOAE extension agents, task forces of specialists will be available at project sites.

Demonstration plots for appropriate crops and farming practices will be established, and promising varieties and techniques will be distributed to farmers by DOAE extension agents. A crop insurance system will be established to encourage farmers to use the new techniques. The Bank of Agriculture and Agricultural Cooperatives will use mobile teams to provide credit to farmers, especially for cash crops during the dry season. Finally, DOAE will contract with selected interested farmers to grow registered vegetables and other seeds.

DESCRIPTORS

AGR TECHNOLOGY	WATER DELIV SYS	AGR PRODUCTION	AGR DELIV SYS
AGR PROD CREDIT	IRRIG FARM	IRRIG SYS MAINT	FARM MKT ROAD
IRRIG CANALS	AGR COOP	WATER SUPPLY	WATER SUP DESGN
ROAD MAINT	WATER SUP FINAN	DEMO FARM	GEOLOGY SURVEY
AGR EXTEN TRNG			

SUB-PROJECT NUMBER: 00 BATCH NUMBER: 98

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UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D.C. 20523

THAILAND

NORTHEAST SMALL SCALE IRRIGATION

493-0312

August 1980

UNCLASSIFIED

SMALL SCALE IRRIGATION
PROJECT PAPER

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Abbreviations and Acronyms

ADB	Asian Development Bank
AIT	Asian Institute of Technology
ARD	Office of Accelerated Rural Development (MOI)
BAAC	Bank for Agriculture and Agricultural Cooperatives
BOB	Bureau of the Budget
BOI	Board of Investment
CDD	Community Development Department (MOI)
CDSS	Country Development Strategy Statement (AID)
CLCO	Central Land Consolidation Office (MOAC)
CP	Condition Precedent (AID)
CSC	Civil Service Commission
DLD	Department of Land Development (MOAC)
DOA	Department of Agriculture (MOAC)
DOAE	Department of Agricultural Extension (MOAC)
DOCP	Department of Cooperative Promotion (MOAC)
DOF	Department of Fisheries (MOAC)
DOLA	Department of Local Administration (MOI)
DTEC	Department of Technical and Economic Cooperation (Prime Minister Office)
FA	Farmer Association
HH	Household
IBRD	International Bank for Reconstruction and Development
LMVR	Long Maturity Variety Rice
MD	Man (person) days
MOAC	Ministry of Agriculture and Cooperatives
MOF	Ministry of Finance
MOI	Ministry of Interior
NEROA	Northeast Regional Office of Agriculture/Ag Dev Center (Tha Phra)
NESDB	National Economic and Social Development Board
NIDA	National Institute of Development Administration
OAE	Office of Agricultural Economics (MOAC)
PWD	Public Welfare Department (MOI)
RDVR	Recommended Variety Rice
RID	Royal Irrigation Department (MOAC)
SE	RID Site Engineer
SMS	Subject Matter Specialists
USAID	United States Agency for International Development
WUA	Water Users Association

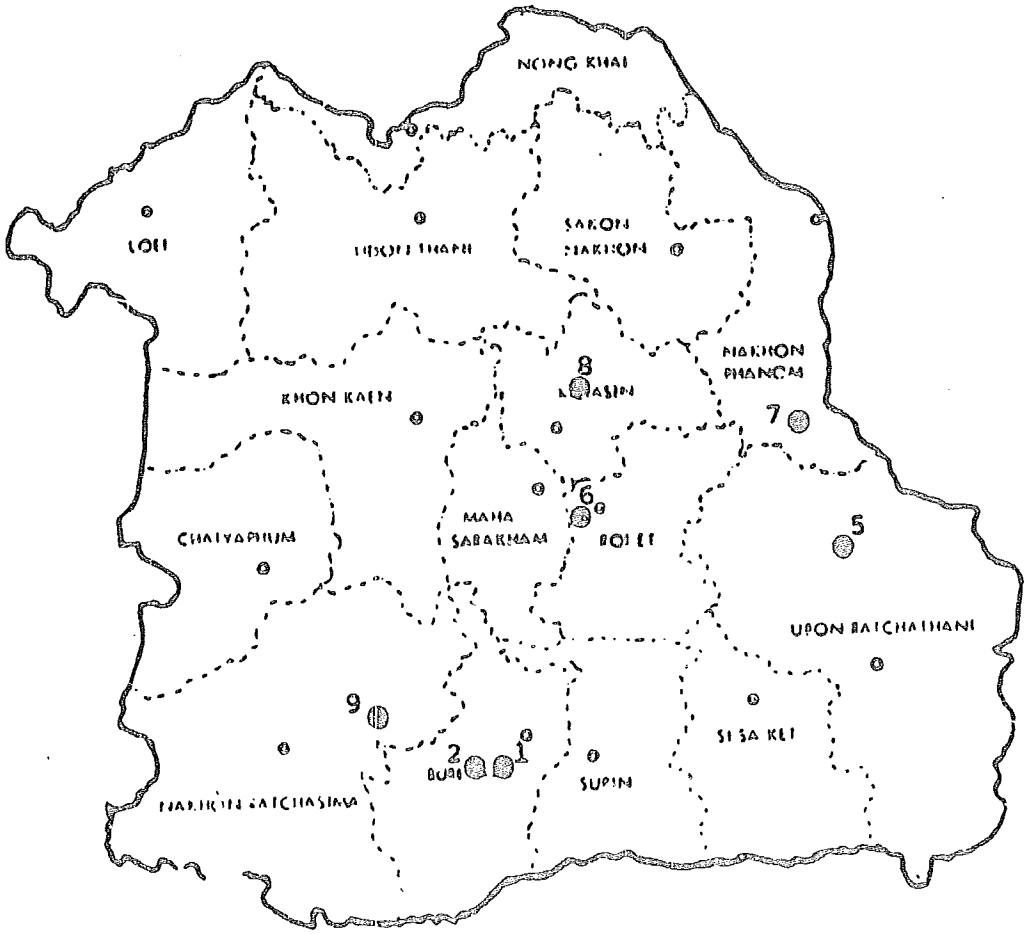
Other farm income = Income from livestock/fish/poultry, rental of equipment and land.

Other farm cost = Equipment depreciation, interest on working capital, explicit and imputed.

Thai Language Terms

Changwat	=	Province
Amphoe	=	District
Tambol	=	Sub-district (Community)
Mu Ban	=	Villages
Nai Amphoe	=	Chief District Officer
Kamnan	=	Elected Chief of Sub-district
Puyaiban	=	Elected Chief of Village
Kaset Amphoe	=	District Agri. Ext. Officer
Kaset Tambol	=	Tambol Agri. Ext. Agent
Pattanakorn	=	Community Development Workers
Rai	=	0.16 hectares (or 1 hectare = 6.25 rai)

NORTHEASTERN THAILAND



* Project Tank Locations

	TANK	PROVINCE
1.	Huai Talat	Buri Ram
2.	Huai Chorakhe Mak	Buri Ram
5.	Phuttha Utthayan	Ubon
6.	Huai Aeng	Roi Et
7.	Huai Khilek	Nakhon Phanom
8.	Huai Kaeng	Kalasin
9.	Lam Chamuak	Nakhon Ratchasima

* Tanks #3, 4, and 10 (Lam Phok, Huai Keaw and Sub Pradoo) were eliminated for technical and economic return considerations.

SMALL SCALE IRRIGATION PROJECT - KEY STATISTICS

Tank & Location (Province, District)	Number of Farm Households Served	Average Household Land Holding (Hectares)	Average 1/ Net Household Farm Income (Dol.Equiv.)	Average Cropping Intensity		Present Irrigated Area (Hectares) 2/		Expected Irrigated Area End of Project (Hectares)	
				Present	After Project	Wet Season	Dry Season	Wet Season	Dry Season
Huai Talat (Buri Ram, Amphoe Muang)	624	6.9	$1,463	1.09	1.39	480	35	2,240	880
Huai Chorakhe Mak (Buri Ram, Amphoe Muang)	486	4.2	$ 959	1.17	1.15	1,120	440 3/	1,120	160
Phuttha Utthayan (Ubon Ratchathani, Amphoe Amnat Charoen)	560	4.4	$ 778	1.03	1.01	770	55	2,240	∅
Huai Aeng (Roi Et, Amphoe Muang)	1,138	5.0	$ 885	1.15	1.35	1,840	450	3,040	1,250
Huai Khi Lek (Nakhon Phanom, Amphoe Kham Soi)	528	4.3	$ 402	0.92	1.84	420	90	1,440	1,440
Huai Kaeng (Kalasin, Amphoe Muang)	720	4.5	$ 537	0.92	1.57	960	105	2,400	1,600
Huai Lam Chamuak (Nakhon Ratchasima, Amphoe Huai Talaeng)	540	9.1	$1,481	0.94	1.01	1,410	325	1,730	∅
Totals:	4,596	5.7 Hectares (Average)	$ 929 (Average)	-	-	7,000	1,500	14,210	5,330

1/ Assigns value to all farm production, including livestock, and products for home consumption.
2/ Indicates amount of land effectively irrigated.
3/ Not sustainable.

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: THAILAND

3. PROJECT NUMBER: 493-0312

4. BUREAU/OFFICE: ASIA — 04

5. PROJECT TITLE (maximum 40 characters): Northeast Small Scale Irrigation

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 10 DD 15 YY 86

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 80 B. Quarter 4 C. Final FY 82

8. COSTS ($000 OR EQUIVALENT $1 = 20.00)

A. FUNDING SOURCE	FIRST FY 80/81 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(310)	(40)	(350)	(1,900)	(900)	(2,800
(Loan)	(60)	(210)	(270)	(100)	(5,700)	(5,800
Other U.S. 1.						
Other U.S. 2.						
Host Country		125	125		8,350	8,350
Other Donor(s)						
TOTALS	370	375	745	2,000	14,950	16,950

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	212	022	064	-	-	1,000	5,800	2,800	5,800
(2)									
(3)									
(4)									
TOTALS				-	-	1,000	5,800	2,800	5,800

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 023 | 032 | 012 | 071

11. SECONDARY PURPOSE COI

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BS	TNG	PART			
B. Amount						

13. PROJECT PURPOSE (maximum 480 characters)

The objective is to establish a replicable approach and the necessary institutional capabilities for increasing agricultural incomes for poor farmers in small/medium-sized irrigable areas of Northeast Thailand.

14. SCHEDULED EVALUATIONS
Interim MM 09 YY 82 | MM YY | Final MM 04 YY 87

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[X] 000 [X] 941 [X] Local [ ] Other (Specify)

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

17. APPROVED BY
Signature: K Blasko
Title: Acting Director USAID/Thailand
Date Signed: MM 07 DD 23 YY 80

18. DATE DOCUMENT RECEIVEI IN AID/W, OR FOR AID/W DOCI MENTS, DATE OF DISTRIBUTIC
MM DD YY

AID 1330-4 (8-79)

PROJECT AUTHORIZATION

THAILAND

Northeast Small Scale Irrigation
Project No. 493-0312

Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended (the "FAA"), I hereby authorize the Northeast Small Scale Irrigation Project (the "Project") for Thailand (the "Cooperating Country"), involving planned obligations not to exceed Eight Million Six Hundred Thousand United States Dollars ($8,600,000), of which amount not to exceed Five Million Eight Hundred Thousand United States Dollars ($5,800,000) will be provided in loan funds (the "Loan") over a six year period from the date of authorization and Two Million Eight Hundred Thousand United States Dollars ($2,800,000) 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 a replicable approach and institutional capabilities for increasing agricultural incomes for small farmers within command areas of existing tank irrigation systems in Northeast Thailand.

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 Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. 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 U.S. 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

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in the Cooperating Country or (in the case of Grant funds) the United States or (in the case of Loan funds) countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

Ocean shipping financed under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of (in the case of Grant funds) the United States or (in the case of Loan funds) the United States or the Cooperating Country.

c. Initial Conditions Precedent to Disbursement

Except as A.I.D. may otherwise agree in writing, prior to any disbursement or the issuance of any documentation pursuant to which funds will be disbursed under the Project Agreement, the Cooperating Country will furnish in form and substance satisfactory to A.I.D., evidence of:

(1) Establishment of the Project Coordination Committee, Provincial Operation Committees, as well as designation of the first site team.

(2) Appointment of Project Co-managers.

Waivers

The following waivers of A.I.D. procurement procedures are hereby approved:

(1) A proprietary procurement waiver to permit the purchase of seven (7) right-hand-drive utility vehicles of American Motors Corp. manufacture on the basis that they are the only American vehicles suitable for rural areas of Thailand because of parts availability, standardization, and maintenance requirements. The total expected cost of procurement for these vehicles is Eighty Four Thousand United States Dollars ($84,000).

(2) A waiver of the provisions of Section 636(i), FAA, to permit the purchase of Thirty Eight (38) locally assembled small motorcycles on the basis that U.S.-manufactured motorcycles are unsuitable because of their large size and problems in obtaining servicing and spare parts in rural Thailand, and that no alternative financing could be arranged under this Project. The total cost of procurement of these motorcycles is estimated at Twenty-Seven Thousand United States Dollars ($27,000).

Clearances	Date	Initial
DAA/ASIA, Frederick Schieck	8/21/80	FCS
A/GC, Charles Costello	8/24/80	CEC
AA/PPC, Alexander Shakow	8/25/80	AS

Joseph C. Wheeler
Acting Administrator

August 26, 1980
Date

ASIA/PD:BBlackman jk:8/20/80:58582

PART I SUMMARY AND RECOMMENDATIONS

A. Project Data Sheet - See Previous Page

B. Recommendations

It is recommended that funds be approved for the Northeast Small Scale Irrigation Project as follows:

FAA Sect. 103 Grant	$2,800,000	(five years)
FAA Sect. 103 Loan	$5,800,000	(six years)
Total	$8,600,000	

The terms of the Loan will be 40 years, 10 year grace period with interest 2% during the grace period and 3% thereafter.

The following waivers are requested:

1. Proprietary Procurement of 7 American Motors Jeep Vehicles. Approximate cost - $84,000 ($36,000 grant, $48,000 loan).

2. Waiver of 636I requirements for a) 36 locally manufactured light-weight motorcycles (125 cc or less) and b) 2 locally-assembled RHD pick-up trucks, for purchase under the loan. Approximate cost - $37,200.

Justification for the above waivers is given in Part IV of this PP.

C. Summary Description

The objective of this $17 million, 6 year project is to establish a replicable approach and the necessary institutional capabilities for increasing agricultural incomes for the rural poor in Northeast Thailand. The target group is the rural farm population within the potential command areas of existing small reservoirs (tanks) in Thailand's most deprived region. Approximately 4600 households within the irrigation areas of seven tanks will be served by this Project, but the potential replication area encompasses more than 200 similar sites.

The Project will include the improvement of deteriorated embankments; the rehabilitation, extension and improvement of main canal systems; improved access roads; the design

and construction of effective on-farm distribution systems; a land development component; the provision of assistance to farmers in water management and agricultural practices; assistance for water user groups; marketing linkages; improved operation and maintenance programs; a crop insurance component; operational research and demonstrations; and the development of training programs for farmers and RTG personnel.

There will be a heavy emphasis on farmer participation in all facets of the Project which will be supported by a sizeable input of technical assistance.

By the end of the Project, it is expected that the irrigated area at the seven Project sites will have expanded by at least 100% and net farm income will have increased by a minimum of 40% on average. It is also expected that a viable organizational and training system will have been institutionalized to extend the Project approach throughout the Northeast.

D. Issues

The status of Issues raised in the PID approval cable (State 325280 - See Annex A) is discussed below:

1. What is the rationale for AID financing the costs of construction of on-farm distribution systems?

Attempts in the past to require farmers to self-construct on-farm distribution systems in the Northeast have almost invariably been failures. Northeastern farmers tend to assume that all basic irrigation infrastructure is the responsibility of the Government. Moreover, they have been reluctant to invest in systems that have not demonstrated their worth, and the farmers' impoverished state makes such investments difficult. Unfortunately, the usual RTG policy is to leave the construction of farm systems to the farmers and this is certainly a major reason why very few distribution systems extend beyond farm turnouts. However, although this Project does propose to finance the on-farm distribution system from the AID loan, farmers will be expected to help plan and design the systems (with RID engineers and consultants) and will also maintain the on-farm systems. Presently, RTG law does not permit charging farmers for O&M costs of the off-farm, or main, system. Similarly, direct capital investment cost recovery is not authorized. It is the government's judgment that developing a political consensus to permit O&M and capital cost recovery will be difficult. However, a strong economic argument exists for AID/RTG financing of on-farm development; much of the farmers' decisions to avoid risk and not invest in HYV-based irrigated agricultural production stems

to the farm turnouts, AID assistance for the on-farm distribution system appears both reasonable and proper in view of the innovative nature of such financing.

2. USAID should minimize the AID contribution to construction while increasing the level of AID financing for research and farmer involvement

About 30 per cent of the assistance package is now allocated to technical assistance, with another 6 per cent for generally experimental or research oriented components. What is not so obvious from the financial plan, however, is the organizational revisions proposed under the Project. These are directed at providing a more responsive RTG linkage to farmer's needs as well as an improved farmer organization for managing water distribution. These changes would not be likely to occur without AID input into the actual construction component as evidence of AID's commitment to the whole Project.

3. USAID should be aware of Asia Bureau Future Country Evaluation Efforts.

USAID considered during Project design the issues paper prepared by Gilbert Levine on "Irrigation Development and Strategy Issues for the Asian Region." The arguments at the end of Part II A (Background) are aligned with the issues discussed by Levine.

4. A clear link between proposed project benefits and intended beneficiaries is needed

The target group is described in the Economic and Social Analyses. These analyses show that the population expected to benefit under the Project qualify as the rural poor AID target group.

5. Have results of Ford Foundation study been considered in designing the Project?

The results of a Ford Foundation/IRRI study recently completed on irrigation projects in Northeast Thailand were especially helpful in designing the Project. Several recommendations from Ford Foundation staff in Thailand were also incorporated into the Project, and a paper prepared by IF's Project Specialist, Sam Johnson, on Organization and training needs has been incorporated into Annex D.

6. Does salt content in soil necessitate drainage?

RTG soil surveys indicate that there is presently no salt problem at any of the Project sites. On the contrary soils tend to be acidic. Adequate drainage structures have been built into the Project design to mitigate any possible future problems with water logging or salt build-up.

7. How does USAID plan to overcome an apparent reluctance on the part of Thai farmers to pay for water?

The need to provide for adequate maintenance and operation of the irrigation system will be explained in special workshops for farmers. Observation tours to systems in the North where water-charges are routinely levied will also be run. It is expected that once the system has demonstrated it can provide reliable water to farmers when they need it (as opposed to the current situation), most reluctance to pay for O&M will disappear.

8. Focus on exclusive cultivation of rice may be too narrow, and cash crops should be encouraged

The Project encourages cash crop production wherever feasible and is directed at resolving major constraints to cash crop as well as increased rice production (See Economic and Technical Analyses for discussion of cash cropping emphasis). However, it should be noted that supplementary irrigation in the wet season is most suitable for enhancing rice production and this is the Project's first priority. Also, even with no cash cropping in the dry season economic returns have been found favorable for rice alone.

9. Issue of Need for Environmental Assessment

State 105293 indicated a request for a Negative Determination was forwarded to the AA/Asia for signature. However, environmental effects are briefly discussed in the Social Analysis.

10. IRR's should be at least 10% for any given tank under the Project

Two potential Project tanks were rejected because of low IRR's. Remaining tanks all meet the 10% criterion with a total IRR for the Project calculated at 31.41%.

E. Summary Findings

The results of the analysis prepared for this Project indicate the Project is administratively, technically, socially and economically sound as designed and that cost estimates are reasonable and firm. The Project meets all applicable statutory criteria and the Mission Director has certified that the host country has the capability to maintain and effectively utilize the sub-projects (Annex F, 611(e) certification).

PART II DETAILED PROJECT DESCRIPTION

A. Background

The 1978 Report on Water for the Northeast prepared by the Asian Institute of Technology for the Royal Thai Government's Water Resources Subcommittee points out that the farmers of the Northeast are plagued by unreliable seasonal rainfall and this is one of the main reasons that the northeast has the lowest crop yields per area of any region in Thailand. Most rainfall is lost to the farmers as it quickly percolates through the sandy soils. In the dry season water is scarce. Despite these problems the report concludes that much of the demand for basic household water requirements could be met through existing water resources and that the first priority for water resource development in the Northeast should be the better distribution of available water resources through improvements to existing systems.

The 1978 Report is verified by the farmers themselves. Several surveys, including a 1968 USAID/BUREC study in Roi Et Province, have shown that rural people of the Northeast desire irrigation projects (including irrigation improvement projects) above all other rural development projects.

There is considerable potential for increasing crop yields in the Northeast that is not being realized due at least in part to poor utilization of available water resources. Estimates vary depending on source, but it appears that less than 20% of the Northeast's irrigable area from existing water resources of about 650,000 hectares is actually being irrigated in the wet season, and less than 5% in the dry season.

One of the important resources for irrigation in the Northeast is the more than 200 small to medium sized reservoirs (tanks) in the region. RID estimates that these

tanks, ranging size from about 5 million cubic meters to over 20 million cubic meters, command an irrigable area of over 175,000 hectares. However, since most of these tanks have incomplete or deteriorated systems that are being inefficiently utilized, only a fraction of their potential is being realized.

There are numerous problems in improving the crop production and incomes of farmers within the command areas of these tanks. Many existing tanks and their delivery systems require some design modifications and/or considerable rehabilitation as well as extension of their canal systems in order to maximize their water delivery and utilization potential. Construction and/or improvement of the on-farm structures (ditches and dikes) is especially needed in many cases, and construction of related infrastructure such as O&M roads and farm to market roads can also be important.

Besides the capital improvements needed to existing tank systems, however, there are many other constraints that must be overcome before the water available from improved tank systems can be properly utilized to improve agricultural yields. Maintenance of existing systems has been poor and irrigation water even when available is generally not well managed within the distribution system and when it reaches farmer's fields. Cropping patterns and cultural practices do not maximize returns and cropping intensities are low. Farmer access to agricultural inputs such as quality extension services, lowcost credit, unadulterated fertilizer, pesticides, seeds, etc. has been generally inadequate. Marketing problems are also important constraints and farmers need assurance of dependable market access and attractive prices before they will invest their money and labor to improve yields. In addition to the above problems, there is danger that benefits from improving yields may accrue mostly to the more wealthy farmers in the command areas unless care is taken to particularly involve smaller farmers.

Although the problems associated with trying to improve production and incomes of people in the command areas of existing tanks are formidable, there are several cogent reasons for attaching priority to these areas for agricultural development (Note - several of these points were discussed in Gilbert Levine's Irrigation Issues paper): (1) They have an existing basic infrastructure that may be improved and extended to serve more people at less cost than development of new tanks (cost/effectiveness argument); (2) Most of the best locations for tank irrigation systems have already been developed, and few easily-developed sites for new irrigation

tanks can be found in the Northeast (availability argument); (3) The difficult questions related to environmental impact, right of way and relocations of people within impoundment areas have been resolved for existing tanks (environmental argument); (4) Existing tanks serve a potential population of more than a quarter of a million poor people, and improvement of such tanks plus provision of related services might very well be one of the fastest ways to provide sustainable economic benefits to large numbers of rural people in the Northeast (population argument); (5) When considering the large vs. small issue it should be noted that distribution of existing tank sites provides for equitable locational distribution of irrigation benefits in the Northeast as opposed to only about 20% of the Northeast being irrigable from large reservoirs and pumping from reliable rivers (dispersal argument); (6) A related argument is that local people, local institutions such as banks, and small contractors can more easily become involved in construction and management of the relatively inexpensive, small and uncomplicated tank systems as opposed to more capital intensive and sophisticated large reservoir systems (simplicity argument); (7) Finally, when considering the rainfed vs. irrigation issue, although a complete development strategy must concentrate on the extensive rainfed area in N.E. Thailand as well as potentially irrigated areas, there are more unknowns associated with development of rainfed areas and their development is likely to be slow to realize major income gains. It's a fact that most agricultural research in Thailand has been directed at irrigated agriculture problems and the higher-yield technology already exists for rapid improvement in these areas. (rapid impact argument).

B. Detailed Description

1. Project Approach

The Project aims to establish a sustainable system for increasing the agricultural productivity and income of more than 30,000 rural poor within the potential command areas of seven existing small-medium sized tanks in the Northeast of Thailand. The strategy of the Project is to address the major identified constraints to improved productivity in the Northeast Region through a package of consultant assistance, demonstrations, training and construction that would provide: (1) basic infrastructure for reliable delivery of water to farmer's fields; (2) improved arrangements for key RTG agricultural service organizations to deliver

their services to farmers; (3) adequate procedures to help link up farmers to necessary agricultural inputs and markets; (4) a strengthened farmer organization structure for managing and maintaining on farm water delivery; (5) a system of training/motivating farmers to properly utilize inputs to increase yields and market their crops.

The Project will test and refine the approach for Accomplishing the above objectives on the command areas of seven tanks during a six year period (see map at front). It is intended that the seven tanks will establish the replication potential of the approach and will provide a pool of trained manpower to continue at other sites the momentum begun under the Project.

The Project will be carried out primarily by two departments of the Ministry of Agriculture and Cooperatives (MOAC): the Department of Agricultural Extension (DOAE) and the Royal Irrigation Department (RID), although other agencies will also be involved for specific tasks (see Part IV for details). The Bank for Agriculture and Agricultural Cooperatives (BAAC) and local banks will provide credit, Department of Land Development (DLD) will conduct soil surveys, and Provincial Governors, District Officers and village leadership will help direct and coordinate the Project.

AID's major role in the Project will be to provide necessary technical assistance and provide financing for relatively high risk and/or innovative and experimental aspects of the Project (on-farm water management structures and land preparation, market support components, crop insurance, demonstrations, observation travel, research and training/ workshops). These components are especially important to help assure that the infrastructure improvements financed by the RTG under the Project have the desired impact at the farm level and maximize benefits for the rural poor in the target areas, as well as provide a model for future tank improvement projects.

2. Relation to RTG/AID Policy and Other Projects in the Northeast

The Royal Thai Government (RTG) has an active program underway to respond to farmers' needs in many of the irrigable areas of the Northeast. The Royal Irrigation Department (RID) is already engaged in a priority program with several donors to improve irrigation systems downstream of large reservoirs (i.e. reservoirs above about 50 million

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cubic meters each). The World Bank has estimated that completion of these works before the year 2000 will bring year round irrigation to 160,000 hectares, more than 75 per cent of the potential from existing large reservoirs. In addition, AID's Lam Nam Oon Project is targetted on improving the irrigation system for about 20,000 Ha. and the German assistance program (KFW) and ADB also have projects for completing irrigation systems underway or in planning for a similar number of hectares in the Northeast at Nam Pong.

Several projects to exploit the potential for pump irrigation in the Northeast are also being undertaken. The RTG National Energy Administration (NEA) has a particularly successful program for pumping water from rivers in the Northeast and since 1968 has expanded their coverage to about 40,000 Ha., almost 15% of the total existing potential. Plans call for more than doubling this total during the next three years. RID also has a mobile pumping program underway for supplementary irrigation.

Despite progress in the above areas, there is presently no major effort underway to better exploit the irrigation potential of medium to small reservoirs (tanks) in the Northeast. (Note: AID is presently sponsoring a village fish ponds demonstration project for 14 tanks in the Northeast, but these are too small for significant irrigation.) The proposed Project thus represents an important initiative to better exploit a heretofore generally neglected resource: more than 200 tanks of the 5 - 40 million cubic meter class that have significant potential for bettering the lives of perhaps 5% of Northeast Thailand's rural poor. Such an effort does not conflict with other donors' efforts, and indeed is quite complementary to their projects on large reservoirs. Coordination between AID, IBRD, ADB, Japanese Aid, KFW and other donors active on irrigation projects in the Northeast will be maintained so that lessons learned on irrigation related issues may benefit all projects.

The Project is also a constituent of AID's Country Development Strategy for assisting the poor of Northeast Thailand in the future. It complements the other program interventions targetted on rainfed areas and directly addresses several causes of poverty discussed in the 1980 CDSS. The Project strategy conforms closely with AID's general strategy in Thailand as expressed in the CDSS:

> "AID will give preferential support to activities which are intended to (1) demonstrate cost effective approaches

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to service delivery and (2) strengthen RTG and local capabilities to plan, manage, and evaluate development programs. AID will be prepared to engage in experimental activities, even in situations where technical and economic results are uncertain, in the interests of determining what works in local situations and what does not. At the same time AID will seek to achieve a direct and immediate impact on as large a target population as possible who otherwise would not be reached by the larger resources projected by the IFI's and the Japanese Government."

The CDSS also provides for a program intervention specifically targetted on effective utilization of the irrigation potential of Northeast Thailand.

The RTG Fourth National Economic and Social Development Plan (1977-81) recognizes the importance of expanding on- farm irrigation. The Plan provided a target of 2.7 million rai (432,000 ha.) of additional irrigation coverage, and notes that, "It is believed that the development of irrigation at the farm level will not only contribute to better utilization of land within the area covered, but will also generate a substantial amount of employment."

3. Logical Framework Narrative (See Annex B for Log Frame)

a. Goal

The long range goal to which this and other AID development projects contribute is to improve the quality of life of the rural poor. This Project approach, targetted in Northeast Thailand where the bulk of the rural poor are located, should have a substantial beneficial effect assuming the approach is replicated. As the Social Analysis (Part III and Annex D) points out, about 55 per cent of the Project's target beneficiaries appear to be below the "absolute poverty" line as defined by the World Bank, and this percentage conforms closely to the commonly accepted percentage (60%) for the rural Northeast as a whole.

Measures of Goal achievement include higher per capita earnings and decreasing disparity between the rich and the poor as shown by their equitable share in increased

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cropping areas, land productivity, cash earnings from agriculture, and local level decision making groups. To achieve these objectives it is assumed that the RTG will continue to focus major efforts on rural development and equity improvement.

b. Project Purpose

The purpose of the Project is to establish a replicable approach and institutional capabilities for increasing agricultural incomes for small farmers within command areas of existing tank irrigation systems in Northeast Thailand. The developmental hypothesis implicit in this purpose is that through interventions (input-outputs) which address the major identifiable constraints to increasing agricultural production in irrigable areas of the Northeast, and by addressing marketing constraints, the Project will help farmers in the target areas to increase incomes (purpose) and train RTG technicians to replicate the approach elsewhere, thus contributing to better living standards throughout the Northeast (Goal).

End of Project Status (EOPS) will be indicated by improvements in cropping patterns and increases in area cropped, higher farm incomes, established training programs and plans to replicate the Project. Specifically, in the command areas of the seven tanks the following conditions should exist at a minimum:

(1) Cropped area in wet season increases by a minimum of 100% to 14,000 hectares with cropping intensity of at least 125%.

(2) Average net farm income increases by minimum of 40% to more than $1300 equivalent per household, with equitable distribution of benefits.

(3) Training program for participating agency personnel and farmers based on project approach are instituted.

(4) RTG plans to replicate approach in other sites.

Several important assumptions are necessary to realize the EOPS:

(1) Price structures are favorable for inputs/crops. The economic analysis supports this assumption and indicates that the trend is favorable.

(2) Farmers accept new techniques and risks associated with intensive irrigated agriculture. This assumption has been proven to be valid in the Chao Phya River basin as well as Northern Thailand where rice yields are more than 50% above the average for the Northeast. Although modern practices are not as established in the Northeast, there is certainly adequate precedent to expect to see new varieties and practices adopted there once water and supporting services are reliably available.

(3) Adequate labor is available for dry season cropping. The economic analysis for this Project indicates that there is an opportunity cost of about one dollar per day for unskilled labor. However, the return to the farmer for growing cash crops is much higher than this generally and should provide adequate incentive for farmers to grow these crops rather than work elsewhere once they are assured adequate inputs and markets for their crops.

(4) Rainfall is adequate. Since tanks can only provide supplemental irrigation in the rainy season and limited dry season cropping in some cases, reasonable rainfall is required to meet farmers needs and fill the tanks. This assumption is discussed in the technical analysis and appears valid.

(5) RTG maintains commitment to rural areas and tank irrigation in the Northeast. As indicated in the Background Section above, the RTG appears strongly committed to developing irrigation in the Northeast. This Project should reinforce that commitment especially for tank irrigation.

c. Project Outputs and Inputs

For better understanding, the Project outputs have been grouped into several categories: (1) water delivery infrastructure, (2) access/O&M roads, (3) irrigation service centers, (4) water management system and organization, (5) agricultural support services. The sum total of these Project output components is designed to provide a replicable package for improving farmer incomes. Each component is described below:

(1) Water Delivery System Rehabilitated/ Improved for Each of the Seven Tanks
(2) and O&M Roads Constructed

Surveys have shown that incomplete, poorly designed/constructed, and/or deteriorated tanks and

water distribution systems often constrain water availability to farmers in the Northeast. The objective of this component is to provide the infrastructure for timely and reliable delivery of adequate water to farmers' fields. The component will include the design and construction of an effective on farm distribution system (farm ditches and structures) as well as the necessary topographical surveys, soils classification, and land preparation (levelling, diking, grading) needed to carry out adequate design and system utilization. It will provide for rehabilitation, improvement and extension of the main and lateral canals where recommended by consultants, and the provision of necessary lining, culverts, drainage inlets, turnouts and checks to provide better water control.

In some cases, rehabilitation and improvements will be made to tank embankments to ensure their safety and reliability. This work will include such items as adding more riprap and widening emergency spillways. A laterite surfaced roadway will be constructed along the main canals and lateral canals where necessary to provide O&M access and farm to market access. A quantification of each of these components is attached in Table II 1. Part III discusses their technical characteristics.

RID design teams and site co-managers will receive on-the-job training in on-farm design techniques from the consultants at the first site. Following that they will proceed to the other tanks and design those systems with guidance as needed from the consultants. Supervision and contracting of the construction will also be the responsibility of RID. The Department of Land Development (DLD) will conduct soil surveys at each site prior to final design work.

It should be noted that virtually all the work on embankments, main and lateral canals, and access roads will be financed and carried out by the RTG; AID will assist this effort with expert assistance and per diem support. AID financing will cover all the costs of consultants, sub-lateral canals, farm distribution systems, and land preparation.

(3) Water Management and Maintenance System Improved

This component will test alternatives for better farmer [illegible] and maintenance of the water distribution [illegible] and [illegible] for increased RTG water management assistance at the field level in order to help

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Table II-1

Physical Infrastructure

Item	Huai Aeng		Huai Khi Lek		Huai Kaeng		Phuttha Utthayan		Lam Chamuak		Huai Talat		Huai Chorakhe Mak		Total	
	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID
Dams																
Install toe drain and Filter (m)	0		0		0		1,385		0		1,200 2/		900 3/		3,485	
Riprap and filter (1,000 m^3)	0		0		0		0		0		23.0		13.0		36.0	
Regrade, compact and trim (1000m^3)	0		0		0		0		0		24.5		14.0		38.5	
Main and Lateral Canals																
Lining (km)	17.24		28.40		52.09		18.92		22.0		31.80		4.80		175.25	
Canal enlargement (km)	0		0		27.16		0		20.7		0		0		47.86	
Excavation (km)	12.85		2.80		32.04		2.45		20.7 1/		5.1		0		75.94	
Turnouts (ea)	83		56		149		30		44		86		31		479	
Checks (ea)	19		14		24		14		10		25		15		121	
Regulators (ea)	12		13		16		5		3		10		2		61	
Cross Drainage Structures (ea)	1		1		0		0		0		40		18		60	
Bridges (ea)	0		0		0		5		0		29		26		60	
Sub-lateral Canals (km)		72.50		62.04		83.16		65.25		31.85		66.10		47.40		428.30
Drainage Ditches (km)		13.10		7.76		31.92		3.50		0.50		10.80		2.40		69.98
Roads/laterite surfacing																
4-m width along mains (km)	14.00		23.90		36.16		18.90		20.70		35.9		25.05		174.61	
3-m width along laterals (km)	7.95		6.25		18.88		2.05		1.6		5.1		0		41.83	
Land Preparation (rai) 4/		6,330		8,330		5,000		4,670		3,600		4,670		2,330		34,930
Service Meters (ea)		1		1		1		1		1		1		1		7

1/ Compaction and trim.
2/ Also modify vertical gates and construct bridge.
3/ Also improve emergency spillway.
4/ Includes land leveling, rearrangement of bunds, on-farm canals and drainage, etc.

assure that available water is effectively managed and maintained. Observations have shown that poor water management is a major reason for unreliable water supplies, and lack of effective maintenance along all parts of the system are readily apparent. The World Bank has reported, for example, that since construction of distribution systems was not coordinated with main canals in most cases, the canals have fallen into disrepair because they cannot be adequately utilized. Moreover, visits to tank sites by USAID design team members revealed that water control and management is often impaired by lack of adequate coverage by RID personnel and by weak Water User Associations(WUA's).

Inputs for this component will include on-the-job training in O&M by consultants for RID and DOAE personnel at the sites, assurance of adequate O&M budgets and coverage by RID personnel, provision of one additional DOAE subject matter specialist (SMS) in water management and one additional RID engineer (SE) at each site to be trained under the Project and help manage it, a total of 14 additional extension agents to help coordinate with farmers and provide an extension agent-to-farmer ratio of 1:400 minimum, seminars and workshops for WUA's to help motivate them and improve operations and maintenance (approximately 2 per site), and organizational assistance for farmer sub-groups in WUA's to help them improve their on-farm water management systems. This latter component will include assistance in obtaining agricultural inputs and marketing and described below). In order to assure early participation of beneficiaries, farmers will be involved fully with RID teams during the design of the on-farm ditches.

Besides the above, the Project will finance farmer's field days to other successful irrigation projects (about 2 trips per site) so that farmers can see how a successful system operates. Finally, the Project will construct an irrigation service center at each site. The centers will be used as office space for Project personnel, and will also be used as a meeting place and storage facility for Water User Associations.

Organizational interventions to improve the management of the irrigation system are more fully discussed in Part IV.

(4) Agricultural Support Services and Inputs Adequately Available

The objective of this component is to assure that other agricultural inputs besides water are

available for target farmers when they need them. A description of each element of this component and its importance is briefly presented below:

(a) Agricultural Extension

The Department of Agricultural Extension (DOAE) has one extension agent in each tambon covered by the Project. However, the coverage per farm family is only about 1:1,000 which is not considered adequate to overcome the multiple constraints to effective utilization of the irrigation facilities that will be available to them. Furthermore, practically none of the agents has had any special training in irrigated agriculture or water management. DOAE will accordingly provide for 14 additional extension agents, as mentioned above, to provide a minimum coverage of 1:400. Including the existing agents, a coverage approaching 1:300 will result.

It is recognized that the RTG cannot presently afford the provision of this intensive coverage indefinitely and it is planned that the additional extension agents will be phased out after the Project has met its objectives. (Existing agents should be able to continue the momentum developed under the Project). The Project will also have access to special extension "task forces" that can be formed by the Committee for Accelerated Water Resources Development (See Part IV). The task forces will consist of teams of specialists from various disciplines that can be provided to Project sites for short periods when required.

DOAE, in conjunction with RID, will have a major management function in the Project as discussed in Part IV. A key concept is the provision of one subject matter specialist at each site to be trained and gain experience under the Project so that they may later manage and train extension agents to replicate the Project.

(b) Agricultural Research/Demonstrations

Since current farming methods in the Northeast rely mostly on traditional cropping practices, it is important that farmers have an opportunity to see whether new technology and crops work in their areas. The Department of Agriculture will provide technical assistance to the DOAE extension agents to prepare demonstration plots for appropriate crops and practices and will also test promising varieties and

techniques at the sites. DOA should provide the DOAE agents with all appropriate information in research and field trails for distribution to the farmers.

(c) Agricultural Credit

To properly utilize the irrigation system especially for cash crops in the dry season, adequate agricultural credit must be available to farmers. The Bank of Agriculture and Agricultural Cooperatives (BAAC) will be expected to play an important role in meeting farmers' credit needs at the sites. BAAC has branch offices in each district served by the Project except one (for Huai Khi Lek), but BAAC mobile teams can service Huai Khi Lek since it is about 1½ hours from the nearest branch office. It is planned that BAAC will coordinate with Project personnel at each site on a regular basis. The Project will make every effort to facilitate necessary credit for farmers at Project sites, and this may include providing the services of a short term consultant to help resolve problems and helping to link up farmer groups to credit sources.

(d) Crop Insurance

In order to encourage farmers to risk the necessary time and labor to improve their traditional yields, the Project will provide a $200,000 grant component to share farmer's risks in using new techniques. It is planned that up to 50 per cent of the value of selected farmer's crops may be paid to the farmers from the Project if their crops fail due to unforeseen breakdowns in the Project system (e.g. if water is not available to farmers as promised). This facility will be selectively administered by extension agents in order to help motivate farmers to grow certain crops during the dry season. The successful use of this system in the Thai-German Project will be drawn on during tests at this Project's sites. The insurance program will be used as an extension device to promote adoption of improved technology with a high probability of success. Once this success has been demonstrated and adoption is widespread, the insurance program will no longer be necessary and will be terminated.

(e) Provide Market Assurance

The Project will provide marketing assistance to farmers at each site by helping to establish linkages between farmer groups and reasonable markets for

their crops. A $50,000 market support fund will be available in the Project to help facilitate marketing linkages. The fund could be used to provide transport for groups of farmers to nearby markets to assist them to locate buyers, and it might also be used to charter trucks for groups of farmers in order to encourage them to proceed with plans for cash cropping. The intent of the fund is to help break potential marketing bottlenecks and monopolistic structures that might be preventing farmers from proceeding with initial dry season cropping plans, and it is not intended as a long term support device. Part of a $100,000 research fund will also be available to study marketing constraints.

In addition to the above, it is planned that the DOAE's Seed Division will contract with interested farmers at the sites for growing registered vegetable and other seed, thus helping to assure a market for a limited number of farmers.

It is expected that several months of consultant assistance will be needed to help identify and resolve marketing constraints. A marketing specialist will be contracted under the Grant portion of the Project to satisfy this requirement.

(5) Consultant Assistance

In order to assure the necessary expertise and intensive management effort required to initiate the tank rehabilitation program described above, it is proposed that a considerable amount of expatriate and local consultant assistance be provided under the Project. The idea behind the consultant package is that consultants will help backstop and provide on the job training to personnel of the RTG implementing agencies, particularly RID and DOAE. It is not expected, for example, that the consultants will actually carry out the detailed design or supervision of the water system improvements. That will be RID's job. However, the consultants can review designs, suggest improvements, assure that all elements of the Project are considered during the planning and construction process, provide on-the-job training and help resolve problems and provide recommendations for Project design changes during implementation. A list of proposed consultant assistance needs, to be financed under the AID grant, is attached as Table II-2.

(6) Equipment/Facilities

The Project will finance certain equipment, vehicles and facilities to support consultants

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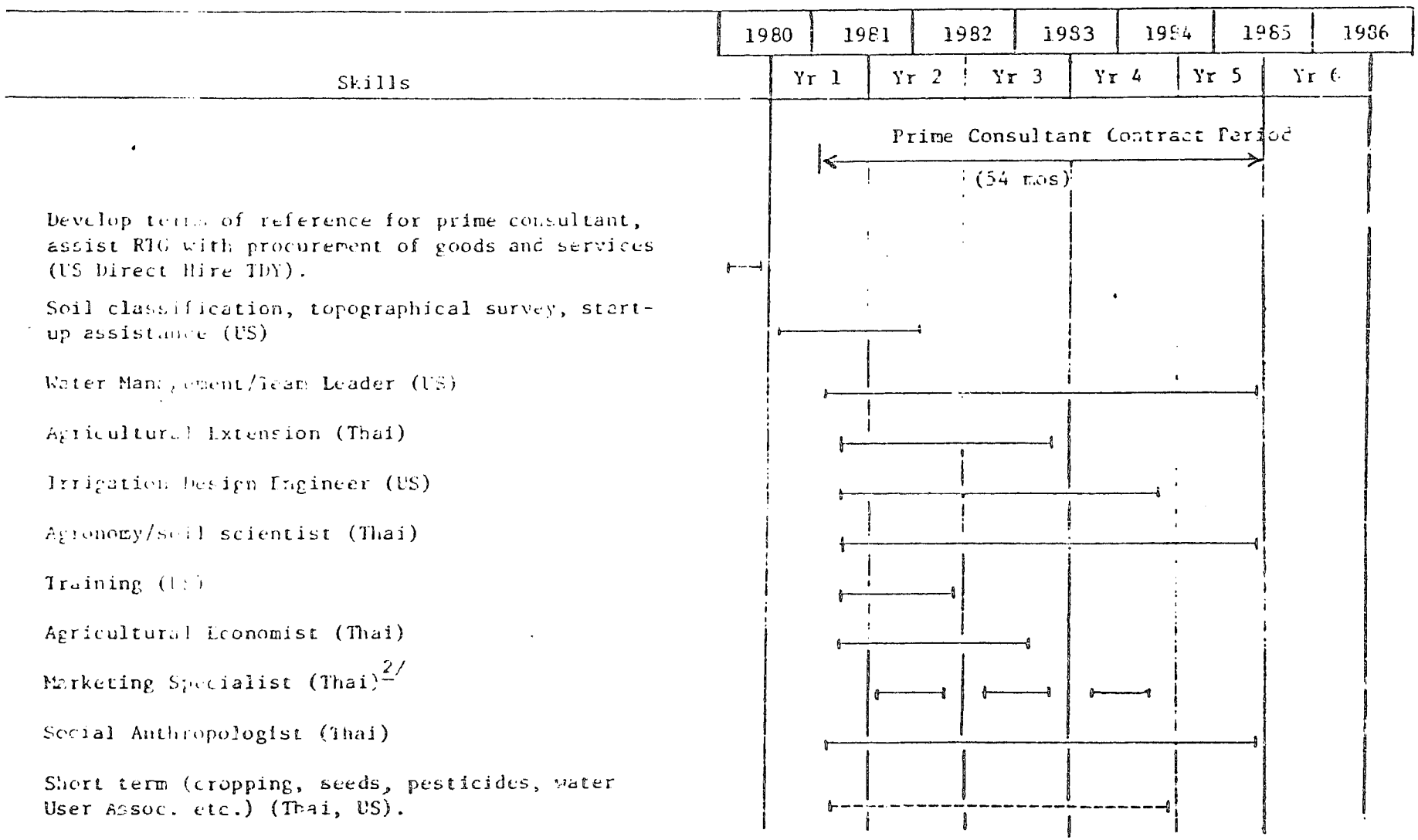
Table II-2 ILLUSTRATIVE REQUIRED TECHNICAL ASSISTANCE 1/



1/ Non-RTG personnel

2/ Not an advisor/consultant in the usual sense. Emphasis must be on actually forging market links.

and RTG agencies. The 16 subject matter specialists/site engineers and 14 extension agents will each be provided a motorcycle and an equipment kit to help ensure adequate mobility in and around the sites. The topographic survey team will be supported with two jeeps and surveying equipment, and the soil classification team will also be provided with two jeeps and soil test equipment. These items will provide needed mobility and will also serve as an incentive to the participating agency personnel to consider their work in the Project as a "top priority" against competing demands on their time. The RTG Project Co-Managers will each be provided an RHD pick-up truck. Other equipment proposed under the Project includes 8 motorcycles and equipment for construction supervision technicians. Irrigation service centers are proposed for each site and the Project will finance all design and construction costs plus equipment operation and maintenance costs during the Project's life. Consultants will be supported with DTEC counterpart funds, but Grant funds will provide 3 jeeps for the team.

PART III PROJECT ANALYSES SUMMARIES

The detailed social, technical, and economic analyses are contained in Annex D with additional backup material available from the feasibility report done by Asian Institute of Technology (AIT) for the Project. This report was submitted to AID/W in final draft form. The final report will be forwarded upon completion. Summaries of each analysis are contained below.

A. Social Analysis Summary

Beneficiaries of this Project are some 35,000 - 40,000 people living within the potential service area of seven medium-scale irrigation tanks in Northeast Thailand. Culturally they are predominantly Northeast Thai, but most can speak serviceable central Thai language as well. Family size is larger than average for the Northeast (7.3 vs. 6.1), with the bulk of the population (57%) below the age of 21, foreshadowing future population density problems on the agricultural land base. This indicates the need for projects like this one which will help speed agricultural intensification and thus allow the land to produce more to better support growing food and income needs.

Comparing the beneficiary population with their rural neighbors in rainfed agricultural areas, [illegible] that differences in income and crop sales are not significant although the project beneficiaries are already slightly better off than their (exclusively rainfed agricultural)

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neighbors. Nevertheless, despite an unexpectedly high degree of socio-economic stratification (in both groups) there are sufficient numbers of poor to justify assistance through this type of project: among the beneficiaries about 55% of the households are judged to be within World Bank defined "absolute poverty" (see CDSS), whereas about 64% of the nearby households outside the project areas fall into this category. Virtually all of the target population fall within AID's $250 per capita definition of poverty.

Annex D contains a more complete description of the beneficiaries and details social constraints. Generally, constraints to utilization of irrigation water (less than half of households with access to water appear to use it) relate to organization, inputs and marketing. The analysis concludes that management of water at the farm level would be improved by having smaller, less administratively complex groupings at the farm ditch level rather than rely solely on Water User Associations. Local level participation is critical to having the poor benefit. Moreover patron-client relationships that often discourage farmers from putting more effort into cash-cropping must be addressed, and attempts made to decrease farmers' dependence on marketing and credit monopsonies. The Project interventions relating to crop insurance, workshops, market support, observation travel, and research should all be useful in helping to resolve these constraints.

The positive effects of this Project can be expected to spread throughout the irrigated areas of the Northeast, perhaps eventually to some 15% of the population in that region. Nearby areas (rainfed) will also receive some secondary economic benefit. All project sites are on or near major roads, thus facilitating spread effect.

Effects on women, migration, fertility and population are in the main desirable. Women will benefit on a roughly equal basis with men, but special efforts should be made to promote their participation in irrigators' associations. Rural to urban migration will be reduced, but population in the irrigated areas may rise faster than elsewhere as a result of attracting exployment. Fertility may decrease with rising income, but the Project offers an ideal forum to teach family planning as a companion effort to agricultural intensification, since there are limits to intensification as a solution to population pressure, as should be apparent to this particularly young population in the coming years.

Overall, the project is deemed socio-culturally feasible, with reservations concerning the existing degree of

socio-economic stratification, its possible effects on the project and the project's effects on it. For this reason, as well as for the crucial role of local organization, a social anthropologist is recommended as a full time member of the project implementation technical assistance team, for the life of the Project.

B. Technical Analysis: Section 1 - Agriculture

1. Climate

The climate of Northeast Thailand has two seasons; a wet season from May-October followed by a dry season from November-April. The average annual rainfall is 1,415 mm of which 89 percent falls in the wet season. However, the distribution of rain is somewhat erratic which frequently results in prolonged droughty conditions. During the dry season pan evaporation greatly exceeds rainfall; consequently crop production is generally not practical without irrigation. Despite this lack of water the dry season offers one important production advantage; greater photosynthetic potential. Northeast temperatures are favorable for year-round production although occasional low temperatures in January and February may delay germination and emergence (see Annex D1, Table D1-1).

2. Land Resources

Northeast soils have limitations which constrain crop production and the Project sites are no exception. The soils tend to be sloped, highly erodible, sandy textured, poor structure, low water holding capacity, infertile, low organic matter content, and generally acidic. These soils generally have low available phosphorus and potassium. Infertility is a function both of the low cation exchange capacity and soil acidity. Table D1-2 in the Annex shows the general characteristics of tank command area soils. Corrective measures include both moderate liming and application of mineral fertilizer to provide recommended levels of N, P_2O_5, and K_2O. As noted under "Inputs" below, liming is not necessary for paddy although it would benefit most upland and cash crops. According to the AIT survey most farmers use at least some fertilizer on their fields although levels are generally far below optimum. General fertilizer recommendations are shown in Table D1-3. Mineral fertilizers should be supplemented with organic matter such as animal and/or green manures. The primary importance of organic

matter is that it improves both soil physical properties and chemical properties such as cation exchange capacity and nutrient availability. In short, additions of organic matter are recommended to help provide a more favorable soil nutritional and physical environment for crop growth and thus stimulate yield increases. It is expected that the large extension agent input for the Project can help ensure these recommendations are adopted.

The general shape of project sites may require some terracing and levelling in order that lateral and sub-lateral conveyance channels adequately serve the fields. Design care must be exercised to minimize cut depths and thus not adversely disrupt the soil fertility relationships.

3. Other Land Concerns

No feasibility concerns for the seven sites are evident from an examination of household farm size (average 5.7 ha), farm fragmentation (2.56 plots/household), land tenure (85% of average holding owned by tillers), or land use (94% of average holding cultivated).

4. Water Resources

While rainfall is sufficient for wet season crop production its erratic distribution results in periods of drought and crop water stress. Accordingly tank irrigation systems were established to: (1) provide supplemental irrigation for rice in the wet season, and (2) to stimulate dry season cash crop production.

To fulfill this original intent the systems require both rehabilitation and physical extension to permit the precise management of water essential for high yielding rice production and to permit greater water savings for dry season production. Water balance studies prepared on the sites by AIT indicate sufficient water is available for some dry season cropping at most tanks (see Key Statistics table at front of PP). However, in addition to rehabilitation of the systems improved management practices are needed for timely delivery of adequate water amounts to maintain paddy water levels for effective weed control and to avoid crop water stress. For dry season production adequate amounts must be delivered on a timely basis to meet crop needs and yet not exceed the soil water holding capacity.

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Observations indicate that at most tank sites water is taken directly from the two main channels and flows from field to field to a central drain. Approximately 50 per cent of the water appears to flow into the drain and is consequently not used on crops. Development of the physical capabilities required for better water control and management is provided for in this project design, and this includes gated control structures and checks which allow delivery of measured amounts of water to each field in a specified sequential (rotational) manner. Such control avoids the wasteful application of water inherent in the present "constant flow" delivery. Provision of water management extension services should help ensure proper utilization of infrastructure. See Annex D-1 for personnel needs and terms of reference for extension service personnel.

5. Technical Agricultural Inputs

Agricultural inputs discussed in this section are seeds, fertilizers, pesticides, and lime. Sources and availability of these components are as follows:

(a) Seed: Farmers cultivate a mixture of both local and high yielding rice varieties. Generally, they save local variety seed for future plantings, and this practice is expected to continue for the best tasting local varieties. Since the Project advocates greater use of high yielding varieties both for their increased yields and the smaller water requirements it is important that farmers have access to quality seeds. Seed for recommended varieties is available from dealers or through cooperatives located in the district capitals, and the relatively small increments required under this Project should be easily obtained. Similarly, other adapted field crop seed is generally available. In order to assure that seed is of adequate quality, Project extension agents will stress the use of seed of "certified quality" which will be made available to the project under special arrangement with the Seed Division, DOAE, through the USAID financed, "Thailand Seed Development" Project (Loan No. 493-T-017). All RD rice varieties from RD-1 through RD-11 are available from the DOAE Seed Division plus Suwani Corn, Hegari sorghum, Taiwan 9, Lampang and Sukhothai peanuts, and Uthong 1 mung bean.

Vegetable seed is also available from district sources. It is not anticipated that dry season cultivation will increase beyond supply availability. However, one of the agronomic extension agents' duties will be to estimate the cultivated area for the next seasons' crops

and alert the district seed dealers and cooperatives of the coming seasons' seed requirements.

(b) Fertilizers and Pesticides: Mineral fertilizers, which are essential for HYV rice production, are presently used at all tank sites. Shortages are not anticipated.

Pesticides, though readily available in the district cities, are rarely used. Because of their high cost the project advocates but minimal use of pesticides. Extension Agents, trained to detect early pest damage, will stress the use of only those agrochemicals currently approved in the United States.

(c) Lime: While lime and marl are produced in the the Northeast they are not readily available at all locations.

Lime is not a requirement for paddy rice cultivation, and while moderate lime applications are recommended for optimum yields and efficient nutrient utilization, adequate yields of corn, sorghum, and various vegetables have been produced without liming. Nevertheless, the Project consultants and extension workers should do this best to help farmers locate suppliers of lime especially when effective cropping patterns call for cultivation of lime sensitive crops such as peanuts.

6. Crops

While various crops are adapted to the climatic and soil conditions of the project sites as shown in Table D1-4 in the Annex, market and other practical considerations will dictate the final cropping patterns. Presently both improved and local glutinous and non-glutinous rice varieties are grown in the wet season per Table D1-5, but long duration varieties (LDV's) are preferred. Surveys at the seven sites showed average yields of 1.5 MT/ha on irrigated land for local non-glutinous and glutinous long duration varieties, but the potentials of both are more than 50% higher with proper cultivation and fertilization, double with recommended LDVs and almost triple with recommended short duration varieties. The Project will emphasize wet season production of improved short duration varieties both for their higher yielding capabilities and their smaller water requirements. Short duration rices significantly increase the tank water available for dry season production. However, since few farmers are familiar with the new varieties, some farmer resistence to

them is expected, and this Project assumes that 40 percent of the wet season cropping area will remain in traditional long meaturing varieties.

Dry season production of rice, peanuts, mixed vegetables, water melons, kenaf, sweet corn are expected under the Project and these are already well established in the Northeast. Within the constraints of market requirements emphasis should again be placed on shorter duration crops to conserve water and plus allow more farmers to participate in dry season production. Thus, paddy is not recommended as a dry season crop and efforts will be made under the Project to encourage farmers to adopt other crops. Services of an Agronomist and Agricultural Economist are recommended during the early part of the Project to help develop recommendations on the best available varieties and cropping schedules suited to each tank.

7. Technical Feasibility of Approach

The main thrust of this Project is to provide supplemental irrigation during the wet season and thereby stimulate increased crop production. Field observations indicate all present tank systems to a large degree presently practice wet season supplemental irrigation with limitations. The Project intent then is to increase the wet season efficiency by physically improving the distribution system, improving its operation and maintenance, providing intensive extension assistance, develop markets, and motivate farmer cooperation. The associated technical problems in both construction and production are ones which present technical knowledge can readily address.

The secondary objective is to stimulate dry season production of cash crops. The primary technical constraint here is availability of water. Available data from water balance studies done by AIT indicate a potential for cultivating and much as 32 per cent of the total commanded area of the seven Project tanks. Field observation indicated that this estimate may be conservative; dry season production at some sites already exceeds the projected cultivated area.

General management recommendations for improving the soil, water availability and cropping patterns are established and available in the AIT report and summarized above. While future results may refine some of the recommendations on fertility, lime, organic matter, cropping and other management practices these recommendations are considered valid and applicable.

The failure of the tank systems in the past does not appear to be primarily due to the lack of adapted or adaptable agro-technical practices. Failures more likely resulted from inadequate system operation and maintenance practices, lack of market, insufficient extension assistance, and other constraints discussed elsewhere in this PP. Since the components of this Project deal with each of these constraints as well provide technical assistance for resolving observed technical agricultural constraints, the Project is considered technically feasible as designed.

Technical Analysis: Section 2 - Engineering

An engineering analysis conducted for the Project by AIT provided preliminary plans and cost estimates for the seven Project sites. It was determined by AIT that all sites had catchment areas sufficient to provide for almost all of the supplemental irrigation needs in the wet season if design recommendations were adopted vs. less than half of the area effectively irrigated in the wet season now. Dry season irrigation should increase fourfold to more than 5000 hectares provided other non-engineering concerns are also addressed.

Recommended improvements to the irrigation infrastructure include rehabilitating the embankments where needed, repairing and extending the lining on the main and lateral canals, constructing more turnouts, adding more cross drainage culverts and drainage inflow/outflow structures, constructing checks and regulators in the canals, building more bridges for people and livestock crossing, designing and constructing a complete on-farm distribution system, providing for laterite surfaced roads along the main and lateral canals, and designing and constructing a service center building at each of the tanks. It is recommended that consultant assistance be sought to help RID prepare designs for the first tank where the above improvements will be made. After the initial tank, RID design teams should have adequate capability to complete detailed design work with minimal consultant assistance.

Lining is recommended for all the main and lateral canals to prevent the high seepage losses on the sandy soils of the Northeast and to minimize maintenance needs. Turnouts will be increased to an average of one per 300 meters from one per 400-500 meters. Cross drainage has been a major problem in the past and will be addressed through many more cross drainage structures. Bridges are needed to prevent livestock damage to the canals.

Minimum standard laterite roads are considered important to allow for adequate maintenance of the system. Very few canals have more than a small track along their alignments now.

One of the most important items to improve the existing irrigation systems is construction of on-farm distribution systems. In the past farmers were expected to provide these but they were rarely completed. The sub-lateral system provided under the Project will consist of unlined on-farm canals that will carry water from each turn-out to an area of 100-300 rai. These will have smaller canals emanating from them to and from each farmers' land. Considerable land leveling and terracing may be needed in some areas to provide for adequate distribution and drainage on the fields and these costs have been considered in the Project design.

In order to prepare for detailed design of the on-farm system, a soil survey and topographic survey of each site will be carried out as an initial action.

Construction is recommended by local contractors. There are many construction contractors in the Northeast capable of doing the recommended work.

Scale drawings of design recommendations at each site and typical sections of the lined canals are attached in Annex D-2. More detailed drawings, design and cost data may be found in the Consultant's (AIT) report.

C. Economic Analysis Summary

1. General

The economic internal rate of return (EIRR) calculated for the entire Project was found to be 31.41% using a 12% cost of capital and a $0.20/kg. economic price for paddy. As shown in Table III C below, all tanks have an EIRR above 10.0 as provided in the PID approval cable. Furthermore, under a worst case scenario where only supplemental wet season irrigation is utilized and no dry season cropping is practiced, the EIRR remains above 10% in all cases except one. Sensitivity analyses that assumed a 20 per cent decrease in yields (Case 1), a 20 per cent increase in production costs (Case 2), and a 20 per cent increase in investment costs (Case 3) were also run for each tank site and the results shown in the table. One other calculation shown in Table III C is the benefit cost ratio to the farmers at each tank based on farm gate (financial)

Table III-C Expected Returns to the Project

Project Area	EIRR	Sensitivity Analyses 1/			Wet Season Only EIRR	B:C Ratio to Farmer
		Case 1	Case 2	Case 3		
H. Talat	17.42	9.05	14.51	14.80	14.10	1.62
H. Chorakhe Mak	10.38	7.90	6.55	10.17	8.20	1.89
H. Phuttha Utthayan	27.71	6.88	21.82	21.73	NA	1.46
H. Aeng	27.79	21.58	24.98	23.82	21.43	1.73
H. Khilek	46.85	14.29	18.38	18.75	10.26	1.66
H. Kaeng	36.02	15.92	27.06	29.20	14.62	1.54
H. Lam Chamuak	23.55	18.34	22.30	20.22	NA	2.63
	Average 31.41					

NA = Not applicable since no dry season cropping is recommended in these two project areas.

1/ Case 1. Yield of Major Crops (Paddy, Mung Bean, Peanuts, Vegetables) down 20%.
Case 2. Production cost increased by 20%.
Case 3. Investment cost increased by 20%.

prices. This figure substantially exceeds 1.0 in all cases, indicating that farmers should be persuaded to adopt proposed cropping patterns and practices as long as necessary support services are provided. A full discussion of the economic analysis methodology and assumptions is contained in the AIT consultant report. A brief summary is contained below with a more detailed description of likely benefits at each tank provided in Annex D-4 along with key supporting tables.

2. Assumptions

This Project Paper relied heavily on the World Bank Report, "Thailand -- Appraisal of the Northeast Irrigation Project II" to provide guidelines in making "with project" projections. For example paddy yields were based on about 80% of the levels used by the World Bank However, the Project used approximately the same fertilizer cost (adjusted for price increases) and the same labor requirements as those indicated in the report for its yields. The report also provided guidelines for yields, costs and labor requirements for groundnut and mung bean production.

It was assumed that over the 7 sub-project areas local variety paddy would yield an average of about 2.5 mt/ha by the 7th year of the project life. By that time all rainy season paddy would be receiving supplemental irrigation and approximately $70/ha (13-14 nutrient kg) of fertilizer. Beginning generally with the second year of the project, growth in yields are projected to gradually increase. Different project areas achieve different levels of final yields, depending on the original level and the fertilizer application is proportional to the growth in yields. Other production costs (in addition to fertilizer and labor and which include other chemicals, seed, hire of animals and equipment, fuel, manure, draft animal costs, rent, etc.) are projected to increase (from base year) by 10% of the percentage growth in yield. Labor requirement per ha. is assumed to be 110 man days by the 7th year, increasing gradually from the level indicated in the survey. Labor requirements for HYV are placed at 116 man-days per ha., fertilizer costs at approximately $86 and other production costs at 20% higher than for local variety paddy at its maximum yield. Average yield overall 7 sub-project areas is projected at approximately 3.1 mt/ha. All HYVs receive supplemental irrigation. This is not necessarily the case for all local variety paddy, however, until the 7th year. (Note: AIT recommended 60% of the paddy areas be planted in HYVs and 40% in local

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varieties. Local varieties planted on this area are expected to provide enough rice for local consumption).

Mung bean and ground nuts are to be introduced as rapidly as is deemed feasibly taking into account the technical assistance available to farmers.

3. Farm Prices

All financial prices are farmgate prices based on the first six months of 1980. Relative prices are assumed to be consistant over the 20 year economic life of the project. Paddy was the only commodity which was shadow priced for the economic analysis since the farm gate financial price is substantially lower than the F.O.B. export price, adjusted for transport, processing and handling costs. A financial price of 12.5 cents per kg. is used in this Project Paper and an economic price of 20 cents 1/. The financial price of ground nuts appears to be close to the world price (again adjusted to transport, other costs) although there were difficulties in determining the costs of transportation, etc. from farm to port. Foreign exchange was not shadow priced 2/. An exchange rate of ฿20/US$1 was used. A household's contribution to farm labor was valued at the going rate for farm laborers. This overstates the economic costs for at least some household members during some parts of the year, but not by enough to change the economic internal rate of return except marginally. Output prices are given in the farm budgets. Ammonium phosphate and urea are both priced at $300 per product ton.

4. Farm Budgets

The farm budgets (see Annex D-4) for "without project" are based on field data obtained from a survey conducted for the USAID by AIT during the second quarter of CY 1979. Data were collected for the 1978/79 crop year, i.e. for the 1978 rainy season and the 1979 dry season. Approximately 350 farm households from the command area of

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1/ This compares with 15 cents and 21 cents for respective prices used by the World Bank for 1979. See Thailand -- Agricultural Credit Project, Staff Appraisal Report, February 15, 1980. Respective prices for 1985 are projected at 15 cents and 25 cents.

2/ This is in agreement with IBRD treatment. See Ibid.

each of 9 tanks (two were later rejected) were included in the sample. While a larger sample would have been desirable, the samples appear to give a fairly representative picture of the agriculture in each of the sub-project areas.

Apparently, there is very little change occuring in agriculture in the Northeast, at least in paddy production. Official data for such production show a very flat trend for the decade ending in 1978/79. The relative variation in production over this period was fairly small -- the coefficient of variation was a relatively low 14%. AIT deems the 1978/79 crop year to have been about normal with respect to rainfall and crop yields.

All the survey data collected has not yet been processed. In particular, survey data on farm income other than from crops (on, e.g. livestock, poultry, fish, rental of animals and equipment) have yet to be processed as have the associated costs. However, to give a more complete picture of farm income, estimates of the net farm income from these sources has been made and are included in the summary farm budgets. However, it should be noted that except for interest cost on production expenses, other farm costs and income will not be affected by the Project; that is, they will be the same with the Project as without. This statement also applies to net investment in farm equipment by farmers -- AIT projects that such investment will be affected only marginally, if at all, by the Project.

D. Financial Analysis and Plan

Tables III D1 and III D2 summarize the Project costs over the life of Project. Total cost of the Project is estimated at $16,950,000 with AID financing $5.8 million with an FAA Section 103 development loan and a $2.8 million Section 103 development grant. The RTG will finance the remaining costs, estimated at $8.35 million equivalent including a $550,000 contribution from DTEC counterpart funds for local costs of consultant support and facilities for workshops. The RTG contribution accounts for approximately 49 per cent of the total costs, thus exceeding the requirements of FAA Section 110(A).

The cost sharing arrangement between the RTG and AID provides that the costs of rehabilitation/improvement of the main irrigation system (embankment, canals, roads) will be borne 100 per cent by the RTG's Royal Irrigation Department through a special budget allocation from the Bureau of the Budget for FY 81, and regular budget allocations

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Table III D-1

SUMMARY BUDGET - LIFE OF PROJECT

PROJECT COMPONENT	AID LOAN		AID GRANT		RTG		TOTALS
	FX	LC	FX	LC	DTEC	Implementing Agencies	
1. Construction/Rehabilitation:							
a. Embankments						465	465
b. Main/Lateral Canals						2,180	2,180
c. Access Roads						1,085	1,085
d. Sub-lateral canals		185					185
e. Land Preparation/ On-Farm Systems		3,030					3,030
f. Design/Construct Service Centers		65					65
2. O&M of Dams & Main Systems 1/						565	565
3. RTG Staff Support							
a. Salaries						180	180
b. Per Diem		55					55
c. Equipment/Vehicles	60	85					145
d. Vehicle O&M		140					140
4. Technical Support							
a. Thai Salaries				370			370
b. Expatriate Salaries			1,270				1,270
c. Housing, In-country travel, staff					340		340
d. Vehicles			40				40
e. Vehicle O&M					50		50
5. Grant Support							
a. Research/Workshops				90	10		100
b. Farmer travel				40			40
c. Seeds, Fertilizer, Pesticides 2/				10			10
d. Marketing Support				50			50
e. Crop Insurance Fund				200			200
6. Evaluation			100				100
Sub-total	60	3,560	1,410	760	400	4,475	10,665
Contingency	15	530		50		670	1,265
Contingency for tax (10% of AID loan funded local costs)						350	350
Inflation (10% annually)	10	1,620	490 3/	90 4/	150 4/	2,305	4,665
Totals (Rounded)	90	5,710	1,900	900	550	7,800	16,950

1/ Main & lateral canals and structures, main drainage ways and structures, roads.
2/ For demonstration plots.
3/ Excluding evaluation
4/ Technical support items only. Inflation already included in Grant Support items.

Table III D-2

ANNUAL FINANCIAL SUMMARY

AID COSTS*
($000)

PROJECT COMPONENT	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
A. Loan Portion							
1. Construction/O&M	0	345	1,350	1,730	1,230	550	5,205
2. Design/Construct Service Centers	80	0	0	0	0	0	80
3. RTG Staff Support							
a. Per Diem	5	15	25	25	20	10	100
b. Vehicles/ Equipment	175	0	0	0	0	0	175
c. Vehicle O&M	10	20	35	55	60	60	240
Loan Sub-total	270	380	1,410	1,810	1,310	620	5,800
B. Grant Portion							
1. Technical Support							
a. Consultants	270	660	530	500	260	0	2,220
b. Vehicles	40	0	0	0	0	0	40
2. Grant Support	40	110	110	70	60	50	440
3. Evaluation	0	30	0	70	0	0	100
Grant Sub-total	350	800	640	640	320	50	2,800
Grand Total	620	1,180	2,050	2,450	1,630	670	8,600

*All annual costs include contingency and inflation factors.

thereafter. All salaries of RTG employees associated with the Project will be funded by the RTG. The RTG will also finance costs of maintaining the main system at an adequate level, but may initiate a program of recovering O&M costs for the main system from the beneficiaries after two years if RTG law permits. The economic analysis provides data on the beneficiaries ability to pay these costs and possible methdologies for cost recovery.

AID willI finance sub laterals, land preparation, on-farm systems, and service centers through a development loan (40 years including 10 years grace, 2% during grace, 3% thereafter) in order to provide a soft loan cushion for these relatively innovative components. AID will also fund incremental costs of RTG staff support (per diem, survey equipment, vehicles) under the Loan.

The AID Grant is to be used for all consultant costs except for housing, local travel, and per diem and these will be funded by DTEC. The Grant will provide three jeep vehicles for the consultant team, and DTEC will provide for vehicle O&M. About $390,000 of the Grant plus a contingency of $50,000 is reserved for supporting research, workshops and observation travel for farmers, marketing support elements, and an experimental crop insurance fund. The breakdown for these elements is illustrative only and a Grant condition precedent requires a utilization plan for each element before disbursements can be made. A $100,000 evaluation component is provided from the grant for consultant services and other evaluation support.

Summary tables and breakdowns for the above elements are provided in Annex E. Detailed cost data is available in the AIT consultant report, available separately from this PP in Asia/PD.

PART IV IMPLEMENTATION PLAN AND ARRANGEMENTS

A. Administrative/Organizational Analysis

1. RID

The organization generally responsible for the development and operation of irrigation works is the Royal Irrigation Department (RID). RID was formed in the early 1900's and has constructed water control works for more than two million hectares of land since it was organized. RID is one of the largest organizations in Thailand employing more than 75,000 employees. It is organized into 22 functional

divisions and twelve regional offices.

There are three regional offices in the Northeast, each under a regional director. Each regional director is responsible for coordinating RID operations and maintenance in his area, and administratively for staff seconded to the region for small construction projects such as these tank rehabilitation schemes. In practice, RID offices in Bangkok retain most authority and regional offices serve mostly to relay messages from Bangkok to the field.

The usual project implementation procedure is for RID's Central Construction Division to plan and construct works and then turn responsibility over to the O&M Division for operation. This has caused problems in the past, however, since there is no continuing management unit responsible for the entire project. In addition, different branches of the O&M Division have responsibility for Water Management Operations System Improvement and Maintenance, Irrigated Agriculture, Ditches and Dikes, and Management Support.

RID continues to do most of its work by force account, but the importance of contractors for RID construction projects is increasing as RID's workload increases. Obviously, one way to lessen workload pressure on the agency is to encourage increasing amounts of contract work. This is particularly important in view of the considerable increase in RID's workload over the past few years (RID budget has increased from about $175 million in FY 77 to $270 million in FY 80).

After construction is completed and the O&M Division inherits responsibility for tank irrigation schemes of the size proposed under this Project, on-site management is supposed to be carried out as described below. The RID management plan for water control calls for a RID "master irrigator" at each tank and one RID "zoneman" to maintain and regulate water as well as serve an extension function on each 1600 hectares being irrigated. One "common irrigator" for each 160 hectares is supposed to represent farmers and help manage water below the farm-turnout. However, the above coverage is rarely evident on most tanks, and even if it were, there is considerable doubt that it would be adequate to provide reliable maintenance and to ensure farmers' water requirements are met (In the Philippines, for example, the zoneman function is allocated to every 250 hectares). Furthermore, neither training nor incentives

appear sufficient to satisfy the performance requirements of the job (common irrigators receive less than 2 cents equivalent per rai of irrigated land per cropping season). The above problems have led to sporadic water control and canal maintenance and have consequently increased risk to farmer irrigators who depend on RID management of the canal system. In view of these problems, it is little wonder that even farmers with apparent access to water in the dry season appear reluctant to become dependent on irrigation. One encouraging sign that the RTG is placing increasing emphasis on resolving the above problems, however, is the fivefold increase in money allocated to O&M for tank irrigation in FY 80 over FY 79, from $600,000 to $3.25 million. It is expected that a good portion of the increase will go for increased staff at the tanks.

2. DOAE

The Department of Agricultural Extension (DOAE) is responsible for extending modern agricultural practices and other information and assistance aimed at helping farmers increase farm yields and incomes. It is thus a key agency in this Project. A complete description of the DOAE's organization and management is contained in USAID's FY 77 Project Paper on the Agricultural Extension Outreach Loan (Project No. 493-0280) and will not be repeated here. The national extension program that the AEO Loan supports is well underway, and will result in an extension agent (Kaset Tambon) in every community served by the Small Scale Irrigation Project by 1981. In addition, the extension agents will recruit contact farmers from each village to serve as a focal point for demonstrations, research trials, training, etc.

Unfortunately, the extension agent/farm family ratio will not exceed 1:1000 under the AEO Project, and while this is an improvement over the past, it is not likely to be sufficient to adequately support the water management techniques and cropping practices that should be extended in conjunction with an irrigation improvement project. In addition, extension agents have little training in water management and are not generally equipped to respond to farmer's questions on irrigated cropping and management requirements. Furthermore, there are no DOAE subject matter specialists (SMS) available to train or backstop extension agents in this area.

3. Water User Associations

Water User Associations in the Northeast (WUA's) are supposed to ensure the equitable distribution of water and efficient maintenance of the on-farm systems.

As a 1978 report on the Nong Wai Pioneer Project pointed out, however, these associations often do not function at all or at best are operationally very weak. Part of the problem again seems to stem from the lack of staff support from RID to create and assist these organizations to function. Also their generally large size (over 1000 households in some cases) precludes active participation by many members. The Social Analysis Annex indicates that many farmers do not understand the WUA function. Finally, although the Irrigation Act allows for collection of O&M fees for maintenance and operating of the on-farm system, these have rarely been collected and WUA's consequently have little or no operating budget. (One reason they have not been collected is probably because farmers see little reason to contribute to support a system that doesn't function very well anyway.) The above problem areas tend to preclude any kind of broad farmer participation in the control and management of irrigation water and certainly contribute to inefficient water utilization and poor system maintenance.

4. Other Organizations

Besides the above organizations which must play a key role in the Project, it will be important to coordinate the Project with the MOAC's Department of Land Development for carrying out necessary soil classification work, and with the MOI's Department of Local Administration (DOLA) to ensure that local government officials are actively involved in management of the Project. In addition, MOI's Community Development (CDD) workers are active in some site areas working with local organizations and the Project should be coordinated with CDD. CDD may well have an important role in the Project and could serve as an intermediary between Project staff and local groups, including WUA's, and CDD's role should be considered carefully as Project Implementation gets under way. Since BAAC provides over 80% of the institutional credit needs to the Northeast, it should also have a vital interest in Project management. The Department of Agriculture is the main research arm of MOAC and will provide expertise for agricultural research and demonstrations at the sites. Department of Fisheries (DOF) will have a role in helping farmers develop the potential of existing water resources for aquaculture.

B. Proposed Project Organization and Implementing Arrangements

Studies have been made on ways to ameliorate the problems constraining the above organizations, including a major organization and management study of RID financed by

the World Bank under IBRD's $95 million Phitsanuloke Project. USAID understands the RTG is reviewing this recently completed study and a Government response to the study is expected by the end of calendar year, 1980. It is planned that any innovations resulting from that study will also be incorporated into the administration and management of this Project. In the interim, the following implementation arrangements are proposed in order to alleviate major organizational constraints.

1. Organization

Figure IV 1 shows the proposed organizational diagram for the Project. It should be noted that the Central Policy Committee proposed for the Project is the same as that functioning for AID's Lam Nam Oon Project and for the IBRD's irrigation projects. This will facilitate consistency in policy pertaining to all the projects.

a. Project Coordinating Committee

A Project Coordinating Committee will function as a forum for coordinating the departments involved with Project implementation. Besides the agencies mentioned above, the Department of Technical and Economic Cooperation (DTEC) will be a member of the committee since it is the agency responsible for administration of the grant portion of the assistance and will also contract and administer the technical assistance financed under the Grant. Additionally, this committee, with advice from the technical consultant team, with establish a priority ordering of project implementation activities.

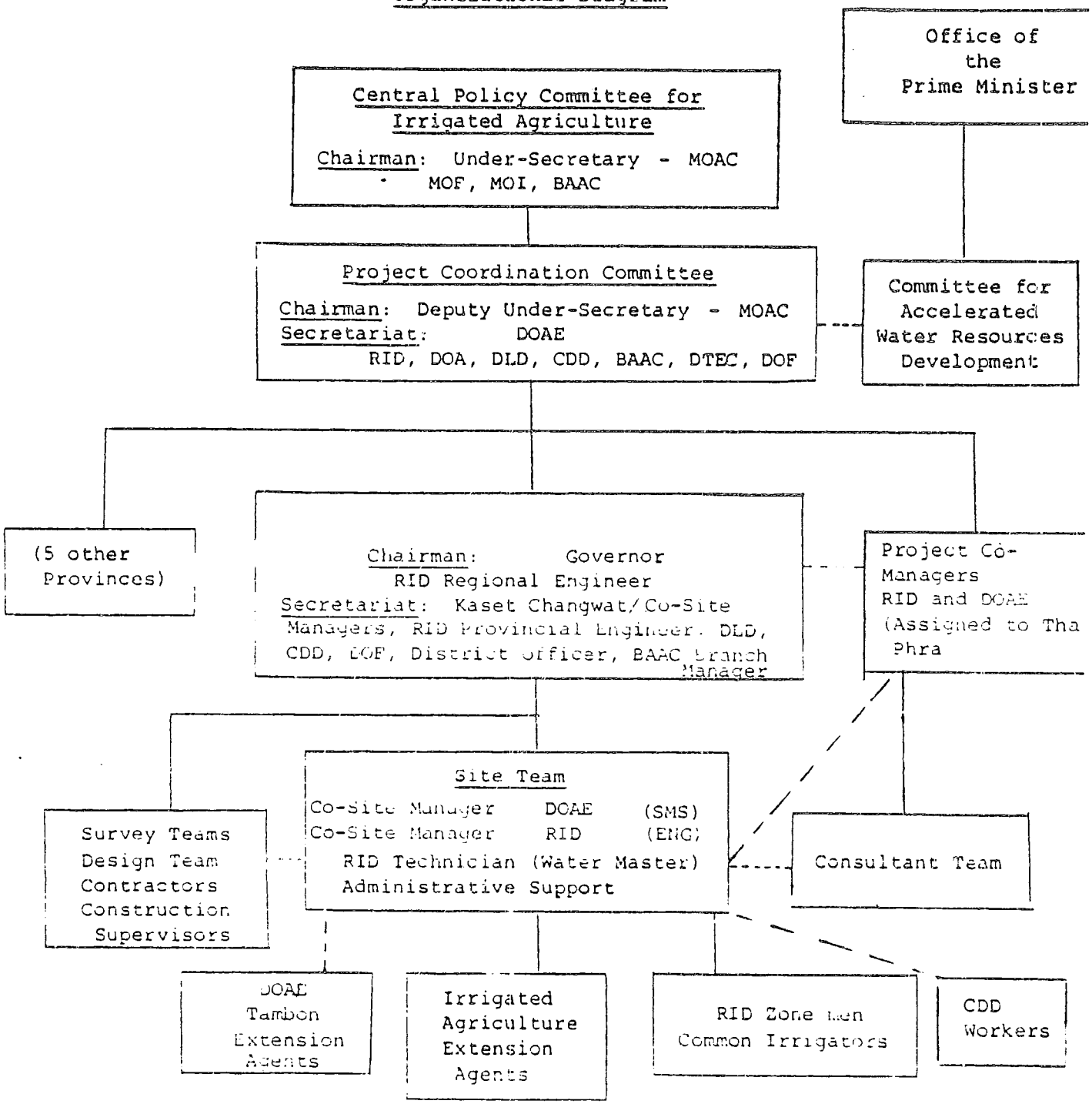
The Project Coordinating Committee will be able to call upon the Prime Minister Office's Committee for Accelerated Water Resource Development to help resolve implementation problems. The AWRD has extensive technical resources from the public sector and universities that it calls upon to form task forces in water resource related subject areas. These task forces are fielded in support of priority projects when needed.

Although it is expected that the Deputy Under-Secretary of MOAC will chair the Project Coordinating Committee, the role of Secretariat to the committee is key since the Secretariat will actually prepare all documentation for the committee's approval, prepare necessary agenda, and organize the meetings when they are required. It is proposed that this key position be occupied by a division level chief of DOAE for several reasons:

(1) Resolving most of the constraints to improving farmer productivity is the responsibility

Figure IV 2

Small Scale Irrigation Project
Organizational Diagram



of DOAE; RID's concern is primarily the construction of facilities and the distribution of water to the farm turnout.

(2) DOAE has an ongoing relationship with the target beneficiaries at each site and this is a crucial element if the Project is to be responsive to their needs.

(3) DOAE already plays a coordinating role with BAAC and DOA in helping farmers obtain credit and conducting demonstrations.

(4) The release/distribution of water from the tanks should depend on cropping patterns, crop types, and other on-farm water management plans, not vice-versa. DOAE is best equipped to prepare water demand schedules based on farmers needs.

(5) DOAE has expressed an active interest in managing this Project, despite its relatively limited scope, because it complements the National Extension Project and addresses several of DOAE's major concerns in the Northeast.

Naturally, RID has a predominant role during construction of infrastructure and they will assume responsibility for this aspect of the Project, but the responsibility for coordinating all components of the Project at the Central (department and ministerial) level should rest primarily with DOAE because, as noted above, the objectives and components of the Project more closely parallel the responsibilities, capabilities and interests of DOAE than any other agency.

b. Project Manager

It is proposed that the DOAE and RID each station full time Project Co-Managers at the Northeast Agricultural Development Center (Tha Phra), in Khon Kaen to coordinate and monitor the field activities of the Project. The Project Co-Managers would serve as an extension of the central Project Coordination Committee and would help ensure that each site team is properly supported and progressing satisfactorily. It is also expected that they would maintain close contact with the consultant team and help them make necessary contacts with other MOAC agencies that have representation at Tha Phra. Each co-manager will coordinate and monitor those activities assigned to his particular agency, i.e. DOAE or RID. Such division of responsibility should not introduce conflict or confusion since the Project Coordinating

Committee will establish a priority for implementing project activities. This priority order will govern when possible conflict or confusion develops.

A linkage with Tha Phra is also important because the MOAC plans to build up its capability to coordinate and support many future development projects in the Northeast including AID's Rainfed Agriculture Project. So far its capabilities have been untested and this Project will be one of the first to have a formal link with the Center. The coordination function will depend almost entirely on the Co-Project Managers and not the Center staff per se, so no institutional analysis of the Center appears necessary at this time.

c. Province Operations Committee

Province/Regional representatives of each operating agency will have action responsibility for initiating much of the activity under the Project. Each participating agency is represented on the Province Operations Committees chaired by the Governor of each province. Basically, members of the Committee (RID, DLD, BAAC, DOAE, CDD, DOF) will ensure that necessary inputs for the Project (staff, funds, services) are provided to the site teams in a timely manner and help resolve implementation problems on the spot. Since it is expected that the Site Team Co-Managers will serve as the Secretariat of the Committee under the supervision of the Province Agricultural Officers, close contact with each Project Site is assured.

d. Site Teams

Finally, a team composed of a site co-managers (RID engineer and DOAE subject matter specialist) RID site personnel (watermaster, zonemen), and CDD and DOAE extension agents will carry out Project activities at each site. The site teams will be supported by the consultant team who will provide on-the-job training for the team members and technical expertise as necessary.

There are several reasons for utilizing SE and SMS as site co-managers. (1) They are college graduates with a technical agricultural or irrigated engineering specialty and should be able to best benefit from further on-farm water management training and on-the-job training from a high level consultant team; (2) Their usual role is to function at a province level as technical resource persons and (and for SMS) as trainers for extension agents and they can accordingly relate to extension agents and RID personnel in the field; (3) They have the necessary status to function as a deputy to the Secretariat for the Province Operations Committee (under

the Kaset Changwat) and thus facilitate the Project at the Province level; (4) After about two or three years it is anticipated that SMS and SE will have been adequately trained at each site and the most intensive phase of site development will have been completed. SMS and SE may then be reassigned to the Province level (one per Project province). SMS will assume their regular training/resource person role at the province level - but for a new speciality in water management - and can be called upon to help replicate the Project in other areas as required.

The RID site co-manager/engineers will also receive valuable, innovative water management training, and can subsequently -- similar to the DOAE SMS -- transfer to and replicate their knowledge in other Northeastern provinces.

In order to assure adequate field extension of water management and irrigated agriculture practices the regular Kaset Tambon who have responsibility for the site areas will be supplemented with two additional extension agents at each site so that extension coverage is upgraded to no less than 1:400 households. It is planned that the 14 additional agents needed in this capacity will be provided from the more than 20 special agents who already have been trained under the IBRD Northeast Irrigated Agriculture Project that was completed in 1979. These agents have been used to supplement other activities over the past year and will be phased into this Project as each site is developed. Their experience with irrigated agriculture will be a useful complement to the water management skills they will develop under this Project. Current plans call for one of the irrigated agriculture extension agents to emphasize extension of water management aspects of the Project while the other would concentrate on agronomic concerns. A detailed discussion of these specialist's roles is contained in Annex D-1. After SMS and SE are withdrawn, it is planned that one of the extension agents will assume the role of site manager. It is expected that at the completion of the Project, regular Tambon agents will have learned enough from their contact with Project specific personnel to maintain the gains achieved under the Project, and the special irrigated agriculture agents will then be available for activities at other irrigation sites.

Operation and maintenance of water control/distribution system above the farm turnout will continue to rest with RID personnel under the Project, however, the level of staffing will be closely controlled so that minimum needs are met, and budget levels will be increased to adequately

fund O&M requirements. RID staff for each site would include:

- One Site Engineer (temporary)
- One Watermaster (Gatekeeper)
- two Zonemen
- six - ten maintenance technicians

These individuals would also be trained by the consultant team at each site and would be under the operational control of the site co-managers. This arrangement will help ensure that water schedules and maintenance plans are closely coordinated under one operational head.

e. WUA's

Management and maintenance of the on-farm structures will rest with the Water User Associations. WUA's will be represented on the site teams by common irrigators.

To help overcome weaknesses referred to above, the Project will test various models of WUA's at different sites. The details of the tests will be worked out by the consultant team but basically they will try to address identified constraints by:

(1) Experimenting with various sizes, organization and groupings of WUAs.

(2) Attempting to decentralize the management so that WUAs are more representative of smaller farmers.

(3) Working out an equitable system of collecting water user fees to provide for O&M costs of the distribution system.

(4) Research and testing arrangements for cost recovery from farmers of the capital improvement elements.

As mentioned above, it is expected that CDD workers will be valuable in working with WUA's since they generally have good relations with local organizations. Training and workshop sessions set up with WUA's will accordingly be closely coordinated with local CDD workers.

2. Conclusion

The arrangements sketched out above are designed to meet the most serious organizational constraints to increasing agricultural production in the command areas of tank irrigation sites. It is expected that the most successful elements of the above approach will be adopted and further refined for future projects. Formal training

courses are expected to replace much of the on-the-job training offered by the Project consultants and one of the consultant team's tasks will be to refine manuals that are already being developed with Ford Foundation and other donor support for water management training. Furthermore, as training courses in irrigated agriculture subjects are developed by the RTG, it is expected that Project personnel will be given priority consideration for early training.

It is not expected that this Project will resolve all of the organizational constraints to increasing yields and incomes of farmers in the Project Sites and other interventions, such as development of an effective multipurpose cooperative-type system, development of a land consolidation system, and provision of a dependable agricultural input production/distribution system would clearly benefit the target group, but are simply beyond the scope of this Project. Despite these unavoidable shortcomings, from an administrative/management point of view, the Project should accomplish its objectives as stated in the Log Frame and is considered administratively sound as designed.

3. AID Monitoring Arrangements

One U.S. direct hire development officer will devote from one-third to one-half of his time to monitoring the Project. One FSN assistant project officer will also be assigned to the Project on a one-third time basis. A USAID Project Committee has been formed to assist the Project officer. The committee is composed of an engineer, economist, agricultural specialist with water management experience, financial analyst and capital development officer.

In addition, the USAID Mission expects to involve the Project design/feasibility contractors, Asian Institute of Technology, in key meetings on design, monitoring, and evaluation. AIT has expressed an interest in continuing its involvement by helping to monitor the Project.

USAID also expects to utilize the services of an engineering contractor to conduct on site inspections during construction of the systems. The AID Mission is currently working on the terms of reference for a basic ordering agreement with an A&E firm to bolster the Mission's monitoring capability for several projects including this one, that are about to commence implementation.

C. Financial and Procurement Arrangements

1. Grant

DTEC will be the Grantee and will provide financial control of the Grant and serve as contracting agency for grant financed goods and services. DTEC has long experience in this role. DTEC will use its baht counterpart fund to finance local costs initially and AID will reimburse agreed costs upon DTEC's submission to AID of necessary vouchers. AID will pay for foreign exchange costs through the direct letter of commitment mechanism. It is planned that DTEC will contract with a consultant firm to provide the technical assistance package. DTEC is familiar with AID Handbook 11 requirements for host country contracting.

2. Loan

Most goods and services financed under the Loan will be procured by RID. Local costs will be initially financed by RID and reimbursed by AID up to agreed maximums. RID has had wide experience with donor financed procurement activities and is considered by USAID to have the capability to do the necessary procurement under the Project.

RID will contract for all construction services and equipment using RTG competitive contracting requirements. These procedures generally conform to AID Handbook 11 requirements but USAID will approve AID financed contracts and monitor procedures to ensure fair competition and prices are obtained. Equipment costs are small, and no purchase is expected to exceed $20,000. Except for vehicles, equipment is accordingly expected to be purchased off the shelf. Waivers for proprietary procurement of AMC jeeps are requested and justified at the end of Part IV. AID will issue direct L/Comms for the jeeps and assist RID in preparing purchase orders. The relatively small amount of procurement for DOAE (22 motorcycles) and DLD (2 jeeps) will be coordinated with the RID procurement so that costs may be minimized. Procurement of 38 motorcycles will be done locally as justified in the waiver section of this PP.

For recurrent costs financed by AID under the Loan (per diem and vehicle support) AID will consider maintaining a small advance (nor more than $10,000) for paying Project related per diems and travel costs. It is expected that the advance funds would be under control of the Project Manager at the fiscal office in Tha Phra, and disbursed to the provinces as needed.

D. Implementation

The Project is expected to be authorized in August 1980 and the agreement signed in September 1980. An illustrative schedule of events leading up to the prime consultant's mobilization is contained in Table IV-2. Before the agreement is signed, certain pre-implementation actions will be needed for preparing the documentation for procurement of vehicles and other equipment, preparing the contract for the service center design, and completing terms of reference for the prime consultant services. TDY services from an AID engineer and the Area Contracting Officer will be sought for three weeks in August to complete these pre-implementation actions. Soon after the Project Agreement is signed and initial CPs have been met, a Thai A and E firm will be contracted by each province Operations Committee to design the service center buildings. Service centers will be built by local contractors and supervised by construction supervisors assigned by the provinces. The building at the first site is to be completed before the prime consultant arrives in mid 1981.

Topographic survey and soil classification teams, furnished by RID and DLD respectively, will begin working on the first site immediately following the wet season of 1980. A short-term consultant, preferrably under a DS/AG contract which will allow a short lead time, will be procured to assist with the topographic and soil classification work on the first site and to help work out other start-up problems. Thus the prime consultant team will have the data it needs to begin the design work as soon as it arrives, and construction can commence in the following dry season. The topographic and soil classification teams will move on to two more sites during the next dry season and will then continue the process with two more each year.

RID design engineers will work with the consultants on designing the first system, and starting the following year will begin design work at two other sites as soon as the topographic and soils data are available. The main system and on-farm system design will be done simultaneously so they can be coordinated. The designers will be charged to work closely with the affected farmers on all phases of the design work. In this they will be assisted by the site teams (especially the agriculture extension agents) who by this time will also be assigned to the sites.

Table IV-2

Implementation Schedule

Event	Date	
1.	6/30/80	PP draft completed.
2.	7/15/80	Assistance requested by RTG.
3.	7/18/80	PP sent to Washington.
4.	7/31/80	APAC review.
5.	8/11/80	Loan/Grant authorized.
6.	8/15/80	Pre-implementation actions commence.
7.	9/1/80	Project agreement signed.
8.	9/20/80	Advertise in CBD for expression of interest for technical assistance.
9.	9/25/80	Begin procurement of jeeps and motorcycles.
10.	10/15/80	Contract signed with Thai A/E firm for design/supervision of construction of service center buildings.
11.	10/15/80	Expressions of interests due from consultant firms.
12.	10/15/80	Request consulting assistance for project start-up from DS-AG contract.
13.	12/15/80	Terms of reference for consultant completed. Pre-implementation contract conpleted.
14.	11/15/80	Request technical proposals from short listed consultant firms with cost proposals included in separate envelope.
15.	11/15/80	Arrival of DS/AG consultant.
16.	11/30/80	Service center building plans completed.
17.	12/15/80	Contract signed for construction of service center buildings.
18.	12/31/80	Begin construction of service center buildings.
19.	1/31/81	Consultants technical proposals due. RTG/AID begin to evaluate.
20.	3/15/81	Consultant chosen - Begin negotiations.
21.	3/15/81	Begin procurement of surveying, drafting, soil survey and service center equipment.
22.	4/15/81	Contract signed with consultant - Consultant begin mobilization.
23.	5/15/81	Equipment on board.
24.	5/15/81	Jeep and motorcycles on board.
25.	6/1/81	Service center buildings completed.
26.	6/1/81	Consultant on site. Begin work.
27.	6/15/81	DS/AG consultant work completed.
28.	9/15/82	Evaluation.
29.	9/15/82	Evaluation.
30.	4/15/86	Consultant contract completed.
31.	10/15/86	End of project.
32.	4/15/87	Begin post project evaluation.
33.	6/15/87	Post project evaluation completed.

FIGURE IV-3 - ILLUSTRATIVE STAFFING AND SCHEDULING NEEDS FOR RTG

Site No.	Project Year 1		2		3		4		5		6	
	1981		1982		1983		1984		1985		1986	
	← Prime Consultants Contract Period →											
1	PM(1) TS(1) SC(1)	PM(1) SS(3) SE(3) EA(2) D(2)	PM(1) SS(3) SE(3) EA(2) D(2)	PM(1) SS(3) SE(3) EA(2) D(2)	PM(1) SS(3) SE(3) EA(2) CS(2)	PM(1) SS(3) 1/ SE(3) EA(2)	PM(1) SS(3) SE(3) EA(2)	PM(1) SS(1) 2/ SE(1) EA(2)	PM(1) SS(1) SE(1) EA(2)	PM(1) EA(2)	PM(1) EA(2)	PM(1) EA(2)
2			TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	SS(1) SE(1) EA(2) CS(2)	EA(2)	EA(2)	EA(2)	EA(2)	EA(2)
3			TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	SS(1) SE(1) EA(2) CS(2)	EA(2)	EA(2)	EA (2)	EA(2)	EA(2)
4					TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	SS(1) SE(1) EA(2) CS(2)	EA(2)	EA(2)	EA(2)
5					TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	SS(1) SE(1) EA(2) CS(2)	EA(2)	EA(2)	EA(2)
6							TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	SS (1) SE(1) EA(2) CS(2)	EA(2)
7							TS(1) SC(1)	SS(1) SE(1) EA(2) D(2)	SS(1) SE(1) EA(2) CS(2)	SS(1) SE(1) EA(2)	CS(1) SE(1) EA(2) CS(2)	EA(2)

(DOAE) { PM - Project Manager (Stationed at Khon Kaen)
SS - Subject Matter Specialist
EA - Extension Agent

(DLD) SC - Soil Classification Team (1 professional)

(RID) { TS - Topographical Survey Team (2 professionals)
CS - Construction Supervision Team (2 technicians)
D - Design Engineer

(SE - Site Engineer

1/ Bring in 2 more SS and 2 more trainees to replace those going to other tanks. The other SS and SE will remain at Tank No. 1 with EA's.

2/ Bring in last SS and last SE for training.

FIGURE IV-4 - ILLUSTRATIVE CONSULTANT ACTIVITIES AT FIRST SITE

	Project Year				
	1	2	3	4	5	6
	1981	1982	1983	1984	1985
	Prime Consultant Contract Period				
Contact farmers	XX	X			
Assist design on-farm irrigation system	XX	XXXX			
Assist design main irrigation system	XX	XXXX			
Help develop demonstration plots	XX	XXXX	XXXX	XXXX	XXXX
Work with water user groups	XX	XXXX			
Assist field days for demonstration plots		XXXX	XXXX	XXXX	XXXX
Interact with farmers on design of systems for first site	XX	XXXX			
Farmer field trips to successful systems	XX	X			
Technical Assistance for management of agronomy		XXXX	XXXX	XXXX	XXXX
Technical Assistance for management of water		XXXX	XXXX	XXXX	XXXX
Monitor construction		XXXX	XXX		
Train SMS and extension agents	XX	XXXX	XXXX	XXXX	XXXX
Help train farmers in improved farming and irrigation methods	XX	XXXX	X		
Review RID designs		X	XXXX	XXXX	XXXX
Work to develop markets for dry season crops		XXXX	XX	XX	
Experiments on crop insurance		XXXX	XX		

FIGURE IV-4

A similar pattern will be followed by the RID construction supervision teams - working with the consultants at the first site and then branching out to the other sites as they reach the construction phase. It is anticipated that construction will require at least two years at each site so that after the fourth and fifth years of the project there will be four sites under construction at once. Construction will be done by Thai contractors and it is expected that RID will handle the tendering.

Three DOAE Subject Matter Specialists and three RID engineers on-the-job training with the consultants for one year at the first site and then two each will be assigned to the two other sites while the remaining two begin their duties at the first site. At that time, two new SMS and two new RID engineers will be brought in for training at their sites and so on every year during the consultants' contract period. At the same time special extension agents will be phased into each site to supplement Kaset Tambon. These activities are illustrated in Figure IV-3.

While the consultants will concentrate on the sites currently under construction, they will be available for assistance at the other sites and will review the activities at these sites at key junctures. Suggested activities for the consultant are shown in Figure IV-4.

E. Evaluation Plan

The multiple and interrelated outputs of this Project and the consequent complex measurement of purpose achievement will require two in-depth evaluations over the six year life of project. There will be no other annual evaluations separate from the ongoing management responsibility for project monitoring. Comprehensive and sufficient baseline data have been gathered through the pre-project efforts of the Asian Institute of Technology.

The first evaluation will take place toward the end of the second year of project implementation. This review is to consider primarily the non-construction-related aspects of the Project, although the fact that the first irrigation tank should be under construction will provide some basis for judgment of how the Project is moving in this area.

The second special evaluation is scheduled for the beginning of the fourth year of project implementation.

At this point in time, the first tank is scheduled to have been completed and one wet season of tank use will have passed. It will therefore be possible to begin assessing the degree to which there has been progress toward achievement of the Project purpose.

A post-project evaluation is proposed to take place after the Project has been completed.

$100,000 has been budgeted to fund the first two evaluations. This amount of money will provide the Project Manager with enough flexibility to be able to respond to currently unforeseen additional data or other requirements. It is expected that the post-project evaluation will be funded from PDS funds or other funding sources. AIT has expressed interest in this type of activity to measure long range impact of the Project.

F. Conditions Precedent, Covenants and Waiver Requests

The following special CP's and covenants are anticipated for the Grant Agreement and Loan Agreement. There is agreement between AID and the RTG on all substantive aspects of the CP's and covenants, and no significant delay is expected for executing the Agreements after the Project is authorized.

1. Initial Conditions Precedent to Disbursement for the Grant

(a) Establishment of the Project Coordination Committee, Provincial Operations Committees, and first site team designated.

(b) Co-Project Manager Appointed.

2. Condition Precedent to Disbursement for Each Project Component Other than Advisory Services

Plan of Action and Financial Plan for the component.

3. Initial Conditions Precedent to Disbursement for the Loan

(a) Same as Grant
(b) Same as Grant

(c) Legal Opinion
(d) Appointment of Borrower's Authorized Representatives.

4. Condition Precedent to Procurement of Equipment (except jeeps)

Procurement Plan for all items.

5. Conditions Precedent to Construction of Each Service Center

(a) Detailed Plans for construction, operation and maintenance of the center, acceptable to AID.

(b) Agreement on maximum costs payable from the loan for each center.

6. Conditions Precedent to On-Farm Development at Each Site

(a) A comprehensive plan of construction and firm cost estimate for on-farm development.

(b) Plan of Action and evidence that work is proceeding satisfactorily on construction/rehabilitation of important off-farm infrastructure.

(c) Satisfactory Staffing Plan and evidence that adequate staff has been assigned to the site team to carry out the Project.

(d) Operation and Maintenance Plan for off-farm and on-farm irrigation system approved by local Water User Association.

7. Special Covenants (Loan and Grant)

(a) The Borrower/Grantee agrees to establish an evaluation program as an integral part of the Project and to conduct an evaluation after the Project terminates.

(b) The Borrower/Grantee agrees to assure an effective program of and adequate annual budgetary provisions for operation and maintenance for all infrastructure components of the Project.

(c) The Borrow/Grantee, within two years following substantial completion of the construction phase of system physical rehabilitation, expansion, and/or land development at each site, agrees i) to establish for each

site a program satisfactory to AID for recovery of on-farm O&M expenses, and ii) to make best efforts to establish for each site a program satisfactory to AID for recovery of main system O&M expenses.

(d) The Borrower/Grantee agrees to make best efforts to implement a program satisfactory to AID to test options during the Project for recovering from the beneficiaries of the Project a portion of the Borrower/Grantee's investment costs in the Project, particularly land development.

G. Waivers

The following waivers from AID procurement procedures are requested:

1. Proprietary Procurement of 7 American Motors Jeep Vehicles - Approximate Cost - $84,000 ($36,000 Grant, $48,000 Loan

Three jeep vehicles are needed to support the consultant team in the field, two for the soil survey teams and two for the topological survey teams. Four wheel drive utility vehicles are essential for the advisors to make site inspections during the construction phase of the Project and to have adequate mobility to visit all sections of the site command areas, especially during the rainy season when road conditions are difficult. Right hand drive is a safety requirement in this country. As previously justified in 79 Bangkok, 49240 and Bangkok 00404 for the Hill Area Education Project, only AMC jeep vehicles are suitable for rural areas of Thailand because of parts availability, standardization, and maintenance problems with other U.S. vehicles of similar specifications.

2. Waiver of 636I Requirements for 38 locally Manufactured Small (less than 125cc) Motorcycles

Approximate Cost: $27,000 from the Loan. Motorcycles will be provided to site managers and assistants (16), special extension agents (14) and construction supervisors (8) to provide necessary mobility around each site. U.S. motocycles are unsuitable due to their large size and problems in obtaining servicing and spare parts in rural Thailand.

3. Waiver of 636I Requirements for 2 Locally-RHD Pick-Up Trucks

Approximate Cost: $12,000 from the Loan. Two wheel drive, RHD pick-up trucks of under 2,000 cc. displacement will be provided to the DOAE and RID Project Co-Managers located at Tha Phra Northeast Agricultural Development Center, near Khon Kaen. Four-wheel drive utility vehicles are inappropriate for this task for reasons of operating economy and reliability since most PM travel will be on hard-surface roads between the 7 project sites and on existing roads within the sites themselves. U.S.-made pick-ups are also not suitable because of inadequate spare parts and servicing capability in this area.

The Interface Teams

The Functions

The interface teams have the overt function of bring about understanding between the Project staff and the rural people, to enable the implementation phase to proceed on a basis of effective two-way communication. They must prepare these groups to understand each others' objectives, functions and attitudes before they come into contact. It is especially important for the rural people to know in what ways the Project staff can help them and in what ways it cannot, but it is also necessary for, say, an agricultural extension officer to know what the people can make use of that he is able to show them. Left to themselves what follows is the kind of situation that tends to be repeated over and over.

An extension officer, for example, is instructed to promote the growing of coffee, because it is departmental policy. He approaches people who have only the most generalised notions of him as a "government official" from whom they expect help, if anything. Their perception of the help theyneed is probably related to such things as subsistence rice shortfalls, irrigation water or something quite apart from coffee, and coming from the government, they will expect him to contribute directly on these matters. When he does not, (because this is not the kind of help he is empowered to give) they are disappointed, angry or contemptuous, and not inclined to accept his advice on coffee which they did not ask for. This ignores the strong probability that if they did follow his advice they would eventually be much better off.

BEST AVAILABLE

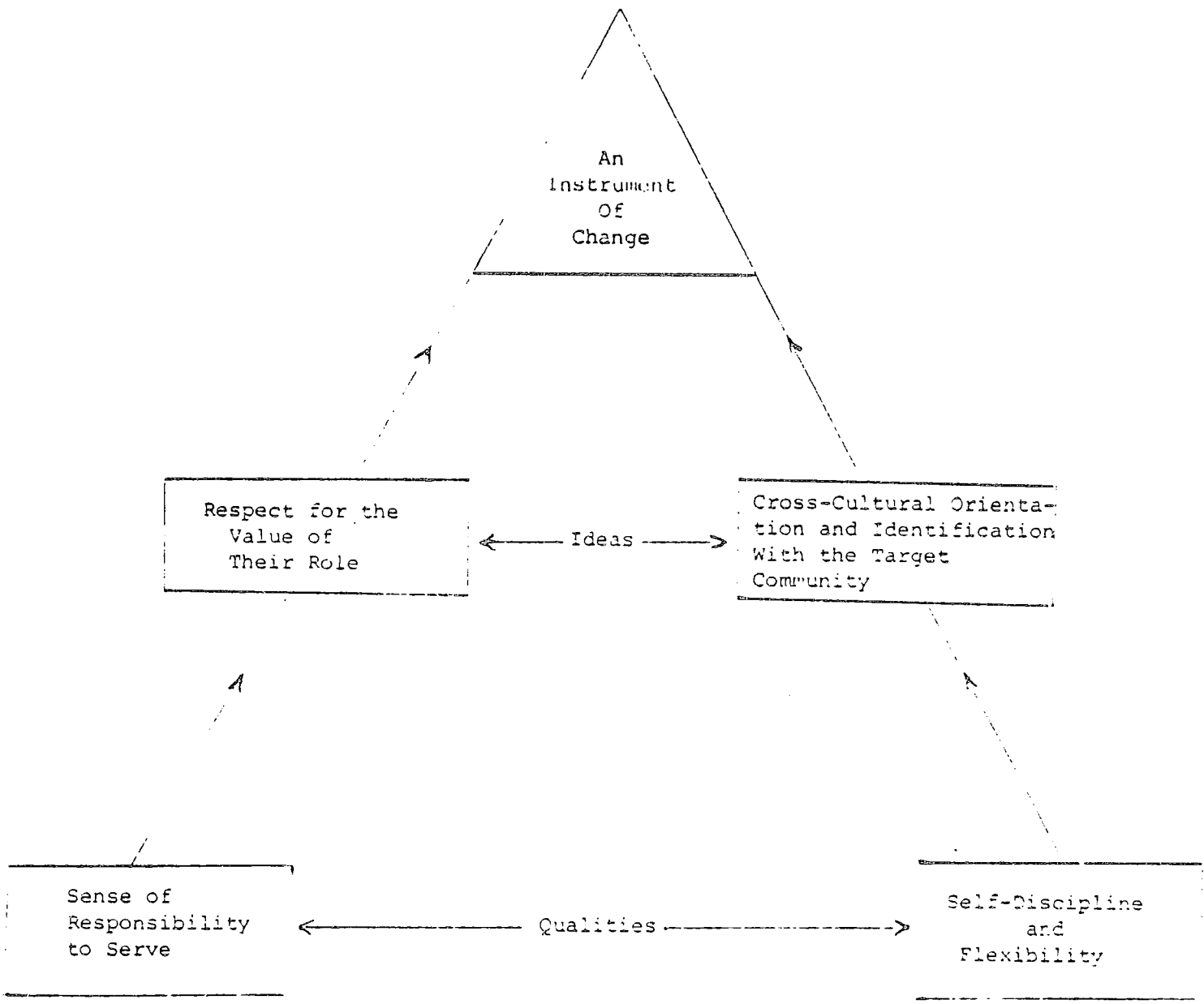
In brief the interface teams, through knowing the people and having their trust, can help them to make proper use of the technicians in the field as resource persons, which is what they are. It is unreasonable and inefficient to expect these resource persons to serve simultaneously as "community workers", yet these sorts of functions are essential to the development process. Hence the need for interface teams.

At a deeper level the team's task is to encourage the habit of group discussion leading to analysis of problems and interpretation of the human and physical environment, how the people fit into it and what they should and should not expect from it. This sort of process is sometimes called "consciousness raising" or "self awareness" development but its basis is really in the habit of analytical thinking and group problem solving. If one listens to group conversations in isolated Thai or ethnic minority villages, they habitually take a circular route; the subject ends where it begins. Any problem is introduced as a complaint, confirmed with a wealth of similar examples and left hanging. Usually something or someone is identified as being to blame, (government official, merchant, weather) but no analysis or line of attack to solve the problem is developed.

The underlying need in this situation is slowly and patiently to break down the attitude of passive acceptance of difficulty, injustice or disaster as inevitable consequences of a way of life, and replace it with a more active seeking for solutions. To do this contact must be

frequent, informal, prolonged and based on a growing trust. It is very rarely possible for any technical resource person to combine this role with his own. Teaching people how to perform certain functions in a more disciplined efficient manner requires a very different approach from that of helping them to think analytically for themselves. Yet analytical thinking is the basis fo improved management and it is only in the context of improved management that technical knowledge and skill can be usefully applied. The last sentence is the most important statement of this section. Only if applied on sound management principles is technology any use.

IF TEAMS BEHAVIOURAL MODEL



Selection Procedure and Criteria

The criteria for and methods of selecting people for the IF teams will be critical to the success of this operational unit of the Project.

A variety of people are needed, of both sexes, some Thai and some of representative ethnic minorities, mainly Karen. The importance of this diversity should not be overlooked; there is no doubt that the possibilities for success will be greatly enhanced if both sexes and all groups understand the Project and what it can offer them.

Every effort must be made to select candidates who already have the basic qualities and ideas expressed in the Behavioural Model attached. In such case the training function is to strengthen and reaffirm the candidate in tendencies which are already present, a task much easier of achievement than toinculcate fully through training alone.

In addition to those qualities the candidates need to be in sound metal and physical health and their work is exhausting, particularly in the emotional sense.

The education standard of the candidates should be as high as possible, provided that in seeking for educational qualifications the selectors do not lose sight of other qualities--native intelligence, imagination and sensitivity--which, given the necessary minimum of education, qualify the individual to do excellent work. The emphasis needs to be on flexibility and individual selection rather than on formal qualifications alone.

Essential Curriculum for Pre-Entry Training of I.F. Team Candidates

The curriculum for pre-entry training for the IF teams needs to cover 3 main areas of knowledge. These are:

1. a methodology for systematically building up understanding of the basic features of the target population

2. a capability to use techniques of group dynamics in helping people

3. a knowledge of the precise technical resources available to village people through the Project and how these can be used by them to help themselves.

The basic requirements in these 3 areas are listed for convenience. Precise details are provided to ensure adequate coverage.

1. Target population studies
   - social values
   - way of life and customs
   - leadership system, i.e. authority structure and main sources of ideas.
   - indigenous technology i.e. health, agriculture, etc.
   - the special language terms related to the above.

N.B. This study should emphasize the need for Change Agents to take these important ideas habits and attitude into account in the course of their work.

The responsibility of the Training Team is to give the students an outline of what they must find out and know about their own target population in order to do their work, and also to give them the techniques for learning it. Getting the actual information should be the candidates private responsibility, but some opportunity for field work on this subject must be given in the training program and the results evaluated.

2. Techniques of group dynamics

- leadership identification techniques, e.g. sociograms, cross-check questions.

- how to conduct surveys in people identification of consensus problems.

- how to involve people in analysis and reaching agreement on ways of attacking consensus problems.

- techniques for the conduct of useful large and small group meetings.

- techniques to achieve villager evaluation of project resources.

- techniques for majority review of minority opinion with the objective of reaching consensus or acceptance of some alternatives.

N.B. It is very important to avoid the development of destructive sub-groups.

In listing the most important techniques it is not intended that these should be regarded as separate from each other. A useful meeting where people arrived at a willingly agreed upon decision might need to employ all or most of them.

3. Knowledge of technical resources available.

- know in general what technical resources the Project provides.

- how to evauate the relative usefulness of <u>specific</u> resources for <u>specific</u> village needs and in <u>what order</u> different forms of assistance should be sought. (using consultation with technical personnel).

In particular detailed studies should be made of the following:

- ricebanks
- rural credit availability and administration
- land development assistance
- small scale irrigation development assistance
- forms of cooperative organization
- agricultural research and extension assistance.
- family planning and health care services
- malaria control operations
- adult education programs

Training of Interface Teams - Prototype Course Outline -

The course outline set out below should be used as a basic for discussion; as noted in the heading it is offered as a prototype only in which role it may be useful.

12 week course in Chiang Mai Teachers College. First 5 weeks, basic principles at practical level as far as can be arranged.

Course objective for this section:

- To familiarize students with the fundamental principles and useable techniques of consciousness--raising and the development of group dynamism among isolated traditional conservative communities.

- To give students a feeling of group identity in sharing this knowledge and technique in a professional spirit.

Subject headings suggested

1. The methodology of group dynamics.

2. The psychology of isolated traditional socièties.

3. Cultural differences, with special reference to the communication of ideas and innovations i.e. importance of differing rationales and expectations etc.

4. Principles of education - educational needs of rural people, useful methods in non-formal adult education basic literacy program organization etc.

5. Psychology of development.

Course divided into lecture outlines and student participanting programs with time for preparation of students own notes. Testing.

Sixth Week. Fieldwork in Mae Chaem. Students go as far as possible to the Tambol where they will be working at the end of the course. Introduction to Tambol Council and to village people must include a clear explanation of the role of the IF teams by the staff members accomapnying the students to the fieldwork. Reinforced by the students in informal discussions. Students assigned to sleep in villages by arrangement learn about village socio-economics, take notes, write a structured report on previously identified topics on return to Chiang Mai.

Last 6 weeks: Operational training

1. Study of RTG agencies as they will/do operate in Mae Chaem. DOLA, RFD, DLD, DAE, DA, PWD, and agencies involved in delivering social services. Their Role, and How they operate What their objectives are in Mae Chaem. Students make small administrative handbook for selves in hard covered notebook. Checked by staff, corrected by students.

2. Operations of a Rice Bank. How a village gets one, what they must understand and do, what project must understand and do, how to borrow rice, how to pay back, how to maintain the RB in existence, who should run it, how to reward them, how to deal with defaulters, why have one?

3. Operation of a credit system. How to apply for a loan, interest payments, what money can be borrowed for, repayment system, how to use loan money to increase income. Individually secured lending/borrowing, group secured lending/borrowing. Commitments and defaulting.

4. Organization of irrigation development. How to apply for scheme, land identification and release by RFD, role of DLD, villagers, IF teams, in Planning, and construction, employment conditions.

5. Organization of terrace development Criteria and organization of land capability survey, land tenure terms on which RFD will allot land to farmers, basic for allocating, i.e. who has priority? What does he have to do to apply for land? How must he develop it before getting his certificate to hold it?

7. Relevant agricultural knowledge <u>for the role of If teams.</u> - What research is being done into important needs, upland rice, wet rice, livestock, annual crops, perennial crops. Who is doin it? Where? Market information and to get it.

8. Primary health care

9. Non-formal teaching methods and skills, especially literacy training.

10. How to teach basic subjects to villagers who request them.

Objective of this last five weeks is to make these young people informed as well as sympathetic--not only willing but able. Aware of how the Project works, the issues, the constraints and the limitations.

This would be a useful means of giving them the dual understanding needed by interface teams.

Resource people for this course might be drawn from:

- The Government agencies to be deployed in Mae Chaem, and already there.
- The TC Department, MOE
- TAHAP
- TALD
- CMU
- YMCA Chiang Mai
- etc.

I. PROJECT CHECKLIST

A. General Criteria for Project

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	The project was included in AID's 1980 Congressional Presentation as a $5.0 million project.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Agreed plans and firm cost estimates are incorporated into the Project Paper.
3. FAA Se. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No further legislative action is required.
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	All appropriate standards and criteria have been met.

5. FAA Sec. 611(e). 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?	Project is not for capital assistance.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
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.	The project is not designed to have any significant effect on any of these items.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	See above, Sec. 601(a)

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 U.S. are utilized to meet the cost of contractual and other services.	The Royal Thai Government contribution to this project will exceed 25 per cent. These are no U.S. owned local currencies available for this project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FAA Sec. 601(e). 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 productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?	The project is not for this purpose.

B. Funding Criteria for Project

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-	(a) The project is intended to directly involve the rural poor of the project area and will provide a basis (e.g. integrated land and inputs) for widespread participation in the benefits of development.

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

(b) The project will help organize farmer organizations and (c) Will promote local participation in the development and implementation of project components. (d) The Project is not directly targetted on women but should promote their participation in the national economy by improving the general economic levels of the project area. (e) The outcome of the project may be useful to other countries with major watersheds in the region.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph 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;

The Project Purpose is to increase the income of the rural poor.

(2)	(104) for population planning under sec. 104(b) or health under sec. 104(c); if so, ex tent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poor est 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.	N/A
(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: (i) technical cooperation and development, especially with U.S. private and voluntary,	N/A

	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 programs 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.	
c.	(107) Is appropriate effort placed on use of appropriate technology?	N/A
d.	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 for a "relatively least-developed" country)?	Yes, per the PP Financial Plan.

e. 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 the recipient country "relatively least developed"?	This is not a capital project.
f. 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 resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.	This project is designed to be directly responsive to felt development needs of the rural poor. Attention is given to developing local institutions (e.g. rice banks) and to provide basic skills (e.g. literacy training) needed to effectively participate in governmental and political processes essential for self-government.
g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?	Yes, these are major objectives.
2. Development Assistance Project Criteria (Loans only)	
a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.	N/A

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 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

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D.C. 20523

THAILAND

NORTHEAST SMALL SCALE IRRIGATION

493-0312

ANNEXES

August 1980

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AMERICAN EMBASSY BANGKOK PROJ: 493-9/5

UNCLASSIFIED

CN: STATE 325280

Annex A

PID Approval Cabl

Date Received 28 DEC 1978

DEC 28 7 30 A

ACT	DISTRIBUTION	INFO
	D	✓
	O/FIN	✓
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E.O. 11206 N/A

TAGS:

SUBJECT: NORTHEAST SMALL SCALE IRRIGATION (493-0312)

REFS: (A) BANGKOK 32418; (B) STATE 211710

1. THE ASIA PROJECT ADVISORY COMMITTEE (APAC) MET DECEMBER 12, 1978, AND APPROVED THE SUBJECT PROJECT AS AN FY 80 SHELF ITEM WITH THE UNDERSTANDING THAT, IF SUFFICIENT FUNDING IS NOT AVAILABLE IN FY 80, THE PROJECT WILL BE INCLUDED IN THE FY 81 PROGRAM. IN THE APAC'S VIEW, USAID/T SHOULD PROCEED WITH DEVELOPMENT OF THE PP.

2. AS A RESULT OF AN EARLIER REVIEW OF THE SUBJECT PID BY THE PROJECT COMMITTEE (PC) ON DECEMBER 5, 1978, A NUMBER OF CONCERNS WERE DEVELOPED FOR AN ISSUES PAPER FOR THE APAC. THESE INCLUDED THE FOLLOWING ISSUES WHICH SHOULD BE TAKEN INTO CONSIDERATION IN PROCEEDING WITH PROJECT DESIGN:

....A- WITH REGARD TO PARTICULAR PROPOSED AID-FINANCED INPUTS, WHAT IS THE RATIONALE FOR AID FINANCING THE COSTS OF CONSTRUCTION OF ON-FARM DISTRIBUTION SYSTEMS, IN ADDITION TO THE CONSTRUCTION OF SECONDARY SYSTEMS AND APPURTENANT FACILITIES AT THE TANK SITES? ASSUMING THAT MOST OF THE COSTS OF CONSTRUCTING ON-FARM DISTRIBUTION SYSTEMS ARE IN FACT LABOR COSTS, THIS COMPONENT SHOULD BE A FARMER/VILLAGE CONTRIBUTION TO THE PROJECT OR, IF IT PROVES IMPOSSIBLE TO GENERATE SUFFICIENT FARMER SUPPORT DURING THE PROJECT DESIGN PHASE, AN RTG INPUT.

....B- ALTHOUGH THE APPARENT RATIONALE FOR AN AID-FINANCED IRRIGATION PROJECT IN THE NORTHEAST IS THE NEED TO MOTIVATE AN RTG INSTITUTIONAL INTEREST IN WATER UTILIZATION AS WELL AS WATER DEVELOPMENT, 80 PERCENT OF PROPOSED AID FINANCING IS FOR CONSTRUCTION WHILE ONLY 12 PERCENT OF PROPOSED AID FINANCING IS FOR THE COSTS OF PROVIDING TECHNICAL ASSISTANCE. USAID SHOULD CONSIDER ATTEMPTING TO MINIMIZE THE AID CONTRIBUTION TO CONSTRUCTION WHILE INCREASING THE LEVEL OF AID FINANCING FOR RESEARCH AND PROJECT ACTIVITIES ADDRESSED TO INCREASING THE LEVEL OF FARMER INVOLVEMENT IN THE IRRIGATION SYSTEM.

WHICH PROMOTE FARMER COOPERATION AND VIABLE WATER USER ASSOCIATIONS; AIT, IN COLLABORATION WITH THE KASETSART UNIVERSITY SOCIAL SCIENCE FACULTY, IS REPORTEDLY INTERESTED IN CONDUCTING SUCH RESEARCH. IN PLANNING A RESEARCH COMPONENT, USAID SHOULD BE AWARE THAT THE ASIA BUREAU HAS PROPOSED AN INTER-COUNTRY EVALUATION OF IRRIGATION PROJECTS (IN BANGLADESH, INDIA, INDONESIA, PAKISTAN, THE PHILIPPINES, SRI LANKA), THE OBJECT OF WHICH WOULD BE TO GAIN INSIGHTS WHICH WOULD BE OF USE AGENCY-WIDE TO DESIGNERS AND PLANNERS OF SIMILAR PROJECTS IN THE FUTURE.

3. A NUMBER OF ADDITIONAL ISSUES WERE RAISED DURING THE COURSE OF APAC DISCUSSIONS OF THE PID. THE FOLLOWING CONCERNS ARE GERMANE TO PROJECT DESIGN:

....A- A CLEAR LINK BETWEEN PROPOSED PROJECT BENEFITS AND INTENDED BENEFICIARIES IS NEEDED. IN THIS REGARD, WHAT IS THE NATURE OF LAND HOLDING PATTERNS IN THE REGION? WHAT IS THE NATURE OF TENANCY? IN DEVELOPING BENEFICIARY LINKAGES, IT MAY BE IMPORTANT TO DEMONSTRATE WHETHER BENEFICIARIES ARE TILLERS OR LAND OWNERS. IF LAND OWNERS PREDOMINATE, DATA ON SIZE OF LAND HOLDINGS, ETC. WOULD BE DESIRABLE.

.. B- IT IS AID/W'S UNDERSTANDING THAT THE FORD FOUNDATION IS CURRENTLY SUPPORTING A MAJOR STUDY OF IRRIGATION IN IS CURRENTLY SUPPORTING A MAJOR STUDY OF IRRIGATION IN THAILAND AT CHIANG MAI UNIVERSITY WHICH HAS AS ONE OF ITS PURPOSES A COMPARISON OF RTG WATER USER ASSOCIATIONS WITH PRIVATE, FARMER-INITIATED ONES. IS IT ANTICIPATED THAT THIS STUDY WILL YIELD PERTINENT INSIGHTS IN TIME FOR CONSIDERATION IN DESIGNING THE SUBJECT PROJECT?

....C- DOES THE SOIL IN THE PROPOSED PROJECT IMPLEMENTATION AREA HAVE A SUFFICIENTLY HIGH SALT CONTENT TO SUGGEST THE NEED FOR DRAINAGE FACILITIES AS IS THE CASE IN THE LAM NAM OON AREA? IF SO, WILL THE FARMERS MAKE SUFFICIENT LAND AVAILABLE FOR DRAINAGE FACILITIES? IN VIEW OF SERIOUS SALINITY PROBLEMS ASSOCIATED WITH AID-FINANCED IRRIGATION PROJECTS ELSEWHERE, ESPECIALLY PAKISTAN AND AFGHANISTAN, THIS FEASIBILITY ISSUE SHOULD BE ADDRESSED EARLY IN THE PROJECT DESIGN PROCESS.

....D- IN VIEW OF THE HISTORY OF DISINTEREST IN AND HENCE DETERIORATION OF IRRIGATION FACILITIES IN THE REGION, IT IS AID/W UNDERSTANDING THAT THE FORMATION OF WATER USER ASSOCIATIONS AND LEVYING OF WATER USER CHARGES TO SUPPORT MAINTENANCE ARE PLANNED TO ASSURE THE CONTINUING INTEREST IN THE PROPOSED IRRIGATION SYSTEM ON THE PART OF AFFECTED FARMERS. HOW DOES USAID PLAN TO OVERCOME AN APPARENT RELUCTANCE ON THE PART OF THE THAI FARMER TO PAY FOR WATER?

....E- THE CURRENT FOCUS OF THE SUBJECT PROJECT ON RICE CULTIVATION DESPITE THE DIFFICULTIES OF GROWING IT IN THE AREA IS APPARENTLY THE RESULT OF A USAID VIEW THAT THE PRIMARY EFFECT OF INCREASED WATER AVAILABILITY WILL BE AN INCREASE IN RICE OUTPUT FOR CONSUMPTION BY PROJECT BENEFICIARIES. IN AID/W'S VIEW, THIS GOAL MAY BE TOO NARROW. USAID SHOULD EXPLORE AND PP SHOULD ADDRESS THE FEASIBILITY OF INCLUDING A SECONDARY CROP PROMOTION COMPONENT IN THE PROJECT FOR THE PURPOSE OF ENCOURAGING THE RAISING OF CASH CROPS WHICH MIGHT ENHANCE THE DEVELOPMENT OF THE AREA.

....F- ISSUE OF THE NEED FOR AN EA WAS RAISED DURING THE APAC BUT NO DECISION WAS MADE IN THIS REGARD IN VIEW OF BILL ACKERMAN'S ABSENCE BECAUSE OF HIS ATTENDANCE AT AN ENVIRONMENTAL SEMINAR IN THAILAND. UNDERSTAND FROM ACKERMAN THAT DURING SEMINAR IT WAS AGREED THAT EARLIER NEGATIVE IEE WOULD STAND AND THAT THERE IS THEREFORE NO NEED FOR AN EA IN CONNECTION WITH THIS PROJECT.

4. DESPITE USAID EXPECTATION, REF. A, THAT PROJECT COSTS WILL BE LOWER THAN ENVISIONED WHEN SUBJECT PID PREPARED, PC, IN ITS MOST RECENT REVIEW OF THE PID; REITERATED ITS CONCERN THAT PROJECTED OVERALL AID FINANCED COSTS PER FAMILY OF THE PROJECT ARE HIGH. DURING APAC DISCUSSION OF THE PID, DON COHEN INDICATED THAT IF THE PROJECTED RATE OF RETURN FOR IMPROVEMENTS ON A SPECIFIC TANK WAS NOT AT LEAST

TEN TO FIFTEEN PERCENT, IT WOULD NOT BE INCLUDED IN THE PROJECT. COHEN INDICATED THAT BECAUSE OF THE VARIABILITY OF BOTH COSTS AND RATES OF RETURN, FEASIBILITY STUDIES ARE PLANNED SERIATIM. AID/W CONCURS WITH VIEW THAT RATE OF RETURN SHOULD BE MINIMALLY TEN PERCENT ON ANY GIVEN TANK SLATED FOR IMPROVEMENT UNDER THE PROJECT. VANCE

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ANNEX B.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: NORTHEAST SMALL SCALE IRRIGATION PROJECT 493-0318

Life of Project: From FY 80 to FY 86
Total U.S. Funding: $ 9.2 MILLION
Date Prepared: AUG 1980

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1) To improve the quality of life of the rural poor.	Measures of Goal Achievement: (A-2) Rural inhabitants of the Northeast receiving a greater proportion of increasing benefits from: 1. Continuing increase in acres cultivated and productivity of land. 2. Increase in cash earnings from cash cropping. 3. Increased participation in local level decision making.	(A-3) Government statistical reports, general and specific.	(A-4) 1. Government policy continues to support programs in rural development and equity improvement. 2. General economic growth continues at sufficient rate.
Project Purpose: (B-1) Establish a replicable approach and institutional capabilities for increasing agricultural income for small farmers within command areas of existing tank irrigation systems in Northeast Thailand.	Conditions that will indicate purpose has been achieved: End of project status: (B-2) 1. Cropped area in wet season increases by a minimum of 1000 to 14,000 hectares with cropping intensity of at least 125%. 2. Average net farm income increases by minimum of $50 to more than $1200 equivalent per household, with equitable distribution of benefits. 3. Training program for participating agency personnel and farmers based on project approach is instituted. 4. RTG plans to replicate approach in other sites.	(B-3) 1. Reports from RTG agencies active in the project. 2. Management information system reports. 3. Evaluation reports.	Assumptions for achieving purpose: (B-4) 1. Price structure for inputs/crops remains favorable and market demand attractive for project crops. 2. Farmers accept new techniques and risks associated with intensive agriculture. 3. Adequate labor available for dry season cropping. 4. Rainfall does not deviate drastically from average annual patterns during project. 5. RTG maintains commitment to rural areas of the Northeast and tank irrigation systems.
Outputs: (C-1) 1. Water delivery system rehabilitated/improved for seven sites. 2. O&M/Farm to market roads constructed. 3. Irrigation service centers established. 4. Water management and maintenance systems improved. 5. Agricultural support services and inputs adequately available at each site.	Magnitude of Outputs: (C-2) 1. Total improvements as follows: (a) Dam Inflall and diversion filters (m) 3,493 Riprap and filters (1,000 m³) 33 Aprons, sargent and weirs (100 m³) 33 (b) Main and Lateral Canals Lining (km) 173 Canal enlargement (km) 45 Excavation (km) 73 Turnouts (ea) 400 Checks (ea) 120 Regulators (ea) 60 Cross Drainage Structures (ea) 60 Bridges (ea) 60 (c) Sub-Lateral Canals 438 (d) Drainage Ditches (km) 70 2. 173 km of laterite roads along main canals; 60 km of laterite roads along lateral canals. 3. 7 irrigation service centers equipped and operating. 4. (a) Water user groups trained and functioning in support of farmers needs at 7 sites, (b) RID maintenance crews at each site, (c) consultant recommended O&M plan adopted. 5. (a) 16 trained irrigated agricultural specialists, (b) 16 trained extension agents, (c) BAAC providing credit, (d) demonstrations at all tanks, (e) crop insurance program tested at all tanks, (f) market support plans and research carried out at all tanks, (g) 14 farmer observation tours completed, (h) linkage with and multiplication project at all sites.	(C-3) Consultant and RTG reports, reviews and evaluations. Site visits.	Assumptions for achieving outputs: (C-4) 1. Social organizations of the villages will support self-help water users groups. Government irrigation policies will be consistent, clear, and stable. 2. Farmers will cooperate and assist with installation, operation and maintenance of ditches by providing labor and land as needed. 3. RID/DOAE establish cooperative relationship to carry out project. 4. Farmers accept new cultural practices needed for intensive agriculture.
Inputs: (D-1) RTG Budget for: Personnel stationed at tanks Extension program (DOAE) Research program (DOA) A&E services (RID) Construction contracts for main system (RID) Topographical survey (RID) Soil Survey (DLD) AID Funding for: Training Consultants Research support Crop insurance Educational/Publicity Program Construction of on-farm system Land preparation Evaluation Farmers: Labor Water use fees BAAC/Commercial Banks: Production credits	Implementation Target (Type and Quantity): (D-2) (See Financial Plan)	(D-3) Project records and vouchers (RTG and AID)	Assumptions for providing inputs: (D-4) 1. RTG personnel needs approved by civil service commission. 2. Budget needs approved by RTG. 3. Adequate numbers of trained, motivated persons found to work on project as consultants and technicians

BEST AVAILABLE COPY

Annex C

O/RD
C&R

PROJ: 493-312

No. Ac. 0205/

Received
11 AUG 1980

MINISTRY OF AGRICULTURE AND COOPERATIVES
Rajadamnern Ave., Bangkok
THAILAND

August 11, 1980

ACTION TO:
DUE DATE: 8-18-80
ACTION TAKEN: cable to AID/W
INITIAL: SW
DATE: 8/11/80

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

Dear Mr. Cohen:

During recent months officials of the Royal Thai Government and USAID have consulted about specific ways to improve productivity and farm income in the Northeast.

As the result of these discussions a project has been prepared entitled "Northeast Small Scale Irrigation". The Project would rehabilitate seven existing small reservoirs and their water distribution systems to include: construction of effective on-farm distribution systems; a land development component; intensive extension assistance; assistance to water users groups; marketing assistance; improved operations and maintenance programs; crop insurance; operational research and demonstrations; and training programs for farmers and MOAC personnel.

Thus, we are requesting that USAID provide concessional assistance to support this Project in the amount of US$8.6 million. Of this amount US$2.8 million in grant funds and US$5.8 million in loan funds has been estimated to be required. The total Project estimated cost is US$17 million.

As you know, RTG standard procedures require Thai Cabinet approval of the Project and its financing before an agreement can be signed. These procedures are in process and are expected to be completed in time to sign an agreement before the end of this fiscal year.

We would very much appreciate hearing from you at your earliest convenience.

Sincerely yours,

(Kangwan Devahastin)
(Deputy Under-Secretary of State)

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	TRG	
	EMB	
	C&R	✓

Annex D

Detailed Analyses Material

1. Technical Analysis (Agriculture)
2. Engineering Analysis
3. Social Analysis
4. Economic Analysis

Annex D Technical Analysis

Part 1 - Agriculture

ORGANIZATION AND TRAINING NEEDS FOR MEDIUM-SIZED IRRIGATION RESERVOIRS

Introduction

Numerous consultants from international banks, from research institutions and from aid organizations have cited the potential for using small- and medium-sized reservoirs for irrigation purposes in Northeast Thailand. Unfortunately, while more than 500 small, medium and large reservoirs and ponds have been built the full potential for use for irrigation has yet to be proven. In many instances the full potential cannot be realized due to the lack of necessary infrastructure. Yet, probably more importantly, the lack of proper operation and maintenance staffing and procedures has resulted in poor management of the water and has led to rapid deterioration of the systems. This poor management structure has discouraged adoption of irrigated agriculture such that very little of the potentially irrigated land under the medium-sized reservoirs is actually irrigated. In order to realise the potential of these reservoirs the management structure must be re-organized and the staff trained in operation and maintenance procedures. In addition, it is necessary to provide proper on-farm water management and agronomic extension services.

Staff Requirements

In order to manage a medium-sized reservoir in addition to a gatekeeper to operate the gate at the reservoir it is necessary to have management personnel at the main and secondary canal level as well as a water user group representative (common irrigator type) at the tertiary level of the system. There also must be a maintenance staff available both for preventive maintenance and regular repairs as well as for emergency repairs during the cropping seasons. Finally, it is necessary to have competent extension staff with training in irrigated agriculture and with a motivation to impact this training to the users of the system.

Obviously, unless the permanent staff are of sufficient quantity and have proper training it is not possible to manage and maintain the system. It seems necessary that, in addition to the gatekeeper, there is a minimum of two systems operations personnel coordinating the water demands from the main and secondary canals to the Chak outlets. If the system is very large there may be a requirement for additional operation personnel. Within the Chak there is a need for on-farm water management extension personnel as well as regular agronomic extension personnel. If the normal Chak is from 500 to 800 rai in area the on-farm water management and agronomic extension agents should be able to serve about ten Chaks. Yet even with this intensity of staff it is not going to be possible for the system to work effectively unless there exists a strong water users association including a properly trained common irrigator. The on-farm water management extension staff

will work very closely with these groups and help to train the common irrigators but it is probably necessary to also have one subject matter specialist (SMS) to help organize these associations initially. Finally, there must be a permanent maintenance crew stationed at each reservoir. Therefore for a system that has two main canals and serves from 20-24 Chaks the following staff are required:

Position	Number
Gatekeeper	1
System Operations Staff	2
On-Farm Water Management Extension Agent	2
Agronomic Extension Agent	2
Maintenance:	
Supervisors	1-2
Technicians	2
Laborers	4-6
Subject Matter Specialists*	
Water Management	1
Water Users Associations	1

If the system is larger additional staff will be required, but even if it is smaller this is probably the minimum staff required to manage the system. After the system is working properly and the common irrigators are well trained it will be possible to reduce part of the extension input assuming the regular extension agent from the tambon can provide some of the required services. The subject matter specialists will be rotated to another set of reservoirs once they have trained their respective staff and have established the necessary working procedures.

Staff Training

The majority of the young engineering technicians working for the Royal Irrigation Department (RID) have received their training at RID's School of Irrigation. The zoneman and common irrigators have a much less formal training program and thus are even less prepared for the demands of their position. Unfortunately, even this limited training is not very applicable to on-farm water management needs of the medium-sized reservoirs nor has RID shown much interest in improving the operation of these systems. Recent research has already demonstrated that there exists a significant gap between the needs of water users within the Chak and the schedule of releases followed by the gatekeeper.

In many instances the gatekeeper simply opens the gates or he waits for a specific request from a farmer. In either case the system

---

*To work on a number of systems depending upon location and scheduling.

is not being operated optimally. The first individual that needs to be trained is the gatekeeper himself. He needs to learn something about plant-water requirements, irrigation delivery system efficiency and about the inflow/outflow patterns for his particular system. Once the gatekeeper understands the fundamentals of water demand than working closely with the operations staff, the water management extension agents and the water management subject matter specialist the supply side can be scheduled without too much difficulty. The formal training for gatekeepers should take about two-three weeks with another two weeks of on-the-job working with the other personnel in the system developing and modifying the tentative operation schedule. However, the gatekeeper must also learn to very carefully monitor the water flowing in the system as well as the water leaving the system in order to learn the unique characteristics of his reservoir system. This knowledge will allow him to modify his schedule from year to year as appropriate for that year's rainfall/runoff pattern.

The systems operations personnel have perhaps the most difficult set of tasks particularly if the system is operated so that water is rotated within the irrigated area. During each dry season given the amount of water stored the systems operations personnel are going to have to determine the limits of the system to be served. Within this system they are going to have to decide on the most efficient rotation system and are then going to have to see that the water is rotated to serve all the water needs of the users within the different Chaks. This is going to require very careful coordination with the other systems operation personnel, with the gatekeeper and with the common irrigators for each Chak. And, of course, the systems operation personnel will have to work closely with the maintenance staff in order to schedule maintenance so that it has the least impact on the use of the irrigation system.

The training for the systems operations personnel should include modules on crop-water demand, schedule rotation development, systems coordination, maintenance supervision, water management, drainage, irrigation techniques and farmers organizations. This training should take about eight weeks with about six weeks of formal training divided roughly into two week segments related to: (1) systems scheduling and operation, (2) water measurement, maintenance and drainage, and (3) irrigation techniques and working with farmer organizations. The last two weeks of training should be on-the-job training in their system where they put their training to use under close supervision both from the subject matter specialists and the concerned consultants.

The extension agents, both for the on-farm water management agent and the agronomic agent, must have specialized training in irrigation water management. In addition, the water management extension agents should have some idea about systems operations and drainage so they can explain the rotation and drainage systems to their farmers and also so they can help train the common irrigators. The training in on-farm water management should take about four weeks of formal

training and then there should be another two weeks of specialized training in systems and drainage operation. The final two weeks of training should include the common irrigators and, again, should be on-the-job practical training to begin to learn exactly what is required to operate their system within each Chak. The agronomic extension agents will need about two weeks of formal and informal training in market development and marketing.

The maintenance supervisors and technicians, in addition to their regular technical training, require training in maintenance scheduling and drainage repairs. They also need to have some knowledge of the operation of the system because they may need to slightly modify the distribution system where there are problem areas.

Training Materials and Sites

The regular extension training and zoneman orientation courses can be held at the normal sites as the location requires. However, the specialized training for the gatekeepers, the systems operation personnel, the extension agents and the subject matter specialists could require the development of a new training site. In the Philippines the National Irrigation Administration has established a center for training irrigation technicians (B.Sc. agriculture graduates) that has a one-year curriculum which includes systems operation, on-farm water management, maintenance scheduling and supervision and extension. Parts of this training course are applicable to the training needs for medium-sized reservoirs and an effort should be made to obtain all the training materials that are available from this center. The International Rice Research Institute (IRRI) in the Philippines organizes each year a 6-8 week training course in water management which is often run in conjunction with one of the IRRI rice production courses. The materials from both these courses should be obtained. In addition, as part of an RID-IRRI joint research project, a training course for training RID zonemen and watermasters in irrigated rice production and water management was organized in June-July, 1979 at Khon Kaen and Kalasin. The Thai language materials that were developed for that course are now with Khun Prasert Kanoksing at RID and if all goes as planned will be combined into a training manual in August, 1980. Tahal Engineering, as part of its Lam Pao contract with RID, has developed training materials for zonemen, common irrigators, and water user organizations. These materials should be obtained and evaluated for usefulness.

Probably the best site for the majority of the training is at the Experimental and Demonstration Farm for Irrigated Agriculture at Kalasin. This area receives its water indirectly from Lam Pao Dam via the medium-sized reservoir of Huey Sithon. Hence, the site can be operated as a reservoir irrigation system and therefore it is good for training gatekeepers, systems operation personnel and on-farm water management and agronomic extension agents. In addition, the farm itself has a controlled water delivery that is excellent for on-farm management instruction. Finally, hostel, classroom and dining facilities are available to accommodate the trainees and the staff. Other possible

sites include the Northeast Agricultural Research Center/Extension Training Center at Tha Phra, the Community Development Regional Training Center in Ubon, the Nong Wai Project Center outside of Khon Kaen, the RID facilities at Lam Pao Dam and perhaps at Huey Seng reservoirs outside of Roi Et. However, none of these sites have all the facilities that are available at Kalasin.

In order to make this program work the training should be a joint RID-Extension Department exercise. RID can provide some of the staff from the School of Irrigation particularly from the Department of Irrigation Engineering and Irrigation Agronomy as well as experienced staff from the RID [illegible] centers such as Khun Nukul Tongtavee at the Khon Kaen RID Center. Extension can provide training personnel from the Tha Phra training center such as Dr. Thanya Terasart who is very interested in water user organizations. Extension and maintenance personnel from the NEA small-scale pumping schemes could also play a valuable role in the training. If approached through RID it might be possible to persuade someone such as Dr. Al Early from the IRRI Water Management Section to help organize and run the first training course building on his experience with the course he helped organize in 1979 at Kalasin.

BEST AVAILABLE

Terms of Reference for

On-Farm Water Management/Agronomic Extension Staff

Much of the management of the system should be the shared responsibility of a water management and agronomic secialist assisted by Tambon Agents.1/ Since these specialists can best estimate the crop water requirements and the system's irrigation efficiency, they should schedule the water distribution and allocation. Their management and operational responsibilities are as follows:

1. - Water Management Specialist: His duties are similar to those of an irrigation engineer. He would assume responsibility for the conveyance, distribution and allocation of all water below the dam. Thus, based on both the crop and variety need, the cultivated area, and water availability, he schedules the distribution of water on a rotational basis such that each farmer receives his equitable share. Additionally, he must assure that the system efficiently conveys water, that the system allows precise water control, and that the water is efficiently utilized for crop production.

To achieve efficient water management he must project, from the available supplies both the potential wet season and dry season irrigable area and deliver the required amounts of water on a timely basis. This requires knowledge of potential evapotranspiration (Ept) and crop coefficients (Kc) for both rice and various upland crops, the system's delivery efficiency, the probability of rainfall and rainfall intensity, effective rainfall, soil permeability, and the soil field capacity (FC) and wilting point percentages, etc.2/

This water management specialist must advise farmers on the amount of water to apply, when to apply, and how to apply within the limits of the rotational delivery system. Essentially he is in charge of the planning, operation, and

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1/ The number of Specialists and Agents on the tank system will be established at a ratio of 1:400 farm families, minimum.

2/ While most of the required information is not presently available for each tank, all except Ept, Kc, and precipitation probabilities can be determined by the water management specialist.

utilization of the irrigation system. He will consult and cooperate with RID engineers in the release and allocation of water particularly for irrigation (some tanks also provide water for city and village use), for flood control, in regard to maintenance and closure, and the duties of the zone man and water master concerning the opening and setting of gates and checks.

It is anticipated that system operation experience may dictate the need for changes, relocation, extension of channels and structures within the command area. The water management specialist must be able to design and supervise all additionally required construction. To assure continued efficient operation of the system he must advise on cleaning and maintenance procedures. In scheduling maintenance his maintenance request and needs must be complied with first.

Additionally, the water management specialist must understand and be able to fulfill the duties of the agronomic specialist listed below. Each of these specialists must be able to substitute for the other in order that supervision and assistance is always available at the command site.

To perform in this above capacity, this specialist must possess a command of the following disciplines: (1) surveying and mapping, (2) open channel design, (3) water measurement including conveyance, delivery, and application efficiency, (4) soil intake measurements, (5) calculation of crop water requirement - both rice and upland crops, (6) determination of soil textures, wilting point and field capacity percentages, (7) meteorological measurements and interpretations, in terms of evapotranspiration, effective rainfall, (8) field irrigation techniques including application rates, etc., (9) moisture conserving cultivation practices (10) construction techniques, (11) principles of cleaning and maintenance.

2. - Agronomic Specialist: This specialist's duties concern the activities in the field. In particular his concern is soil and crop management but overlaps with the water management specialist in on-farm water management. In effect his duties are most closely aligned with those of an agronomist and soil scientist.

Specifically, he advises farmers on their cropping patterns and crop varieties recommended for both wet and dry season production. Recommendations should reflect present and projected market demands, farmers family requirements, soil and climatic suitability, and water utilization. The

latter refers to prefering those crops with shorter maturity periods and minimal water requirements in order to conserve water for greater dry season cultivation. Continuing, this specialist advises the farmer on planting date, seedbed and soil preparation, seeding rates and plant spacing, fertilizer and lime requirements and time of application, water requirements and application frequency and methods, use of pesticides and herbicides when required.

Additionally, this specialist must play a lead role in demonstrating to farmers the advantages of improved water management and agronomic techniques. He would select various progressive farmers with which to work on their land within the command site, establish demonstration plots with various crops, water, fertility and other management treatments which demonstrate their yield advantages. Sites would be so selected and marked to allow maximum exposure and information for other farmers in the command area.

To fulfill these duties the agronomic specialist must be knowledgeable in the following disciplines: (1) soil fertility and nutrient availability, (2) soil pH and liming requirements, (3) soil physics and soil physical properties including the role of organic matter in improvement of soil physical properties, (4) identification of crop disease, insect, and nutrient problems and their preventive and remedial treatments, (5) crop and variety selection and adaptability to the soil and climatic conditions, (6) plot design and layout, (7) extension techniques, (8) statistical analysis, etc. This agronomic specialist must be knowledgeable in all disciplines required of the water management specialist.

Despite what appears as formidable subject matter requirements, it is felt these responsibilities could be managed by selected graduates of a 5-year vocational agricultural curricula. Their field and classroom training would emphasize methodologies with but a minimum of theory. One of the primary products of the technical assistance would be a system's operational handbook which would outline in detail, step by step, the methods and procedures required in operating all phases of the system and which will serve as a guide in fulfilling their day-to-day job responsibilities. Additional assistance and advice will be available to them from the DOAE's regional water, soils, and crops subject matter specialists.

Their training as described elsewhere consists of a one year period of mixed classroom and "on-the-job" experience. At the end of this period, continued back up training and assistance will be available from the technical advisor on an "as-needed" basis. While both specialists will receive similar training, the difference will be in the intensity of their field application. The water management specialist field training will emphasize primarily water problems while the agronomic specialist will concentrate on soils and crops.

TABLE D1-1 - PRECIPITATION, PAN EVAPORATION, AND TEMPERATURE AT SEVEN TANK SITES

	Mean Annual Precipitation (mm)	Mean Annual Class A Pan Evaporation (mm)	TEMPERATURE (°C)		
			Average Monthly Mean	Warmest Monthly Mean	Coolest Monthly Mean
Huai Khi Lek	1,960	1,940	-	-	-
Huai Aeng	1,411	1,863	27.2	29.7 (May)	23.3 (Dec)
Phuttha Utthayan	1,495	2,154	26.5		
Huai Kaeng	1,376	1,863	27.2	30.6 (Apr)	23.6 (Dec)
Lam Chamuak	1,210	1,925	26.2	28.7 (Apr)	22.2 (Dec)
Huai Chorakhe Mak	1,300	2,273	27.0	29.6 (Apr)	23.4 (Dec)
Huai Talat	1,621	2,273	27.0	29.6 (Apr)	23.4 (Dec)
MEAN	1,481	2,041	26.9	-	-

TABLE D1-2 - General Characteristics of Tank Command Area Soils

No.	TANK	SOIL SERIES	CLASSIFICATION 1. USDA - 1970 2. National	SOIL TEXTURE	EFFECTIVE SOIL DEPTHS (cm)	COLOR PROFILE	STRUCTURE a. Upper A - horizon b. Subsoil	SLOPE (%)
1.	Huai Talat	Roi Et Loamy Variant	1. Aeric Paleaquults 2. Low humic gley soils	Fine sandy loam or silt loam over clay loam.	>150	Pale brown or brown with Reddish yellow or strong brown mottles over light Brownish grey with yellow brown or yellowish mottles.	a. Weak fine and medium subangular blocky. b. Strong medium and coarse subangular blocky.	0-1
2.	Huai Charakhe Mak	"	"	"	"	"	"	"
3.	Phuttha Utthayan	Roi Et (Mixed Series)	1. Aeric Paleaquults 2. Low Humic	Loamy sand, sandy loam over sandy clay loam or sandy clay.	"	Dark grey with dark brown and yellowish brown mottles over light brownish grey.	a. Weak fine and medium subangular blocky. b. Moderate medium to coarse subangular blocky.	0-3
		Korat	1. Oxic Paleustults 2. Grey Podzolic Soils	Sandy loam over sandy clay loam	"	Very light grey or brown over brown or pale brown.	a. Weak medium subangular blocky. b. Moderate medium and coarse subangular blocky.	0-3
4.	Huai Aeng	Korat	"	"	"	"	"	"
		Ubon	1. Aquic Dystropepts 2. Hydromorphic Regalsols	Loamy sand over sandy loam grading to sandy clay loam below 80 cm.		Dark grey to very dark grey with dark yellowish brown mottles over light brown with strong brown mottles.	a. Weak subangular blocky or single grain. b. Moderate subangular blocky breaking to single grain.	0-3

TABLE D1-2 - (Cont'd)

No.	TANK	SOIL SERIES	CLASSIFICATION 1. USDA - 1970 2. National	SOIL TEXTURE	EFFECTIVE SOIL DEPTHS (cm)	COLOR PROFITE	STRUCTURE a. Upper A - horizon b. Subsoil	SLOPE (%)
5.	Huai Khilek	Korat	--------- Similar Characteristics as Korat Nos. 3 and 4 above ----------					
6.	Huai Kaeng	Roi Et	Same as No. 3 above.	Sandy loam over sandy clay loam.	>150	Same as No. 3 above.	a. Moderate fine and medium subangular blocky. b. "	0-3
7.	Lam Chamuak	Korat	Same as Korat Nos. 3, 4 and 5 above.	Same as Korat Nos. 3, 4 and 5 above.	"	Very dark grey or brown over brown or pale brown.	Same as Korat Nos. 3, 4 and 5 above.	0-3

TABLE D1-2 - (Cont'd)

No.	a. Drainage b. Permeability c. Surface runoff	Period of Water Saturation a. Surface b. Subsurface	Organic Matter 0-30 cm (%)	C.E.C. meq/100 grams a. 0-30 cm b. >30 cm	Base Saturation (%) a. 0-30 cm b. >30 cm	Available Phosphorus (PPM of P) a. 0-30 cm b. >30 cm	Available Potassium (PPM of K) a. 0-30 cm b. >30 cm	pH a. 0-30 c b. >30 c
1)	a. Poorly b. Slow c. Slow	a. 3-4 months b. Ground water level between 2-3 meters for 3-4 months in dry season	Very low 0.35%	a. Moderate low 6.75 b. Medium 14.1	a. Medium 47.0 b. Low 24.0	a. Very low 2.50 b. Very low 2.54	a. Very low 22.0 b. Low 39.9	a. 5.5 (5.0-6.5 b. 5.2 (4.5-6.0
2)	"	"	"	"	"	"	"	"
3)	a. Poorly b. Rapid over moderate c. Slow	a. 20-30 cm of rain water impounded 3-4 mos. b. G.W. falls below 2-3 m in dry season	High 3.6%	a. Moderate low 5.2 b. Moderate low 6.1	a. Medium 36.8 b. Medium 48.7	a. Very low 0.6 b. Very low 0.6	a. Low 31.1 b. Low 44.9	a. 5.3 b. 5.3
	a. Moderately well b. Moderate c. Rapid	Ground water below 1 meter for most of year	Low 1.0%	a. Low 3.4 b. Low 3.5	a. Low 25.4 b. Low 33.5	a. Very low 1.9 b. Very low 0.6	a. Very low 24.2 b. Very low 23.8	a. 5.0 b. 4.9
4)	"	"	"	"	"	"	"	"
	a. Moderately well b. Rapid c. Slow	a. Rain water impounded 2-3 months b. Ground water level drops to 4-5 meters during dry season	Low 0.85%	a. Very low 1.1 b. Very low 1.2	a. Medium 48.6 b. Medium 42.6	a. Very low 0.52 b. Very low 0.83	a. Very low 21.8 b. Very low 21.0	a. 5.5 (6.0-6.5) b. 5.5 (7.5-7.8)

TABLE D1-2 - (Cont'd)

No.	a. Drainage b. Permeability c. Surface runoff	Period of Water Saturation a. Surface b. Subsurface	Organic Matter 0-30 cm (%)	C.E.C. meq/100 grams a. 0-30 cm b. >30 cm	Base Saturation (%) a. 0-30 cm b. >30 cm	Available Phosphorus (PPM of P) a. 0-30 cm b. >30 cm	Available Potassium (PPM of K) a. 0-30 cm b. >30 cm	pH a. 0-30 c b. >30 c
5)	---------- Similar Characteristics as Korat Nos. 3 and 4 above ----------							
6)	a. Poorly b. Rapid over Moderate c. Slow	a. Rain water impounded up to 30 cm for 3-4 months b. Ground water level falls below 3 meters during dry season	Low 0.5%	a. Low 3.1 b. Low 7.6	a. Medium 49.4 b. High 76.2	a. Very high 46.9 (doubtful) b. Very high 62.7 (doubtful)	a. Very low 15.3 b. Low 49.3	a. 5.5 - 5.7 b. 6.4 - 6.9
7)	Same as Korat Nos. 3, 4 and 5 above	Same as Korat Nos. 3, 4 and 5 above	Low 0.5 - 1.0	Same as Korat Nos. 3, 4 and 5 above	Same as Korat Nos. 3, 4 and 5 above	a. Low 5.4 b. Moderately low 6.7	a. Very low 18 b. Very low 19.3	a. 5.5 - 6.0 b. 5.2 - 5.5

Table D1-3 - Cropping Recommendations for Field Crops

Crop	Growing Season	Crop Duration (Days)	Nursery Period	$N-P_2O_5-K_2O$ Kg/ha	Planting Method	No. of Irrigations	Cultural Practices	Average Yield Mt/ha
Rice: RD-1 RD-2	July-Nov	< 140	4 weeks starting mid-June	60-60-40 split nitrogen	Sow nursery in beds. Transplant at 15 cm. x 15 cm.	Maintain 5 cm. water level	Puddle Soil 2-3 times in June. Cultivate 3-4 times.	4.06
Rice: RD-5	"	< 160	"	"	Sow nursery in beds. Transplant 15 cm. x 20 cm.	"	"	4.00
Rice: N. Sanpathong	July-Dec	> 160	5 weeks starting in June	40-30-20 split nitrogen	Sow in nursery. Transplant 20 cm. x 25 cm.	"	"	3.5
Rice: RD-1, RD-2	Jan-May	< 140	4 weeks starting mid-Dec.	60-40-20 split nitrogen	Sow in nursery. Transplant 15 cm. x 15 cm.	"	"	5.0
Corn: Super Sweet	Monsoon Dry season	65 75-80		46-20-25 split nitrogen	Plant in ridges, 2-3 seed/hill	2-4 at 2-4 week intervals	Weeding 4 times. Drain in monsoon.	25,000 green cobs
Sorghum: Early Hegari	Dry season Feb-April	85-90		90-90-60 split nitrogen	Plant in ridges 50 cm. x 15 cm.	4 irrigations at 2-4 week intervals	Weeding 4 times. Ratooning possible.	3.0-4.0

Table D1-3 Continued

Crop	Growing Season	Crop Duration (Days)	Nursery Period	$N-P_2O_5-K_2O$ Kg/ha	Planting Method	No. of Irrigations	Cultural Practices	Average Yield Mt/ha
Peanuts: Tainan No. 9 Tainan No. 6 SK 38	Dry season			20-60-40 preplant	Spacing 50 cm. x 15 cm.	4-6 light irrigations	Moderate liming	1.6-3.0
Soybeans: S.J.-2	Dec-April	90-115	-	20-40-40	Plant spacing 50 cm. x 20 cm. 2-3 seed/hill	4-5	Inoculate seed.	1.9-3.1
Cotton: Delta Pine BTK-12	Nov-April	150-160	-	75-75-40 split nitrogen 3 applications	Plant on ridges 100 cm. x 45 cm.	3	10-12 spraying for pests	1.9-2.5
Jute: JRC-321 Burma	Mar-June	90		50-50-25 split application	Plant spacing 30 cm. x 10 cm.	Flood one month after sowing + 2 more light	Thin to 10 cm. 3 weeks after sowing. Weed out ridge 2 times	1.9-2.5
Mungbean: M-7-A	Nov-April	85-90		20-60-40 preplant	50 cm. x 20 cm. on ridge. 30 cm. x 20 cm. on flat beds.	3	Thin, weed, hoe and ridge	1.9
Sweet Potato: D.S.-Huey Sithon W.S.-Guatemala	Nov-May	120		50-50-100 preplant in dry season	Plant on ridges 100 cm. x 30 cm.	2-3	Lift vines	

Table D1-4 - Area Under Cultivation in Hectare within Each Project Area According to Crop Types and their Percentage (Dry Season) (Percentages are given within brackets)

Cultivated Area / Project Area	Total Area Cultivated	Area Under Rice	Area Under Oil Seeds	Area Under Water Melon	Area Under Sweet Corn	Area Under Vegetables	Area Under Kenaf	Area Under Others	Total Area Cultivated as a % of Rainy Season Cultivated Area
Huai Talat	5.79 (100.0)	5.76 (99.53)	- -	- -	- -	- -	- -	0.03 (0.47)	2.42
Huai Chorakhe Mak	16.59 (100.0)	16.35 (98.55)	- -	- -	- -	0.08 (0.48)	- -	0.16 (0.96)	16.09
Phuttha Utthayan	6.96 (100.0)	0.80 (11.50)	- -	1.02 (0.15)	3.48 (60.06)	1.49 (21.46)	- -	0.16 (2.30)	5.29
Huai Aeng	20.47 (100.0)	2.93 (14.43)	2.92 (14.24)	8.64 (42.14)	4.88 (39.41)	0.74 (3.61)	0.32 (1.60)	0.04 (0.19)	14.11
Huai Khi Lek	13.65 (100.0)	1.12 (8.21)	3.28 (24.04)	0.40 (2.93)	1.22 (8.95)	5.56 (40.78)	1.76 (12.90)	0.31 (2.20)	14.38
Huai Kaeng	9.38 (100.0)	- -	8.32 (88.68)	0.88 (9.40)	0.08 (0.85)	0.06 (0.67)	- -	0.04 (0.43)	9.32
Huai Lam Chamuak	22.76 (100.0)	- -	14.84 (65.20)	- -	- -	1.04 (4.57)	0.48 (2.11)	6.40 (28.12)	15.70
Total:	95.60 (100.0)	26.96 (28.29)	29.36 (30.71)	10.94 (11.44)	9.66 (10.10)	8.97 (9.38)	2.56 (2.68)	7.14 (7.47)	7.42

Table D1-5 - Average Yield of Paddy and the Different Varieties (Mt/Ha.) For Each Tank

Paddy Variety / Project Area	TNG	RNG	TG	RG	Mixed	Weighted Average
Huai Talat	1.9	2.0	-	-	0.4	1.9
Huai Chorakhe Mak	1.7	1.5	1.2	1.3	1.1	1.6
Phuttha Utthayan	1.6	1.5	1.5	1.7	0.9	1.6
Huai Aeng	0.4	1.1	0.7	1.6	1.7	1.2
Huai Khi Lek	1.4	1.5	1.7	1.5	1.3	1.6
Huai Kaeng	2.5	3.3	1.5	1.5	1.2	1.5
Huai Lam Chamuak	2.1	2.4	2.2	2.6	0.3	2.0
						1.6

TNG = Traditional Non-Glutinous Variety
RNG = Recommended Non-Glutinous Variety
TG = Traditional Glutinous
RG = Recommended Glutinous

PART 2 ENGINEERING ANALYSIS

A. Irrigation System

1. Existing Situation

The seven tank systems included in the Project were all constructed as part of an RTG tank construction program which began in 1951. Since the program began, 181 tanks have been completed ranging in capacity from less than one million cubic meters to as much as 35 million cubic meters. Of these, 146 are primarily for irrigation and 35 for domestic water supply.

For a number of reasons, discussed more fully elsewhere in this PP, the irrigation potential of the tanks has not been fully realized. Not the least of these is the fact that the irrigation system infrastructure has never been completed at any of the tanks. An essential component to a successful project is to complete these systems so that every irrigator can get water where and when (at least during the wet season) he needs it.

The seven project tanks have drainage areas ranging from 62 to 180 square kilometers giving them enough inflow to provide for at least 80% of the supplemental irrigation needs during the wet season except for Huai Chorakha Mak, which has only enough for about 56%.

The percentage of the potential irrigable area which is being effectively irrigated is shown in Exhibit D2-1. There appears to be little relationship between the amount of runoff inflow to the tanks and the area actually being utilized for irrigation in the projects. For example, Huai Talat has the highest runoff amount but is actually irrigating only 21% of the potential area. This compares to Huai Chorakhe Mak which has a very low runoff but has one of the higher utilization rates at 56%. There seems to be, however, a high correlation between the percentage of the existing canal systems which is lined versus the rate of utilization as is illustrated in Exhibit D2-1.

From the descriptions given in the AIT feasibility study, it would indeed seem to be the case that the effective water delivery is limited to the lined reaches of the canal. Most of the unlined portions suffer from being washed out, being filled with sediment, having excessive

seepage losses, or being damaged by livestock crossing or wallowing in the canal.

Even in the area covered by the lined portions of the canals, however, there are problems of too few turnouts and lack of distribution systems other than ineffective paddy to paddy flow. Many illegal turnouts have been dug through the canal dikes, but the effective irrigation is usually limited to the area nearby the main and lateral canals. There does not appear to be a strong tradition of cooperation via the paddy to paddy approach as is found in a few other Asian countries and the downstream farmers complain that their upstream neighbors are often unwilling to release water to them when they need it.

2. Recommended Improvements

The recommended improvements to the irrigation infrastructure include rehabilitation of the embankments, repairing and extending the lining on the main and lateral canals, constructing more turnouts, adding more cross drainage culverts and drainage inflow/outflow structures, constructing checks and regulators in the canals, building more bridges for people and livestock crossings, designing and constructing a complete on-farm distribution system, providing for laterite surfaced roads along the main and lateral canals, and designing and constructing a service center building at each of the tanks. Scale drawings of each of the seven sites with canal improvements sketched in are included in Appendix One of this Annex.

a. Embankments

Generally the embankments are being adequately maintained by RID and for only three of them are any improvements suggested (See Table II-1). Even these improvements are not critical to the stability and safety of the embankments and, consequently, it is not necessary to the integrity of the Project that these improvements be made in the immediate future. RID may wish to schedule the suggested improvements according to their regular maintenance schedule.

b. Main and Lateral Canals

In most of the systems, the main canals had been designed and constructed to adequately cover the desired area. Some new laterals need to be added but primarily

what is needed is to rehabilitate the main and lateral canals by excavating the areas which are filled with silt and fill in, compact and trim the sections where flood flows and cross drainage have washed out the dikes or scoured the channel making it too wide and rough.

Lining is recommended for all the main and lateral canals for the following reasons: 1) these are light, sandy soils and the seepage losses in the unlined reaches have been observed to be extremely high, 2) these light soils also scour badly during times of excessive flows resulting in canals sections which are too wide and rough and are hydraulically inefficient, 3) because of a generally low priority for maintenance, the effective life of the unlined canals has been quite short, and 4) it is more difficult for farmers to make illegal turnouts when the canal is lined. Typical drawings showing the dimensions of the lining are shown in Exhibit D2-2. Lining is the largest single RTG budget item for the infrastructure improvement, but AID belives that it is essential for the development of a maintenable system. It can be seen from the existing situation that the only effective irrigation being done in these systems is from the lined sections.

A large number of structures must be added to the mains and laterals to make the system effective. Typical drawings of the structures are shown in Exhibit D2-2. For better control and distribution of the water, enough new turnouts will be added to reduce the distance between them to an average of 300 meters instead of the existing 400 to 500 meters. There will be a number of check structures built in the canals in order to stop the flow of water and to raise its level. Additional regulating structures will be provided at the critical junctures of the canals. Many more cross-drainage culverts and drainage inflow/outflow structures will be constructed and in some cases the natural drainage ways will be enlarged. Cross drainage has been one of the major problems on the systems, causing washouts, scouring, and sediment build ups. Where the canal goes through a cut section and there is considerable flow into the canal from the adjoining high ground, interceptor ditches will be provided to divert these flows to the neatest culvert. A number of wooden bridges spanning the canals will be built to eliminate the damages done by livestock climbing up and down the canal sides.

The AIT feasibility study recommended that laterite-surfaced roads be constructed alongside the main and lateral canals to allow for easier access for maintenance and, in some cases, to provide better farm to market access for the farmers. AIT specified four-meter wide roads along the main canals and three-meter wide roads along the laterals. AID agrees that a surfaced roadway is essential alongside the main and lateral canals to provide for better maintenance, but there is some question as to whether roadways of these widths are necessary unless they are also utilized as a farm-to-market road. AID believes that in most cases a narrower roadway sufficient for a notorcycle would suffice. Since this is a costly item on the RTG funding side, it is suggested that the roadway width requirements for each system be reassessed during the detailed design phase.

c. On-Farm System

The most pressing need on all of the systems is to improve the on-farm distribution of the irrigation water once it leaves the main and lateral canals. As mentioned before, no provision was made in the original RID designs for the provision of teriary, quaternary and on-farm canals and drainage so that the individual farmer can control the flow of water to his plots. This was not an oversight on the part of RID, but, in fact, it was the policy at that time that the farmer should be able and willing to finish the system. This was an almost universally held concept in Asia for many years but it has now been recognized to be invalid in most cases.

The Project will provide for sub-lateral canals served by the turnouts on the main and lateral canals which will carry water to an area ranging from 100 to 300 rai. From these sub-lateral canals, which will be a triangular or trapezoidal unlined ditch, ranging in top width from one-half to three fourths of a meter, will emanate sufficient smaller ditches to carry water to, and from, each farmer's land. In order to accomplish this, particularly in the steeper sections, it will be necessary to do some rearranging of the parcels and their bunds, to do some minor land leveling and to provide adequate drainage to all areas. It is impossible to predict the exact amounts and costs of this on-farm development without having the detailed topographic surveys[1/], the land classification, and the detailed designs. However, the unit costs are correlated with the various slopes occurring in

1/ The topographical maps will be at least to the scale of 1:5000 with a contour interval of 25 CM. The surveys should be done with a plane table and should define all the rice field boundaries as well as the existing watercourses and drainage ways.

the systems and are well substantiated by projects now underway - notably the Chao Phya Irrigation Improvement Project. The distribution of slopes and the cost extensions are given in Exhibit D2-3. The final project costs, of course, will be based upon detailed designs.

d. Maintenance

The maintenance facilities at the tanks are inadequate and underfunded. There are not enough technicians, laborers or vehicles and there is hardly any budget for materials. AIT recommends that each maintenance crew have a technician in charge, two inspectors, and a laborer for each two kilometers of main or lateral canal. They also specify, two motorcycles and one vehicle per site as well as increased budget for materials. AID fully agrees that upgrading the maintenance capability at each tank is essential to prolonging the life of the system and will urge RID to increase its maintenance budget. On the other hand, maintenance of the main and lateral systems will be greatly facilitated by the completed lining, by the provision of access roads, and by improvements in the drainage system. Also, with the addition of two full-time extension agents to each system, there will be much more pressure on the maintenance crews to perform.

AID recommends and AIT agrees that RID should be responsible for maintaining the embankments, the main and lateral canals and the major drainage ways while the farmer groups should be responsible for maintaining the sub-lateral canals and the on-farm systems. This should be made clear to and agreed to by the farmers at the outset of the project. But until a viable farmer organization is in place, RID may have to assume responsibility for maintaining the whole system temporarily if farmers efforts initially fall short of minimum maintenance requirements.

e. Service Centers

As a final item of infrastructure, a service center building will be designed and constructed at each tank. These centers will be primarily to provide offices for the two extension agents to be stationed at each tank and to provide a meeting place for the various farmer activities, such as Water User Group meetings and for training and instruction to be offered by the extension services.

The buildings will be simple concrete slab and concrete block structures with minimum furnishings and an outside latrine. A sketch and cost breakdown for the structure is contained in the Financial Annex.

3. Technical Analysis of Water Balance

AIT did a suitably rigorous water balance analysis for each system based on average rainfall and evaporation values. The pertinent data used in the water balance is shown in the Technical Agricultural Analysis.

As can be seen from Exhibit D2-4, the outlooks for substantial amounts of dry season cropping are not promising, and for Huai Chorakhe Mak, only a 56% capability is predicted for the wet season. It is AID's belief that this analysis by AIT is on the conservative side. AIT assumed an overall irrigation efficiency of 40% which is a good figure to use for the present situation. However, with lined mains and laterals and with improved irrigation practices, this efficiency should increase. The total acreages which can be irrigated would increase considerably with an efficiency of 60%. Experience in the past has shown that these efficiencies are attainable under good management.

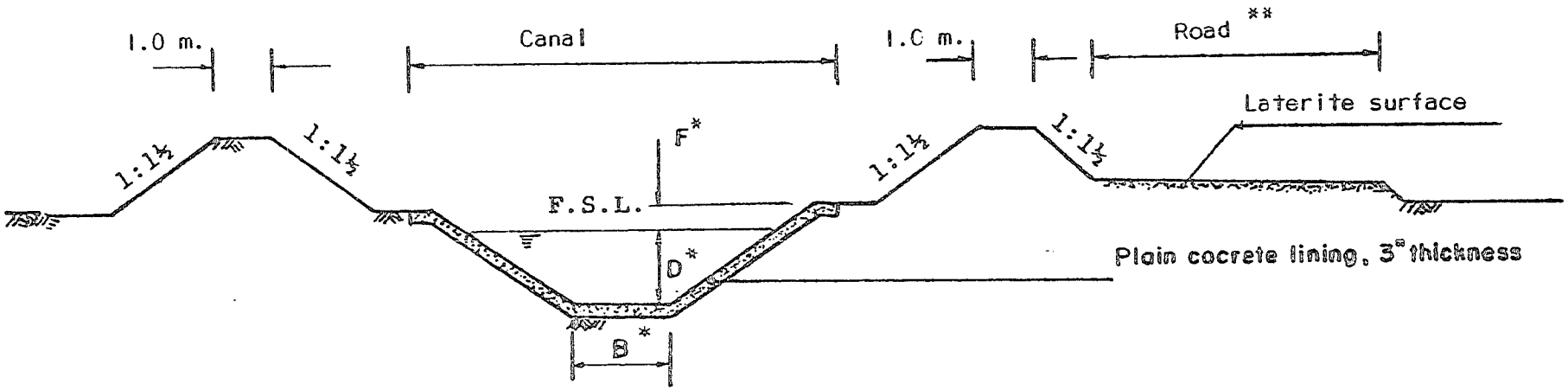
Other practices can be improved to save water. For example, at four of the tanks, the rice planting begins in June even though the wet season usually begins in May. Exhibit D2-8 demonstrates that the water requirement is reduced considerably if the planting is begun a month earlier. In the case of Huai Chorakhe Mak, moving the planting date to May and increasing the rice mix of long duration and short duration varieties from 50% - 50% to 40% - 60% respectively, the water requirement is reduced enough to enable the irrigation of an additional 1,000 rai in the dry season. With the provision of an assured water supply for irrigation in May, this change could most likely be implemented.

Condition of Existing Irrigation Systems

Tank	Drainage Area (Km^2)	Active Storage (Mm^3)	Inflow to Tanks (Mm^3/Yr)	Potential Irrigable Area 1/ (Ha.)	Area Effectively 2/ Irrigated in 1979		Length of Main and Lateral Canals (Km.)	% of Mains and Laterals Lined
					(Ha.)	% of Potential		
Huai Talat	153.0	18.53	69.71	2,240	480	21	40.30	23
Huai Chorakhe Mak	96.3	20.35	31.76	2,000	1,120	56	30.05	67
Phuttha Utthayan	62.0	14.56	25.60	2,560	770	30	18.50	11
Huai Aeng	147.5	21.00	46.63	3,070	1,840	60	22.75	65
Huai Khilek	80.6	22.20	43.52	1,440	420	29	30.15	19
Huai Kaeng	149.0	35.22	46.61	2,400	960	40	41.96	65
Lam Chamuak	180.0	22.19	43.56	2,160	1,410	65	22.30	65
TOTALS	706.4	154.05	307.39	15,870	7,000	44	206.01	45

1/ Irrigable area within command of present system as designed.
2/ AIT estimate.

Exhibit D2-1



* *Variable*

** *4 m. width on main canals; 3 m. width on lateral canals.*

TYPICAL CANAL SECTION WITH ROAD

Exhibit D2-2

Land Preparation Costs

Tank	Area vs. Slope			Costs (US$1,000)			
	0-2% (Ha.)	2-4% (Ha.)	4-6% (Ha.)	0-2% Slope	2-4% Slope	4-6% Slope	Total
Huai Talat	2,240	0	0	347.2	0	0	347.2
Huai Chorakhe Mak	1,120	0	0	173.6	0	0	173.6
Phuttha Utthayan	2,095	145	0	324.7	90.6	0	415.3
Huai Aeng	3,040	0	0	471.2	0	0	471.2
Huai Khi Lek	930	380	130	144.2	237.5	162.5	544.2
Huai Kaeng	1,790	465	145	277.5	290.6	181.2	749.3
Lam Chamuak	1,490	240	0	230.9	150.0	0	380.9
TOTAL	12,705	1,230	275	1,969.3	768.7	343.7	3,081.7

Unit Costs Used: 0-2% slope - $310/ha. for one-half the area; 2-4% slope - $625/ha.; 4-6% slope - $1,250/ha.

Recommended Irrigable Area with Improved Systems

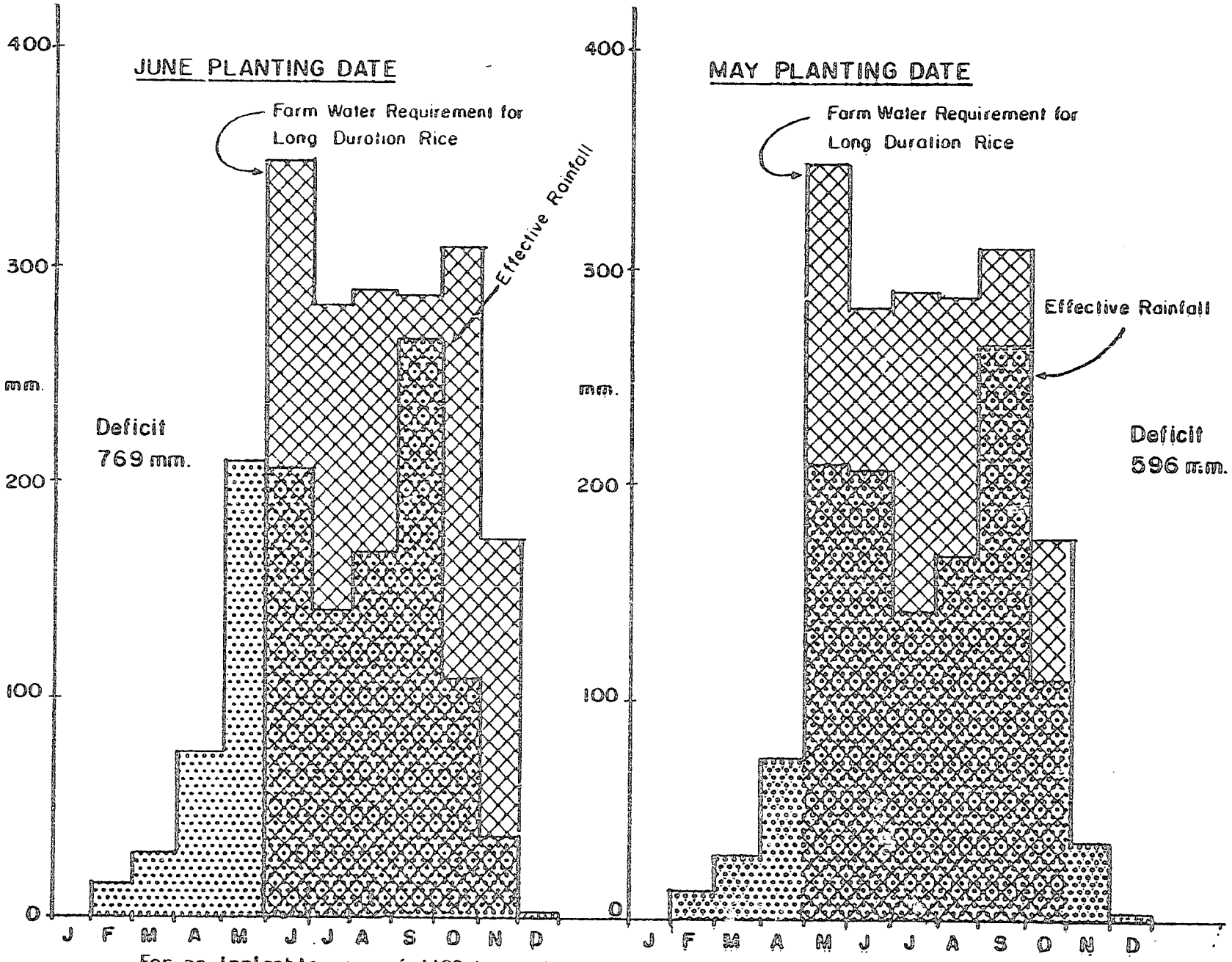
Tank	Potential Irrigable Area (Ha.)	Recommended Irrigable Area with Improved System (Ha.)			% Potential Irrigable Area Recommended by AIT		Start of Planting (Month)
		Wet Season		Dry Season	Wet Season	Dry Season	
		1/	2/				
Huai Talat	2,240	900	1,340	880	100	39	June
Huai Chorakhe Mak	2,000	450	670	160	56	8	June
Phuttha Utthayan	2,560	900	1,340	0	88	0	May 1/ June 2/
Huai Aeng	3,070	1,220	1,820	1,250	99	41	May
Huai Khi Lek	1,440	580	860	1,440	100	100	May
Huai Kaeng	2,400	960	1,440	1,600	100	67	June
Lam Chamuak	2,160	690	1,040	0	80	0	June
TOTALS:	15,870	5,700	8,510	5,330			

1/ Long duration rice

2/ Short duration rice

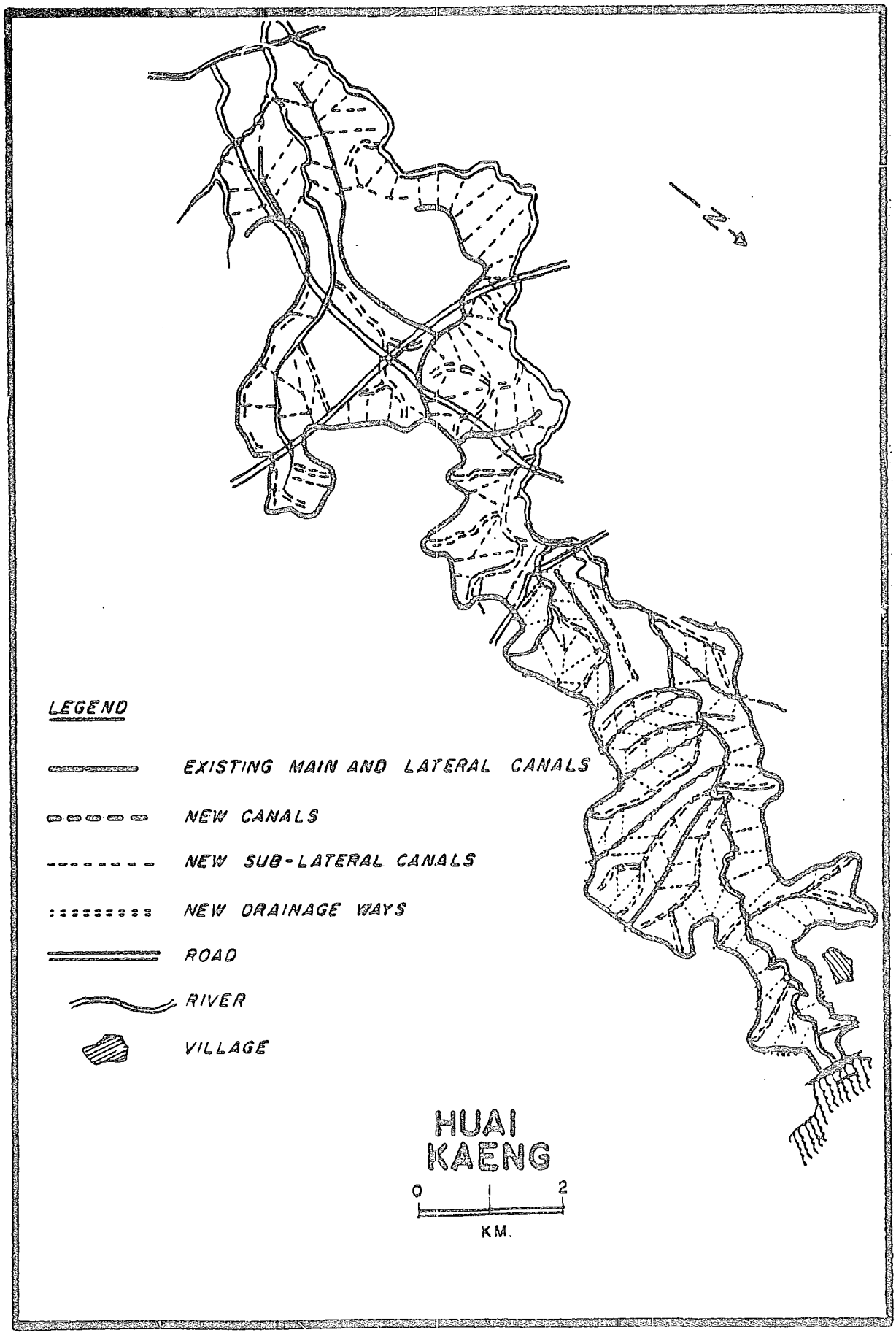
Exhibit D2-4

SAVINGS IN FARM WATER REQUIREMENT BY SHIFTING PLANTING DATE - HUAI CHORAKHE MAK



For an irrigable area of 1120 ha. this would be a savings of 1.94 $Mm.^3/Yr$

Exhibit D2-5


LEGEND
EXISTING MAIN AND LATERAL CANALS
NEW CANALS
NEW SUB-LATERAL CANALS
NEW DRAINAGE WAYS
ROAD
RIVER
VILLAGE
HUAI KAENG
0
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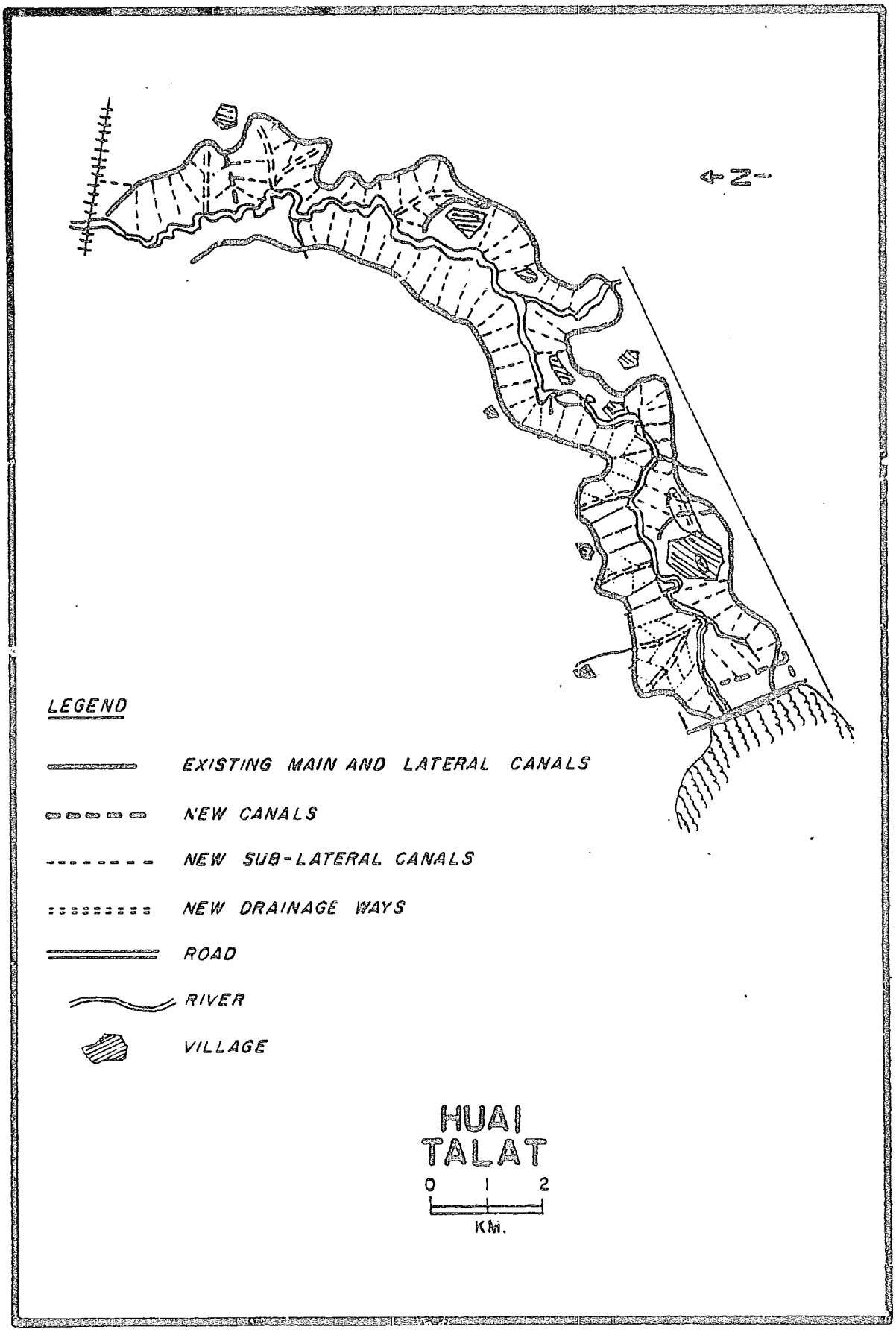
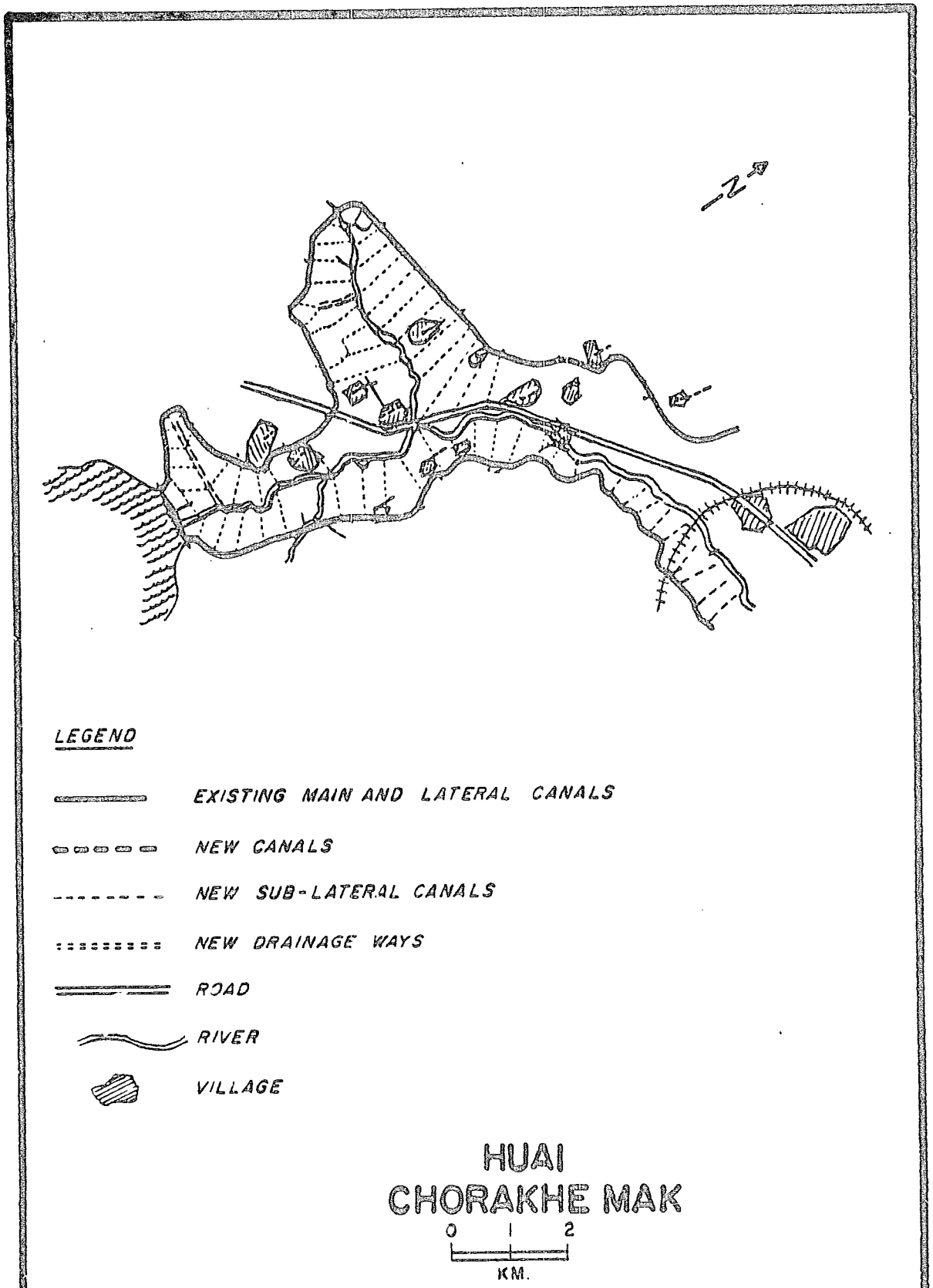
2
KM.


LEGEND
EXISTING MAIN AND LATERAL CANALS
NEW CANALS
NEW SUB-LATERAL CANALS
NEW DRAINAGE WAYS
ROAD
RIVER
VILLAGE
HUAI TALAT
0 1 2
KM.


N
LEGEND
EXISTING MAIN AND LATERAL CANALS
NEW CANALS
NEW SUB-LATERAL CANALS
NEW DRAINAGE WAYS
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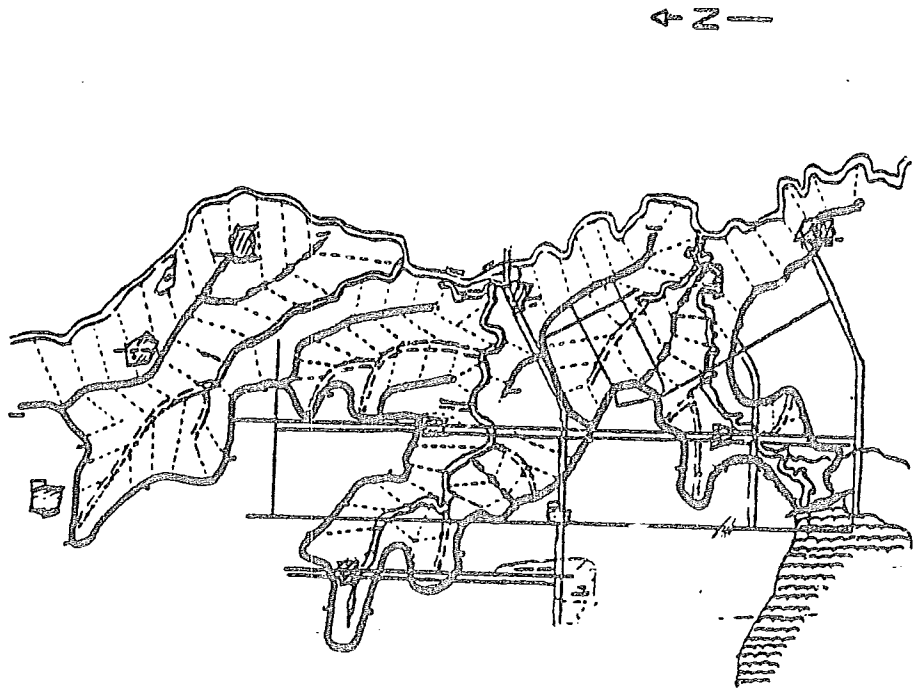
VILLAGE
HUAI
CHORAKHE MAK
0 1 2
KM.



LEGEND

EXISTING MAIN AND LATERAL CANALS

NEW CANALS

NEW SUB-LATERAL CANALS

NEW DRAINAGE WAYS

ROAD

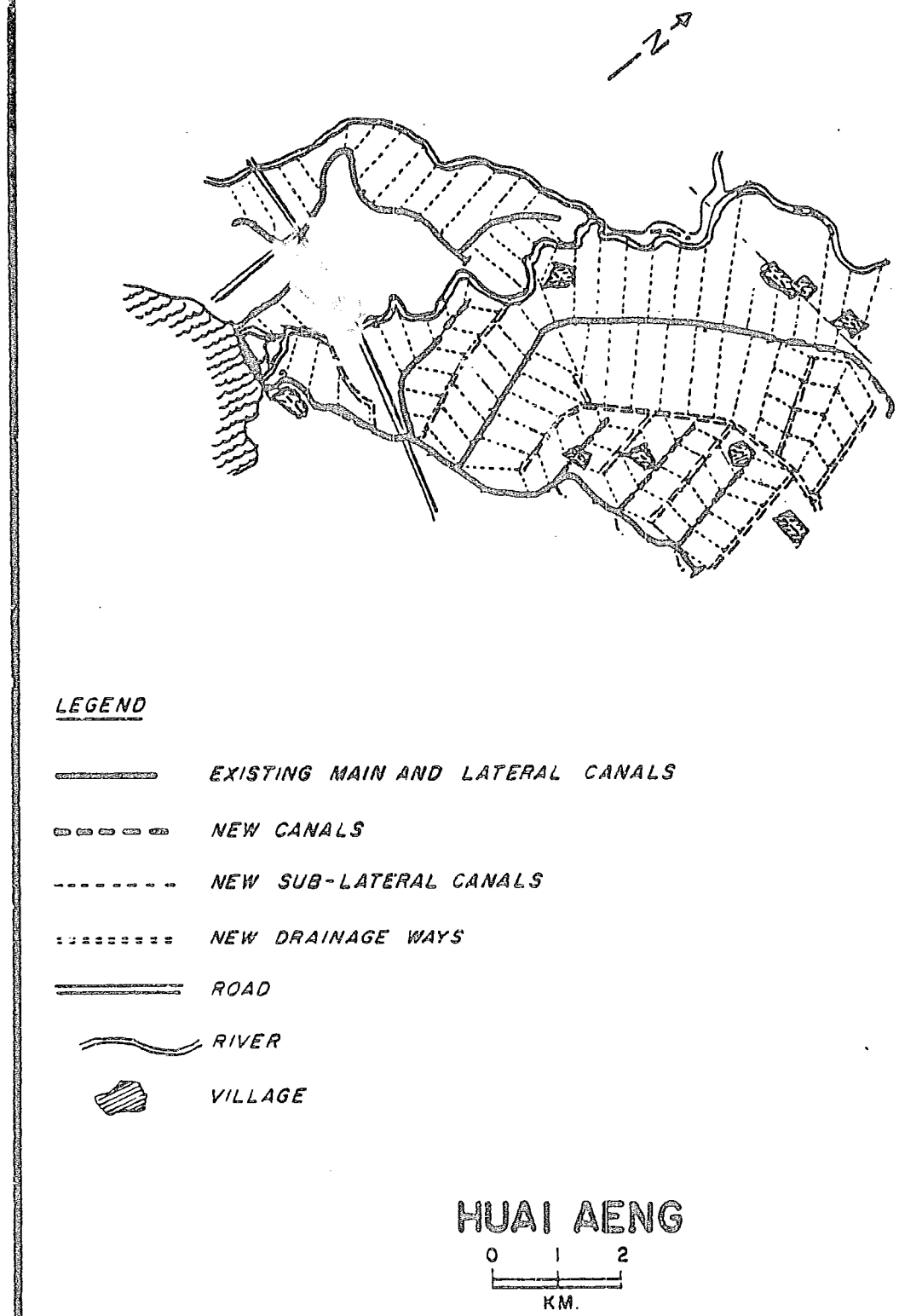
RIVER

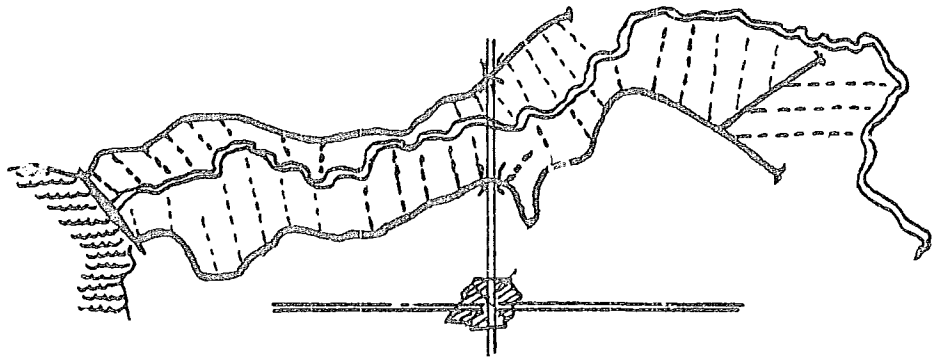
VILLAGE

HUAI KHI LEK

0 1 2

KM.


N
LEGEND
EXISTING MAIN AND LATERAL CANALS
NEW CANALS
NEW SUB-LATERAL CANALS
NEW DRAINAGE WAYS
ROAD
RIVER
VILLAGE
HUAI AENG
0 1 2
KM.



LEGEND

EXISTING MAIN AND LATERAL CANALS

NEW CANALS

NEW SUB-LATERAL CANALS

NEW DRAINAGE WAYS

ROAD

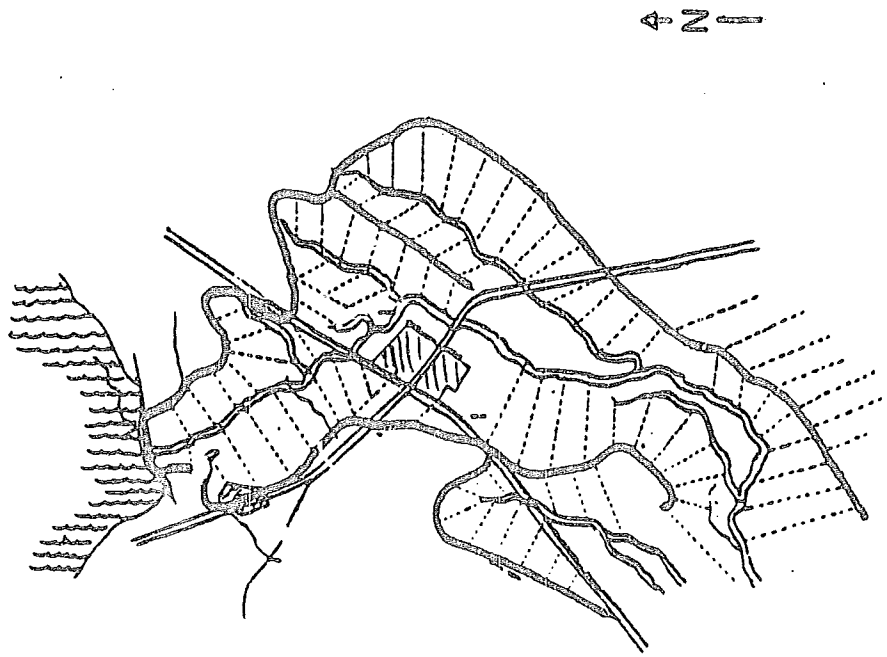
RIVER

VILLAGE

Lam Chamuak

0 1 2

KM.



LEGEND

EXISTING MAIN AND LATERAL CANALS

NEW CANALS

NEW SUB-LATERAL CANALS

NEW DRAINAGE WAYS

ROAD

RIVER

VILLAGE

PHUTTHA UTTHAYAN

0 1 2

KM.

ANNEX D.

PART 3 - SOCIAL ANALYSIS

A. Beneficiaries: Present Characteristics

The beneficiaries of this project are some 40,000 people living within the potential service area of seven medium-scale irrigation dams in Northeast Thailand. Culturally, the population of these service areas is in the main Northeastern Thai (Lao-Isan) but some Cambodian-descended peoples are also involved in some of the southern-most areas. The majority of the population can speak serviceable Central Thai language (the Cambodian-descended peoples seem to insist on speaking it with outsiders, even though many of them are also fluent in Lao-Isan). The vast majority (99%+) are Buddhists although a few Christian families can be found.

In terms of education, the beneficiaries approximate recognized Thai education profiles, although some interesting anomalies exist. For example, while only 90% (of those past primary school age) have not completed fourth grade (literacy level), nearly 30% have studied beyond the fourth grade (more than the national figure). Heads of household, however, usually in their mid-forties, only average about 5 years educational attainment.

The beneficiaries population shows the fertility rates that have characterized the Northeast in the recent past (Table 1). About 29% of the population is age 10 and under, average household size being 7.3 persons (average household labor force is 5.0 adult equivalents). Also, the 11 to 20 age bracket contains a further 29% of the population, indicating that there are likely to be serious land shortage problems over the next ten years unless intensification occurs. This points out the timeliness for the present project. While average farm size among beneficiaries (about 35 rai) ought to be able to support a somewhat expanded population if yields are increased through irrigation, irrigation is not being effectively utilized despite the nearby water supply.

It is instructive to compare the beneficiaries population with the average (rainfed agricultural) population of the Northeast in more detail. To do this three variables have been chosen: land value, gross crop sales, and off-farm income (Table 2). A fourth variable, as a proxy for income, is the household sum of off-farm income and gross sales. This approximates average net income (which includes in-kind income) but may be 15 to 20% lower in actual baht figures than the more laboriously computed net annual income. Table 2 shows that on most dimensions of comparison, the beneficiaries of the project are not now much better off economically than their rainfed-agricultural neighbors. Allowing for an inflation factor and using the data quoted in the 1980 CDSS, and assuming that the 4th variable in Table 2 is a surrogate for about 50% of real net income,* we can posit that any household below the surrogate income of ฿8,000/year/household (7.3x1,800x 1.2x.5) is below the level of "absolute poverty" as defined by the World Bank. From the last section of Table 2, then, we can assume about 57% of the beneficiaries population is in this group, compared with 64% of the "outside" population nearby. This is near the accepted percentage of rural Northeasterners in "absolute poverty" (60%). It seems reasonable then to assume that the project is indeed targetted on an appropriately needy population. The one glaringly anomalous statistic is land value. Why land within the project area should be valued so much higher than outside land may reflect more the aspirations or preconceptions of the owners than real productivity value (compare land value with crop sales in Table 2), or it may reflect the surveyor's opinions about the value of irrigated land.

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*(c.f. economic analysis. Surrogate average is about ฿10,500 whereas overall average net income is about ฿20,000 (฿15,000 net farm income plus ฿5,000 off-farm). Surrogate does not have farming costs subtracted out to get net sales income, but does not include income, but does not include income from cottage industries, livestock, income in kind, i.e. home consumption, etc.).

Table 1

Beneficiaries Population Age Distribution*

Age (Years)	% of Population
0 - 5	14.6
6 - 10	13.9
11 - 15	15.7
16 - 20	13.3
21 - 25	8.5
26 - 30	5.4
31 - 35	4.1
36 - 40	4.6
41 - 45	4.8
46 - 50	4.8
51 - 55	3.1
56 - 60	3.0
61+	4.2
	100.0

(Average Household Size = 7 3 persons).

* (Not computed by sex, but sample population did show approx. same number of males and femals, 49.4% males, 50.6% females).

Table 2

Comparison of Project Beneficiaries with Those Nearby But Outside the Project Area (i.e. with Typical Northeastern Rainfed Farmers)*

SELECTED VARIABLES

Values of Household Variables for Comparison	% of Households in Variable Range	
Land Value (Baht)	Beneficiaries	Outsiders
0 - 10,000	9	18
10,000 - 30,000	15	29
30,000 - 60,000	21	19
60,000 - 100,000	20	15
100,000 - 150,000	17	12
150,000 - 250,000	9	4
250,000 +	9	3
	100	100
Gross Crop Sales (Baht/Yr.)		
0 - 100	13	19
100 - 2,000	25	25
2,000 - 5,000	22	23
5,000 - 10,000	25	22
10,000 - 15,000	5	5
15,000 - 20,000	3	3
20,000 - 30,000	5	2
30,000 - 40,000	2	1
	100	100
Off Farm Income (Baht/Yr.)		
0 - 1	46	40
1 - 2,000	18	15
2,000 - 5,000	14	23
5,000 - 10,000	9	12
10,000 - 30,000	10	6
30,000 - 260,000	3	4
	100	100

Table 2 (Cont'd)

Off-Farm Income Plus Gross Crop Sales (Baht/Yr.) 1/	% of Households in Variable Range: Beneficiaries	Outsiders
0 - 1,000	5	11
1,000 - 3,000	18	14
3,000 - 5,000	16	21
5,000 - 8,000	18	18
8,000 - 15,000	21	22
15,000 - 30,000	15	10
30,000 - 260,000	6	5
	99	101

1/ (Computed another way: Among beneficiaries the bottom 40% average 2,600 ฿/Household, the top 10% average 54,000 ฿/Household; among outsiders the bottom 40% average 2,300/฿/Household, the top 10% average 51,400 ฿/Household.)

* Based on Sample surveying by AIT, Project beneficiaries for this Table defined as anyone holding land within the potential irrigation service area, even if most of their land is elsewhere. Outsiders defined as having no land at all within potential irrigation service area.

Table 2 also shows that in crop sales, the project beneficiaries are already doing somewhat better than their neighbors (e.g. 40% sell more than ฿5,000 worth of crops a year, versus 33% for the outsiders), but this is somewhat made up for by the outsiders in off-farm employment among "middle" income families (฿2,000 to ฿5,000 range), although the poor groups are again at a disadvantage. The last section of Table 2, however, shows that these discrepancies between beneficiaries and outsiders are not as serious as they seem: except for the very poor and the well-off who both fare somewhat better inside irrigation areas, the others make up for crop income with off-farm income and vice versa. Von Fleckenstein (1980) reached similar conclusions in comparing irrigated and rainfed farmers in the Northeast: the rainfed farmers had to work harder but their incomes were quite similar.

In terms of income stratification, the data in the footnote of Table 2 reveal two very important pieces of information. First, surrogate income is much more stratified than one might expect of rural Northeastern Thailand - the idea of the fairly uniformly poor Northeastern rural village seems to be contradicted by these findings. The top 10% of the households have about 20 times the average household income of the bottom 40%. Certainly some of this, but probably not most of it, is explained by differences <u>among</u> rather than <u>within</u> the various irrigation areas (see data in economic analysis). Second, stratification of beneficiaries population is quite similar to that of the nearby "outsiders," indicating that it is <u>not</u> the presence of irrigation per se that explains the unexpected degree of stratification. This raises questions about project feasibility and effects on the various groups (discussed below).

That the beneficiaries group may indeed have high hopes for irrigation and thus value their land more highly is reflected in attitude surveying conducted in the various areas. The vast majority of those expressing an opinion did see the advantages of irrigation for increased yields, labor saved, and livestock and fish-raising opportunities.

Of the beneficiaries population, the median age of the household head is 46 years. 95% are men (husbands). Women household heads were usually wives whose husbands were not present or occasionally daughters of former household heads. 92% of the household heads surveyed characterized themselves as fully occupied in agriculture. 5% said they were part-time farmers and only 3% did not farm. Nevertheless, only 26% of the households surveyed did not have someone working off the family farm for at least part of the year. 86% of the household heads worked their own (owned) fields, whereas about 11% used others fields free of charge (a common example is parents allowing children this privilege), and only about 3% had to rent land or mortgage their land. Finally, it may come as a surprise to many to discover that the majority of farmers in these areas not only do purchase and use fertilizer, but they invest quite a bit in it and use it on their subsistence (rice) crops.

B. Feasibility: Considerations

Of the beneficiary households surveyed by AIT (excluding here only those whose holdings were entirely outside the potential irrigation survey area) well over half had at least some amount of wet season irrigation. Furthermore, nearly two out of six had at least some amount (greater than 5% of their total farm area) of dry season irrigation as well. Nevertheless, the project sites were chosen because in each case the water in the system was not being fully utilized in either the wet or the dry season. Why, then, are people not using all the water they might? Situations vary from site to site but a general discussion is possible. On the average farm of 35 rai, 23 rai are cultivated in the rainy season, 5 rai are cultivated in the dry season, 4 rai are non-agricultural land, and the remaining 3 rai are left unclutivated for various reasons. Of those that use at least some wet season irrigation, the average irrigated area is about 17 rai (median = 15). In the dry season, the average irrigated area (of those that have at least 1 rai, i.e., other than kitchen gardens) is 3 rai (median = 4). This indicates that expansion of dry season irrigation may not be a problem of physical infrastructure. Of those with access to water in the wet season, well less than half (about 36%) use dry season irrigation and of those that do, they vastly reduce the amount of land they crop, compared to the amount of irrigated land they use in the wet season. A seasonal reduction in water supply alone cannot explain this vast reduction: it is clearly evident at the site that in nearly all cases vast amounts of water remained in the reservoirs at the end of the dry season.

Table 3

DRY SEASON IRRIGATION AND INCOME*

3A. WHO DOES AND DOES NOT USE DRY SEASON IRRIGATION, IN RELATION TO INCOME:

	Very Poor (5,000฿/hh)	Poor (5-10,000฿/hh)	Better Off (10,000+฿/hh)
No real irrig. (Kitchen garden only)	28%	16%	17%
Irrigation (≥1 rai)	13%	8%	18%

3B. OF THOSE USING DRY SEASON IRRIGATION, WHO USES MORE, IN RELATION TO INCOME:

	Poor (10,000฿/hh)	Better Off (10,000+฿/hh)
Low Irrigation (1 to 4 rai)	32%	18%
Medium to High Irrigation (> 4 rai)	22%	28%

*Surrogate income used: cropsales plus off-farm income (see Table 2). The associations implied here in Table 3 are significant at least the .04 level (Chi Square) in a single 9 x 8 matrix (63 degrees of freedom, 242 cases total).

The statistics become even more compelling when one focuses on the poorer farmers whom the project aims to assist. Table 3 makes the point. The statistics summarized in this table support results of non-structured field interviewing. In the villagers' opinions, "other poor don't irrigate in the dry season" (opinions for why this was the case varied according to who was asked - the better off farmers said the poor were lazy, poorer farmers saw themselves facing a plethora of insurmountable obstacles many of which they couldn't understand; some blamed var.ous others, etc.).*

All in all, four main potential problem areas exist for greater and more effective utilization of irrigation: physical infrastructure, organization (especially of irrigation), inputs, and marketing. The problem areas are also interconnected with each other, thus solutions are not necessarily specific to particular individual problem areas. While added and improved physical infrastructure (mainly canals and roads) will reduce or eliminate physical constraints, the statistics cited above indicate clearly that this alone will not mean that the area actually irrigated in the dry season will significantly increase, nor will farmers, especially poorer farmers, be certainly benefitted. Were the data available, it is likely that a significant part of the average 13 out of 28 rai cropped but not irrigated in the wet season would also evidence problems other than physical infrastructure. We will thus narrow the discussion here to constraints on organization, inputs and marketing, and especially their social aspects.

1. Organization

Many studies in Northeast Thailand have shown that a principal problem in irrigated areas is the quantity and especially timing of water delivered to the fields. This is predominantly true of the project area also. During non-structural field interviewing, it was apparent that

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*It is recognized that an association between poverty and non-irrigation does not prove direction of causality. In the present case, we can be fairly certain of mutual effect, actually of the "viscious circle" variety.

farmers in the beneficiary population are rather bewildered by the subject of irrigation organization. Most seemed to think it was something the government did, not they themselves. They were quite surprised to hear about the high degree of locally initiated and controlled irrigation organization existing in parts of North Thailand. The organizational functions they did perform themselves were not perceived by them as being organized. Instead they characterized them either as just "helping each other out" or else individual participation for direct individual interest. For example, in describing how shared farm ditches were maintained, one farmer answered people just helped each other, another said everyone took care of only the section fronting his own property, another said that downstream farmers only came up to work on the ditch (by themselves) if the water wasn't getting through. In most cases if disputes arose that could not be settled between the parties involved, the WUA only served as a conduit to bring the problem to the attention of the chief irrigation official who would usually (probably wisely) base his decisions on precedent (i.e., status quo ante). In part of one irrigation area farmers stated the village headman settled disputes - in their view they used to have a WUA but it had been disbanded.

The single case found (during the few days interviewing) where disputes were settled by farmers rather than officials thus occurred where a WUA did not even exist. What then is wrong with the WUA's? In the AIT survey, a majority of farmers thought the WUA was inefficient and a vast majority thought WUA members could not agree on what to do when faced with problem, that various groups competed and conflict existed. On the other hand; most felt that WUA rules should be enforced strictly (and were not), that a WUA leader should be elected, that water allocation was necessary and that there should be a system to allocate it. A significant minority did not even recognize that WUA had any rules at all, yet, two to one, farmers, interviewed expressed their hopes for WUA by saying that WUA membership should be compulsory. They were more divided on such topics as whether or not water rotation would help solve conflicts and whether or not WUA should expand its activities beyone irrigation management per se.

Various researchers have pointed out problems with irrigation organization in Thailand. AIT (1978) cited the lack of support for WUA's by the Royal Irrigation Department but other research points in a different direction. In studying irrigation organization effectiveness in North Thailand, Vanpen et al (1979, in Thai language) found that organizational effectiveness resulted when the farmers themselves ran the system, made the rules, selected the leaders, took part in building the system, etc., and that the effective organizations were small and administratively easy to manage. Gillespie (1975), Srifunya and Early (1980) and others (e.g. Thanya) have independently reached the same conclusion.

The major problem with WUA's is that they are far too big, often many hundreds or even more than a thousand households in one organization. The more ideal size would be about 50 households or, less a size in which participatory decision-making and problem-solving could be expected to occur. The logical organization of this size would be along a farm ditch, which, according to several farmer's opinions serves 10 to 50 farmers. Table 4 points out the difficulty, however, the majority of farmers have plots in different locations, thus would need to be members of more than one farm ditch group at a time, creating a network instead of solid groupings. The solution to this dilemma must be found locally, by farmers themselves. A number of alternatives are possible. First, in areas where the majority on a ditch have primary interest in the plot on that ditch, an effective group might be organized. Second, land consolidation has been demonstrated to raise productivity in Thailand (Jerachone 1980) and may be feasible if locally desired, through informal trading, compensation system, etc. The key point here is that the method chosen must be selected locally in order to fully succeed. If organization by farm ditch group is impractical, other alternatives are available (subvillage, neighborhood, area where fields located regardless of ditch, etc.). Gillespie (1975) supports focusing on the farm-ditch level, pointing out that this level has the greatest potential for effective local leadership. His paper has many useful suggestions for initiating such organization.

The organization of irrigation also will have to vary with the size of the system. In each case (Local variation), it must be clear what responsibilities are at each level, and these must be feasible to the organization charged with carrying them out. The organizational issue is flagged here as the key item for investigation and follow-up by the project technical assistance team. A social anthropologist or rural spciologist would be the appropriate advisor to deal with this matter further on a full-time basis throught the life of the project.

2. Inputs and Marketing (and Credit)

The key item of feasibility, concern with inputs and marketing is profitability, in both a narrow and wide sense. In the narrow sense, the Baht return to the farmer must be sufficient for him to choose to expand cropping instead of pursuing other alternatives. This is necessary but not sufficient. In the sider sense, the farmer's accounting system will include many factors not readily quantified nor easily discernable to others. For example, one farmer stated that he was dissatisfied with the prices offerred by the merchant he dealt with. When asked why he did not look for another merchant, the following considerations emerged in a lengthy discussion. First, the merchant had a virtual monopsony in the area and the farmer doubted it could be broken. Even if he went to another merchant, he could not be certain the merchants were not in collusion with each other. The merchant treated him well in other respects, for example, giving him instantaneous loans in emergencies. Turning elsewhere would jeopardize this relationship, perhaps meaning that a sick child would not be able to receive medical treatment at a later date if an emergency illness occurred. So many of these factors the farmer perceived as beyond his own control. What he could do himself, however, was to limit the amount of those cash crops the merchant would buy from him and pursue other options instead, which was what he did.

What can the project, then, hope to do about profitability in this wider sense? A number of options are possible, but the choice of option and the number of strategies adopted will influence success. If pared down too far success will be difficult (keep in mind that if

Table 4

Potentially Irrigable Plots
per Household
Frequency Distribution

# of Potential Irrigable Plots	% of Households in Survey
1	37
2	37
3	15
4	8
5	3

it were easy the farmers would have done something about it already). The basic strategy would seem to be to help provide for as many as possible of the farmer's wider concerns through other channels than he currently has access to while at the same time strengthening his ability to deal himself with the concerns remaining. For example, to reduce the various kinds of risk the farmer faces, he will benefit from some form of partial crop insurance and emergency loan credit fund. These are administratively simple to run and could be organized locally using group guarantor methods. To increase his own bargaining ability as well as lower his costs, purchase of inputs and volume sales are also likely to help. Such techniques should logically fit in with water user organization at the farm ditch (or other small-scale level) but could also be promoted in other ways depending on the local situation. Local organization will also help to get a sufficient number of farmers cropping in the same place at the same time. Water is more likely to be provided on time to such a group, labor exchange helps out, marketing is easier, etc.

A key methodology is one of better communications. Nearly all the factors discussed by Adul (1980) as influencing participation in irrigation are susceptible to improvement through better communications, i.e. such things as more frequent WUA meetings in smaller groups, more visits by extension agents, clear knowledge of water schedules from RID, farm-market newsletters (which should pay for themselves once organized) to inform farmers on market conditions, inputs available, etc. Transport may be a problem. The project can contact various truckers and make a list of their rates and farmers can go together in hiring a truck. A sufficiently energetic communications strategy, initiated, supported and advocated by the project, should go far in leading to appropriate local solutions to overcome the wider, less tangible problems of credit, inputs and marketing. The prestige of the government agency, its concern for wider interests, the backing of technical advisors - all these could go a long way in encouraging sufficient communications leading to the solution of local problems.

C. Feasibility; Effects

Given the generative rather than predetermined nature of this project it is difficult to assess the effects that may occur. Like all projects, it will depend on the skill, sincerity and hard work of the implementors. What we can attempt here, however, is a discussion of some of the likely stumbling blocks and suggest ways to cope with them.

In section B. above, some results of the AIT attitude survey were summarized. However, section A. showed that there is a great deal of variation in the beneficiary population, of particular concern here being variation in income and degree of seasonal irrigation utilization. In the present section then, we will examine the attitude survey as attitudes are or are not associated with this variation, to understand what it may mean for project strategy toward various groups. Several other findings will also be examined.

Among the various attitudes which did not differ appreciably no matter what the income level or degree of dry season cropping were feelings that WUA rules should be strictly enforced and WUA ought to elect leaders, plus all those discussed above that demonstrate farmers' awareness of the benefits of irrigation. Interestingly, another statistic which did not vary appreciately across income level was how many families did and did not take loans (an average 20% did). Some differences did appear in attitudes once the responses were stratified, however. These are presented in Table 5.

Table 5 suggests, although not at all conclusively, that two types of systematic variation may be occurring. On the one hand, the middle income group seems to stand out from the others while on the other, opinions seem to change with the degree of dry season irrigation utilization. Middle income earners generally seem to have more faith in WUA than others, perhaps hoping to expand their opportunities. The similarity between low and high income earners is probably not for the same reason. The poor, like the middle income earners think that those upstream (usually those better off than they?) are unfair to downstream

Table 5

Selected Results of Attitude Survey
Stratified by Income
and Dry Season Irrigation
Utilization*

Statement	Stratified by (variable)	Response by Stratification Level** (low)	(low mid)	(hi mid)	(high)
Upstream farmers reluctant to pass water	income	A	A	A	D
	dry seas irg	A	A	E	A
Rotation of water avoids conflict	income	E	A	A	E
	dry seas irg	A	A	A	A
WUA members usually pay for system upkeep	income	D	A	A	D
	dry seas irg	D	D	E	D
WUA membership should be compulsory	income	A	A	E	D
	dry seas irg	A	A	E	E
WUA doesn't enforce its rules	income	A	A	A	A
	dry seas irg	A	A	A	E
WUA works efficiently	income	D	A	A	D
	dry seas irg	A	E	D	D

* Surrogate for income = gross crop sales plus off farm income (see Table 2). Percentages corrected to exclude no answer/no opinion categories.

** A = majority in strat. level agreed, D= maj. disagreed with statement, E - about equal agree/disagree.

irrigation users, but they are more cynical about water rotation, WUA efficiency, and don't agree with paying for WUA, probably because they get little benefit from it. The high income earners don't see upstream users (themselves?) as selfish, they don't want WUA to be compulsory, they don't think people pay for it, they don't think it works efficiently. Presumably they are happy with things as they are and have no interest in strengthening WUA.

Along the dimension of degree of dry season irrigation, Table 5 seems to show that opinions change the more one irrigates in the dry season. The high users are not as enthusiastic about compulsory WUA membership, do not think it works efficiently, are not eager for WUA to enforce its rules.

If the above interpretations are meaningful Table 5 suggests that middle income groups are likely to be most enthusiastic about the project, high income earners and high irrigators may be rather reluctant, and the poor, while willing, are probably a little unrealistic about what WUA might be able to do for them and how easily they can be helped.

For the implications for project implementation we turn to a few last findings. We have no data on the time spent in "off-farm" employment but we do know high income earners and high irrigators employ more labor, while field interviewing strongly suggested that local wage employment, within the same rural area, was a primary dry season occupation for the poor. All this together with the unexpected degree of socio-economic stratification found in the survey data implies that while middle income earners and middle irrigators will be likely to benefit most easily from the project, in order to involve the poor special effort will be needed and that if any opposition to project goals occurs, it is likely to come from the better off farmers, some of whom are apparently quite well-off indeed. The project strategy implications are not clear. A possible solution might be to interest the better off farmers in some sort of scheme that provides relatively high returns (in this case acceptably with relatively high investment) but requires little labor during critical times in wet or

dry season cropping, if indeed the main thing this group is likely to lose as a result of the project is cheap and abundant labor.

This issue is uncertain but is flagged here as an item of potential concern for the project implementation team.

D. Spread Effects

There will of course be some benefits to local inhabitants nearby the project area (secondary economic effects). Also if the local communications and organizational techniques prove successful they can be expected to spread rapidly through many areas of the Northeast, since the irrigation areas are nearly all on or very near major roads and are thus some of the least isolated places in Northeast Thailand.

The principal value of the project, however, in terms of spread, is its replicability throughout most of the irrigation areas of the Northeast. The underutilization of irrigation in the Northeast is not an isolated phenomenon, thus the opportunity for replication is quite large, eventually to perhaps as many as 15% of the population of the Northeast. Although the size of irrigation systems vary from quite large to quite small, many of the techniques to be developed and tested in the project can find real use in both larger and smaller systems.

E. Effects on Women, Migration, Fertility, Population

The project should result in greater on-farm employment and thus reduce rural to urban migration for both men and women. There seems to be nothing in this project that would benefit women more than men, but neither is there any evidence of the reverse. Women should be encouraged to participate in WUA and in the smaller group organizations. Whether or nor reduced rural to urban migration benefits women more than men depends on whether women migrate more from the Northeast than men (demographic figures in the project areas do not evidence this but it may be true of some age groups) and, ultimately, on value judgments concerning the status of women in urban vs. rural settings.

Effects on population through fertility and displacement within the project areas are uncertain. Fertility, hopefully, will decrease as income increases and as farmers begin to see the effects of having to fit more adult population onto limited land resources. Judging from the population age profile (Table 1) this effects may become increasingly severe over the next decade or so. Local officials and development workers should compute a local population age profile and teach farmers what it will mean for them, both as a means of encouraging family planning but also as a means to generate interest in irrigation and agricultural intensification.

It is likely that population within project areas may effectively increase also as a result of attracting local outsiders to various types of employment, especially once incomes within project areas begin to increase. Effects of this type are certainly to be expected when projects are confined to particular scattered geographical settings with restricted resource access, an inevitable characteristic of irrigation projects in Northeast Thailand. The government can recognize these characteristics in its area development planning and endeavor to promote other types of projects in the area, targetted to benefit those without access to irrigation.

F. Effects on Environment

Analysis of environmental impact was not considered necessary for this project, since the project does not involve building any new dams or other major infrastructure. Rather, the improvement, extension and rehabilitation of existing physical infrastructure will result in an improved environment. Nevertheless, increased use of irrigation could present different types of environmental problems which should be mentioned here in order that project monitoring may be on the look out for them. Such sensitization will facilitate appropriate corrective actions if they are necessary.

While the use of irrigation in the dry season and to supplement rainfed wet-season farming should not lead to significantly increased health hazards

compared to present conditions, there are areas of health hazard associated with water in Northeast Thailand that are in need of attention. The cultural preference for (uncooked) fermented fish is one of the main reasons for the prevalence of liver fluke (opisthorchis viverrini) and intestinal in the Northeast. The supply of fish may indeed increase with increased water utilization, providing much needed protein and income, but the health hazards of consuming the fish uncooked should be stressed to the project area inhabitants.

Luckily, schistosemiasis has not been found in the target areas of Northeast Thailand. Poor drainage of irrigation water from fields and water ways can lead to increased disease vectors, such as mosquitoes, increased seivage pollution problems, increased soil salinity and concentration of chemical residues from farm inputs and adequate drainage should be designed into the Project.

Learning to manage and deal safely with an irrigation environment is certainly a feasible task. Northeasterners have long been accustomed to dealing with water problems in wet-season rainfed-flooded agriculture and small-scale dry season stream irrigation. Furthermore, the presence of hundreds of irrigation projects throughout the Northeast over the past three decades has provided an experience base that should insure that no unpleasant or unmanageable environmental problems are in store for the inhabitants of the present project areas.

Annex D4 - Economic Analysis

1. Project Economic Analysis: Farm Budget and Other Key Statistics

In the following section, summaries of the economic analyses of the individual sub-projects are presented. The potential wet season and dry season irrigable areas have been derived from the AIT engineering and technical studies. The estimate of the potential irrigable area in the wet season has been based on a 60:40 mix of HYVC to LDVs in all cases. For the dry season, the estimate of irrigable area is based on the water requirements of non-paddy crops notably, mixed vegetables and fruit, groundnuts and mung-beans.

Prices Used

In constructing the farm budget, the following financial (farm-gate) for the major inputs and outputs.

Inputs

Amonium phosphate	฿6/product kg.
Area	฿6/product kg.
Labor (wet season)	฿22/man day
Labor (dry season)	฿24/man day

Outputs

Paddy	฿2.5/kg.
Groundnuts	฿5.75/kg.
Mung Beans	฿5.80/kg
Vegetables (wet season)	฿1,200/rai 1/ At full develop-
Vegetables/Fruits (dry season)	฿1,800/rai ment

The lower return on vegetables the wet season, reflects the fact that this refers to a rai of mixed vegetables only excluding fruits which offer high returns. Although some fruits can be grown in the wet season, conditions in the wet season are in general not conducive to their successful cultivation. They have, therefore, been excluded from the wet season farm budget.

The prices of other minor outputs have been taken from the results of the AIT survey and expressed in 1980 prices to conform with the above. In conducting the economic analysis, relative prices are assumed to be constraint over the 20 year economic life of the project. Paddy is the only

1/ One hectare = 6.25 rai.

commodity which has been shadow priced for the economic analysis, since the farm-gate price is substantially lower than the FOB export price adjusted for transport, processing and handling costs. An economic price of ฿4/kg. is used. In the case of groundnuts and mung beans their financial prices approached close to world market prices.

Labor

Although there is undoubtedly some underemployment of labor during part of the year labor has not been shadow priced. Given the tendency for underemployed labor to seek off-farm work during slack periods, particularly in the dry season it is believed that the opportunity cost of labor does not deviate significantly from the respective seasonal wage rules. In addition, the project will lead to a significant increase in demand for both household and hired labor, reducing the incidence of underemployment. A combined total man-years of man-years of employment will be created annually in the project areas once they reach full development.

In most of the project areas the area under wet season paddy increases as fallow land is brought under cultivation. In most cases there is also a significant increase in dry season cropping. However, in Huai Phuttha Utthayan and Huai Lam Chamuak there is a slight decline in dry season cropping to allow for complete wet season supplemental irrigation over the wet season area. In both cases, although dry season cropping is not recommended, a small area of vegetable and fruits are included in the farm budget. In the case of Huai Chorake Mak there is a more significant decline in the level of dry season cropping even assuming a change in the current emphasis on dry season paddy to the recommended non-paddy crops. According to AIT engineers, the current level of dry season paddy cultivation in the sub-project area will anyway adversely affect the current wet seasons paddy crop by reducing the amount of water available. Thus some decline in the level of dry season cropping could be expected even in the absence of the project. However, even though cropping intensity does not increase in these cases, the project was still justified as a result of the increased in productivity of wet season cropping and any remaining dry season cultivation.

An indication of farmers capacity to pay the charges necessary to cover full O&M costs and the full cost of on-farm development has been made by including these charges at the end of the summary farm budget. (See notes on farm budget for details.)

In the farm budgets, all produce including that retained for home consumption, is valued at farm-gate prices.

The following notes apply to the summary farm budgets:

(a) Includes irrigable and non-rrigable areas within the project boundaries.

(b) Includes presently fallow land but exclude waste land and pasture.

(c) Includes small areas of groundnuts (wet season) tobacco, cotton sweet corn and sugar cane.

(d) Details on the production of vegetables/fruits and other crops such as sweet corn, are not included here but their value is included in the "Gross Value of Production".

(e) Includes an estimate of the net return from livestock, poultry and their products whether consumed on-farm or sold, and the actual return from fish raising and fish catching.

(f) Includes depreciation on agricultural equipment and interest on working capital. The increase in this item is due solely to the increase in the level of interest payments on production credit, the level of which will increase as a result of the project.

(g) O&M charges sufficient to repay full costs of O&M per year at full project development and capital cost charges sufficient to repay the full costs on-farm development over 15 years at 12% rate of interest assuming a three year grace peri .

2. Project Economic and Farm Financial Analysis

For the project's economic analysis, the values of EIRR by tank and all 7 tanks combined were based on the farm budget data provided by the AIT survey of 1978/1979 crop year. The total estimated number of farm households for 7 tanks are 4,596 households. Incremental net farm income derived from net incremental income from rainy season, dry season, annual and perennial crops plus net other farm income. (Other farm income1/ minus other farm cost2/).

1/ Other farm income = income from livestock/fish/poultry, rental of equipment and land.

2/ Other farm cost = equipment depreciation, interest on working capital, explicit and inputed.

Investment costs were broken down into 5 main categories - rehabilitation cost, vehicles and equipment cost operation and maintenance cost, personnel and technical assistance plus 15% contingency on rehabilitation and vehicle cost, the total basic EIRR was 31.4 percent on the 20 year life of project as shown in Table D4-1. EIRR for each individual tank was computed in the same way.

For the farm financial analysis, the price of paddy of ฿2.5/kilogram was used instead of the shadow price ฿4.0/kilogram as in the project economic analysis. The series of Benefit/Cost Ratios for each individual tank were shown in Table D4.2.

Net present value of the flow of net income of 20 year period average s 49.8 thousand baht per farm or 33,713 thousand baht for all farms in the total 7 project areas. For each individual area the Table D4.2 also gives the detail.

Summary of Economic Analysis

Huai Talat

Impact of Rehabilitation

Wet Season Irrigable Area	14,000	Rai
Dry Season Irrigable Area	5,500	Rai
Paddy - Target Yield: LDV	535	Kgs/rai
Paddy - Target Yield: HYV	668	Kgs/rai
Number of Benefiting Households	624	
Incremental Employment Created	160,992	man-years
Benefit Cost Ratio to the Farmer	1.62	
Net Present Value of Net Incremental Income to the Farmer	56,400	Baht
Economic Internal Rate of Return	17.42	Percent
Sensitivity: Case 1	9.05	"
Case 2	14.51	"
Case 3	14.80	"

Summary of Economic Analysis

Huai Chorakhe Mak

Impact of Rehabilitation

Wet Season Irrigable Area	7,000	Rai
Dry Season Irrigable Area	1,000	Rai
Paddy - Target Yield: LDV	395	Kgs/rai
HYV	495	Kgs/rai
Number of Benefiting Households	486	
Incremental Employment Created	11,664	man-years
Benefit Cost Ratio to the Farmer	1.89	
Net Present Value of Net Incremental Income to the Farmer	20,981	Baht
Economic Internal Rate of Return	10.38	Percent
Sensitivity: Case 1	7.90	"
Case 2	6.55	"
Case 3	10.17	"

Special Comments

In this sub-project dry season cropping is only possible if the current cultivation schedule for LDVs is shifted forward by 3 - 4 weeks. Rainfall data indicates that farmer could start land preparation at the beginning of May rather than June as currently happens. The present practice almost certainly reflects the unreliability of rainfall and water require at this time. With the provision of wet season supplemental irrigation this will no longer be a problem.

The low EIRR in the case of Huai Chorakhe Mak is due to a number of factors. Firstly, in an effort to maximize the potential wet season irrigable and dry season irrigable area, it is proposed that the existing area under paddy in the dry season be replaced by vegetables, mung beans and groundnuts. While these provide a good return to the farmer, when, compared with paddy, their economic value is lower, thereby reducing the level of incremental benefits from dry season cropping. In addition, this tank serves the smallest potential wet season irrigable area of the seven projects and,

Summary of Economic Analysis - Huai Chorakhe Mak (Cont'd)

has only a limited dry season cropping potential. However, since assumptions regarding the target yields of the main crops are on the conservative side, the project is considered to be fully justified on the basis of our analysis. It is also worth emphasizing that there are certain to be some indirect benefits from the project, particularly as a result of improved extension, on crop production or non-irrigable land outside of the project boundaries, but operated by project beneficiaries, where paddy is the major crop. Such indirect benefits have not been included in the economic analysis because of the difficulties of quantifying them.

Summary of Economic Analysis

Phuttha Utthayan

Impact of Rehabilitation

Wet Season Irrigable Area	14,000	Rai
Dry Season Irrigable Area	0	Rai
Paddy - Target Yield: LDV	418	Kgs/rai
Paddy - Target Yield: HYV	506	Kgs/rai
Number of Benefiting Households	560	
Incremental Employment Created	59,920	man-years
Benefit Cost Ratio to the Farmer	1.46	
Net Present Value of Net Incremental Income to the Farmer	22,394	Baht
Economic Internal Rate of Return	27.71	Percent
Sensitivity: Case 1	6.88	"
Case 2	21 82	"
Case 3	21.73	"

Summary of Economic Analysis

Huai Aeng

Impact of Rehabilitation

Wet Season Irrigable Area	19,000	Rai
Dry Season Irrigable Area	7,800	Rai
Paddy - Target Yield: LDV	425	Kgs/rai
HYV	530	Kgs/rai
Number of Benefiting Households	1,138	
Incremental Employment Created	109,110	man-years
Benefit Cost Ratio to the Farmer	1.73	
Net Present Value of Net Incremental Income to the Farmer	56,243	Baht
Economic Internal Rate of Return	27.79	Percent
Sensitivity: Case 1	21.58	"
Case 2	24.98	"
Case 3	23.82	"

Summary of Economic Analysis

Huai Khi Lek

Impact of Rehabilitation

Wet Season Irrigable Area	9,000	Rai
Dry Season Irrigable Area	9,000	Rai
Paddy - Target Yield: LDV	395	Kgs/rai
HYV	490	Kgs/rai
Number of Benefiting Households	1,443	
Incremental Employment Created	590,187	man-years
Benefit Cost Ratio to the Farmer	1.66	
Net Present Value of Net Incremental Income to the Farmer	68,469	Baht
Economic Internal Rate of Return	46.85	Percent
Sensitivity: Case 1	14.29	"
Case 2	18.38	"
Case 3	18.75	"

Summary of Economic Analysis

Huai Kaeng

Impact of Rehabilitation

Wet Season Irrigable Area	15,000	Rai
Dry Season Irrigable Area	10,000	Rai
Paddy - Target Yield: LDV	363	Kgs/rai
HYV	454	Kgs/rai
Number of Benefiting Households	720	
Incremental Employment Created	256,320	man-years
Benefit Cost Ratio to the Farmer	1.54	
Net Present Value of Net Incremental Income to the Farmer	60,389	Baht
Economic Internal Rate of Return	36.02	Percent
Sensitivity: Case 1	15.92	"
Case 2	27.06	"
Case 3	29.20	"

Summary of Economic Analysis

Huai Lam Chamuak

Impact of Rehabilitation

Wet Season Irrigable Area	10,800	Rai
Dry Season Irrigable Area	0	Rai
Paddy - Target Yield: LDV	550	Kgs/rai
HYV	688	Kgs/rai
Number of Benefiting Households	540	-
Incremental Employment Created	22,140	man-years
Benefit Cost Ratio to the Farmer	2.63	
Net Present Value of Net Incremental Income to the Farmer	63,739	baht
Economic Internal Rate of Return	23.55	Percent
Sensitivity: Case 1	18.34	"
Case 2	22.30	"
Case 3	20.22	"

TABLE D4-1 PROJECT ECONOMIC ANALYSIS (All 7 Tanks Combined)

(Unit = ₱1,000)

Year	INVESTMENT COST (₱1,000)						Net Incremental Project Farm Income	Project Net Income
	Rehabilitation Cost	Vehicles & Equipment	Operation & Maintenance	Personnel & T.A.	Contingency	Total		
0	1,132	1,442	-	3,590	250	6,414	-	- 6,414
1	12,438	-	418	8,062	1,808	22,784	- 1,808	- 24,592
2	35,500	-	1,414	6,230	5,322	48,566	13,460	- 35,106
3	39,730	-	2,502	6,122	6,350	54,704	29,646	- 25,058
4	38,554	-	3,480	5,242	6,172	53,448	43,745	- 9,703
5	21,906	-	3,408	386	3,286	28,986	55,913	26,927
6		-			-	3,794	64,940	61,146
7		-			-	3,794	71,543	67,749
8		546			84	4,424		67,119
9		-			-	3,794		67,749
10		-			-	3.794		67,749
11		-			-	3,794		67,749
12		-			-	3,794		67,749
13		-			-	3,794		67,749
14		-			-	3,794		67,749
15		-			-	3,794		67,749
16		546			84	4,424		67,119
17		-			-	3,794		67,749
18		-			-	3,794		67,749
19		-			-	3,794		67,749
20	- 23,319	- 205	3,408	386	-	- 19,730	71,543	91,273
								EIRR = 31.41

TABLE D 4-2 - FARM FINANCIAL ANALYSIS[1/]

1/ Not including cost recovery.

Year	Huai Talat #1		H. Chorakhe Mak #2		Phuttha Utthayan #5		Huai Aeng #6		Huai Khi Lek #7		Huai Kaeng #8		H. Lam Chamuak #9	
	Incremental Farm		Incremental Farm		Incremental Farm		Incremental Farm		Incremental Farm		Incremental Farm		Incremental Farm	
	Income ฿	Cost ฿	Income ฿	Cost ฿	Income ฿	Cost ฿	Income ฿	Cost ฿	Income ฿	Cost ฿	Income ฿	Cost ฿	Income ฿	Cost ฿
0	- 1,896	- 681	- 2,144	- 1,530	0	281	251	194	535	379	732	1,083	793	745
1	4,275	2,605	555	- 38	2,444	1,684	3,931	2,766	3,905	2,406	6,711	5,264	4,605	2,157
2	9,088	5,665	2,895	1,453	4,911	3,392	8,848	5,289	9,565	5,922	13,766	9,215	9,238	4,122
3	15,155	9,446	5,240	2,887	7,288	5,014	14,802	8,575	15,985	9,664	21,375	13,927	11,735	4,882
4	20,405	12,636	6,784	3,761	9,595	6,586	19,527	10,963	22,148	13,560	25,427	16,309	13,818	5,093
5	24,702	15,343	7,646	4,187	11,348	7,803	21,910	12,613	27,730	16,806	27,812	17,688	15,812	5,853
6	26,884	16,456	8,370	4,553	12,630	8,577	23,192	13,312	31,535	18,795	28,654	18,290	17,209	6,214
7	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
9	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
11	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
12	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
14	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
15	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
16	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
17	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
18	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
19	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
20	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Present Value	148,046	91,646	44,520	23,539	71,323	48,929	133,417	77,174	171,438	102,969	172,621	112,232	103,099	39,360
B/C Ratio	1.62		1.89		1.46		1.73		1.66		1.54		2.63	
Net P.V. income per farm (฿1,000)	56.40		20.98		22.39		56.24		68.47		60.39		63.74	
Net P.V. income per project (฿1,000)	35,194		10,197		12,541		64,004		36,152		43,480		34,419	

HUAI TALAT

AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area a/			
Land Area b/	(rai)	22.64	22.64
Cropped Area			
Wet Season LDV Rice	(rai)	22.23	8.94
RDV Rice	(rai)	-	13.40
Kenaf	(rai)	0.04	0.04
Vegetables	(rai)	0.03	0.10
Other c/	(rai)	-	-
Dry Season LDV Rice	(rai)	0.97	-
Mung Beans	(rai)	-	4.71
Groundnuts	(rai)	-	3.85
Vegetables/Fruits	(rai)	-	0.25
Other c/	(rai)	-	-
Upland Crops (Mulberry/Trees)	(rai)	0.15	0.15
Total	(rai)	23.42	31.44
Cropping Intensity		1.04	1.39
Crop Production d/			
Wet Season LDV Rice	(Kg)	7,547	4,783
RDV Rice	(Kg)	0	8,951
Kenaf	(Kg)	8	10
Dry Season LDV Rice	(Kg)	281	-
Mung Beans	(Kg)	-	895
Groundnuts	(Kg)	-	1,155
Total Labour Requirement	(man-days)	300	558
Gross Value of Production	(B)	19,703	46,587
Production Costs, excl. Labour	(B)	1,933	11,969
Hired Labour Costs	(B)	1,349	3,840
Net Crop Income, Inside Project Area	(B)	16,421	30,778
Net Crop Income incl. HH. Labour Cost	(B)	11,141	22,025
Outside Project Area			
Land Area	(rai)	17.01	17.01
Cropped Area	(rai)	17.01	17.01
Net Crop Income, Outside Project Area	(B)	9,288	9,288
Net Crop Income, incl. HH. Labour Costs	(B)	5,364	5,364
Total Net Crop Income	(B)	25,709	40,066
Total Net Crop Income (incl. HH. Labour)	(B)	16,505	27,389
Net Farm Income from Livestock/Fisheries e/	(B)	5,335	5,335
Other Farm Costs f/		1,784	2,242
Total Net Farm Income	(B)	29,260	43,159
Cost Recovery g/		-	4,096
(O&M Costs)		-	(949)
(Capital Costs)		-	(3,147)
Net Farm Income	(B)	29,260	39,063

a/ - g/ = See Annex D4-3 for explanation.

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HUAI CHORAKHAEMAK

AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area[a]			
Land Area[b]	(rai)	14.34	14.34
Cropped Area			
Wet Season LDV Rice	(rai)	13.75	5.72
RDV Rice	(rai)	-	8.58
Kenaf	(rai)	-	-
Vegetables	(rai)	0.04	0.10
Other[c]	(rai)	-	-
Dry Season LDV Rice	(rai)	2.92	0
Mung Beans	(rai)	0.03	1.06
Groundnuts	(rai)	0	0.70
Vegetables/Fruits	(rai)	0.01	0.30
Other[c]	(rai)	-	-
Upland Crops (Manioc/Trees)	(rai)	-	-
Total	(rai)	16.75	16.46
Cropping Intensity		1.17	1.15
Crop Production[d]			
Wet Season LDV Rice	(Kg)	3,431	2,259
RDV Rice	(Kg)	-	4,247
Kenaf	(Kg)	-	-
Dry Season LDV Rice	(Kg)	844	-
Mung Beans	(Kg)	4	201
Groundnuts	(Kg)	0	210
Total Labour Requirement	(man-days)	281	634
Gross Value of Production	(฿)	10,746	19,244
Production Costs, excl. Labour	(฿)	1,775	5,703
Hired Labour Costs	(฿)	902	1,122
Net Crop Income, Inside Project Area	(฿)	8,069	12,419
Net Crop Income incl. HH. Labour Cost	(฿)	2,696	6,767
Outside Project Area			
Land Area	(rai)	5.23	5.23
Cropped Area	(rai)	5.20	5.20
Net Crop Income, Outside Project Area	(฿)	2,100	2,100
Net Crop Income, incl. HH. Labour Costs	(฿)	555	555
Total Net Crop Income	(฿)	10,169	14,519
Total Net Crop Income (incl. HH. Labour)	(฿)	3,251	7,322
Net Farm Income from Livestock/Fisheries[e]	(฿)	10,665	10,665
Other Farm Costs[f]		1,655	1,830
Total Net Farm Income	(฿)	19,179	23,354
Cost Recovery[g]		-	2,618
(O&M Costs)		-	(584)
(Capital Costs)		-	(2,034)
Net Farm Income	(฿)	19,179	20,736

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PUTTHA-UTTAYAN

AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area[a/]			
Land Area[b/]	(rai)	24.99	24.99
Cropped Area			
Wet Season LDV Rice	(rai)	24.41	9.96
RDV Rice	(rai)	-	14.93
Kenaf	(rai)	-	-
Vegetables	(rai)	0.05	0.10
Other[c/]	(rai)	-	-
Dry Season LDV Rice	(rai)	0.16	-
Mung Beans	(rai)	-	-
Groundnuts	(rai)	-	-
Vegetables/Fruit	(rai)	0.51	0.25
Other[d]	(rai)	0.65	-
Upland Crops (Banana/Trees)	(rai)	-	-
Total	(rai)	25.78	25.24
Cropping Intensity		1.03	1.01
Crop Production[d/]			
Wet Season LDV Rice	(Kg)	6,276	4,163
RDV Rice	(Kg)	-	7,553
Vegetables/Fruits	a/	15	35
Dry Season LDV Rice	(Kg)	40	-
Mung Bean	(Kg)	-	-
Groundnuts	(Kg)	-	-
Other	b/	1,160	-
Total Labour Requirement	(man-days)	356.25	462.5
Gross Value of Production	(฿)	17,070	29,700
Production Costs, excl. Labour	(฿)	2,455	8,374
Hired Labour Costs	(฿)	902	2,904
Net Crop Income, Inside Project Area	(฿)	13,713	18,422
Net Crop Income incl. HH. Labour Cost	(฿)	6,722	11,137
Outside Project Area			
Land Area	(rai)	1.17	1.17
Cropped Area	(rai)	1.17	1.17
Net Crop Income, Outside Project Area	(฿)	439	439
Net Crop Income, incl. HH. Labour Costs	(฿)	132	132
Total Net Crop Income	(฿)	14,152	18,861
Total Net Crop Income (incl. HH. Labour)	(฿)	6,854	11,269
Net Farm Income From Livestock/Fisheries[e/]	(฿)	4,129	4,129
Other Farm Costs[f/]		2,710	3,073
Total Net Farm Income (excl. HH. Labour)	(฿)	15,571	19,917
Cost Recovery[g/]		-	4,179
(O&M Costs)		-	(717)
(Capital Costs)		-	(3,462)
	(฿)	15,571	15,738

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HUAI ANG

AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area a/			
Land Area b/	(rai)	18.14	18.14
Cropped Area			
Wet Season LDV Rice	(rai)	16.50	6.60
RDV Rice	(rai)	-	9.90
Kenaf	(rai)	0.44	0.44
Vegetables	(rai)	0.07	0.10
Other c/	(rai)	-	-
Dry Season LDV Rice	(rai)	0.53	-
Mung Beans	(rai)	-	3.20
Groundnuts	(rai)	0.52	2.15
Vegetables/Fruits	(rai)	1.41	1.00
Other c/	(rai)	0.79	0.50
Upland Crops (Manioc/Trees)	(rai)	0.62	0.62
Total	(rai)	20.88	24.51
Cropping Intensity		1.15	1.35
Crop Production d/			
Wet Season LDV Rice	(Kg)	4,092	2,805
RDV Rice	(Kg)	-	5,247
Kenaf	(Kg)	51	61
Dry Season LDV Rice	(Kg)	107	-
Mung Beans	(Kg)	-	608
Groundnuts	(Kg)	44	645
Other	b/	990	627
Total Labour Requirement	(man-days)	376	471
Gross Value of Production	(฿)	13,734	30,229
Production Costs, excl. Labour	(฿)	1,965	8,028
Hired Labour Costs	(฿)	616	1,417
Net Crop Income, Inside Project Area	(฿)	11,153	20,784
Net Crop Income incl. HH. Labour Cost	(฿)	3,570	11,857
Outside Project Area			
Land Area	(rai)	9.33	9.33
Cropped Area	(rai)	9.33	9.33
Net Crop Income, Outside Project Area	(฿)	2518	2518
Net Crop Income, incl. HH. Labour Costs	(฿)	-83	-83
Total Net Crop Income	(฿)	13,671	23,302
Total Net Crop Income (incl. HH. Labour)	(฿)	3,487	11,774
Net Farm Income From Livestock/Fisheries e/	(฿)	5,840	5,840
Other Farm Costs f/		1,808	2,086
Total Net Farm Income	(฿)	17,703	27,056
Cost Recovery g/		-	2,617
(O&M Costs)		-	(293)
(Capital Costs)		-	(2,324)
Net Farm Income	(฿)	17,703	24,439

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HUAI KHILO

AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area a/			
Land Area b/	(rai)	20.39	20.39
Cropped Area			
Wet Season LDV Rice	(rai)	12.03	6.63
RDV Rice	(rai)	0	10.02
Kenaf	(rai)	0.52	0.52
Vegetables	(rai)	0.35	0.35
Other d/	(rai)	0.71	0.61
Dry Season LDV Rice	(rai)	0.17	0
Mung Beans	(rai)	0	9.3
Groundnuts	(rai)	0.50	5.92
Vegetables/Fruits	(rai)	0.96	1.70
Other d/	(rai)	0.31	0.31
Upland Crops (Manioc/Trees)	(rai)	3.20	2.22
Total	(rai)	18.75	37.58
Cropping Intensity		0.92	1.84
Crop Production d/			
Wet Season LDV Rice	(Kg)	2,891	2,607
RDV Rice	(Kg)	0	4,910
Kenaf	(Kg)	59	59
Dry Season LDV Rice	(Kg)	49	0
Mung Beans	(Kg)	0	1,763
Groundnuts	(Kg)	200	1,776
Other	b/	25	25
Total Labour Requirement	(man-days)	230	639
Gross Value of Production	(฿)	13,457	44,417
Production Costs, excl. Labour	(฿)	2,721	11,394
Hired Labour Costs	(฿)	630	4,146
Net Crop Income, Inside Project Area	(฿)	10,106	28,877
Net Crop Income incl. HH. Labour Cost	(฿)	5,606	18,169
Outside Project Area			
Land Area	(rai)	1.27	1.27
Cropped Area	(rai)	1.10	1.10
Net Crop Income, Outside Project Area	(฿)	640	640
Net Crop Income, incl. HH. Labour Costs	(฿)	302	302
Total Net Crop Income	(฿)	10,746	29,517
Total Net Crop Income (incl. HH. Labour)	(฿)	5,908	18,169
Net Farm Income From Livestock/Fisheries e/	(฿)	5,662	5,662
Other Farm Costs f/		8,371	8,769
Total Net Farm Income	(฿)	8,037	20,410
Cost Recovery g/		-	7,550
(O&M Costs)		-	(1,076)
(Capital Costs)		-	(6,474)
Net Farm Income	(฿)	8,037	18,860

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AVERAGE FARM BUDGET WITH AND WITHOUT PROJECT

		Without Project	With Project
Inside Project Area [a]			
Land Area [b]	(rai)	22.78	22.78
Cropped Area			
Wet Season LDV Rice	(rai)	17.77	8.18
RDV Rice	(rai)	0	12.27
Kenaf	(rai)	0.14	0.14
Vegetables	(rai)	0.01	0.10
Other [c]	(rai)	0.05	0.05
Dry Season LDV Rice	(rai)	-	-
Mung Beans	(rai)	0	7.32
Groundnuts	(rai)	1.49	5.98
Vegetables/Fruits	(rai)	0.19	0.35
Other [c]	(rai)	-	-
Upland Crops (Manioc/Trees)	(rai)	1.41	1.41
Total	(rai)	21.06	35.80
Cropping Intensity		0.92	1.57
Crop Production [d]			
Wet Season LDV Rice	(Kg)	4,223	2,969
RDV Rice	(Kg)	0	5,571
Kenaf	(Kg)	34	38
Dry Season LDV Rice	(Kg)	-	-
Mung Beans	(Kg)	0	1,391
Groundnuts	(Kg)	110	1,794
Total Labour Requirement	(man-days)	247	603
Gross Value of Production	(฿)	12,335	41,010
Production Costs, excl. Labour	(฿)	1,048	10,675
Hired Labour Costs	(฿)	364	3,404
Net Crop Income, Inside Project Area	(฿)	10.943	26,931
Net Crop Income incl. HH. Labour Cost	(฿)	5,929	16,765
Outside Project Area			
Land Area	(rai)	2.11	2.11
Cropped Area	(rai)	1.45	1.45
Net Crop Income, Outside Project Area	(฿)	1,827	1,827
Net Crop Income, incl. HH. Labour Costs	(฿)	1,463	1,463
Total Net Crop Income	(฿)	12,770	28,758
Total Net Crop Income (incl. HH. Labour)	(฿)	7,392	18,228
Net Farm Income From Livestock/Fisheries [e]	(฿)	7,910	7,910
Other Farm Costs [g]		9,948	10,421
Total Net Farm Income	(฿)	10,732	26,247
Cost Recovery [g]		-	4,156
(O&M Costs)		-	(1,159)
(Capital Costs)		-	(2,997)
Net Farm Income	(฿)	10,732	22,091

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HUAI LAM CHAMAUK

Average Farm Budget with and without Project

		Without Project	With Project
Inside Project Area a/			
Land Area b/	(rai)	26.99	26.99
Cropped Area			
Wet Season LDV Rice	(rai)	18.28	7.98
RDV Rice	(rai)	-	11.96
Kenaf	(rai)	0.31	0.31
Vegetables	(rai)	0.02	0.10
Other c/	(rai)	-	-
Dry Season LDV Rice	(rai)		
Mung Beans	(rai)	1.14	-
Groundnuts	(rai)	2.65	-
Vegetables/Fruits	(rai)	0.19	0.25
Other c/	(rai)	0.09	0.09
Upland Crop. (Manioc/Trees)	(rai)	6.80	6.64
Total	(rai)	25.41	27.33
Cropping Intensity		0.94	1.01
Crop Production d/			
Wet Season LDV Rice	(Kg)	6,727	4,389
RDV Rice	(Kg)	-	8,228
Kenaf	(Kg)	11	14
Dry Season LDV Rice	(Kg)	-	-
Mung Beans	(Kg)	29	-
Groundnuts	(Kg)	107	-
Total Labour Requirement	(man-days)	424	465
Gross Value of Production	(B)	26,048	43,257
Production Costs, excl. Labour	(B)	2,611	7,745
Hired Labour Costs	(B)	2,090	3,285
Net Crop Income, Inside Project Area	(B)	21,347	32,227
Net Crop Income incl. HH. Labour Cost	(B)	13,910	25,177
Outside Project Area			
Land Area	(rai)	20.57	20.57
Cropped Area	(rai)	15.11	15.11
Net Crop Income, Outside Project Area	(B)	6,902	6,902
Net Crop Income, incl. HH. Labour Costs	(B)	3,732	3,732
Total Net Crop Income	(B)	28,249	39,129
Total Net Crop Income (incl. HH. Labour)	(B)		
Net Farm Income from Livestock/Fisheries e/	(B)	6,284	6,284
Other Farm Costs f/		4,911	5,183
Total Net Farm Income	(B)	29,622	40,230
Cost Recovery g/			
(O&M Costs)		—	3,463
(Capital Costs)		—	(741)
		—	(2,722)
Net Farm Income	(B)	29,622	36,767

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3. Cost Recovery

The Project proposes that each tank have developed a complete surface water delivery and drainage system, down to and including capital investment in land preparation, improvement on the farmers' fields. Generally, the RTG/RID has hesitated taking managerial and financial responsibility for more than the tank headworks, main (right and/or left bank) canals and principal laterals. The so-called sublaterals, or tertiary canals, and farm ditching have been left to the farmer, although RTG technical assistance to varying degree have been available to the farmers in preparing the quaternary and field-level water conveyances. The arguments for the RTG limiting itself to the upper end irrigation facilities of tank systems are understandable from replicability, beneficiary equity, and absolute budgetary limiting standpoints. Comprehensive RTG financial responsibility for all major aspects of irrigation infrastructure from prime water source to the plant's rootzone could increase by 10-20% the costs (in present dollar terms) which the government has committed itself to in the main facilities listed above. Unrecovered RTG capital investment for irrigation in excess of $900 total per hectare or $5,000 per average Northeastern irrigated farm may represent an excessive windfall to a sharply-limited, fortuitously-situated group of farmers, poor though they may be.

In USAID's view, the considerable benefit arising from farmers' perceptions of reliable water delivery justifies an RTG policy shift which would include construction of sublaterals in the RID program which heretofore have in tank systems been left to the farmers to complete. Completion by RID of a primary/secondary/tertiary watercourse system built according to sound engineering design represents a modest additional capital cost to the basic primary/secondary system undertaken in RID medium-to-small tanks, and should if properly operated and maintained assure reliable delivery of irrigation water to 15-45 hectare blocks, i.e. close to if not actually at the edge of each farmer's fields. Accordingly, the AID loan will support sublateral construction as part of the RID-financed infrastructure.

As is usually appropriate with all irrigation infrastructure facilities developed for private (farmer) benefit, some if not all of the development costs should be recovered from the principal beneficiaries. At the very least, USAID believes, operations and maintenance (O&M) costs of the irrigation -- and especially the downstream, near-farm network -- should be

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recovered from the users. In the case of those irrigation facilities which constitute the final legs of the distribution system, specifically the on-farm (quaternary) ditches and field-level land consolidation and development, an additional capital cost recovery from the farmers would appear to be appropriate. The question is what cost recovery technique is practical, fair, and effective. Several approaches would appear to be available, with built-in pros and cons:

-- water user charges. Based upon a pro rata calculation of the total stored/delivered irrigation water expressed by some standard unit of measure (such as m3 or acre/feet) estimated to be available over the useful life of the project investment, farmers are charged by the government for the on-farm capital investments which the government would have initially financed and implemented on their behalf. This cost recovery approach has the major related advantage of encouraging water conservation practices on the part of the farmer. A water user charge on a unit basis roughly equates the farmer's fair share of capital cost recovery for the system as a whole, since the larger the area serviced the larger the amount of water used. The straight water user charge approach does not precisely recover from individual farmers the unique and variable costs of detailed, downstream systems (i.e. sublaterals, farm ditches, and land leveling) which each individual farmer faces. There will be some intra-command area subsidy of hard-to-irrigate farms by easy-to-irrigate farms, although the non-contiguous nature of individually owned farm plots common in Thai irrigation systems mitigates this inequity to some extent. The most equitable arrangement for sharing of downstream irrigation system costs is the individual farmer investment method, which follows.

-- individual farmer investment. Under this approach, now commonly in use in Northeast tank systems, the farmer takes financial responsibility for the necessary capital investment involved in ditching below the lateral or sub-lateral level and land development (levelling, bunding, etc.). For the proposed Project, the most practical variant would be for the farmer to receive gratis technical assistance from MOAC and medium-to-long term capital loans (perhaps including a working capital component) from BAAC. The farmer would then pay the cost of capital improvements unique to his own fields' irrigation requirements, with the government essentially picking up financial responsibility for the sublateral-and-above common capital infrastructure. The approach also permits the greatest flexibility to the farmer in use of

his/her own labor in lieu of borrowing, and in that sense fosters greater local beneficiary participation in the initial capital investment and perhaps a more solid sense of ownership and responsibility.

-- land betterment charges. A further variant of the individual farmer investment method might involve MOAC undertaking the on-farm ditching and levelling work under a master construction contract(s) or with its own forces throughout the command area or subarea, and then assigning each farmer his pro rata share of the investment costs on a per hectare basis. This might almost be considered a euphemism for water charges, without however, he advantage of stimulating the farmers' interest in water conservation. As was done in the IBRD-supported Chao Phya Basin projects, costs could be amortized over a longer period at subsidized or unsubsidized (market clearing) interest rates. It might be prudent for the government to establish a grace period on interest payment/principal repayment until farmers have had several seasons' experience with the expanded and rehabilitated system, but with clear prior agreement to repay. One practical implementation problem under this approach is that not all farmers in the command area of subarea may agree to comprehensive development under a master construction contract, which could greatly complicate, inter alia, layout efficiency and drainage problems. To the extent that the Project undertakes capital investment in the tertiary and below conveyance system, this will be a problem, and must be considered in arriving at the optimum investment and cost recovery program.

All of the above approaches to investment cost recovery have met with a greater or lesser degree of resistance in Thailand previously. At the present time, capital cost recovery outside of officially-designated land consideration are as is not possible due to statutory and/or policy restriction. Nonetheless, the Project strategy should offer as an option open to the RTG the opportunity to develop at least one recovery method which recaptures most if not all the government's investment in "on-farm" development.

Annex E

1. Equipment Costs
2. Vehicle Costs
3. Service Center Buildings
4. Consultants
5. Total Costs per Site
6. Software Components

Equipment Costs ($US)

9 Surveying sets @ 2,000 each	$ 18,000
9 Soil test sets @ 750 each	6,750
2 Hand-held power augers @ 1,000 each	2,000
7 Bull horns @ 200 each	1,400
14 Cameras @ 100 each	1,400
15 Hand levels @ 100 each	1,500
3 Drafting sets @ 250 each	750
3 Calculators @ 100 each	300
8 25 m. tape measures @ 75 each	600
7 Overhead projector @ 400	2,800
7 Slide projectors @ 300	2,100
7 Loud speaker sets @ 500	3,500
14 Typewriters @ 500	7,000
	$ 48,100
Vehicles	86,600
	$134,700
	÷ 7
	$ 19,243/tank

LC (Local Cost)

Equipment	$48,100
Motorcycles	26,600
	$74,700

Vehicle O&M Costs ($US)

Tank	Agency	Year 1	2	3	4	5	6	Total
1	PM O&M	1,400	4,200	4,200	4,200	4,200	4,200	
	EA O&M (2)		474	1,900	1,900	1,900	1,900	
	SS O&M (2)		474	1,900	1,900	1,900	1,900	
	TS O&M (1)	1,144						
	Soil Survey O&M (1)	1,144						
	Construct Supv. O&M (2)		948	948				
2	SS O&M		474	1,900	1,900	1,900	1,900	
	EA O&M		474	1,990	1,900	1,900	1,900	
	TS O&M		1,144					
	SS O&M		1,144					
	CS O&M			948	948			
3	SS O&M		474	1,900	1,900	1,900	1,900	
	EA O&M		474	1,900	1,900	1,900	1,900	
	TS O&M		1,144					
	SS O&M		1,144					
	CS O&M			948	948			
4	SS O&M			474	1,900	1,900	1,900	
	EA O&M			474	1,900	1,900	1,900	
	TS O&M			1,144				
	SS O&M			1,144				
	CS O&M				948	948		
5	SS O&M			474	1,900	1,900	1,900	
	EA O&M			474	1,900	1,900	1,900	
	TS O&M			1,144				
	SS O&M			1,144				
	CS O&M				948	948		
6	SS O&M				474	1,900	1,900	
	EA O&M				474	1,900	1,900	
	TS O&M				1,144			
	SS O&M				1,144			
	CS O&M					948	948	
7	SS O&M				474	1,900	1,900	
	EA O&M				474	1,900	1,900	
	TS O&M				1,144			
	SS O&M				1,144			
	CS O&M					948	948	
	TOTAL							135,902

	Co-Proj. Mgrs. - 2 pick-ups @ 6,000	12,000
	SMS's - 8 motorcycles @ 700	5,600
	SE's - 8 motorcycles @ 700	5,600
Total Vehicles:	Extension Agents - 14 motorcycles @ 700	9,800
	Topo Survey - 2 jeeps @ 12,000	24,000
	Soil Survey - 2 jeeps @ 12,000	24,000
	Construction Superv. - 8 motorcycles @ 700	5,600
		$86,600

SERVICE CENTER BUILDINGS AND EQUIPMENT - DESCRIPTION AND COSTS

TANK 1 (Consultant Head Quarters):

1. Building: A single story, concrete block and wooden building with corrugated asbestos sheet roof, concrete slab floor on ground; 8m x 14m, consisting of three individual offices, one group office, and a meeting room; electrical wiring and plumbing; separate latrine. (See drawing) Cost ฿153,500 or $7,675

2. Equipment/Furnishings:

	Amount	Unit Cost(฿)	Cost (฿)
Special Desk & Chair	8	2,500	20,000
Regular Desk & Chair	4	1,500	6,000
Typing Desk & Chair	2	1,000	2,000
Storage Cabinet, steel	2	1,000	2,000
4 Drawer File, steel	4	1,000	4,000
16" Electric Fan	8	1,250	10,000
Meeting Room Chair	50	60	3,000
Meeting Room Table	1	7,000	7,000
			54,000
		Total Cost	฿207,000 or $10,350

TANKS 2 through 7:

1. Building: a single story, concrete block and wooden building with corrugated asbestos sheet roof, concrete slab floor on ground; 6m x 12m consisting of one group office and a meeting room; electrical wiring and plumbing; separate latrine. (See drawing) Cost ฿113,500

2. Equipment/Furnishings:

	Amount	Unit Cost(฿)	Cost (฿)
Regular Desk & Chair	4	1,500	6,000
Storage Cabinet, steel	1	1,000	1,000
4 Drawer File, steel	2	1,000	2,000
16" Electric Fan	3	1,250	3,750
Meeting Room Chair	50	60	3,000
Meeting Room Table	1	7,000	7,000
			22,750
		Total Cost	฿136,250 or $6,810

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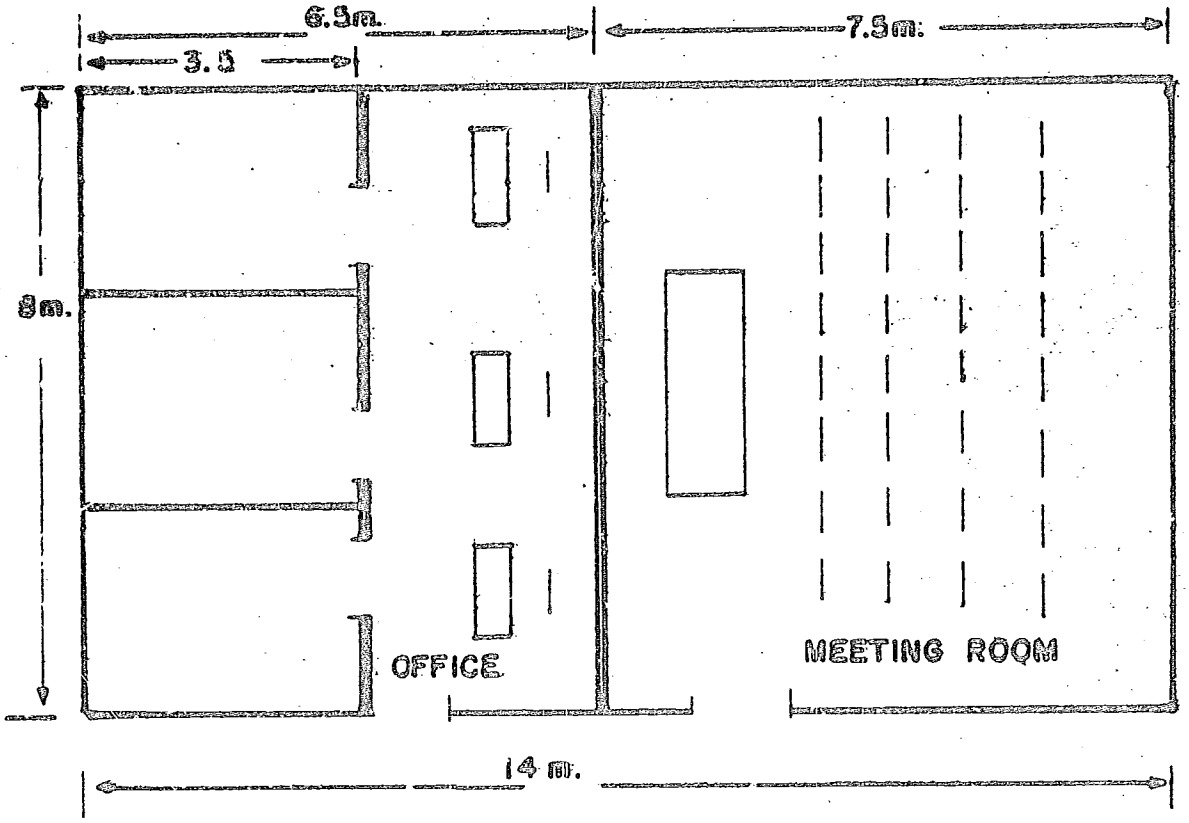
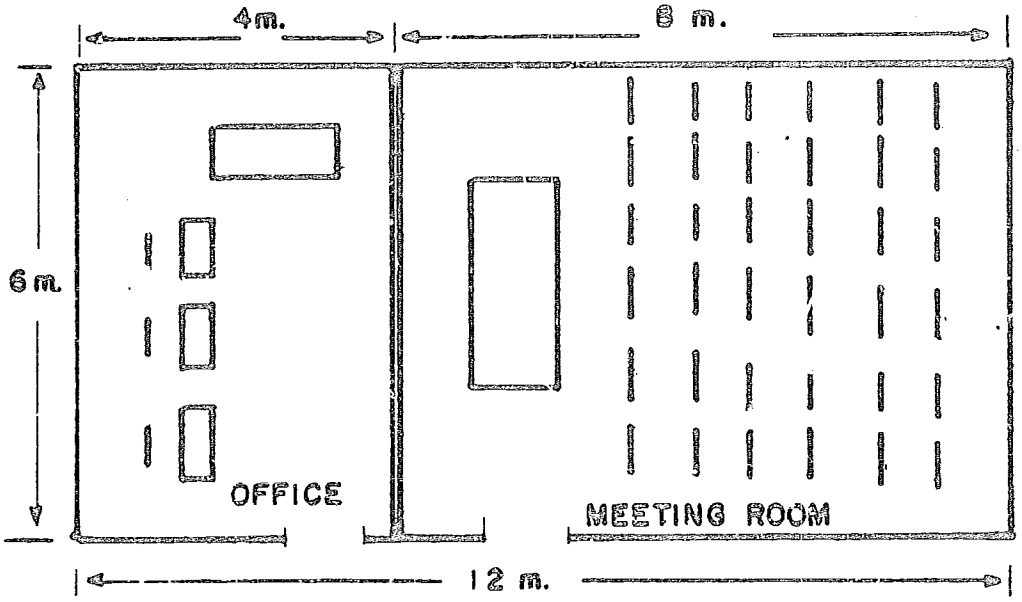


SERVICE CENTER — CONSULTANT HEADQUARTERS



SERVICE CENTER OFFICE

Cost Breakdowns for Consultants

Table A. Foreign Consultants

	6 mos	9 mos	1 yr
AID			
Salary ($150 day)	$19,500	$29,250	$39,000
Post Diff. (10%)	1,950	2,925	3,900
			5,000
Travel Trans*	11,800	11,800	11,800
Medical/Ins.	300	300	300
Workmen's Comp (12%)	2,340	3,510	4,680
Materials	150	200	250
Total	$36,000	$47,985	$64,930
RTG			
Local Travel - per diem (฿600x10d/mo)	฿ 36,000	฿ 54,000	฿ 96,000
- transport	12,000	18,000	24,000
Quarters Allowance - temporary (฿600 x 15 days)(short term ฿1,460/day)	262,800	384,300	384,300
Regular Quarter Allowance $9460/yr = ฿15,800/mo - regular (฿4,000/mo.)	-	94,800	142,200
Secretary (฿3,000/mo.)	18,000	27,000	36,000
Transportation to Office	6,000	9,000	12,000
Misc.	5,000	5,000	5,000
Total	฿339,800	฿592,100	฿699,600
	$ 16,990	$ 29,605	$ 34,980
Total Cost	$ 52,990	$ 77,590	$ 99,910

*includes 3 dependents when period over 3 months

Employee, wife & 2 children (1 over 12 & 1 under) = 3.5 persons.
Education allowance $2,250 + $2,650 = $4,900 or ฿98,000 + Lab. Fee ฿300 + Transportation ฿8,800 = ฿102,700 for 2 children/year.

Table B. Thai Consultants

	3 mos	6 mos	9 mos	1 yr
AID				
Salary	45,000	90,000	135,000	180,000
Materials	2,000	3,000	4,000	5,000
Total	47,000	93,000	139,000	185,000
RTG				
Quarters Allowance	13,000	25,000	37,000	49,000
Local Travel	8,500	17,000	25,500	34,000
Secretary	9,000	18,000	27,000	36,000
Transportation to Office	3,000	6,000	9,000	12,000
Recruitment, Insurance, Misc.	800	9,000	10,000	11,000
Total	41,500	75,000	108,500	142,000
Total Cost Baht	88,500	168,000	247,500	327,000
US$	4,425	8,400	12,375	16,350

Tables a and b provide cost estimates for the first year of the project. Years 2-5 should be inflated by a minimum of 10% annually.

Consultant Cost to be Paid by DTEC ($US)

	Year					
	1	2	3	4	5	Total
Man Yrs	2.7	3.5	6.3	5.1	2.7	25.3
X Housing (7,000/yr), In-country travel (1,000/yr) and in-country per diem (5,000/yr) = total 13,000/yr. —	35,100	110,500	81,900	66,300	35,100	328,900
X Inflation 10%/yr	1.1	1.21	1.33	1.46	1.61	
Subtotal to subtract from AID consultant costs.	38,610	133,700	108,930	96,800	56,500	434,540
339/mo each {3 driver's salaries / O&M for 3 pickups}	3,050	12,200	12,200	12,200	12,200	51,850
w/infl	1,100	4,840	5,320	5,840	6,440	23,540
167/mo each 2 secretary's salaries	1,000	4,000	4,000	4,000	2,000	15,000
Subtotal	4,050	16,200	16,200	16,200	14,200	
X Inflation 10%/yr.	1.1	1.21	1.33	1.46	1.61	
Subtotal	4,455	19,600	21,550	23,650	22,860	use 90,000
Total						526,650

	U.S.	Thai	Total
Man months	127	177	304
Man Years		14.8	25.3
%			
Salaries	1,270,000	368,691	

ANNEX E-5

PROJECT COSTS (1,000 $ US) - All Sites

Item	Huai Talat		Huai Chorakhe Mak		Phuttha Utthayan		Huai Aeng		Huai Khi Lek		Huai Kaeng		Lam Chamuak		TOTAL	
	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID	RTG	AID
Embankments	265.3		147.9		50.9		0		0		0		0		464.1	
Main Canals																
Lining	481.1		147.5		265.9		218.8		185.0		79.4		209.7		1,587.4	
Structures/Drainage	12.9		14.8		15.3		9.2		10.1		18.3		7.8		88.4	
Lateral Canals																
Lining	48.0		0		22.3		159.8		113.6		118.3		13.4		474.4	
Structures	5.9		0		0		6.6		7.6		10.8		0		30.9	
Access Roads	206.4		116.5		95.6		179.6		12[illegible].7		233.1		126.6		1,082.5	
Sub-lateral canals		27.9		15.8		21.9		36.7		24.4		49.6		9.8		186.1
Land Preparation		347.2		173.6		415.3		471.2		544.2		695.3		380.9		3,027.7
Service Centers		8.5		8.5		8.5		13.5		8.5		8.5		8.5		64.5
Maintenance	56.4		34.8		59.2		84.9		101.0		161.6		64.7		562.6	
RTG Staff Salaries	22.9		22.9		24.9		28.6		26.9		26.9		24.9		178.0	
RTG Staff Per Diem		7.6		7.6		7.7		9.7		7.8		7.8		7.7		55.9
Vehicles/Equipment		19.2		19.2		19.2		19.2		19.2		19.2		19.2		134.4
Vehicle O & M		12.8		12.8		16.6		39.5		20.4		20.4		16.6		139.1
Subtotal	1,098.9	423.2	484.4	237.5	534.1	489.2	687.5	589.8	567.9	624.5	648.4	800.0	447.1	442.7	4,468.3	3,607.7
Contingency(15%)	164.8	63.5	72.6	35.6	80.1	73.3	103.1	88.5	85.2	93.7	97.3	120.1	67.0	66.4	670.1	541.1
Inflation(10%yr)	755.9	273.8	331.1	145.7	288.9	249.1	204.4	160.6	239.8	239.6	273.8	309.0	241.8	224.3	2,335.7	1,602.1
TOTAL	2,019.6	760.5	888.1	418.8	903.1	811.6	995.0	838.9	892.9	957.8	1,019.5	1,229.9	755.9	733.4	7,474.1	5,750.0

Software Components

	Quantity	Cost	
		DTEC	AID
Technical Assistance	Approximately 27 man-years of technical assistance.	$540,000	$2,220,000
Market Support	Farmer trips transport of goods, etc.		50,000
Demonstrations	Seeds fertilizers Pesticide for demonstration plots (3 per year per site)		10,000
Crop Insurance	Insurance of up to 50% of market value of farmers crops on demonstration basis.		200,000
Evaluation	Two evaluations		100,000
Farmer observation travel to successful systems.	Two trips per site		40,000
Research and work-shop	Operational research and 2 workshops per site.	10,000	90,000
Contingency			50,000
Total		$550,000	$2,760,000

Annex F

Thailand - Small Scale Irrigation Project Certification
Pursuant to Section 611(e) of the Foreign Assistance

I, Thomas R. Blacka, acting principal officer of the Agency for International Development in Thailand, having taken into account among other things the maintenance and utilization of projects in Thailand previously financed or assisted by the U.S. and the commitment of the Royal Thai Government to carry out an effective Small Scale Irrigation program, do hereby certify that in my judgment Thailand has the financial and human resources capability to implement, maintain, and utilize effectively the subject Small Scale Irrigation Project.

Date: July 22, 1980

Thomas R. Blacka
Acting Director
USAID/Thailand

ANNEX G

PROJECT CHECKLIST

A. General Criteria for Project

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	(a) The project was not included in in AID's FY 1980 Congressional Presentation. A notification of the project will accordingly be forwarded to Congress and the required waiting period observed prior to obligating funds for the project; (b) Proposed loan assistance is within OYB, but additional funding will be sought for the grant component.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Agreed plans and cost estimates are incorporated into the Project Paper.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No further legislation is required.
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	All appropriate standards and criteria have been met.

5. FAA Sec. 611(e). 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?	Director's certified statement is incorporated in the Project Paper.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
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.	No significant effect expected.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and 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 designed to have any significant effect on any of these items.

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 U.S. are utilized to meet the cost of contractual and other services.	The Royal Thai Government contribution to this Project will exceed 25%. There are no US owned local currencies available for this Project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No
11. FAA Sec. 601(e). 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 productive capacity becomes operative, 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. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in

development, by extending access to economy at local level, increasing labor-intensive 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; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

Project is designed to increase income of poor rural people in Northeast Thailand through improved use of available water resources. Appropriate technology will be used to established benefits. Benefits from the improved irrigation systems will be forthcoming on a sustained basis once established.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph 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;	The Project purpose is to increase the income of the small farmers in Northeast Thailand.
(2) (104) for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for 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;	

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

(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 programs 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.

c.	(107) Is appropriate effort placed on use of appropriate technology?	N/A
d.	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 as sistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	Yes.
e.	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 the recipient country "relatively least developed"?	No grant fund will be used for the capital project portion of this Project.
f	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 resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.	Project will satisfy peoples' felt needs for better access to water for irrigation. Local Water User Associations will play an active role in management of the Project.
g.	FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic Growth?	Yes, these are major objectives.

2. Development Assistance Project Criteria (Loans only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.	There is a reasonable expectation that the loan portion of the Project will be promptly repaid.
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 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

PROJECT AUTHORIZATION

Name of Country: Thailand

Name of Project: Northeast Small Scale Irrigation

Number of Project: 493-0312

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Northeast Small Scale Irrigation Project for Thailand involving planned obligations of not to exceed $5,800,000 in loan funds and $2,800,000 in grant funds over a six 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.

2. The project will establish a replicable approach and institutional capabilities for increasing agricultural incomes for small farmers within command areas of existing tank irrigation systems in Northeast Thailand.

3. 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.

4. a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. 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 U.S. Dollars interest from the Date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) 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

Goods and services, except for ocean shipping, financed by A.I.D. under the project shall have their source and origin in the Cooperating Country, in the United States and in countries included in A.I.D. Geographic Code 941 except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States or the Cooperating Country.

c. Initial Conditions Precedent to Disbursement for the Grant and the Loan

(1) Establishment of the Project Coordination Committee, Provincial Operations Committees, and first site team designated.

(2) Project Manager Appointed.

d. The following waivers to A.I.D. regulations are hereby approved:

(1) Proprietary Procurement for 7 American Motors Jeep Vehicles.

(2) Section 636(i) of the FAA of 1961 for 38 locally manufactured small (less than 125 cc) motorcycles.

(3) Section 631(i) of the FAA of 1961 for 2 locally assembled right hand drive pick-up trucks.

Signature: _____

Title: _____

Date: _____