TECHNICAL NOTE

NO. 9

MASTER PLAN DEVELOPMENT

AT

THE

LAM NAM OON INTEGRATED RURAL DEVELOPMENT

PROJECT

SAKON NAKHON, THAILAND

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ISSUED BY

CENTER FOR RURAL DEVELOPMENT

LOUIS BERGER INTERNATIONAL, INC. U.S.A.

UNDER CONTRACT WITH MINISTRY OF

AGRICULTURE AND CO-OPERATIVES OF THE

KINGDOM OF THAILAND

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FOREWORD

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For those interested, additional copies of this Technical Note may be obtained from the Center for Rural Development, c/o Louis Berger International, Inc. 100 Halstead St. East Orange, New Jersey 07019, U.S.A.

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A. OVERALL INTRODUCTION

This Technical Note describes the evolution as well as presents the content of the Lam Nam Oon Integrated Rural Development Master Plan.

What happened seems to be typical of the course of development project planning. There are often so many variables and essential data is lacking in such degree that initial and follow-up planning efforts often fail to focus on ascertaining what is essential to long-term project success.

The Lam Nam Oon experience is another in this genre. Yet, it is also somewhat different because through the persistent quest for a viable plan, coming from many quarters, there ultimately emerged a concise, focused, statement of what was needed.

Still, despite all of the effort to date, there are gaps in the existing plan. Two of these are very basic and they continue. One concerns the fact that an accurate picture of the economic context of this project was never developed. This is a crucial constraint on a project which depends upon specific economic behavior on the part of beneficiaries in order to signal success or failure. This is not to say that economic research was not done and is not continuing on the project. Such work goes forward but the collection of such data and it's careful analysis requires far more time and varying perspectives than was originally anticipated by project designers and planners alike.

In the same way, another serious gap concerns lack of an accurate sociological picture of the farmer-irrigators of the Lam Nam Oon irrigation project. Nothing was ever done to sketch this picture in any degree of depth and nothing is being done now. Yet, the experience at Lam Nam Oon to date shows clearly that some groups of villages are more receptive to technological change than others. In some cases, it is sub-sets of villages that best respond. In other cases, it is just a few families in a village or those coming from different villages but farm-located in a specific irrigation block. Finally, in some cases it appears that farm location on the right-of-way of a ditch/dyke has considerable effect upon the risk-taking and investment proclivities of specific farmer-irrigators. Why? Nobody knows and no one is investigating these matters in a carefully designed manner.

Yet the content of these two kinds of studies would greatly influence planned development in an area like Lam Nam Oon. It is to be hoped that, in future, more detailed investigations of the economic and sociological aspects of the Lam Nam Oon development can be programmed.

These gaps, as well as other possibilities not mentioned here, place the existing Master Plan in context. It cannot be regarded as a final statement of what needs doing by whom. It should be reviewed at intervals and upgraded in the light of new facts and earned experience.

B. THE GESTATION OF THE LAM NAM OON MASTER PLAN

I. The First Period: 1976-1981

1. Introduction:

Designing, planning and administering development assistance projects does not often follow a orderly and logical sequence.

This happened in the case of the Lam Nam Oon Integrated Rural Development Project. In fact, it's evolution was so disorderly and fraught with uncorrected or mis-conceived policy decisions that there are two Lam Nam Oon Integrated Rural Development projects.

These can be dated chronologically:

First project - starting from the project design stages in 1976 to the summer of 1981.

Second project - starting from July-November of 1981 to the end of the first loan extension on September 30, 1983.

There may be a third project, if the loan is extended beyond September 30, 1983; but the internal content of that project will be dependent upon decisions taken by the Ministry of Finance of the Royal Thai Government (representing the borrower) and the loan agency, the United States Agency for International Development.

This paper deals with the first and second projects as defined above.

2. Design and Operation of Project 1:

In this particular section, the object of attention will be the first project together with the background accompanying it's establishment and growth.

The Lam Nam Oon Integrated Rural Development Project (first project) was designed by a joint United States Agency for International Development (USAID) and Royal Thai Government (RTG) team during the 1976-1977 period.

The origins of the project were dual.

As a consequence of the dangerous security conditions in the Northeastern region of Thailand during the 1960's and 1970's, the Royal Thai Government addressed increased developmental attention to the region. They were assisted in this policy by the United States of America which was then engaged in efforts to 'contain' the expansion of Communism within Southeast Asia.

At that time, the Lam Nam Oon area was indentified as one which possessed some potential for development as a irrigated agricultural system. Accordingly, starting in 1962 with studies and construction beginning in 1966 the Royal Irrigation Department began to construct an earth-filled catchment dam on the Lam Nam Oon river and design/construct 350 Kms. of cement-lined Right and Left main and lateral canals for the system.

They were assisted in this work by an American loan which provided funds to buy construction and shop equipment and also employ the consultant services of an American firm, Engineering Consultants,Inc. (ECI). By the close of 1975 a considerable portion of the main system was constructed; but there remained about 200 Kms. of lateral canals to be built by 1980. There was also the question, at that point, what kind of on-farm delivery system was to be built for the Lam Nam Con irrigation system - after the main canals and laterals were completed?

Another question, at that time, arose over whether merely completing the main systems and the on-farm water delivery systems would be a sufficient condition to insure that the farmers in the area would embrace year-around irrigated agriculture as a new way of life. An affirmative answer to this question appeared to be very dubious. These were farmers with no experience in irrigated agriculture. They operated a subsistence agriculture in which cultural practices, capital requirements, and market potentials were of a very low order. How could it be expected that the provision of irrigation water only would modify these conditions sufficiently to fuel the adoption of year-around irrigated agriculture?

This question became more pointed when it was understood that the soils of the area were relatively poor and fragile, the terrain either rolling or low-lying with a tendency to water-logging and salinization, no varieties of crops had been tested for irrigated agriculture in the area, crops would have to be diversified because the irrigation system would not supply sufficient water for year-around rice cultivation, and the markets were non-existent and remote.

By 1976 these questions and conditions at Lam Nam Oon made that area and project a very promising candidate for a second wave of American assistance. This was founded upon a different set of principles than those marking the security-conscious Thai and American perspectives of the 1960's. Now, under the U.S. Congressional legislation of 1972, USAID looked for projects that would deal with Basic Human Needs particularly in remote, disadvantaged, rural areas. Lam Nam Oon fitted these new principles very well; and it had a potential for further development at relatively modest cost since a great deal of money, particularly Baht, had already been invested in constructing portions of the irrigation system.

Furthermore, the foreign consultant company - E.C.I. had completed some crucial studies and background reports on the area. These included a Land Classification study on the soils of the Lam Nam Oon area, studies concerning cropping patterns and crop calendars, water supply and demand studies, and reservoir operation and water balance studies. While these certainly did not cover all of the subjects which required intensive investigation prior to operating the irrigation system, they did appear to provide a considerable technical base.

These circumstances, together with the priority attached by the Permanent Under-secretary of the Ministry of Agriculture and Co-operatives, Dr. Thalerng Thamrongnavasawat, to the need to rapidly upgrade the productivity of the Northeastern region irrigation systems, led to a decision to design an intergrated kind of project for Lam Nam Oon.

2.1 Faulty Design Assumptions and Planning Requirements

In retrospect, it can be seen that the designers of that time based part of their reasoning on some unrealistic assumptions. Three of these are singled out here because their presence affected all Lam Nam Oon plans and operations from 1976 onwards.

They included:

- An assumption that a five-year span of project life would provide a sufficient time interval to diagnose and remedy the major technical constraints affecting an irrigation area of 31,000 Hectares (185,000 rai) in the Northeast.

- An assumption that a irrigation project located under such adverse conditions (climatic, soils, water supply, un-developed crops, and markets, and subsistence farming cultural practices) could be subjected to suitably adjusted cost/benefit criteria on a meaningful basis.

- An assumption that a number of participating Royal Thai Government agencies would rapidly perceive what had to be done to alter the internal content of their technical services and management systems so that they significently affected the development of irrigated agriculture in the area.

None of these assumption turned out to be valid, but it was the first and second which were the most damaging.

In the instance of a five-year project life for an irrigation area the time for counting meaningfully begins when the schedules are established for constructing on-farm water delivery systems. In 1976 such schedules were not established; and, in the event,

it will not be until 1987 when all on-farm water delivery systems are completed at Lam Nam Oon. Once on-farm water delivery systems are installed and operational it usually requires about ten years of training, research, and crop/market development before portions of the irrigation system begin to produce effectively. In such a context, the minimum time frame for the Lam Nam Oon Integrated Rural Development Project should have been fifteen years and not five.

Measuring cost/benefits for a project with such a low economic starting base assures a chronic exercise in futility. As has been described earlier, the selection of Lam Nam Oon for development, initially, was on political grounds associated with security as well as demonstrating a helpful Royal Thai Government presence in the area. Economic criteria were not involved and the technical feasibility was marginal.

Yet, starting with the project design work of 1976 and continuing until today, policy makers in the RTG Ministry of Finance and USAID insisted upon the imposition of cost/benefit criteria in order to justify loan financial conditions and project support. The result was an unending series of adverse studies or absurdly skewed numbers which only served to confuse proponents of the project or arm opponents with nonsense-data. The entire continuing episode strongly suggests that current economic analytical techniques for remote-area and physically/socially disadvantaged projects are so intellectually barren that they act as impediments rather than props to attaining constructive development assistance judgements.

The design work which began on this project in 1976 was circumbscribed by certain parameters. The first of these was the physical area and population of Lam Nam Oon. Irrigation was to be extended to 31,000 Hectare (185,000 rai) farmed by 12,500 cultivators who lived in 92 villages. These villages were located in 13 Tambol(1) and 3 Amphur(2) all within Sakon Nakhon changwat.(3)

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(1) Tambol - Sub-district

(2) Amphur - District

(3) Changwat - Province

A second parameter was that the loan would be in the amount of $4,500,000 scheduled for use over a five-year period. A third was that the contents of the loan would be used in the following approximate proportions: 39% for the purchase of equipment; 40% for technical assistance; and 21% for providing Baht funds for use by participating agencies.

Three conditions or planning requirements were specified by the designers as critical to project start-up:

- The project would start in July 1977 with all selected participating agencies jointly organising Financial and Work Plans for submission and action in the Fiscal Year of 1978 which began on October 1, 1977.

- The technical assistance team would quickly be selected and assist in developing the Work Plans and Financial Plans of the participating agencies. That team would be of sufficient size so that it could provide a range of special skills suitable to meeting all the needs specified on a timely basis.

- There would be continuity of leadership in the project by the Royal Thai Government and, similarly, the loan agency - USAID - would provide adequate and continuious monitoring.

None of these conditions were met. Time slipped, participating agencies did not plan and implement together initially, the technical assistance input was cut by almost 50%, and the leadership of the project changed near the start while USAID monitoring was diluted by assignment of responsible personnel to other projects.

Prior to examining what happened in each of these cases and how these changes affected the project, it is necessary to summarise the contents of the Project Paper for the Lam Nam Oon Integrated Rural Development project. It called for three major categories of activity:

- The irrigation system and land improvement.
- Rural development activities.
- Project organization and management.

Each of these categories, in turn, were sub-divided into a series of special concerns:

- The irrigation system and land improvement:
  - Water management and control.

- Land improvement, pilot areas with Operations Research programs.
- Operations and Maintenance improvement.

- Rural Development Activities:
  - Agricultural research and extension
  - Community development and occupational promotion
  - Fisheries development
  - Farmer organization development
  - Credit and marketing
  - Expanded adult education services
  - Expanded health and family planning services and Private Voluntry Organization programs

- Project Organization and Management:
  - Three-tier organization, national, changwat, project.
  - Project Field Director and Team Leaders centered at project site and organised as a single project management authority.
  - Technical advisory services at site
  - Training emphasis
  - Periodic evaluation

Measurable progress towards attainment of goals in each of these cases was specified in the Project Paper; but the accompanying records do not indicate to what extent key personnel in each participating agency comprehended what would be required to attain those goals. In any case, the subject remained academic for over a year as USAID/Bangkok, USAID/Washington, and the RTG Ministry of Finance engaged in a three-way argument over the economic viability of the project. Hence, the project start-up was delayed.

Another dispute developed between the Ministry of Finance and USAID/Bangkok over the proportion of the loan that was to be utilised for technical assistance. As mentioned above, the designers envisaged a technical assistance team of sufficient size that it would render a considerable number of services at a cost that would absorb about 40% of the loan.

The Ministry of Finance forced a reduction in the technical assistance funds assigned to the project to $1,028,249 or approximately 23% of the total loan. This was a drop of severe magnitude; and it caused a number of long-term and short-term technical positions to be dropped from the technical assistance team. Particularly damaging was the loss of positions for long-term specialists on agronomy, agricultural extension, and integrated planning/management. It was, at this juncture, that both USAID/Bangkok and the selected consultant firm; Louis Berger International,Inc. erred. They did not insist in a change in the terms of reference for the consultant team. Instead, those terms were left as specified in the Project Paper.

Clearing up all the above arguments took time. Therefore, it was not until the beginning of the Fiscal Year of 1978/1980 or two years behind the Project Paper schedule that the participating agencies developed Work Plans and Financial Plans for activities under the loan.(4) Because of haste and the fact that the project field management was not yet adequately staffed while technical assistance was still absent, these initial plans set a pattern that was to continue (with some exceptions) for the participating agencies.

Essentially, these Work Plans and Financial Plans contained national priorities and programming techniques for each agency distributed uniformly among the villages of the Lam Nam Oon project area. The only exception,initially, concerned the Work Plans and Financial Plans of R.I.D. That agency, at least, knew that the project concerned irrigation and that irrigation system design, construction, and operation demanded special plans and priorities. The same could not be said, initially, for any of the other five participating agencies including: the Department of Agriculture; the Department of Agricultural Extension; the Department of Fisheries; the Department of Community Development; and the Department of Non-Formal Education.

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(4) The participating agencies included: Royal Irrigation Department (RID), Department of Community Development (CDD), Department of Agriculture (DOA), Department of Agriculture Extension (DOAE), Department of Fisheries (DOF) and Department of Non-Formal Education (DNFE). Those Departments were in the Ministries of Agriculture and Co-operatives; Interior; and Education.

It may be noted here, both in extenuation of blame upon those agencies or the USAID/Bangkok acceptance of such Work Plans and Financial Plans, that the on-farm irrigation systems development prospects for Lam Nam Oon were very confused at that time. During the two-year delay from 1977 onwards, R.I.D. had gone forward with construction at Lam Nam Oon. It had done this in good faith because the Project Paper clearly signalled that two types of on-farm water delivery systems were to be installed in the Lam Nam Con area. One would be intensive and total about 26,300 rai (4,400 Hectare) and the remainder would be extensive and constructed for about 159,000 rai (26,500 Hectare). The Project Paper did not specify what kind of intensive and extensive on-farm delivery system should be installed.

R.I.D., therefore, selected an intensive model and began construction of Pilot areas at Lam Nam Oon. This work started in 1977. The model selected, without adaptation to Lam Nam Oon conditions, was the most advanced R.I.D. system (Number 4) or the Chanasutr model. This was based upon designs and useages in the Central Plains of Thailand. No construction work was started on extensive systems of on-farm water delivery and by the time that the project got started in late 1979 no decision had yet been made on what kind of a extensive on-farm irrigation model to construct.

Within two years of it's introduction at Lam Nam Con in Pilot Area 1 and 3, the Chanasutr model fell under increasing criticism from quarters outside R.I.D. The Bureau of the Budget of the RTG regarded the cost of construction per rai as much too high. Particularly so, when the relatively low yield potentials of irrigated crops in such a remote irrigated area as Lam Nam Con were factored into calculations. The late-arriving and reduced technical assistance team at Lam Nam Oon also began to voice and publish adverse findings shortly after it's arrival on site in December 1979.

The technical assistance team, fielded by Louis Berger International,Inc., faced a particularly difficult situation. It's contractual terms of reference called for it to develop Operations Research of a detailed character in three Pilot Areas at Lam Nam Con. Yet upon arrival, the team found that the model (Chanasutr) being installed was inappropriate to the soils, terrain, and water supply conditions of the project. It, therefore, chose to suspend all efforts to develop Operations Research activities on the Pilot Areas as prescribed in the contract. Instead, the team concentrated upon trying to get R.I.D. to either adapt the Chanasutr model to Lam Nam Con conditions or reduce the area to which that model was to be applied.

In addition to embroiling the technical assistance team in a long-term and time-wasteing struggle over how much area should be devoted to intensive on-farm development, the net effect of R.I.D.'s premature adoption of an inappropriate model was that it further complicated and slowed the processes by which the participating agencies were gaining experience on planning and implementation at Lam Nam Con.

This situation is best exemplified by what happened in the annual planning for the Work Plans and Financial Plans for the 1980/81 Fiscal Year at Lam Nam Oon. By that time, the technical assistance team had been in place for almost a year; and it's personnel were increasingly familiar with what had to be done by the participating agencies. Yet, at that point, it was not clear whether the Chanasutr model was going to be constructed on the entire 26,300 rai originally scheduled and there was total uncertainty about where, when, and what kind of extensive on-farm water delivery systems would be constructed.

Under these circumstances, some participating agencies such as the Department of Community Development adopted a long-term view. It began to build what became the Ban Fang Daeng Rural Development Training Center as a venue for imparting irrigated agriculture principles to Lam Nam Oon farmers who would be affected by either intensive or extensive on-farm water delivery systems. Two others doing somewhat the same thing were the Department of Agriculture and the Department of Fisheries.

Thus, the 1980/81 Work Plans and Financial Plans for Community Development, Agriculture, and Fisheries reflected a considerably tightened and focused set of goals - each specific to the interests and programming style of the Department concerned - but nevertheless related to the long-term needs of the irrigation project. Yet, because the Project Paper goals were rather broad and "quality-of-life" oriented even these more alert and responsive Departments presented portions of their Work Plans and Financial Plans which were area-wide and far from fully concentrated on what they should best do to support an irrigation project. Other Departments, such as Non-Formal Education and Agricultural Extension continued to present Work Plans and Financial Plans which resembled the national priorities first reflected in their submissions for Fiscal Year 1979/80.

At the same time this was happening the technical assistance team was now almost totally embroiled in the struggle to stop expansion of the Chanasutr model. It won grudging RID consent to design an on-farm water delivery systems model specifically tailored to Lam Nam Oon conditions. Installed on 2,400 rai (400 Hectare) by the summer of 1981 and located at Pilot Area 2, this became known as the Lam Nam Oon model. It later was the venue for a series of Operations Research studies which continue until the present. This development, together with the steady emergence of new and informed project leadership at Lam Nam Oon began to set the stage for the growth of the second Lam Nam Oon project as defined above.

As remarked earlier in this paper continuity of project leadership had been a pre-condition postulated by the project designers. Yet, within seven months after the project began and the technical assistance team was in place, R.I.D. changed the Project Field Director. He was Khun Vichai snguanpaiboon an experienced engineer who had directed R.I.D. - associated rural development projects in other parts of Thailand. This was a distinct boost to the Lam Nam Oon project; but it required the passage of over a year before the new Project Field Director was sufficiently familiar with all the problems in the project - that he could exert influence upon it's content and conduct.

Similarly, USAID/Bangkok was to provide continuious monitoring of the project from the outset. However, shortages of staff within USAID forced dual assignments of USAID personnel to other projects. The result was that continuious monitoring ceased and USAID/Bangkok began to feel that the project was "adrift".

2.2 First Planning Starts:

2.2.1 "4-Month Planning Strategy"

Within thirty days of arrival at site the Louis Berger International,Inc. advisory team produced a "4-Month Planning Strategy" (December 31, 1979).

This was an internal document aimed at focusing team attention upon developing the elements of a planning strategy.

The document, in particular, drew team attention to the following points:

- Area-wide planning/development would be too diffuse and there was insufficient project staff and resources to support such an approach. Therefore, a limited area-specific set of planning targets, probably Tambol by Tambol, would be more appropriate.

- Because of uncertainty about the efficiency as well as lack of farmer acceptance of the Chanasutr (Model 4) intensive water delivery model, efforts should be directed at fostering farmer participation in the design and implementation of various aspects of the project.

- Similarly, and for the same reasons as above, much attention should be devoted to examening the costs and efficiencies of the water delivery models.

- In the absence of precise team knowledge about what crops and cultural practices were best suited to the soils climate, and water supply conditions of the Lam Nam Con area,small-scale tests and experiments with different crops and varieties should be designed and implemented.

- The various participating agencies should be encouraged to perform their regular programs with emphasis upon the selected Tambol areas.

2.2.2 "Phased Work Plans and Financial Plans"

By February 1980 or two months into the "4-Month Planning Strategy" period described above the advisory team issued suggested guidelines for operation of the Work Plans and Financial Plans for each participating agency in the current fiscal year of 1980. These guidelines also suggested the strategy to be pursued in the coming fiscal year 1981 submissions.

There were a number of "key" constraints to these suggested guidelines:

- A basic premise stated was that "a strategy for integrating inputs with soil, water, and cropping conditions"must be developed and tested.

- It was noted that the advisory team would have only one Dry Season (irrigation period of November 1980 to May 1981) to test an Integrated Strategy with all technical inputs.

- Also the participating agencies RID, CDD, DOAE, DOA, and Non-Formal Education were not yet adequately staffed at Lam Nam Oon to assure adequate planning and implementation at site.

- Furthermore, it was observed that the AID loan contents provided a "mix" of construction, supplies, equipment, and operating funds to the participating agencies. Some of these elements, notably construction and equipment procurement, would naturally impose enlarged administrative burdens on the agency concerned. This, in turn, would interfere with the capacity of such agencies to participate in strategy planning and implementation at the field level.

Give the above constraints the guidelines were shaped as follows:

(a) Focusing all participating agencies on a geographic area containing several Tambols, pilot test areas, and irrigation lateral canal zones.

(b) Use of such a geographic area over a period of two Dry Seasons and one Wet Season as a place for testing integrated program development.

(c) Selection of Pilot Area 2 for use in testing irrigated on-farm water delivery systems and techniques with integration of Department of Agriculture and Department of Agriculture Extension programs.

(d) Developing on-farm training, village training, and consolidated or special training programs and facilities based on experience earned in the geographic area that had been selected.

(e) Involving farmers, local leaders, and official in all of the activities undertaken.

(f) Attention to costing inputs/outputs and determining sound water management practices and cropping patterns for the area.

These guidelines gradually began to affect project planning and implementation at Lam Nam Oon; but they did so in a marginal manner. This was because the participating agencies, the team leaders, and the project leadership remained unconvinced that such a "phased work plan" with concentration upon one geographic area was desirable or practicable.

2.2.3 Physical Planning based upon total "Water Space"

The next advisory team effort to foster planning at Lam Nam Oon took place during March-September 1980.

It was decided that since the previously recommended Tambol-by-Tambol test and planning approach was not gaining acceptance, a more quantitatively-based and area-differentiated planning approach should be tried.

This eventuated in the organization and publication of Project Note No. 2 in October 1980, "Lam Nam Oon Preliminary Water Space and Integrated Rural Development Planning."

Six factors were selected as area-specific and with comparative values attached by area. Twenty-three zones were delineated within the total Lam Nam Oon water space - or area to be served by irrigation water. These zones were later adopted by the Lam Nam Oon project leadership as the Units around which the construction and management of the on-farm water delivery system was based.

In Project Note No. 2 the six factors included: soils, drainage, land use, population density, type of water delivery system to be installed and cropping efficiencies. Access to markets, credit, etc. were mentioned as a factor also but not weighted.

Once values were attached to the six factors and applied to the twenty-three zones a preliminary set of recommendations emerged concerning where to concentrate planning and implementation work for Fiscal Year 1981. These were grouped as areas for: Most Intensive Development; Middle Level Development, and Least Intensive Development.

This grouping was accompanied by recommendations for United Work Planning by all participating agencies for Fiscal Year 1981.

Again, this document had an effect upon planning and implementation at Lam Nam Oon; but it was marginal. The problem, in this case, was that the RID leadership differed with the advisory team concerning the weight to be attached to zones above the four electric pumps which had been installed at certain points in the irrigation system. These pumps had cost much money to install and their operational costs were high. Therefore, it seemed to RID personnel that the areas served by those pumps should be given the highest or at least intermediate priority for development.

While this basic difference resulted in only qualified acceptance of the preliminary recommendations given by the advisory team, the general approach recommended gained attention and began to influence developmental thinking at Lam Nam Oon.

2.2.4 Unified Work Plans and Financial Plans - Fiscal Year 1981

The third planning effort by the advisory team took place during September-December, 1980. The focus was upon "unified" work planning and financial planning by participating agencies using the contents of Project Note No. 2 as a base for area-reference while at, the same time, introducing targeted subject matter activities.

Thus, the 146-page combined Unified Work Plan and Financial Plan of December 1, 1980 contained eight major subject matter activities subdivided into 120 special subjects and topics. All of these were centered around the Most Intensive Development, Intermediate Development, and Least Intensive Development areas presented in Project Note No. 2.

Again, this effort had some marginal effect upon future planning and implementation at Lam Nam Oon. Among other things, it drew attention to differentiating planning by crops, seasons, and types of activity. It also introduced the overall topic of marketing and credit as a vital element of any future development at Lam Nam Oon.

However, as in previous instances, the initiative and content for such an effort came only from the advisory team. The project leadership, the team leaders and the participating agencies at Bangkok continued to preoccupy themselves with preparing the traditional or conventional types of annual Work Plans and Financial Plans mentioned earlier. USAID/ Bangkok continued to fund these without insisting that the advisory teams planning efforts be at least partially incorporated in the annual Work Plans and Financial plans.

2.2.5 Dry Season Production Season Planning

Another exercise, which started in December 1980 also occupied the attention of the project leadership and the participating agencies during the early 1981 period. This was the establishment of the Bangkok-based Dry Season Production Committee for the four major Northeastern Thailand projects.

The Committee, with it's demands for crop targets, scheduling of inputs, and coordination of activities caused the Lam Nam Oon project leadership including the team leaders to institute procedures for targeting, planning, and coordination not hitherto established. The advisory team provided technical advice on relating crop targets and areas to suitable soils, water supply schedules, etc.

3. The 1981 USAID/RTG Evaluation and Project Re-Design:

By the early months of 1981 USAID/Bangkok leadership was convinced that it was necessary to evaluate the Lam Nam Oon Integrated Rural Development Project.

Accordingly, an evaluation was held in May-June 1981.

The evaluation was in two parts: an impact evaluation performed by Dr. Robert Muscat; and a substantive review of all aspects of the project by a team led by William Schoux, Program Analysis Division Chief in AID/W's Bureau for Program and Policy Coordination. Members of that team comprised: Charles Stevens, engineering consultant; William Cox, irrigation specialist from the U.S. Soil Convervation Service; Niles Dimick equipment specialist, USAID; John Blackton capital projects officer, USAID/Cairo; Preeda Chantagul, agriculture economics consultant; Chakrit Norantiphaduangharn, consultant in public administration; and Sara Schwartz, agricultural economist, USAID/Bangkok.

In his paper published on the evaluation "Lam Nam Oon : An Irrigation and Area Development Project in Thailand" (September 1982) Dr. Muscat observes as a result of his impact evaluation that:

> ".....Although the integrated rural development activities have been operating only 2 to 3 years, they have made definite contributions to the achievement of the irrigated production attained, and have developed some management characteristics unusual for Royal Thai Government field bureaucracy. Compared with "full scale" area development projects in other countries, administered by powerful semi-autonomous authorities, the Lam Nam Oon inter-ministerial mechanism had only coordinating responsibilities and modest project funds other than regular ministry budgets. Despite this apparent lip service to the concept of integration the coordination mechanism has resulted in significantly greater planning and operational cooperation than is normally the case in the provincial workings of the sharply vertical Royal Thai Government bureaucracy..."

Among the various recommendations for change, as voiced by the evaluation team, the following were the most significant:

3.1 The project design should be narrowed to comprise only the irrigation system, on-farm water management and use, and agricultural production. Cooperating agencies should utilise remaining project funds to address only these objectives. The consultant contract should be revised to correspond to the new emphasis.

3.2 Research on dry and wet season crops suitable to Lam Nam Oon soils should be expanded.

3.3 Agricultural personnel be trained to transfer irrigation water management technology to the field.

3.4 The Lam Nam Oon on-farm water delivery model (designed by the Louis Berger International,Inc. advisory team) should be subjected to 2-3 years of dry season experience with careful operations research conducted.

3.5 During the above test, expansion of the irrigation system should be restricted to Ditch/Dyke methods and the use of land levelling (Chanasutr model) should be deferred.

3.6 The management of the project be reorganised in Bangkok and in Lam Nam Oon and routine procedures instituted. A Project Executive Officer should be established in Bangkok to support the Project Director. A Project Implementation Working Group with representatives from each Department and USAID should be formed.

3.7 "There is considerable evidence of the benefits of the integrated project team concept....Adoption of improved planning techniques and completion of the original integrated rural development staffing arrangements would increase the effectiveness of the coordinating mechanism...."

4. The revised Project - Project Implementation Letter No. 14 of January 27, 1982

This was a follow-up on the results of the evaluation described above.

Among other things, it:

- Narrowed the focus of the project as recommended in the evaluation.
- Placed increased emphasis upon management and coordination of project activities. Particularly at the project site.
- Authorised the creation of an operations and management center at the site in order to centralize information and facilitate management.
- Suggested the organization of an informal working group at the site in order to coordinate the agricultural information activities.
- Defined detailed targets and programming emphasis for each of the participating agencies.
- Called for amendment of the consultant contract to meet the change in emphasis of the project.

II. The Second Period - Content and Operation of Project 2:

1. Origins in June - August 1981

While the evaluation mentioned above was the formal occasion for project re-design, the actual evaluation activities - particularly by participating agencies such as the Bureau of the Budget, the Royal Irrigation Department produced an internal Royal Thai Government consensus that change was needed.

In the planning context it was the work done by Khun Chaiwat Preechawit of RID during the evaluation which produced the impetus for a new approach. After examining the project for several weeks, Khun Chaiwat recommended that a Master Plan be developed. In his view, this would only concern the physical infrastructure development of the on-farm water delivery system. It should be linked to an effort to apply the Land Consolidation Act of 1974 to the entire area; but he did not lay that down as a precondition to completing the Master Plan.

This recommendation was seize upon by the Project Field Director Khun Vichai Snguanpaiboon as a means to exploit another recommendation coming from the Bureau of Budget. In that latter case, the Bureau of the Budget argued strongly against continued expansion of the land levelled, Chanasutr, on-farm water delivery system at Lam Nam Oon.

The Project Field Director therefore argued at the August 1981 meeting of the National Committee of the Lam Nam Oon Integrated Rural Development Project that a 10-Year Master Plan should be developed for the area and that it should be linked to application of the Land Consolidation Act of 1974 to the entire area. Furthermore, he did not regard a Master Plan as a document confined only to physical infrastructure development. In his view, it was necessary to start defining the management arrangements, responsibilities, and targets of all participating agencies so that the project could be continued once the USAID loan funds were exhausted. All of this could be incorporated in Master Plan that would stretch over a period of time. He favored a 10-year period.

Such a plan would be needed, it was argued, because application of the Land Consolidation Act of 1974 to the entire Lam Nam Con area would generate certain obligations by the farmer-irrigators of the area. Under that law they would be expected to pay back to government up to 50% of the cost of constructing the on-farm water delivery systems. However, under that law also, they

would not be expected to start such repayments until their productivity and income had measurably increased. It, therefore, followed logically that the government participating agencies should do all that they could to speed the pace of development at Lam Nam Oon including attempts to boost productivity and income of the farmer-irrigators.

The National Committee accepted the Project Field Director's recommendations in August 1981. It was agreed that the Land Consolidation Act of 1974 would be applied to the entire area of Lam Nam Oon. This decision caused that project be the only major irrigation project in the Northeast of Thailand at that time - to which the Act would be applied to the entire area.

The National Committee, furthermore, endorsed the idea of developing a broadly based Ten-Year Master Plan for Lam Nam Oon and the consultant advisory team was instructed to assist in developing such a plan.

2. Project Planning Notes:

The consultant advisory team had already, in May-June 1981, started a new planning approach to the Lam Nam Oon area. It had been decided that further emphasis upon improving work plans and financial plans for participating agencies tended to draw planning attention away from defining specific problems and planned solutions at Lam Nam Oon. Therefore, detailed problem definition and implementation action-plans would be drafted and circulated to the Project Field Director and Team Leaders.

Under this system, once a draft Project Note was drafted and circulated, it was up to specific Team Leaders to incorporate the contents in their planning and actions including their annual Work Plans and Financial Plans. The drafting process began in early June, 1981 and it continued until April 1983. A total of nine Project Planning Notes were published and circulated. Of these, all or portions of seven were put to use by the Team Leaders and the Project Field Director.

The Project Planning Notes included:

No. 1 Pilot Area 2 and 3A, Test and Training, June 17, 1981.

This Note provided the basis for the operations research which began in Pilot Area 2 and other areas starting in December 1981 and continuing until the present.

No. 2 Integrated Development of Areas above Pump Stations, June 21, 1981.

This Note has not yet been implemented; but it provides the basis for integrated planning and action in the "above-pump" areas once the new on-farm water delivery systems are constructed and operational.

No. 3 Farmer Testing/Adoption of Improved Crop Production Practices for Irrigated Northeast Thailand Areas - Lam Nam Oon, September 5, 1981.

This Note provided the basis for a series of applied research programs organised by the Department of Agriculture at Lam Nam Oon from the Dry Season of 1981/82 to date.

No. 4 Self-Help Ditch/Dyke Improvement Program for Groundnut Production, September 13, 1981.

This Note was not implemented. Instead, RID had already started a small-scale rehabilitation program for broken turnouts and cement-lined ditches. This was deemed sufficient to take care of the short-term needs.

No. 5 Lam Nam Oon Situation Room, February 12, 1982.

This Note has been steadily implemented.

No. 6 Training and Information Systems - Lam Nam Oon, November 11, 1981

Some portions of this Note have been gradually adopted at Lam Nam Oon.

No. 7 Irrigation Systems Water Management - Lam Nam Oon, May 20, 1982. (English and Thai language versions)

This Note provides the basic outline for all of the micro-computer-based irrigation water delivery system development at Lam Nam Oon. It has been supported and applied in detail by the Project Field Director.

No. 8 Crop Production Manual for Department of Agricultural Extension Worker's - Lam Nam Oon, April 1983.

This draft has been under study by the Department of Agriculture at Lam Nam Oon since April 1983. It has never been circulated further than that Department.

No. 9 Management Information System - Lam Nam Oon, November 11, 1981.

Portions of this Note have been adopted and applied at the Lam Nam Oon Operations Center.

No. 10 Non-Formal Education Irrigation Technology Transfer at Lam Nam Oon.

The drafting and circulation of this Note was never completed at Lam Nam Oon.

No. 11 Crop Production and Marketing - Lam Nam Oon, July 15, 1982 (English and Thai language versions)

This Note provides the basis for all market development, market information, and market research activities at Lam Nam Oon.

3. Master Plan Development:

During October 1981 the Project Field Director and the R.I.D. Office of Engineering at Lam Nam Oon completed the physical plans for on-farm water delivery systems construction at Lam Nam Oon. These were based upon adoption of the Nong Wai (modified) Ditch/Dyke system of extensive on-farm water delivery. Further construction of the Chanasutr (Model 4) land levelled water delivery system was limited to a total of about 8,000 rai. These decisions and plans provided the framework, along with the evolution of the Project Notes described above, for the drafting of a Ten Year Master Plan.

3.1 First Phase - February-April 1982:

During this period the consultant team engaged the services of Dr. Thomas Morgan to work at Lam Nam Oon. The Project Field Director assigned Dr. Morgan to drafting a first edition of a Master Plan.

The approach adopted by Dr. Morgan was to establish the following:

- A set of guidelines for participating agencies so as to assist them, long in advance, in preparing those personnel, material, and budgetary resources needed of them.

- Organise the Master Plan into three sections: "critical activities", "essential activities" and "regular activities" within the context of the demands imposed by application of the Land Consilidation Act of 1974 to the entire area.

- Reference to area-specific needs of the Lam Nam Oon irrigation system.

- Specific technological methodologies suitable to irrigated farming only.

These were incorporated into a first draft which was completed by early May 1982.

3.2 Second Phase - May-August 1982:

During this period, Mr. James J. Dalton, Team Leader of the Louis Berger International,Inc. advisory team worked with the various Team Leaders and the Project Field Director in reviewing and further developing the draft Master Plan.

Team Leader meetings held at Lam Nam Oon in May, June, and July 1982 went through the draft in detail and additional draft materials were developed. In these sessions, a consensus was gradually established in which it was agreed that not all activities of interest to each participating agency should be or could be a part of the Master Plan.

The Project Field Director chaired each of these sessions; and it was through his guidance that the focus was kept upon limited activities, sharply targeted goals, and a simple but project-wide Master Plan framework.

Once agreement was obtained upon these general matters, the consultant team was asked to re-employ Dr. Thomas Morgan in order to draft the final edition of the Master Plan.

3.3 Third Phase - August-October 1982

Dr. Morgan worked at Lam Nam Oon during August-September 1982 in completing a final draft of the Ten-Year Master Plan. He incorporated a number of recommendations from the second phase period. He also struck out some recommended activities as either not "critical" or "necessary".

The completed English language version of the final draft was reviewed by the Team Leaders at Lam Nam Oon in November, and December 1982. Prior to forwarding to the National Committee for consideration, this draft went through one more review.

3.4 Fourth Phase - March 1983

A Thai language version of the final draft of the 10-year Master Plan was utilised as the basis for a Policy Conference on Lam Nam Oon held at Udorn from March 15-18, 1983.

Organised by the Working Group at Lam Nam Con this Conference presented a series of long-term policy recommendations keyed to the contents of the Ten-Year Master Plan. Participants included personnel drawn from all participating agencies at Bangkok and senior policy-makers.

At the close of the session the Master Plan, as drafted, was formally accepted for forwarding at a later date to the National Committee of the Lam Nam Con Integrated Rural Development Project.

3.5 Fifth Phase - July-August 1983

During this period, the Thai language version of the Ten-Year Master Plan for Lam Nam Con was presented to the National Committee for review. As of the date of this Technical Note, the contents are still undergoing review by the various agencies who are members of the National Committee.

3.6 Application to Final Two-Years of Work Plans and Financial Plans of Participating Agencies Under AID Loan

In September, 1983 the consultant team working with Lam Nam Con staff completed a draft of a two-year set of Work Plans and Financial Plans through September 30, 1985. These were based upon the assumption that the USAID loan would be extended for two years at a value of approximately $1,000,000. Furthermore, the plans were based upon the final draft of the 10-Year Master Plan; and it was assumed that this Plan would be accepted formally as the basis for such annual planning during the October 1, 1983-September 30, 1985 period.

B. THE MASTER PLAN FOR LAM NAM OON: 1983-1992

I. Introduction:

There are three sections "critical", "essential", and "regular". "Critical" activities must be completed in a short period of time (by end of 1985). If not done "essential" activities will not be effective.

There are five "critical" activities:

- Application of the Land Consolidation Act of 1974 and development of a cost recovery program.
- Completion of the on-farm ditch and drainage network.
- The organization and training of Water-User Groups.
- Establishment of a water management system.
- Installation of an effective irrigation system maintenance program.

The second section contains those activities which are "essential" to achieving the goals of increased agricultural production, improved economic income, and established capacity to pay-back on a cost recovery program. These activities are not treated as "critical" because their importance is constant. They must be performed continually, both during the early stages of the project and as it matures during the remainder of the plan period.

There are four "essential" activities:

- Development of new technology relevant to irrigated agriculture and to the operation and maintenance of the irrigation system.
- The transfer of this technology (particularly concerning agriculture and irrigation) to farmers in the LNO area.
- The provision of services by the Lam Nam Con Operations Center to agencies participating in the project and to residents of the project area.
- The development of markets for Lam Nam Oon agricultural production.

The third section concerns "regular" activities which participating agencies perform in the Lam Nam Oon area but which are not directly related to the requirements of irrigated agriculture or the irrigation system. These are not presented in the Master Plan because they are assumed to be regularly funded, staffed, and planned in on-going annual operations of each agency. There follows a discussion of each of the "critical" and "essential" activities.

II. CRITICAL ACTIVITIES

1. Application of the Land Consolidation Act of 1974 and development of a cost recovery program.

This is the most important of all the "critical" activities. Everything else planned and implemented at Lam Nam Oon is contingent on full and complete application of the Act to the entire 185,000 rai irrigation area.

This involves:

- Completion of a cadastral survey
- Completion of a "spot height" survey
- Obtaining more than 50% of the farmers' consent to application of the Act.
- Issuance of Royal Edicts for each designated area
- Compilation and issuance of Plot designated maps together with eventual issuance of land title deeds to each farmer.
- Design and construction of on-farm water delivery systems which provide regular water supply to between 70% and 100% of all farm plots.
- Initiation and scheduling of economic analysis and farmer income studies so as to ascertain the effects of improved irrigation systems upon family levels of income.
- Development of means by which the worthiness, quality, and costs of each installed irrigation system is certified prior to activation of a cost recovery collection program.
- Periodic reviews to determine at what levels and under what terms should cost recovery collection programs be established.

Already, at the time of adoption of this Master Plan, several tasks have now been completed including the cadastral survey and "spot height" survey. Also, agreement has been reached on schedules for applying the Land Consolidation Act to different areas of the project. Appropriate on-farm water delivery systems have been designed and are being constructed. Furthermore, economic analysis and farmer income studies are under way. Other measures are under development.

2. Completion of the on-farm ditch and drainage networks:

The second "critical" activity is to complete the network of on-farm ditches and drains begun in 1976 at Pilot Area 1. Since that time, it has been decided to adopt a on-farm ditch/dike design which supplies water to at least 70% of the farmers rather than 100%, as in the Chanasutr land - leveled model.

This network is necessary because it is an intrinsic part of the application of the Land Consolidation Act; and it is also the technological follow-on to the completion of the main and lateral canal systems, which has been achieved.

By the end of the 1982 Dry Season ditches and drains (including Extensive Intensive Land Development) serving 17,334 rai has been completed. The Master Plan now calls for the construction of ditches and drains to serve an additional 168,066 rai by the end of the 1985 Dry Season.

This is an ambitious goal but it is achievable so long as preparations are made sufficiently in advance of each stage of the construction program.

The Lam Nam Oon project has adopted the following schedule to insure that construction contracts are awarded in time for all planned work to be completed in a single Dry Season.

Task	Time/Frame
1. Completion of Ditch/Dyke Design	July (designs for 1984 construction finished)
2. Quantities Estimate	August (A computer program has been prepared to do this and can finish work within one week of receipt of data)
3. Preparation of Bidding Documents	September
4. Call for Bids	October - November
5. Awarding of Contracts	December
6. Commencement of Construction	January
7. Completion of Construction	May - June

As part of the On-Farm construction program, a planned set of on-farm ditching and drainage targets has been established for the 1983 - 1985 period. These targets are feasible based upon use of a combination of Force Account and private contracting. However, since private contractors will perform more than eighty percent of this work, the Construction Section will have to provide close supervision in order to insure quality and to identify problems and bottlenecks before they threaten the construction schedule.

	On-Farm Development	Drainage Ditches
Extensive		
Total Planned		
Rai	176,936	
Km.	1,230.458	691.886
Completed (end of 1982)		
Rai	11,180	
Km.	80.335	38.594
1983:		
Rai	58,663	
Km.	400.472	224.920
1984:		
Rai	55,000	
Km.	385.000	220.000
1985:		
Rai	52,093	
Km.	364.651	280.372
Intensive		
Total Planned:		
Rai	8,864	
Km.	70.246	54.722
Completed (end of 1982)		
Rai	6,154	
Km.	48.925	39.901
1983:		
Rai	2,710	
Km.	21.321	14.821
1984:		
Rai	-	-
Km.	-	-
1985:		
Rai	-	-
Km.	-	-

		On-Farm Development	Drainage Ditches
	Combined Total		
Extensive			
Rai		176,936	
Km.		1,230.458	691.886
Intensive			
Rai		8,864	
Km.		70.246	54.772
	Rai	185,800	
		1,300.704	746.658

Another part of the On-Farm construction program concerns Primary and Secondary drainage. Construction of these drains is scheduled to parallel the work on on-farm ditches and drains. The drains must be completed on schedule. If Dry Season cropping commences in areas before the main and secondary drains are constructed there is a possibility that water tables will rise and contribute to a potentially serious problem of increased salinization throughout the area. The salinization problem will be continually monitored by that part of the Operations Research Program (engineering) located within the Operations and Maintenance Section at Lam Nam Oon. If this problem shows signs of worsening, it may be necessary to improve the secondary and tertiary drainage systems in the future.

The primary and secondary drainage construction program is of the following dimensions:

	Drain (Km.)	
	Primary	Secondary
Total required	100.600	245.400
Completed (end of 1982)	0.0	75.108
1983:	40.000	45.000
1984:	40.00	60.00
1985:	20.600	66.392

3. Water User Groups:

The third "critical" activity is formation and training of Water User Groups and their integration into the operation and maintenance of the irrigation system. These Water User Groups will be responsible for the on-farm distribution of water and for the maintenance of the on-farm ditches. Each Water User Group will be the fundamental unit of social organization for the purpose of the project. If they do not function effectively it will not be possible to attain steady increases in agricultural production, expanded income, and the on-farm water distribution network will quickly become unusable.

Additionally, the Land Consolidation Act of 1974 is dependent - for its proper implementation - upon the formation and operation of Water User Groups. Article 47 of the Act emphasizes the importance of co-operatives in Land Consolidation areas and subsequent regulations issued by the Central Land Consolidation Committee clearly delineates the joint roles of the Department of Co-operative Promotion, Agricultural Extension, the Royal Irrigation Department, and the changwat Land Consolidation Office in organizing User Groups.

The establishment of viable Water User Groups is the most difficult requirement to achieve, since it involves a major change in the culture of Lam Nam Con residents. Sustaining this change will require the attention of all government agencies active in the project, as well as those designated under Land Consolidation Act regulations. Therefore, the Lam Nam Con Project has determined that a concerted effort must be made to get these Groups operating and that this must be done as quickly as possible consistent with the physical expansion of the on-farm ditch network.

As the ditching program is completed in each of the 23 units of the project, Water User Groups will be formed for each chak[3] in that unit. Chaks vary in size because of terrain and because of the type of ditching system installed. Normally, one Water User Group will be formed for each chak.

The formation of these Groups will follow the schedule for construction of on-farm ditching. Prior to the completion of construction in each unit, Groups will be organized and given initial training at the Ban Fang Daeng Center.

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(3) "Chak" is a Royal Irrigation Department Term referring to an area supplied by water from a single constant head orifice (CHO). It usually comprises an area of ten to fifty farm plots.

Water User Group Formation 1982 - 1986

Total Required	697
Existing (1982)	64
1983	277
1984	197
1985	159

Forming the Groups is the first, and perhaps the simplest, of the steps in creating the social infrastructure needed for the survival of the irrigation system. Beyond this each Group will have to be trained in on-farm water management and irrigated agriculture. In order to preserve the social cohesion of the Water User Groups regular contact should be made with them by the R.I.D. zoneman and other officials of the Project Operations Center. It will be most useful for all agencies to rely as much as possible on the Water User Groups as their contact points, particularly on issues directly related to irrigated agriculture.

The support requirements for Water User Groups will vary and will change as the Groups mature. Initial training for Water User Groups will be provided by the Ban Fang Daeng Training Center. This Center, under the Community Development Department, is organized to provide a wide range of programs focused on irrigated agriculture. The Ban Fang Daeng Center will train three to four members of each Water User Group. These will comprise the elected head of the Group and at least one assistant. A multiple-day training program has been developed consisting of water management, infrastructure maintenance, as well as techniques of irrigated agriculture and marketing. This initial training of Water User Groups will be supplemented by other programs both in the field and at the Ban Fang Daeng Center.

Water User Groups represent a major cultural innovation for the people of the Lam Nam Oon Project area. Merely organizing these Groups and providing them with a basic introduction to their responsibilities will not insure their continued operation. They will require regular and frequent support so that they become fully integrated into the operation of the irrigation system. This support will be provided by several agencies, in particular DOAE and NFE, as well as the Department of Co-operative Promotion. The role of DOAE and NFE are discussed in the section on "Technology Transfer."

In this connection it is useful here to describe the long-term role of the Ban Fang Daeng Training Center. It will play an important part in the training of Water User Groups. When this task is completed in 1985-1986, the role of the Center will change from an initiator of change to a sustainer of change.

After 1985 the Center will focus its attention on providing supplementary training to existing Water User Groups to deal with particular problems which emerge during their normal operations and on training the next generation of Group members in the rudiments of the irrigation system, irrigated agriculture and marketing.

During the period 1983 - 1985 operations research will closely monitor Water User Groups. The results of this research will be analyzed and used to develop short-course training programs to deal with problems of particular importance. Examples of such programs are training in improved techniques for maintaining on-field ditches and drains and training to prevent over-irrigation of fields (both are expected to be a persistent problem for many years). Periodic short-course training for Water User Groups at the Center will be needed on these and other subjects through the end of the plan period. Training the next generation of farmer irrigators will become on important part of the activities of the activities of the Ban Fang Daeng Center in the second half of the plan period (1986 - 1991). Youth who are expected to become active farmers during these years and in the early 1990's will be trained in the principles of water management, the maintenance of on-farm ditches and drains, and in the principles of irrigated agriculture. The training need not be as intense as that given to Water User Groups. Emphasis should be upon making youth aware of the adverse consequences of poor maintenance and improper irrigation.

Age differences will be taken into account in curriculum development. Young children will be given tours of the Ban Fang Daeng Center with a few simple demonstrations. Older youth will be given greater training over several days. Training will emphasize the importance and integrity of Water User Groups. To the extent possible, trainees should be selected on the basis of Water User Group membership to foster the same group identity sought for their parents.

Ban Fang Daeng can also contribute to strengthening marketing skills in the Lam Nam Oon area. By giving greater emphasis to marketing in its training of women's groups the Center can create a nucleus of village leaders with an understanding of marketing processes and opportunities. At present, training of women's groups does not comprise a major activity at Ban Fang Daeng. In the period after 1985 this will become a major activity.

4. Water Management System (System Operations):

The fourth "critical" activity is efficient management of the irrigation water. Agricultural cultivation during the Dry Season under irrigated conditions requires the delivery of precise amounts of water at specific times. This situation is complicated when

a number of different types of crops are planted, each with different requirements for water.

In order to insure precise and timely delivery of water it is essential to organize a water management system. Until 1983, there was no water management system at Lam Nam Oon and water levels in canals fluctuated greatly over short periods of time. This is potentially damaging to the physical infrastructure, but as yet has had little impact on cultivation because Dry Season cropping is not widespread. However, by the end of 1984, 124,873 rai of land will be able to practice Dry Season cultivation under irrigated conditions. Ordinary practices of casual water management will no longer suffice.

A computer-based model water management system now is being developed at Lam Nam Oon for a portion of the canal network. After tests prove satisfactory, the system will be expanded to include the entire network. Relying on an extensive data base and a computerized model of the Nam Oon irrigation network the water management system will permit a more detailed monitoring of conditions throughout the Nam Oon Project Area and a more precise targeting of water supplies.

Before this computer-based model water management system can become fully operational, it will be necessary to control the volume of water in the right and left main canals with considerable accuracy. Through 1982 water levels in the main canals fluctuated by as much as two meters over short periods of time. The plan calls for an immediate effort starting in 1983 to develop the capacity to maintain constant water levels in the right main canal. A first step to achieving this capacity is to reduce the amount of fluctuation from two meters to less than a meter. Operations research will provide data and information on the major causes of the fluctuation and will indicate a series of corrective actions to reduce it. With improved monitoring of water levels, more effective communication with zonemen, and prevention of tampering with water control structures, it is feasible to reduce fluctuations to plus or minus 50 centimeters by the end of FY 1983. Once this has been achieved, operations research will focus on the less conspicuous reasons for water level fluctuations. Further refinements in water monitoring and control procedures should limit fluctuations to plus or minus 25 centimeters by the end of FY 1985. Further reductions are theoretically possible, but this level will be quite satisfactory for the needs of the computer-based water management system.

Among the specific outputs to be expected from the computer-based model water management system, the following are representative:

4.1 Control of water and maintenance of consistent full supply levels in canals. This is necessary to deliver required quantities at appropriate times.

4.2 Establishment of target flows for chaks and canals so that schedules for timely water delivers can be made.

4.3 The reservoir has limited storage capacity. Therefore only a portion of the total area can be irrigated. The system being developed will permit Nam Oon Project managers to "stretch" the available water supply resulting in a larger irrigated area. This is not a prime objective at this time when the water supply is under-utilized. However, it will become one as Dry Season irrigation expands substantially over the next few years.

4.4 Expansion of irrigated agriculture may proceed unevenly. The area served by a particular canal system may begin to exert pressure on the capacity of that system long before the project as a whole is extensively irrigated. Preparations must be made now to meet these needs.

4.5 Soil salinity is recognized as a potential serious problem in the Nam Oon Project. Prudent water management is one of the more effective means of minimizing the salinity problem. This is accomplished mainly by preventing excess water from increasing the level of the water table and by providing for proper leaching of soils.

4.6 The water management model in conjunction with pre-season crop surveys will provide Nam Oon Project managers with projected water needs. They will then be able to identify problem areas in time to take corrective action.

4.7 The water management system will permit the projection of future maintenance requirements and will provide a basis for preparation of more accurate maintenance budgets. There is an urgent need to provide a historical record of maintenance required for canals, structures and other facilities. This record should include amounts and volumes of equipment, materials and labor for each maintenance task. This should be broken down by type of maintenance, kilometers of canal maintained, and by canal section.

The model has been programed to run on a Apple III micro-computer at the Lam Nam Oon Operations Center. The basic components of the program and description of inputs and outputs required are as follows:

- Main program taking information from data files (as noted below) the main program does the following on a weekly basis:

  - Calculates the weighted week of growth for a particular crop in a chak.

- Calculates a weighted crop coefficient for the chak area.

- Calculates the irrigation water requirement for the chak taking into account consumptive use, deep percolation and seepage, effective rainfall, and system efficiency.

- Lists water requirements by Constant Head Orifice (CHO), lateral, and canal.

- Summarizes total area of each crop and total system water requirements.

- Crop Data File The crop data file is updated weekly for each chak with following information:

  - Name of canal and number of CHO
  - Kind of crop grown
  - Area in rai of each crop
  - Planting data

- Potential Evaporation File This file contains the estimated weekly potential evapotranspiration for project area.

- Crop Coefficient File Contains the weekly crop coefficient values for each crop grown in project area.

However, this system is a new innovation in water management. No one in the Nam Oon Project is as yet familiar with its operation. Therefore, beginning immediately O&M officials should begin receiving training on this system and continue working with the system as it is expanded to include the entire network.

A critical link in the water management system is the zoneman. The zoneman will be responsible for monitoring the condition of the distribution network, the intended and actual cropping throughout the zone and for reporting emergency situations to the O&M office. The zoneman will also be the major conduit for information from O&M to the farmers on water availability. It is necessary that a pattern of regular communication be established with the zonemen on a continuous basis. There must be a concerted effort to get the zonemen experienced in operating the system. This will require frequent field trials.

Each element in the chain from the farmer to the O&M office must be permitted to develop confidence in the system and in each other. This is a process of social learning based on experience. No amount of training will be able to substitute for this experience. Therefore, the process should be closely monitored and encouraged by the O&M office.

There follows an outline of scheduled needs for 1983. 1984:-

1983: Basic water management system has been tested. Additional tests and continuous monitoring and evaluation will be performed to keep O&M staff skills at a high level. Results of 1982 and 1983 tests analyzed and set out in manuals for use by O&M staff: central office, pumpmen, zoneman.

Testing of rotational irrigation practice in several areas where modified ditch and dike work has been completed. This might be associated with actual cultivation, but in the absence of this cultivation could be simulated for test purposes. Areas selected for rotational irrigation tests should be scattered along main canals.

1984: Onwards. The water management system should be ready for regular operations by 1984. There will still be a need to modify the system from time to time as ways are found to reduce discrepancies between water delivery targets and actual delivery of water.

The on-farm network of ditches is scheduled to be completed in 1985. However, several more years are likely to pass before farmers are extensively engaged in Dry Season cropping. As the number of farmers using the system increases, changes in management procedures may be required. One of the changes foreseen is a gradual decentralization to watermasters, zonemen and pumpmen for taking corrective action when anomalies appear in the flow of distribution of water in the system. Such decentralization of responsibility will require the development of standard procedures for various situations and a stimulation of which person is to implement the corrective action.

Once the procedures and responsibilities have been defined a schedule for carrying out the decentralization will need to be prepared. The Master Plan envisages this decentralization to be in effect by 1988. The following schedule is suggested for the period following 1984.

1985: Training of relevant officials. Transference of responsibility for the less critical procedures to these officials. Monitoring of the performance of these officials throughout the year.

1986: If performance in 1985 proves satisfactory, officials may be assigned responsibility for taking corrective action in more critical situations. Close monitoring

of performance will continue to be needed. Performance will be evaluated to determine reasons for problems and to modify procedures as needed.

1987: Based on performance in 1986 a decision will be made to routinize the decentralization of responsibility or to continue the closely monitored decentralization training.

The micro-computer will be located at project headquarters where it will serve as the focal point for management of water distribution. It will also be an invaluable aide in monitoring cropping patterns, analyzing productivity of different cropping regimes under field conditions, and as production expands it will facilitate market development and the monitoring of contract farmers.

RID has assigned two officials to Lam Nam Oon to learn to operate the water management system model. The next step will be to train the Head and Assistant Operations officers, as well as several other engineers responsible for operations and maintenance, in the use of the computer based system. Basic familiarity with the model can be acquired in a few months, but it will take several Dry Seasons before they will be able to operate the system with confidence. A number of the non-engineering staff of the Operations Center should be trained in the operation of the micro-computer in order to be able to use it to analyze economic,agronomic and social topics relevant to the Project. Computer training for all of those staff members will commence at the beginning of FY 1984 so that will be able to begin operations before the Dry Season of 1984

5. Irrigation System Maintenance:

The irrigated area of Lam Nam Oon is 185,800 rai. This is served by two major canals (Right, Left Main which are cement-lined) and fifty-four Laterals and Sub-Laterals (cement-lined). The total length of all cement-lined major canals, laterals, and sub-laterals is 313.402 Kms.

This system was constructed during a seven-year period from 1973 to 1980. It is accompanied by approximately 275 Kms. of laterite-topped access roads of varying widths. It contains more than 900 structures including: regulators, syphons, waste-ways, Constant Head Orifices (CHO's), pumping stations, and bridges.

Additionally, the entire system will contain 1,300.704 Kms. of on-farm water delivery ditches, 746.658 of tertiary drainage ditches and 346 Kms. of primary and secondary drains. All of this will be in existence by the end of 1985.

The kinds of maintenance that will be required for all of these systems falls into two broad categories: "Catch-up", and "Preventive". The "Catch-up" category exists because much of the system, by 1983, was already ten years old and has never had

preventive maintenance. Whole portions of the system need "catch-up" maintenance.

The "catch-up" category is sub-divided into three types: emergency; contract; and Force Account. Each of these has a special meaning at Lam Nam Oon. The meaning and details are specified in the "Maintenance Plan for Lam Nam Oon", December 1982 by Gaylord Skogerbow, Suphakiet Olansatien, and Sanae Sangsuk. The general meanings are:

5.1 Emergency Maintenance:

Refers to 284 canal wall panels which need replacement and 32 which need repair in that section of the Left Main Canal which lies between station 12 + 500 (12.5 Km.) and station 16.00 (16 Km.). This stretch of canal also requires the construction of 3.5 Kms. of deep open drains on both sides, cutting down of right and left berms to 15 cm. above the tops of the canal panels, cavities filled, and joints sealed with asphalt.

5.2 Contract Maintenance:

This is a large construction job which requires detailed design. It will be done on a contract basis.

The tasks, specifically, refer to the Right and Left Main canals where special deep open drains and concrete interception or perforated pipeline drainage are needed.

These areas total 22 Kilometers scattered along both sides of 39 Kilometers of the Right Main Canal. Similarly there are 8 Kilometers scattered along both sides of 8 Kilometers of the Left Main Canal which require like treatment.

5.3 Force Account Maintenance:

This will be done by O&M personnel and it refers to: repair/replacement of concrete lining panels, filling of cavities with grout (mortar), providing surface and sub-surface drainage, repair and maintenance of CHO's, repair and replacement of turn-out gates and gate frames, and removal of sediment from the canal.

This latter task is a formidable one, with the total volume of silt to be removed from all mains, laterals, and sub-laterals calculated at 44,134 M^3.

The locations, volumes, and priorities for all of the "catch-up" Force Account repairs are listed, in detail, in the referenced December 1982 report.

The estimated costs for these various types of maintenance are as follows:

Emergency	Baht 9,500,000
Contract	Baht 19,000,000
Force Account	Baht 6,198,271

The fore-going figures have been allocated within the Master Plan together with funds for on-going "preventive" maintenance.

The staffing and equipment requirements for the "catch-up" and "preventive" maintenance have been planned and budgeted.

III. ESSENTIAL ACTIVITIES

6. Technology Development

6.1 Operations Research

The Lam Nam Oon Operations and Maintenance Section will also be responsible for conducting five types of on-going research and monitoring on a variety of subjects important to the functioning of the irrigation system and to the physical condition of the Lam Nam Oon project area. The primary concerns of the Operations and Maintenance Section will be: 1) water distribution; 2) follow-up on Water User Groups; and 3) monitoring of maintenance activities and costs; 4) climatological data collection and analysis; and 5) monitoring of water table levels and soil salinity. Additionally, the Lam Nam Oon Operations Center will conduct operations resource on the agro-economic aspects of the Project.

6.1.1 Water Distribution

Effective water distribution is the basic requirement for any increase in Dry Season agricultural production at Lam Nam Oon. Therefore, a continuing program to monitor the reliability of water delivery will have to be implemented. Weekly checks will be made on the extent to which water delivery schedules are met. Serious discrepancies between schedules and actual water delivery will be investigated and remedial action taken. A related issue is determining the extent of the area which is irrigated. Among the factors which can affect the size of the irrigated area are the water storage levels, management of the distribution system, the cropping patterns, the condition of canals and water distribution structures, and the type of the on-farm distribution network. Since at Lam Nam Oon there are three distinct models for on-farm distribution, it is important to determine which contributes most effectively to extending the

irrigable area and to control of water at the field level. The Operations and Maintenance Section will monitor the volumes of water at farm Turnouts and at the end of on-farm distribution networks for a period of three years, and on the basis of the data generated will determine which of the three models are cost effective in best assuring that water will reach the ends of the farm distribution network.

The volume of water in the main canals and laterals will determine to a large extent the potential irrigable area. A predictable supply of water depends on maintaining constant water levels in canals and laterals. Therefore, the Operations and Maintenance Section will undertake a program to monitor canal water levels on a regular and frequent basis. Fluctuations beyond predetermined parameters (perhaps 50 centimeters above and below the full water mark) will be investigated and solutions developed. It will also be necessary to regularly monitor the level of water in the reservoir. This information is essential to the water management system, the preparation of annual cropping plans, and will be a major factor in developing long-range production targets.

The counterpart of water delivery is proper drainage of water from fields. Inadequate drainage will adversely affect production in the short terms and can contribute to long term impairment of productive capacity by raising water tables and by increasing soil salinity. Both of these are already potentially serious problems at Lam Nam Oon. Therefore, regular monitoring of empondment conditions and the adequacy of tertiary and secondary drains must be done. Monitoring of water table levels as well as the extent and severity of salinization must be done. The Operations and Maintenance Section installed 20 Observation Wells in FY 1983 and should add 50 to 60 additional wells by the end of FY 1985 when the on-farm construction will have been completed. In addition, test borings should be done in these areas where data from previous observation wells shows a perched water table. Results of this research will determine where drainage should be augmented and whether emphasis should be placed on water control and special drainage or salt-tolerant crops in areas where salinization problems exist.

6.1.2 Water User Groups

The second major area for operations research will involve close monitoring of Water User Groups to identify their strengths and weaknesses and to suggest ways in which these Groups can be made more effective as components of the irrigation system and as agricultural production units. Problems affecting Water User Groups can be expected to arise from several sources. First, farmers in the Lam Nam Oon area lack experience in irrigated agriculture and in the requirements for operating and maintaining an irrigation system. Therefore, a variety of technical difficulties are likely. Second, Water User Groups represent a new pattern of social organization in the Northeast. The composition of the Groups and the patterns of behavior which they must adopt are determined by the technical requirements.

Much of the basic information on the functioning of Water User Groups will be provided in regular reports by zonemen, water-masters and other staff of the Operations and Maintenance Section who are in frequent contact with these Groups. On the basis of this information support may be provided to individual Groups or a program might be developed to assist Groups in general. However since Water User Groups are a cultural innovation in the Lam Nam Oon area some of the problems will stem from factors less obvious than mere lack of familiarity with technical requirements. Therefore, there will be a need for more intensive sociological research into specific issues of Water User Group organization and operation. This research must be performed from time to time by small teams drawn from Thai academic institutions and other government agencies in response to some important problem uncovered in the regular monitoring program. The emphasis in this research must be on finding practical solutions in the Lam Nam Oon context, not on generating information of general academic interest. The danger of the latter occuring suggests that this applied research be relatively infrequent.

6.1.3 Erosion

Silting of main and lateral canals is a major problem and contributes significantly to maintenance costs. Erosion of canal embankments contributes most to this problem, though erosion of upland areas is also a factor. Embankment erosion is extensive throughout the Lam Nam Oon area and is growing. To combat this

situation a program of applied research will be established to identify useful techniques of erosion control and to bring these techniques to bear on the problem at the earliest opportunity. Two obvious techniques are ditching along canal embankments to trap silt and the use of ground cover to impede erosion.

The large amount of erosion taking place does not allow time to run tests and then apply the ideal ground cover. Some action must be taken immediately. Therefore, drawing on advice of experts at the Land Development Department, the Forestry Department and other agencies as to what types of ground cover are appropriate for various conditions at Lam Nam Oon, the Operations and Maintenance Section will undertake a program to plant ground cover and then to monitor results. Eventually the more successful types should be generally applied.

Ditches to trap silt are also important. The Operations and Maintenance Section will conduct a series of tests in areas where erosion is most serious to determine the most effective designs for these ditches. Tests will run for at least one rainy season and results applied the following Dry Season. Monitoring of erosion control will then continue on a regular basis to identify necessary modifications in the designs and extent of the ditches. This program will begin in FY 1983 and be completed by the end of the Dry Season of FY 1984.

6.1.4 Climatological Research

Accurate climatological data is required for effective water management and projection of agricultural production targets. Rainfall, temperature, windspeed and evaporation data are available from the Sakon Nakhon Meteorological Station. However, this data is not specific enough to the Lam Nam Oon area to be of use. Therefore, a continuing program for collecting and analyzing climatological data will be established at the Lam Nam Oon project itself. The Operations and Maintenance Section will set up 12 rainfall measuring devices around the Lam Nam Oon area. Five of these are already in place, and the remaining seven devices will be in place early in FY 1983.

6.1.5 Ground Water Monitoring

Monitoring of water table levels and soil salinity. Existing data show that water table levels for the period December through June are not high enough to pose a threat to Dry Season cropping in most areas of the project. However, this data was gathered prior to widespread Dry Season irrigation at Lam Nam Oon. The area to be brought under irrigation will expand by more than 1200% between 1983 and 1986.

This coupled with the fact that farmers inexperienced in irrigation tend to over-irrigate their fields, may contribute to raising the water tables to high levels even during the dry season. Therefore, a network of observation wells should be established immediately to provide data on current water table conditions and to permit monitoring during and after the expansion of dry season irrigation.

Soil salinity is a modest problem in the Lam Nam Oon area at the present time; but as Dry Season irrigation grows, the seriousness of the problem is likely to increase. Test borings should be conducted in areas where high water tables and perched water tables persist during the Dry Season to determine whether salinization is occurring. Furthermore, a program of test borings should be undertaken immediately to determine the present extent of salinization and then to regularly monitor changes in salinization throughout the project area. This information will be incorporated into the water management system and the crop promotion program.

6.1.6 Agro-Economic Operations Resource

An on-going responsibility of the Lam Nam Oon Operations Center will be to organize recurrent operations research on the Agro-Economic developments taking place in Land Consolidation Act areas. This data-gathering will be aimed at learning about farmer input costs, labor practices, equipment useages, returns, and varying efficiencies of labor, traction power, and cultivation practices.

6.2 Agricultural Research

An adaptive research program to develop crops and cropping technologies particularly suited to the Lam Nam Oon area is essential to achieving optimum agricultural production. Especially important are crops which will take best advantage of the water available during the Dry Season. Emphasis

should be placed on crops which have actual or potential markets, but some attention must also be given to crops for home consumption. The former will be a source of income for local farmers, while the latter will help them to reduce expenditures and improve nutrition.

A basic package of the Dry Season crops must be available by the time the construction of on-farm ditches is completed in 1985. This package will include upland crops such as legumes, peppers and root crops, for regional and national markets, as well as vegetables that could be marketed or consumed locally. Some areas are not suitable for upland crops even in the Dry Season because of high ground water levels. Therefore, research on rice varieties will continue at its present level. The work now being done on higher yielding glutinous varieties will also be pursued because these will permit farmers to devote more of their land to production of income generating non-glutinous varieties without reducing the production of glutinous rice.

During the period 1984-1991 increased emphasis must be given to training the field staff of participating agencies in the new crops and technologies. The objective for Lam Nam Oon during this period is to expand the area planted with a first cycle Dry Season crop from the 5 - 8,000 rai at the present time to approximately 97,000 rai by the end of the plan period. Reaching this objective will require steady pressure on promoting basic proven crop packages rather than on innovations.

As farmers gain experience in growing a first cycle Dry Season crop, many of them will become interested in crops for a second, but shorter, Dry Season cycle. Therefore, during the period 1986-1991 research should concentrate on developing crop packages for a second Dry Season cycle. Development of these packages must take into account market opportunities, as well as the home consumption needs of farm families.

Research is being done on mixed farming on raised-bed garden plots, and by 1985 more than 100 of these plots will be in operation. These plots may be able to serve as the foundation for second-cycle cropping, if areas adjacent to the plots are brought into production using water from the plots themselves. Research on the potential for extending the area cultivated around these plots can begin immediately. If results are promising, promotion of this practice could begin simultaneously with the promotion of first cycle crop packages.

Although research emphases need to change over the period of the plan to suit the increasing level of agricultural activity at Lam Nam Con, the research should not be separated into discrete phases. Research on crops for first and second Dry Season cycles need to proceed simultaneously. Farmers will progress from single to triple cropping at different rates. Therefore, the local research stations must be ready at all times to supply individual farmers with crops and technologies appropriate to their needs.

7. Technology Transfer

Farmers at Lam Nam Oon are accustomed to farming under rainfed conditions. The irrigation system and the possibility of substantial cultivation in the Dry Season are major innovations for which most farmers are unprepared. In order to take advantage of the potential for increased Dry Season production Lam Nam Oon farmers will have to acquire knowledge and experience in a variety of areas, and will have to develop new patterns of cooperation.

This plan defines a concentrated program for the transference of technology to farmers, Lam Nam Oon staff and other officials working in the area. This program will involve formal and informal training, demonstations and increased technical support to farmers by field personnel. Since the Water User Groups are the basic unit of organization for both water management and crop production, training and technical support will be oriented toward these groups, rather than towards farmers in general. Doing this will help to address the specific needs of each group and will contribute to strengthening group identity.

7.1 Water User Group Training

As soon as possible after their formation Water User Groups should be trained in water management and in the basic technologies of irrigated agriculture. According to the procedures adopted at Lam Nam Oon Water User Groups are formed in those units and areas where construction of on-farm ditches has just been completed. The time taken to organize all of the Groups in an area will vary according to the number of Groups, but should be completed within the period December through June each year. Training should commence in the Dry Season and proceed at a rate of 10 Groups per week until completion. To insure that all Groups formed will be able receive training before the following Dry Season it has been decided to train only the Group leader and three assistants from each Group.

The training program for other Water User Group members should be prepared during FY 1983 in order to be ready for implementation in FY 1984 and subsequent years. There are about 10,000 farmers to be trained, but because the training need not be intensive, a large number of farmers can complete the program every year. The plan calls for 10 to 12 Training Sessions per year from 1984 through 1987. Each session would include about two hundred farmers. Sessions lasting two days would be conducted at an appropriate Training Center and in the field. Preparation of training curricula should take into account the results of operations research and agricultural research.

7.2 Training of Officials

Officials, particularly those who will work closely with Water User Groups, must also be well-acquainted with the Lam Nam Oon irrigation system and its principles of operation. They must also have a firm understanding of how to derive maximum benefit from irrigated agriculture. At the present time RID is training zonemen, and this training is reinforced at monthly zonemen meetings at the Project Operations Center. Training or formal exposure of other officials to the requirements of the system and irrigated agriculture is intermittant or non-existent.

The following table indicates, by agency, the type and number of officials to receive training.

Training of Officials

AGENCY	POSITION	NUMBER
RID	Watermaster	4
	Zoneman	32
CDD	District CD Officer	3
	Tambon CD Worker	13
DOAE	District Agricultural Officer	3
	Tambon Agricultural Worker	25*
DOA	Team Leaders	10
NFE	Curriculum Specialists	2
	Field Trainers	10
DOF	Field Officers	4
		106

* This figure includes 17 permanent workers and 8 temporary hire workers scheduled to be added in FY 1983.

The training for each type of official will necessarily differ according to their individual roles. Water masters and zonemen, for example, will need more detailed knowledge of the characteristics and operation of the irrigation system than would the District CD or Agriculture officers. Training of officials will be done in two ways: (1) basic training provided by the Lam Nam Oon Operations Center and (2) training provided within individual departments.

Basic training has been provided to tambon Community Development and agriculture workers by the Lam Nam Oon Operations Center. Two semi-annual training sessions, each lasting five days, have been completed. This training will continue in the future, but will be upgraded.

Due to personnel transfers and attrition it will be necessary to hold recurrent basic training sessions for officials new to the Lam Nam Oon area. For example, in FY 1983 DOAE plans to add 8 (temporary hire) tambon agriculture workers in the Lam Nam Oon project area as part of Phase 3 of its National Training and Visit program. This training can be done by mini-sessions in conjunction with the regular semi-annual training sessions.

The Ban Fang Daeng Center provides monthly training to the 13 CD workers in the Lam Nam Oon Project area. DOAE holds fortnightly training sessions for its tambon agricultural workers. Since this training is standardized in keeping with the National Training and Visit (T & V) System, supplementary training in irrigated agriculture is needed. This supplementary training could be most easily provided by giving the 13 tambon agricultural officers one half hour to one hour of additional training in conjunction with the scheduled T and V training.

Departments will also provide training on matters related to irrigated agriculture as part of their regular in-service training programs. The Lam Nam Oon Operations Center will help these agencies to develop training materials and data specific to the needs of farmers in the Lam Nam Oon area.

7.3 Demonstration and Reinforcement

The transfer of technologies necessary or useful for farming under irrigated condition cannot be accomplished solely by formal or informal instruction. Instruction often must be accompanied by demonstrations of the new technology. This is especially true for the farmers at Lam Nam Oon who are being asked to make a radical change in their farming habits. Therefore, it is essential that demonstrations and various kinds of reinforcement be directed as much as possible at the problems and requirements particular to irrigated agriculture.

Three agencies will be responsible for much of the technology transfer. These are the Department of Agricultural Extension (DOAE), the Department of Non-Formal Education (NFE), and the Department of Fisheries (DOF). Through demonstrations, field training and the provision of technical support these agencies will extend the range of technologies available to the farmers and will reinforce knowledge and skills already acquired through the Ban Fang Daeng Center and the Lam Nam Oon Operations Center.

7.3.1 Demonstrations of Dry-Season crops and cropping technologies will be conducted throughout the Lam Nam Oon project area by DOAE. Single crop demonstration packages have been prepared which are suitable for irrigated farming. Crops to be promoted over the next three years are: groundnuts, soya beans, field crops, corn and vegetables.

These have been selected because of their appropriateness to ecological conditions at Lam Nam Oon and because potential markets are favorable. Each year DOAE will conduct approximately two demonstrations in each of the 92 villages in the Lam Nam Oon area.

Demonstration packages will be varied each year or so in order to expose farmers to a range of new technology. In some instances it may be necessary to continue a demonstration for several years in order to prove the reliability of the technology.

Between 1983 and 1985 the demonstrations should focus on crops suitable for the first Dry Season farming cycle. Generally such crops will be ones likely to generate significant cash income for farmers, rather than ones meeting only subsistence needs. By 1985-1986 it is expected that first cycle Dry Season cropping will be widespread at Lam Nam Oon with up to 97,000 rai under cultivation. As this goal comes close to being realized, DOAE should change its focus to promoting crops for a second Dry Season cycle. Crops for this cycle would be those which mature rapidly, provide a good return on investment either in terms of cash income or in meeting subsistence requirements.

DOAE will also conduct demonstrations of farm management techniques, including mixed farming procedures. Two plots, each of 10 rai, will be selected in each tambon annually. The objective of these demonstrations will be to show farmers how to handle entire farm systems.

7.3.2 Particularly relevant is the joint RID-DOA mixed farming test program. Under this program a total of 100 test models will be constructed by the end of 1983. These test sites, called raised-bed garden models (Rangsit) include elements of multiple cropping and crop rotation, fish production, animal husbandry, and fruit tree cultivation. Animal and vegetable waste products are recycled to raise soil fertility and fish production. Some of these test models should be incorporated into the farm management program of DOAE.

In addition DOF officers at Lam Nam Oon estimate that there are about 300 privately built fish ponds in the project area. The quality of these ponds is not uniform. However, many owners are already attempting mixed farming techniques. A survey of these ponds will be made by the Lam Nam Oon Operations Center in cooperation with DOF. A number (4-5) of the more suitable ones should also be included in the farm management demonstration program.

7.3.3 The DOAE T & V program can be a valuable means for reinforcing and supplementing the training already received by Lam Nam Oon farmers. This program offers opportunity for frequent contact with farmers and the rapid exchange of information. However, for the T & V program to be beneficial to these farmers, it must be adapted to the particular conditions of the Lam Nam Oon area. Tambon agriculture officers must be thoroughly familiar with both irrigated agriculture and with the social organization required for its success at Lam Nam Oon. Since the Water User Groups will be the basic unit for agricultural production, as well as for on-farm water management, it is important for the tambon agriculture officers to work closely with these Groups. To assist the tambon agricultural officers, the Lam Nam Oon Operations Center will provide them with detailed (scale: 1:10,000) maps of their tambon. The maps will contain the following information:

7.3.3.1 Location of main canals, laterals, CHOs and on-farm ditches and drains.

7.3.3.2 Farm plots by owner.

7.3.3.3 Chak boundaries and names of leaders and assistants.

7.3.3.4 Soil and hydrological characteristics.

7.3.3.5 Crop suitability for types of soil and hydrological conditions.

7.4 Fisheries Development

The development effort at Lam Nam Oon is not limited to wet and dry season agriculture, but includes a package of initiatives to meet a variety of needs. The Department of Fisheries (DOF) is engaged in a program to transfer fishery technology to the population of Lam Nam Oon. This program as it expands will greatly improve the level of nutrition in the area and may eventually provide an important source of cash income.

The objective of DOF is to construct a minimum of 40 community fish ponds per year, particularly in areas where agricultural cultivation is a problem. In both 1981 and 1982 DOF was able to construct 70 ponds, but despite this achievement local demand exceeds the annual capacity of the department. At present, virtually all of the fish produced are consumed in the villages where they are raised. Little is yet available for sale to other villages or to local markets. However, as production increases over the next few years and as the Lam Nam Oon local marketing effort expands, a greater portion of fish production will be marketed.

This plan tentatively calls for the construction of 460 ponds of one rai each by 1991. This amounts to about 5 rai for each of the 92 villages in the project area. Since current demand for these fish ponds is high, the rate of construction should not fall below 50 ponds per year, and for the first few years should be maintained at 70 ponds. A re-evaluation of this program should be made in 1985 taking into account two other activities. The first is the DOA-RID program to construct 100 raised-bed test (Rangsit models) sites. Each of these 2 rai sites includes fish raising as an important component of the mixed farming regime. The second is the private construction of fishponds by individual farmers. These tend to be smaller and of uneven quality, and their productive capacity is unknown. At some time in the future the combined production of fish from all three sources may saturate local markets. Officially sponsored efforts, whether by DOF or DOA-RID, should be curtailled before reaching this point.

Fish breeding in necessary to support fish raising in the Lam Nam Oon area. Up to the present time all fish breeding has been done by the Sakon Nakhon Fisheries Station. As the number of fishponds increases the capacity of the station to supply fingerlings to farmers will be strained. To meet this need the fisheries station is beginning a program to establish small fish hatcheries around the project area. The first has been established at the Ban Fang Daeng Training Center. The Fisheries Station plans to develop an additional 12 ponds to serve as hatcheries. The capacity of these hatcheries to service the needs of local fish raisers will be evaluated annually.

The Fisheries Station is also undertaking an experimental program to introduce the raising of fresh water prawns at Lam Nam Oon. There is a good market for prawns in the area, but the optimal level of production has not yet been determined. This program must be monitored closely over the next 2-3 years in order to determine its potential to contribute to raising the income of Lam Nam Oon farmers.

A longer-term objective should be the development of the fishery potential of the Lam Nam Oon reservoir. The DOF is now engaged in stocking the Lam Nam Oon reservoir with various types of fish. The objective is to achieve a density of 30 kg. of fish per rai of surface in the reservoir. The purpose of this stocking program is to permit commercial and subsistence fishing in the reservoir. Despite the stocking program and despite the fact that the reservoir has been filled for the past seven to eight years, little fishing has taken place. The DOF, perhaps in cooperation with the Department of Public Welfare, should begin a program to gradually increase the level of fishing in the reservoir.

As a first step the DOF should determine the density of the fish population in the reservoir, and the level of fishing sustainable without depleting the fish population. A combination of natural causes and over-fishing have drastically reduced fish levels in other reservoirs in the Northeast. This can be prevented at Lam Nam Oon by means of a reservoir management program. Entrepreneurs will be sought among the non-farming community at Lam Nam Oon and nearby who might be interested in setting up reservoir fishing operations. Employment opportunities for local people will be encouraged by requiring that labor-intensive fishing practices be used. The level of fishing by these entrepreneurs will be controlled by issuing licenses or franchises specifying maximum annual fish harvests.

7.5 Reinforcement and Supplementary Training

Transferring new technology is a difficult task, especially when substantially new behavior patterns are required. Therefore, it is necessary that understanding of the new technology be regularly reinforced. The Department of Non-Formal Education is ideally suited to assist in this reinforcing process and to provide supplemental training to farmers in areas which will increase their overall competence.

Reinforcement of the new technology should not be restricted solely to those who have received training. Rather, it should be extended to the entire communities where these persons live. Three programs will be implemented by NFE as part of the reinforcement process at the village level.

7.5.1 The first is the monthly publication of a wall newspaper ("Nam Oon News") to be distributed to every household in the 92 villages of the LNO area. This newspaper is designed to be put on a wall of a farmer's house where it can be seen and read by the entire family. This newspaper will carry basic information on irrigation, irrigated agriculture, fishponds, as well as items on health and nutrition.

Twelve thousand copies of the wall newspaper are distributed each month. Beginning in 1983 copies of this newspaper also will be distributed to all district offices, health and midwifery centers, temples, and to all elementary and secondary schools in the Lam Nam Oon area. This will increase publication by about 1,000 copies per month; but it will insure that copies are displayed in places where people congregate or seek advice.

7.5.2 The second program calls for motion picture and slide showings in villages on various topics concerning irrigation and irrigated agriculture. These showings will permit pertinent information to be presented to entire villages, but especially to the young who will be growing up with an existing irrigation system. By the time they are ready to become farmers they should be more sophisticated in practicing irrigated agriculture than were their parents.

Reinforcement requires regular exposure to relevant information. Eventually each village will be visited several times each year with seasonally appropriate programs.

A total of 92 slide and motion picture presentations are programmed for each year of the plan. Sixty-two villages will be visited each year - approximately two-thirds of the villages in the Lam Nam Oon area. Each village will be contacted at least twice every three years. Beginning in 1983 one presentation will be made in 32 villages, while two presentations will be made in an additional 30 villages which have a greater need for reinforcement. The latter might be villages with poorly functioning Water User Groups or which experience serious problems with Dry Season cultivation. Similarly, in 1984 and 1985 as large new areas are brought under Dry Season irrigation greater emphasis will continue to be needed by some villages with pressing problems

During 1985 a reassessment of the slide and motion picture program should be carried out in order to adapt it to the problems expected in the second half of the plan period. Among the issues likely to be important are the promotion of second cycle Dry Season crops and marketing. Emphasis should be given to extensive coverage of villages in the project area.

The Ban Fang Daeng Water User Group training program and DOAE training programs are designed to provide basic guidance to farmers, so that they may quickly begin to derive benefits from the irrigation system. Some potentially useful topics will not be covered or will treated only briefly. Augmenting this training with a village-based program of supplemental instruction can help farmers to broaden and deepen their understanding of Dry Season agriculture using irrigation. An example of the kind of training that might be provided is instruction in the wate requirements for various Dry Season crops. The first tendency of Lam Nam Oon farmers will be to over-irrigate Dry Season crops.

NFE could address this need by following several programs. First, it can provide training on water management and irrigated agriculture to 10 groups (approximately 500 farmers) each year. Second it can provide training in areas of interest to particular groups of farmers. The specific content of these courses will vary to suit each group, but the range of courses can be limited to subjects closely related to agriculture or irrigation. Among the subjects included might be: marketing, bookkeeping, irrigated agriculture fisheries management, and animal husbandry. NFE estimates it has the capacity to train approximately 250 of these groups per year. If this rate could be sustained it will contribute greatly to strengthening the foundations for irrigated agriculture at Lam Nam Oon.

8. Lam Nam Oon Operations Center - Support Services

The Lam Nam Oon Operations Center will provide various kinds of support to agencies working in the project area and to potential investors and purchasers of crops. The micro-computer will serve as a data collection and storage point for all agencies. The Operations Center will prepare data files and format data needed by an agency and will analyze data on request. Procedures and conditions for the release of this information must be worked out.

8.1 Specific Assignment Team (SAT)

The Operations Center at Lam Nam Oon has developed a multi-purpose Specific Assignment Team to permit it to handle urgent tasks and to respond rapidly to contingencies. The SAT has been used to conduct socio-economic surveys, cropping surveys and training of farmer-irrigators. The SAT maintains close contact with the farmer-irrigators with each SAT member assigned responsibility for an area of the project. SAT members assist in the organization of Water User Groups and in monitoring conditions in their areas. SAT members are very familiar with all aspects of project operations - technical, agricultural and social. Member of this team will be made available for temporary assignment to assist other participating agencies which need additional personnel for urgent work. The SAT will also assist private sector firms and persons who request assistance from the Operations Center in identifying and contacting farmers concerning participation in contract farming and other production efforts.

8.2 Popular Participation

The success of the Lam Nam Oon Project in raising production and incomes will depend heavily on increasing the level of social organization within the project area and on developing an identification among local residents with the project and its objectives. The land consolidation as well as efforts to program, establish, and train Water User Groups are key steps in creating the necessary social organization. Additional programs conducted by DPAE, NFE and the Lam Nam Oon Operations Center will contribute to reinforcing this process. Identification with the project requires that residents play an active role in the various aspects of the project, particularly that of cost recovery.

Ultimately the participation of Lam Nam Oon residents in project affairs will be channelled through several district level cooperatives or, even more appropriately, a single cooperative serving the entire area. Through these cooperatives members will acquire a voice in determining area-wide cropping and marketing plans, as well as in the operation and maintenance of the irrigation system. It will be a number of years before the presence of cooperatives will be a significant factor at Lam Nam Oon. The Department of Co-operative Promotion under the Land Consolidation Act must promote and assist the development of cooperatives in the area by providing advice, facilities and services.

The Lam Nam Oon Operations Center can also encourage local residents to participate in project affairs in other ways. It will maintain regular contact with tambon and village

headmen to provide them with topical information and to solicit their views on issues concerning the project. Representatives of the Operations Center periodically attend meetings of tambon councils in the area. Council members will be encouraged to share their views and suggestions on project matters.

There is a wide variety of expertise in the project area which has yet to be effectively mobilized to support project requirements. Local academic institutions, particularly agricultural and technical colleges, and many private citizens can make valuable contributions to the project. The Operations Center can play an active role in identifying these resources and in indicating particular areas where their services are needed. As with directly participating agencies, the Operations Center will make its facilities available and will assist in arranging training programs, seminars and conferences relevant to project goals.

8.3 Maps

The Operations Center will prepare a basic set of maps for use by field officers. The set will include tambon level maps (scale: 1:10,000) of the irrigation system, chaks and farm plots, soils and hydrological conditions, and crops appropriate for each area. The Center will also prepare maps on request for special purposes. Agencies will be responsible for providing the Center with necessary data. After consultation with the agency on its particular requirements, Center draftsmen will prepare a master map. Each agency will bear its own costs for duplication.

8.4 Second Generation Irrigators

Preparing the next generation of farmer irrigators at Lam Nam Oon will be an important task for all of the agencies operating in the Lam Nam Oon area. Each will come into contact with the youth in various ways.

Methods by which the Ban Fang Daeng Center Training can to do this were described earlier. In a similar fashion NFE can reach village youth through its program of slide and movie presentations. Both NFE and BFD programs will provide only infrequent direct exposure to information about the LNO system.

Other means of stimulating among the youth an identification with and understanding of the Lam Nam Oon irrigation system can also be pursued. One way of doing this is to build into the elementary school system a program for developing and reinforcing basic knowledge about the irrigation system. NFE is particularly well suited to assist in preparing such a program because of their progessional skills and long experience working with the Lam Nam Oon Project.

Beginning in 1984-1985 the Lam Nam Oon Operations Center, in conjunction with NFE and other participating agencies, will begin to develop a curriculum and instructional materials for use in elementary schools. Once the basic structure of this curriculum is developed, local elementary school officials and administrators of the local teachers' colleges will be consulted for advice on how to incorporate this curriculum into the schools of the Lam Nam Oon area. The teachers' college already has a curriculum on rural development and a short additional component on Lam Nam Oon could be added without much difficulty. Allowing a year for preparations and discussions among the parties, the elementary school program could be introduced in Lam Nam Oon elementary schools at the beginning of FY 1986.

The elementary program should consist of slide and film presentations to students at least once each term. In addition there should be a programs to maintain a continuing interest in aspects of activities around the Lam Nam Oon area. The Public Relations Section of the Lam Nam Oon Operations Center should begin in FY 1983 a program of providing information to the schools in the form of wall posters and periodic visits to schools by Operations Center personnal. Such visits might be directed at various school groups such as the Boy Scouts, Girl Guides and relevant school clubs concerned with science or agriculture. Presentations could deal with general issues or might focus on problems affecting the particular area where a school is located. Both the Lam Nam Oon curriculum and the school visitation program should seek as one of their objectives to develop an identification by the student with the part of the irrigation system where he lives and attends school. If this identification can be nurtured through adolescence, these students will be better prepared to advance from organization by Water User Group to organization by Lateral Canal association. This is, admittedly, a difficult and a long term goal. However, unless steps are not taken immediately to begin movement toward this objective it will even more difficult to begin at a later time.

9. Marketing

The Lam Nam Oon irrigation system and the various sources of technical support available are making it possible to increase Dry Season agricultural production substantially. While some increase in production can be expected to occur to satisfy household consumption needs, large-scale rises in production will only come about when farmers are confident that they can sell their crops profitably. Assured markets for much of the potential production at Lam Nam Oon do not yet exist, or the links between buyers and producers have not yet developed sufficiently to stimulate farmers to increase production. On the relatively few occasions when a market was available Lam Nam Oon farmers showed

themselves to be highly responsive. In the 1981 Dry Season, for example, when the Government guaranteed the purchase of groundnuts at a good price, Lam Nam Oon farmers produced 1630 metric tons. The next year when a similar guarantee was not made, production fell to 361 metric tons.

This situation calls for an aggresive program of market development- essentially an entrepreneurial activity.

9.1 Market Research

Market research at Lam Nam Oon has identified many regional, national and international commodities outlets and agro-business firms. These firms were contacted to obtain market information and to interest them in Lam Nam Oon as a source of supply. Representatives of some of these firms have visited Lam Nam Oon to assess conditions themselves. Surveys of local markets for vegetables, fish and poultry indicate substantial opportunities for involvement by Lam Nam Oon farmers. Although there is a need for additional market research, that which has been done indicates the desirability of pursuing existing markets immediately.

9.2 Market Development

The staff of the Lam Nam Oon Operations Center will maintain regular contacts with commodities outlets and agro-business firms to sustain their interest in Lam Nam Oon.

The Center will assist firms and individuals by providing them with information on potential production, as well as actual seasonal production. For those who wish to purchase crops at Lam Nam Oon, the Center will help to organize farmers and to arrange collection points throughout the project area. The Center will also advise farmers on quality control to insure that purchasers are not disappointed. Several months prior to the Dry Season, the Center will inform farmers of the market for various crops so that they are able to respond in time.

Lam Nam Oon will develop the market through the private sector and as noted later by means of co-operative development. The private sector development may also require creation of an incorporated mechanism capitalised at about Baht 20,000,000. This latter development will require national government policy support.

Contract farming is another option that will be pursued at Lam Nam Oon. A number of private firms involved with processing specialty crops such as young ear corn and tomatoes have expressed an interest in obtaining part of their supplies from Lam Nam Oon. One firm will run a production test on several hundred rai in FY 1983. Other firms in Khon Kaen, and Bangkok have expressed interest in acquiring Lam Nam Oon

produce on a regular basis. These may be developed into contract arrangements when the volume of Lam Nam Oon production is able to assure a steady supply. If the farmers chosen to participate in the test are able to meet the volume and quality requirement specified by the firm, the area under production will be steadily expanded in future years. Consistent high quality production is the foundation of contract farming. Since Lam Nam Oon farmers are as yet inexperienced in Dry Season cropping they will need supervision and assistance. During the first year test of contract farming (involving young ear corn) the Lam Nam Oon Operations Center will assign staff from the Special Assignment Team (SAT) to work closely with participating farmers. Once contract farming is firmly established at Lam Nam Oon (by 1985) processing firms are expected to assign their own extension agents to Lam Nam Oon during the Dry Season.

A third component of the market development plan is the encouragement of local processing for Lam Nam Oon products. Local processing is attractive to many firms because it offers to reduce their costs for transporting raw materials and to lessen the amount of spoilage. Among the types of processing being considered for Lam Nam Oon are peanut shelling and canning of fruits and vegetables. As Dry Season cropping matures at Lam Nam Oon over the next five years opportunities for additional types of processing will become available. At the present time staff of the Lam Nam Oon Operations Center are providing assistance to a regional marketer of groundnuts who intends to open a peanut shelling plant at Lam Nam Oon during FY 1983.

9.3 Cooperatives Development

The long-term viability of a marketing program at Lam Nam Oon will also require the development of a soundly based cooperatives organization. The Nam Oon-Phanna Cooperative, established in 1981, is a first step in developing a co-operative marketing capability at Lam Nam Oon. At the present time the cooperative lacks experienced staff to carry out a marketing program. Therefore, this plan calls for the assignment of a senior Department of Co-operative Promotion staff member together with a senior SAT staff member from the Lam Nam Oon Operations Center to work with the cooperative in developing its marketing program. Officers and staff of the cooperative will be invited to work with the marketing staff of the Lam Nam Oon Operations Center during FY 1983 to familiarize them with marketing opportunities and techniques.

A more appropriate solution is to revise the charter of the Nam Oon-Phanna Cooperative to permit it to serve the entire Lam Nam Oon Area, including the Amphurs of Muang and Phang Kone. This change has been proposed, and it should be implemented by 1984-1985. Failing this, separate Lam Nam Oon - oriented cooperatives should be created in Amphur Muang and Amphur Phang Khone. Whichever alternative is adopted, cooperative staff should be assigned to the Lam Nam Oon Operations Center to form a market development core group or a joint marketing team.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
II. Critical Activities										
1. LAND CONSOLIDATION ACT - 1974 APPLICATION AND COST RECOVERY PROGRAM										
OBJECTIVE: Obtain agreement of over 50% of Farmers in Lum Nam Oon irrigated area of 185,800 rai - to application of Act; complete cadastral survey, design/install on-farm water delivery system; start economic analysis and establish collection program.										
Status - 1982: All of cadastral survey completed; all of areas consenting to Land Consolidation as of end of 1982 total: 78,800 Rai										
Cadastral Survey	Complete									
Spot - Height survey	Complete									
Area Approval yet to be obtained	55,000 Rai	52,000 Rai								
Economic Studies Started	55	65	Complete							
Review of Discretionary Farm Plot Collection levels			Review	Review						
First Collection Areas and Rates Fixed				Begin on 10,000 Rai	Add 10,000 Rai.	Add 50,000 Rai	Review to add larger amounts of Rai	Continue	Continue	
2. LAND DEVELOPMENT										
2.1 Extensive: Modified Ditch/Dyke On-Farm water delivery systems (Nong Wai model)										
Objective: PLANNED										
* Construct a total of Ditch/Dyke serving 176,936 Rai or 1,230.458 Kms. of ditch by end of 1985	58,663 Rai or 400,472 Kms.	55.000 Rai or 385.000 Kms.	52,093 Rai or 364.561 Kms.	Completion Residual work from 1985. Corrective action where need.	O&M follow up. Assistance to farmer's and modification of on-farm water delivery network as indicated by results Operations Research	Same as 1987	Same as 1987	Same As 1987	Undertake further corrective actions as indicated by Operations Research	Continue as in 1991
* Construct Drainage Ditches (tertiary) 691.886 Kms.	224.920 Kms.	220.000 Kms.	280.372 Kms.							
Status: (as of end 1982)										
* Ditch/Dyke constructed serving 11,180 Rai or length of 80.335 Km.										
* Drainage ditches (tertiary) constructed for length of 38.594 Kms.										

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
II. Critical Activiites (Continued)										
2. LAND DEVELOPMENT (Continued)										
Location: PLANNED Status as of 1982 Areas 15,17 Pilot Area 2 Completed.	Areas 1, 2,4,10, 16,18	Areas 3, 5,6,7,8 9,12,14	Areas 19, 20,21,22, 23							
2.2 Intensive Block fields, land-levelled, Chanasutr water delivery model										
Objective: PLANNED *Construct a total of 8,864 Rai or length of 70.246 Kms.	2.710 Rai or 21.321 Kms.	No further construct-ion of this model	Same as in 1984	Same as in 1984	Same as in 1984	Same as in 1984	Same as in 1984	Same as in 1984	Same as in 1984	Same as in 1984
*Construct Drainage Ditches (tertiary) 54,722 Kms.	14.821 Kms.	No further construct-ion of this model								
Status: (as of end 1982) Completion Chansutr Model: 6,154 Rai or 48,925 Kms. Drains: 39.901 Kms.										
Location: PLANNED Status as of 1982 Pilot Areas 1,3,3A Completed.	Pilot Area 4									
2.3 Drainage: Primary Objective: Drains 100.600 Kms. Secondary drains: 245.400 Kms.	40.000 Kms. 54.000 Kms.	40.000 Kms. 60.00 Kms.	20.600 Kms. 66.000 Kms.	Additional construction as indicated by Operations research	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986
Status: (as of end 1982) Primary drain - 0 Secondary drains 74.108 Kms. Completed										
3. WATER USER GROUPS (WUG's)										
3.1 Organization: Average of 1 WUG/ Chak (1)										
Objective: PLANNED 697 WUG's organised and trained.	277 WUG's	197 WUG's	159 WUG's	Organize and WUG's not yet set up in 83-85 period	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986
Location: Status as of end 1982: Areas 15,17, Pilot Areas 1,2, 3,3A completed.	Areas 1, 2,4,10, 16,18,11, Pilot Area	Areas 3, 5,6,7,8, 9,14,	Areas 19,20, 21,22, 23							

(1) The organizing of Water User Groups will be done during the construction of on-farm ditches and drains (November - May) each year.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
II. Critical Activities (Continued)										
3. WATER USER GROUPS (WUG'S) (Continued)										
3.2 Training:										
Training of 1 Leader and 3 Assistants/WUG (Ban Fang Daeng Training Center 20/ sessions per year: 50/60 trainees/session)	1,108	788	636	Training of any additional WUG's leaders in Lam Nam Oon are	Same as 1986	Same as 1986				
Objective: 2,788 trained leaders by 1985										
Status (at end of 1982) 256 leaders trained										
3.3 Development of Second Generation Irrigators		Develop-ment of curricu-lum determine group priorities preparation of 5 year plan to cover Lam Nam Oon Area	Same as 1985	1000 in 20 Groups 50 trainees each	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986	-
Objective: To provide Lam Nam Oon youth with exposure to and detailed training in water management and principles of irrigation. (This does not replace regular youth training at Ban Fang Dang)										
Status (at end of 1982) No training of this kind started until 1985.										
4. WATER MANAGEMENT SYSTEM										
4.1 Main Canal Management										
Objective: PLANNED Achieve steady water levels in reach Main Canal(at least plus/ minus 50 cm.)	Measure-: ments of Head Regula-tors and Gates completed; Measure-ment of Canals completed. Special manage-ment st staff of engineers assigned and trained. Systems of scheduling established/ tested. Zonemen trained in how to relate to system.	Same as 1983	Normal Operations with new system fully installed, Left and Right Main Canals	Same as 1985	Holding to 25 cm. variances throughout both Left and Right Main Canals	Same as 1987	Same as 1987	Same as 1987	Same as 1987	Same as 1987
Status (at end of 1982) Wide and frequent fluctuations in Right and Left Main Canal water levels.										

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
II. Critical Activities (Continued)										
4. WATER MANAGEMENT (Cond')										
4.2 Micro-computer based on-farm water delivery system management.										
Objective: PLANNED Operational system tested and established as described in Project Planning Note #7 - and applied to all laterals and sublaterals.	System further tested in Units 15, and 17: refine control procedures. Determine target flows; training of Zonemen in how to collect/ report crop data.	Extend to Units 1,2,4,10, 16,18, PA's 1, 2,3,3A and 4	Extend Operations to Units 3, 5,6,7,8, 9,12,14	Extend Operations to Units 19,20,21 22,23	Same as in 1986	Water management system operating in 100% of project area, with staff trained and Zonemen/Water User Groups fully involved.				
Status: (at end of 1982) Micro-computer-based program developed/ tested in one area for L-11 and Chaks Operational staff being trained. Zonemen - being trained in how to relate to system.										
5. IRRIGATION SYSTEM MAINTENANCE										
5.1 System Status Inventory;										
Objective: PLANNED Complete physical inventory entire system and establish physical audit system keyed to Situation Room	Extend Physical Audit to Units 15 and 17 and Zonemen/ Situation Room Staff	Extend to P.A.4 Units 1,2,4, 10,16, 18	Extend to Units 3,5,6,8, 7,9,12, and 14	Extend to Units 19,20, 21,22, 23	Continue to operate systems	Continue to operate system	Continue	Continue	Continue	Continue
5.2 Catch-up Maintenance:										
Objective: PLANNED Perform Emergency, Contract, and Force Account maintenance as outlined in Skogerboe Report of December,1982	Review Skogerboe Report in detail and begin budget preparations for FY 84 based on Report. Order equipment.	Schedule Left Main Canal Emergency Maintenance & Force Account Maintenance Receive/ use equipment	Continue as in 1984	Continue each year onwards						
Status (at end of 1982) Skogerboe Report Completed; no equipment ordered.										

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
II. Critical Activities (Continued)										
5. IRRIGATION SYSTEM MAINTENANCE (Cont'd.)										
5.3 Preventive Maintenance										
Objective: PLANNED										
Develop and execute annual preventive maintenance programs addressed to the entire project area each year	Develop system for preventive maintenance planning/ implementation. Budget for FY 84 and order equipment	Begin operations, train staff, order equipment	Continue as in 1984	Continue each year onwards						
Status (at end of 1982)										
No preventive maintenance planning or capacity to maintain on widespread basis.										
III. Essential Activities										
6. TECHNOLOGY DEVELOPMENT:										
6.1 Operations Research										
6.1.1 Water Efficiency and Distribution										
Objective: PLANNED	Continue in P.A.2; extend to R-9L and R12-L	Continue in P.A.2; R-9L and R-12L. Extend to L-JL	Continue in P.A.2; R-9L, R-12L and extend to R-6L	Review Data	Determine which systems are most efficient and suggest design changes	Begin new cycle of observations	Continue	Continue	Continue	Determine which systems are the most efficient and suggest design changes
Operate tests/ measures in order to gather data on most efficient systems and areas										
Status (end of 1982)										
System of measures installed and operated in P.A.2 only.										
6.1.2 Water User Groups										
Objective: PLANNED:	Begin in P.A.2: Units 15, and 17, P.A.3A	Continue in P.A.2, Units 15, and 17 and P.A.3A, and extend to Units 1,10, and 16	Continue in P.A.2, Units 15, 17, P.A.3A Units 1, 10, 16 and extend to Units 12 and 14	Review Data	Determine which Groups, practices, and areas are the most effective in solving problems	Begin new cycle of observations	Continue	Continue	Continue	Again do as above.
Establish systems of observation/ study of Water User Group problems and development.										
6.1.3 Erosion Control										
Objective: PLANNED:	Begin work with Dept. of Forestry on identifying appropriate cover crops.	Test cover crops and engineering approaches	Continue tests.	Expand demonstrated cover crops and engineering approaches	Continue as 1986	Continue as in 1986	Continue as in 1986	Continue as in 1986	Continue as in 1986	Continue as in 1986
Develop, test, and apply cover cropping and engineering techniques designed to reduce serious siltation of Lam Nam Con canals.										
Status: (at end of 1982)										
Only one, failed, test run. Skogerboe Report suggests some engineering approaches.										

III. Essential Activities (Continued)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
6. TECHNOLOGY DEVELOPMENT (Cond')										
6.1 Operations Research (Cond')										
6.1.4 Climatolcgical Monitoring										
Objective: PLANNED:										
Establish systems for recording evapotranspiration and other weather data within Lam Nam Con irrigated area	Begin recording data from at least 10 Rain Guages and other measuring devices	Relate findings to contents Technical Note #6	Develop up-dated Technical Note #6	Continue recording and observations	Continue	Continue	Continue	Continue	Continue	Continue
Status (at end of 1982) RID has completed installation of 5 Rain Gauages in the Lam Nam Con area.										
6.1.5 Water Table and Soil Salinity Monitoring/testing										
Objective: PLANNED; Establish 60 Observation Wells throughout area; set up monotoring program; establish Perched Water Table Observation program; apply engineering tests	Install/ monitor 27 Observation Wells. Design Perched Water Table Monitoring. Design/ apply one engineering test on saline soils	Add 33 Obs.. Wells. Begin Perched Water Table monitoring, Design/ apply two engineering tests on saline soils	Monitor Obs.Wells Continue Perched Water Table Monitoring Operate four engineering tests on saline soils	Continue as 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985
Status (at end of 1982) One failed engineering test in P.A.3A; no monitoring										
6.1.6 Agro-Economic Research										
Objective: PLANNED: Development a series of input studies on irrigated farmers, labor useages, and outputs, with an economic basis established for seasonal, annual comparisons	Continue at P.A.2; with additional areas included. Complete analysis at end of Dry Season	Same as 1983	Same as 1983	Same as 1983	Same as 1983	Review in comparision with Land Consolidation Act economic analysis studies	Reorganize studies	Continue on basis of new approaches derived from 1989 reorganised studies	Continue as in 1990	Continue as in 1990
Status: (end of 1982) First studies operated in P.A. 2.										

III. Essential Activities (Continued)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
6. TECHNOLOGY DEVELOPMENT (Cond')										
6.1 Operations Research (Cond')										
6.1.4 Climatological Monitoring										
Objective: PLANNED:										
Establish systems for recording evapotranspiration and other weather data within Lam Nam Oon irrigated area	Begin recording data from at least 10 Rain Guages and other measuring devices	Relate findings to contents Technical Note #6	Develop up-dated Technical Note #6	Continue recording and observations	Continue	Continue	Continue	Continue	Continue	Continue
Status (at end of 1982) RID has completed installation of 5 Rain Gauages in the Lam Nam Oon area.										
6.1.5 Water Table and Soil Salinity Monitoring/testing										
Objective: PLANNED; Establish 60 Observation Wells throughout area; set up monotoring program; establish Perched Water Table Observation program; apply engineering tests	Install/ monitor 27 Observation Wells. Design Perched Water Table Monitoring. Design/ apply one engineering test on saline soils	Add 33 Obs.. Wells. Begin Perched Water Table monitoring, Design/ apply two engineering tests on saline soils	Monitor Obs.Wells Continue Perched Water Table Monitoring Operate four engineering tests on saline soils	Continue as 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985	Continue as in 1985
Status (at end of 1982) One failed engineering test in P.A.3A; no monitoring										
6.1.6 Agro-Economic Research										
Objective: PLANNED: Development a time-series of input studies on irrigated farmers, labor useages, and outputs, with an economic basis established for seasonal, annual comparisons	Continue at P.A.2, with additional areas included. Complete analysis at end of Dry Season	Same as 1983	Same as 1983	Same as 1983	Same as 1983	Review in comparision with Land Consolidation Act economic analysis studies	Reorganize studies	Continue on basis of new approaches derived from 1989 reorganised studies	Continue as in 1990	Continue as in 1990
Status: (end of 1982) First studies operated in P.A. 2.										

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
6. TECHNOLOGY DEVELOPMENT (Cond')										
6.2 Agricultural Research										
Objective: PLANNED										
Development of cropping packages for Dry Season and Wet Seasons with emphasis upon cash crops and "mixed" farming by: *Rice Experiment Station *Field Crops Experiment Station *Horticulter Experiment Station *Other DOA components	10 Activities and 30 tests on 250 Rai total. Focus on crop packages for First Dry Season cycle also, raised garde bed plot tests (Rangsit model)	Same as 1983	Same as 1983	Same as 1983	Same as 1983 Begin work on crops for Second Dry Season cycle.	Same as 1983 with 1986 additions	Same as 1983 with 1986 additions	Same as 1983 with 1986 additions	Same as 1983 with 1986 additions. Review entire research plan.	Adopt new research plan.
Status: (at end of 1982) Department of Agriculture operating in it's third year of applied research and technology transfer training for Lam Nam Con irrigated agriculture.										
7. TECHNOLOGY TRANSFER										
7.1 Water User Group Training										
7.1.1 Training of Water User Groups and Assistants.										
Objective: PLANNED: Provide basic training in on-farm water management, in-field water management, systems maintenance.	1,108	788	636	Training of any additional WUG leaders in LNC area.	Same as in 1986	Same as in 1986	Same as in 1986	Same as in 1986	Same as in 1986	Same as in 1986
Status: (at end of 1982) Training under way see Section II, 3.2 above.										
7.1.2 Training of other Water User Group Members.										
Objective: PLANNED: Train 10,000 Water User Group members within a 5-year period. Supply them with same basic facts as previous training for WUG leaders and Assistants.	Begin to design program.	Start work on curriculum development, budget for 12 session year at 175/ session	Activate on test basis for 2 sessions	Expand to full 12 sessions	Continue as 1986	Continue as 1986	Continue as 1986	Continue as 1986	Complete any sessions left over	--
Status: (at end of 1982) No program of this kind planned or in action.										

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.2 Training of Officials:										
7.2.1 Seminars										
Objective:PLANNED To foster discussion among officials of participating agencies, other agencies and local officials about irrigated agriculture problems and opportunities. Status (at end of 1932) Seminar held in 1979 for natl. officials; two semi-annual seminars held in 1982 for local technical officers; 1 seminar held for Zonemen and SAT members.	1 Policy-Planning Seminar; 2 Semi-annual technical seminars 2 semi-annual seminars for zonemen, WUG Leaders, and local officials	Same as 1983	Same as 1983	Review Seminar progress and plan for the 1987-1992 period.						
7.2.2 Tambol Community Development Workers										
Objective: PLANNED Monthly training sessions in irrigated agriculture and information exchange for Tambol DCL workers at Ban Fang Daeng Center. Status (at end of 1982) Steady schedule of monthly meetings	Continue schedule; but improve content of meetings.	Same as 1983	Same as 1983	Review Schedules and content and plan for the 1987-1992 period.						
7.2.3 Tambol Agricultural Workers										
Objective:PLANNED Monthly training sessions in irrigated agriculture for Tambol Kasets (Ag. workers) at Ban Fang Daeng Center and in T&V. Status: (at end of 1982) Meetings held infrequently with insufficient attention to irrigated agriculture content.	Organize monthly meetings in alignment with national T&V training. Place more emphasis upon irrigated agriculture	Same as 1983	Same as 1983	Review schedules and content and plan for the 1987-1992 period.						

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Actiivties (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.3 Demonstration and Reinforcement (Supplemental Training)										
Objective: Development of a number of programs aimed at strengthening and broadening the requirements for irrigated agriculture among farmers and the general community at Lam Nam Oon. Status (at end of 1982) Some programs in operation, i.e. Wall Newspapers, and others in test and design stages										
7.3.1 Wall Newspapers:										
Objective: PLANNED To present simple illustrated (color) information on important aspects of irrigated agriculture to entire Lam Nam Oon area population. Status: (at end of 1982) Illustrated, color, Wall Newspaper distributed Monthly to Lam Nam Oon households.	144,000 copies per year designed produced, distributed in Lam Nam Oon area.	Same as 1983	Continue as 1983 but survey readership and impact of information. Modify format and content accordingly.	Apply new format and content. Also add more stress on co-operatives and second cycle Dry Season crops.	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986	Same as 1986
7.3.2 Village Film and Slide presentations:										
Objective: PLANNED To present filmed information on import - aspects of irrigated agriculture and water management to entire communities at Lam Nam Oon. Minimum of 92 presentations per year, with emphasis on "mixed" farming; main crops; first and second cycle Dry Season Crops; marketing and quality control. Status (at end of 1982) Some presentation work taking place; but organised program not yet designed.	Design/and apply programs in 20 Villages.	Expand programs to 92 presentations in 62 villages (1 showing in 32 villages: 2 showings in 30 villages) 2 showings determined on basis of need for greater reinforcement of local information	Continue as in 1984	Review program, assess priority areas for reinforcement and training; development of new materials and techniques.	Continue as reviewed in 1986	Continue as in 1987	Continue as in 1987	Continue as in 1987	Continue as in 1987	Continue as in 1987

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.3 Demonstration and Reinforcement (Supplemental Training) (Continued)										
7.3.3 Village-based training of farmer-irrigators Objective: PLANNED To provide training in villages for farmers who have not received formal training on on-farm water management, principles of irrigated agriculture, and who need initial training/ information. Status(at end of 1982) Curriculum and materials, staff, in initial preparation/ test; but much more intensive preparatory effort needed.	2 test training sessions, in Units 15 and 17 or Pilot Areas 1,2, 3,3A. Sessions for 50 farmers in one village for 5 days.	Expand to 5 training sessions in 5 villages Select villages on basis of expanding on-farm water delivery systems.	10 training sessions in 10 villages	Same as 1985	Same as 1985; but review where training is needed most. In some cases, this may result in second round of training for some villages.	Same as 1985	20 sessions in 20 villages on-going annual review of location choices, content, etc.	Same as 1989	Same as 1989	Same as 1989
7.3.4 Demonstration of Crops and Technology (Dry Season) (Agency: DOAE) Objective: PLANNED To stimulate increased production by introducing farmers to new higher yielding crops and technologies. Status(at end of 1982) DOAE program in operation; but much greater emphasis needed on Dry Season crops using irrigation.	2 rai of demonstration plots per village (92 villages) In cooperation with DOA and Lam Nam Con marketing staff select crops for promotion in 1984. (emphasis upon high value per area and market potentials).	2 rai of demonstration plots/ village. (92 villages) emphasis upon first Dry Season crop cycle.	Same as 1984	2 rai demonstration plots per village(92 villages) in cooperation with DOA test results begin demonstration of second cycle Dry Season crops. Identify areas with problems in first cycle cropping, design demonstrations to remedy problems for 1987.	2 rai of demonstration plots,per village. (92 villages). Increase emphasis on second cycle Dry Season crops. Identify areas with problems in first cycle cropping. Design demonstrations to remedy problems for 1988. Implement remedial demonstrations.	Same as 1987	Same as 1988	Same as 1989. Also, introduce demonstration of higher yielding varieties of glutinous rice as one way to make more area available for higher yielding varieties of non-glutinous rice.	Same as 1990 Reintroduce emphasis on new crops for first cycle Dry Season crops which markets show to be in demand.	Same as 1991

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.3 Demonstration and reinforcement (Supplemental Training) (Continued)										
7.3.5 Farm Management Demonstration. (DOAE, assisted by OAE, DOA, LNO Operations Center) Objective: PLANNED To introduce farmers to techniques of farm management including labor allocation, farm accounts, optimal cropping mixtures. Status (at end of 1982) Models for such demonstrations have been developed; but these must be analyzed and modified to fit LNO irrigated agriculture conditions 9 site identified.	Demonstrations started at 9 sites. 4 additional sites must be identified and prepared for demonstration in 1984	Demonstrations on total of 13 sites. LNO joint team support to demonstration effort. Potential adopters identified and assisted in farm management techniques.	Continue as in 1984. Also, select 13 new sites for 1986. Return 13 first demonstration sites to original status.	Results evaluated. If results favorable and farmer interest high activate 13 new sites. If interest is not high review again and plan to reduce/ alter/ eliminate program.	Continue on basis 1986 evaluation.	Continue on basis of 1986 evaluation.	Same as 1988	Same as 1988	Same as 1988	Same as 1988
7.3.6 Mixed Farming Development Objective: PLANNED To introduce mixed farming techniques to selected farmers with appropriate management skills and resources. Program operating to establish 100 raised-bed (Rangsit model) garden plots by end of FY 83 to test applicability of moderate scale mixed farming technologies under LNO irrigated agriculture conditions.	Complete 100 raised-bed sites as scheduled. Collect data on on performance	Begin detailed evaluation of effort including costs of construction, other inputs, returns. Modify designs and technologies so that new adapters are responsible for all costs of construction, operation	Continue to encourage Mixed Farming at LNO with new adapters bearing costs. LNP Operations Center to provide technical and marketing assistance. Continue the evaluation of first 100 sites.	Same as 1985	Same as 1985	Consolidate results of evaluation and previous four years of experience into revised Mixed Farming models.	Apply revised 1988 findings	Same as 1989	Same as 1989	Same as 1989

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.4 Fisheries Development										
Overall Objective: Increased consumption of protein by Lam Nam Oon residents; increased income from raising and catching fish.										
7.4.1 Fishponds:										
Objective: PLANNED: 400 to 600 Fishponds (1 rai each) installed in Lam Nam Oon area. Status (at end of 1982): 120 Fishponds established.	Install 50 Ponds	Same as 1983	Same as 1983 Review demand.	Install 50 Ponds	Install 50 ponds Review demand	Install 50 Ponds	Same as 1988	Same as 1988	Same as 1988	Review entire program and plan for next cycle.
7.4.2 Local Hatcheries:										
Objective: PLANNED: Expand hatchery capacities in Lam Name Oon area by establishing at least 13 hatcheries (1 in each tambol). Status (at end of 1982): 1 local hatchery established at Ban Fang Daeng.	Establish 4 hatch-eries	Same as 1983	Same as 1983	Review needs for local hatch-eries and exist-ing oper-ations.	Re-plan					
7.4.3 Freshwater Prawns:										
Objective: PLANNED: Expand the base for this type of fishery production at Lam Nam Oon. Within three years establ-ish 120 ponds. Status (at end of 1982): Now in experimental stage at Lam Nam Oon. 45 ponds are trying production: 10 in Phang Khone; 15 in Phannanikom; 15 in Muang	Install 30-40 ponds	Same as 1983	Same as 1983	Review exper-ience of 1983-85 period and re-plan.						

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
7. TECHNOLOGY TRANSFER (Continued)										
7.4 Fisheries Development (Continued)										
7.4.4 Reservoir Fishery Development:										
Objective: PLANNED Increase fish density in reservoir to level which can support commercial fishing; promote organised fishing by Lam Nam Con residents; provide adequate management of reservoir. Status (at end of 1982) Fisheries not now managed in reservoir. Density is probably about 10 kgs./rai. Low level of fishing and not organised. DOF stocks annually at rate of 1,000,000 fingerlings.	Determine fish density. Survey reservoir fishery management problems/conditions and develop plans for action. Survey opportunities for organised fish production/harvesting in reservoir. Continue stocking. Begin development of LNO Reservoir Fisheries Management Unit including studies of requirements, staff facilities and equipment.	Continue as in 1983 Begin installing LNO Reservoir Fisheries Management Unit.	Continue as in 1983	Intensify reservoir fishery management, production, and harvesting programs.	Continue as in 1986	Same as 1986	Review entire program and replan.			
8. LAM NAM CON OPERATIONS CENTER - SUPPORT SERVICES										
8.1 Data Collection - storage and Analysis (includes computerised and manual data) Objective: PLANNED Provide a central data base for all participating agencies, local farmers and other interested parties. Supply data or analyses on request. Status (at end of 1982) Data storage facilities in place. Computerization of data in initial stages. Data analysis limited to water management systems.	Develop data reporting channels and processing. Determine data/reporting needs of participating agencies. Develop data management systems. Install/train staff in microcomputer processing of data.	Same as in 1983	Same as in 1983	Standardize all operations and expand training of staff.						

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
8. LAM NAM OON OPERATIONS CENTER - SUPPORT SERVICES (Continued)										
8.2 Maps, Operational Manuals, Handbooks, Market Information.										
Objective: PLANNED Provide field personnel with easily referenced basic information on their subjects/areas of operation at Lam Nam Oon. Provide farmers with market information in time for them to use it in making annual crop plan decisions. Status (at end of 1982) Five crop-related soil suitability maps completed but not yet oriented to Tambols, plots, or lateral canal locations. Some technical handbooks developed; but not tested.	Prepare 1:4,000 Tambol-oriented maps of area showing soil/crop suitabilities; plot numbers; locations on laterals and ditch/dykes. Duplicate maps in quantities sufficient for all participating agencies. Prepare Operations Handbook and distribute. Prepare market information.	Same as 1983	Same as 1983	Review developed materials and useages; and plan expansion and use of additional matrials	Apply results of 1986 review.	Same as 1987	Same as 1987	Same as 1987	Same as 1987	Same as 1987
9. MARKETING:										
9.1 Market Research:										
Objective: PLANNED Obtain current information on market conditions for actual and potential Lam Nam Oon crops; identify outlets and agro-business firms; estimate regional, national, and international market opportunities. Status (at end of 1982) Program operational; but work being done only by consulting firm.	Establish LNO Operations Center capacity to operate various aspects of program. Also, develop Co-operative Promotion involvement in operations.	Same as 1983	Same as 1983	Review progress in establishing systems and institutions; and develop additional initiatives	Apply results of 1986 study.	Same as 1987	Same as 1987	Same as 1987	Same as 1987	Same as 1987

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
III. Essential Activities (Continued)										
9. MARKETING: (Continued)										
9.2 Market Development:										
Objective: PLANNED Establish linkages between Lam Nam Oon farmers and marketing outlets. Promote contract farming for speciality crops. Promote local processing of LNO crops, Promote village-based marketing groups. Promote co-operation development for marketing and also explore feasibility of establishing incorporated marketing capacity for Lam Nam Oon. Status (at end of 1982) Program operational; but work is being done ONLY by consulting firm. Also, co-operatives not well established and no work developed on incorporated marketing capacity.	Establish Lam Nam Oon Operations Center capacity to operate programs. Develop powerful co-op for whole irrigated area. Start feasibility studies on possibility of establishing incorporated marketing entity. Develop feasibility studies for marketing/ processing of Lam Nam Oon produced crops.	Same as 1983	Review co-op organization staffing, policy situation. Also review study on creating incorpporated marketing entity. Continue, otherwise, as in 1983.	Reorganise market development programs on basis of 1985 findings.	Same as 1986	Same as 1986	Same as 1986	Review entire market development in light of first and second crop cycle Dry Season production and adopt appropriate strategies and organizational features.		

AUTHORS

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He is currently employed by Louis Berger International Inc.; but most of his active career has been with the Asia Foundation, the United States Agency for International Development (USAID) and the Ford Foundation.

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