CHAPTER III SURVEY ON BACKWARD VILLAGES

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III-1 INVENTORY ON BACKWARD VILLAGES

III-1-1 Information System for Rural Development

The information system for rural development in Thainland was developed in 1982 at the beginning of the 5th 5-year National Economic and Social Development Plan period under the supervision of the National Rural Development Committee (NRDC) whose main members are from the National Economic and Social Development Board (NESDB). This information system contains various secio-economic data on nation-wide, approximately 55,000 villages, and the main purpose of the system is to achieve the optimum allocation of national budget for rural development through project planning, coordination, monitoring and evaluation.

III-1-2 Target Villages

In the information system, NESDB divides all villages into three categories: backward, middle-level and progressive villages in accordance with the level of development. In four provinces, there are 2,617 villages in total, and out of them, 994 villages are regarded as backward by NESDB 1988 data. The composition ratio of backward villages in all villages is the highest (49 percent) in Tak, the lowest (32 percent) in Sukhothai, and 38 percent on the average. Only Amphoe Si Nakhon in Sukhothai province has no backward villages.

BACKWARD VILLAGES IN THE STUDY AREA

Province	Number of Amphoe	Number of Tambon	Number of Villages	Number of Backward Villages	(%)
Phitsanulok	9	67	825	282	(34)
Sukhothai	9	61	654	209	(32)
Kamphaeng Phet	7	61	695	288	(41)
Tak	8	46	443	215	(49)
Total	33	235	2,617	994	(38)

III-1-3 Contents of Inventory

Since 1982, the stored data in the information system for rural development has been updated every two years. The updated data in 1988 is composed of 97 socio-economic items and 34 development level items. The inventory for 994 backward villages has been formulated based on these 131 items of 1988-updated data. 97socio-economic items are divided into nine sectors, and main items are as follows.

SOICO-ECONOMIC ITEMS

Main Sector/Subsector	Item	
1. General Data	- Location - Number of Household - Reserved Forest	- Sanitation District - Population - Land Tax
2. Water /Domestic Water /Agricultural Water	- Wells - Availability of Drinking Water - Availability of Surface Water - Usage of Surface Water	- Pipeline Water - Availability of Domestic Water - Kind of Surface Water
3. Social Infrastructure /Public Service /Electricity /Transportation /Housing /Marketing /Fuel /Agri-supporting Infrastructure	- Availability of Village Public Service - Availability of Electricity - Amphoe Road - Vehicles - Roof - Business Shop - Availability of Fuel - Agricultural Organization	- Availability of Tombon Public Service - TV Sets - Market Road - Toilet - Market - Agricultural Credit - Mill
4. Agricultural Economy	- Employment - Short Upland Crop Production - Orchard - Flower - Horticulture - Livestock - Fish culture - Animal Labour - Soil	- Rice Production - Long Upland Crop Production - Gardening - Rubber - Dry Agriculture - Fishery - Cottage Industry - Machinery - Land Tenure
5. Education	- Compulsory - Training - Sports	- Literacy - Religion
6. Public Health	- Babies' Weight - Child Disease - Family Planning - Medicine	- Nutrition - Adult Disease - Vaccination - Hospital
7. Labour/community	- Migration	- Disputes
8. Quality of Life	- Refer to III-2	
9. Opinion of Head	- Amphoe	- Village

III-2 ANALYSIS OF INVENTORY

In order to formulate the integrated rural development plan for 994 backward villages in four provinces, the inventory data of the backward villages from the information system for rural development have been analyzed. The main purpose of the analysis is to select the priority villages for development and to grasp the present development level of the backward villages.

The economic development level will be represented by annual income per capita and the social development level will be represented by frequency of unsatisfaction for the quality of life, so that the economic and social development level can be the indicators to judge the priority for development. The purpose of 34 development level items by NESDB is to categorize villages into backward, middle level, and progressive villages and some items are not quantified and duplicately quantified. Therefore, following two indicators are set for selecting the priority villages.

III-2-1 Income Indicator

In addition to the general data such as number of households, cultivated area, and selling prices of agricultural products, following 14 development level items are related with the economic development level (*indicates the development level items indirectly related with the economic development level.).

*(1) Land Right
*(2) Rice Mill
(3) Income Rate
*(4) Animal Labour
(5) Wage Rate
*(6) Land Ownership
(7) Rice Yield
(8) Upland Crop Yield
(9) Cattles and Buffaloes Sale
*(10) Migration for Employment
*(11) Agricultural Cooperative
*(12) Agricultural Credit
(13) Cropping Intensity
*(14) Agricultural Water in Dry Season

The income indicator is not a figure contained in the inventory survey but a logical and theoretical figure calculated by annual total income per capita including wage, rice production, upland crop production, other agricultural products, and livestock which are available in the inventory. The average

income indicators shall be calculated for village, Amphoe, and province level, and their rankings shall also be calculated.

III-2-2 Quality of Life Indicator

The quality of life indicator represents the social development level such as accessibility to various kinds of social infrastructures and public services. In 1988, NESDB has introduced 32 questionnare items on the quality of life which are categorized into five sectors. These 32 items have each criteria to judge whether or not a village is satisfied with the quality of life, thereby making it possible to use them as indicators for the quality of life. The contents of 32 items are shown below, and the criteria for satisfaction with the quality of life are shown in Table III-2.

(1)	Agriculture	:	Soil maintenance, fertilizers, chemicals, vaccination for livestocks, high-yield varieties.
(2)	Drinking Water	:	Minimum supply of drinking water
(3)	Public Health	:	0-5-year-old children's nutrition, 5-14-year-old children's nutrition, new-born babies' weight, housing durability, housing cleanliness, housing with toilet, vaccination for under-1-year-old children, vaccination for 7-14-year-old children
(4)	Education	:	Primary compulsory education, literacy, information, self-education, maintenance of regional culture
(5)	Community	:	Security for life and property, association, cooperation for maintenance of public property, activity for conservation of natural resources, participation in election, activity for village committe, cooperation mind, religious activity, gambling, smuggling

The frequency of unsafisfaction against 32 items of the quality of life shall be counted, and the ratio of unsafisfaction for villages, Amphoe,and provinces shall be calculated.

III-3 SELECTION OF PRIORITY BACKWARD VILLAGES FOR DEVELOPMENT

III-3-1 Priority Amphoe for Development

The priority for development will be judged by the average ranking of the income Indicator and the quality of life indicator calculated on a village, Amphoe, and province basis.

The backward villages area scattered over the project area : however, for the effective implementation of the project, irrigation development requires the reasonable extent of farm lands, and rural road development needs numbers of villages to be linked, and the project shall involve several villages regardless of development priority of each village. Therefore, in the selection of priority project areas, priority Amphoe is firstly selected.

In the first place, the priority for development by province is calculated as below:

PRIORITY AMPHOE FOR DEVELOPMENT

Province	Income Indicator (฿/person Year)		Quality of Life (percent)	Ranking	Average Ranking	Number of Backward Villages
Phitsanulok	8,034	3	44.1	3	3	282
Sukhothai	7,898	2	45.6	2	2	209
Kamphaeng Phet	9,665	4	41.8	4	4	288
Tak	2,704	1	55.9	1	1	215

As for the income indicator, Tak province is the lowest at 2,704 Baht/person a year, and Kamphaeng Phet is the highest at 9,665 Baht/person a year. In the quality of life indicator, Tak province is the highest at 55.9 percent, and Kamphaeng phet province is the lowest at 41.8 percent.

The result shows that since the ranking of the income indicator is just same as the ranking of the quality of life indicator, the priority for development by province is 1st, 2nd, 3rd, and 4th in Tak, Sukhothai, Phitsanulok, and Kamphaeng Phet, respectively. The present development level in Phitsanulok, Sukhothai, and Kamphaeng Phet is almost same, and Tak is extremely low among four provinces. In the same manner, the priority Amphoe for development in four provinces are shown in Table III-3.

(1) Phitsanulok Province

The income indicator of Amphoe Muang Phitsanulok is the lowest at 4,609 Baht and Amphoe Nakhon Thai is the second lowest at 4,642 Baht. Amphoe Phrom Phiram is the highest at 15,696 Baht. With regard to the quality of life indicator, Amphoe Nakhon Thai located in the East boundary has the highest unsatisfaction ratio of 52.9 percent, and Amphoe Noen Maprang has the second highest of 52.1 percent. Amphoe Bang Krathum has the lowest unsatisfaction ratio of 32.4 percent, and Amphoe Muang Phitsanulok in the center of province has the second lowest of 33.8 percent.

According to the average ranking of the income indicator and the quality of life indicator, the priority ranking for development by Amphoe is as follows ; ①Nakhon Thai, ②Noen Maprang, ③Muang Phitsanulok, ③Chat Trakan, ⑤Wat Bot, ⑥Bang Krathum, ⑥Wang Thong, ⑧Bang Rakam, and ⑨Phrom Phiram, in order of priority.

(2) Sukhothai Province

The income indicator of Amphoe Thung Saliam is the lowest at 4,532 Baht and Amphoe Ban Dan Lan Hoi located in the boundary with Tak is the second lowest at 4,557 Baht. Meanwhile, Amphoe Si Satchnarai is the highest at 10,936 Baht, and Amphoe Si Samrong in the center of province is the second highest at 10,337 Baht. With regard to the quality of life indicator, Amphoe Ban Dan Lan Hoi has the highest unsatisfaction ratio of 51.2 percent, and Amphoe Muang Sukhothai has the second highest of 50.3 percent.

According to the average ranking of the income indicator and the quality of life indicator, the priority ranking for development by Amphoe is given in order of priority as follows ; ①Ban Dan Lan Hoi, ②Muang Sukhothai, ③Thung Saliam, ④Khiri Mat, ④Sawan Khalok, ⑥Si Satchanalai, and ⑧Si Samrong,

(3) Kamphaeng Phet Provicne

Kamphaeng Phet province has the highest income indicator among four provinces. Amphoe Khlong Lan has the lowest income indicator of 6,581

Baht, and Amphoe Phran Kratai has the second lowest of 7,676 Baht. On the other had, Amphoe Sai Ngam has the highest income indicator of 14,298 Baht. With regard to the quality of life indicator, Amphoe Pran Kratai has the highest unsatisfaction ratio of 50.9 percent and Amphoe Muang Kamphaeng Phet has the second highest of 45.3 percent.

The priority ranking for development by Amphoe is given in order of priority as follows: ① Phran Kratai, ②Khlong Lan, ③Muang Kmphaeng Phet, ④Khanuworalak Buri, ⑤Khlong Khlung, ⑥Lan Krabu, and ⑦Sai Ngam.

(4) Tak Province

Tak province has the lowest level of income indicator as well as the quality of life indicator. The income indicators of Amphoe Mae Ramat, Sam Ngao, and Tha Song Yang are 1,384 Baht, 1620 Baht, and 1,817 Baht,respectively. The highest income indicator is marked by Amphoe Mae Sot, a center of border trade, located along the boundry with Myanmar at 3,421 Baht. With regard to the quality of life indicator, Amphoe Tha Song Yang located in the north boundary with Myanmar has the highest unsatisfaction ratio of 71.8 percent and Amphoe Umphang located in the south boundary with Myanmar has the second highest of 65.9 percent.

The priority ranking for development by Amphoe is given in order of priority as follows: ①Tha Song Yang, ①Mae Ramat, ③Umphang, ④Sam Ngao, ⑤Ban Tak, ⑤Mae Sot, ⑦Muang Tak, and ⑧Phop Phra.

III-3-2 Priority 150 Villages

In this study ,in order to efficiently grasp the present situation of backward villages in the limited time, the field survey shall be concentrated on 10 percent - 20 percent of backward villages. And, due to the financial limitation, all 994 backward villages cannot be included in the 5-year rural integrate development plan. Therefore, 150 priority backward villages were firstly selected for the formulation of the development plan.

In selecting priority backward villages, 150 backward villages were allocated in the first place to four provinces in consideration of the present

development levels of provinces so that uneven distribution of development projects can be avoided. Then, the selected priority backward villages on a provincial basis were allocated to Amphoe in the same manner.

NUMBER OF PRIORITY BACKWARD VILLAGES BY PROVINCE

Province	① Priority Rank	② Number of Backward Villages	③ Score (②/①)	%	Number of Priority Backward Village
Phitsanulok	3	282	94.0	19.4	29
Sukhothai	2	209	104.5	21.5	33
Kamphaeng Phet	4	288	72.0	14.8	22
Tak	1	215	215.0	44.3	65
Total		994	485.5	100.0	150

III-4 CONSTRAINTS FOR DEVELOPMENT IN BACKWARD VILLAGES

By the income indicator representing economic development level and the quality of life indicator representing social development level, the backwardness of the villages could be quantitatively expressed. In this section the constraints to hamper the improvement of income indicator and quality of life indicator shall be carefully analyzed, thereby giving clear-cut development objectives for the 5-year integrated rural development plan.

III-4-1 Income Analysis

(1) Poverty Level Analysis

The average annual income per capita of all the backward villages are clarified in Table III-4, and the distribution of villages by income bracket is summarized as follows:

DISTRIBUTION OF VILLAGES BY INCOME BRACKET

Income Bracket (Baht/person·year)	Province				
	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak	Total
Below 2,000	14	8	8	122	152
2,001~4,000	52	39	39	50	180
4,001~6,000	69	44	60	18	191
6,001~8,000	55	39	59	11	164
over 8,000	92	79	122	14	307
Total	282	209	288	215	994

According to NESDB criteria, the poverty line which indicates the income bracket boundary between absolute poverty and relative poverty was 5,849 Baht/person · year and 3,666 Baht/person · year at the 1986 price in city districts and rural districts, respectively. The number of backward villages whose annual income per capita is below 4,000 Baht is 172 (80 percent of all backward villages), 66 (23 percent), 14 (22 percent), and 47 (16 percent) in Tak, Phitsanulok, Sukhothai, and Kamphaeng Phet, respectively.

Consequently, about 30 percent of backward villages are regarded as absolutely poor below the poverty line. Especially, in Tak, about 80 percent of backward villages are categorized into absolutely poor villages. In terms of Amphoe, the composition ratio of absolutely poor villages in all backward villages is 100 percent, 96 percent, 92 percent, 89 percent, 89 percent, in Amphoe Sam Ngao, Mae Ramat, Tha Son Yang, Umphang and Ban Tak respectively.

(2) Poverty Factor Analysis

(a) Income Breakdown Analysis

The composition ratio of each income in total income is tabulated below with the comparison with national and North Thailand average calculated by 1988 NESDB data.

INCOME BREAKDOWN BY INCOME SOURCE

- Unit : % -

Province	Total Income	Agricultural Income				Non-Agricultural Income		
		Rainy Season	Dry Season	Others	Total	Wage	Cottage Industry	Total
Phitsanulok	100	92.5	0.7	4.0	97.2	2.7	0.1	-
Sukhothai	100	89.1	2.4	6.5	98.0	1.5	0.5	-
Kamphaeng Phet	100	93.3	2.0	2.2	97.5	2.4	0.1	-
Tak	100	86.4	3.7	6.1	96.5	2.8	0.7	-
North Thailand	100				49.1	27.2	14.2	9.5
Thailand	100				41.2	33.7	17.1	8.0

The result shows that the economy of backward villages in four provinces totally depends on agricultural income in the rainy season,

monoculture relying on rainfed cropping. The diversification of income source such as agricultural income in the dry season and non-agricultural income is not promoted.

(b) Correlation Analysis by Sector

It is estimated that the agricultural and social infrastructure sectors have direct connection with income indicator. In order to clarify the real cause of rural poverty, the correlation coefficients with income indicator are calculated, thereby analyzing the constraints to be eliminated for income increase.

① Agricultural Sector

The agricultural sector is represented by the following two productivity indicators of paddy price and yield, two surface water indicators of agriculture water use, and four indicators of dry season agriculture.

8 INDICATORS IN AGRICULTURAL SECTOR

Indicator	Description
Price of Paddy	Average price, rainy season and dry season
Yield of Paddy	Average yield, rainy season and dry season
Surface Water (1)	Composition ratio of villages with surface water available
Surface Water(2)	Number of surface water available per village
Dry Season Agriculture(1)	Composition ratio of villages with dry season farming
Dry SeasonAgriculture(2)	Composition ratio of villages with surface water for dry season farming
Dry Season Agriculture(3)	Ratio of farm household engaged in dry season farming
Dry Season Agriculture(4)	Ratio of income from dry season farming

The ranking of these eight indicators by province is shown in Table III-5. In addition, the correlation coefficients with income indicator based on the correlation analysis by Amphoe average data (N=33) are calculated. The result shows that all the indicators have positive correlation coefficients with income indicator, and especially, price, yield and dry season agriculture indicators have high correlation coefficients of more than 0.600 with income

indicator. This conclusion implies that the income from dry season farming has a large impact on income indicator.

② Social Infrastructure Sector

The social infrastructure sector is divided into rural infrastructure and agriculture supporting infrastructure, including the following 17 indicators:

9 INDICATORS IN RURAL INFRASTRUCTURE SECTOR

Indicator	Description
Electricity	Ratio of household with electricity
Road (1)	Ratio of paved or laterite Amphoe road
Road (2)	Ratio of paved or laterite market road
Transportation(1)	Number of pickups per 1,000 persons
Transportation(2)	Number of farm trucks per 1,000 persons
Housing	Number of households with toilet
Shop	Number of business shops per 1,000 persons
Meeting Hall(1)	Composition ratio of village with village hall
Meeting Hall(2)	Composition ratio of village with Tambon hall

8 INDICATORS IN AGRICULTURE SUPPORTING INFRASTRUCTURE SECTOR

Indicator	Description of Indicate
Facilities	Composition ratio of village with agricultural storage facilities
Rice Mill	Number of rice mills per 1,000 paddy farmers
Farm Credit (1)	Composition ratio of village using BAAC
Farm Credit (2)	Composition ratio of village with Rice Bank
Farm Credit (3)	Composition ratio of village with Cattle-Buffaloes Bank
Market (1)	Composition ratio of village with product-selling market
Market (2)	Composition ratio of village with material-buying market
Organization	Ratio of persons belonging to famer's cooperatives

The ranking of these 17 indicators by province is shown in Table III-6 and 7. According to the ranking, in Tak province with lowest income and quality of life, 15 indicators out of 17 indicators in social infrastructure sector are lowest in four province, indicating that the accessibility to rural and agriculture supporting infrastructure is worst in Tak province. And the total

ranking by province in the social infrastructure sector is just in line with the average ranking of income indicator and quality of life indicator. It is argued that the poor arrangement of social infrastructures directly affects the agricultural productivity and quality of life in backward villages.

In addition , the correlation coefficients with income indicator based on the correlation analysis by Amphoe average data(N=33) are calculated. The result shows that all the indicators have relatively positive correlation coefficients with income indicator, and especially, six indicators of ratio of paved or laterite Amphoe road, ratio of paved or laterite market road, number of pickups per 1,000 persons, number of rice mills per 1,000 paddy farmers, composition ratio of village with product-selling market, and composition ratio of material-buying market, have considerably high correlation coefficients of more than 0.600 with income indicator. This conclusion implies that the marketing and price negotiation of agricultural products are closely connected with income indicator.

III-4-2 Quality of Life Analysis

The correlation analysis by sector is also performed for the quality of life indicator. It is estimated that the social infrastructure, public health and education sectors have close connection with the quality of life indicator. In order to clarify the real cause of rural poverty, the correlation coefficients with the quality of life indicator are calculated, thereby analyzing the constraints to be eliminated for improvement of the quality of life. In addition the rural road sub-sector and the rural water supply sub-sector in the social infrastructure are particularly analyzed in detail for importance in rural development.

(1) Social Infrastructure Sector

The indicators and ranking utilized in the analysis are same as those in the case of income indicator. The correlation coefficients with the quality of life indicator are calculated. The result shows that five indicators of ratio of household with electricity, ratio of paved or laterite Amphoe roads, ratio of paved or laterite market roads, number of households with toilet, and composition ratio of villages with Tambon hall, have high correlation coefficients of more than 0.600 with the quality of life indicator. Especially the coefficient of Amphoe roads with the quality of life is the highest at 0.728.

(2) Public Health Sector

The public health sector is one of the most important sectors related with satisfaction of basic human needs. The following 14 indicators are adopted to clarify the present situation of public health sector.

14 INDICATORS IN PUBLIC HEALTH SECTOR

Indicator	Description
Hospital (1)	Composition ratio of villages with hospital
Hospital (2)	Composition ratio of villages with Child Nutrition Center
Nutrition (1)	Malnutrition ratio for 1-5 year-old children
Nutrition (2)	Ratio of nutrition survey service for 1-5year old children
New-Born Baby (1)	New-born babies death ratio
New-Born Baby (2)	Ratio of new-born babies with birth weight of less than 3,000 grams
Family Planning	Family planning ratio
Pregnancy (1)	Ratio of qualified person's assistance at births
Pregnancy (2)	Ratio of pregnant women's death at birth
Disease (1)	Child disease cases per 1000 children
Disease (2)	Adult disease case per 1000 adults
Vaccination (1)	Ratio of pregnant Woman receiving full-course vaccination
Vaccination (2)	Ratio of under-1-year -old children receiving full-course vaccination
Vaccination (3)	Ratio of 5-14-year-old children receiving full-course vaccination

The ranking of these 14 indicators by province is shown in Table III-8, and the present situation of public health sector in four provinces is as follows.

Hospital : The number of villages with public hospitals and /or health centers is extremely few. Only 4-5 percent, except for eight percent of Kamphaeng Phet. Meanwhile, more than 80 percent of villages in every province have child nutrition centers.

Nutrition : The ratio of nutrition survey service for 1-5-year-old children is 94 percent, 85 percent, 84 percent, and 65

percent in Kamphaeng Phet, Sukhothai, Phitsanulok, and Tak, respectively. This sequence directly affects the malnutrition ratio for 1-5-year-old children, and the malnutrition ratio of Phitsanulok and Tak is both more than 20 percent.

New-Born Baby: and Pregnancy: Although the ratio of pregnant women's death at birth is low at less than 0.6 percent in every province, the new-born babies death ratio of Tak and Kamphaeng Phet is considerably high at 3.6 percent and 2.0 percent, respectively.

Disease : The number of child disease cases per 1,000 children is relatively high at 384 cases and 427 cases in Phitsanulok and Tak, respectively, which reflects the high malnutrition ratio for 1--5-year -old children.

Vaccination : The ratio of children receiving full-course vaccination in Tak is relatively low, ranging from 85.1 percent to 63.0 percent.

The correlation coefficients of above 14 indicators with the quality of life indicator are calculated. Every indicator in the public health sector has a positive correlation coefficient with the quality of life indicator. Especially, two indicators of composition ratio of villages with hospital and malnutrition ratio for 1-5-year-old children has more than 0.600 correlation coefficients with the quality of life indicator.

(3) Education Sector

Education is closely connected with the quality of life, as well as indirectly connected with the improvement of agricultural productivity through agricultural technique extension, improvement of public health through public health knowledge, and increase in job opportunities through technical training.

The inventory has the following three indicators in the education sector.

3 INDICATORS IN EDUCATION SECTOR

Indicator	Code	Description	Unit
Primary Education	E-1	Primary compulsory education ratio	%
Literacy	E-2	Literacy ratio	%
Training	E-3	Number of training per person a year	No's

The ranking of these three indicators by province is shown below.

RANKING OF 3 INDICATORS IN EDUCATION SECTOR

	Data			Ranking			
Province	E-1	E-2	E-3	E-1	E-2	E-3	Total
Phitsanulok	62.3	90.4	0.6	2	2	4	2
Sukhothai	65.9	96.7	0.4	4	4	2	4
Kamphaeng Phet	63.2	94.4	0.5	3	3	3	3
Tak	23.1	90.1	0.2	1	1	1	1

In Tak, the primary compulsory education ratio is very much low at 23.1 percent when compared with other three provinces, due to the fact that the accessibility to schools is not good and the income is low. The literacy ratio is rather high as more than 90 percent, including Tak. This is caused by the effective adult education for literacy promoted by the Government of Thailand in spite of the low primary compulsory education ration. The frequency of training per person per year is less than once per person per year in every province.

The correlation coefficients of three indicators in the education sectors with the quality of life indicator are all positive. The coefficients of the frequency of training per person per year with the quality of life indicator is the height at 0.464 and the coefficient of the literacy is the second highest at 0.364. The coefficient of the primary compulsory education ratio is 0.262.

(4) Rural Road Subsector

Rural roads are important infrastructure for rural people; they provide access to public services as well as markets. It can not only add benefits to

present activities, but stimulate new activities. The following six indicators with respect to Amphoe roads to connect villages with Amphoe and market roads are employed for analysis of the rural road subsector.

6 INDICATORS IN RURAL ROAD SECTOR

Indicator	Description
Amphoe Road (1)	Ratio of villages without access-to-Amphoe road
Amphoe Road (2)	Ratio of non-paved access-to-Amhpoe road
Amphoe Road (3)	Ratio of villages with access-to-Amphoe road impassable in rainy season
Market Road (1)	Ratio of villages without access-to-market road
Market Road (2)	Ratio of non-paved access-to-market road
Market Road (3)	Ratio of villages with access-to-market road impassable in rainy season

Table III-9 gives the ranking of above six indicators revealing underdeveloped road networks in Tak province. 30.2 and 38.1 percent of backward villages in Tak province have no access to Amphoe roads and market roads respectively, while 0.7to 2.0 percent and 1.0-2.4 percent of the backward villages in other three provinces have no access to Amphoe roads and market roads respectively.

(5) Rural Water Supply Subsector

Rural water supplies are closely related to the quality of life of rural peoples through supply of water drinking and daily use. The general situation of the present rural water supply is examined by applying the following six indicators:

6 INDICATORS IN RURAL WATER SUPPLY SUBSECTOR

Indicator	Description
Well (1)	Number of sallow wells per 1,000 persons
Well (2)	Number of deep wells per 1,000 persons
Piped Water (1)	Ratio of villages with water pipeline
Piped Water (2)	Ratio of households with water pipeline
Drinking Water	Ratio of households satisfied with drinking water supply of more than 2 ℓ/day /person
Domestic Water	Ratio of households satisfied with domestic water supply throughout the year

The ranking of six indicators on rural water supply is presented in Table III-10. As far as the rural water supply is concerned, Tak province is distinguished from the other three province by the high spread of water pipelines; 21 percent of backward villages have pipelines and 14 percent of households are equipped with pipelines.

III-5 FARM MANAGEMENT ANALYSIS

In addition to the macro-economic analysis at province and Amphoe levels presented in III-4, the farm management analysis is performed based on the average farm household information derived from the inventory.

III-5-1 Farm Household Economy

The average annual income per capita by income source in four provinces is tabulated in Table III-11. The average annual income per capita is 9,665 Baht, 8,034 Baht, 7,898 Baht and 2,704 Baht in Kamphaeng Phet, Phitsanulok, Sukhothai, and Tak, respectively. The feature of the income breakdown by income source is summarized as below :

- The income from rice production and upland crop production occupies 80~90 percent of total income.

- The composition ratio of agricultural income during the dry season is extremely low as 0.7~3.7 percent of total income.

- The composition ratio of wage income during the dry season is extremely low as 1.5~2.8 percent of total income.

- The income from livestock, fishery, silk, and cottage industries is low.

The composition ratio of farm households that have the sufficient surplus of rice to be marketed after home consumption is 32 percent, 30 percent, 30 percent, and 22 percent, in Phitsanulok, Kamphaeng Phet, Sukhothai and Tak, respectively. The average daily wage earned by farmers is 35 Baht in Phitsanulok and Sukhothai , and 33 Baht in Kamphaeng Phet and Tak, which

are lower than the minimum wage prescribed by the Government. This wage rate may reflects the lack of job opportunities in backward villages.

III-5-2 Agricultural Input Materials

(1) Seeds

The Government is trying to improve the agricultural productivity by supplying high-yield varieties to farmers through the government seed centers. The ratio of farm households using high-yield varieties, representing the present situation of seed utilization, is 40 percent, 36 percent, 34 percent, and 11 percent in Sukhothai, Phitsanulok, Kamphaeng Phet, and Tak respectively. Except Tak, one-third of farm households are using high-yield varieties.

(2) Fertilizer and Chemicals

In the inventory, the ratio of farm households applying chemical fertilizers is available. The ratio is 50 percent, 39 percent, 31 percent, and 9 percent in Phitsanulok, Kamphaeng Phet, Sukhothai, and Tak, respectively. The ratio of farm households using agricultural chemicals is also available in the inventory. The ratio is 49 percent, 46 percent, 28 percent, and 12 percent in Kamphaeng Phet, Sukhothai, Phitsanulok, and Tak, respectively. Except for Phitsanulok, the agricultural chemical using ratio is higher than the chemical fertilizer applying ratio.

(3) Animal Labour

In the Lower North Thailand, the utilization of animal labour in land preparation is decreasing. The inventory shows this situation by the ratio of farm household using animal labour. The ratio is 28 percent, 11 percent,10 percent and five percent in Tak, Sukhothai, Phitsanulok and kamphaeng Phet respectively. The higher the income level is, the more animal labour is switched to agricultural machinery in land preparation works.

(4) Agricultural Machinery

The ratio of farm households with 2-wheel small tractors is 34 percent, 34 percent, 26 percent, and five percent in kamphaeng Phet, Sukhothai,

Phitsanulok, and Tak, respectively. The ratio of farm households using rental 2-wheel small tractors is 37 percent , 28 percent, 22 percent and 12 percent in Sukhothai Phitsanulok, Kamphaeng Phet, and Tak, respectively. In Tak, 2-wheel small tractor using ratio including rental is lowest as 17 percent.

The annual rental charge of 2-wheel small tractors paid by one farm household is 2,500 Baht, 1,811 Baht, 1,686 Baht, and 1,096 Baht in Sukhothai, Phitsanulok, Kamphaeng Phet, and Tak, respectively. The rental charge for tractors occupies a large part of farm household economy and it is a heavy burden to farmers.

III-5-3 Agricultural Output Products

(1) Paddy

The yield represents agricultural productivity on micro basis and the inventory reports the yield of main crops as follows:

- Paddy

The yield of paddy in the inventory is reported as the average yield of the rain season paddy and the dry season paddy. The yield of paddy is 2,498 kg/ha, 2,278 kg/ha, 2,204 kg/ha and 2,187 kg/ha in Kamphaeng Phet, Phitsanulok, Tak and Sukhothai respectively. These data coincide almost with data reported in the agricultural statistics.

- Upland Crops

The yield of main upland crops is tabulated below , and these data are almost same as data reported in the agricultural statistics.

YIELD OF MAIN UPLAND CROPS

-Unit : kg/ha-

Crop	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak
Maize	2,046	2,070	1,985	2,193
Soybean	1,128	1,204	1,049	1,309
Mungbean	595	1,055	731	686
Groundnuts	1,097	-	1,344	1,524
Cassava	11,700	-	14,400	-
Sugarcane	44,800	44,800	45,100	30,00

(2) Price

The selling prices of agricultural products as well as quality may represent the farmers' capability for price negotiation in markets. According to the inventory, the average selling prices of main crops are summarized. The result shows that the selling prices are lowest in Tak, and this might be mainly due to poor accessibility to markets.

PRICES OF MAIN CROPS

- Unit : Baht/kg -

Crop	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak
Paddy	3.4	3.5	3.2	2.8
Maize	5.6	5.7	5.0	4.0
Soybean	8.9	9.3	10.1	8.4
Mungbean	9.2	9.0	8.3	7.7
Groundnuts	8.0	-	-	7.9
Cassava	5.9	-	5.5	-
Sugarcane	3.9	4.2	4.2	4.1

TABLE III-1 CRITERIA OF BACKWARD VILLAGES / NESDB DATA

Indicator	Backward	Middle-Level	Progressive
I. Infrastructure			
1. Land right	None	Most official certificate	Most title deed
2. Electricity	None	A half or less than	More than half
3. Transportation to Amphoe	No cab run in rainy season	Not more than 15min.	Not more than10min.
4. Rice-mill and/sotre-shop	No or only one	2-3 places	More than 3 places
5. Roof of house (Galvanized)	less than 50%	50-70%	More than 70%
6. Use charcoal made of wood origin	Far from over 10 km	5-10km	Not over 5km
7. No. of household of income over 30,000Bahts	Less than 50%	50-70%	More than 70%
8. No. of cattle and buffalo rented	More than 30%	Not more than30%	No rent
9. Wage rate	Less than 32Bahts	32-39Bahts	More than 39 Bahts
10. Hired land household	More than 25%	10-25%	Less than 10%
II. Production			
1. Rice yield	Not more than 330 kg/rai	331~430kg/rai	More than 430 kg/rai
2. Upland crop yield (maize, mungbean)	Less than(380kg,100kg)	(380~450kg,100-120kg)	More than (450kg,120kg)
3. Cattles and buffaloes for sale	Less than 40%	40~80%	More than 80%
4. Migration for employment	More than 10%(no working)	More than 10%(working)	Less than 10%or no
5. Agricultural co-op or group	No co-op. or group	Member of co-op.or group	Member and credit
6. Source of agricultural credit	Merchants	BAAC or Bank	Credit of co-op.or group
7. Double season paddy or upland crop	Less than 20%	20-50%	More than 50%
III. Public Health			
1. Medical fund and boxes	None	Yes but no training	Yes with training
2. Public health services	Take more than one hour	A half an hour-one hour	a half an hour
3. Toilets in house	Less than 30%	30-60%	More than 60%
4. Disease of stomach, cholera, tuberculosis, malaria	Death	Disease	No disease
5. Treatment	Buying from drugstore	Health center or clinic	Medical fund or box
6. Baby weight more than 3,000g	Less than 30%	50-60%	More than 60%
7. Baby 5 years old	Level 2,3morethan 2%	Level 2,3 not over 2%	No mal-nutrition
8. Vaccine injection	Lower than 65%	65-90%	90-100%
9. Family planning	Lower than 60%	60-69%	70-100%
IV. Water Supply			
1. Drinking water cleaned or domestic	Less than 50%,70%	50~70% 70~90%	More than 70%,90%
2. Agricultural water in dry season	Unavailable	Use remain water	Use surface water
V. Education			
1. Education level(write and read)	Less than 50 % of 14-50years old	90~95%	More than 95%
2. Compulsory education	less than 30%	30~50%	More than 50%
3. Education time for a year	Less than 3 times	3~6times	More than 6times
4. High and primary school	Nothing	anyone	both
5. Library and notice board	Nothing	only village library	Public or school Library
6. Religion and sport	Less than 60% 2times	60-89% 2~5times	More than 90% 5times
Total 34 Items			

Source : NESDB, Sruvey of Fundamental Data of Village Levels

TABLE III-2 INVENTORY ON QUALITY OF LIFE

Item		NESDB Standard of Satisfication
Agriculture		
- Maintenance of soil fertility		More than 30%
- Fertilizer application		More than 50%
- Use of agricultural chemicals		More than 60%
- Vaccination for animals		More than 40%
- High yielding varieties		More than 60%
Drinking Water		
- Minimum water supply		More than 95%
Public Health		
- Malnutrition level of 0-5 years old children	Level 1	Less than 25%
	Level 2	Less than 2%
	Level 3	0%
- Malnutrition of 5-14 years old children		Less than 8%
- Newborns with birth weight of more than 3,000 g		More than 60%
- Houses with durability of more than 5 years		More than 80%
- Satisfication of home sanitary condition		More than 60%
- Toilet in house		More than 75%
- Vaccination for children under 1 year old		-
- Vaccination for children of 5-14 years old		More than 90%
- Vaccination for adult of 14-50 years old		More than 95%
- Pregnant women received assistance before children birth		More than 70%
- Pregnant women received assistance in children birth		More than 70%
- Family planning		More than 75%
Education		
- Completion of compulsory education		100%
- Availability of necessary information		More than 85%
- Participation in self-developing		100%
- Maintaing activities of rural culture		100%
Community		
- Security of life and properties		100%
- Organization of peoples' group		More than 50%
- Cooperation to reserve natural resources		100%
- Activities to maintain public properties		100%
- Participation in voting in election		More than 50%
- Activities of village committee		100%
- Cooperation of villagers		100%
- Religious activities once a month		More than 90%
- No gambling		More than 80%
- No smuggling		More than 90%

TABLE III-3 PRESENT DEVELOPMENT AND DEVELOPMENT PRIORITY ON AMPHOE BASE

(1) Phitsanulok Province

Amphoe	Income Indicator (฿/Person)	Rank	Quality of Life Indicator (%)	Rank	Average Rank	Priority	Nos. of Backward Villages
Muang	4,609	1	33.8	8	4.5	3	26
Chat Trakan	8,559	6	50.3	3	4.5	3	35
Nakhon Thai	4,642	2	52.9	1	1.5	1	33
Bang Krathum	6,212	3	32.4	9	6.0	6	11
Bang Rakam	11,417	8	45.6	5	6.5	8	24
Phrom Phiram	15,696	9	36.8	6	7.5	9	25
Wang Thong	7,845	5	35.9	7	6.0	6	52
Wat Bot	8,581	7	46.8	4	5.5	5	34
Noen Maprang	7,159	4	52.1	2	3.0	2	42

(2) Sukhothai Province

Amphoe	Income Indicator (฿/person)	Rank	Quality of Life Indicator (%)	Rank	Average RanK	Priority	Nos. of Backward Villages
Muang	6,936	4	50.3	2	3	2	27
Kong Krailat	6,913	3	41.8	8	5.5	6	31
Khiri Mat	9,013	6	45.9	4	5	4	52
Thung Saliam	4,532	1	43.5	7	4	3	6
Ban Dan Lon Hoi	4,557	2	51.2	1	1.5	1	25
Si Satchanalai	10,936	8	48.8	3	5.5	6	20
Si Samrong	10,337	7	45.0	6	6.5	8	29
Sawan Khalok	8,670	5	45.6	5	5	4	19
Si Nakhon	-		-				-

(3) Kamphaeng Phet Province

Amphoe	Income Indicator (฿/Person)	Rank	Quality of Life Indicator (%)	Rank	Average Rank	Priority	Nos. of Backward Villages
Muang	11,100	6	45.3	2	4	3	68
Khanuworalak Buri	9,562	3	35.9	5	4	3	62
Khlong Khlung	10,138	5	43.5	4	4.5	5	59
Phran Kratai	7,676	2	50.9	1	1.5	1	36
Sai Ngam	14,298	7	27.4	7	7	7	20
Khlong Lan	6,581	1	45.0	3	2	2	26
Lan Krabu	9,632	4	32.9	6	5	6	17

(4) Tak Province

Amphoe	Income Indicator (฿/Person)	Rank	Quality of Life Indicator (%)	Rank	Average Rank	Priority	Nos. of Backward Villages
Muang	2,723	5	39.7	7	6.0	7	35
Tha Song Yang	1,817	3	71.8	1	2	1	35
Ban Tak	2,899	6	47.1	5	5.5	5	50
Mae Ramat	1,384	1	56.2	3	2	1	9
Mae Sot	3,421	7	50.6	4	5.5	5	27
Sam Ngao	1,620	2	39.7	7	4.5	4	11
Umphang	2,561	4	65.9	2	3	3	19
Phop Phra	4,295	8	45.3	6	7	8	29

TABLE III-4 DISTRIBUTION OF VILLAGES BY INCOME RANGE

(1) Phitsanulok Province

Amphoe	Average Annual Income per Capita (Baht)											Total
	Below 1,000	1,001 ∫ 2,000	2,001 ∫ 3,000	3,001 ∫ 4,000	4,001 ∫ 5,000	5,001 ∫ 6,000	6,001 ∫ 7,000	7,001 ∫ 8,000	8,001 ∫ 9,000	9,001 ∫ 10,000	over 10,000	
Muang	1	2	2	5	5	5	2	3	1			26
Chat Trakan		2	7	2	5	2	2	1	4	1	9	35
Nakhon Thai		3	6	7	7	1	3	2	2		2	33
Bang Krathum				1	2	2	2	2	1		1	11
Bang Rakam				3	3	1	1	4	3	1	8	24
Phrom Phiram				2		2	6	4	6		5	25
Wang Thong		4	2	3	8	10	3	5	1	5	11	52
Wat Bot			4	3	8	1	2	1	3	2	10	34
Noen Maprang	1	1	2	3	2	5	4	8	1	2	13	42
Total	2	12	23	29	40	29	25	30	22	11	59	282

(2) Sukhothai Province

Amphoe	Average Annual Income per Capita (Baht)											Total
	Below 1,000	1,001 ∫ 2,000	2,001 ∫ 3,000	3,001 ∫ 4,000	4,001 ∫ 5,000	5,001 ∫ 6,000	6,001 ∫ 7,000	7,001 ∫ 8,000	8,001 ∫ 9,000	9,001 ∫ 10,000	over 10,000	
Muang			1	3	2	6	3	4	1	2	5	27
Kong Krailat			1	4	3	5	5	5	3	1	4	31
Khiri Mat		2	6	3	5	9	6	3	3	4	11	52
Thung Saliam			3	1		1					1	6
Ban Dan Lon Hoi		3	3	7	3	1	2	2	1	1	2	25
Si Satchanalai		1	1	1		2	1	2	2	2	8	20
Si Samrong				3	2	3	2	2	2	1	14	29
Sawan Khalok	1	1	1	1	1	1	1	1	3	2	6	19
Si Nakhon												
Total	1	7	16	23	16	28	20	19	15	13	51	209

(3) Kamphaeng Phet Province

Amphoe	Average Annual Income per Capita (Baht)											
	Below 1,000	1,001 - 2,000	2,001 - 3,000	3,001 - 4,000	4,001 - 5,000	5,001 - 6,000	6,001 - 7,000	7,001 - 8,000	8,001 - 9,000	9,001 - 10,000	over 10,000	Total
Muang	1	3	5	7	10	6	11	6	3	4	12	68
Khanuworalak Buri		1	1	6	5	4	9	5	5	5	21	62
Khlong Khlung		1	6	3	8	6	5	2	7	1	20	59
Phran Kratai		1		4	6	7	7	1		1	9	36
Sai Ngam				1		4	2	2	2		9	20
Khlong Lan		1	1	5	1	1	2	1	1	3	10	26
Lan Krabu					2		2	4	1	1	7	17
Total	1	7	13	26	32	28	38	21	19	15	88	288

(4) Tak Province

Amphoe	Average Annual Income per Capita (Baht)											
	Below 1,000	1,001 - 2,000	2,001 - 3,000	3,001 - 4,000	4,001 - 5,000	5,001 - 6,000	6,001 - 7,000	7,001 - 8,000	8,001 - 9,000	9,001 - 10,000	over 10,000	Total
Muang	6	6	9	4	3	2	4	1				35
Tha Song Yang	26	15	3	2		1		1			2	50
Ban Tak		7	1								1	9
Mae Ramat	18	4	3	1		1						27
Mae Sot	4	5	7	5	2	1	1		2	1	1	29
Sam Ngao	1	6	3	1								11
Umphang	10	12	7	2	1	1	1		1			35
Phop Phra		2	1	1		6	3		4		2	19
Total	65	57	34	16	6	12	9	2	7	1	6	215

TABLE III-5 CORRELATION BETWEEN AGRICULTURE SECTOR AND INCOME INDICATOR

(1) Agriculture Sector Indicator

Indicator	Code	Description	Unit
Price of Paddy	A-1	Average of rainy season and dry season	฿ / kg
Yield of Paddy	A-2	Average of rainy season and dry season	kg / rai
Surface Water (1)	A-3	Ratio of villages in use of surface water	%
Surface Water (2)	A-4	Nos. of surface water per village	
Dry Season Farming (1)	A-5	Ratio of dry season farming villages	%
Dry Season Farming (2)	A-6	Ratio of villages in use of surface water	%
Dry Season Farming (3)	A-7	Ratio of dry season farm households	%
Dry Season Farming (4)	A-8	Ratio of income from dry season farming	%

(2) Value by Indicator

Province	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8
Phitsanulok	3.4	364.5	90.8	1.3	19.1	13.8	3.9	0.7
Sukhothai	3.5	349.9	88.5	1.3	27.3	19.6	10.9	2.4
Kamphaeng Phet	3.2	399.7	82.3	1.1	24.7	19.4	7.0	2.0
Tak	2.8	352.7	99.1	1.3	20.9	19.5	5.7	3.7

(3) Rank by Indicator

Province	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	Rank
Phitsanulok	2	2	2	1	4	4	4	4	4
Sukhothai	1	4	3	1	1	1	1	2	1
Kamphaeng Phet	3	1	4	4	2	3	2	3	3
Tak	4	3	1	1	3	2	3	1	2

TABLE III-6 CORRELATION BETWEEN RURAL INFRASTRUCTURE AND INCOME INDICATOR

(1) Rural Infrastructure Indicator

Indicator	Code	Description	Unit
Electricity	S-1	Ratio of households with electricity	%
Road (1)	S-2	Ratio of paved Amphoe roads	%
Road (2)	S-3	Ratio of paved market roads	%
Transportation (1)	S-4	Nos. of pickup car per 1,000 persons	vehicle
Transportation (2)	S-5	Nos. of farmtruck per 1,000 persons	vehicle
House	S-6	Ratio of households with toilet	%
Shop	S-7	Nos. of shops per 1,000 persons	shop
Meeting hall (1)	S-8	Ratio of villages with village hall	%
Meeting hall (2)	S-9	Ratio of villages with Tambon hall	%

(2) Value by Indicator

Province	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9
Phitsanulok	52.0	94.3	93.0	4.2	11.0	60.5	7.9	24.8	83.7
Sukhothai	33.4	95.5	95.0	3.1	18.1	62.7	6.1	14.4	56.6
Kamphaeng Phet	38.2	94.7	91.6	4.4	19.0	48.5	6.7	24.3	69.1
Tak	20.1	62.3	55.8	3.8	3.2	23.5	4.9	22.8	48.4

(3) Rank by Indicator

Province	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9
Phitsanulok	4	2	3	3	2	3	4	4	4
Sukhothai	2	4	4	1	3	4	2	1	2
Kamphaeng Phet	3	3	2	4	4	2	3	3	3
Tak	1	1	1	2	1	1	1	2	1

TABLE III-7 CORRELATION BETWEEN AGRICULTURE SUPPORTING INFRASTRUCTURE AND INCOME INDICATOR

(1) Agriculture Supporting Infrastructure Indicator

Indicator	Code	Description	Unit
Storage Facilities	S-10	Ratio of villages with storage facilities	%
Rice Mill	S-11	Nos.of rice mills per 1,000 farm households	place
Finance(1)	S-12	Ratio of villages using BAAC	%
Finance(2)	S-13	Ratio of villages with rice bank	%
Finance(3)	S-14	Ratio of villages with cattle bank	%
Market(1)	S-15	Ratio of villages with product selling market	%
Market(2)	S-16	Ratio of villages with farm material market	%
Cooperatives	S-17	Ratio of member of cooperation	%

(2) Value by Indicator

Province	S-10	S-11	S-12	S-13	S-14	S-15	S-16	S-17
Phitsanulok	4.3	3.0	71.6	21.6	19.1	5.3	1.6	0.8
Sukhothai	2.4	3.0	89.5	25.8	16.7	4.4	1.8	2.6
Kamphaeng Phet	5.3	3.9	88.2	26.9	17.7	5.6	2.8	2.3
Tak	1.9	2.3	17.2	14.4	15.8	3.3	1.4	0.6

(3) Rank by Indicator

Province	S-10	S-11	S-12	S-13	S-14	S-15	S-16	S-17
Phitsanulok	3	2	2	2	4	3	2	2
Sukhothai	2	2	4	3	2	2	3	4
Kamphaeng Phet	4	4	3	4	3	4	4	3
Tak	1	1	1	1	1	1	1	1

TABLE III-8 CORRELATION BETWEEN PUBLIC HEALTH SECTOR AND QUALITY OF LIFE INDICATOR

(1) Public Health Indicator

Indicator	Code	Description	Unit
Hospital(1)	P-1	Ration of villages with Tambon hospital	%
Hospital(2)	P-2	Ration of villages with child nutrition center	%
Nutrition(1)	P-3	Malnutrition ration of 1-5 years old children	%
Nutrition(2)	P-4	Ratio of nutrition survey services for 1-5 years old children	%
New born(1)	P-5	Death ration of new born babies	%
New born(2)	P-6	Ration of new born babies with birth weight of less than 3,000g	%
Family Planning	P-7	Ratio of family planning	%
Pregnancy(1)	P-8	Ration of qualified persons' assistance at birth	%
Pregnancy(2)	P-9	Death ratio of pregnant women at birth	%
Disease(1)	P-10	Children disease cases per 1,000 children	%
Disease(2)	P-11	Adult disease case per 1,000 adults	%
Vaccination(1)	P-12	Ration of pregnant women receiving vaccination	%
Vaccination(2)	P-13	Ration of 0-1 years old children receiving vaccination	%
Vaccination(3)	P-14	Ration of 5-14 years old children receiving vaccination	%

(2) Value by Indicator

	Data				Rank			
Indicator	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak
P-1	5.3	3.8	8.3	4.7	3	1	4	2
P-2	90.8	89.0	84.7	97.2	3	2	1	4
P-3	24.2	17.4	16.4	28.2	2	3	4	1
P-4	83.7	85.4	93.6	64.6	2	3	4	1
P-5	0.7	1.0	2.0	3.6	4	3	2	1
P-6	45.3	48.2	36.4	53.7	3	2	4	1
P-7	74.6	78.5	66.4	43.7	3	4	2	1
P-8	76.8	83.7	71.5	50.0	3	4	2	1
P-9	0.0	0.6	0.4	0.3	4	1	2	3
P-10	383.9	245.2	262.7	427.0	2	4	3	1
P-11	105.5	48.7	61.6	176.1	2	4	3	1
P-12	81.5	85.3	73.4	53.7	3	4	2	1
P-13	88.4	86.3	81.7	63.0	4	3	2	1
P-14	95.6	96.9	89.3	58.1	3	4	2	1
Overall Rank					3	4	2	1

TABLE III-9 CORRELATION BETWEEN RURAL ROAD SUB-SECTOR AND QUALITY OF LIFE INDICATOR

(1) Rural Road Sub-sector Indicator

Indicator	Code	Description	Unit
Amphoe Road (1)	R-1	Ratio of villages without access-to-Amphoe road	%
Amphoe Road (2)	R-2	Ratio of non-paved access-to-Amphoe road	%
Amphoe Road (3)	R-3	Ratio of villages with access-to-Amphoe road impassable in rainy season	%
Market Road (1)	R-4	Ratio of villages without access-to-market road	%
Market Road (2)	R-5	Ratio of non-paved access-to-maket road	%
Market Road (3)	R-6	Ratio of villages with access-to-market road impassable in rainy season	%

(2) Value by Indicator

Province	R-1	R-2	R-3	R-4	R-5	R-6
Phitsanulok	1.8	5.7	23.0	1.4	7.0	19.1
Sukhothai	2.0	4.5	43.1	2.4	5.0	36.8
Kamphaeng Phet	0.7	5.3	20.8	1.0	8.4	23.6
Tak	30.2	37.7	53.9	38.1	44.2	55.3

(3) Rank by Indicator

Province	R-1	R-2	R-3	R-4	R-5	R-6	Rank
Phitsanulok	3	2	3	3	3	4	3
Sukhothai	2	4	2	2	4	2	2
Kamphaeng Phet	4	3	4	4	2	3	4
Tak	1	1	1	1	1	1	1

TABLE III-10 CORRELATION BETWEEN RURAL WATER SUPPLY SUB-SECTOR AND QUALITY OF LIFE INDICATOR

(1) Rural Water Supply Sub-sector Indicator

Indicator	Description	Code	Unit
Well(1)	Nos.of shallow wells per 1,000 persons	W-1	Place
Well(2)	Nos. of deep wells per 1,000 persons	W-2	Place
Pipeline(1)	Ratio of villages with pipeline system	W-3	%
Pipeline(2)	Ratio of households with pipeline system	W-4	%
Drinking Water	Satisfactory ratio of drinking water	W-5	%
Domestic Water	Satisfactory ratio of domestic water	W-6	%

(2) Value by Indicator

Province	W-1	W-2	W-3	W-4	W-5	W-6
Phitsanulok	30.4	18.8	17.0	11.4	62.1	62.1
Sukhothai	23.0	12.3	8.1	2.7	66.5	66.0
Kamphaeng Phet	34.7	16.2	3.5	1.2	49.1	56.5
Tak	10.1	2.5	20.5	13.7	71.3	72.1

(3) Rank by Indicator

Province	R-1	R-2	R-3	R-4	R-5	R-6	Rank
Phitsanulok	3	4	3	3	2	2	3
Sukhothai	2	2	2	2	3	3	2
Kamphaeng Phet	4	3	1	1	1	1	1
Tak	1	1	4	4	4	4	4

TABLE III-11 ANNUAL INCOME BY SOURCE OF AVERAGE FARM HOUSEHOLD

- Unit : Baht / Person -

Income Source	Phitsanulok		Sukhotai		Kamphaeng Phet		Tak	
	Income	(%)	Income	(%)	Income	(%)	Income	(%)
Wage	217	2.7	118	1.5	232	2.4	76	2.8
Paddy	3,238	40.3	3,704	46.9	4,610	47.7	722	26.7
Upland Crop	4,170	51.9	3,254	41.2	4,378	45.3	1,579	58.4
Orchard	16	0.2	71	0.9	10	0.1	8	0.3
Vegetable	16	0.2	0	0.0	0	0.0	27	1.0
Flower	0	0.0	0	0.0	0	0.0	0	0.0
Dry Season Farming	56	0.7	190	2.4	193	2.0	100	3.7
Livestock	313	3.9	466	5.9	203	2.1	157	5.8
Fisheries	0	0.0	39	0.5	0	0.0	8	0.3
Sericulture	0	0.0	8	0.1	0	0.0	0	0.0
Cottage Industry	0	0.0	39	0.5	10	0.1	19	0.7
Others	8	0.1	9	0.1	29	0.3	8	0.3
Total	8,034	100.0	7,898	100.0	9,665	100.0	2,704	100.0

CHAPTER IV DEVELOPMENT PROPOSAL

CHAPTER IV DEVELOPMENT PROPOSAL

IV-1 OBJECTIVES OF INTEGRATED RURAL DEVELOPMENT

The Government of Thailand is advancing the rural development projects, as one of the most important policies, to improve the quality of life for socially and economically deprived rural people, to promote self-reliance and to increase adaptability to economic and environmental conditions. Development activities are oriented towards solving the socio-economic problems of each area according to the actual conditions and needs of the people.

The social and economical problems, which confront the people of 994 backward villages, have been revealed by the analysis of the NESDB data base survey. Based on the outcome of the analysis, the problems to be solved for the development of the backward villages have been identified as: ① low agricultural productivity leading to inadequate income, ② shortage of water to meet the people's basic needs, ③ inconvenient road systems covering villages with Amphoe and markets, ④ poor health and sanitation, and ⑤ lack of knowledge of developing the quality of life and income increase.

Economic depression may be the basic cause of disease, poor health and the lack of knowledge and education. For stimulating economic growth, in addition to investment in agricultural development, the provision of infrastructure-roads, water, electricity, schools, and so forth on which farm productivity and the quality of life depend should be made. From this point of view, the development objectives of the Integrated Rural Development at the Lower North Thailand have been set forth as follows:

① To increase the income level of the people in the backward villages through the improvement of agricultural productivity and production, the major economic activity in the areas, and

② To improve the access of the peoples in the backward villages to social infrastructures and public services.

IV-2 AGRICULTURAL DEVELOPMENT

IV-2-1 Basic Approach

The increase in agricultural production so far attained in the study area is mainly attributed to farm land expansion. There is little scope for the supply of unused arable land as forest is to be reserved. Cropping is being practiced in the backward areas without irrigation, hece they are relying on rainfall that fluctuates seasonally and yearly.

Under such circumstances, agricultural development for the project emphasizes the improvement of agricultural production on the existing farm land with the aim of achieving self-sufficiency in food production particularly rice, an important staple food, and then shifting to commercial agriculture in order to increase farm income and job opportunities. Agricultural development involves development of irrigation and production support such as extension services, supply of input (i.e., seeds, fertilizers, etc., institutional credit, and so on.) Irrigation development shall be promoted as much as possible where physical conditions allow to develop water resources. Guidelines for agricultural development are summarized as follows: ① improvement of paddy cropping system, ② crop diversification, ③ improvement of rainfed agriculture, and ④ introduction of mixed farming.

IV-2-2 Paddy and Upland Crop Farming

(1) Paddy

For the improvement of paddy cropping, high yielding varieties as recommended by DOAE shall be used with the application of fertilizers and chemicals. The growing period shorter than the local varieties can afford the distribution of farm labor force and selection of second crops. The Phitsanulok rice research institution recommends RD21, RD23, PSL60-1, Khao Dok Mali 105, having a growing period of 120 days.

For irrigable paddy fields, consideration is given to the selection of varieties so as to meet the market demand, and to enhance additional value. Short season crops will follow rainy season paddy cropping in use of residual

soil moisture in paddy fields, for which soybean and mungbean are recommended for increasing soil fertility.

(2) Upland Crop

With irrigation development, crop diversification with a high crop intensity will be promoted. In consideration of present farming practice and market systems, maize, soybean, mungbean and sugarcane are proposed as major upland crops. Attractive prices and marketing opportunity will determine the selection of crop diversification. Oil seed crops such as soybean, groundnut, sesame, and cotton, maize for livestock, vegetables and sugarcane are at present in high demand.

The intensive cropping of vegetables are proposed to increase cash income at upland crop fields located around villages, where irrigation is developed, for local markets, and then to shifting to commercial agriculture. Contract farming of asparagus and baby corn, and vegetables including water melon, green peas, long bean, chili and garlic are recommendable.

IV-2-3 Fruit and Tree Crops

Fruit and tree crops suitable for the study area include mangos, tamarinds,, bananas of Khloh Khwai species and bamboo shoots, which are much in demand for domestic consumption, agri-industries and export. The improvement and reclamation of orchard needs relatively high investment and several years before orchard has gained profit: for example seven years for mango and five years for bamboo shoots.

Trees are tolerable for drought to some extent; however, shortage of soil moisture during stages of flowering and fruiting, yields and quality of mango are lowered. And, supplemental irrigation water supplies in the early rainy season is effective for bamboo shoots growing since it is the stage of germination.

Bamboo shoots, either fresh or canned, are able to sale in every local market as it is a popular food. Exported products are canned and dried bamboo shoots for foreign markets including Japan, USA, Hong Kong, Singapore and EC. The stalk of bamboo can be processed to make paper pulp. In the areas far

away from a pulp processing plant, the stalk has other uses: making furniture, household utensils, scaffold for construction works and raft. Other marketable parts of bamboo are twig for supporting rod for use of stringbean growing, branch with node for propagation, leaf for wrapping some kinds of dessert and bud and root for medicine.

IV-2-4 Sericulture

In Thailand there are two kinds of sericulture farming. The one is a traditional sericulture which use polyvoltine silkworm eggs, make warp and weft with hand spun silk yarn and weave. The other is a modern sericulture which use bivoltine silk worm eggs of two times hatching only in a year in natural condition. The former traditional sericulture has a merit to create employment opportunity of spinning, weaving and so on by rural woman labor force. In 1990, the Tak sericulture center was established aiming at extension of a modern sericulture in the North Thailand.

ARD is promoting sericulture projects on the village base through organizing silkworm rearing groups. A typical group consists of 20 farmers interesting in silkworm rearing activity. Each farmer has 3.5 rai (or 0.56 ha) of his own mulberry fields and the group provides a cooperative rearing house for young silkworms and 30 rai (or, 4.8 ha) of mulberry fields for group use to be located around the cooperative rearing house. The silk worm rearing group is divided into two sub-groups of young age (1 - 3, or 1 - 2 years) silkworm rearing group and grown silkworm (4 - 5, or 3 - 5 years) rearing group. The former group is composed of two to three farmers to rear young age silkworms for sale to the later group which rears grown silkworms to sale cocoon to silk reeling factories. The target income of one silkworm rearing group is 12,000 Baht a year. To this end, with irrigation of mulberry farm, it is proposed to attain yields of 48 kg/rai (or, 300 kg/ha) by six times of rearing per year.

IV-2-5 Livestock

Cattle in the study area are raised generally at natural grasslands with extensive pasturing farming, resulting in low capacities of carrying and breeding. Cattle raising is based on wild grass during the rainy season and standing hay after reaping paddy or new shoots germinated from paddy stumps during the dry season. Soils of natural grass land mixed with shrub are not

suited for crop growing. As cattle slightly increase weight a year, repeating their weight increase during the rainy season and decrease during the dry season every year, it takes five to seven years to sell them to animal markets.

There can be seen potential pasture lands around forest along rivers. With the improvement of pasture lands and bathing places, as well as provision of supplemental feed during the dry season, the carrying capacity of grass land is estimated to be 2.5 heads per ha (or 0.4 ha for head). It takes five years to sell cattle with a weight of 600 kg, assuming that annual increase in weight is 60 kg. The selling price of 50,000 Baht could be expected at the current market price. In order to get average annual income of 10,000 Baht, one farmer needs to raise at least one head of cattle and 2.5 rai (or, 0.4 ha) of improved pasture.

IV-2-6 Inland Fisheries

In the Lower North Thailand, so called flood fisheries were ever extensively practiced with abundant flood water from big rivers running through the area; however, inland fisheries are on the decline because of sedimentation of swamps and decrease in high floods from such rivers after the completion of large scale water resources development projects. Under the situation, the Department of Fisheries (DOF) is implementing the village fish pond project, the small swamp inland fisheries project (SSIFP) and the large swamp inland fisheries project to raise the annual fish protein consumption level to 20 kg per capita.

In the study area, there are many small swamps possible to be developed for inland fisheries. The average water surface area of swamps is assumed to be 11.2 ha for Phitsanulok province, 16.9 ha for Sukhothai province, 18.3 ha for Kamphaeng Phet province and 6.1 ha for Tak province, basing on the study report of DOF for SSIFP. Swamps will be rehabilitated with the construction of dikes, spillways and outlet works so as to maintain water surface area with a moderate water depth for fisheries.

The present capture fisheries are to be shifted to semi intensive fisheries by stocking of fry and fertilization. The fishery stations release fry for farmers. Main fish species are Tilapia Nil, Thai carp, Indian carp and Grass carp. The target yields are estimated at 1,500 kg/ha for small swamp inland

fisheries. For management of proposed small swamps for fishery use, farmers' groups will be organized.

IV-2-7 Regional Agricultural Development

As far as agricultural development is concerned, the study area is divided into the following four regions, in consideration of present land use and topographic conditions: ① low-lying area along the rivers of Nan, Yom and Ping, ② central plain area, ③ upland area in highland, and ④ Thai-Myanmer border area. The guidelines on agricultural development of the regions are based the topographic maps with a scale of 1 : 50,000, reconnaissance field survey and agricultural statics and data on soils, farming practice, marketing and so on, thus, the guidelines as given below are to be supplemented by detailed survey and investigation prior to the implementation of projects.

① Low-lying Area along the Rivers of Nan, Yom and Ping

Muang Phitsanulok	:	Paddy, vegetables, fisheries
Bang Rakam	:	Paddy, fisheries
Bang Krathum	:	Paddy, fisheries
Phrom Phiram	:	Paddy, fisheries
Muang Sukhothai	:	Paddy, vegetables, fisheries
Kong Krailat	:	Paddy, vegetables, fisheries
Si Samrong	:	Paddy, soybean
Phran Kratai	:	Paddy, soybean, sericulture, livestock
Khlong Khlung	:	Paddy, sugarcane, sericulture, livestock
Lan Krabu	:	Paddy, sugarcane, sericulture

② Central Plain Area

Wang Thong	:	Paddy, maize, mungbean, sericulture
Noen Maprang	:	Paddy, maize, mungbean, sericulture
Wat Bot	:	Paddy, mungbean, fisheries
Khri Mat	:	Paddy, soybean, sericulture, fisheries
Thuling Saliam	:	Paddy, soybean, mungbean, livestock, tree crops
Ban Dan Lan Hoi	:	Paddy, boybean, mungbean, livestock, sericulture, bamboo shoots
Muang Kamphaeng Phet	:	Paddy, vegetables, sugarcane, sericulture

Khanuworak Buri	:	Paddy, sugarcane, bamboo shoots, sericulture
Sai Ngam	:	Paddy, sugarcane, livestock
Muang Tak	:	Paddy, vegetables, mungbean, sericulture, livestock
Ban Tak	:	Paddy, mungbean, livestock
Sam Ngao	:	Paddy, mungbean, livestock

③ Central Plain Area

Nakhon Thai	:	Paddy, soybean, bamboo shoots, sericulture, livestock
Chat Trakan	:	Paddy, mungbean, bamboo shoots, livestock
Si Satchanalai	:	Paddy, soybean, bamboo shoots, tree crops
Sawan Khalok	:	Paddy, soybean
Khlong Lan	:	Paddy, soybean, mungbean, sericulture, livestock
Tha Song Yang	:	Paddy, soybean, bamboo shoots
Phop Phra	:	Paddy, soybean, bamboo shoots
Umphang	:	Paddy, soybean

④ Thai-Myanmar Border Area

Mae Sot	:	Paddy, maize, vegetable, fisheries
Mae Ramat	:	Paddy, soybean, maize, bamboo shoots, fisheries

IV-3 IRRIGATION DEVELOPMENT

IV-3-1 Basic Approach

The annual rainfall is 1,000 to 1,300 mm on the average of the study area except the west Tak and the eastern mountains of Phitsanulok. 90 percent of annual rainfall concentrate in six months of the rainy season, or 50 percent in three months of the rainy season. The river-flow rapidly drains as rainfall concentrates within a short season. Most of farm lands in the backward areas are lacking in irrigation facilities and agriculture relies on rainfall that fluctuate seasonally and yearly.

For the improvement of income level of people in the backward villages, the development of agriculture, main economic activity in the area, should be promoted through increase in agricultural productivity in the rainy season and introduction of dry season farming with the implementation of irrigation development projects. Water resources development for irrigation use requires some form of artificial storage and regulation of free-flowing water resources. The run-of-river scheme to ddraw free-flowing needs larger catchment area than storage scheme so as to divert water into farm lands during low flow periods.

For the development of relatively limited water resources for irrigation use in the backward areas, first priority will be given to the storage scheme, as the most effective way of water resources development. Second priority will be given to irrigation projects of the run-of-river scheme in areas where there is no possibility to construct a storage project, though the projects do not secure the year round irrigation water supply.

IV-3-2 Irrigation

Basing on proposed cropping calendars, evaporation records observed at Phitsanulok meteorological station and crop factors, crop water consumption is estimated. In addition to this, the following additional water is needed for successful crop growing:

For paddy, water for deep percolation, nursery beds and land preparation is required. The deep percolation through paddy fields is estimated at two mm/day on an average throughout the irrigation period. Nursery beds will be prepared 30 days prior to transplantation of paddy to main fields. The water requirement for nursery beds includes those for land soaking, maintaing standing water and supplying evaporation and percolation losses. It is assumed that 400 mm of water is required during the entire nursery period covering the nursery bed area equivalent to four percent of transplanting area for storage scheme and 1/15 for run-of-river scheme. 200 mm of water is needed for land preparation: 150 mm for land saturation and ploughing at the initial stage and additional 50 mm to provide standing water at the final stage.

For upland crop fields, pre-irrigation is required for dry season field crop growing during the period of land preparation for sowing in order to

replenish the end-of-season water depletion. The pre-irrigation water requirement is estimated at 60 mm for the total area of dry season field crop cultivation. Percolation through fields are regarded as irrigation losses.

Not all of the rainfall covering the irrigation area is effective. The amount of rainfall that can be considered effective will depend upon many factors such as rainfall intensity, field storage capacity, water requirement, irrigation method, etc. The average rainfall in Sukhothai province is used as the representative for all the project area and 75 percent of the monthly rainfall is taken as effective rainfall.

Rainy season paddy cropping with a growing period of 105 days needs 840 mm of water, of which 562 mm may be supplied by rainfall, and thus 280 mm of water is to be supplemented by irrigation. Peak water requirements occur in July and August, during the period of land preparation. Water to be released form water source facilities is determined in consideration of losses at farm operation and conveyance systems.

IV-3-3 Water Resources

Distribution of rainfall and river runoff is variable by zone in the study area. So the hydrological analysis has been carried out dividing the study area into five zones; ① Phitsanulok, ② Sukhothai, ③ Kamphaeng Phet, ④ Eastern Tak, and ⑤ Western Tak. Division of these zones were made considering local characteristics of topographic and meteorological conditions. Monthly runoff pattern and probable unit runoff for respective zone were calculated based on annual river runoff data. Five to six ℓ/s/sq.km may be available in western Tak and Sukhothai, and almost 10 ℓ/s/sq.km in other zones, through the year on the average.

The annual inflow to a reservoirs is estimated at 340,000 cu.m/sq.km as the average runoff of the rivers with catchment area less than 1,000 sq.km in four provinces. As 20 percent of the inflow to the reservoir will be lost by evaporation from the reservoir water surface and deep percolation through the foundation and the dambody, 272,000 cu.m/sq.km per year will be potentially available water. If the storage capacity of a reservoir is large enough to regulate all the inflow to the reservoir, the potentially available water will be fully utilized for irrigation. For the sake of simplicity in the study of the overall

plan, the available water is estimated on the assumption that 100 percent of the inflow up to the reservoir storage capacity and 50 percent of inflow exceeding the capacity is utilized for irrigation.

Water to be utilized for irrigation of paddy with run-of-river scheme is runoff during growing period of 90 days from July to September. Considerable fluctuations of runoff discharge have been observed and all runoff discharge cannot be diverted to irrigation canals during these periods. Available water by diversion weir is estimated at 84,000 cu.m/sq.km as 60 percent of the total runoff discharge of 140,000 cu.m/sq.km.

IV-4 SOCIAL INFRASTRUCTURE DEVELOPMENT

IV-4-1 Rural Road Development

(1) Basic Approach

The present conditions of rural roads are available in the NESDB data base, in which rural roads are classified into two in view of their functions: Amphoe roads to connect backward villages with Amphoe, access to public services, and market roads to connect backward villages with market for agricultural product. According to this, rural roads in three provinces exclusive of Tak province are well developed so that only around 10 percent of backward villages have no access to Amphoe and markets, while in Tak province about 30 percent of backward villages are equipped with Amphoe roads and 44 percent backward villages with market roads. Though rural roads in three provinces are well developed, the problem to be pointed out is that many roads are impassable during the rainy season because of poor maintenance of roads and in som case malfunction of drainage facilities. Amphoe roads and market roads are impassable during the rainy season for 30 to 40 percent backward villages in the three provinces.

This project will provide the ARD standard road networks as rural trunkroads to connect isolated Tambon with market centers, towns and government facilities and services, and service road networks to connect the backward villages with existing all-weather roads or proposed ARD road networks, as well the improvement of existing roads. Provision of rural roads

will enable farmers to go to markets, and visits to the villages by traders, middlemen and service officials will be increased. As a result of the construction of rural roads, electrification will be easily promoted.

(2) Proposed Road

Roads constructed in the study area may be classified into ① national highway, ② provincial highway, ③ rural trunkroad, ④ service road, and ⑤ farm road. National and provincial highways are under the responsibilities of the Department of Highways. Rural trunkroads are constructed to connect sub-district (Tambon) and districts (Amphoe) to the network of primary highways. Other government agencies than the Department of Highways are involved in the construction and maintenance of the rural trunkroads, of which ARD is the leading agency. Service roads are constructed to connect villages to rural truankroads and/or national and provincial roads. Most of roads connecting with backward villages in the study area are classified as service roads with a width of about 2 m.

In this development plan, the construction and improvement of rural trunkroads and service roads, which is under the responsibility of ARD, are proposed. The construction of farm roads will be planned for the respective irrigation development projects where necessity arises. In addition to roads under construction/planned by ARD, new construction of rural trunkroads is proposed by the study team. Rural trunkroads will be of the ARD standard road with a width of six m and laterite pavement, and service roads of the ARD type I road with a width of three m and laterite pavement, or type II road with a width of four m and laterite pavement. Village sections of both new construction roads and existing roads will be paved with I concrete blocks.

IV-4-2 Rural Water Supply Development

In the most backward villages, rain water stocked in rain jars is used for drinking, while some backward villages have installed elevated tanks for use of river streams, or shallow wells; however, these villages face the problems of unsteady quantity and poor water quality, especially in the dry season.

The goal of rural domestic water supply toward which government's effort is directed is to upgrade service levels to level three as specified by

NESDB that at least 70 percent of households in a village enjoy fresh drinking water throughout the year in terms of both quantity of two ℓ/person/day and quality. Out of total 32 Amphoe in the study area, 19 Amphoe are not satisfied with drinking water. The project proposes to provide deep wells in the backward villages where groundwater with a yield of more than 20 gpm is available, in order to supply water for drinking and daily use at the ARD rate of 60 ℓ/person/day.

Deep wells will be provided for backward villages, but no distribution system. Groundwater, which requires no treatment, is preferable to surface water as a low-cost technology to rural development.

IV-4-3 Rural Electrification Development

According the NESDB data base on rural electrification, the number of Amphoe where more than 50 percent of households are not electrified is three in Phitsanulok province, seven in Kamphaeng Phet province, seven in Sukhothai province and eight in Tak province, totaling 25 Amphoe. The average distance between the nearest electrified village and the village without electrification is one to two km for three provinces except Tak province where the distance is two to 51 km.

As rural electrification is a basic minimum need and plays an important role in the improvement of agricultural production and quality of life, the project proposes to promote the rural electrification development to raise the electrification ratio to more than 50 percent for all backward villages. With the implementation of rural road development projects, rural electrification works will be accelerated.

The rural electrification works are implemented by the provincial electricity authority concerned. When villagers are to use electricity for domestic purposes, the villagers shall share 30 percent of the construction cost excluding connection lines and meters, for which the villagers may offer their services. The cost for connecting lines and meters are paid by the villagers. One of the reasons for low electrification ratio of Tak province may be high investment costs of long transmission lines, thus leading to a burden to people in the backward villages.

IV-5 RURAL INFRASTRUCTURE

IV-5-1 Rural Infrastructure Development Programme

In the integrated rural development, in addition to the agriculture and social infrastructure development such as irrigation facilities, roads, and water supplies, the arrangement of rural infrastructure plays an important role for the purpose of agricultural extension, enhancement of value addition to agricultural products, and creation of employment opportunities. In this view, ARD is promoting the arrangement of rural infrastructure under the programme of rural youth and agricultural technology training, employment promotion and income increase, and agri-business promotion.

In this integrated rural development project at the Lower North Thailand, the rural infrastructure development programme shall be formulated, taken into account the actual situation of the project areas which can be grasped on the inventory and field survey.

IV-5-2 Rural Youth and Agricultural Technology Training

In order to improve the agricultural productivity by shifting traditional agriculture to modern agriculture, it is essential for farmers:

- to adopt high-yield varieties
- to rearrange farming works such as preparation, seeding, and herbicide
- to apply effective fertilizers and chemicals
- to manage irrigation water
- to use agricultural machinery

The Department of Agricultural Extension is responsible for these agricultural technology extension to farmers. However, since one extension officer has to cover 1,100 - 1,400 farm households on the average under the present extension system, their extension services are not satisfactory.

In this integrated rural development project, the agricultural extension will be performed for the selected young farmers as well as female farmers in the project areas. The obtained agricultural technique shall be

transferred to other regional farmers, thereby improving the agricultural technique of all farmers shortly and efficiently together with extension services by the Department of Agricultural Extension. In addition to agricultural extension, the technical training for cottage industries, fishery, sericulture, and livestock raising, participation in the planning of integrated rural development, operation and maintenance of project, and job training for rural youth and women shall be carried out.

According to the NESDB inventory, the average training man-day enjoyed by farmers in backward villages is less than 1 man-day per annum, which is much lower than six man-days per annum of NESDB standard for progressive villages. The composition ratio of villages with village meeting hall is only 25 percent, 14 percent, 24 percent, 23 percent and 22 percent in Phisamulok, Sukhothai, Kamphong Phet, Tak, and average of four provinces, respectively.

The integrated rural development project proposes to establish the multi purpose training center with meeting hall, training room, library and office for the purpose of rural youth and agricultural technology training. When the training for rural youth and agricultural technique is not performed, these facilities shall be used for meeting among villagers and demonstration of agricultural products and cottage industries products. One multi purpose training facility shall be projected at the center of an Amphoe or at the center of an integrated rural development project area.

IV-5-3 Employment Promotion and Income Enhancement

The purpose of employment promotion and income enhancement programme is to absorb the surplus of labor in dry season, to create the job opportunities for practical use of abilities of women, and to increase the cash income by improving the value of agricultural products.

According to the NESDB data, the main cottage industries in four provinces include silk weaving, food processing, bamboo art craft, silk weaving, ceramic processing, and Jewelry polishing. In 1988, the total production value in four provinces is 9,420 thousand Baht, and this amounts to 2,562 Baht for an average farmer engaged in cottage industry. The ratio of households engaged in cottage industry is 4.5 percent, 3.8 percent, 3.2 percent and 1.4 percent in

Tak province, Sukhothai province, Kamphaeng Phet, and Phisanulok, respectively, and the composition ratio of the income from cottage industries in all income is only 0.65 percent in four provinces.

The improvement of productivity through joint works and the stabilization of price through joint marketing shall be made, thereby improving the cottage industries. The kinds of the cottage industries to be promoted shall be selected considering market size, procurement of materials, extension of technique.

According to the NESDB data, the sales of cottage industries of Thailand in 1988 was 11.87 billion Bath of jewelry polishing, 3.81 billion Baht of leather production, 1.79 billion Baht of furniture production, 1.55 billion Baht of silk weaving, and 0.52 billion Baht of bamboo art craft, respectively. Among them, in bamboo processing and silk weaving, the procurement of raw materials such as bamboo and cocoon is relatively easy, and the processing technique for bamboo and cocoon is also prevailing. Bangkok is one of the most important central markets for jewelry in the Asian countries. The jewelry traders in Bangkok are buying original stones from Srilanka, Myanmar, and India, and are utilizing farmer's labour force for jewelry polishing. In Sukhothai province, there are some cases of the jewelry polishing cottage industry operated by jewelry traders.

Taking into account the accessibility to raw materials and skills, the cottage industries to be promoted are silk weaving, bamboo hand craft, and jewelry polishing. These products will be marketed basically through local traders. In addition to this local channel, however, bamboo and silk products will be jointly marketed through the Government-assisted Narayana handy-craft products center, and jewelry shall be also marketed through the Government-assisted Asian jewelry science center.

IV-5-4 Agri-business Promotion

As agricultural product increases, the importance of the post-harvest systems such as marketing, storage, processing, transportation, and retailing is increased. Among these, this plan proposes to provide, rice mills, grain storage

facilities, and village shops in order to enhance the selling valve of agricultural products.

(1) Grain Storage Facilities

The increasing agricultural products have to be absorbed by the market. The inadequate market capacity forces a price decline of surplus. Therefore, the proper operation of storage facilities shall stabilize the prices of agricultural products, thereby giving reasonable profits to farmers

In the inventory, the data showing the present situation of grain storage facilities are not available, except for availability / non-availability of grain storage facilities of agricultural cooperatives' own in villages. The result shows that the number of villages with grain storage facilities of agricultural cooperatives' own is 15 villages (5.3 percent) out of 282 villages, nine villages (4.3 percent) out of 209 villages, seven villages (2.4 percent) out of 288 villages, and 4 villages (1.9 percent) out of 215 villages in Phisanulok, Sukhothai, Kamphaeng Phet, and Tak respectively. Consequently, the number of backward villages with grain storage facilities in four provinces is only 35.

(2) Rice Mill

According to the inventory, the number of rice mills in four provinces is 479, 418, 547 and 237 in Phitsanulok, Sukhothai, Kamphaeng Phet, and Tak, respectively, with the total number of 1,681. The number of rice mills per village is, therefore, calculated at 1.7, 2.0, 1.9, 2.0 in Phitsanulok, Sukhothai, Kamphaeng Phet, and Tak, respectively. According to the field survey, the number of large-scale rice mills with the milling capacity of 30 ton per day is 27, and medium-scale rice mills with the capacity of 10 ton per day is 208. These large- and medium-scale rice mills are operated by agricultural cooperatives or local traders. Almost all the rice mills in four provinces are small-scale rice mills with the milling capacity of one to four ton per day of each farm households own.

Although the present small-scale rice mills must be converted into medium-scale and large-scale rice mill in order to meet with the increased production amount of rice.

In this integrated rural development plan, however, rice mills with the milling capacity of 20 ton per day or 40 ton per day will be provided, considering the increasing production amount in the irrigation project areas.

(3) Village Shop

In order to improve the agricultural productivity through irrigation development project, the smooth procurement of agricultural input materials such as nigh-yield variety seeds, chemical fertilizers, and agricultural chemicals is essential. In addition to the above reason, village shops, dealing with agricultural input materials and daily commodities are necessary for the improvement at the quality of rite in backward villages.

The available data on village shops in the inventory is availability / unavailability of village shops for agricultural input materials and daily commodities operated by farmers. The result shows that the number of villages with village shops is 260 (90.3 percent) in Phitsanulok, 184 (88.0 percent) in Sukhothai, 259 (89.9 percent) in Kamphaeng Phet, and 124 (57.5 percent) in Tak. In three provinces except for Tak, more than 90 percent of villages have villages shops operated by farmers.

Although, in the center of Amphoe, there are some business shops operated by local traders, it takes on the average 107.0 minutes in Phitsanulok, 84.2 minutes in Sukhothai, 101.8 minutes in Kamphaeng Phet, and 132.2 minutes in Tak to go to the center of Amphoe and back by public transportation services. The arrangement of village shops in backward villages removes this inconvenience and also contributes to shorten women's labour hours.

For 167 villages who are identified by NESDB inventory that these is no village shop operated by farmers, the arrangement of village shops will be promoted for farmers' own operation. The facilities shall be simply composed of store, office, and storage.

IV-6 INSTITUTION BUILDING AND HUMAN RESOURCES DEVELOPMENT

IV-6-1 Institution Building

The success of a development project especially on integrated rural development project including various kinds of project components totally depends on the institution building and human resources development for the implementation. In this integrated rural development, the institution and human resources shall be mobilized by ARD based on the following basic approach.

(1) Participatory Approach

The first basic approach is the participatory approach. The participatory approach puts stress on the voluntary participatory of beneficiaries in the project, reflecting the reconsideration of "the Government-leading development". The project is composed of various kinds of works including reservoirs, weirs, roads, deep wells, and rural infrastructures for 994 backward villages, and, therefore, the successful implementation of the project needs the voluntary participation of rural people in the backward villages in the project, in order to incorporate demands for development in the project. The participatory approach is concretely composed of effective utilization of present institution, proper provision of incentive, preparation of manual, training of leadership, and promotion of women's participation.

(2) Government's Coordination Approach

The second basic approach is the government's coordination approach. This government's coordination approach is to make ARD the coordinator for the smooth project implementation with the cooperation of the government authorities concerned. The government's coordination approach is concretely composed of effective utilization of present institution, establishment of good communication network, and training of leadership.

IV-6-2 Woman in Development

① Background for Woman in Development

The concept for woman in development (WID) has been formulated through the internationally prevailing philosophy that in order to improve the status of women, the participation of women in development projects should be promoted. This philosophy is based on 'Nairobi Future Strategy in Improvement of Woman's Status" in Nairobi World Women's Conference in 1985 of the last year of 'United Nations Women's Decade'. Under the international circumstances, the present situation of WID has been clarified by 'Development Council by Sector' of JICA in in the field of women's participation in economic activities, women and education, women and public health, and women and environment. OECF also has clarified the clear-cut guideline for WID consideration in development projects by "OECF Guideline for Development and WID consideration.

② Present Situation

- Women's Participation in Agricultural Production Activities
  Generally speaking , in developing countries, it is often reported that the burden of domestic works and farming works is unfavorably heavy for women in terms of number of labour items and time. In lower North Thailand, however, men and women evenly share the burden of farming works such as land preparation, weeding and harvesting by helping each other and, therefore, there is almost no heavy burden for women. In some cases heavy burden of fetching water for women.

- Women's Participation in Decision Making
  Generally speaking, in developing countries, it is often reported that there are few chances for women to demonstrate their opinions and take part in decision makings in the meeting of farmer's group, and village group. In the rural district of Thailand including lower North Thailand, however, the accessibility of women to decision making is relatively high because of high adult literacy ratio, except that there are few cases of women heads of villages.

- Women's Accessibility to Land Ownership
  Generally speaking, in developing countries there are some cases that women heads of families are discriminated from men heads of families in terms of land ownership right, and wives are not able to receive agricultural extensions services and agricultural financial services due to no land downership right. In Thailand there is no such descrimination for services by the Ministry of Agriculture and Agricultural Cooperatives, ARD, and BAAC Bank for Agriculture and Agricultural Cooperatives.

- Women's Accessibility to Agricultural Extension
  Generally speaking, in developing countries, there are some problems that the accessibility to the agricultural extension services and information services such as introduction of newly developed agricultural machinery, modern irrigation facilities, and high-yield varieties seeds are limited only to men are not available for women.

  In Thailand including the lower North Thailand, agricultural extension officers are rendering their services to women through farmer's group and women's group and, therefore, there are less discrimination for women on these service, compared with other developing countries.

TABLE IV-1 PROBABLE MONTHLY RUNOff

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
Huai Sam Ru CA = 28 km² (Station N-36 Khue Noi)													
Average (1/sec/km²)	1.97	4.43	9.60	19.20	33.50	42.61	23.02	7.94	3.87	2.73	2.20	1.77	12.37
Average (MCM)	0.15	0.33	0.70	1.21	2.51	3.09	1.73	0.58	0.29	0.20	0.15	0.13	11.07
1/10 Dry Year (MCM)	0.09	0.20	0.43	0.75	1.56	1.92	1.07	0.36	0.18	0.12	0.09	0.08	6.85
1/10 Wet Year (MCM)	0.22	0.49	1.03	1.78	3.69	4.54	2.54	0.85	0.43	0.29	0.22	0.19	16.27
Huai Nong kHo CA = 34 km² (Station Y-26 Nam Mae Mok)													
Average (1/sec/km²)	0.02	3.22	7.75	2.62	3.86	14.59	19.20	5.02	0.93	0.31	0.13	0.01	4.81
Average (MCM)	0.00	0.29	0.68	0.24	0.35	1.29	1.75	0.44	0.08	0.03	0.01	0.00	5.16
1/10 Dry Year (MCM)	0.00	0.13	0.31	0.11	0.16	0.58	0.79	0.20	0.04	0.01	0.00	0.00	2.33
1/10 Wet Year (MCM)	0.00	0.55	1.29	0.46	0.67	2.45	3.33	0.84	0.15	0.06	0.02	0.00	9.82
Khlong Samo Khon CA = 13 km² (Station Y-26 Nam Mae Mok)													
Average (1/sec/km²)	0.02	3.22	7.75	2.62	3.86	14.59	19.20	5.02	0.93	0.31	0.13	0.01	4.81
Average (MCM)	0.00	0.11	0.26	0.09	0.13	0.49	0.67	0.17	0.03	0.01	0.00	0.00	1.96
1/10 Dry Year (MCM)	0.00	0.05	0.12	0.04	0.06	0.22	0.30	0.08	0.01	0.00	0.00	0.00	0.88
1/10 Wet Year (MCM)	0.00	0.21	0.49	0.17	0.25	0.93	1.27	0.32	0.06	0.02	0.00	0.00	3.72
Khlong Sai CA = 47 km² (Station P-26a Khlong Suan Mak)													
Average (1/sec/km²)	1.17	4.42	8.53	9.29	11.23	33.54	47.81	25.71	6.23	2.54	1.18	0.87	13.04
Average (MCM)	0.14	0.62	1.04	1.17	1.41	4.09	6.02	3.13	0.78	0.32	0.13	0.11	18.96
1/10 Dry Year (MCM)	0.06	0.27	0.46	0.51	0.62	1.80	2.65	1.38	0.34	0.14	0.06	0.05	8.34
1/10 Wet Year (MCM)	0.25	1.10	1.84	2.07	2.50	7.24	10.66	5.54	1.38	0.57	0.23	0.19	33.57

CHAPTER V OVERALL 5-YEAR DEVELOPMENT PLAN

CHAPTER V. OVERALL 5-YEAR DEVELOPMENT PLAN

V-1 PROJECT COMPONENT

V-1-1 Project by the Office of Accelerated Rural Development

To attain the objective of rural development aiming to raise income through the improvement of productivity and production of agriculture, main economic activities in the area, and to improve access to social infrastructure and public services, the integrated rural development project for 994 backward villages in four provinces of Phitsanulok, Sukhothai, Kamphaeng Phet and Tak has been proposed covering the fields of agriculture, irrigation, rural roads, rural water supply, rural infrastructure, rural electrification, public health and education.

Among several project components deemed necessary to solve the problems confronting rural populations in the backward villages, four project components of irrigated agriculture development, rural road development, rural water supply development and rural infrastructure development, which are practicable under the responsibility of the Office of Accelerated Rural Development with the close cooperation of other government agencies concerned, have been incorporated into the integrated rural development, as given below:

① Irrigated Agriculture Development

- Water resources development for irrigation by constructing dams and weirs,
- Construction of irrigation canal systems,
- Construction of on-farm facilities,
- Water management on farm level by water users' group, and
- Strengthening of agricultural supporting services.

② Rural Road Development

- Construction of rural trunkroads to connect main villages with markets and centers of public services,
- Construction of service roads to connect backward villages with rural trunkroads, and
- Improvement of existing roads.

③ Rural Water Supply Development

- Construction of deep wells for water supply of drinking and daily use

④ Rural Infrastructure Development

- Establishment of rural youth and agricultural technology training centers, and
- Promotion of cottage industries.

V-1-2 Project by Other Government Agencies

Projects for the development of rural electrification, public health and education, which is closely related to the improvement of the quality of life, shall be implemented by other government agencies than the Office of Accelerated Rural Development, through the coordination by the National Rural Development Coordinating Centre, in line with the proposed implementation schedule for this integrated rural development project. The development levels for these three projects are set forth as follows:

PROPOSED DEVELOPMENT LEVELS

Project		Proposed Development Levels
Rural Electrification	:	more than 50 percent of households to be electrified.
Public Health		
- Medical Fund and Medical Box	:	medical fund and medical box with trained staff to be established for all villages.
- Public Health Service in Tambon	:	a health center or hospital to be provided at a within 0.5 hours distance.
- Toilet in House	:	more than 60 percent of households to have a toilet.
- Vaccination	:	more than 90 percent of peoples to receive vaccination services.
- Family Planning	:	more than 70 percent of married couples to obtain family planning services.
Education		
- Primary School	:	every village
- Secondary School	:	every Tambon
- Literacy Rate	:	more than 95 percent
- Training	:	more than 6 times a year

V-1-3 Project by Private Sector

A part of the infrastructure network that assumes increasing importance as farm surpluses grow is the postharvest system for collecting, storing, transporting, processing and retailing those surpluses-referred to as marketing. The integrated rural development project at Lower North Thailand has proposed to promote the establishment of rice mills, vegetables and fruits collecting facilities, storage facilities, and village shops, in order to increase the value added from the marketing.

Efficient marketing of the surpluses of small farmers calls for rapid responses to varied and quickly changing local requirements, a task not suited to farmers nor centrally administrated agencies. Therefore, the project expect that these projects will be invested and managed by the private sector.

The construction of primary infrastructure consisting of irrigation facilities, roads, and electricity under the integrated rural development plan shall create the incentives to private sector to participate in the project.

V-1-4 5-Year Plan

The implementation and operation of the integrated rural development projects involve many government agencies and villagers concerned, and need such agricultural supporting services as extension of improved farming management, prompt supply of farm input materials, proper water management and so on. There is a financial conflict with other development projects and limitation of engineering capacities when the integrated rural development project at Lower North Thailand is proposed to implement on a short-term program.

Basing on the development proposal discussed in Chapter IV, potential projects were identified. Then, the priority projects that are in need of urgent development, or have high project impacts on rural areas have been incorporated into the overall 5-year development project to be implemented in the next national plan period from 1992 to 1996.

V-2. MODEL AREA

(1) Necessity of Model Project

At the initial stage of the implementation of the integrated rural development project, the project should be started on a model project basis in a few selected areas. This is necessary in order to : ① formulate a development plan that will concentrate on actual problems confronted by the rural peoples in different backward villages scattered over the four provinces with different natural, socio-economic conditions, through analysis of the NESDB data base, and ② assess the benefits to be generated from different project components through monitoring and evaluating of implementing problems, obstacles in project areas and changes in rural standards of living. And, the experience and the achievement help in planning long-term schemes on the integrated rural development.

Four model projects, in four provinces, one project for each province, have been selected for the purpose mentioned above. The feasibility study was carried out for four model projects, based on which the overall 5-year development plan has been prepared. The model areas were selected on the basis of the following criterion: ① first priority is given to areas in need of urgent development because of their low present development levels with respect to economy and the quality of life, ② areas shall have the high effect of demonstrating the implementation of model projects; areas shall represent most of the general situation in the region concerned; areas shall have better access, ③ in and around areas, there shall be a potentiality to develop water resources for irrigation of dry season crops, the key industries in the study area, and ④ villagers in areas shall have willingness to join in the project.

(2) Selection of Model Areas

As a first step, the following Amphoe was selected as high priority areas: top three high priority Amphoe as mentioned in Chapter III.

PRIORITY AREAS

Province	First	Second	Third
Phitsanulok	Nakhon Thai	Noen Maprang	Chat Trakan
Sukhothai	Ban Dan Lan Hoi	Muang Sukhothai	Thung Saliam
Kamphaeng Phet	Phran Kratai	Khlong Lan	Khanuworalak Buri
Tak	Tha Song Yang	Mae Ramat	Umphang

As a second step, the demonstration effect of areas was examined. As for rainfall that has a great influence on agricultural production, quantities and seasonal pattern of rainfall prevailing in nine priority areas in three provinces of Phitsanulok, Sukhothai and Kamphaeng Phet are representative of the province concerned. Annual rainfall in three priority areas in Tak province is as high as 1,500 - 1,900 mm, being located in the western parts of the province, when compared with annual rainfall of around 1,000 mm in the areas along Ping river, the center of Tak province. All priority areas are linked to the center of provinces with the network of national highways and rural trunkroads. The distances between priority areas and provincial seats are 80 to 100 km for Phitsanulok province, 10 to 50 km for Sukhothai province, and 30 to 80 km for Kamphaeng Phet province, while 130 to 220 km for Tak province. As

a result of the second step selection, two priority areas of Tha Song Yang located in the northernmost and Umphang located in the southernmost, both in Tak province, were screened out from the list of priority model areas.

As a third step, potentialities to develop water resources for irrigation use were examined. The water resources will be developed with construction of a dam and reservoir that enable to introduce dry season irrigation. 12 potential dam and reservoir sites were identified from the view points of engineering as mentioned later. Three areas of Nakhon Thai in Phitsanulok province, Ban Dan Lan Hoi in Sukhothai province and Phran Kratai in Kamphaeng Phet province, which are given top priority for development from the view point of socio-economy, have the potential dam and reservoir sites. Accordingly, three areas as mentioned above have been selected as model areas.

Mae Ramat area in Tak province has a potential dam and reservoir site; however, the catchment area is as small as nine sq.km. Muang Tak area is selected as an alternative to Mae Ramat area. Muang Tak area is situated in the river basin of Ping which flows down through the center of Tak province, and is at a distance of about 30 km from the provincial capital with better access through the road networks of the national highway and the rural trunkroads. In Muang Tak area, there is a potential dam and reservoir site with a catchment area of 38 sq.km.

As a result of the comparison of Muang Tak area with Mae Ramat area, Muang Tak area has been selected as a model area in Tak province since the area represents the general situations of physical and socio-economic conditions. Muang Tak model area could be characterized as an economically, socially stagnated area, though being located in the relatively developed Amphoe where the provincial capital is seated. In the course of the selection of the model area in Tak province, unique features of the western Tak along the Thai-Myanmer border have been revealed, and the Office of Accelerated Rural Development have had an intention to prepare urgently an integrated rural development plan in the western Tak.

In staring the feasibility study of the integrated rural development project on model areas, meetings were called for four days in February, 1991, in order to explain the policies of the development and exchange views on the rural development. Attendances at the meetings were officials from the

provincial offices of ARD and other government agencies, local government officials, representatives of Tambon and villages, and the JICA study team. The points at issue raised by the persons concerned are low agricultural productivity, unstable agricultural production, less opportunities of off-farm employment and so on. There is a great demand for the construction of irrigation facilities and rural roads.

Four model areas have been selected through the process of selection as mentioned above. Topographic maps with a scale of 1 : 5,000 and contour intervals of 1.0 m were prepared to cover the model areas. Present situations of the model areas are presented in Chapter VI. The followings give the outline of model areas.

MODEL AREAS

Name of Model Area	Province	Amphoe	Nos. of Villages Concerned	Nos. of Backward villages
Huai Sam Ru	Phitsanulok	Nakhon Thai	3	3
Huai Nong Kho	Sukhothai	Ban Dan Lan Hoi	4	2
Khlong Samo Khon	Kampheng Phet	Phran Kratai	2	2
Khlong Sai	Tak	Muang Tak	4	1

V-3 IRRIGATED AGRICULTURE DEVELOPMENT

V-3-1 Water Resources Development

Agriculture in the backward villages is operated under the influence of rainfall fluctuating in annual amount and seasonal pattern. For the improvement of agricultural productivity and production, irrigation development is the key project component. The introduction of new inputs for crop growing, especially of fertilizer and pesticides, can be successfully applied only where high yields are assured by irrigation throughout the growing season. In this context, it is proposed to incorporate the so-called irrigated agriculture development into the overall 5-year development project.

Two types of water resources development, a storage scheme and run-of-river scheme, are proposed for the project. Irrigable areas are selected

among existing farm lands located at the immediate downstream of the proposed water source facilities so as to apply gravity irrigation. The construction of a diversion weir across a river with a flat grade needs a high diversion structure and long supply canals to provide gravity irrigation, resulting in high investment costs. River pumping is the alternative to the construction of a diversion weir in a such river as have a flat grade; however, no river pumping is proposed for the overall 5-year development plan due to its high operation and maintenance costs to be shared by farmers.

V-3-2 Storage Scheme

The initial selection of possible damsites was based on the RTSD topographic maps with a scale of 1 : 50,000 and contour intervals of 20 m on which all the information of the existing irrigation projects and locations of the backward villages were shown. Every possibility of construction of the medium scale dams was examined on the said maps. The damsites that cause any village or considerable wide farm lards to be submerged, or may conflict with the existing irrigation projects were excepted from the list of possible damsites. As a result, 43 possible damsites have been listed: seven damsites in Phitsanulok province, 18 damsites in Sukhothai province, 12 damsites in Kamphaeng Phet province and six damsites in Tak province.

The reconnaissance field investigation was made into the possible damsites, beneficial areas and backward villages, and a series of discussions was made between the JICA study team and ARD officials concerned. Major findings during the reconnaissance investigation and discussions are summarized as follows:

① Farmers encroached for farming on some proposed reservoir areas where no cultivation is recognized from the topographic maps,

② Some proposed reservoir areas are classified as wild animal sanctuary areas or the A1 reserved forest areas where no development activity is permitted,

③ Development plans of some damsites are being prepared by other government agencies than ARD.

④ Topography of some damsites is proved not so suitable for the construction of medium scale dams as firstly judged based on the topographic maps because of the limited accuracy of the maps, and

⑤ Some damsites have the potentialities of large scale water resources development. The damsites with catchment area of more than 100 sq.km are not recommended for ARD projects aiming to develop the medium scale irrigation projects.

The field reconnaissance investigation leads to selection of 12 potential damsites for the medium scale irrigation development, of which four damsites have been proposed to be implemented under the overall 5-year development plan in consideration of the engineering capacities and financial constraint. The four damsites are located in the model areas. Outline of the proposed irrigation projects of storage scheme is given below:

OUTLINE OF IRRIGATION PROJECT OF STORAGE SCHEME

Province	Project	Dam			Irrigation Area (ha)	Nos. of Backward Villages
		Storage (MCM)	Length (m)	Width (m)		
Phitsanulok	Huai Sam Ru	3.98	23.9	260	1,022	3
Sukhothai	Huai Nong Kho	6.79	19.4	935	574	2
Kamphaeng Phet	Khlong Samo Khon	2.40	11.0	1,380	179	2
Tak	Khlong Sai	2.14	12.1	1,345	390	1
Total		15.31			2,165	8

The proposed dams will be of a earthfill type with a crest width of six m, embankment slopes of 1 : 3.0 for upstream and 1 : 2.5 for downstream, judging from the topographic and geological conditions of the proposed sites as well as the availability of construction materials. The overflow type spillway and conduit type outlet facilities are planned.

The layout of the proposed canal system was made based on the topographic maps. The alignment of canals is planned to enable farm lands to be irrigated by gravity, running in parallel with contour lines as far as possible so that the number of appurtenant structures like drops and checks and the quantify of earthwork are reduced to a certain extent. main and lateral canals

are designed to be trapezoid channels with concrete lining. Canals will be constructed to command a project area down to a terminal irrigation block of 16 ha (or, 100 rai). Irrigation ditches and drains will be provided as on-farm facilities.

V-3-3 Run-of-River Scheme

The locations of proposed diversion weirs are confined to areas that are located just upstream of the backward villages within a several hundred meters, based on the topographic maps with a scale of 1 : 50,000 on which the existing irrigation projects and the backward villages are shown. The project excluded such sites with a catchment area of more than 100 sq.km, which needs high investment costs for spillways, and less than five sq.km. As a result of the selection of construction sites of diversion weirs, 55 potential construction sites have been screened as potential sites: 10 sites in Phitsanulok province. Nine sites in Sukhothai province, 19 sites in Kamphaeng Phet province and 17 sites in Tak province.

In the selection of the priority projects for the overall 5-year development plan, first priority is given to projects which are connected with the existing and/or proposed rural trunkroads, and second priority to projects which cover the backward villages with high priority for development, resulting in selection of 26 irrigation projects of run-of-river scheme, as summarized below:

OUTLINE OF IRRIGATION PROJECT OF RUN-OF-RIVER SCHEME

Province	Nos. of Project	Irrigation Area (ha)	Catchment Area (sq.km)	Nos. of Backward Villages
Phitsanulok	5	1,080	95	11
Sukhothai	4	1,210	104	5
Kamphaeng Phet	9	2,580	290	11
Tak	8	2,270	204	16
Total	26	7,140	693	43

The proposed diversion weirs are planned to be of a concrete gravity type with a trapezoidal crest. The length of a weir is estimated on the assumption that the required length of the weir has a correlation with the size of catchment area and the required weir height depends on the river slope.

Weir Length and Catchment Area		Weir Height and River Slope	
Catchment Area (sq.km)	Weir Length (m)	River Slope	Weir Height (m)
5~ 10	10	1/500 more than	2.0
10 ~ 20	20	1/500~1,1000	3.0
20 ~ 50	30	1/1,000 ~ 1/2,000	4.0
50 ~ 100	45	1/2,000 more less	5.0

V-3-4 Agricultural Development

(1) Cropping Area

With the implementation of irrigation projects, four projects of storage scheme and 26 projects of run-of-river scheme, under the overall 5-year development plan, 9,305 ha of farm lands will be irrigable. The model projects will supply water for irrigation of 2,165 ha farm lands composed of paddy fields, upland crop fields and orchards as is discussed in Chapter VII. The irrigable areas with the run-of-river scheme are selected among paddy fields located along the rivers, just downstream of the proposed weirs. The weirs divert river flows for paddy cropping in the rainy season and cropping of soybean and mungbean as the second crop to paddy for the 10 percent area of paddy fields in the dry season. The overall 5-year development plan will provide the following irrigation projects:

PROPOSED IRRIGATION PROJECT

Province	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak	Total
Nos. of Irrigation Project					
- Storage Scheme	1	1	1	1	4
- Run-of-River Scheme	5	4	9	8	26
Total	6	5	10	9	30
Irrigation Area (ha)					
- Paddy Fields	1,267	1,565	2,711	2,373	7,916
- Upland Crop Fields	647	119	26	143	935
- Orchards	188	100	22	144	454
Total	2,102	1,784	2,759	2,660	9,305

(2) Development of Sericulture and Livestock

In line with the regional agricultural development plan prepared on an Amphoe basis, the overall 5-year development plan has proposed to promote sericulture and cattle raising: sericulture promotion in nine Amphoe and cattle raising promotion in 10 Amphoe. For sericulture promotion, farmers' groups shall be organized; each group consisting of 20 farmers with 16 ha of mulberry fields, as a standard. Farmers' groups shall also be organized for the promotion of cattle raising, and one standard group shall be composed of 50 farmers with 50 ha of pasturelands. Outline of the proposed projects for promotion of sericulture and cattle raising are shown as follows:

SERICULTURE AND CATTLE RAISING

Province	Sericulture		Cattle Raising	
	Nos. of Amphoe	Nos. of Project	Nos. of Amphoe	Nos. of Project
Phitsanulok	3	12	2	4
Sukhothai	2	8	2	4
Kamphaeng Phet	3	12	3	6
Tak	1	4	3	6
Total	9	36	10	20

(3) Inland Fisheries Development

In the study area there are many small scale swamps that have development potentialities for inland fisheries purpose. The small swamp inland fisheries development project is being promoted by the Department of Fisheries in and around the study area. Proposed small swamps in the model areas are identified on the topographic maps with a scale of 1 : 5,000; however, for other areas, the number of proposed swamps and water surface areas are assumed based on the experience of the small swamp inland fisheries project, because detailed topographic maps are not available for other areas than the model project areas. Outline of the inland fisheries projects are given as follows:

INLAND FISHERIES DEVELOPMENT PROJECTS

Item	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak	Total
No. of Projects	14	17	14	7	52
Total Water Area (ha)	149	272	241	42	704

V-4 RURAL ROAD DEVELOPMENT

The plan to develop rural road networks to connect the backward villages with Amphoe and market centers are based on the topographic maps with a scale of 1 : 50,000 showing the routes of ARD roads under construction and proposed and the locations of the backward villages. To select priority roads to be implemented under the overall 5-year development plan, first priority is given to the completion of the on-going ARD road projects, and to the construction of service roads to connect the backward villages with the proposed first priority roads, as summarized below:

OUTLINE OF FIRST PRIORITY ROADS

Province	Rural Trunkroads		Service Roads (km)	Nos. of Backward Villages
	Nos. of Roads	Length (km)		
Phitsanulok	11	235.9	32.7	32
Sukhothai	5	105.6	13.5	7
Kamphaeng Phet	7	89..0	11.0	21
Tak	3	23.0	-	6
Total	26	453.5	57.2	66

Second priority is given to the construction of service roads to connect the backward villages with the existing national, provincial and rural trunkroads, and to the pavement of the sections within villages of ARD roads. The access of peoples in the backward villages to the centers of market and public services will be improved with the implementation of projects, and thus the existing roads will be used more effectively than planned originally. Outline of the second priority roads is summarized as follows:

OUTLINE OF SECOND PRIORITY ROADS

Province	Pavement of Rural Trunkroads		Service Roads (km)	Nos.of Backward Villages
	Nos.of Roads	Length (km)		
Phitsanulok	18	27.8	95.0	116
Sukhothai	11	10.5	122.0	90
Kamphaeng Phet	23	16.0	241.0	157
Tak	30	5.5	91.0	113
Total	82	59.8	549.0	476

As a result of selection of priority rural roads development projects, as mentioned above, the following roads have been proposed to be implemented with the overall 5-year development plan.

SUMMARY OF PROPOSED RURAL ROAD PROJECT

Province	Rural Trunkroads		Service Roads (km)	Pavement of Existing Road (km)	Nos.of Backward Village
	Nos.of Roads	Length(km)			
Phitsanulok	11	235.9	127.7	27.8	148
Sukhothai	5	105.6	135.5	10.5	97
Kamphaeng Phet	7	89.0	252.0	16.0	178
Tak	3	23.0	91.0	5.5	119
Total	26	453.5	606.2	59.8	542

V-5 RURAL WATER SUPPLY DEVELOPMENT

The backward villages where more than 30 percent of households are not satisfied with the present water supply were selected from the NESDB data base, amounting to 442 backward villages: 126 villages in Phitsanulok province, 85 villages in Sukhothai province, 157 villages in Kamphaeng Phet province and 74 villages in Tak province. Potential yields of groundwater are shown on the topographic maps together with the locations of the 442 backward villages based on the hydrogeological information prepared by the Department of Mineral Resources. There are 411 backward villages located on areas where the development of groundwater of more than 20 gpm (75.7 ℓ per minute) is expected.

Since the water supply for domestic use is the basic human needs, the project has proposed to provide deep wells to the above 411 backward villages for supply of drinking and daily use water in the overall 5-year development period. Summaries of the rural water supply development projects are as follows:

OUTLINE OF RURAL WATER SUPPLY PROJECTS

Province	Objective Backward Village	Proposed Backward Villages	Nos.of Deep Wells
Phitsanulok	126	126	176
Sukhothai	85	85	118
Kamphaeng Phet	157	150	211
Tak	74	50	69
Total	442	411	574

V-6 RURAL INFRASTRUCTURE DEVELOPMENT

V-6-1 Rural Youth and Agricultural Technology Training Center

The training center for rural youth and agricultural technology will be established on an Amphoe basis. And, the overall 5-year development plan will provide four centres: one center for each model project. The center will be stationed in the center of Amphoe for better access and maintenance of facilities.

RURAL YOUTH AND AGRICULTURAL TECHNOLOGY TRAINING CENTER

Item	Huai Sam Ru	Huai Nong Kho	Khlong Samo Khon	Khong Sai
Province	Phitsanulok	Sukhothai	Kamphaeng Phet	Tak
Nos. of Center	1	1	1	1
Amphoe	Nakhon Thai	Ban Dan Lan Hoi	Phran Kratai	Muang Tak

V-6-2 Cottage Industries

The overall 5-year development plan has proposed to promote three kinds of cottage industries of silk weaving, bamboo art craft and jewelry polishing, which are in practice in the study area, because of increasing demand. For the promotion of cottage industries, farmer's groups shall be organized with group working facilities: five farm households for a silk weaving group, 20 farm households for a bomboo art craft group and 20 farm households for a jewelry polishing group. The following group working

facilities will be constructed on a pilot basis for the promotion of cottage industries.

GROUP WORKING FACILITIES FOR COTTAGE INDUSTRIES

Province	Silk Weaving		Bamboo Art Craft		Jewelry Polishing	
	Nos.of Amphoe	Nos.of Facilities	Nos.of Amphoe	Nos.of Facilities	Nos.of Amphoe	Nos.of Facilities
Phitsanulok	1	1	2	4	2	2
Sukhothai	1	1	3	6	2	2
Kamphaeng Phet	1	1	2	4	2	2
Tak	1	1	5	10	2	2
Total	4	4	12	24	8	8