

## CHAPTER 4 : TABLES



**Table 4.2.1 External Requirements for Development of Nam Dan District  
in the Field of Agro-industry and Marketing (1/2)**

A. National / Provincial		Requirement	Contents	Effect to be expected
1. Expansion and strengthening Credit Program			<ul style="list-style-type: none"> <li>- To increase amount of fund</li> <li>- To simplify requirements and procedure for application</li> <li>- To prepare simple and fare procedure of examination for applicants</li> <li>- To eliminate different treatment on application of credit between state-owned enterprises and private ones</li> </ul>	<ul style="list-style-type: none"> <li>- To increase chances for new-comers on business</li> <li>- To increase chances for improving and expanding activities of existing enterprises</li> <li>- To eliminate oligopolistic condition due to more investments</li> <li>- To generate fare competitive condition between enterprises including state-owned ones</li> </ul>
			<ul style="list-style-type: none"> <li>- To make betterment to more effective contents of laws and regulation and strengthen official activities concern</li> <li>- To improve provisions to meet market regulation and avoid restriction on free market competition</li> </ul>	<ul style="list-style-type: none"> <li>- To strengthen official services due to making stable condition of tax income</li> <li>- To know actual condition through tax collection</li> <li>- To minimize irregular economic activities</li> </ul>
			<ul style="list-style-type: none"> <li>- To prepare system to collect market information in conformity with market mechanism</li> <li>- To collect and accumulate market information and proclaim timely</li> </ul>	<ul style="list-style-type: none"> <li>- To generate proper commodities movement</li> <li>- To introduce and ensure activities of production, processing and trading in cope with market needs</li> <li>- To avoid unfair condition due to uneven distribution of market information</li> </ul>
			<ul style="list-style-type: none"> <li>- To develop and disseminate necessary technologies for development of economic activities based on free market mechanism, such as farming, processing, storage, management and marketing</li> <li>- To train and supply experts having necessary technologies</li> </ul>	<ul style="list-style-type: none"> <li>- To improve and reinforce quality of human resources as fundamental condition of economic activities</li> <li>- To support and ensure development of economic activities</li> </ul>
			<ul style="list-style-type: none"> <li>- To improve and prepare necessary laws and regulations to create proper trading such as standard of agricultural products, food sanitation law and weighing law</li> <li>- To strengthen official services to instruct and supervise trading condition</li> </ul>	<ul style="list-style-type: none"> <li>- To generate smooth and efficient trading and transportation practices</li> <li>- To improve sanitary condition for consumers</li> </ul>
			<ul style="list-style-type: none"> <li>- To define facility requirements such as treatment of garbage, water supply, power and lavatory</li> <li>- To prepare regulation and rule for wholesale trading</li> <li>- To collect and proclaim data and information of trading in market</li> <li>- To strengthen management and supervision activities</li> </ul>	<ul style="list-style-type: none"> <li>- To make effective activities in market</li> <li>- To generate smooth and efficient commodities flows</li> <li>- To introduce and ensure activities of production, processing and trading in cope with market needs</li> <li>- To avoid unfair condition due to uneven distribution of market information</li> </ul>

Table 4.2.1 External Requirements for Development of Nam Dan District  
in the Field of Agro-industry and Marketing (2/2)

B. Nghe An Province

Requirement	Contents	Effect to be expected
1. Renovation of markets in Nghe An Province including in Nam Dan District	<ul style="list-style-type: none"> <li>- To improve and prepare market laws and regulations</li> <li>- To renovate facilities such as for truck cargo, access road, garbage treatment, water supply, power supply and lavatory</li> <li>- To collect and proclaim data and information of trading in market</li> <li>- To strengthen management and supervision activities</li> <li>- To make and specify Vinh Market as wholesalers market and introduce proper trading mean in place of current face to face trading with small units</li> </ul>	<ul style="list-style-type: none"> <li>- To make effective activities in market</li> <li>- To avoid unfair condition due to uneven distribution of market information</li> <li>- To generate smooth and efficient commodities flows</li> <li>- To adjust conditions for increasing trading amount by truck and of wholesaling</li> <li>- To introduce and ensure activities of production, processing and trading in cope with market needs</li> </ul>
2. Renovation of Qua Lo Port	<ul style="list-style-type: none"> <li>- To renovate condition of port to meet requirements for international trading</li> </ul>	<ul style="list-style-type: none"> <li>- To eliminate disadvantage of present condition, far distance to export ports and ensure advantage to enterprises engaging export and import</li> </ul>
3. Training and supplying experts and specialists	<ul style="list-style-type: none"> <li>- To train and supply experts and specialists having necessary technologies due to free market mechanism as well as competition in agro-industry</li> </ul>	<ul style="list-style-type: none"> <li>- To meet needs of enterprises and contribute development of this sectors</li> <li>- To enforce absorbency of extra-labors in agriculture providing pre-training to them</li> </ul>
4. Advertisement and selling promotion of local products	<ul style="list-style-type: none"> <li>- To establish display shop in Vinh City and in major cities such as Hanoi City and HCMC if possible in which local products would be displayed and promoted selling</li> <li>- To feed back visitors' information to producers</li> <li>- To have exhibition timely inviting traders in local as well as foreign</li> </ul>	<ul style="list-style-type: none"> <li>- To support local producers and traders providing buyers and consumers needs, promoting to sell products and expanding markets</li> </ul>
5. Renovation of existing agro-processing factories such as sugar mill, ground nuts oil mill and frozen sea products factory	<ul style="list-style-type: none"> <li>- To establish new management system to give raw-materials suppliers in surrounding area profitable condition by contract and make them cultivating and/or harvesting certain raw-materials in favor</li> <li>- To renovate old facilities based on new management plan</li> </ul>	<ul style="list-style-type: none"> <li>- To ensure proper and stable income to suppliers</li> <li>- To ensure stable production and profitability, and increase export amount</li> </ul>

**Table 4.2.2 Production Plan of Main Crops**

**(1) Rice**

(Unit : Area is ha, Yield is ton/ha, Production is ton)

Season	Proposed Production Plan			Present			Increased Product	
	Area	Yield	Product	Area	Yield	Product	Value	%
W. Sp.(irrigated)	4,146	5.82	24,346	3,299	4.32	14,245	10,101	1.71
W. Sp.(rainfed)	2,698	3.80	7,285	3,495	2.15	7,529	-244	0.97
Sub Total	6,844	5.02	31,631	6,794	3.20	21,774	9,857	1.45
Su. Au (irrigated)	6,771	4.90	31,494	5,924	3.31	19,609	11,885	1.61
Summer (rainfed)	614	1.99	1,044	839	1.30	1,091	-47	0.96
Total	14,229	4.83	64,169	13,557	3.13	42,474	21,695	1.51

**(2) Upland Crops**

(Unit : Area is ha, Yield is ton/ha, Production is ton)

Crop	Season	Proposed Production Plan			Present			Increased Product	
		Area	Yield	Product	Area	Yield	Product	Value	%
Maize	W. Sp.	950	2.20	2,090	980	1.80	1,764	326	
	Su. Au.	0		0	0		0		
	Winter	1,502	1.79	2,690	1,187	1.40	1,662	1,028	
	Total	2,452		4,780	2,167		3,426	1,354	1.40
Sweet potato	W. Sp.	1,018	5.40	5,497	1,018	4.50	4,581	916	
	Su. Au.	0		0	0		0	0	
	Winter	1,179	5.40	6,367	1,179	4.50	5,306	1,061	
	Total	2,197		11,864	2,197		9,887	1,977	1.20
Groundnut	W. Sp.	2,010	1.70	3,417	2,040	1.40	2,856	561	
	Su. Au.			0	0		0	0	
	Winter			0	0		0	0	
	Total	2,010		3,417	2,040		2,856	561	1.20
Green bean & Soybean	W. Sp.	0		0	0		0	0	
	Su. Au.	620	0.81	500	630	0.70	441	59	
	Winter	0		0	0		0	0	
	Total	620		500	630		441	59	1.13
Sesame	W. Sp.	0		0	0		0	0	
	Su. Au.	50	0.70	35	50	0.60	30	5	
	Winter	0		0	0		0	0	
	Total	50		35	50		30	5	1.17
Vegetables	W. Sp.	200	7.20	1,440	200	6.00	1,200	240	
	Su. Au.	532	7.20	3,830	532	6.00	3,192	638	
	Winter	480	7.21	3,462	460	6.00	2,760	702	
	Total	1,212		8,732	1,192		7,152	1,580	1.22
Chili	W. Sp.	70	1.06	74	60	0.80	48	26	
	Su. Au.	0		0	0		0	0	
	Winter	0		0	0		0	0	
	Total	70		74	60		48	26	1.54
Sugar cane	W. Sp.	210	58.00	12,180	210	48.00	10,080	0	
	Su. Au.	0		0	0		0	0	
	Winter	0		0	0		0	0	
	Total	210		12,180	210		10,080	2,100	1.21
Mulberry	W. Sp.	200	6.50	1,300	200	5.90	1,180	120	
	Su. Au.	0		0	0		0	0	
	Winter	0		0	0		0	0	
	Total	200		1,300	200		1,180	120	1.10

Note:

W. - Sp. is from late January to May.

Su. - Au. is from early June to middle September.

Summer is from early July to middle November.

Winter is from late September to middle January.

**Table 4.2.3 Summary of Irrigation and Drainage Improvement Plan (1/3)**  
**(1) Reservoir Irrigation System**

No	Name of Reservoir	Location (Commune)	Actual Irrigated Area (h)		Main work quantities (m <sup>3</sup> )			Activities
			Presently	Proposed	Earth Exc. & Filling	Rock masonry	Concrete	
R1	Vung Huyen	Nam Kim	10	20	1,500	850	3	Repairing main outlet, raising main dam and spillway (0.5 m). Upgrading 0.8 km of main canal by rock masonry and 2 outlets
R2	Ho Thanh	Nam Kim	45	80	5,000	2,000	30	Reconstructing outlet under the main dam, main canal (by rock masonry 1.5km) and one elevated flume and 5 outlets
R4	Vuc Mau	Thanh Son	20	50	1,000	850	3	Raising main dam & spillway (1m) Upg. main canal (1 km) and 2 outlets.
R5	Hao Hao	Khanh Son	15	20	1,000	850	5	Repairing spillway. Upg. 1 km of main canal by rock masonry 2 outlets
R6	Trang den	Nam Hung	45	100	4,500	3,300	15	Upgrading Sub-dam (300m). Repairing spillway; Upgrading 3 km main canal by rock masonry, constructing 3 elevated flumes & 5 outlets
R7	Thung Pheo	Nam Hung	10	15	12,000	1,800	30	Building a new pond upstream. Upgr. main canal by rock mas (2 km) and 2 outlets
R9	Cua Ong	Nam Nghia	100	150	9,000	3,200	10	Raising & enlarging main dam, building filter layer down stream foot, Upgrading 2 km main canal and 10 outlets
R10	Thanh Thuy	Van Dien	70	100	12,000	3,000	100	Repairing outlet, digging pond bed, Upg. main canal 2 km & outlets. (6 units)
R11	Rao Bang	Nam Thanh	100	160	7,000	1,800	5	Raising spillway & dam (50cm). Upg. main canal (1 km) and 10 outlets.
R17	Khe Dinh	Nam Xuan	40	60	3,500	900	-	Raising and enlarging main dam 0.5 and 1 m respectively, repairing spillway and energy dissipater. Upg. 1 km main canal and 5 outlets (20 units)
R19	Khe Bo	Nam Linh	15	35	4,000	1,700	20	Raising main dam (50cm). Repairing main outlet, Upg. main canal (2km) by rock masonry and 3 outlets.
R20	O O	Nam Linh	15	15	4,000	900	5	Raising main dam (50cm), repairing spillway. Upg. main canal ( 1 km) and outlets of 2nd canals (2 units)
RN1	Khe Dien	Nam Hung	0	30	30,000	2,100	45	Newly built of head work, main canal 2 km and 3 outlets of 2 nd canals
RN2	Da Han	Nam Thanh	95	220	170,000	5,700	1,000	Completing 2nd phase of main dam from +29.4 to +33.4, main spillway, main canal
RN3	Ba Khe	Nam Loc	0	150	220,000	7,000	270	Newly built of head works and 2km main canal, outlets of 2nd canals (8 units).
<b>TOTAL:</b>			<b>580</b>	<b>1205</b>	<b>484,500</b>	<b>35,950</b>	<b>1541</b>	

Note RN : New Construction

**Table 4.2.3 Summary of Irrigation and Drainage Improvement Plan (2/3)**  
**(2) Pump Irrigation System**

Code No.	Name of Pumping Station	Location (Commune)	Required Total Capacity (m <sup>3</sup> /h)	Dimensions		Command Area		Main work quantities			Activities
				Presently	Proposed	Presently	Proposed (ha)	Earth excavation & filling	Rock masonry	Concrete	
P1	Duong dap	Nam Kim	968	1x1,000	2x1,000	90	100	500	1,500	10	Upp. pump house, 1 km of main canal & 6 outlets of 2 nd
P7	Nam Cuong	Nam Cuong	1,355	2x1,000	2x1,000	96	140	1,100	1,600	20	Upp. pump house, 1 km main canal and 8 outlets of secondary
P9	Nam Trung	Nam Trung	4,841	6x1,000	5x1,000	450	500	3,500	9,000	95	Newly building pump house for flood protection, Upp. main canal (3 km) and 10 outlets of 2nd canal.
P10	Du DU	Khanh son	775	2x1,000	2x1,000	40	80	1,000	1,500	5	Upp. 1 km of main canal, 5 outlets of 2 nd canal
P13	Khanh Son 2	Khanh Son	678	2x1,000	2x1,000	60	70	1,500	1,100	40	Newly building pump house for flood protection and repairing canal system (0.5 km) by rock masonry, 3 outlets of 2 nd canal
P16	Nam Dong	Nam Dong	7,745	9x1,000	9x1,000	253	800	11,000	22,500	120	Upp. 8km main canal by rock masonry, 20 outlets of 2nd canals, 3 elevated flumes and tertiary outlets (100 units)
P17	Nam Loc	Nam Loc	968	3x1,000	2x1,000	100	100	2,000	2,800	65	Replacing pump sets, newly building pump house for flood protection, Upp. 1 km main canal by rock masonry & 6 outlets
P19	Nam Tan	Nam Tan	1,936	4x1,000	4x1,000	110	200	3,000	5,000	15	Upp. 2.5 km main canal, 2nd outlets (10 units) and 6 bridges across main canal
P20	Dai Dong 1	Nam Thuong	871	2x420	2x540	60	90	1,100	1,200	10	Exchanging pump type, Upp. 1 km of main canal & 7 outlets.
P21	Dai Dong 2	Nam Thuong	581	1x1,000	1x1,000	20	60	2,000	1,000	45	Newly building pump house, Upp. 500 m of main canal & 5
P22	Hong Son	Nam Thuong	775	1x480	2x480	50	80	1,000	1,200	10	Upgrading 1 km main canal, 6 outlets of 2nd canals, adding one more pump set.
P23	Ru Dun	Van Dien	1,936	2x540 m <sup>2</sup> /4x540 m <sup>2</sup>		70	200	3,500	4,400	95	Newly building pump house, upgrading 3km main canal, 10 outlets (enlarged command area) of 2nd canal and 2 elevated
P26	Nam thai	Nam Thai	968	2x1,000	2x1,000	80	100	1,500	2,500	90	Newly building pump house for flood protection, Upp. 1.5km of main canal and 8 outlets of 2nd canals.
P27	Sen doi	Nam Xuan	775	1x1,000	1x1,000	30	80	800	1,200	3	Upp. 1 km of main canal, 4 outlets of 2 nd canal
P28	Ghenh station	Hung tu	3,098	4x1,000	4x1,000	102	320	1,500	4,000	15	Upp. 2 km of main canal, 2 outlets & 4 bridges of 2 nd canal.
P29	Hong Long 1	Hong Long	1,307	2x1,000	2x1,000	80	135	1,500	2,500	90	Newly building pump house for flood protection, Upp. 1.5km of main canal and 9 outlets of 2nd canals.
P30	Hong Long 2	Hong Long	1,936	3x1,000	3x1,000	150	200	2,000	3,500	90	Newly building pump house for flood protection, Upp. 1.5km of main canal and 10 outlets of 2nd canals.
P31	Xuan Lam	Xuan Lam	3,195	3x1,000	4x1,000	200	330	2,500	4,000	95	Newly built at other site, Upp. canal system (2 km) and 15
P33	Ru Doi	Nam quang	484	1x1,000	1x1,000	20	50	1,500	1,200	10	Newly building pump house, 1km of main canal, 3 outlet of 2
PN1	Nam Cuong	Nam Cuong	1,162	-	2x1,000	-	120	2,000	3,200	90	Newly built at Lam river bank, 2 km of main canal and 8 outlets of 2 nd canal.
<b>TOTAL:</b>						<b>2,061</b>	<b>3,755</b>	<b>44,500</b>	<b>74,900</b>	<b>1,013</b>	

Note PN : New Construction

## 4.2.3 Summary of Irrigation and Drainage Improvement Plan (3/3)

### (3) Drainage System

#### (a) Flood Privation Plan

No.	Region	Befitted Area (ha)		Main work quantities		
		Total	Cultivated Land	Earth Exca. & Filling	Rock Masonry (m <sup>3</sup> )	Concrete (m <sup>3</sup> )
F1	Nam Nam Dike	7,727	2,370	16,600	3,400	50
F2	North the Lam River Dike Onfarm	1,070	1,750	25,500	500	50
		510	360	1,000	100	10
		560	1,390	24,500	400	40
F3	Tan Loc Thuong Dike Onfarm Embankment	2,665	808	402,000	15,000	105
		750	750	381,000	4,600	45
		2,665	808	16,000	400	60
				5,000	10,000	
F4	Thien Nhan Mauntain Dike Onfarm	4,500	750	20,000	300	30
		4,500	750	20,000	300	30

#### (b) Drainage Improvement Plan

No.	Region	Befitted Area (ha)		Main work quantities		
		Total	Cultivated Land	Earth Exca. & Filling	Rock Masonry (m <sup>3</sup> )	Concrete (m <sup>3</sup> )
D1	Nam Nam Drainage improvement	1,650	1,400	57,000	650	60
D2	Hong Long Drainage	1,699	950	36,000	450	50



Table 4.2.4 Outline of Agricultural Supporting Service Project

Title	Type of Organization	Facility/Equipment	Activities/Functions	Precondition/Requirement	Benefits expected
Agricultural Extension Center	Official Organization under The People's Committee of Nam Dan District (New establishment)	1) Facility Office building, Equipment warehouse, Garage, Parking 2) Equipment Computer, Copying machine, Audio-visual instruments, 4WD Vehicle, Motorbike	1) Analysis of limiting factors of productivity 2) Introduction & propaganda of good varieties 3) Exhibition of single technologies (through Model Plot) 4) Exhibition of model farming practice (High profitable farming system by original idea of farmers themselves, in addition to the instruction by the Center) 5) Visiting instruction by commune specialist 6) Technical training, course tours	1) District Authority should prepare land 2) District Authority should arrange 35 staff 3) District should prepare budget	1) Definition of essential factor for productivity up 2) High yielding & high profit farming is achieved by introduction of good varieties and new technology 3) Farmers of model farm understand necessity of level up by self-effort 4) Many farmers who visited model farm can get easily new technology
Seed Supply Center	Official Organization under The People's Committee of Nam Dan District (New establishment)	1) Facility Office building, Processing room, Seed storage (with equipment for low temperature & low humidity), Equipment warehouse 2) Equipment Seed processing equipment, Truck, 4WD Vehicle, Heat insulator panel, Thermo-humid automatic control equipment of seed storage	1) Production of high quality seed on the contract basis 2) Preservation of the produced seed keeping high quality 3) Timely distribution of the high quality seed to farmers	1) District Authority should prepare land 2) District Authority should arrange 16 staff 3) District should prepare budget	1) Cash income of farmers increases by sale of farm surpluses which are got owing to use high quality seeds 2) Cropping increase of more profitable crops becomes possible 3) Crop diversification becomes easy
Nursery Center	Official Organization under The People's Committee of Nam Dan District (New establishment)	1) Facility Office building, Working building, Equipment warehouse, Garage, Nursery field 2) Equipment Hand tractor with implement Truck, Motorbike The Center covers 1,400 ha of fields which are located in the Priority Irrigation and Drainage Improvement Project Area	1) Introduction, multiplication and distribution of seedlings of good variety of fruit tree	1) District Authority should prepare land 2) District Authority should arrange 5 staff 3) District should prepare budget	1) Increase of production and improvement of quality of fruits are achieved
Agricultural Mechanization Service Center	Official Organization under The People's Committee of Nam Dan District (New establishment)	1) Facility Office building, Agr. machinery warehouse, Equipment warehouse, Nursery facility, Workshop, Worker post, Garages, Car wash area 2) Equipment Power tiller with rotary set, Rice transplanter, Reaper, Power thresher, Trailer, Plow, Ridger, Nursery equipment, Truck, 4WD Vehicle, Motorbike. Equipment for workshop	1) Training of operation technique of farming machine and conferment of the license 2) Lending of farming machine to licensed farmers 3) Implementation of contracted farming 4) Maintenance and repair of machinery 5) Advice and guidance on farm mechanization 6) Guidance on farm mechanization for the Farming Model Farms	1) District Authority should prepare land 2) District Authority should arrange 76 staff 3) District should prepare budget	1) Increase of crop production is resulted through timely farming 2) Farmer's income increases because surplus labor force is used to animal feeding, fish culture and fruit tree cultivation, and is used also other industry which makes get higher wages

Table 4.2.5 Contents of Projects formulated by the Study in the Field of Agro-industry and Marketing (1/2)

No.	Title	Type of Organization	Facility/equipment	Activities/Functions	Precondition/Requirements	Benefits expected
1	Agro-processing Complex	Private Enterprise by Farmers Established newly	1)Rice Mill 2)Husk Fed Grain Dryer 3)Feed Mill 4)Ground Nuts Expeller 5)Raising Facilities for Cows, Chickens and Pigs 6)Warehouse	1)Rice milling service by reducing processing losses for farmers and procurement of husk and bran 2)Drying service for farmers to avoid losses in rainy season 3)Producing ground nuts oil for farmers and by commercial and procurement of oil cakes 4)Producing feeds using by-products of services above and additional materials procured 5)Intensive raising animals and fishes by extra manpower in the area using produced feed, in addition to operating members' VAC farming in their own lands	1)Organizing Farmers 2)District Authority should allocate appropriate land with pond for the enterprise a)Training of machinery operation and maintenance b)Training for improvement of raising animals and fish	1)Demonstration effect of modern advanced group farming system in conformity with VAC programs and free market mechanism 2)Demonstration effect of better post-harvest processing method to reduce losses and improve quality 3)Provision of profit to member farmers by supplying qualified feed by lower price 4)Generating bargaining power of products to markets 5)Generating procurement power for raw materials 6)Generating profit by selling products 7)Possibilities of expanding activities in the fields of agro-industry as meet processing and of marketing as group forwarding and trading 8)Absorption of extra labor in agricultural sector in the area
2	Group Facility for Silk Yarn Production	Private Enterprise by silk worm raising farmers Established newly	1)Facility for group raising worms and for yarn production 2)Yarn producing equipment from cocoons	1)Group raising worms in a place during first 2/3rd days of whole period to reduce losses occurred by diseases and uniform the quality of silk, after which member farmers raise worms as usual 2) Produce and sell yarn by the Enterprise	1)Organizing Farmers 2)District Authority should allocate appropriate land for group activities to the Enterprise a)Research and introducing appropriate worm variety for exporting market	1)Demonstration effect of modern advanced group silk yarn producing system 2)Demonstration effect of better silk worm raising method to reduce losses and improve quality 3)Generating bargaining power of products by quantity 4)Provision of more profit to member farmers by selling yarn in place of cocoons 5)Possibilities of expanding activities in the fields of agro-industry as knitting silk and of marketing as group forwarding and trading 6)Absorption of extra labor in agricultural sector in the area

Table 4.2.5 Contents of Projects formulated by the Study in the Field of Agro-industry and Marketing (2/2)

No.	Title	Type of Organization	Facility/equipment	Activities/Functions	Precondition/Requirements	Benefits expected
3	Market-oriented Forwarding Center	Private Enterprise by Farmers Established newly	1) Information center equipped with computers and telephone 2) Forwarding facility with warehouse for agricultural products 3) Trucks	1) Collecting and accumulating daily and / or weekly market information of several markets such as Nam Dan, Vinh, Hue and Hanoi 2) Analysis of information to know market needs in view of many parameters such as trend of pricing, quality requirement and trend of exporting by each commodities and by which forecasting markets condition 3) Plan of the strategic farming schedule in view of all farm area of members not for each farm to meet markets needs and more profit 4) Gathering and combining and / or packaging convenient unit to market requirements, and forwarding to markets 5) Utilizing warehouse and watching daily market information, forwarding products on the best time and to the best destination markets by trucks	1) Organizing Farmers in the area which various kinds of commercial crops could be produced through a year 2) District Authority should allocate appropriate land for group activities to the Enterprise 3) Market authorities should give market information with favor a) Training of marketing to the management staff b) Training of information collection and analysis	1) Demonstration effect of strategic group farming system relied on information analysis for market demand 2) Demonstration effect of better storage to reduce losses and improve quality 3) Generating purchasing power for agricultural in pulps 4) Generating bargaining power to markets 5) Generating more profit to member farmers by strategic farming to meet market demand 6) Possibilities of expanding activities in the fields of agro-processing industry adding value to their products 7) Absorption of extra labor in agricultural sector in the area
4	Confectionery Factory	Existing State-owned Enterprise under People's Committee of Nam Dan District	1) A series of machinery producing confectioneries such as candy, cake and snack 2) Packaging, storage and forwarding facilities with trucks 3) Workshop	1) Renovate existing facilities 2) Development new products in addition to candy using local products as raw materials 3) Producing various products with competitiveness in markets in view of price, quality and design	1) District Authority should assign enough No. of qualified workers a) Training of marketing b) Training of machinery operation and maintenance	1) Increasing consuming amount of local products as raw materials 2) Absorption of extra labor in agricultural sector in the area 3) Introduction to new corners of agro-processing factory in the area 4) Possibilities of expanding activities to the general food-processing industry
5	Pine Tree Gum Processing Facility	Existing State Farm for implementing National Program of planting trees in mountainous area in the District	1) A series of processing machinery such as steam distiller (study continuation)	1) Introduction of processing machinery 2) Producing proper products with competitiveness in markets in view of price and quality.	a) Training of machinery operation and maintenance b) Training of marketing	1) Increasing income by emphasizing activities of producing qualified resin and sell it 2) Generating proper incentives for workers even for workers engaging planting activities
6	Group Facility for Soy Source Production	Private Enterprise by soy source producing farmers Established newly	1) Machinery and equipment for preparation and post-fermentation processing 2) Storage facilities to avoid quality deterioration	1) Formulate group activities on preparation process of raw materials and post-fermentation process such as bottling and labeling 2) Fermentation process by each member farmers conserves traditional method.	1) Organizing soy-source producing farmers a) Training of machinery operation and maintenance b) Training of marketing	1) Providing stable subsidiary income to farmers 2) Increasing profitability by stable forwarding in quantity and uniform quality through a year

Table 4.2.6 Summary of Proposed Water Supply Plan

Scheme	New Scheme					Improvement Scheme	
	System N-1	System N-2				Improve I-1	Improve I-2
System No.	Nam Dan Town	Dried-up Area	Inundation Area	Plain Area		Nam Anh Comm.	Out of New Scheme
Service Area							
Number of Communes	1	17		5		1	6
Average Number of Households per Commune	1,328	1,318	1,452	1,722		1,527	1,406
Average of Population per Commune in 2,010	7,092	6,708	7,952	9,456		3,181	7,496
Planning Criteria							
(a) Water source	Deep well	Deep well	Deep well	Deep well	Stream		Shallow well
(b) Type of system	House connection	Public hydrants	Public hydrants	Public hydrants	Public hydrants		Hand pump
(c) Unit water demand (l/capita/day)	60	30	30	30	30	30	30
(d) Average daily demand (m <sup>3</sup> /day)	426	201	239	284		95	-
(e) Average daily distribution (m <sup>3</sup> /day)	501	237	281	334		112	-
(f) Maximum daily distribution (m <sup>3</sup> /day)	680	320	380	450		-	-
(g) Maximum daily intake (m <sup>3</sup> /day)	800	350	400	500		-	-
Major Facilities							
1) Water Source Facility							
Deep well	120m depth x 6Nos	120m depth x 4No	100m depth x 1No	80m depth x 1No			
Submersible intake pump	0.2 m <sup>3</sup> /min x 6 No	0.2 m <sup>3</sup> /min x 4No	0.2 m <sup>3</sup> /min x 1 No	0.2 m <sup>3</sup> /min 1/s x 1 No			
2) Treatment Facility							
Treatment equipment	6 m <sup>2</sup> x 2 beds	3 m <sup>2</sup> x 2 beds	4 m <sup>2</sup> x 2 beds	5 m <sup>2</sup> x 2 beds			
Distribution reservoir	70 m <sup>3</sup>	30 m <sup>3</sup>	35 m <sup>3</sup>	35 m <sup>3</sup>			
Distribution pump	0.4 m <sup>3</sup> /min x 3 units	0.3 m <sup>3</sup> x 1 unit	0.4 m <sup>3</sup> x 1 unit	0.4 m <sup>3</sup> x 1 unit			
3) Distribution Facility							
Distribution pipeline	10,000 m	10,000 m	10,000 m	10,000 m		400 m	-
Number of public taps	5 Nos	30 Nos	30 Nos	30 Nos		3 Nos	-
4) Filter tank	-	-	-	-		2 m <sup>3</sup> x 2 Nos	2 m <sup>3</sup>



Table 4.3.1 Implementation Plan of Master Plan

Project	Project Cost (mil. VND)	OM Cost (mil. VND/Y)	Compreh. Assess.	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Remarks
<b>Irrigation/Drainage</b>																
-Reservoir Irrigation System Ho Thanh, Trang den, Cua Ong, Rao Bang	74,815	1,377	A													
-Pumping Irrigation System Nam Dong, Nam Cuong 2																
-Inundation Mitigation Project Nam Nam Dike																
-Reservoir Irrigation System Vung Huyen, Vuc Mau, Hao Hao, Khe Dinh, Khe Bo	54,684	1,270	B													
-Pumping Irrigation System Nam Cuong 1, Du DU, Nam Tan, Dai Dong 1, Ru Dun, Gheng station, Xuan Tam																
-Reservoir Irrigation System Thanh Thuy, Da Han	94,700	1,535	C													
-Pumping Irrigation System Nam Trung, Dai Dong 2, Sen doi, Hong Long 1, Hong Long 2, Ru Doi																
-Drainage Improvement Project Nam Nam Drainage Improvement																
<b>Agricultural Supporting Service</b>																
Agriculture Extension Center, Seed Supply Center, Agricultural Mechanization Service Center	65,608	9,130	A													
Nursery Center	5,085	40	B													
<b>Agro-industry and Marketing</b>																
Agro-processing Complex, Market-oriented Forwarding Center	20,361	451	A													
Improvement of Confectionery Factory, Group Communal Facility for Silk Yarn, Group Communal Facility for Soy-sauce Production, Pine Tree Gum Processing Facility	10,643	180	B													
<b>Health and Sanitation</b>																
Rural Health and Sanitation Improvement			A													
<b>Education Facilities</b>																
School Electrification, Improvement of School Facilities	23,628		A													
Establishment of Technical Middle School, Providing Teaching Aids for School	52,991	359	B													
Expansion of Regular Educational Center, Expansion of Vocational Center	26,439	209	C													
<b>Rural Road Improvement</b>																
Route 15A (Northern Part), (Southern Part), 42 Dike Road, 42 Dike-Kim Lien Road, Phan Boi-Chua Road, Hung Tien-Nam Linh Road, Kim Lien-Nam Cat Road, Nam Tan-Nam Loc Road, Nam Nam Dike Road, Nam Kim-Nam Phuoc-Nam Trung Road	178,291	2,284	A													
Cau-Sao Market Road, Nam Thanh-Nghi Loc Road, Nam Thai Road, Northern Ring Road, Nam Trung- Nam Phuoc-Nam Cuong Road	66,286	797	B													
<b>Rural Electrification</b>																
Complete Electrification, Rehabilitation of Distribution Network	113,590	1,460	A													
Up-grading of Distribution Network	142,720	903	B													
<b>Rural Water Supply</b>																
Public Water Supply System (Dried-up Area), ditto (Inundation Area), Material Supply of Filter Tank	75,477	1,729	A													
Public Water Supply System (Plane Area), Improvement of Existing Gravity Flow System	10,150	667	B													
House Connection System (Nam Dan Town)	6,603	200	C													
<b>Environmental Conservation</b>																
Erosion Control	2,074		A													
<b>Project Cost</b>	1,023,449	22,590		25,389	191,591	129,264	130,572	49,371	47,131	104,976	114,076	113,980	45,405	38,803	38,803	
<b>OM Cost</b>				2%	19%	13%	13%	5%	5%	10%	11%	11%	4%	4%	4%	
						11,056	13,019	14,945	15,860	26,602	210,932	18,968	20,248	21,023	21,616	

\*: Project Cost excludes price escalation.




 Preparation
 Construction Period
 Program Implementation



Table 4.4.1(1/2) Check List of Initial Environmental Examination ( I: Social Environment )

(1/2)

Category of Environment Impacts	Evaluation	Note	Mark	Remark
<b>1. Socioeconomic Issues</b>				
<b>1) Social Aspects</b>				
(1) Planned agricultural settlement	No	No settlement plan	C	
(2) Involuntary resettlement	Yes	Lands and houses have possibility that are expropriated partially by expansion of road width; resettlements of 8 residential houses are needed by establishment of new pumping station.	B	Land guarantee and monitoring
(3) Substantial changes in ways of life	No	No change of life style	C	
(4) Conflict among communities and peoples	No	Most of people consist of farmer and they can benefit by rural development project.	C	
(5) Impacts on indigenous peoples, ethnic minorities and nomads	No	There are not indigenous peoples, ethnic minorities and nomads in the district.	C	
<b>2) Demographic Issues</b>				
(6) Population increase	No	Rapid increase of population does not occur by the development project.	C	
(7) Drastic change in population composition	No	No drastic change in population composition	C	
<b>3) Economic Activities</b>				
(8) Relocation of basis of economic activities	No	The basis of economic activities is agriculture and the project does not change the basis.	C	
(9) Occupational change, loss of labor opportunity	No	Labor opportunities are accelerated through construction work of the project.	C	
(10) Increase in income disparities	No	Most of people can equally get the benefit of the project.	C	
<b>4) Institutional and Custom related Issues</b>				
(11) Adjustment and regulation of water or fishing rights	Yes	Rehabilitation and new construction of irrigation facilities are proposed. Therefore, adjustment of water right is needed to avoid negative impact between beneficiaries.	B	Proper adjustment and countermeasure are needed.
(12) Changes in social and institutional structures	Yes	Reinforcement of farmer's organization need the change in social and institutional structures.	B	Requirement of new
(13) Changes in existing institutions and customs	No	No change	C	
<b>2. Health and Sanitary Issues</b>				
(14) Increased use of agrochemicals	No	According to farming program, increase use of agrochemicals is not planned.	C	
(15) Outbreak of endemic diseases	Yes	4 schistosomiasis patients are recorded.	B	Countermeasure and monitoring
(16) Prevalence of epidemic diseases	Yes	174 malaria patients are recorded.	B	Countermeasure and monitoring
(17) Residual toxicity of agrochemicals	No	According to farming program, increase use of agrochemicals is not planned.	C	
(18) Increase in domestic and other human wastes	No	Domestic and other human wastes does not increase without drastic increase of population.	C	
<b>3. Cultural Issues</b>				
(19) Impairment of historic remains and cultural assets	No	The development project is not planned in cultural assets.	C	
(20) Damage to aesthetic sites	No	Inharmonious and enormous structures that damage to aesthetic sites are not planned.	C	
(21) Impediment of mineral resources exploitation	No	There are no valuable mineral resources.	C	

Mark classification; A: Impact is deemed strong, B: Some impact, C: Impact is very small



Category of Environment Impacts	Evaluation	Note	Mark	Remark
<b>4. Biological and Ecological Issues</b>				
(22) Deterioration or degradation of vegetation	No	Land reclamation in the forest area is not proposed.	C	
(23) Negative impact on important or indigenous fauna and flora	No	The project area consists of cultivated land and artificial forests.	C	
(24) Degradation of ecosystem with biological diversity	No	Valuable species are seldom found in the project area.	C	
(25) Proliferation of exotic and/or hazardous species	No	According to farming program, exotic crop and alteration of vegetation does not be proposed.	C	
(26) Encroachment on wetland and peat swamp	No	There are not wetland and peat swamp.	C	
(27) Encroachment on tropical forests	No	Tropical forests are seldom found.	C	
(28) Destruction or degradation of mangrove forests	No	Mangrove forest near the estuary of Lam river does not be affected directly by the project.	C	
(29) Degradation of coral reef	No	No coral reefs near the estuary of Lam river inhabit.	C	
<b>5. Soil and Land Resources</b>				
<b>1) Soil Resources</b>				
(30) Soil erosion	Yes	Soil erosion should be paid attention because a large quantity of soil is needed for road plan, reservoir plan and flood protection plan.	B	Regulation for excavation and monitoring
(31) Soil salinization	No	The project does not accelerate soil salinization.	C	
(32) Deterioration of soil fertility	No	It can be avoided by adequate soil management and suitable cropping pattern.	C	
(33) Soil contamination by agrochemical	No	According to farming program, use of agrochemical and fertilizer is existing level.	C	
<b>2) Land Resources</b>				
(34) Devastation or desertification of land	No	The district consists of paddy field and forest area that managed well.	C	
(35) Devastation of hinterland	No	Land reclamation in hinterland does not be proposed.	C	
(36) Ground subsidence	No	Intake from groundwater is limited to domestic water.	C	
<b>6. Hydrology and Air and Water Quality Issues</b>				
<b>1) Hydrology</b>				
(37) Changes in surface water hydrology	No	Increase of intake from Lam river and reservoir is 2 to 3 m <sup>3</sup> /s.	C	
(38) Changes in groundwater hydrology	No	Intake from groundwater is limited to domestic water.	C	
(39) Inundation and flood	No	Rather, flood and inundation decrease by improvement of drainage system.	C	
(40) Soil sedimentation	Yes	Soil sedimentation may occur in reservoirs, canals and pumping station, if no countermeasure.	B	Watershed conservation
(41) Riverbed degradation	No	The construction plan such as head work is not proposed in Lam river.	C	
(42) Impediment of inland navigation	No	There are no facilities plan that affect inland navigation.	C	
<b>2) Water quality and temperature</b>				
(43) Water contamination and deterioration of water	No	According to farming program, increase use of agrochemicals is not planned.	C	
(44) Water eutrophication	No	According to farming program, increase use of fertilizer is not planned.	C	
(45) Sea water intrusion	No	Increase of intake from Lam river and reservoir is 2 to 3 m <sup>3</sup> /s.	C	
(46) Low irrigation water temperature	No	Existing water temperature is over 20 degree (Nov. 1996).	C	
<b>3) Atmosphere</b>				
(47) Atmosphere pollution	No	No source	C	

Mark classification: A: Impact is deemed strong, B: Some impact, C: Impact is very small

## *CHAPTER 4 : FIGURES*



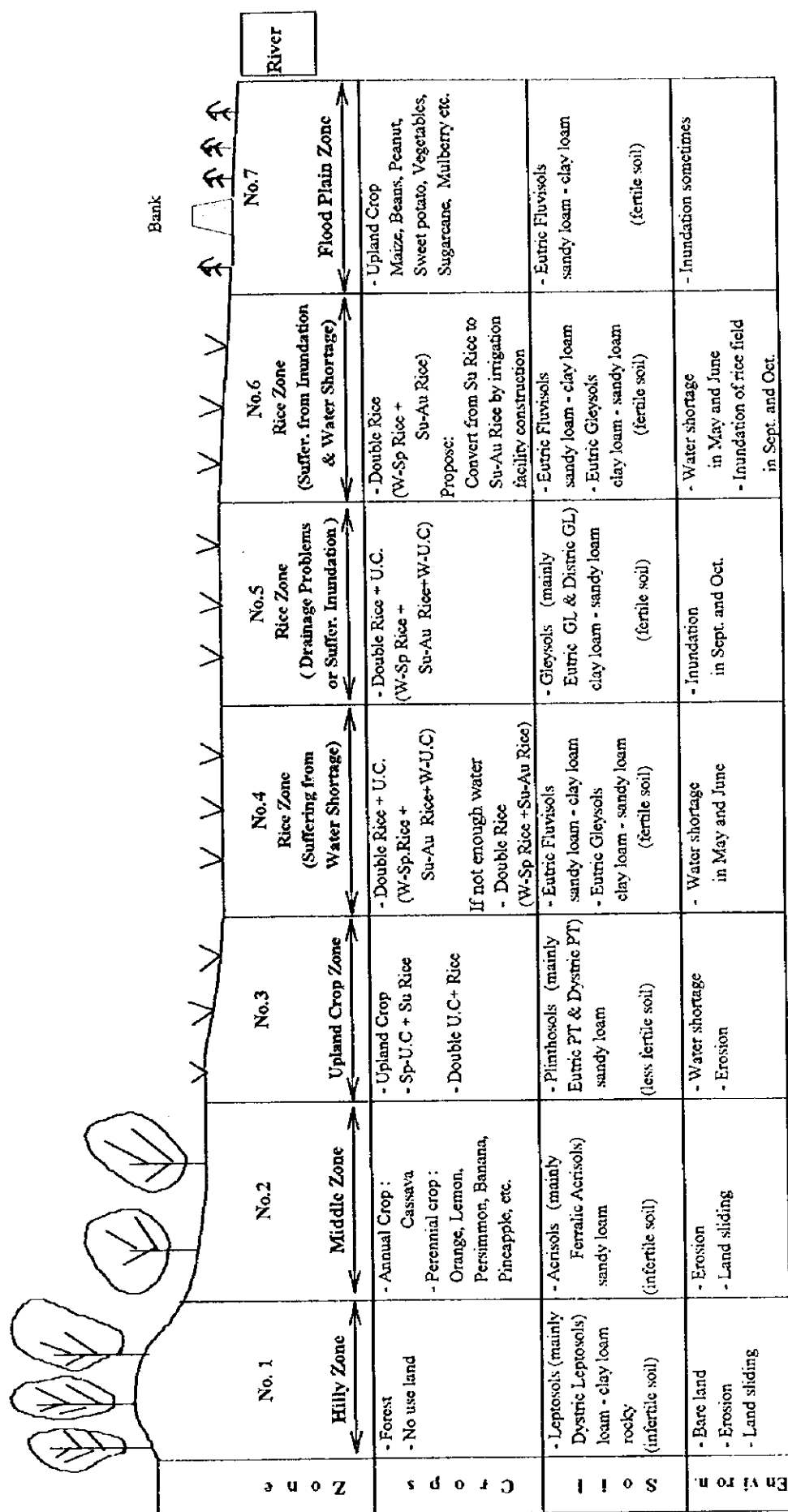


Fig. 4.2.1 Basic Concept of Agricultural Land Use Plan

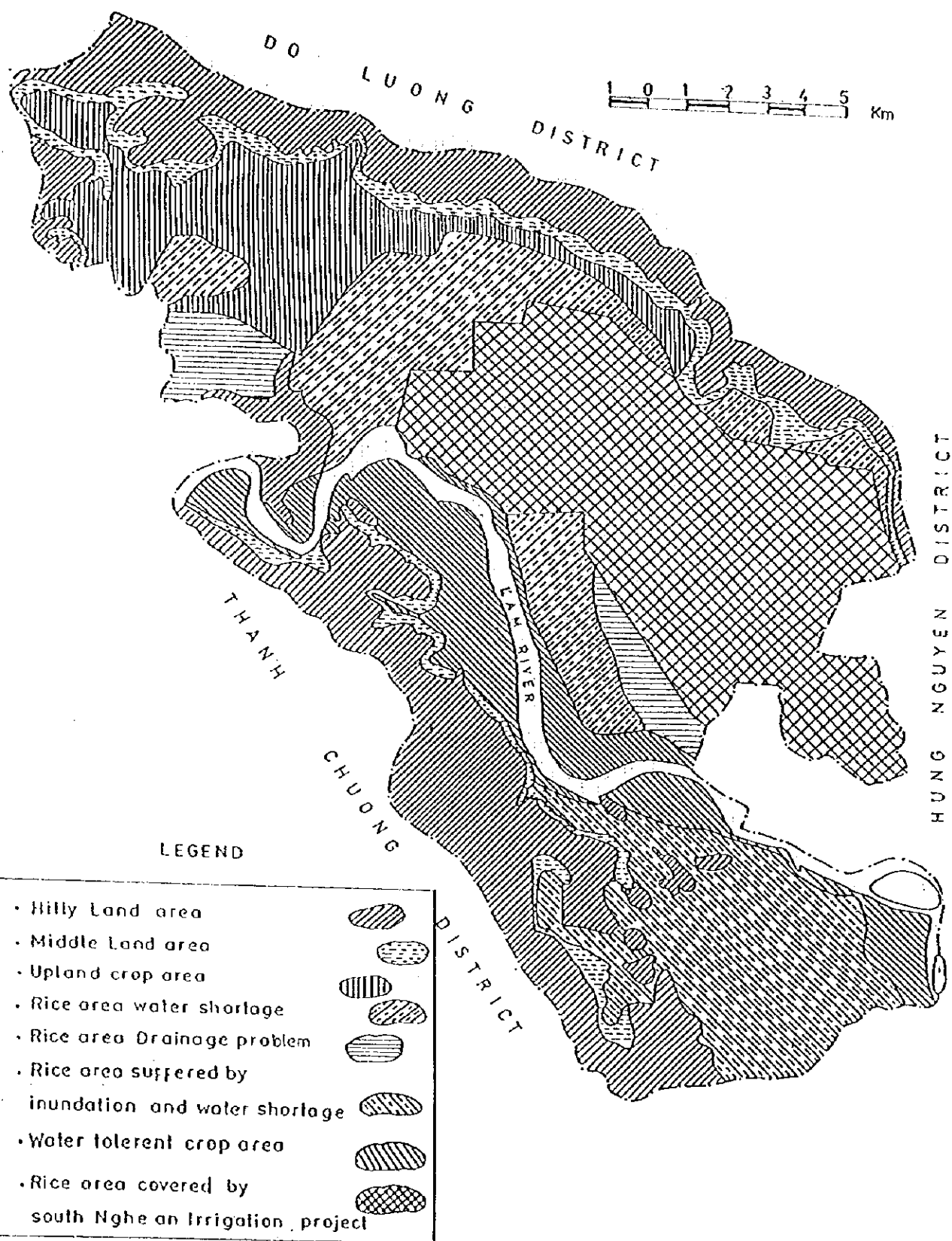


Fig. 4.2.2 Proposed Zoning Map

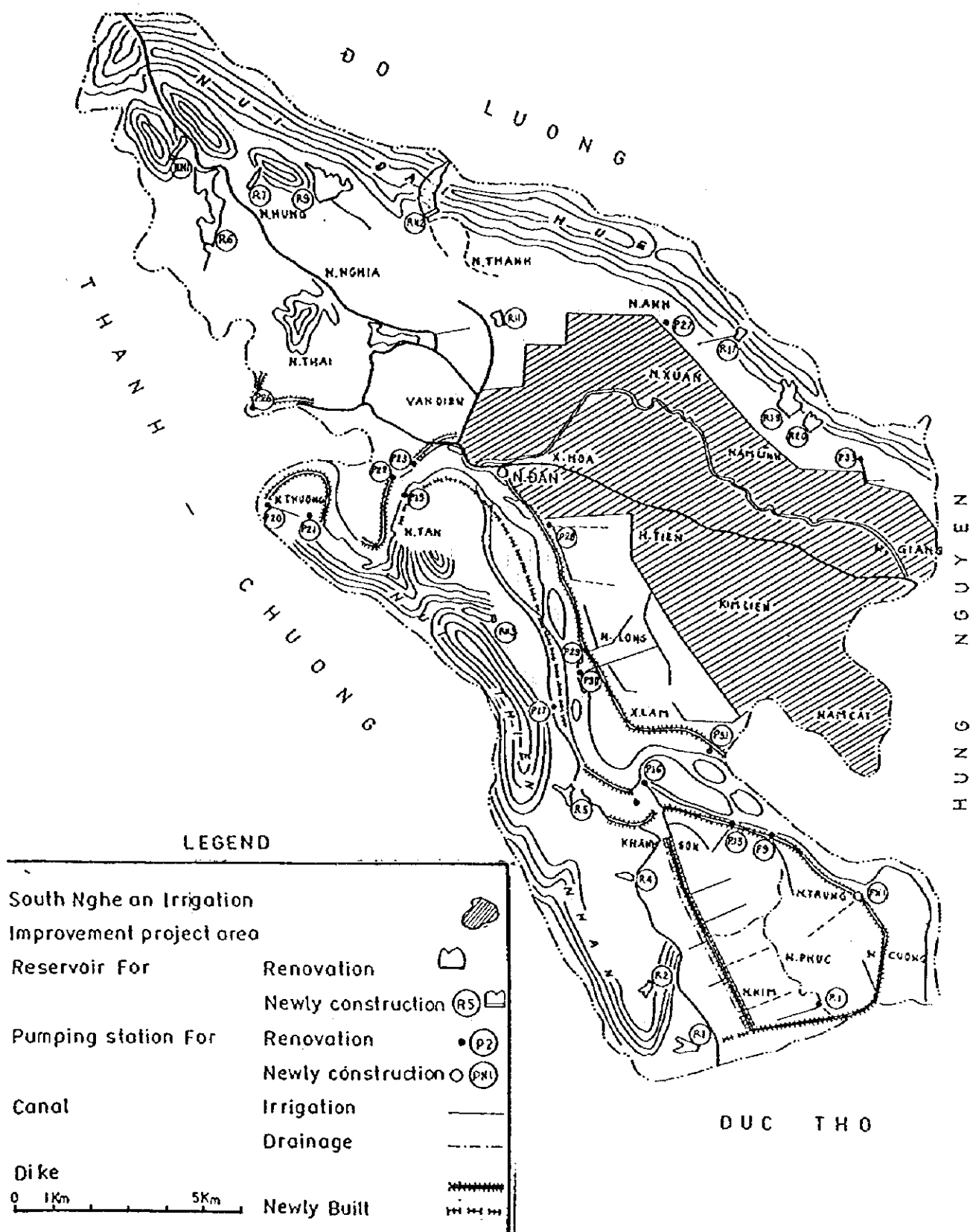


Fig 4.2.3 Proposed Projects for Irrigation and Drainage

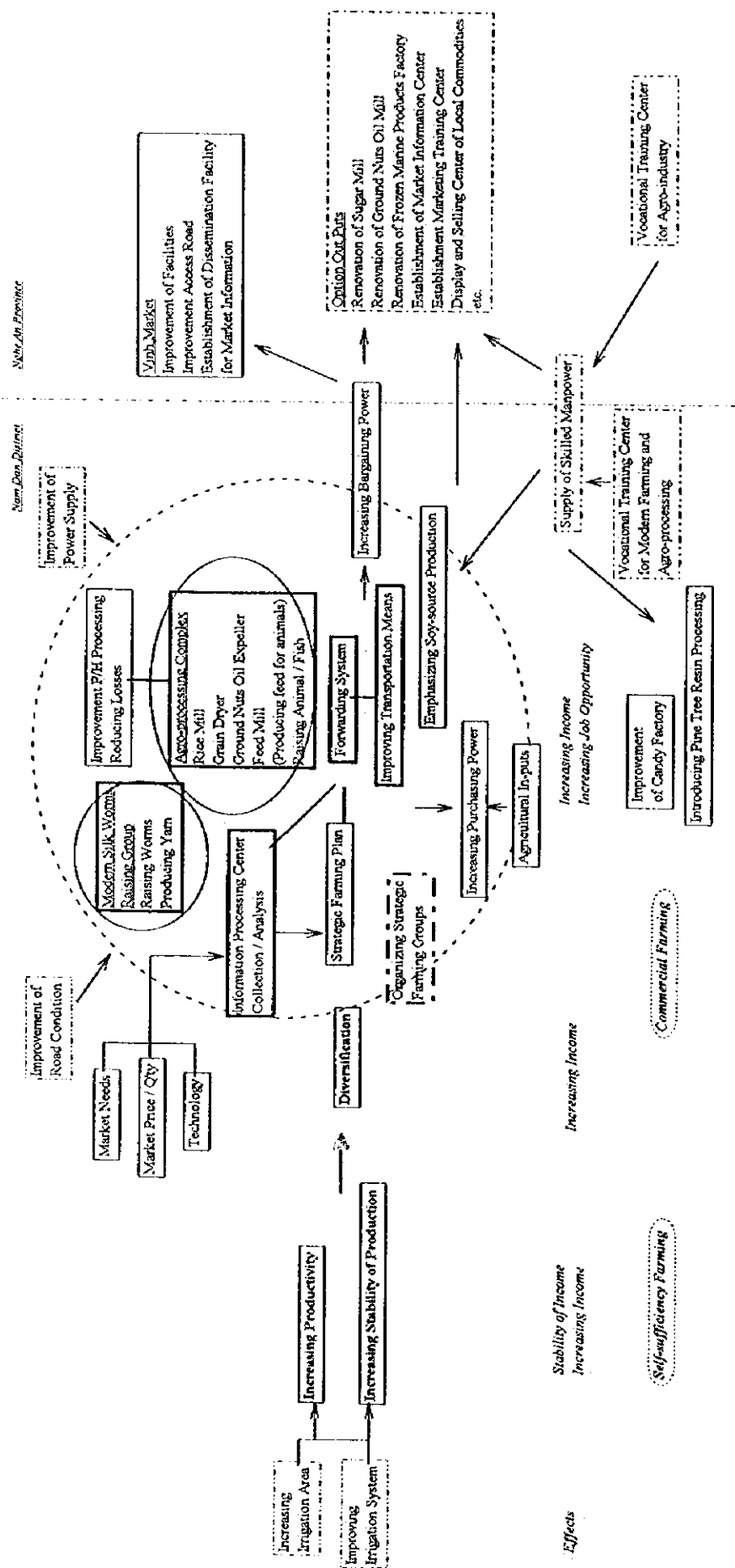


Fig. 4.2.4 Relationship between Farming Practices and Agro-industrial and Marketing Projects

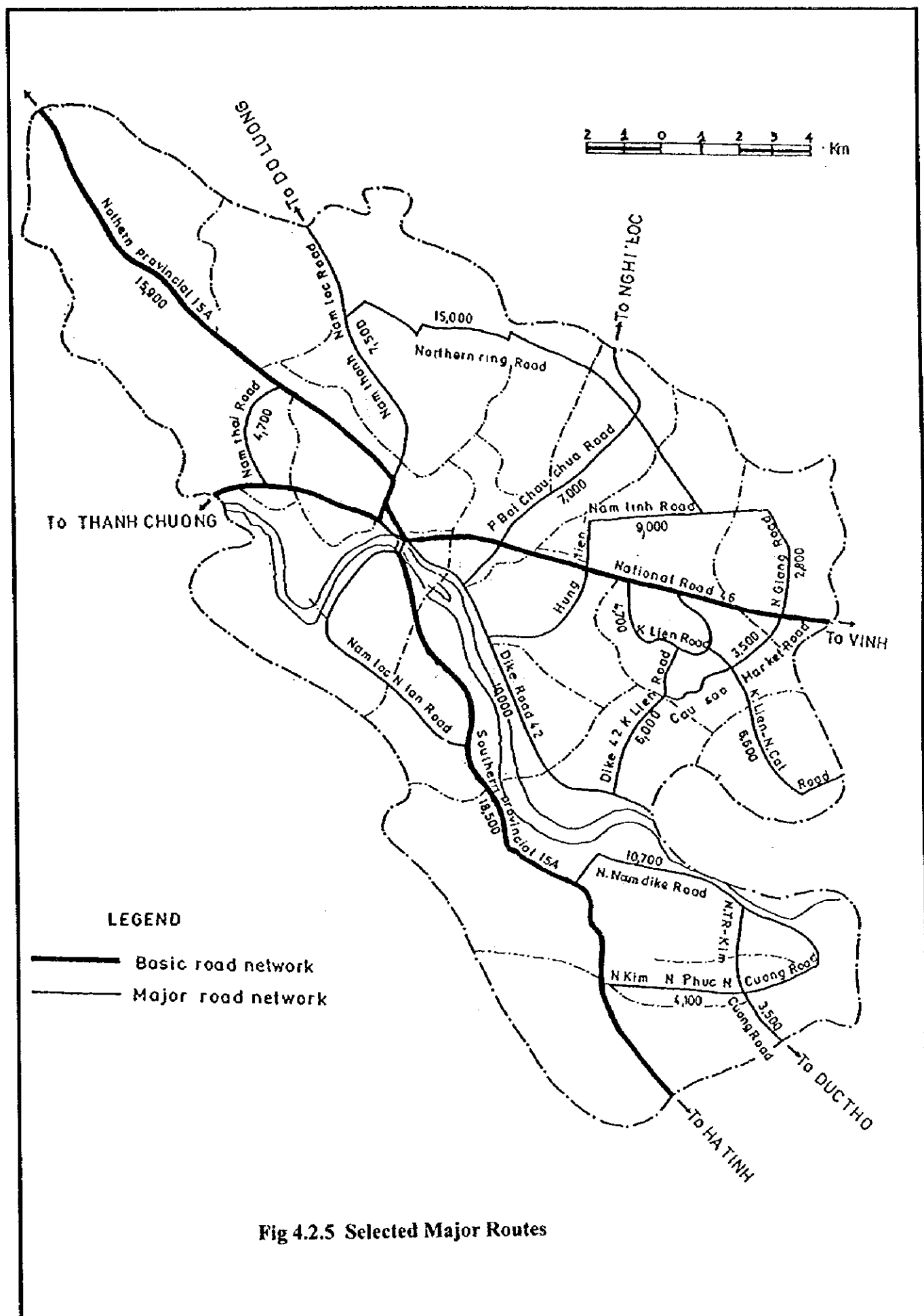


Fig 4.2.5 Selected Major Routes





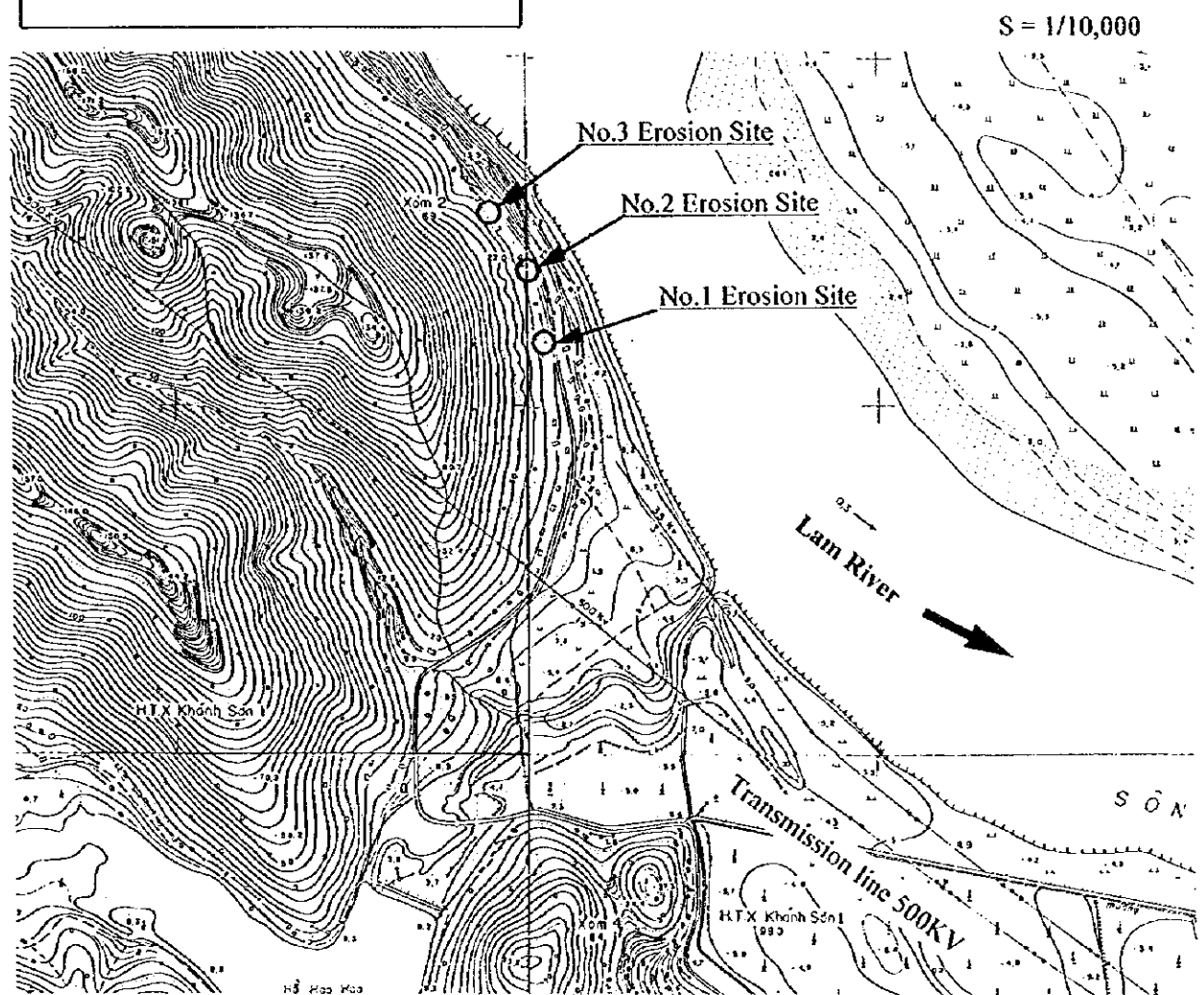
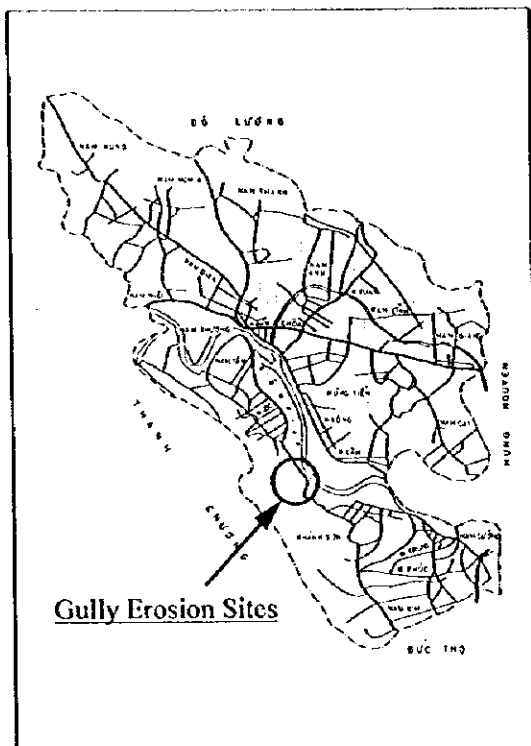


Fig. 4.2.7 Proposed Sites of Erosion Control Project

## *CHAPTER 5 : PRIORITY PROJECTS*

## CHAPTER 5 : PRIORITY PROJECTS

The results of the study on selected priority projects in Chapter 4 are described in this chapter in detail. However, as it is expected that the activities of the improvement plan for the health and sanitation sector will be covered by RII project supported by JICA project type technical cooperation, the description on the project in this sector is omitted from this chapter.

### 5.1 AGRICULTURE

#### 5.1.1 Irrigation and Drainage Improvement

##### (1) Irrigation Improvement

From the results of alternative studies for irrigation improvement based on the present conditions, it was considered that the realization of effective water use by utilizing present water sources as much as possible would have the highest feasibility from the technical, economic and environmental view points. Concretely, improvement of canal facilities including renovation of diversion works and strengthening of water management system are proposed. For the reservoir system, considering safety of structure, water balance with catchment area, etc., the improvement of reservoir structures such as heightening of dike, dredging of reservoir are not proposed except for renovation of spillway. On the other hand, as there is enough capacity for present pumping facilities, it is not necessary to improve the present pumping stations. A new pumping station is considered to be installed for non-irrigated area at present.

The facilities for proposed irrigation improvement plan are summarized below:

No	Name of System	Location (Commune)	Present Irrigated Area (ha)	Proposed Irrigated Area (ha)	Proposed Water Requirement (l/s)	Total Length of Main Canal (m)	Total Length of Secondary Canal (m)	No. of Diversion Works (unit)	No. of Other Structures (unit)
R2-1	Ho Thanh 1	Nam Kim	37	66	126	2,980	1,330	6	37
R2-2	Ho Thanh 2	Nam Kim	8	14	27	660	1,630	1	3
R6-1	Trang den 1	Nam Hung	36	80	151	1,495	790	3	11
R6-2	Trang den 2	Nam Hung	9	20	38	3,435	3,740	7	25
R9	Cua Ong	Nam Nghia	100	150	283	1,900	6,220	10	41
R11	Rao Bang	Nam Thanh	100	160	302	980	6,010	11	15
P16	Nam Dong	Khanh Son	253	800	1,530	7,492	27,650	43	41
Pn1	Nam Cuong	Nam Cuong	0	120	229	1,735	3,950	8	11
Total			543	1,410	2,685	20,677	51,320	89	184

Note Pn1: New pumping irrigation system

#### Ho Thanh Reservoir System (R2)

Ho Thanh reservoir was constructed in 1972 and since then water leakage from the side of spillway has been continued. In spite of the leakage, the structure of dike has been stable for 25 years. On the other hand, the intake flume was damaged 10 years ago and the farmers have not been able to control the intake water since that time. According to the survey, the water loss will be saved by renovating canal system

(main canal: 3.5km) and it is expected that irrigated area will be increased from present 45 ha to 80 ha.

#### **Trang Den Reservoir System (R6)**

One of the serious problems observed in Trang Den reservoir is the damaged spillway and it is necessary to be repaired immediately. The gate structure at intake works of two irrigation schemes are timeworn and these structures should be renovated. It is expected that the irrigated area will be increased from present 45 ha to 100 ha with the renovation of these canal systems (main canals: 4.9km in total).

#### **Cua Ong Reservoir System (R9)**

Small water leakage is observed and the amount of leakage water become quite high when water level is close to the top of the dike. Therefore, it is necessary to enlarge the capacity of existing two spillways for keeping safe water level in the rainy season. It is expected that the irrigated area will be increased from present 100 ha to 150 ha with the renovation of canal system (main canal: 1.9km).

#### **Rao Bang Reservoir System (R11)**

The present condition of existing spillway is quite poor and it is necessary to be renovated. It is expected that the irrigated area will be increased from present 100 ha to 160 ha with the renovation of canal system (main canal: 1.0km).

#### **Nam Dong Pumping System (P16)**

The total capacity of present pumps is more than 1.6 m<sup>3</sup>/s and it is sufficient to irrigate 800 ha. However, the flowing capacity at main canal is not enough and only 253 ha of paddy field is irrigated at present. Therefore, it is necessary to enlarge flowing capacity and to save water loss with the renovation of canal system including related structures (main canal: 7.5km) in order to irrigate 800 ha.

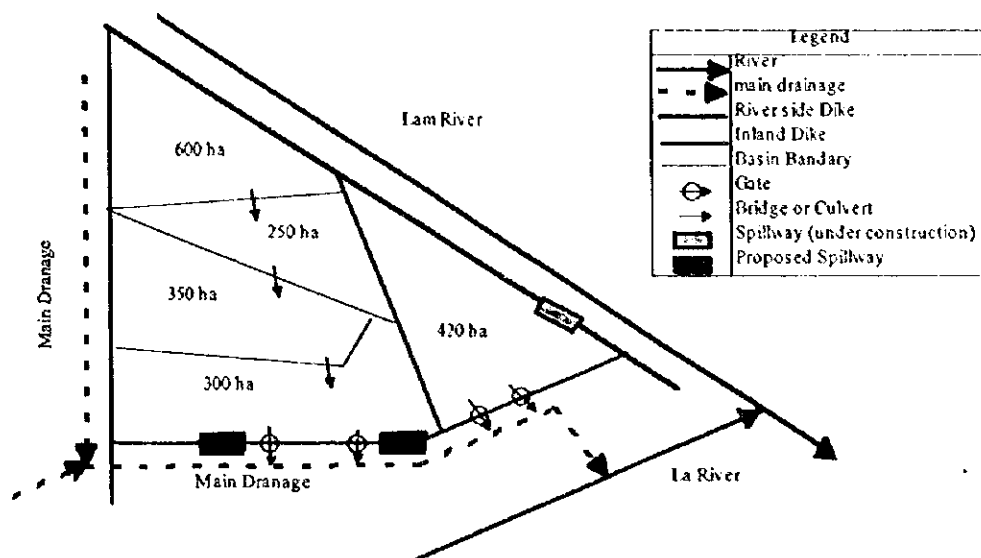
#### **Nam Cuong Pumping System (PN1)**

Nam Cuong pumping system has been planned since 1995 and basic survey was carried out by Nam Dan District. It is expected to irrigate 120 ha of farm land which is not irrigated at present. Therefore, it is necessary to install a new pumping station and to construct a new canal system (main canal: 1.7km).

## **(2) Mitigation of Inundation**

#### **Drainage System of Nam Nam Dike**

The present drainage system is illustrated as shown below:



Inundation caused by back water from the La river occurs mostly every year and inundation period is usually two to three weeks. Even upper part of the inside of dike is influenced by the back water and inundation. For draining the water inside the dike, it is necessary to wait the water level of La river to come down lower than that of the inside. Usually, it takes around two weeks for inundation to drain. The main drainage canal connected to the La river belongs to Ha Tinh Province. Therefore, it is impossible to formulate drastic mitigation plan without improvement of the drainage canal located in Ha Tinh Province. However, after starting of drainage from inside the dike, it will be possible to shorten the inundation period by enlarging the capacity of drainage gate. In addition, installation of two spillways is proposed in order to secure the safety of the dike structure. For mitigation of inundation, it is necessary to renovate/construct the following facilities from the view point of enforcement of drainage capacity and ensuring safety of structure and it is expected that inundation period will be reduced to more or less one week.

	Main facilities	Main works	Purpose of facilities
Renovation of existing drainage gate	4 x 5.5 m 3 gates	Replacement of gate only	Prevention of small inundation Enforcement of drainage capacity
New construction of drainage gate	3 x 5.5 m 3 gates	New construction of gate facility	Enforcement of drainage capacity
Rehabilitation of main drainage canal	soil canal 500 m	Rehabilitation of soil canal 500 m	Enforcement of drainage capacity
Installation of new spillways (2 site)	200 m width each	Excavation and protection of dike	Ensuring safety of structure
Protection of crossing point with present road	Average road width 4 m	Protection of road and slope surface	Ensuring safety of structure

### (3) Implementation Plan

Implementation stage of renovation/construction of irrigation and drainage facilities is divided into two stages, preparation stage (detailed design, tendering) and

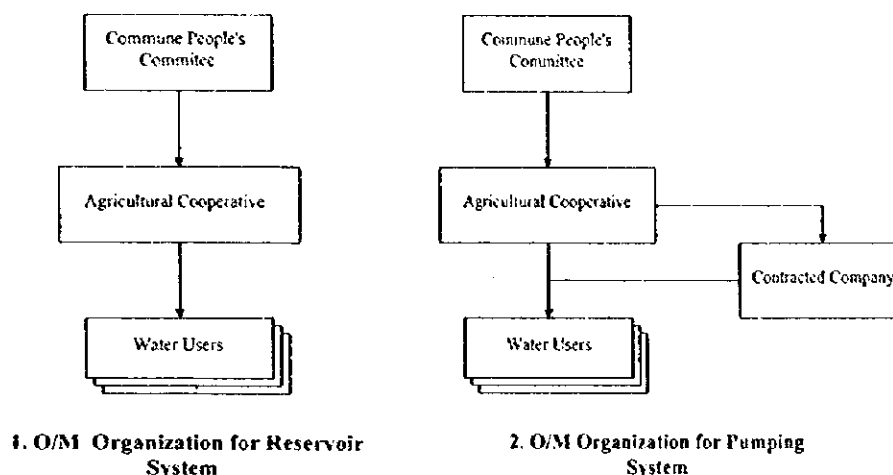
construction stage. Considering effective construction, it is better to set one year for preparation stage and to carry out the construction at the dry season of next year (in this way, it is necessary to compensate for one crop season for present irrigated area and compensation cost is included in the project cost). For the implementation, basically the present implementation system can be used; that is, the agricultural and rural development division of the Nam Dan District will work as the executing agency under the support and inspection of agricultural and rural development department of Nghe An Province and use the local consultant and contractor in the Province. However, in case of using the international fund for finance, sometimes it is necessary to select the consultant and contractor through the international tendering. Considering the effective generation of project benefit, it is necessary to decide the implementation order for each project based on the implementation schedule of relevant sectors such as rural roads and rural electrification.

#### (4) Operation and Maintenance Plan

Operation and maintenance work for irrigation system is consist of water management (decision of water distribution, irrigation water supply, watching), facility maintenance (inspection, repair) and administration (collection of water fee) as shown below:

Operation & maintenance work	Contents	Proposed work interval
Water management		
Decision of water distribution	To collect the information of water requirement from farmers and to decide the distribution plan and water supply plan after adjustment of water amount and period.	Every crop season
Irrigation water supply	To operate the irrigation facilities based on the water supply plan	Every day in the irrigation period
Watching	To observe the water use condition with a periodical patrol	- ditto -
Facility maintenance		
Inspection	To inspect function, water leakage, facility injury, etc. and to make a repair plan of facilities	One time each before and after irrigation period and every time for watching
Repair	To repair the facilities based on the repair plan	Proper times based on the necessity (basically one time after irrigation period in the dry season)
Administration		
Collection of water fee	To decide the water fee with a consideration of required fund for O/M cost and farmers' payment capacity and to collect the water fee	Every crop season

Agricultural cooperatives, which are management agencies, manage the irrigation systems under the supervision of commune peoples' committee. Some part of water management work (irrigation water supply, watching) and facility maintenance are carried out by private company with a contract base.

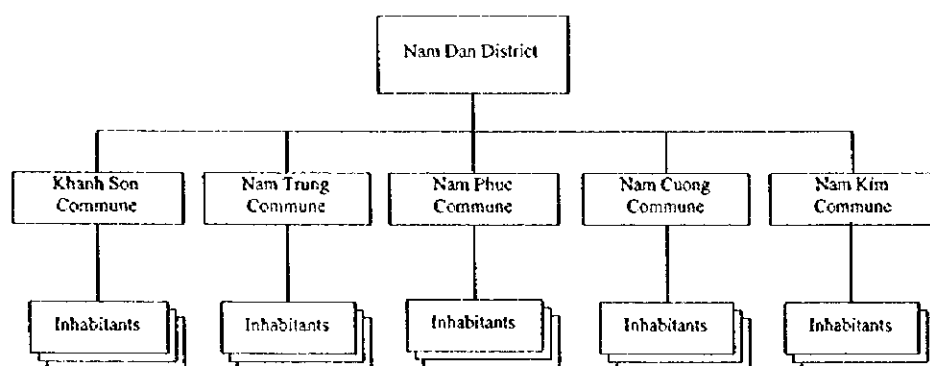


In consideration of the purpose of maintaining the drainage facility function, operation and maintenance work of drainage system is consist of periodic maintenance, routine maintenance and inspection as shown below:

O/M works	Contents	Proposed interval
Periodic maintenance	To inspect with periodic patrol for checking the site and scale to be repaired and to make a periodic maintenance plan	Dry season: one time / month Rainy season: two times / month
Routine maintenance	To Rehabilitate protection work and to replace gate for maintaining facility function	Rehabilitation work: approx. one time for 5years Gate replacement: approx. one time for 20 years
Inspection	To renovate facilities based on the periodic maintenance plan	Proper period based on scale of damage

Peoples' committee of 5 communes which are management agencies carry out the O/M works under the supervision of the District Peoples' Committee, and small-scale maintenance shall be carried out with the inhabitant participation.





### 3. O/M Organization of Dike System

These organizations already exist and are functioning at present and it is not necessary to enforce the present organizations (beneficiaries for the new pumping station have already a experience of irrigation farming.)

### (5) Project and O/M Costs

The project cost are estimated as below:

Name of Project	Project Cost		
	L/C (mill.VND)	F/C (mill.VND)	Total (mill.VND)
1 Ho Thanh Irrigation System	6,558	984	7,542
2 Tang den Irrigation System	10,548	1,484	12,032
3 Cua Ong Irrigation System	9,089	1,164	10,252
4 Rao Bang Irrigation System	7,567	841	8,408
5 Num Dung Irrigation System	19,213	3,448	22,661
6 Nam Cuong Irrigation System	8,779	1,187	9,966
7 Nam Nam Dike	3,503	449	3,952
<b>Total</b>	<b>65,256</b>	<b>9,557</b>	<b>74,813</b>

Note: Engineering cost and physical contingency are included in the project cost. However, price escalation is excluded.

O/M cost for one year is estimated as below:

Annual O/M Cost for Irrigation System					(million VND)	
Name of Project	Command Area (ha)	Canal O/M Cost	Facility Repair	Electricity Fee	Annual Average of Replacement	Annual Average O/M Cost
1. Ho Thanh Irrigation System	80	44				44
2. Tang den Irrigation System	100	61				61
3. Cua Ong Irrigation system	100	61				61
4. Rao Bang Irrigation System	160	56				56
5. Nam Dung Irrigation System	800	39	480	40	20	579
6. Nam Cuong Irrigation System	120	21	72	6	8	107
<b>Total</b>	<b>1,410</b>					<b>1,010</b>

Note: Replacement cost of equipment is estimated as annual average cost.

## Annual O/M Cost for Drainage System

(million VND)

Name of project	Benefited Crop Area (ha)	Routine Maintenance	Annual Average of Replacement	Annual Average O/M Cost
Nam Nam Dike	1,200	359	8	367

Note: Replacement cost of equipment is estimated as annual average cost.

### 5.1.2 Supporting Services

#### (1) Agricultural Extension Center

##### 1) Background

The Nam Dan Agricultural Extension Station started giving services in 1996 in order to enhance the extension services which were previously provided by the Agriculture & Rural Development Department of the District by promoting new technology at model plots. However, the activities of the station are not sufficient because of extreme shortage of technical staff (4 members at present), budget and equipment for extension services including transportation. In view of effect of the extension services contributing greatly to increase the agricultural production, expansion of its organization and enrichment of facilities & equipment are badly necessary. The Extension Center of Nghe An Province is providing training courses for extension staff of the districts.

##### 2) Purpose

To contribute to the increase of agricultural production and to the increase of farmer's income by activation through expansion of extension organization and enrichment of facilities and equipment. In addition, exhibition of model farming practice which is expected to provided a higher profit to the farmers should be initiated.

##### 3) Outline of Project

- Arrangement of the agricultural extension workers at least one person for each commune in order to enhance T & V system (training and visiting)
- Enrichment of the following equipment and materials for extension services.
  - One motorbike for one extension worker: mobile power
  - Computer: preparation of information papers for extension service, accumulation of information on new technologies, composition of adaptable technologies, analysis of effect of the services etc.
  - Copying machine: preparation of information papers for extension service
  - Audio-visual instruments: to provide technical course tours in each commune once a month
- Support to the existing technical model plots: technologies such as new varieties of crops, new feeding method of poultry
- Exhibition of the model farming practice at a model farm to be newly established: 5-6 farmers' group farming; instruction and exhibition of farming

technologies including farm mechanization and farm management technology, etc.

#### 4) Facilities and Equipment

It is desirable to construct the Center at Kim Lien considering the convenience of transportation and the effectiveness as the model facility. The provided facilities and equipment are as shown below:

<b>Facilities</b>			
Office building	200 m <sup>2</sup>	Equipment warehouse	100 m <sup>2</sup>
Garage	50 m <sup>2</sup>	Parking	100 m <sup>2</sup>
<b>Equipment</b>			
Computer	1 set	Audio-visual instruments	1 set
Copying machine	1 set	4WD Vehicle	
Motorbike	25 unit		

## (2) Seed Supply Center

### 1) Background

Nghe An Provincial Crop Seed Company supplies the recommended rice variety seeds to the farmers. However, most of the seeds are not of high quality because the Company does not have capability nor sufficient facilities to produce enough high quality seeds. A Seed Station of the Company is located in Nam Dan District and the recommended variety seeds are produced in the Station on the contracted basis. However, the quantity of seeds produced in the Station is small and the quantity covers less than 10 % of whole rice fields in Nam Dan District. In addition, selection of high quality seeds is not enough because of lack of inspection and test system and seed processing equipment, and keeping high quality of seeds is difficult because of lack of storing facilities in the Station. It is necessary to select high quality seed by inspection on the field and test after harvest, and to preserve seed in environment of low temperature and humidity for supply of high quality seeds. Fortunately, Nghe An Provincial Seed Test & Inspection Center was established and initiated its work in June 1997.

### 2) Purpose

To increase rice production without increasing present cropping area by supplying high quality seeds to whole rice cropping fields of Nam Dan District.

### 3) Outline of Project

The Nam Dan Seed Supply Center is newly established as an organization of the District. The Center carries out undermentioned work making full use of present seed supply system of the Nghe An Provincial Crop Seed Company.

- To produce high quality seeds on the contract basis under the supervision of the Nghe An Provincial Government and with assistance of the Nghe An Provincial Crop Seed Company. Quantity of produced seed will cover cropping areas of

6,844 ha, 6,771 ha and 614 ha for winter-spring cropping, summer-autumn cropping and summer cropping, respectively. Contracted farmers are selected by the cooperatives. Distribution of original seed and collection of produced seed are also made with the cooperation of the cooperatives.

- To preserve the produced seed while maintaining a high quality.
- To distribute timely high quality seed to the farmers.

Scale of contracted seed production is as shown below:

Item	Cropping Season		
	W. - Sp	Su. - Au	Summer
Necessary quantity of seed	273.8 ton	270.8 ton	24.6 ton
Necessary field for seed production	98 ha	108 ha	10 ha

#### 4) Facility and Equipment

It is desirable to construct the center at Kim Lien considering the convenience of transportation and the effectiveness the model facility. The provided facilities and equipment are as shown below:

<b>Facilities</b>			
Office building	200 m <sup>2</sup>	Processing room	500 m <sup>2</sup>
Seed storage(with equipment for low temp. and humid.)	600 m <sup>2</sup>		
Equipment warehouse	100 m <sup>2</sup>	Parking	100 m <sup>2</sup>
<b>Equipment</b>			
Seed processing equipment	1 set	Truck(2ton)	3 units
4WD Vehicle	1 unit	Heat insulator panel	1 set
Thermo-humid automatic control equipment of seed storehouse	1 set		
Spare parts of above equipment	1 set		

### (3) Agricultural Mechanization Service Center

#### 1) Background

Many farmers want keenly farming mechanization in order to be free from heavy labor. However, it may not be profitable because of too small farming scale. Although joint farming is an idea for the solution, it will make farming of small-scale farmers more effective and profitable than joint farming to build up a rental system and a contracted farming service system with machinery.

The expected merits of farm mechanization are summarized as follows:

- To release farmers from heavy work including transplanting which is commonly considered as women's task
- To increase production by implementing timely operation for efficient working (especially the effect will be remarkable in Summer-Autumn rice cultivation through efficient land preparation and transplanting)
- To increase production by decreasing harvesting loss with the introduction of reaper (harvesting machine) and power thresher

- To enable beef production by replacing buffalo which is used for farming labor presently to cattle
- To save labor force to obtain other income sources including hog raising and other industries

In consideration of such circumstances, the Agricultural Mechanization Service Center is established. The Center is an official organization of Nam Dan District and prepares farming machinery for rent a to provide the contracted farming.

## 2) Purpose

The Center keeps a complete set of farm machinery and carry out timely rent of machine or contracted farming service. The Center aims to contribute to raising up of the living standard of the farmers through mitigation of farmer's heavy load, production increase by timely farming , increase of income sources by farm labor saving, etc.

In addition, by showing the above effects to the farmers, the Center promotes the mechanized farming in the area..

## 3) Outline of Project

The Center keeps a complete set of farm machinery to cover 1,400 ha of fields in the Priority Irrigation and Drainage Improvement Project Area. Main activities of the Center are as shown follow:

- Training of operation technique of farming machine for the farmers and issuance of license to the mastered farmers
- Lending of farming machine to licensed farmers
- Implementation of contracted farming
- Maintenance and repair of machinery
- Advice and guidance on farm mechanization
- Guidance on farm mechanization for the farming model plots in coordination Agricultural Extension Center

## 4) Facilities and Equipment

It is desirable to construct the Center at two sites, each at the right bank and the left bank of the Lam river, in considering of convenience for service and the location of objective project area. In addition, it is advisable to have the headquarters at the left bank because of convenience of transportation and expansion of the project in the future. Therefore, the Center at the right bank is the sub-station although its scale of facility is lager than that of the left bank because of larger scale of the objective project area. In consideration of the circumstances, it is desired that the sites of the headquarters and the sub-station are Khanh Son and Nam Thanh, respectively. The provided facilities and equipment are as shown below:

Facilities				
Item	Unit	Headquarters (Nam Thanh)	Sub-Station (Khanh Son)	Total
Office building	m <sup>2</sup>	140	60	200
Agr. machin. warehouse	m <sup>2</sup>	630	1,570	2,200
Equipment warehouse	m <sup>2</sup>	200	500	700
Nursery facility	m <sup>2</sup>	400	1,000	1,400
Garage	m <sup>2</sup>	110	290	400
Workshop	m <sup>2</sup>	140	360	500
Worker post	m <sup>2</sup>	60	140	200
Car wash area	m <sup>2</sup>	30	70	100

Equipment				
Item	Unit	Headquarters (Nam Thanh)	Sub-Station (Khanh Son)	Total
Power tiller with rotary set	pcs	70	180	250
Rice transplanter	pcs	30	80	110
Reaper	pcs	10	30	40
Power thresher	pcs	10	40	50
Trailer	pcs	40	100	140
Nursery equipment	set	1	3	4
Plow	pcs	40	100	140
Ridger	pcs	40	100	140
Truck(2 ton)	pcs	2	6	8
4WD Vehicle	pcs	1	0	1
Motorbike	pcs	3	7	10
Equipment for workshop	set	1	1	2
Spareparts				

#### (4) Implementation Plan

Implementation of the projects consist of the preparation period (design of facilities, selection of materials, tender) and the construction period (construction of facilities, supply of materials). The former take one year and the later is to be implemented during the dry season of the next year in principle. It is necessary to study the timing of supply of materials in consideration of the timing of completion of equipment warehouse. It is also necessary to arrange required staff including extension workers in order to start smoothly operation of the Centers as soon as the facilities and equipment are fully equipped. System and organization for the project implementation are shown as follows:

##### Agricultural Extension Center :

The Agriculture and Rural Development Department of Nam Dan District which becomes the core for the implementation of the Project executes the Project in close connection with the Agricultural Extension Station of the District under the support and supervision of the Nghe An Provincial Agricultural Extension Center.

### Seed Supply Center :

The Agriculture and Rural Development Department of Nam Dan District which becomes the core for the implementation of the Project executes the Project in close connection with the Nghe An Provincial Crop Seed Company under the support and supervision of the Nghe An Provincial Agriculture and Rural Development Department.

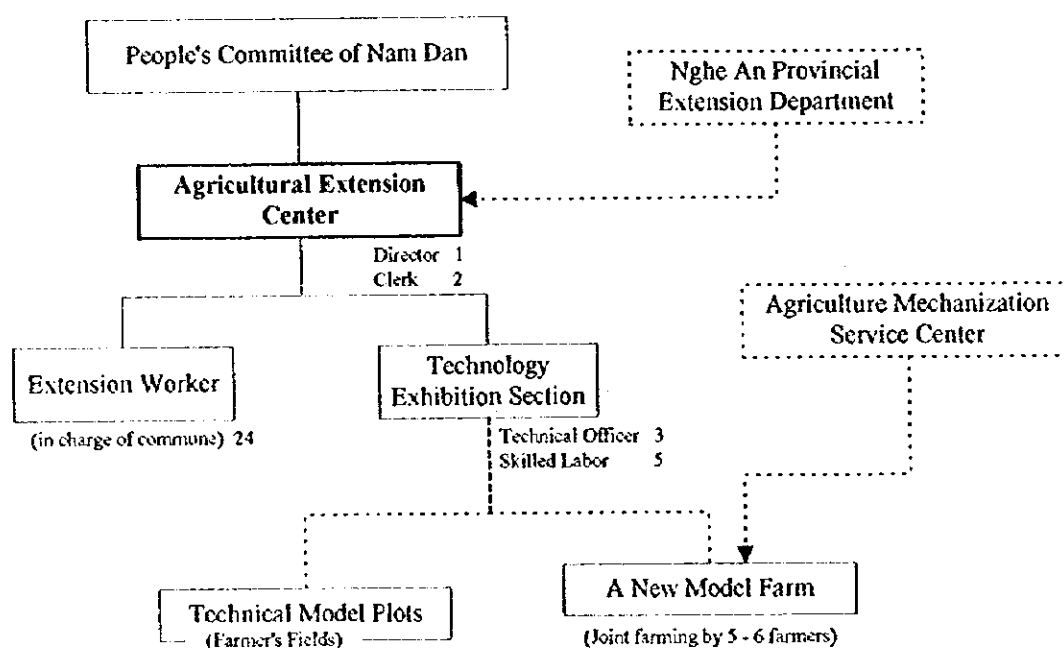
### Agricultural Mechanization Service Center :

The Agriculture and Rural Development Department of Nam Dan District which becomes the core for the implementation of the Project executes the Project in close connection with the Agricultural Extension Station of the District under the support and supervision of the Nghe An Provincial Agriculture and Rural Development Department.

## (5) Operation Plan

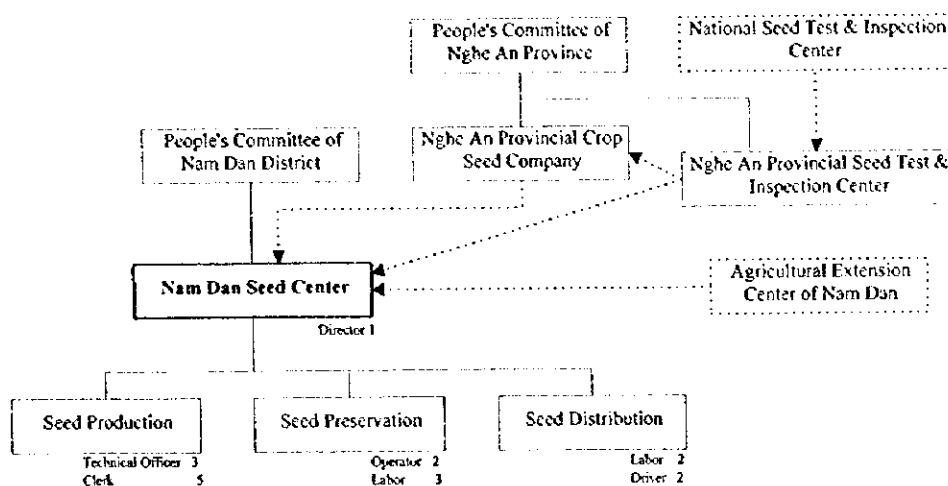
### 1) Agricultural Extension Center

The Center increases extension workers in charge of communes and arranges skilled laborers who assist the technical officers in charge of technology exhibition. Total staff numbers are 35 including 3 technical officers and 24 extension workers. Appointment of extension workers are carried out during the period between the preparation work and completion of the construction and they are made to participate in the training courses concerning method of extension activities, new technologies of farming practice, animal feeding etc. provided by the Nghe An Provincial Agricultural Extension Center. This training includes practical training by the extension workers actively engaged in extension. Term of the training is 2 months. In addition, some extension workers are also made to participate in the short term training courses provided by the Nghe An Provincial Agricultural Extension Center for their technical level brushup every year.



## 2) Seed Supply Center

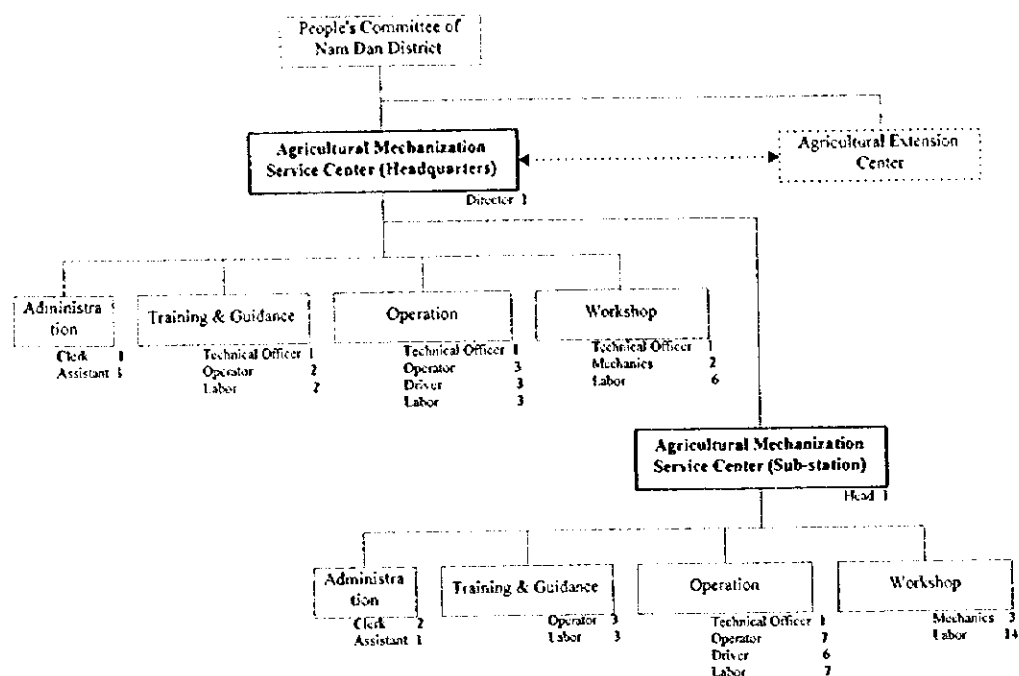
The Center consist of 3 sections such as seed production on contract basis, seed processing and preservation of seed, Seed distribution. Total staff numbers are 16. The Center should request the redeployment of 6 staff including 3 technical officers from the Nghe An Provincial Crop Seed Company. Other 2 technical officers who are to be appointed before the completion of construction works are dispatched to the Nghe An Provincial Crop Seed Company for 1 month in order to learn seed supply practice. Operators are to be appointed before sending the seed processing equipment and the thermo-humid automatic control equipment of seed storehouse, and they are to learn operation technologies of the equipment from the supplier to them for 2 weeks. In addition, the Center requests the supplier to take good care of the equipment for 1 year after its delivery.



### 3) Agricultural Mechanization Service Center

The Center consist of 4 sections such as administration, training & guidance, operation and workshop. Total staff numbers are 76 including 4 technical officers, 15 operators and 5 mechanics. Technical officers, operators and mechanics are to be appointed before sending the agricultural machinery, and they are to learn operation technologies of the machinery from the supplier of them. The technical officers learn mainly general knowledge on farm mechanization and technology for rearing of seedling. The operators take part in the practical training for operation of machinery: it will take 10 days for power tiller and rice transplanter respectively, and 1 month for reaper, power thresher and other machinery. The mechanics learn maintenance and repair techniques of whole machinery and operation method of equipment in the workshop. In addition, the Center requests the supplier to take good care of the machinery and the equipment for 1 year after its delivery.





## (6) Project Cost and Operation & Maintenance Cost

Project cost and O/M cost are estimated as below:

Project Cost

Name of Project	Project Cost		
	L/C (mill.VND)	F/C (mill.VND)	Total (mill.VND)
1 Agricultural Extension Center	134	1,951	2,085
2 Seed Supply Center	3,270	18,449	21,719
3 Agricultural Mechanization Service Center	6,667	35,138	41,804
<b>Total</b>	<b>10,071</b>	<b>55,538</b>	<b>65,609</b>

Note: Project cost includes engineering cost and physical contingency but not includes price escalation.

Annual Operation & Maintenance Cost (mil. VND)

Name of Project	Operation & Maintenance	Annual Average of Replacement	Annual Total O/M Cost
1. Agricultural Extension Center	531	187	718
2. Seed Supply Center	2,781	723	3,504
3. Agricultural Mechanization Service Center	1,432	3,477	4,909
<b>Total</b>	<b>4,744</b>	<b>4,387</b>	<b>9,131</b>

Note: Replacement cost is the annual mean value according to the life of equipment.

### **5.1.3 Agro-industry and Marketing**

#### **(1) Implementing Organization**

As Agro-processing Complex and Market Oriented Forwarding Center projects are to be carried out by the farmers' group, the grouping of farmers is indispensable. The implementing agency of the projects will be the cooperative where the facilities of the projects are installed. The facilities are managed by the farmers' group of proper-scale farmers directly that are selected by a village unit out of all the member farmers in the cooperative. There is a Managing Board in each cooperative. After the decision is made for the project execution, the project will start getting approval by the cooperative's general meeting for the plan of a new organization and activities prepared by the Managing Board. The new organization for the project is expected to become the additional service activities to the existing various services to member farmers. The projects are formulated based on these considerations.

However, as these projects are pilot projects to introduce new ideas for farmers, it is considered that the projects are implemented first by the peoples' committee of Nam Dan District and actually managed by the cooperative under guidance and supervision of the District, then, it is expected that these activities will be extended to the rural area. It is also considered that the technical and financial support of official institutions is required until the time when the management becomes stabilized. It is recommended to promote these projects with establishment of a new agricultural management promotion committee in the peoples' committee of Nam Dan District.

#### **(2) Activities**

The activities that are carried out in "Agro-processing Complex" and "Market Oriented Forwarding Center" are as follows:

##### **1) Agro-processing Complex**

###### **a. Rice mill**

- To process paddy as much as possible produced in the project area.
- To carry out waged processing for the part of paddy for farmers' self-consumption with the same rate as that of existing millers in the area.
- To buy the part of paddy for farmer's selling at the market price rate.
- To give back the qualitative and quantitative merits by technology improvement to the consignment farmers.
- To make effort to sell it with the higher price by quality improvement and to expand profits by selling at proper place on suitable time.

###### **b. Ground nuts oil mill**

- To process ground nuts as much as possible produced in the project area.
- To pursue profits qualitatively and quantitatively by technology improvement.
- To acquire the confidence in the market and expand the regular customers by selling the good products with stable quality.

c. Feed mill

- To produce and sell the combination feed that is mainly for pig raising in order to promote an animal breeding industry in the area.
- To produce feed with mainly rice bran and oil cake generated from the two mills above and other materials procured.

d. Grain dryer and ground nuts sheller

- To make the farmers use the dryer and the shelling machine freely for the purpose of advancing the procurement of ground nuts that is the material of the oil mill and giving the merit of reduction of loss occurred by insufficient drying to the farmers.
- To use the waste such as husk and ground nuts shell generated from this facility as fuel of the dryer, and reduce the operation cost.

e. Miscellaneous

In the future, it is expected that the farmers' groups engaging the activities above will develop and create the following new individual business lines:

- Wholesaling of rice
- General edible oil production sales business including the rice bran oil and salad oil
- Overall combination and concentrated feed production sales business
- Intensive raising and sales business of pig, chicken, beef cattle, etc., not as the side job of the farmers.

2) Market-oriented Forwarding Center

a. Accumulation of market information

- To collect and accumulate market information widely and daily including information that is offered by the People's Committee.

b. Processing and analyzing of accumulated information

- To grasp trading trend and needs in markets by processing and analyzing accumulated information.

c. Market-oriented farming

- To plan the kind of crops, harvest time, sales time, destination place, sales unit etc. in order to get high profits on the basis of the analysis of information.
- To promote group farming as much as possible, not individual farming by each farmer, in accordance with the plan above.
- To promote group procurement of agricultural inputs which provides financial benefits to the farmers.

d. Group collection and forwarding

- To adjust harvest schedule in advance among the farmers and carry out joint collection using a truck.

- To carry out group work by the farmers themselves such as sorting by destination places and binding, packing and grading in case of market requirement, and forwarding by a truck.
- To store the products such as beans that can be stored in a warehouse at first and ship it in good time of market condition.
- To transport the products to the markets in the neighboring area by a truck and to the markets even out of the province when the increase of a profit is expected within a possible area.

### (3) Proposed Project Site

#### 1) Agro-processing Complex

Considering the socio-economic background as well as agricultural production, the District was divided into the following six zones based on the comparison of conditions in the area.

No.	Commune
I	Xuan Hoa, Van Dien, Hong Tien, Kim Lien, Town
II	Khanh Son, Nam Trung, Nam Phuc, Nam Kim, Nam Cuong
III	Nam Nghia, Nam Thanh, Nam Thai, Nam Hung
IV	Xuan Lam, Hong Long, Nam Cat
V	Nam Thuong, Nam Tan, Nam Loc
VI	Nam Anh, Nam Xuan, Nam Linh, Nam Giant

Each zone has been evaluated in order to select the zone which has priority as the project site based on the following factors.

- The easiness of material procurement
- The easiness of product (mainly feed) sales
- The properness of managerial environment condition such as relation which markets, quality of cooperative's activity

#### Comparison of Zones

Zone	Material procurement	Products sales	Managerial environment
I	easy	easy	better
II	easy	easy	good
III	difficult	difficult	average
IV	easy	easy	good
V	easy	average	average
VI	average	easy	good

As a result, it is judged that the location of facility should be selected from the area along the main roads in zone I to zones II/IV.

#### 2) Market-oriented Forwarding Center

From the characteristics of the project, there is no special condition for site selection, because the facility can be used correspondingly to the condition of agricultural production in each area. The following are pointed out as the matters to be considered:

- The location along a main road.
- The enthusiastic area of cooperative management and activities.
- The area in which cooperation nature among farmers is high.

#### (4) Outline of Agro-processing Complex

##### 1) Precondition

Before project implementation, Vietnamese side is to select the construction place and the cooperative as the implementing organization. In the study, the preliminary design was carried out based on the following conditions set as an average model in Nam Dan District.

Project area: a cooperative or commune scale (10 villages, 1,000 farmers)

Farm area: about 300ha

Production of major products: based on the production plan in the district, production is estimated as shown below:

Production plan in Project Area

Cap.	About 10 villages			
	No. of farmers	1000	Area	689.05
Name of Crop	Cultivation Area (ha)		Production (t)	Yield (t/ha)
Paddy	413.14		1840.61	4.46
W-S		200.67	953.16	4.75
S-A		197.72	958.08	4.34
S		14.75	29.36	1.99
Maize	70.82		111.81	1.58
W-S		4.43	9.56	2.16
W		66.40	102.25	1.54
Sweet potato	54.59		294.80	5.40
W-S		1.48	7.79	5.40
W		53.12	286.83	5.40
Ground nuts	66.40		106.90	1.61
Soy bean/Green bean	20.66		17.35	0.84
Sesame	2.95		2.12	0.72
Vegetable	44.26		309.41	6.99
W-S		13.28	92.82	6.99
S-A		13.28	92.82	6.99
S		17.71	123.76	6.99

##### 2) Preliminary design

###### a. Rice mill

###### - Design condition

- Proposed paddy production : 1,840t for 10 villages
- Procurement of material : 1,500t (rate to total production 81.5%)
- Design capacity : 1 t (paddy)/hour
- Average work condition : 300 days/year, 5 hours/day (operation hour will be extended at peak harvesting period)
- Design yield rate : 65 % / paddy processed

- Material flow

The proposed material flow estimated on the condition above is shown below.

**Material Flow of Rice Mill**

Material		Amount (t)	Remarks	
Paddy	100.0%	1,500.0	942t for consignment	
Impurities	3.5%	52.5	Immatured, straw, sand etc. *1 40t	→Feed/fuel
Stone	0.5%	7.5		
Cleaned paddy		1,440.0		
Husk	22.0%	330.0		→Fuel
Brown rice		1,110.0		
Bran	9.0%	135.0	Including starch fine *2 50t	→Feed
White rice		975.0		

↓  
612.2 For consignment \*3

362.8 Procurement

Note: \*1 Figure shows amount (t) excluding sand and dust

\*2 Figure shows amount (t) coming from procurement amount

\*3 Estimated from per-capita consumption (0.1633/y, 1995, FAO) and

As a result, 612 ton of white rice are returned to the farmers and 363 ton is for sales. Also, the by-products other than stones and sand are utilized as a material and fuel for other facilities.

**b. Grain dryer and ground nuts sheller**

As mentioned before, those machines are used by the farmers freely.

Main specifications of each machine are as follows:

- Grain dryer
  - Type : Flat bed
  - Holding capacity : 800 kg
- Ground nuts sheller
  - Capacity : 700 kg/hour

**c. Ground nuts oil mill**

- Design condition
  - Ground nuts production : 106.9 ton
  - Receiving amount : 50 ton (rate to total production 46.8%)
  - Amount without shell : 38 ton
  - Designed processing capacity : 100 kg (raw material)/hour
  - Average working condition : 100 days/year, 3.5 hours /day (to extend operation hours for peak season after harvesting) The cocker is also used for rice bran treatment for eliminate enzyme activity. 100 days/year, 3 hours/day.
  - Designed yield : 40%/ground nuts without shell processed

- Material flow

The proposed material flow estimated on the above condition is shown below:

### Material Flow of Ground Nuts Oil Mill

Material		Amount(t)	Remarks
Ground nuts	100.0%	1,500.0	Without shell
Oil cake	38.0%	52.5	→ feed
Losses	2.0%	7.5	
ground nuts oil	40.0%	1,440.0	

As a result, 15.2 ton of ground nuts oil are produced and 22 ton of oil cake, by product, can be used as feed material.

#### d. Feed mill

##### - Design condition

Variety of feed : The feed for raising pig (weight 30~70kg) is selected as the model for design because it is expected to have the most demand.

Composition of feed : Material composition is set on the basis of the standard nutrients requirement for a design model, centering rice bran and oil cake that are produced as by-products in the complex.

Production plan : 200 ton/year, amount of each raw material is as shown below:

#### Amount of Raw materials and Distribution

Raw material	Composition	
	Amount (t)	Distribution
Maize*	60	30%
Paddy**	15	8%
Sweet potato*	45	23%
Oil cake	22	11%
Rice bran	50	25%
Dried fish*	8	4%
Total	200	

\* Procured materials and others are by-products

\*\* Separated from impurities rejected rice processing

Design processing capacity : 400kg/hour

Average working condition : 100 days/year, 5 hours/day

#### e. General design

##### - Layout plan

The contents are as shown below:

### Contents of Layout Plan

Contents	Area (m <sup>2</sup> )	Detail
Office	30	Office area including inspection area for raw materials received
Raw materials warehouse*	570	Area of storage capacity for approx. 300ton of paddy, 10ton of ground nuts without shell, 15ton of maize, 10ton of sweet potato, 10ton of rice bran and 15ton of oil cake. And area for grain drying and ground nuts shelling
Processing area I	280	Area for rice mill and feed mill
Processing area II	40	Area for oil mill
Products warehouse*	285	Area of storage for approx. 30 ton of white rice, 5ton of ground nuts oil and 5ton of mixed feed.
Workshop	30	Storage area for maintenance tools and equipment and repairing work area for parts and materials of facilities.
Drying yard	540	Used for sun drying of high moisture materials

- Machinery and equipment plan

The major machinery and equipment which are procured and installed in the complex are shown below:

### List of Major Machinery and Equipment

Place	Contents
Office	Equipment for data treatment and communication, Inspection equipment and tools
Raw material warehouse	Grain dryer, Ground nuts sheller, Belt conveyer
Processing area I	Rice mill, Feed mill
Processing area II	Peanuts oil processor
Products warehouse	Belt conveyor
Workshop	Tools, Electric tool, Inspection tool, Air compressor
Others	Truck, Fork lift truck

## (5) Outline of Market-oriented Forwarding Center

### 1) Precondition

Assuming average farm village conditions in Nam Dan District, the preliminary design is carried out.

- Project area : A cooperative or commune scale (10 villages, 1,000 farmers)
- Member farmers : Starting from dozens of farmers, 100 farmers (scale of average village) are selected at the end. The member farmers participate in a production activity in the group based on the analysis of market information, in addition to the operation of the Center as the main activity.



Handling products : All kinds of products produced in the project area are possible to be handled in and by the Center. In the early stage of the project, it is needed to carry out a commerce activity by purchasing the products from farmers in the surrounding area and sell then in markets by effective utilization of the Complex facilities and truck because there is a little amount of products procured from the member farmers. And this situation is effective for collecting extensive market information.

## 2) Preliminary design

### - Design condition

The possible amount of procurement, possible selling amount of farmers, estimated from the production plan of main crops is shown below:

Possible Procurement Amount of Main Crops

Capacity (household)	1000			100	Per-capita consumption *
Name of Crop	Production	Self-consumption	Possible procurement	Possible procurement	
Maize	111.81	51.98	59.83	5.98	0.0113/y
Sweet potato	284.80	89.24	205.56	20.56	0.0194/y
Ground nut	109.80	-	106.90	10.69	
Soy bean/green bean	17.35	-	17.35	1.74	
Vegetable	309.41	223.10	86.31	8.63	0.0485/y

\* Per-capita consumption : actual result in 1995 (FAOSTAT), 4.6 persons/household

- Handling condition of fresh products : a handling condition of fresh products including fruits are as follows:

Handling amount : 100 ton/year

Working days a year : Basically to forward the collected products next day.

Collection 100days/year, forwarding 100days/year

Working days a week : Average 2 days for collection and forwarding, total 4 days a week

Handling amount a day : Average 1 ton a day

- Condition of warehouse : Used for grain, bean and tuber.

Storage amount : About 200ton, 50% of total production in the project area.

Capacity : 60 ton, 50% of the estimated handling amount of maize and sweet potato harvested in winter season as a peak through a year of 120ton. The circulation rate is 3.3.

- Facility plan

The contents are shown below:

### Contents of Facility Plan

Contents	Area (m <sup>2</sup> )	Detail
Office	45	Area for office work
Information processing room	Included in the above	Area for accumulating and processing market information
Warehouse	120	Area of storage capacity for 60 ton of sweet potato with cooling function up to 15 °C
Working place for collection and forwarding	155	Working area for forwarding products such as sorting
Materials storage	15	Storage of materials for handling products such as container boxes, bags and strings.
Drying yard	120	Area used for sun drying of high moisture products

#### - Machinery and equipment plan

The main machinery and equipment introduced to the Center are listed below:

#### List of Main Machinery and Equipment

Name	Remarks
Information processing room	Equipment for data processing and communication
Warehouse	Cooling unit, Container box
Working area	Belt conveyor
Others	Truck

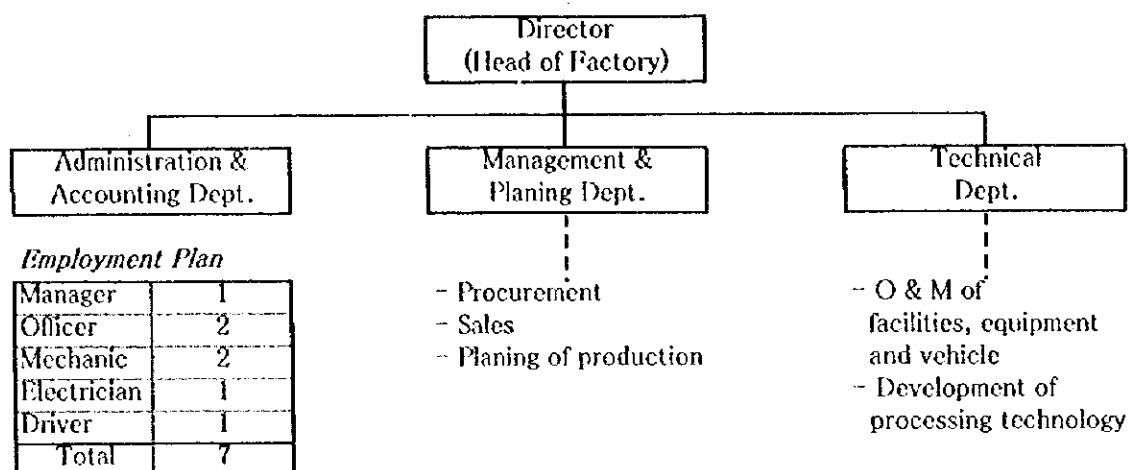
### (6) Implementation Plan

As implementation of the projects in this sector should be carried out after achievement of improvement of agricultural productivity and increasing the treatment amount for rural market, the implementation of projects in irrigation and agricultural supporting sectors is one of the preconditions for the implementation of these projects. On the other hand, it is necessary to consider the coordination with the projects in rural road and electrification sectors for effective generation of project benefit. Therefore, the implementation of those sectors' projects should precede this sector's projects; they should be implemented after the improvement of those other sectors' conditions. Furthermore, it is recommended that new organizations are established in Nam Dan District; that is, "New Agricultural Management Promoting Committee" which is in charge of coordination for overall activities and "New Agricultural Management Promoting Division" which executes the projects in keeping the relation with the operating cooperatives.

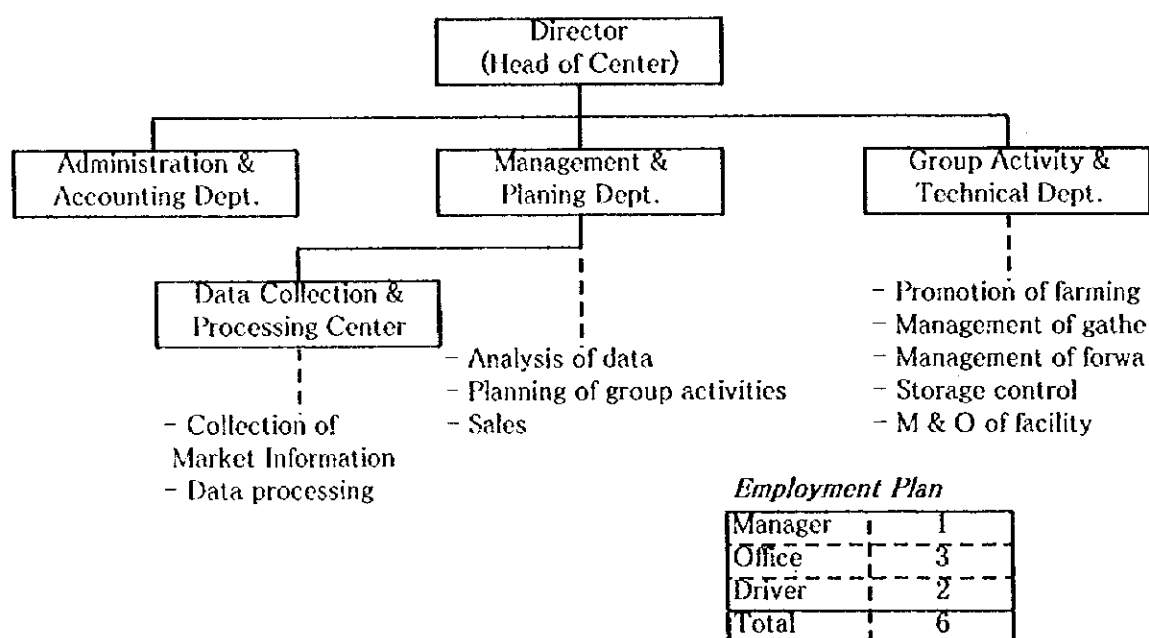
### (7) Operation and Maintenance Plan

The management agencies are sub-organizations belonging to the cooperatives, and the activities are carried out under instruction and supervision of a New Agricultural Management Promoting division". The proposed organizations are shown below. Staff is to be secured by the completion of facility construction and procurement of

equipment. Temporary employees are to be hired for seasonal simple work. For mechanic and electric staff, the training concerning operation and maintenance of equipment is to be carried out for approx. a month by the supplier.



Organization of Agro-processing Complex



Organization of Market Oriented Forwarding Center

### (8) Project and O/M Costs

The project cost and O/M cost are estimated as below:

#### Project Cost

(unit: mill.VND)

Project	L/C	F/C	Total
1 Agro-processing Complex	9,327	6,907	16,234
2 Market-oriented Forwarding Center	1,510	2,517	4,027
<b>TOTAL</b>	<b>10,837</b>	<b>9,424</b>	<b>20,261</b>

Note: Engineering cost and physical contingency are included in the project cost. Price escalation are excluded.

#### O/M Cost

(unit: mill VND)

Project	Operation Cost	Wage (permanent)	Wage (temporary)	Annual Total
1 Agro-processing Complex	93	90	39	222
2 Market-oriented Forwarding Center	44	70	15	129

## **5.2 EDUCATION FACILITIES**

### **(1) Outline of Projects**

The objective of the projects is to support the achievement of the target in education and training sector in Nam Dan District by improvement of frail education facilities. The electricity supply to the schools and lighting of classrooms in compliance with the high inhabitant needs and rehabilitation of school facilities are executed in the projects. The supply of materials for the improvement/rehabilitation only is considered in the projects and the rehabilitation works are to be done by the inhabitants' participation under the supervision of administrative organization of Nam Dan District and Communes.

#### **Material Supply Program for Electricity Supply to Schools**

- Wiring to schools (53 schools in total) : 32 primary schools, 18 lower secondary schools and 3 upper secondary schools
- Set up of electric covering at schools (53 schools)
- Supplying 1,380 lighting equipment as 2 lights per classroom : 388 classrooms for primary schools, 246 classrooms for lower secondary schools and 56 classrooms for upper secondary schools

#### **Material Supply Program for Rehabilitation of School Facilities**

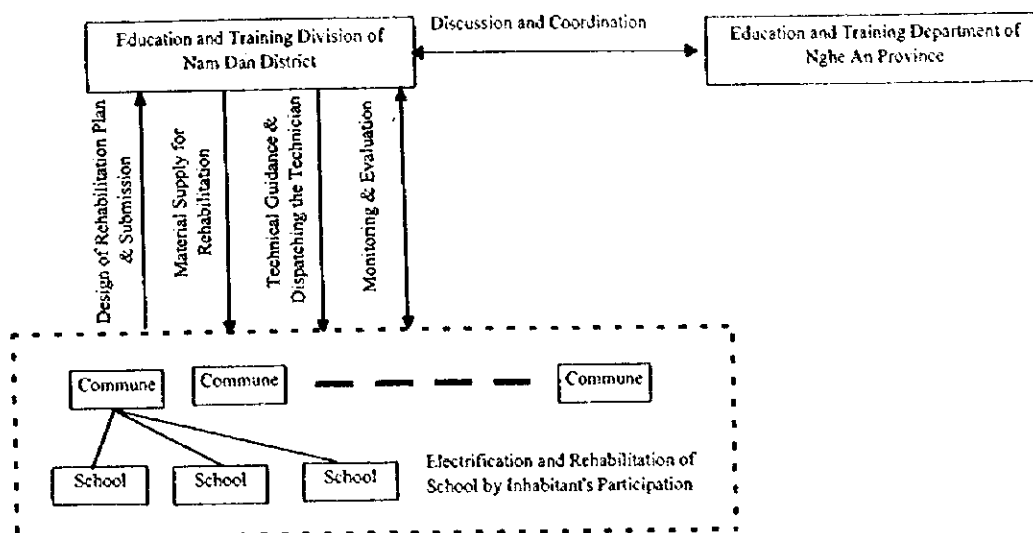
- Reconstruction of 56 classrooms : 24 at the primary schools and 32 at the lower secondary schools
- Heavy repair of 181 classrooms : 126 at the primary schools and 55 at the lower secondary schools
- Repair of 113 classrooms : 26 at the primary schools and 87 at the lower secondary schools

### **(2) Implementation and O/M plan**

#### **1) Form of Management for Program**

It is considered that the program should be executed based on the existing organizations for improvement and maintenance of education facilities and that the Education and Training Division of Nam Dan District is to be the execution agency for the primary and lower secondary schools. Though the upper secondary school is under the Department of Education and Training of Nghe An Province, it is recommended that the electrification of upper secondary schools is to be implemented by the Education and Training Division of Nam Dan District in keeping relation with the Province, because of the presence of only 3 upper secondary schools in the District.

Management formation and organization is shown below:



Education and Training Division of the District requests the Communes to design and submit rehabilitation plan, inspects these plans and supplies the materials required in consideration of total balance of overall plans in the District. The responsibilities of rehabilitation works using these materials belongs to the Communes. Each Commune implements the program including after care with the inhabitants' participation.

## 2) Arrangement of Human Resources

- **Organizing of inhabitants for rehabilitation works**  
The responsibility of rehabilitation works belongs to the Commune and the Commune executes the rehabilitation works using supplied materials and labor supply from inhabitants by organizing inhabitants' organization. In Viet Nam, the inhabitants' participation for public works such as road maintenance and canal rehabilitation is organized and organizing of inhabitants is done by the Commune. Therefore, there is no problem for organizing inhabitants for rehabilitation/improvement of education facilities. However, it is necessary to coordinate with other public works planed by the District regarding the arrangement of human resources.
- **Dispatching of Technician and Technical Guidance**  
Technical guidance by the technician of the District is essential for the implementation of construction works. Especially for the electricity works, as there are big problems such as accidents during installation works and power loss caused by poor technique of inhabitant who has no sufficient knowledge for electricity, the works should be done by the technicians dispatched by the District. Therefore, for implementation of school electrification program, it is necessary to coordinate with rural electrification projects for securing the District technician including technical training for the technician.

### 3) Monitoring and Evaluation

Education and Training Division of the District executes the monitoring and evaluation on the improvement conditions of each school through the Commune. Based on the results of evaluation, the District requests the Commune to execute suitable maintenance and necessary repair of education facilities.

### (3) Project Cost

The purchasing cost for recommendable material supply is shown below:

Description	Project Cost (mill. VND)
School Electrification	1,364
Rehabilitation of School Facilities	22,264

## 5.3 RURAL ROAD IMPROVEMENT

### (1) Priority Routes and Objectives

The selected priority routes and their improvement objectives are shown below:

Route	Objective of Road Improvement
1. Route 15A (Northern Part)	To prepare all-weathered traffic condition for vehicle in the basic road of the northwest region of the District. This is achieved by upgrading road surface to asphalt pavement in the Distance from Nam Dan Town to Nam Hung Commune.
2. Route 15A (Southern Part)	To reduce traffic interruption days of the right bank region from around 50 day at present to around 2 weeks by road embankment and bridge construction at the frequently inundated area. To achieve all-weathered traffic condition for vehicle by asphalt pavement in the Distance from Nam Kim Commune to the Nam Dan Ferry Port.
3. 42 Dike Road	To prepare all-weathered traffic condition for vehicle to Nam Dan Town from the communes along the Lam River left bank by asphalt pavement and road widening. This will contribute to 3 communes of Hung Tien District too.
4. Phan Boi - Chua Road	To prepare all-weathered traffic condition for vehicle to the Chua Market which is the second largest market in the District by asphalt pavement, road widening and bridge improvement.
5. Hun Tien - Nam Linh Road	To prepare all-weathered traffic condition for vehicle to Route 46 from Hun Tien and Nam Linh Commune by asphalt pavement, road widening and bridge improvement. It will improve the access to Nam Dan Town and Vinh City from the communes.
6. 42 Dike - Kim Lien Road	To prepare all-weathered traffic condition for vehicle to Route 46 from the communes along the Lam River left bank by asphalt pavement, road widening and bridge improvement. It will improve the access to Nam Dan Town and Vinh City from the communes.
7. Kim Lien - Nam Cat Road	To prepare all-weathered traffic condition for vehicle to Kim Lien and the September 12 <sup>th</sup> Road in Nam Cat Commune by asphalt pavement, road widening and bridge improvement. It will improve the access to Nam Dan Town and Vinh City from the communes.
8. Nam Tan - Nam Loc Road	To prepare all-weathered traffic condition for vehicle in the densely populated area of the northern part of the right bank region by asphalt pavement, road widening, bridge improvement and drainage improvement. It will improve the access to the left bank region through Route 15A Southern Part from the area.
9. Nam Nam Dike Road	Improvement of the major road of the densely populated area of Nam Nam Region which runs along the Lam River right bank from Yen Xuan Railway Bridge to the intersection with Route 15A. It will achieve all-weathered traffic condition for vehicle in the area and improve access to Nam Dan Town through Route 15A by asphalt pavement.
10. Nam Kim - Nam Phuc - Nam Cuong Road	To prepare evacuation road in the low plain area of Nam Nam region which is frequently inundated and isolated. The evacuation road aims to make inhabitants evacuate safely and quickly at the beginning of inundation. Considering the economic aspect, the route is designed to allow submergence of road surface.

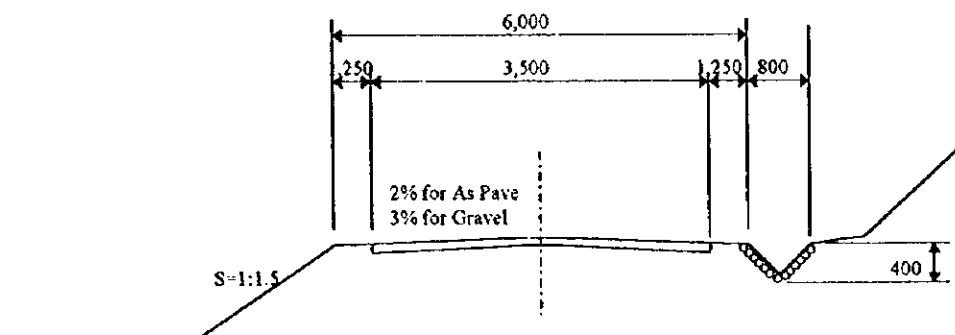
### (2) Facility Plan

#### - Road Structure -

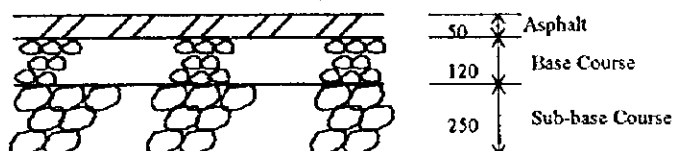
The typical road structure is decided based on the Vietnamese Standard for Motorway and the Grade IV of the Standard is applied due to the expected traffic



condition and characteristic of the routes. The typical cross section and pavement of road structure are as shown below:



Typical Structure of Pavement



Typical Structure of Pavement

Item	Typical Design	Remarks
Road Width	6.0 m	
Road Surface	Asphalt Pavement 3.5 m width or Gravel Cover 3.5 m width	Surface Structure
Cross Sectional Slope of Road Surface	2 % for Asphalt Pavement 3 % for Gravel	
Slope of Road Embankment	1:1.5	
Road Surface Drainage	Earth drainage protected by gravel along the road 80cm-40cm with 1:1.0 slope	Distance in the mountainous area

#### - Bridge Structure -

The following general design conditions are applied to the bridges considered to be renovated or newly constructed in the project.

Item	Condition
Design Loading Capacity	H13-X60 in TCVN4054-85
Effective Bridge Width	4.5 m (1 - lane)

The bridge type has been decided based on the economic aspect at each construction site. For instance, the following criteria of bridge type selection is applied in consideration of the experiences of constructions in other parts of Viet Nam, the ability of the local contractors, maintenance works, etc.

Span Length	Bridge Type
$L < 3.0$ m	Culvert
$3.0 \text{ m} \leq L \leq 6.0$ m	Concrete Slab Bridge
$6.0 \text{ m} < L < 12.0$ m	RC Beam Bridge with Concrete Slab
$12.0 \text{ m} \leq L < 20.0$ m	P C (Pre-tension, hollow type) Beam Bridge with Concrete Slab
$20.0 \text{ m} \leq L$	P C (Pre-tension, T- type) Beam Bridge with Concrete Slab

### - Facility Plan of Respective Routes -

The facility plan of respective routes to achieve the objectives is shown below. Fig. 5.3.1 shows the layout of the facility plan of the proposed rural road improvement.

#### Facility Plan of Rural Road Improvement

Route	Distance to be improved	Pavement plan	Distance to be widened	Road embankment plan
1. Route 15A (Northern Part)	14.8 km	Asphalt Pavement	-	
2. Route 15A (Southern Part)	19.4 km	Asphalt Pavement	-	Distance around the Mong Bridge $L = 3.0$ km $H = 0 \sim 1.9$ m (Average 1.0 m) To cope with the level 3 flood water level of the Lam River (E.L. 7.9 m at Nam Dan).
3. 42 Dike Road	11.0 km	Asphalt Pavement	11.0 km	
4. Phan Boi - Chua Road	7.2 km	Asphalt Pavement	7.2 km	
5. Hung Tien - Nam Linh Road	8.8 km	Asphalt Pavement	8.8 km	
6. 42 Dike - Kim Lien Road	4.2 km	Asphalt Pavement	4.2 km	
7. Kim Lien - Nam Cat Road	7.6 km	Asphalt Pavement	7.6 km	Distance after the Nam Ha Bridge $L = 2.8$ km $H = 0 \sim 1.0$ m (Average 0.8 m) To cope with frequently inundation level. (Road Surface E.L. = 3.5 m)
8. Nam Tan - Nam Loc Road	8.7 km	Asphalt Pavement	8.7 km	
9. Nam Nam Dike Road	9.4 km	Asphalt Pavement	1.8 km	Distance in Nam Cuong Commune $L = 6.0$ km $H = 0 \sim 2.2$ m (Average 0.9 m) To cope with the level 3 flood water level of the Lam River.
10. Nam Kim - Nam Phuc - Nam Cuong Road	7.0 km	Gravel Surface	7.0 km	Distance in Nam Nam Dike $L = 4.8$ km $H = 0 \sim 1.7$ m (Average 1.0 m) To cope with frequently inundation level. (Road Surface E.L. = 4.5 m)

### Bridge Improvement Plan

Renovation/New Construction						Minor Rehabilitation		
Name	Length (m)	Effective width (m)	Height* (m)	Effective Area (m <sup>2</sup> )	Type	Name	Length (m)	Type
Route 15A (Northern Part)						Gang Bridge	30.0	Steel
Route 15A (Southern Part)								
Mung Bridge	30.0	4.5	8.0	135.0	T			
Haohao Bridge	24.0	4.5	7.0	108.0	T			
Vuc Mau Bridge	19.0	4.5	4.0	85.5	P			
Vuc Long Bridge	19.0	4.5	4.0	85.5	P			
Phan Boi - Chua Road								
Phu Dong Bridge	45.0	4.5	4.0	202.5	Px2			
42 Dike - Kim Lien Road								
Bon Huu Bridge	6.0	4.5	2.5	27.0	S			
Man Bridge	18.0	4.5	3.0	81.0	P			
Nam Cat Road						Mat Bridge	5.0	
Xay Bridge	4.0	4.5	2.5	18.0	S	Nam Ha Bridge	5.0	
Nam Nam Dike Road								
Nha Thanh Bridge	5.0	4.5	2.5	22.5	S			
Hung Tien - Nam Linh Road						Nam Linh Bridge	30.0	RC 4 span
Hung Tien Bridge	4.0	4.5	2.5	18.0	S	Dong Ho Bridge	5.0	RC 1 span
Vac Bridge	6.0	4.5	3.5	27.0	S			
Nam Tan - Nam Loc Road						Xi Phong Bridge	6.0	RC Slab
Tan Loc 4 ridge	14.0	4.5	3.5	63.0	P			
Mung 2 Bridge	19.0	4.5	8.0	85.5	P			
N.Kim - N.Phuc - N.Cuong Road								
Xuan My Bridge	28.0	4.5	4.0	126.0	T			
Suy Bridge	26.0	4.5	2.5	117.0	T			
Small Bridge	4.0	4.5	2.5	18.0	S			
Small Bridge	4.0	4.5	2.5	18.0	S			

\* : Bridge height from the elevation of design reverted to bridge surface.

\*\* : Bridge Type S: RC Slab P: PC Hollow Beam T: PC T-Beam

### (3) Implementation Plan

The preparation of adequate rural road network is considered as the basic condition for the overall rural development plan. Thus, the implementation of the rural road improvement should be scheduled ahead of that of other sectors so as to realize their effect quickly and efficiently. Especially, Route 15A is required to be improved ahead of other routes due to its function as an important basic road in this area.

Considering the present system of the road administration in Viet Nam, it is considered to be better that the road improvement be implemented by the present administration system. Because the road improvement itself is implemented independently and these will be no difficulty even if the construction works are executed by the plural administrations if the close coordination is maintained among them. At present, the provincial roads are under the administration of Nghe An Province and other roads under the administration of Nam Dan District. Thus, the improvement of Route 15A only is proposed to be implemented by the Nam Dan Transportation Office of Nghe An Province, and other roads to be implemented by

the District.

#### **(4) Road Management Plan**

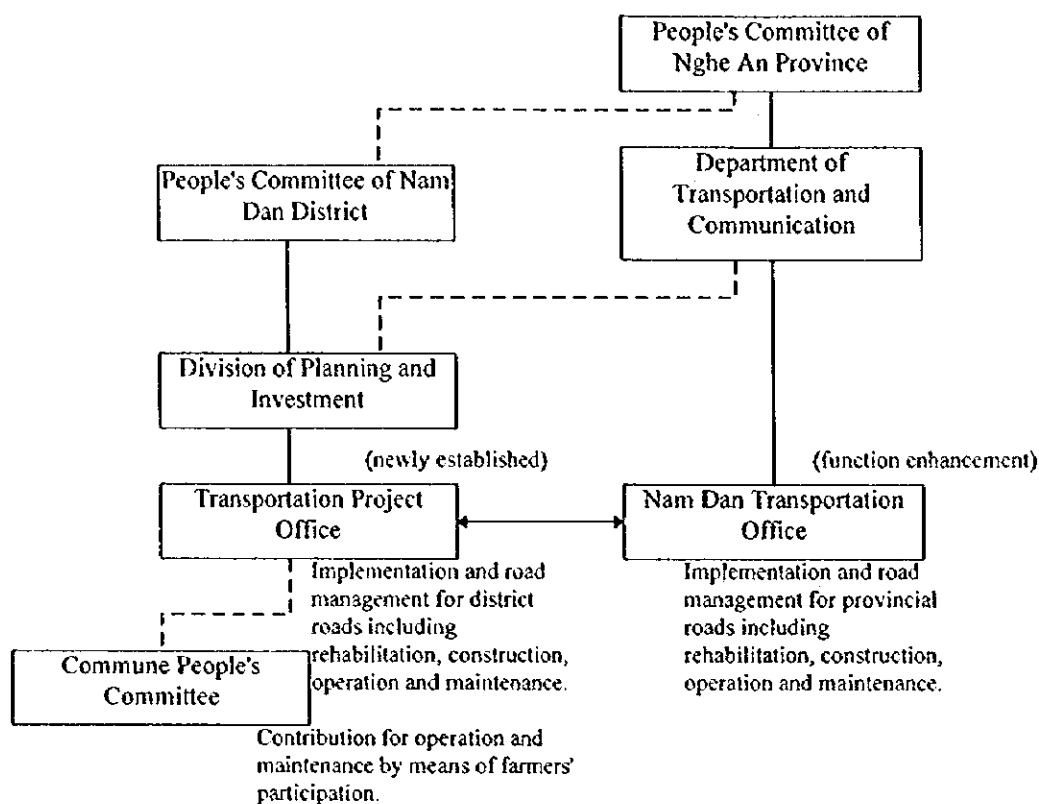
##### **- Maintenance and Operation Plan -**

Road maintenance and operation work consists of road inspection, regular maintenance, periodic maintenance and rehabilitation and that is defined as systematic activities in order to preserve and repair the road system under acceptable conditions. The work plan for the road maintenance and operation is proposed as shown below:

Item	Activities	Recommended Frequency
Road Inspection	To identify the road body, pavement or bridge to be repaired by regular inspection.	Around once a month
Regular Maintenance	To implement partial repair of road body or pavement as to keep function of road in the minimum requirement.	Before and after the rainy season in each year
Periodic Maintenance	To recover the function of road to nearly initial condition by the works such as asphalt overlay.	Depend on the damage, around once in each five years
Rehabilitation	Large scale repair and rehabilitation of road structure and bridges.	Depend on the damage

##### **- Road Management Organization -**

Road management organization for the rural road improvement project is proposed to be of two types due to the present administrative organizations for road management. Route 15A which is a provincial road should be managed by the Nam Dan Transportation Office of Nghe An Province. Other priority routes are classified as district roads and they should be managed by the District. In order to cope with the increase of upgraded roads to be maintained and to enhance the management ability for all the district roads, a new project office for road management is proposed to be newly established under the Planning and Investment Division of Nam Dan District which has responsibility for road administration.



Organization	Function	Necessary improvement
Transportation Project Office (newly established).	<ul style="list-style-type: none"> <li>• Planning and designing of improvement of district and communal roads.</li> <li>• Improving district roads and their maintenance.</li> <li>• Technical guidance for maintaining district and communal roads.</li> </ul>	<ul style="list-style-type: none"> <li>• Allocation of human resources to the Project Office and enhancing ability by training</li> <li>• Adequate budget allocation for proper functioning.</li> <li>• Introduction of maintenance machines.</li> <li>• Coordination with Nam Dan Transportation Office, Nghe An.</li> </ul>
Commune People's Committee (existing).	<ul style="list-style-type: none"> <li>• Improving communal roads and maintenance activities.</li> <li>• Organizing farmers' participation for maintenance of district and communal roads.</li> </ul>	<ul style="list-style-type: none"> <li>• Enhancing ability of staff by training.</li> </ul>
Nam Dan Transportation Office (existing).	<ul style="list-style-type: none"> <li>• Building and maintaining provincial roads located in Nam Dan District.</li> </ul>	<ul style="list-style-type: none"> <li>• Increment of technicians and enhancement of technology.</li> <li>• Budget allocation for increasing supply of road management/maintenance materials and equipment</li> </ul>

##### (5) Project Cost and O/M Cost

The project cost of rural road improvement is estimated below:

### Project Cost Summary of Rural Road Improvement

Routes	Project Cost		
	L/C (mill.VND)	F/C (mill.VND)	Total Amount (mill.VND)
1 Route 15A Northern Part	14,791	2,763	17,554
2 Route 15A Southern Part	31,240	10,193	41,433
3 42 Dike Road	11,011	3,779	14,790
4 Phan Boi - Chua Road	11,995	4,088	16,083
5 Hung Tien - Nam Linh Road	11,126	2,290	13,416
6 42 Dike - Kim Lien Road	6,866	1,895	8,761
7 Kim Lien - Nam Cat Road	9,767	3,279	13,046
8 Nam Tan - Nam Loc Road	12,779	3,841	16,620
9 Nam Nam Dike Road	11,860	4,260	16,120
10 Nam Kim - Nam Phuc - Nam Cuong Road	13,245	7,223	20,468
Total	134,679	43,612	178,291

\*: The project cost includes engineering cost, physical contingency, etc. but does not include price escalation.

The O/M cost for rural road improvement is estimated below:

#### Annual O/M Cost for Rural Road

Items	for Asphalt Paved Road	for Gravel Road
Regular Maintenance	8 mil. VND/km-year	4 mil. VND/km-year
Periodic Maintenance	80 mil. VND/km-5years	20 mil. VND/km-2years

#### Annual Average O/M Cost for Priority Routes

Route	Distance	Annual Average O/M Cost* (million VND)	Road Type
<b>Provincial Roads</b>			
1. Route 15A (North)	14.8 km	355	Asphalt Paved
2. Route 15A (South)	19.4 km	466	Asphalt Paved
Sub-total	34.2 km	821	
<b>District Roads</b>			
3. 42 Dike Road	11.0 km	264	
4. Phan Boi - Chua Road	7.2 km	173	Asphalt Paved
5. Hung Tien-Nam Linh Road	8.8 km	211	Asphalt Paved
6. 42 Dike-Kim Lien Road	4.2 km	101	Asphalt Paved
7. Kim Lien-Nam Cat Road	7.6 km	182	Asphalt Paved
8. Nam Tan-Nam Loc Road	8.7 km	209	Asphalt Paved
9. Nam Nam Dike Road	9.4 km	226	Asphalt Paved
10. Nam Kim - Nam Phuc - Nam Cuong Road	7.0 km	98	Gravel Road
Sub-total	63.9 km	1,464	
Grand-total	98.1 km	2,285	

\*: Annual average O/M cost consists of regular and periodic maintenance cost.

## 5.4 RURAL ELECTRIFICATION

### (1) Facility Plan

#### 1) Extension of Electrification

##### a. Outline of works

The outline of the electrification works are summarized as shown in Table 5.4.1 and Fig.5.4.1. Electric power is to be supplied to existing non-electrification areas using proposed distribution lines and substations to be newly constructed.

##### b. Construction of New Substations

Proposed new substations in each region is shown below:

Region	Number of Substations	Capacity of Transformer (kVA)	Voltage (kV)	Total
1	3	100	1-35/0.4 2-10/0.4	300
2	6	100	10/0.4	600
3	4	100	10/0.4	400
Total				1,300

##### c. Construction of 35 kV and 10 kV Distribution Lines

Proposed distribution lines in each region are shown as follows:

Region	Length of Line (km)	Number of New Poles	Distribution Line Voltage (kV)
1	2.50	6	0.8 km - 35 1.7 km - 10
2	3.10	7	10
3	4.05	10	10
Total	9.65	23	-

##### d. Extension and Construction of 0.4 kV Distribution Lines

The extension and construction of 0.4 kV distribution lines are shown as follows:

Region	Length of Line (km)	Number of New Poles
1	25.30	42
2	30.80	46
3	28.25	44
Total	84.35	132

## 2) Rehabilitation of Distribution Networks

### a. Outline of works

Proposed works for rehabilitation of distribution lines is summarized in Table 5.4.2 and Fig.5.4.1. Through this project, reliance on the distribution network service will be increased and electric power of good quality will be supplied. The works of 0.4 kV distribution lines include the installation of lead-in wires. Half of the existing poles are projected to be replaced.

### b. Rehabilitation of 35 kV and 10 kV Overhead Distribution Lines

For the rehabilitation of distribution lines, the following works is required:

Region	Length of Line (km)	Number of New Poles	Overhead Line Voltage (kV)
1	16.6	14	9.3 km - 35 7.3 km - 10
2	6.3	4	10
3	12.0	10	10
Total	34.9	28	

### c. Rehabilitation of 0.4 kV Overhead Distribution Lines

For the rehabilitation of distribution lines, the following works is required:

Region	Length of Line (km)	Number of New Poles
1	6.2	59
2	33.6	32
3	38.2	37
Total	133.8	128

## 3) Design of Support Structures

### a. Support structure

The following materials for the support (electric pole) are proposed considering the site situations.

- For 3.5 kV and 10 kV distribution lines : Concrete poles
- For 0.4 kV distribution lines : Wooden poles

### b. Support Span

The standard span length between each pole is designed as 50m by taking into consideration the various elements such as tension due to the wire lines, sag due to wire weight, height above the ground, topography, presence of barriers and cost performance.

### c. Length of Pole

Lengths of 10m and 9m are designed for the main power lines and the branch lines, respectively, in order to maintain the minimum height of the wire above the ground and considering the joint use with other lines such as telephone. The estimated design load is set as 300kg, and the angle load is to supported by



the branch lines.

**d. Height of Wire**

The minimum height of the overhead distribution lines above the ground is generally be as follows:

	35 kV	10 kV
Common Areas	5.8m	5.5m
Road Crossing Points	6.4m	6.1m

**4) Design of Wire**

**a. Wire**

Wires are designed to be the same material as the existing AC (aluminum coating) conductor as a rule.

**b. Size of Wire**

The size of the wire is determined based on the standard design specification of Viet Nam considering the voltage drop and the power loss.

**c. Improvement of Voltage Drop and Power Loss**

The voltage at terminal points of the main power line is 40 % of the rated voltage and power loss is 60 % of the supplied voltage at the worst points, according to the results of the field survey. The main reason is considered to be the inappropriate selection of size of the wire. The system design of the distribution networks has been conducted aiming at the goal of reducing the voltage drop to 20 % from the present 40 % at the terminal points of the main power line, and that of the power loss to 20 % from the present worst situation of 60 %. This design can be conducted by the following improvements.

- Determination of the wire size to keep the voltage drop within 15 % at the main power line beyond substations.
- Determination of wire size by estimating the power demand at every distribution section of the branch lines.

**(2) Implementation Plan**

The proposed project shall be implemented first by carrying out the repair and rehabilitation of the distribution networks prior to the expansion of electrification works due to the following matters:

- Interface of both works.
- The schedule of power supply provided by this project shall be coordinated with other projects such as the pumping facility included in the irrigation projects.

### (3) Project Cost

The project cost is shown below:

	Project Cost (Mill. VND)	Maintenance Cost (Mil. VND/Year)
Execution of electrification	37,625	258
Rehabilitation of distribution networks	75,965	1,202
Total	113,590	1,460

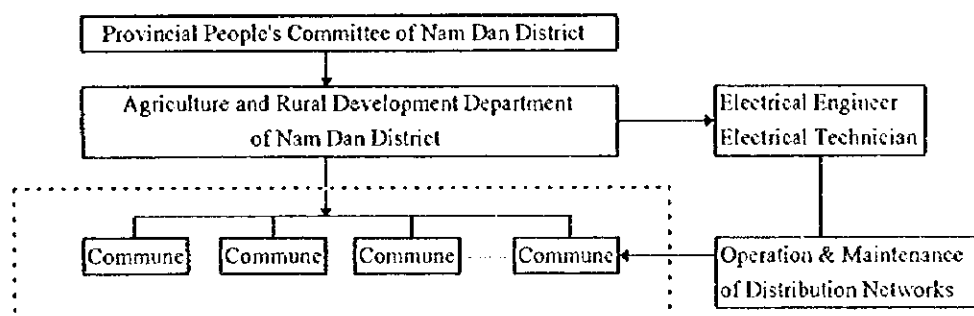
### (4) Operation and Maintenance Plan

#### 1) Organization

The scale of the facilities for the operation and maintenance within Nam Dan District is shown as follows:

- Extension length of 0.4 kV distribution lines : 294 km
- Substation (owned by the cooperatives) : 57 nos.
- Electrification household : 31,532 nos.
- Irrigation pumping facility : 33 nos.
- Public utilities (street light, school, medical office, etc.), and others

The operation and maintenance of distribution networks are to be managed by the electrical engineer and technicians of the Department of Agriculture and Rural Development of the District.



#### 2) Prevention of Accidents and Effective Maintenance

It is important to stress the prevention of accidents in the maintenance of electric facilities. In order to prevent the probable accidents and to make effective operation and maintenance of the electric wiring and facilities, special attention should be paid to the following matters:

- Deterioration of equipment
- Poor action of guard system (deterioration of guard relays)
- Deterioration of cable insulation
- Accidents due to poor installation

- Decrease of the appearance of salt covering the insulators (caused by salt, etc.)
- Degree of sag of overhead wire lines
- Degree of corrosion of wooden poles

## **5.5 RURAL WATER SUPPLY**

### **(1) Public Water Supply System by Deep Wells**

Public water supply system by deep wells including water source facility, treatment facility and distribution facility is adopted for the priority project. In this system, the groundwater is pumped up from deep wells by using submersible pumps, and water is then treated and distributed through pipelines to the users via public hydrants.

#### **1) Design Conditions**

##### **a. Project Area and Population**

Considering the present water supply problems in the area, the following areas had been selected:

- Inundation area along the Lam river where shallow wells are infiltrated with flood water during the rainy season. (7 Communes)
- Dried-up area in relatively high elevation area where shallow wells are dried-up during the dry season. (10 Communes)

The population in the year 2010 is estimated based on the statistical data of Nghe An Province. In this estimation, the population growth rate is set at 1.4% based on the annual average growth rate in Nam Dan District for the period of 1991 - 1995.

##### **b. Service Block**

A service block is a group of villages in which water is provided with one water supply system. In principle, one service block is planned in one commune. However, in consideration of the geophysical and topographical conditions of the communes, it is better to organize a combined or separated blocks due to the construction and O/M costs for some communes. As a result of the analysis, total 19 service blocks are established for the objective 17 communes. Classification map of service block is shown in Fig 5.5.1.

##### **c. Unit Water Demand**

According to the results of interview survey conducted during the field survey, the total water demand in the rural area is estimated to be between 60-90 liters/capita/day, though it varies widely depending on the conditions of the water source. Within this estimated figure, 40-60 liters/capita/day is considered to be used for washing and bathing, and the rest of 20-40 liters/capita/day is considered as the indispensable water for drinking and cooking. Generally in the project area, when peoples have water problems with their wells, they go to other wells every day to get the water for drinking and cooking even if those wells are located far away from their houses. They get water for bathing and washing from rivers, canals and reservoirs nearby their houses. Therefore, the unit water demand is set at 30 liters/capita/day as

the daily minimum required demand based on the consideration of the present water consumption level and the design standard of UNICEF's program presently carried out.

**d. Water Demand**

Considering the standardization of design, installation and maintenance, the water demand of each service block is classified into 3 classes based on population in respective blocks in the year 2010. Unit water demands of Class A, B and C are as shown below:

Item	Class A	Class B	Class C
a. Population	15,854	7,563	4,314
b. Average daily demand (m3/day)	476	227	129
c. Average daily distribution (m3/day)	560	267	152
d. Maximum daily distribution (m3/day)	756	360	206
e. Maximum daily intake (m3/day)	800	500	300

Note: Average daily distribution = Average daily demand / (1 - 0.15), (leakage losses : 15%)

Maximum daily distribution = Average daily distribution X 1.35

Maximum daily intake = Treatment losses are added to maximum daily distribution.

Breakdown of the water demand by service block is shown in Table 5.5.1.

**e. Water Source**

Water source is to be deep groundwater. The test borings were conducted at 6 sites in the project area in order to confirm the availability and water quality of deep groundwater in the Study.

**Aquifers in the Project Area**

Two types of aquifers are distinguished in the project area; namely, aquifer in quaternary sediments and fissured water of fractured limestone in the bedrocks. Aquifer in quaternary sediments are widely distributed along the Lam river and this aquifer has high water content. Most of the abstraction from shallow wells is from this aquifer at surface level. The aquifers are widely found in the area but their thickness varies significantly from place to place and water yield depends on the thickness and composition of the aquifers. As a result of two test borings in the area, it is found that the aquifer gives high discharge at thick aquifer (8.5 liters/sec and 12.48 liters/sec). On the other hand, a previous study indicates low discharge in this aquifer (1 liters/sec.).

Aquifer in bedrocks can be divided into two parts; Dong Trau formation and Long Dai formation. Water from this aquifer has not been utilized and there is still limited information. Pumping test results of four test borings show that discharges are 4.65 liters/sec at Long Dai formation and 2.3, 1.2 and 0.04 liters/sec at Dong Trau formation. Rocks in this aquifer are found to have big cracks that contain water. However, discharge rates of aquifer differ greatly

with respect to their location. Even though the discharge rates are high in the crack areas, there are also places where there is no water. Therefore in order to attain high efficiency in the exploration of wells, it is required to apply integrated geomorphological, geological, geophysical methods before starting the detailed designing of water supply system, especially for the groundwater prospecting in the fractured zones of the bedrock strata.

### Water Quality

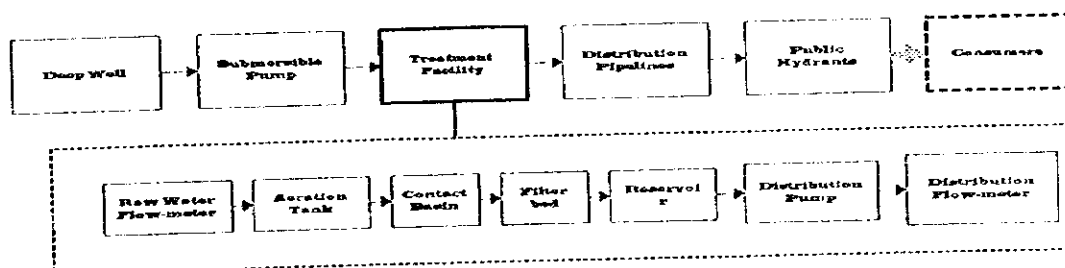
According to the results of water quality analysis at 6 test wells, water quality of groundwater varies site by site. Some wells show higher concentration of parameters than the drinking water standard, such as iron (5 wells), manganese (4 wells), ammonia (2 wells) and bacteria (1 well). Accordingly, the groundwater needs treatment for drinking water, though it is difficult to grasp the relation between geology and high contents of water quality parameters only from the results of 6 test borings. In order to get the water quality complying with the Vietnamese drinking water standard, it is very expensive to install and maintain full treatment facilities. Therefore, the aim of the proposed treatment process is the removal of iron and manganese, considering the present level of treatment by filter tanks within the rural water supply program. Hence, the well sites should be selected carefully trying to find out the places where the concentration of ammonia and bacteria are minimum. The results of test wells and Vietnamese drinking water standard for rural area are shown below:

Item	Water Quality from Test Wells	Drinking Water Standard
Iron	0.12 ~ 62.3 mg / l	Max. 0.5 mg / l
Manganese	0.05 ~ 1.84 mg / l	Max. 0.1 mg / l
Ammonia	1.05 ~ 4.66 mg / l	Max. 3.0 mg / l
Bacteria	0 ~ 2 ml	Max. 0.05 ml

## 2) Facility Plan

### a. Water Supply System

The proposed water supply system consists of water source facility, treatment facility and distribution facility. The proposed water supply system and its facilities are shown below:



b. Intake Facility

The groundwater is to be taken through deep wells by submersible pumps for each service block. The required number of wells for each service blocks is estimated based on the well yield and water demand. The well yield of one well is determined, according to the characteristics of the aquifer, in quaternary sediments and bedrocks. The capacity of submersible pump is determined based on 20 hours-operation of the pumps. Automatic operation is proposed for the submersible pump which is controlled by a console panel installed in the control house. Typical hydrogeological conditions of the wells and the proposed well structure are shown in Fig. 5.5.2.

c. Treatment Facility

The treatment facility consists of treatment equipment, distribution reservoir and distribution pump. The facility is to be constructed nearby the intake well.

Treatment Equipment

The objective of treatment is to remove iron and manganese. The raw water is to be treated to meet the Vietnamese standard for drinking water quality for rural areas. Iron concentration is targeted to be below 0.5 mg/l, and as to manganese concentration, it is targeted to be below 0.1 mg/l of raw water quality. The treatment capacity is decided by the water demand of each class. The equipment consists of aeration tank, contact basin and filter beds. Filter sand is required to be replaced regularly in order to keep the function of manganese sand.

Distribution Reservoir

Volume of distribution reservoir is to be equivalent to two hour's capacity of the daily maximum distribution one, taking into account the hourly change of water consumption and the capacity of reservoir tanks at public hydrants.

Distribution Pump

Distribution pump is to be operated within 20 hours per day. Manual operation is proposed for the distribution pump which is controlled by a console panel installed in the control house.

d. Distribution Facility

Distribution Pipelines

HDPE pipes are to be employed, which in principle are installed underground for water distribution from the distribution reservoir to the public hydrants. Diameter of the pipelines are decided considering the flow rate, pipeline loss, etc..

Public Hydrants

Water is to be supplied to users through public hydrants. Considering the scattered villages, the public hydrants are planned to be located at a distance of 300 m from each other. As consumers get water mainly in the morning and early evening, reservoir tanks with a capacity of 2 m<sup>3</sup> are installed so as not

to bring a water shortage in these hours. Water meters are installed at all the public hydrants for consumption measurement.

### 3) Project Cost

Project cost for 19 water supply systems (19 service blocks) was estimated to be 69,669 million VND. The breakdown of project cost is shown in the following table:

Facility	Project Cost (Million VND)		
	Inundation Area	Dried-up Area	Total
Water Source Facility	5,615	32,389	38,004
Treatment Facility	7,551	14,496	22,047
Distribution Facility	2,886	6,732	9,618
Total	16,052	53,617	69,669

### 4) Construction Plan

The construction works is scheduled to be completed in 10 years including one year for preparation period as shown in the table below. During the preparation period, groundwater investigation and detailed design are to be conducted. The implementation of the works in the inundation area is scheduled to be conducted ahead of the works for dried-up area, because the inundation area is suffering from poorer sanitation conditions than the dried-up area.

Period (Year)	1	2	3	4	5	6	7	8	9	10
Groundwater Survey/ Detail Design										
Inundation Area										
Dried-up Area										

### 5) Operation and Maintenance Plan

#### a. Organizational Structure and Its Functions

The proposed water supply system is an independent system to be operated by each service block. A new organization is to be formed, and have the responsibility for all the activities including billing and money collection as well as operation and maintenance of the system. It is proposed to establish a Rural Water Management Office (RWMO) and an Operation and Maintenance Unit (O/M Unit) for each of 19 service blocks. RWMO shall be established under the administration of the provincial People's Committee and O/M Units shall conduct operation and maintenance work for the systems with the assistance of RWMO. The function of RWMO and O/M Units shall be comprehensive covering the activities mentioned below.



### **RWMO**

- General administration and control of operation and maintenance work for all the systems,
- Technical assistance for operation and maintenance techniques to be provided to operator/worker at site level (periodical maintenance, field repair works, etc.)
- Administration and accounting for water fee collection,
- Purchase and storage of operation and maintenance materials,
- Promoting operation and maintenance activities at commune level.

### **O/M Units**

- Operation and maintenance work of each system at site level,
- Water fee collection from users,
- Guidance and extension of operation and maintenance techniques to the users. (self-awareness of the need for saving water, cleaning of public hydrants, etc.)

The proposed staff is to be 4 persons for RWMO and 3 persons for each O/M Unit. They will be formed by the commune's staff and representatives of the users.

#### **b. Operation and Maintenance Cost**

The operation and maintenance cost consists of the expenditure for RWMO and O/M Units. O/M Unit's cost differs for each system capacities according to the populations of service blocks. The operation and maintenance cost is summarized as shown below:

Components	Cost
Annual Expenditure	
1. RWMO	38,592,000 VND/year
2. O/M Units (19 systems)	1,690,453,600 VND/year
Total	1,729,045,600 VND/year
Cost per Consumption	
1. RWMO	29 VND/m <sup>3</sup>
2. O/M Units	1,258 VND/m <sup>3</sup>
Total	1,286 VND/m <sup>3</sup>

Note: Water consumption :

1,344,047 m<sup>3</sup>/year (30 liters/capita/day x 365 days x 122,744 persons)

#### **c. Water Fee Collection System**

The cost required for the O/M of the systems shall be covered by the water fee to be collected from the users. The water fee rate covers all the expenditures incurred for operation and maintenance works. Based on the estimated expenditures and taking into account the financial capacity of the farmers, it is proposed that a fixed water fee rate of 1,170 VND/person/month at 1997 price level is applied.

Water fee rate for one person is set as follows:

- Monthly rate per person : 1,170 VND/person/month (30

- liters/capita/day x 30 days x 1,300 VND/m<sup>3</sup>)
- Monthly rate per household : 6,201 VND/household/month (5.3 persons/household x 1,170 VND/person/month)
- Monthly net profit per household: 625,000 VND/household/month (based on the results of the rural socio-economic survey conducted by the Study)

The monthly water fee of 1,170 VND per person is estimated based on the unit water consumption per person (30 liters/capita/day) and the basic cost of water fee (1,300 VND/m<sup>3</sup>), and operation and maintenance cost per water consumption is estimated to be 1,286 VND/m<sup>3</sup>. Therefore, the water fee revenue will cover operation and maintenance cost. It is considered that the farmers can afford to pay the water fee, as the monthly water fee is about 2.5% of the average net profit per family.

## **(2) Material Supply of Filter Tank**

Groundwater of shallow wells in the Project Area contains bacteria, iron, manganese etc., concentration of which is extremely higher than those set for drinking water standards. Also water becomes murky in the dry season. Most of the shallow wells are polluted by human and animal wastes due to inappropriate location and structure of the wells. Although filter tanks are installed at the shallow wells by the UNICEF's program in the Project Area, there are still 19,470 wells (70% of total existing wells) which do not have filter tanks because of shortage of funds. Among them, the area of 16,170 wells is to be included in the proposed public water supply system. Therefore, it is planned to provide construction materials for the installation of filter tanks on the remaining 3,300 existing wells only. The filter tank is of the same structure as the one installed by the UNICEF program. The farmers can install filter tanks by themselves with the assistance of Rural Water Supply Program under the Department of Agriculture and Rural Development of Nghe An Province.

Construction materials of filter tank consisting of steel bar, cement, PVC pipe, brick, etc. are to be supplied to the people through the above mentioned Program. The construction material cost of one filter tank is estimated to be 1.76 million VND. Total material cost for 3,300 existing wells is estimated to be 5,808 million VND. Implementation period is planned to be 10 years considering the capacity of present number of the staffs at the Rural Water Supply Office in Nghe An Province.

## 5.6 ENVIRONMENTAL CONSERVATION

### (1) Objective of Protection Works against Gully Erosion

Fundamental countermeasures for maintaining living conditions of the inhabitants should be conservation of forest by afforestation. However, it takes a long time to complete the forest conservation by afforestation. Therefore, urgent countermeasures against gully erosion are proposed to keep the safety of residential houses, roads and farm lands until the lands are conserved by trees. These sites are located in dangerous places that cause damages due to the large-scale gully. The proposed works consist of simple weirs using gabions to be established on the existing gullies and are to decrease the stream by smoothing the longitudinal slope of the stream which contributes to the stabilization or decrease of the development of gullies. Also, this works becomes the model for works to be performed at other erosion sites.

### (2) Summary of Project

#### 1) Location of protection works against gully erosion

The proposed protection works are selected in consideration of the following:

- Living conditions of the inhabitants are seriously affected by the gully erosion.
- Urgent countermeasures are required
- The required protection works cannot be made by the inhabitants by themselves due to the large scale of gully erosion.

There are 3 sites in Khanh Son commune which require urgent protection works. (See Fig. 4.2.7).

#### 2) Method of works

Protection works against gully erosion are planned by employing the method of gabion works. Gabion stores soil in the gully by checking the soil runoff and stabilizes the development of the gully. The summary of the protection works is as follows:

Summary of Protection Works against Gully Erosion

Site name	Present scale of gully (m)			Gabion works		
	Length	Width	Depth	Method	Number of weir	Volume of Gabion (m <sup>3</sup> )
No.1 Erosion site	50	10	6.5	Gabion	2	840
No.2 Erosion site	70	5	3 to 5	Gabion	5	1,180
No.3 Erosion site	60	25	10	Gabion	2	3,110
Total volume of gabion						5,130

### (3) Implementation Schedule

At present, the Department of Forest Protection under the District People's Committee conducts protection works of the forests and these works consist of countermeasures against forest fire, harmful insects and soil erosion. Therefore, the implementation of the project is to be carried out by the Department of Forest Protection. The construction works shall be conducted in the dry season of the next year, considering the preparation period of design and tendering. Furthermore, it is desirable the works are to be conducted after the completion of rural road construction works in view of the transportation of construction materials.

### (4) Project Cost

Project cost of protection works against gully erosion is as follows:

	L/C (mill.VND)	F/C (mill.VND)	Total (mill.VND)
Protection works against gully erosion	1,929	144	2,074

Note: Engineering cost and physical contingency are included in project cost but the price escalation is not considered.

Gabion protection works against gully is a permanent structure that stores soil in the gully and has the function of stabilizing the development of the gully. Therefore, O/M for the main body and treatment of silted deposit in the upper stream of gully is not needed like in the case of a dam.