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Japan International  
Cooperation Agency  
(JICA)

National Irrigation Administration  
(NIA)

**THE FEASIBILITY STUDY  
ON  
THE WESTERN LEGAZPI IRRIGATION AND  
RURAL DEVELOPMENT PROJECT  
IN  
THE REPUBLIC OF THE PHILIPPINES**

Volume I

**MAIN REPORT**

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DECEMBER 1996

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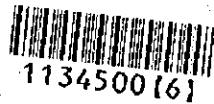
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## P R E F A C E

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a Feasibility study on the Western Legazpi Irrigation and Rural Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Takayoshi Yamazaki, Nippon Koei Co., Ltd., three times between September 1995 and August 1996.

The team held discussions with the officials concerned of the Government of the Philippines, and conducted feasibility study at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the team.

December 1996



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Kimio Fujita  
President

Japan International Cooperation Agency

December 1996

Mr. Kimio Fujita  
President  
Japan International Cooperation Agency  
Tokyo, Japan

### Letter of Transmittal

Dear Sir,


We are very pleased to submit our final report for "The Feasibility Study on the Western Legazpi Irrigation and Rural Development Project in the Republic of the Philippines".

The study was carried out for a total period of 17 months from August 1995 to December 1996. The development plan for the integrated agricultural and rural development was basically formulated with the principal aim to increase agricultural production and improve rural life conditions, paying attention to environment conservation in the study area which covers about 106km<sup>2</sup>. The study was initially formulated a basic development plan covering the study area as a whole and the feasibility study was carried out for the main project components including four (4) model areas selected.

The basic development plan composes of six aspects; (1) irrigation and drainage improvement, (2) agricultural production promotion, (3) agricultural and rural infrastructure development, (4) strengthening of agricultural support systems, (5) establishment of farmers' organization and (6) improvement of rural life condition, and these aspects are lined each other to achieve the goal of the plan. The development plan was formulated on the basis of multi-sectoral components, which includes the establishment of small impounding dam, weir and irrigation canals, land use plan, improvement of rural roads, establishment of nuclear farms including plant nurseries, post-harvest facilities, and improvement of water supply schemes, etc. We believe that the project implementation will help to improve not only the agricultural productivity but also the living condition of rural people in the study area and would recommended that the project should be soon implemented in line with the consultations presented in this report.

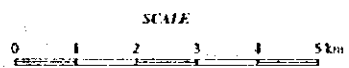
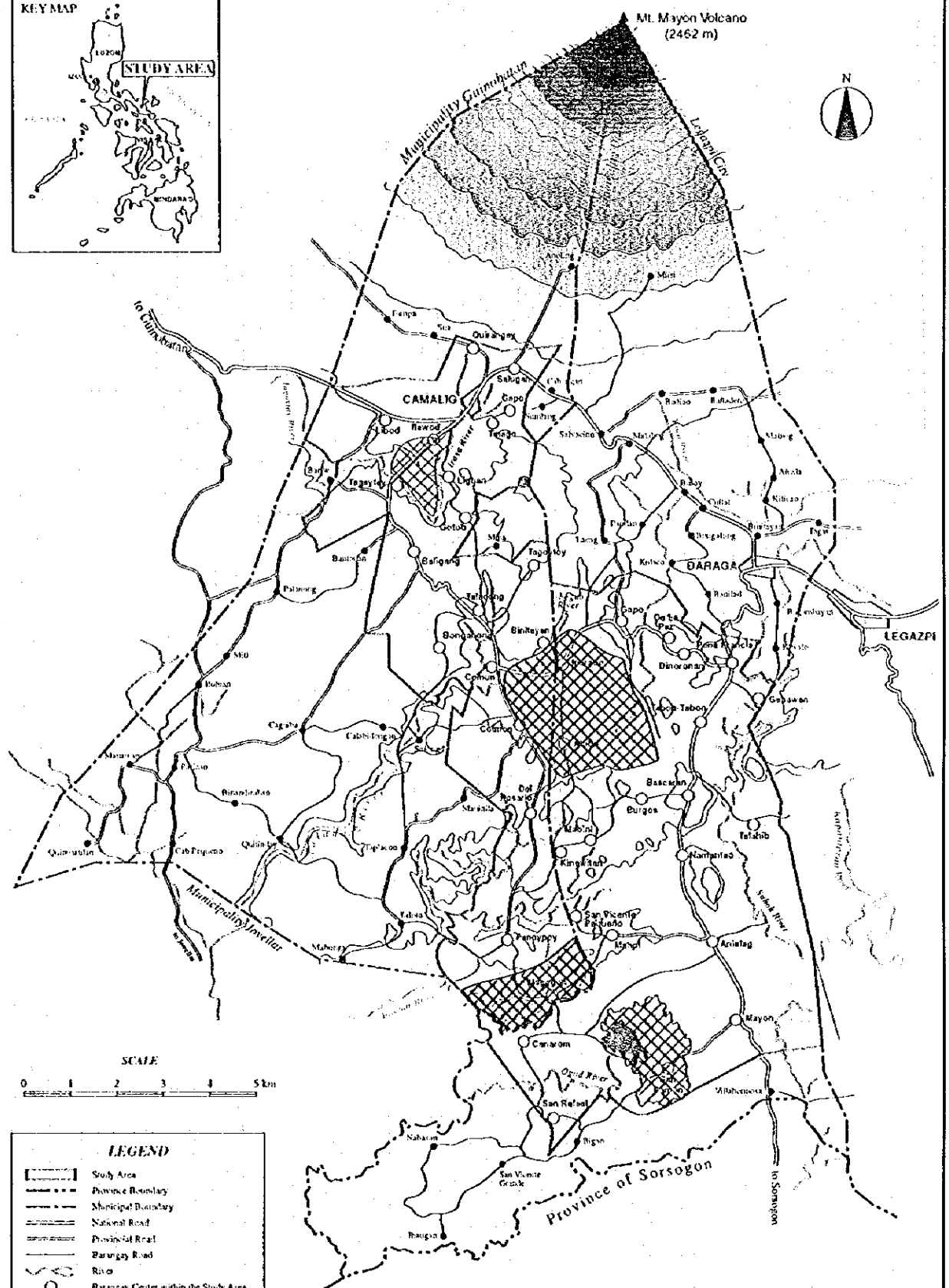
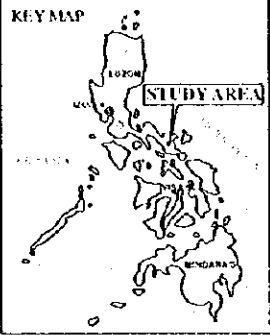
We wish to express our deep appreciation and gratitude to the personnel concerned of JICA and the Advisory Committee, your Philippines Office, the Embassy of Japan in the Philippines, and the Authorities concerned of the Government of the Philippines, as well as various NGOs for the courtesies and cooperation extended to us during our field surveys and studies.

Very truly yours,



Kayoshi YAMAZAKI  
Team Leader of the Study Team for  
the Western Legazpi Irrigation and Rural  
Development Project

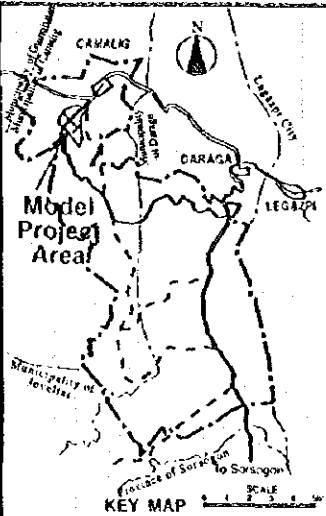
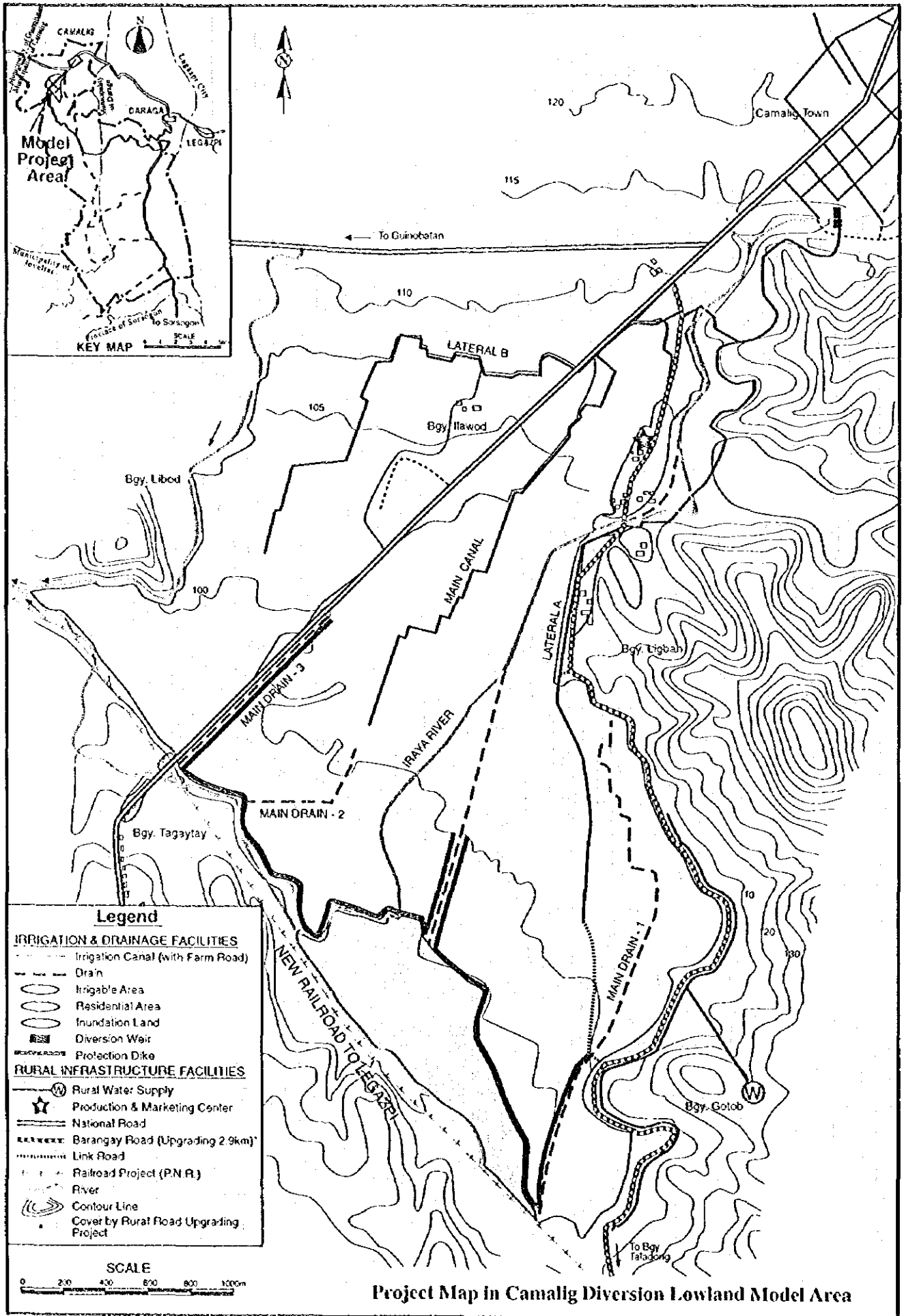




**LEGEND**

	Study Area
	Province Boundary
	Municipal Boundary
	National Road
	Provincial Road
	Barangay Road
	River
	Barangay Center within the Study Area
	Barangay Center out of the Study Area
	Camalig Diversion Model Project Area
	Dam No 2 Model Project Area
	Magasin Model Project Area
	San Ramon Model Project Area

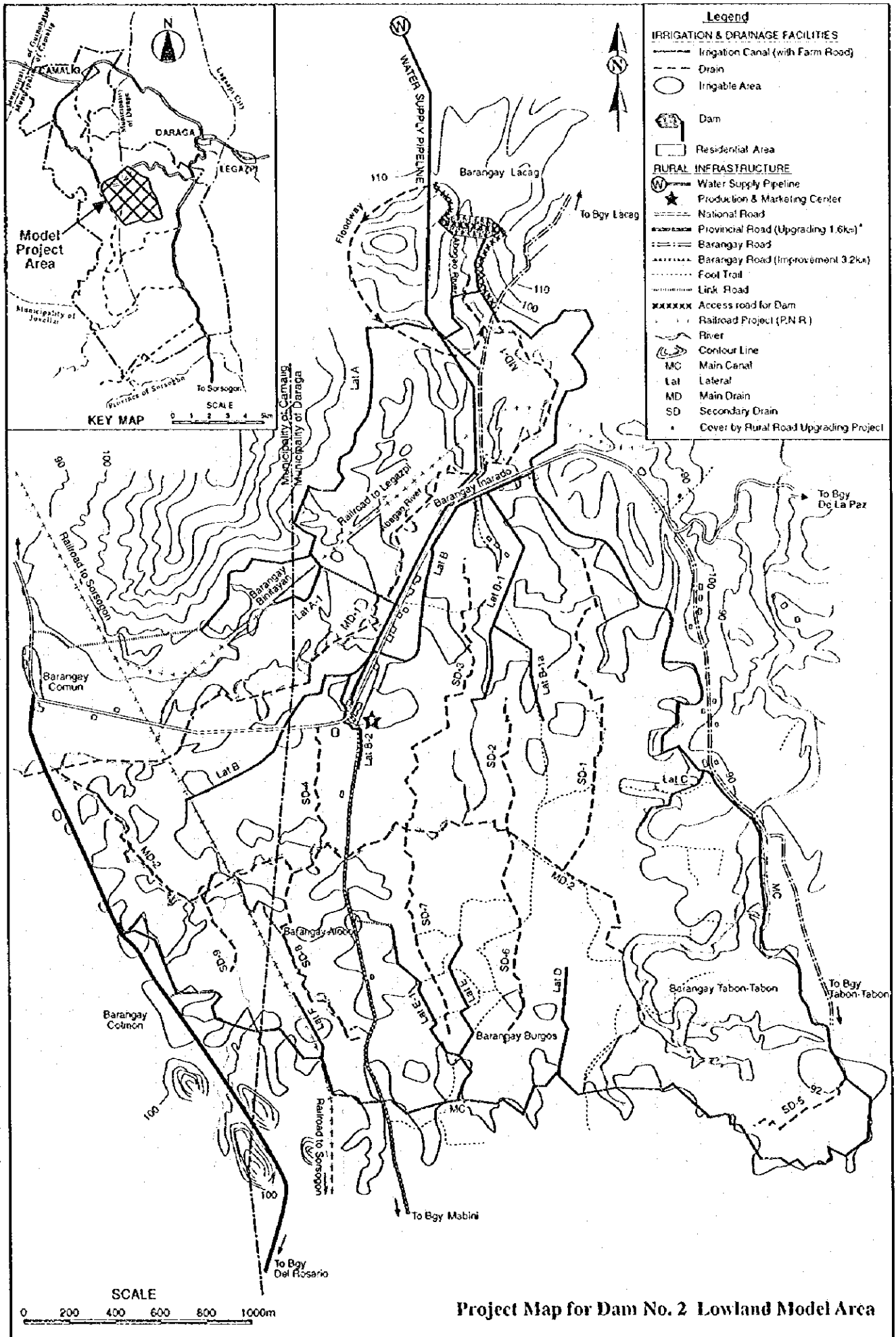
**Location Map**

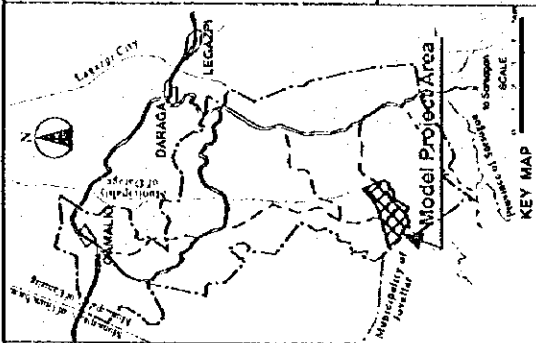


- Legend**
- IRRIGATION & DRAINAGE FACILITIES**
- Irrigation Canal (with Farm Road)
  - - - Drain
  - Irrigable Area
  - Residential Area
  - Inundation Land
  - Diversion Weir
  - ▬ Protection Dike
- RURAL INFRASTRUCTURE FACILITIES**
- ⊙ Rural Water Supply
  - ★ Production & Marketing Center
  - == National Road
  - Barangay Road (Upgrading 2.9km)
  - ⋯ Link Road
  - ⋯ Railroad Project (P.N.R.)
  - ~ River
  - Contour Line
  - ▬ Cover by Rural Road Upgrading Project



**Project Map in Camalig Diversion Lowland Model Area**





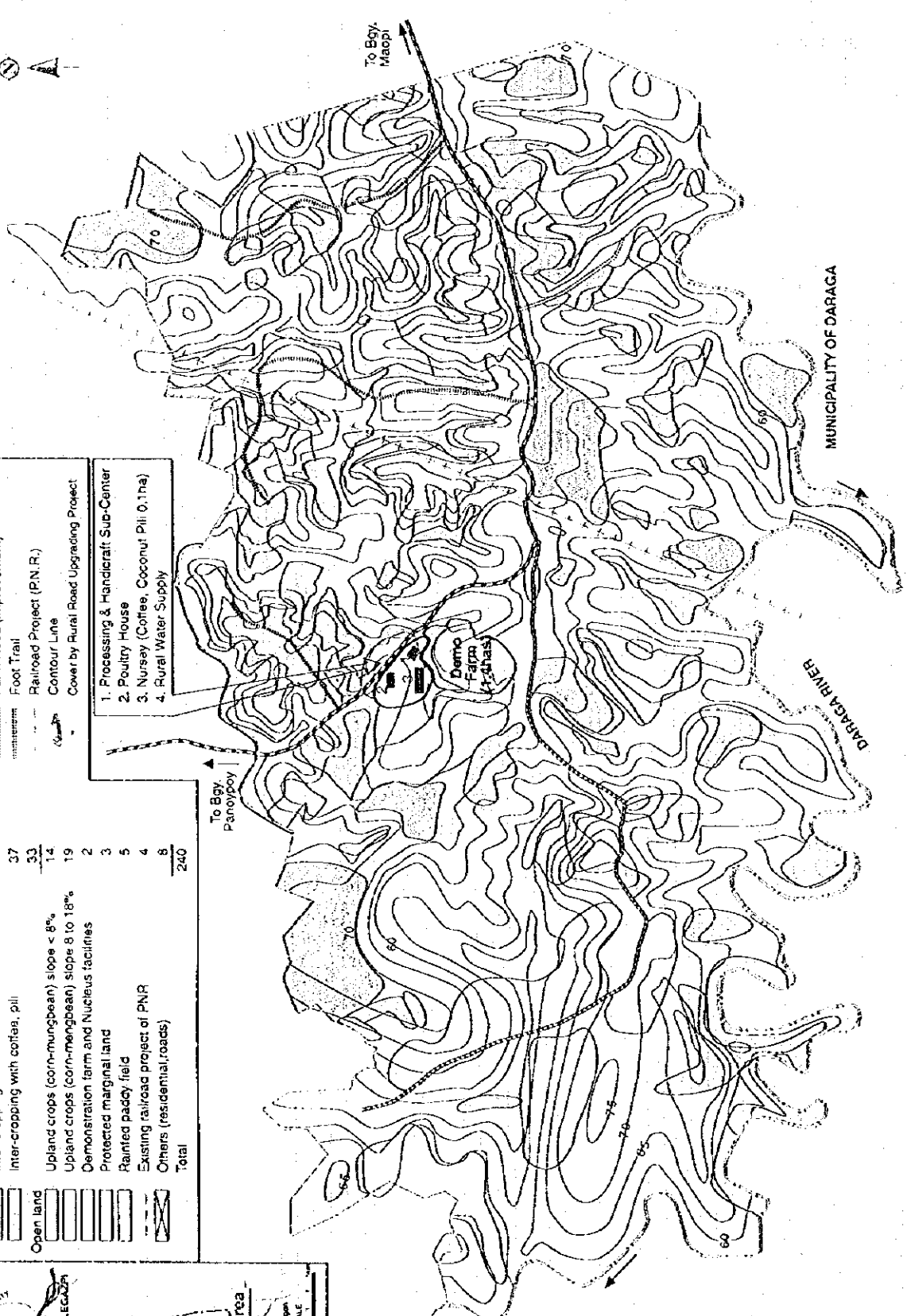
**Legend**

Proposed Land Use	Area (ha)
Coconut land	185
Coconut (without intercropping)	129
Inter-cropping with corn	19
Inter-cropping with coffee, pill	37
Open land	33
Upland crops (corn-mungbean) slope < 8%	14
Upland crops (corn-mungbean) slope 8 to 18%	19
Demonstration farm and Nucleus facilities	2
Protected marginal land	3
Painted paddy field	5
Existing railroad project of PNR	4
Others (residential, roads)	8
<b>Total</b>	<b>240</b>

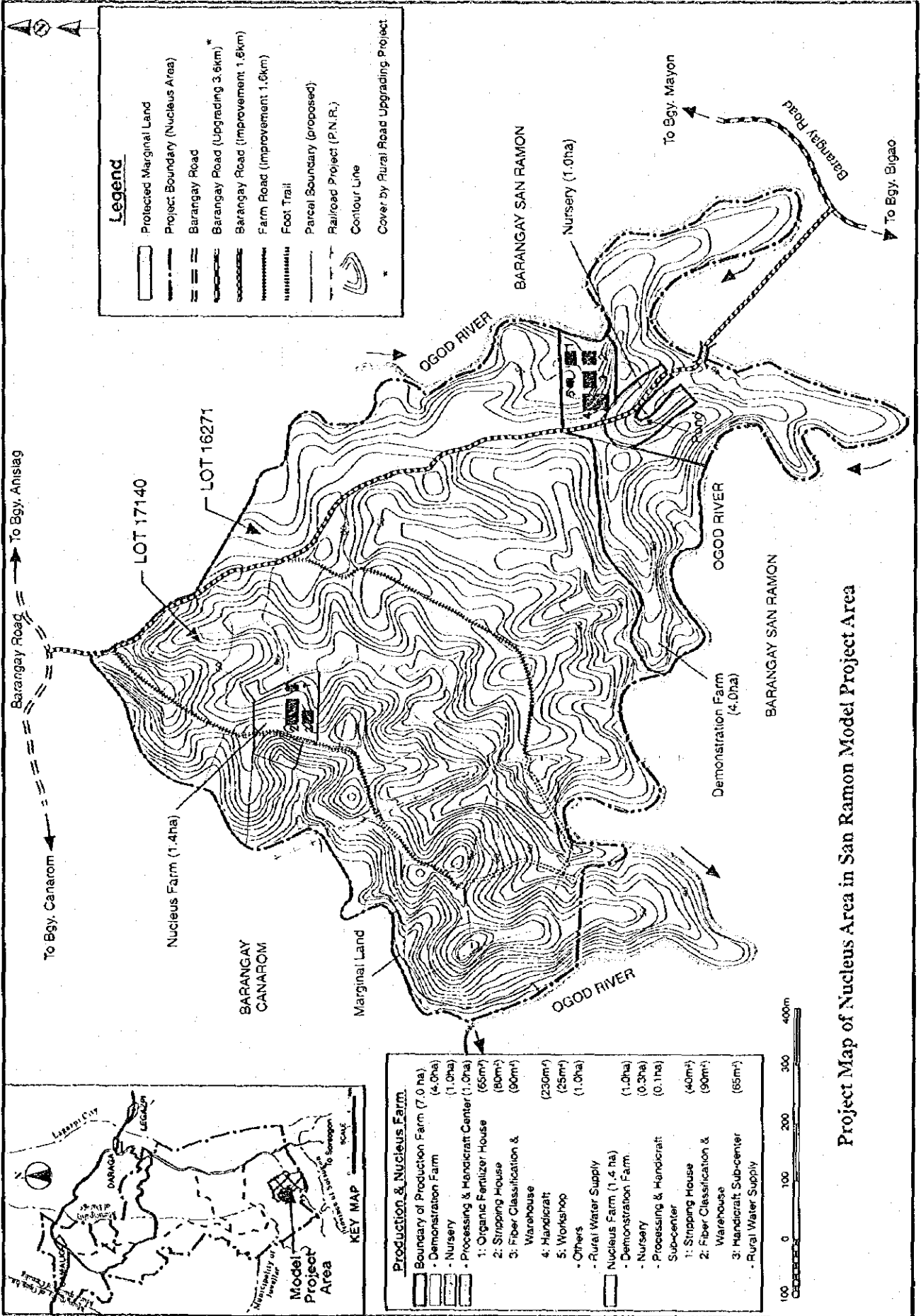
**Legend**

- Boundary of Model Area
- ==== Barangay Road (Upgrading 4.2km)\*
- ==== Barangay Road (Improvement)
- ==== Farm Road (Improvement)
- Foot Trail
- Railroad Project (P.N.R.)
- Contour Line
- Cover by Rural Road Upgrading Project

1. Poultry House
2. Processing & Handicraft Sub-Center
3. Nursery (Coffee, Coconut Pill 0.1ha)
4. Rural Water Supply



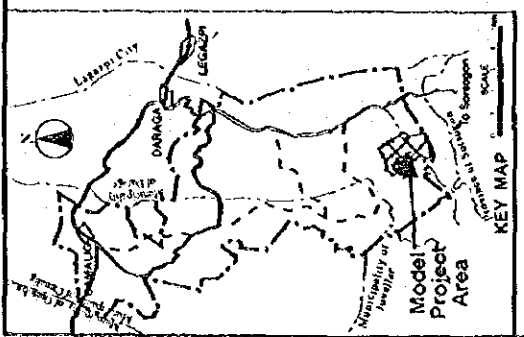
Project Map for Magon Upland Model Rural Development Project Area



**Legend**

- Protected Marginal Land
- Project Boundary (Nucleus Area)
- Barangay Road
- Barangay Road (Upgrading 3.6km)
- Barangay Road (Improvement 1.6km)
- Farm Road (Improvement 1.6km)
- Foot Trail
- Parcel Boundary (proposed)
- Railroad Project (P.N.R.)
- Contour Line
- Cover by Rural Road Upgrading Project

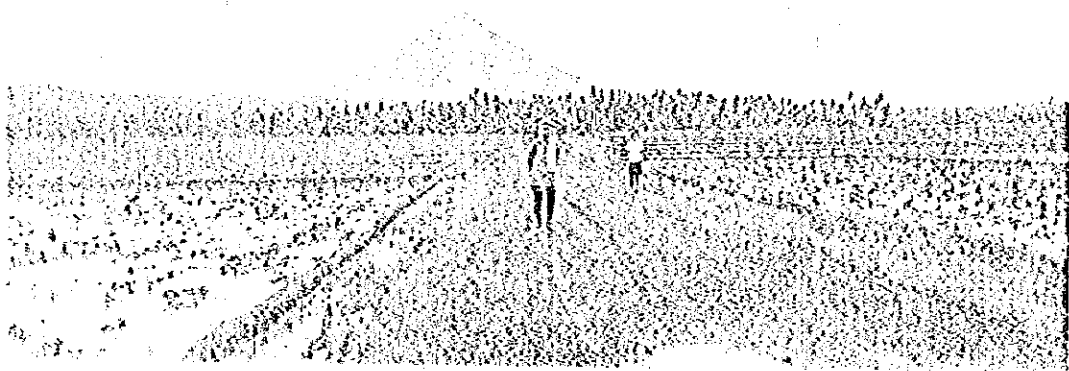
- Production & Nucleus Farm**
- Boundary of Production Farm (7.0 ha)
  - Demonstration Farm (4.0ha)
  - Nursery (1.0ha)
  - Processing & Handicraft Center (1.0ha)
  - 1: Organic Fertilizer House (65m<sup>2</sup>)
  - 2: Stripping House (80m<sup>2</sup>)
  - 3: Fiber Classification & Warehouse (90m<sup>2</sup>)
  - 4: Handicraft (230m<sup>2</sup>)
  - 5: Workshop (25m<sup>2</sup>)
  - Others (1.0ha)
  - Rural Water Supply
  - Nucleus Farm (1.4 ha)
  - Demonstration Farm
  - Nursery
  - Processing & Handicraft Sub-center
  - 1: Stripping House (40m<sup>2</sup>)
  - 2: Fiber Classification & Warehouse (90m<sup>2</sup>)
  - 3: Handicraft Sub-center (65m<sup>2</sup>)
  - Rural Water Supply



Project Map of Nucleus Area in San Ramon Model Project Area



A typical view of the Study Area



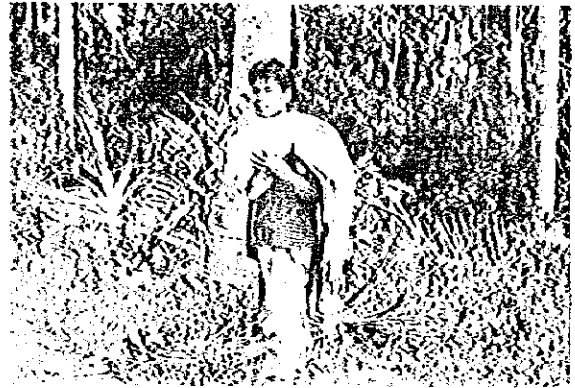
A view of Dam No. 2 Model Project Area



Pre-drying the coconut for making copra (San Ramon Model Project Area)



A young plantation of Abaca "ALINDECO demonstration farm"



Harvesting small quantity of Abaca fiber (Barangay Lacag)



Public Consultation Meeting (Common barangay church)



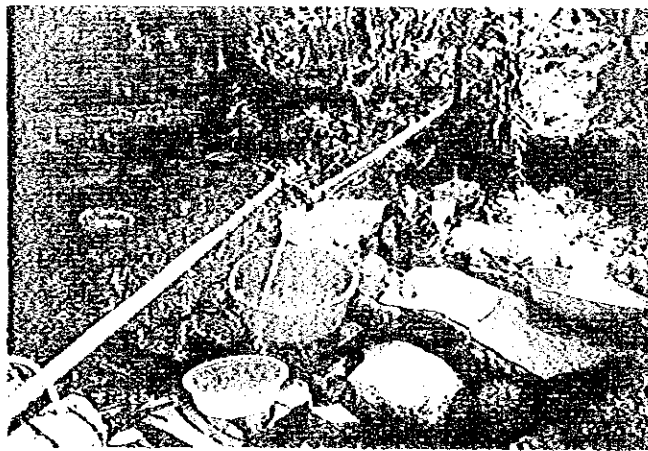
Public Consultation Meeting (School of barangay Magogon)



Barangay road (barangay San Vicente Grande)



A section of the provincial road (barangay Del Rosario)



Faucet of Gabawan level II water supply system



**SUMMARY**  
**Feasibility Study on the Western Legazpi Irrigation and  
Rural Development Project**

**Background and Authority**

1. This Final Report presents the feasibility study on the WLIRDIP following the provisions of the IA which was signed by the NIA and JICA in March 1995. The report consists of 2 volumes. Volume I is the main report highlighting the major findings, conclusions and recommendations of the feasibility study. Volume II contains the different annexes indicating the detailed studies conducted during Phases I and II of the feasibility study.
  
2. The Philippine Government under the Ramos Administration defined a vision for developing the country embodied in the Philippines 2000. The national policies are espoused in the MTPDP, the economic blueprint for the country between 1992-1998. Congruent with the economic development plan is a package of intervention and strategies aimed at uplifting the most disadvantaged sectors in Philippine society. This is the SRA which highlights advancement of social equity in terms of asset reforms; just sharing of the benefits of growth; and peoples participation in the political and economic milieu. In general, the economic targets in the MTPDP are attainable. The prospects are bright for the economy to sustain the real GNP growth of 5.2% it posted in 1994 towards the end of the decade. Inflation rate will also be kept at a single digit at about 4% by 1998. Government economic policies continue to aim at price stability via a continuing deficit reduction program. The sectoral policies are also aimed for a productive agriculture sector composed of strong production and marketing linkages with industry as the core of rural development directed mainly at the poorer regions.

**The Study Area**

3. The Study area located in the province of Albay and in Region V covers the municipalities of Camalig and Daraga. It covers 41 barangays, 20 in Camalig and 21 in Daraga, with a total area of around 106.1 km<sup>2</sup> or 43% of the area of the two municipalities. Total population was estimated at about 52,000 in 1995 and the population growth rate was slightly increasing at 0.74%/annum during 1980 to 1990, while the population in 15 barangays decreased ranging between -0.02 and -2.16%/year. The average family size and population density are 5.3 and 4.9 persons/ha.

4. Approximately 7,080 ha or 66.7 % of the Study area are devoted to coconut plantation. Paddy fields occupy about 1,350 ha or 12.7 % of total area. About 1,225 ha are rainfed paddy fields. Upland crops planted in open areas occupy about 420 ha or 4 % of total Study area. The average land holdings are very small estimated at 0.62 ha for paddy land, 1.41 ha for coconut land and 1.30 ha for total land. The agricultural land holding is relatively small. The smallness is further aggravated by the high incidence of tenancy estimated at 72 % of the total households. The risk of lowland paddy and upland corn production is very high because of untimely and erratic onset of rains and damages caused by typhoon and drought. The cropping intensity of lowland paddy based on the harvested area varies in the range between 139 % to 165 % in rainfed areas and between 170 % and 180 % in irrigated areas. The crop yields are generally low. As a result, the annual net farm incomes of farmers are kept at low levels ranging from 700 pesos to 5,400 pesos with the lowest limit going to the coconut tenant farmers.
5. The Ligban river is the major river stream in the Study area with a mean annual discharge of about 1.01m<sup>3</sup>/sec. There are other small rivers, but in general the water resource potential of these rivers is very limited. There are existing communal irrigation systems nearby the Study area, but these systems encounter problems on water management aspect.
6. Accessibility to the Study area is generally good. It is traversed by a national road and connected by several provincial, municipal and barangay roads. The conditions of the latter type of roads are far from satisfactory, however. Water supply, electricity, telecommunications and other health infrastructure are available but the conditions are also poor.

#### **Basic Development Concept**

7. The development constraints in the WLIRDP range from physical, climate, institutional to socio-economic and other related factors. The development of agriculture is primarily affected by adverse climatic conditions, lack of major infrastructure facilities, weak institutional support for extension, credit and marketing and high incidence of tenancy. Irrigation and drainage development is likewise affected by the limited water resource potential and poor drainage facilities. On the one hand, rural infrastructure development is constrained by the limited technical and financial resources of concerned authorities. A number of the existing road network, water supply facilities, health centers, etc. are inadequate and poorly maintained. The institutional constraints pertain

mainly on weak structures and systems coupled by human factors such as low educational attainment and extreme poverty among tenant farmers.

8. The basic development concept for planning considered four factors: (a) initiation of complementary and critical project components; (b) recognition of the participation of the beneficiaries; (c) recognition of the role of central and local government units; and (e) establishment of model projects. Each factor was considered in designing the configuration of the project components.
  
9. The term "model" is being used as a planning tool for introducing the concept of integration and new approaches to farming. For one, there are limited experiences and resources of the beneficiaries and as such do not warrant the execution of huge development activities. It will take a learning process before the beneficiaries and even the institutions can effectively and efficiently manage their activities. The lowland model project areas were designed based on priority sites for irrigation development. The upland model project areas were selected based on the suitability of dominant crops, existence of functional organizations and positive attitude of farmers to introduce new farming systems. For both areas, they were also considered as priority sites for rural infrastructure development. The last criterion is the consideration of equitable inclusion of barangays between the municipalities of Camalig and Daraga as shown below.

Item	Covering Barangay	
	Camalig	Daraga
<u>Lowland Model Rural Development</u>		
(1) Camalig Diversion Area (Rural Road)	C-6 Ilawod C-8 Ligban C-10 Gotob* (Ligban-Gotob-Taladong)	C-7 Libod C-9 Tagaytay
(2) Dam No. 2 Area (Rural Road) (Watershed Area)	C-14 Binitayan C-15 Comun C-17 Cotmon	D-1 Inarado* D-6 Alobo D-7 Tabon-Tabon (Inarado-Alobo-Mabini) (Lacog)
<u>Upland Model Rural Development</u>		
(1) Upland Corn Based Development Area (Rural Road)	C-20 Magogon (Anislag-Maopi-Magogon)	
(2) Upland Coconut Based Development Area (Rural Road)		D-19 San Ramon (Mayon-San Ramon)

Note : \* Sites covered by Level II rural water supply project

10. Over and above the model projects, as independent projects, are the rural road upgrading, rural water supply rehabilitation and integrated support services project to be implemented outside of the model areas.
11. The institutional development will cover a number of measures to improve the delivery of agricultural extension, credit and marketing; strengthening of farmers' organizations; tightening the coordination with the DAR on the implementation of the CARP; and enhancing the participation of the beneficiaries in livelihood and income generating projects.

### **The Project Areas**

12. To distinguish the boundaries of the Project areas from the Study area, it should be emphasized that the project areas are selected barangays where specific activities or components of the project are envisaged to be implemented. The projects areas are composed of 22 barangays while the Study area is comprised of 41 barangays.
13. The lowland model project areas are composed of Camalig diversion and Dam No. 2 areas. Total population of the related blocks in Camalig Diversion and Dam No. 2 model project areas stood at 5,489 and 4,792 in 1995. Roughly 90 to 95% of the population in both areas is in farming. This translates to approximately 1,000 farm households in each area, and farm population densities of 37.6 and 11.5 persons/ha in Camalig diversion and Dam No. 2 areas, respectively. Compounding this densely populated areas is the high incidence of tenancy ranging from 56.2% to 50.7% of the total farmers in both areas. The share of landless is about 67% to 71% of the total farmers. The potential irrigable areas are estimated at 135 ha (Camalig diversion) and 395 ha (Dam No. 2). Farming as a major occupation leaves much to be desired. The current practice is beset by shortage of farm inputs, notably seeds, post-harvest facilities, crude technologies and poor road network. As a consequence the existing yield of paddy rice is rather low averaging at 0.8 to 3.0 tons/ha (rainfed) to 2.0 to 3.5 tons/ha (irrigated).
14. The upland model project areas are administratively located in barangays Magogon and San Ramon. The Magogon area consisting of 3 blocks is generally corn-based farming, while the San Ramon area composing of 6 blocks is essentially coconut-based farming. Total population of the related blocks in Magogon and San Ramon in 1995 was 496 and 1,137, respectively. Practically 100% of the population is in farming. The number of farm households is placed at 127 (Magogon) and 246 (San Ramon) during the same year. Given the population figures, farm population densities are

estimated at 2.1 and 1.7 persons/ha in Magogon and San Ramon, respectively. In terms of land ownership, 57 to 59% of the total farmers do not own any land. Agriculture in both areas is dominated by monoculture focusing mainly on coconut and corn cultivation. The cultivation of paddy rice under rainfed is practiced in fragmented areas, normally at the bottom of the valley. Crude farming practice is observed in both areas, and soil erosion is critical as most of the top soil and existing cover are slowly being removed. Accessibility to these areas is difficult as the existing road network are in poor condition. Total area in Magogon is estimated at 240 ha while the arable land in San Ramon is placed at 785 ha.

15. The project areas for the rural road cover 19 barangays with a total of 33.1 km, 65% of which are barangay roads. The remainder of 35% are provincial roads. It should be noted that several of the road sections are located in the barangays covered under the lowland and upland model rural development project areas. Total population expected to be covered is estimated at 12,880 people or about 2,500 households. In addition, 4 barangays are covered in the rehabilitation of Level-II water supply system. Total population expected to be served is estimated at around 1,160 people or 211 households.
16. The constraints in developing the project areas are rather varied. In the lowland, the constraints include large proportion of landless farmers, low productivity of paddy rice, damages brought about by frequent typhoons, lack of farming technologies and dormant and inactive farmers cooperatives. The upland area is even worse as the difficulties range from limited farm opportunities, inaccessibility of remote barangays, relatively high proportion of landless farmers, serious soil erosion and inadequate farming technologies. On top of these technical constraints, there are organizational and institutional problems. These include the limited absorptive capacity of the local people, weak internal coordination among the government agencies in the execution of basic services, especially agricultural extension and limited budgetary support which has significantly affected the maintenance activity for rural road network.

### **The Project Components**

17. The project components are : (1) Model Projects Development in the lowland (Camalig Diversion and Dam No. 2) and upland (Magogon corn-based and San Ramon coconut-based); (2) Rural Road Upgrading; (3) Rural Water Supply Rehabilitation (Level II); and (4) Integrated Support Services.

18. The model project development in the lowland consists of Camalig Diversion Lowland model project and Dam No. 2 lowland model project. The Camalig Diversion Lowland Model Project has a net irrigation area of 130 ha; Development of facilities consist of a diversion weir, about 8 km of irrigation and drainage canals. Upgrading or improvement about 8 km of barangay and farm roads; Development of a production and marketing center; and rehabilitation of rural water supply in barangay Gotob. Dam No. 2 Lowland Model Project has a total area of 395 ha to be irrigated in rotation. Development of facilities consist of a Dam; about 39 km of irrigation and drainage canals; Upgrading or improvement about 25 km of barangay and farm roads; Development of a production and marketing center; and rehabilitation of rural water supply in barangay Inarado.
19. The model project development in the upland consists of Magogon upland model project and San Ramon upland model project. Magogon Upland Model Project consist of a nucleus farm for extension of farming practices; a nursery for production of seedlings; nucleus facilities including cooperative office, warehouse, processing sub-center, and poultry house; upgrading or improvement of about 8 km of barangay and farm roads; and small water impounding. San Ramon Upland Model Project consist of a nucleus farm, a production farm, nurseries; nucleus facilities including abaca processing center and organic fertilizer production area; and upgrading or improvement of about 7 km of barangay and farm road.
20. In parallel with the physical infrastructure, new dimensions will be introduced in the organization and strengthening of rural and farmers' organizations. Under the lowland model development projects, new organizations primarily composed of the landless will be organized. This organization will be spinned-off as a service organization to eventually graduate as full-fledged cooperative. This is proposed to be the ISA. The ISAs to be organized in Camalig Diversion weir and Dam No. 2 will handle, among others, activities such as collection of ISF, maintenance of canals, operation of post-harvest, etc. On the other hand, the traditional IAs will now become the IBA. The IBAs will perform different roles. They will concentrate on capital intensive agri-business enterprises such as seed production and crop diversification. In the upland model development project, the existing cooperative in Magogon will be strengthened. In San Ramon, however, landless association and CARP beneficiaries associations will be organized to operate the nucleus farm and production farm, respectively. The organization of the landless is seen as the most pragmatic route in giving meaning and sense to the so-called social reform agenda of the government. Finally, the water users associations known as RWSAs will be reactivated in Inarado, Taladong and Gabawan.

The Gotob RWSA is functioning well, and it is envisaged to replicate its success activities to the 3 non-functional RWSAs.

21. In the lowland development model projects, the production and marketing center is provided to upgrade the quality of rice and sustain improved marketing. The production and marketing center will be composed of semi-mechanical dryer, rice mill and warehouse, etc. The marketing linkages on the upland development model projects shall be strengthened with existing private companies who have invested in some facilities around the project areas such as San Miguel Corporation, Swift Corporation, Nestle Philippines Inc., Alindeco, Isalog Pulp and Paper Co., Legazpi oil, etc. In case of Magogon upland development model project, the cooperative could sell corn grits instead of corn grain to Santo Domingo Peoples Cooperatives. Under contract growing scheme, broilers will be purchased by the San Miguel Corporation or Swift Corporation which have poultry dressing plants in Anislag and Libod, respectively. The coffee beans will be sold directly to the buying station in Legazpi city under the Nestle Philippine Inc. In the San Ramon Project, the abaca marketing linkage with Alindeco and Isalog and the copra marketing linkage with Legazpi Oil Company will be strengthened and sustained.
22. The administration of agricultural credit requirement is proposed to be dovetailed with the current small farmer financing program of LBP. This underscores the importance of having strong and viable cooperatives since LBP courses its financing only to cooperatives. It is proposed that a special lending window be established with LBP as the administration of the fund.

#### **Project Cost and Benefits**

23. The total project cost is estimated at 423.65 million pesos, 56% of which is the foreign currency cost. The cost breakdown by component is given below.

(Unit: P1,000)	
Description	Project Cost
I. Model Projects	
1. Canalig Diversion	47,817
2. Dam No. 2	166,998
3. Magogon	36,863
4. San Ramon	35,979
II. Rural Road Upgrading	125,453
III. Rural Water Supply	1,498
IV. Integrated Support Services	9,040
<b>Total</b>	<b>423,648</b>

24. The benefits of the project will primarily be increase in the production of paddy in lowland model project areas and tree crops, mainly copra and abaca, and field crops in the uplands model project areas. At full project development, the production of paddy will increase 990 tons in Canalig Diversion project area, and 1,900 tons in Dam No. 2 project area. The estimated incremental annual gross value of crop production will be 9.2 million pesos in Canalig Diversion project area and 18.6 million pesos in Dam No. 2 project area. Furthermore, the intensified farming activities will result in the generation of additional annual labor of about 3,800 man-days in Canalig Diversion project area, 8,200 man-day in Dam No. 2 project area. The incremental annual benefit in the upland will be 9 million pesos and 14,500 man-day in Magogon model project area, and 90.5 million pesos and 14,500 man-day of addition labor opportunity in San Ramon model project area.

#### **Project Execution and Implementation Schedule**

25. A semi-autonomous organizational body directly attached to the PGA is proposed to implement the various components of the project. The organizational body will be called the Western Legazpi Irrigation and Rural Development Project Office. Two structures are central to the organizational framework: (a) the establishment of the IAPCC; and (b) establishment of the PMU. The IAPCC is proposed to be the policy-making body which will resolve policy issues affecting project implementation. It will discuss and approve work plans and budgets for the project. The IAPCC is proposed to be chaired by the Provincial Governor and its members will be high level staff(regional director) or local chief executives from agencies directly participating and/or providing staff complement in the execution of the project. The PMU, on the



other hand, will be the implementing organizational body. Its existence is time-bound and co-terminus with the envisaged activities of the project. It will be run by a competent and professional project manager. The PMU will be staffed with middle-level personnel, preferably drawn from the various offices of the PGA, MGCD and other line agencies to ensure continuity of activities the moment project intervention phases out. Consolidating the staff under the PMU is essential in order to train them, particularly those in the provincial and municipal offices in project planning, coordination and supervision. For all its intent and purposes, the structure of the PMU will allow an active participation of the farmers through the farmers committee not only in execution but also in policy-making.

26. The NGOs will handle strengthening of activities related to community organizing of the ISAs, IBAs, landless associations, etc. which include social preparation, credit transfer, and capital build-up. In project execution, the NGOs through the Farmers Committee will advise the PMU. In addition, the farmers organization under management assistance of an NGOs assigned at the relevant farmers organizations will participate in all activities related to project execution ranging from bidding, construction of infrastructure facilities to actual turn-over of facilities. The government agencies will do training on technology development. This delineation of responsibility will be one of the major tasks of the Institutional Development Division of the PMU. This division will see to it that the institutionalization of NGO efforts will be integrated in project execution.
27. The operation and maintenance of the physical facilities, except for those equipment to be provided to government agencies, will be the responsibility of the farmers' organizations and other juridical entities. Efforts will therefore be made to recover the cost of such facilities. In the case of the irrigation component, however, the maintenance will be jointly done by the PEO/MEO and the ISAs. This is consistent with the policy of the NIA where the maintenance of dams and small reservoirs is the responsibility of the agency while the irrigation canals is the responsibility of the IAs. The provincial and barangay roads will also be maintained by the PEO and concerned MEO, respectively.
28. The implementation of the project is estimated to be completed in about 5 years. The first year will be mainly for setting up the organizational structures for project execution and information dissemination through public consultation with the farmer beneficiaries. The second year will be devoted to: planning and design work for the infrastructure facilities to be constructed, notably the irrigation and rural road facilities; installation of post-harvest facilities in the upland model project areas and equipment for

the use of training agricultural extension agents and farmers; and establishment of new farmers' organizations. The construction of the irrigation facility will begin in the middle of the third year and it is expected to be completed until the last quarter of the fourth year. The third and fourth years will focus on the construction of the major infrastructure facilities. The same schedule will also coincide with the institutionalization of farmers' organization and intensive training for both the farmers and extension agents. This activity will continue until the end of the project.

### Project Evaluation and Assessment

29. The calculated EIRRs of the 4 model rural development projects, including the rural road upgrading and water supply rehabilitation outside of the model areas are summarized below. With the exception of Dam No. 2 lowland model rural development project whose EIRR is below the opportunity cost of capital estimated at 15%, the 3 other model rural development projects can be generally considered as economically viable. The rural road upgrading is similarly viable. The rural water supply rehabilitation have low economic IRRs. The IRR of Dam No. 2 model project is significantly influenced by the investment cost of the irrigation dam and reservoir. Similarly, the low EIRR of the rural water supply is caused by the conservative estimate on revenues based primarily on the users' affordability to pay water charges.

	EIRR (%)
<b>I. Model Project</b>	
1. Camalig Diversion	19.9
2. Dam No. 2	9.9
3. Magogon	24.0
4. San Ramon	34.2
<b>II. Rural Road Upgrading</b>	18.8
<b>III. Rural Water Supply</b>	
1. Gabawan	3.4
2. Taladong	6.7

30. The financial analysis reveals significant changes in the household income at full project development. The household income for lowland owner cultivator was estimated to increase by 179 to 182% on average ; 32 to 64 % for lowland landlesses/share croppers; 71 to 152 % for upland owner cultivators; and 59 to 79 % for upland

landlesses/share croppers. The net budget reserve was estimated to increase from 3.1 to 10.4 folds of those of the without project condition.

31. Adverse effect on the human population relative to displacement of families in Dam No. 2 will occur unless a permanent resettlement site be provided. However, the affected families are generally amenable to the execution of this irrigation facility as long as they are properly compensated. No severe problem on soil erosion is expected to occur as this will be addressed by the project through proper soil conservation measures and watershed management.

### **Conclusions and Recommendations**

32. The WLIRDP as a package is recommended for consideration by the Philippine Government. The 4 model rural development projects are generally viable. Although the economic evaluation of Dam No. 2 lowland model rural development project yielded an EIRR of 10% which is below the opportunity cost of capital, this project should be considered for endorsement. Dam No. 2 should be gauged not only from the traditional investment criterion but also from the social and equity standpoint of providing irrigation water to small farm households. In addition, the cost for the improvement of the river course of the irrigation component of the Camalig lowland model project estimated at 65.72 million pesos should be supported by the government. It should be noted that this investment has nothing to do insofar as irrigation efficiency is concerned, but essential to protect flooding of houses and farmlands in the outlying areas.
33. The rural road upgrading and rural water supply rehabilitation components outside of the 4 model project areas, including the integrated support services are equally important and should be supported. The rural road and water supply rehabilitation projects are basic necessities to the population in the project area. The integrated support services project will be the key to improving delivery of agricultural support services.
34. It is also recommended that the Philippine Government should give particular support to *the proposed implementing organizational structure for this project*. The project will test the absorptive capacity of the LGUs in Albay. This will be the first time that the PGA and MGCD through the PMU will implement a rural development project of this magnitude, with the irrigation facility as the biggest investment item. In this regard, it is suggested that the NIA be made to lend its technical support to the implementing body.

35. The implementing authority should address the more critical implementation issues, namely: displacement of 22 houses as a result of the construction of Dam No. 2; just compensation for damaged properties; and cost recovery for the irrigation and post-harvest equipment. It is suggested that permanent resettlement areas provided with basic facilities be in place before commencement of construction. Since the project will be the responsibility of the LGUs in Albay, cost recovery for the irrigation facility should be consistent with the NIA policy on communal irrigation systems. The mechanisms for collection of amortization should be established given the fact that the implementing authority does not have a corporate charter. Although by virtue of the autonomy act, the LGUs have fiscal powers.
36. The success of the project will hinge on the long-term viability of farmers' organizations. New farmers organizations will be established and existing will be strengthened. The integration of lowland and upland farming activities together with the provision of agricultural support services is envisaged to be achieved through these institutions. It is therefore recommended that the institutional budget be made as permanent support during the implementation period.
37. The accelerated means to get the support for the WLIRD is for the implementing authority to get the nod of the DAR to declare the 4 model project areas as ARCs. In so doing, existing support for the ARCs can be extended especially to the lowland model project areas. The implementing authority should work this out with the DAR.

## The Feasibility Study on The Western Legazpi Irrigation and Rural Development Project

### Project Description (1/5)

Project Items		Model Project Development			
		Camalig Diversion Lowland Model Area Development Project	Dam No. 2 Lowland Model Area Development Project	Magogon Upland Development Model Project	San Ramon Upland Model Development Project
Background	(1) Region	Bicol (Region 5)	Bicol (Region 5)	Bicol (Region 5)	Bicol (Region 5)
	(2) Province	Albay	Albay	Albay	Albay
	(3) Municipality	Camalig	Camalig and Daraga	Camalig	Daraga
	(4) No. of Barangays	5	7	1	1
	(5) No. of total households	1033	961	127	257
	(6) No. of farm household	918	915	120	245
	Land owner	28.6%	32.7%	42.5%	40.8%
	Tenant	56.2%	50.7%	35.9%	51.6%
	Caretaker	15.2%	16.6%	21.6%	7.6%
(7) Total population	5,489	4,792	496	1,337	
(8) Farm household population	4,884	4,557	469	1,282	
(9) Topography	Small valley (weir site) Alluvial plain (frr. area)	Small valley (dam site) Alluvial plain (frr. area)	Rolling uplands	Rolling uplands	
Present Condition	(1) Hydrology				
	a) Water resources	Liguan River	Abogon rivers		
	b) Basin area (km <sup>2</sup> )	8.0 km <sup>2</sup>	1.8 km <sup>2</sup>		
	c) Basin rainfall (mm/year)	2,590 to 3,330	2,590 to 3,330		
	d) Basin runoff (1000 M <sup>3</sup> /year)	14,356	3,791		
	(2) Land area (ha)	130 ha agricultural land 17 ha non-agricultural land	540 ha agricultural land 70 ha non-agricultural land	240 ha (total barangay area) 132 ha agricultural land 8 ha non-agricultural land	785 ha (total barangay area) 369 ha agricultural land 16 non-agricultural land
	(3) Agriculture				
	a) Main crop/area	Paddy field Irrigated 0 ha Rainfed 130 ha	Paddy field Irrigated 31 ha Rainfed 364 ha	186 ha coconut 20 ha openland corn (17 ha fallow land) 47 ha coconut (to be replanted) About 20 ha inter-cropping in the coconut land (corn)	534 ha coconut 130 open upland corn (84 fallow) 130 ha coconut (to be replanted) About 50 ha inter-cropping in the coconut land (corn)
	b) Production:				
Average Yield	Paddy 2.1 tons/ha 1st season 1.7 tons/ha 2nd season	Irrigated Paddy 3.3 tons/ha 1st season 3.0 tons/ha 2nd season Rainfed Paddy 2.1 tons/ha 1st season 1.7 tons/ha 2nd season	1.0 ton/ha of copra 1.5 tons/ha corn in openland 1.0 ton/ha corn inter-cropping	1.0 ton/ha of copra 1.5 tons/ha corn in openland 1.0 ton/ha corn inter-cropping	
Harvested Area (ha/year)	201	598	186 of coconut 84 ha of corn	534 ha of coconut 480 ha of corn	
Cropping Intensity (%)	155	151			
Total Production (tons/year)	387	1,212	186 tons of copra 99 tons of corn	534 tons of copra 480 tons of corn	
(4) Irrigation and Drainage					
a) Irrigation Block (nos.)	-	6	-	-	
b) Irrigation area (ha)	-	31	-	-	
c) Numbers of intake structures (nos.)	-	6	-	-	
d) Type of intake structure	-	Brush Dam	-	-	
(5) Rural Infrastructure					
a) Road (km)					
a-1) Road in and around the Model area					
National road	1.8	3.6	-	-	
Provincial road	-	2.0	-	-	
Barangay road	3.4	5.8	3.3	1.6	
a-2) Access road to the Model area					
Provincial and Barangay roads	-	-	3.2	3.6	
b) Water supply					
b-1) Water supply coverage (%) **					
Level I (private)	3	6	2	0	
Level I (public)	19	23	53	35	
Level II	4	3	0	0	
Level III	8	0	0	0	
Unserviced population	66	68	45	65	
b-2) Level II					
Location (Barangay)	Go'oh	Inarado	-	-	
Number of beneficiary households	27	67	-	-	
Number of beneficiary population	149	369	-	-	
c) Electrification %					
Energized Barangay (%)	100	71	0 **	100	
Number of energized Barangays	5 out of 5	5 out of 7	0 out of 1	1 out of 1	
Energized households (%)	48	38	0	5	
Number of energized households	741 out of 8,517	587 out of 8,113	0 out of 496	12 out of 1,337	

Note: \*\* Data are of the whole barangays related to the model area.

\*\* Expansion of distribution line from Maop to Magogon is planned within 1996 by COF Funded

## The Feasibility Study on The Western Legazpi Irrigation and Rural Development Project

### Project Description (2/5)

Project Items	Model Project Development			
	Canalig Diversion Lowland Model Area Development Project	Dam No. 2 Lowland Model Area Development Project	Maggon Upland Development Model Project	San Ramon Upland Model Development Project
(1) Constraints to Development	<b>I. Irrigation and Drainage</b> 1) Limited water resource potential for irrigation purpose 2) Lack of irrigation facilities  <b>II. Rural Infrastructure</b> 1) Limited funding support leads to poor maintenance 2) Inadequate skills and knowledge on O&M 3) Lack of government support to monitor and render technical assistance on O&M 4) Lack of discipline among members  <b>III. Agricultural Institutions</b> 1) Inadequate extension services 2) Weak cooperatives and non-viable farmers organizations 3) Lack of credit access to formal institutions 4) Inadequate marketing system, particularly in post-harvest handling		<b>I. Agriculture</b> 1) Lack of appropriate farming systems and technology 2) Limited investing power coupled with farmers' subsistence level of income 3) Land tenure system	
(2) Development Concept	1) Construction of irrigation facilities 2) Rehabilitation of priority rural road network 3) Improvement of potable water supply facilities 4) Development of agriculture cum provision of necessary support services		1) Rehabilitation of priority rural road network 2) Improvement of potable water supply facilities 3) Development of agriculture cum provision of necessary support services	
(3) Sectoral Development Plan				
i) Agriculture				
a) Main crops/area	Paddy field Irrigated 130 ha Rainfed 0 ha  Mungbean 45 ha	Paddy field Irrigated 190 ha Rainfed 205 ha  Mungbean 135 ha	185 ha coconut 34 ha openland corn (1 ha protected marginal land) 47 ha coconut replanting Inter-cropping in coconut land 19 ha of corn 37 ha of coffee & pili	529 ha coconut 0 ha openland corn (7 ha protected marginal land) 130 ha coconut replanting Inter-cropping in coconut land 317 ha of abaca Open land 190 ha abaca & pili 20 upland rice, mungbean and eggplant
b) Production				
Average Yield	Paddy: 5.5 tons/ha 1st season 5.0 tons/ha 2nd season	Irrigated Paddy 5.5 tons/ha 1st season 5.0 tons/ha 2nd season Rainfed Paddy 3.0 tons/ha 1st season 2.6 tons/ha 2nd season	3.5 tons/ha of copra 3.0 tons/ha corn in openland 2.7 tons/ha corn inter-cropping 1.5 tons/ha coffee 2.0 tons/ha pili 1.2 tons/ha mungbean	3.5 tons/ha of copra 2.6 tons/ha of abaca 2.0 tons/ha pili 2.0 tons/ha upland rice 1.2 tons/ha mungbean 7.0 tons/ha eggplant
Harvested Area (ha/year)	260 paddy 45 mungbean	280 ha of irrigated paddy 410 ha of rainfed paddy 45 mungbean	185 of coconut 108 ha of corn 37 ha of coffee and pili	529 ha of coconut 507 ha of abaca 190 ha of pili 70 ha upland rice 49 ha mungbean 15 ha eggplant
Cropping Intensity (%)				
Total Production (tons/year)	235 1,365 tons of paddy 54 tons of mungbean	234 3,091 tons of paddy 162 tons of mungbean	648 tons of copra 308 tons of corn 55 tons of coffee 74 tons of pili (unshelled) 65 tons of mungbean	1,850 tons of copra 1,318 tons of abaca 380 tons of pili (unshelled) 140 tons of rice 59 tons of mungbean 105 tons of eggplant
	Introduction of soil conservation measures in watershed area			
ii) Irrigation and Drainage				
a) Irrigation services area (ha)	130 ha	395 ha with rotation		
b) Intake structure	Diversion Weir	Dam		
c) Main irrigation canal system				
- Numbers of main & secondary canals	3 nos	1 nos		
- Total length of irrigation canals	5.6 km	21.4 km		
c) Main drainage canal system				
- Numbers of main & secondary drains	3 nos	11 nos		
- Total length of drainage canals	2.3 km	17.4 km		
d) Related canal structures				
- Numbers of major canal structures	68 nos	192 nos		

**The Feasibility Study on The Western Lagazpi Irrigation and Rural Development Project**

**Project Description (3/5)**

Project Items		Model Project Development			
		Camalig Diversion Lowland Model Area Development Project	Dam No. 2 Lowland Model Area Development Project	Magogon Upland Development Model Project	San Ramon Upland Model Development Project
Development Plan	iii) <b>Rural Infrastructure</b>				
	a) Rural Road Upgrading (km)				
	Rural road upgrading (location)	Ligban-Goteb	Comun-Comon	Maopi Panopyoy	Mayon-San Ramon
	Rural road upgrading (km)	2.9	1.6	4.2	3.6
	Barangay road improvement (km)	none	3.2	1.6	1.6
	Farm road improvement (km)	5.4	20.2	1.8	1.6
	b) Rural Water Supply Rehabilitation				
	Level-I (deep well construction) (nos.)	-	-	1	2
	- Location of deepwell			In Nucleus farm	In Nucleus Farm and Production Farm
	Level-II rehabilitation				
	- Expansion & replacement pipe (km)	0.7	4.7	-	-
	- New communal faucets (nos.)	7	20	-	-
	- Additional no. of beneficial HH	35	95	-	-
	- Additional no. of beneficial population	196	532	-	-
	- Total no. of beneficial HH	62	162	-	-
- Total no. of beneficial population	345	901	-	-	
c) Electrification					
Expansion of distribution line (km)	-	-	-	2.0	
iv) <b>Post-Harvest and Marketing</b>					
a) Production and Marketing centers					
- Facilities Area (m <sup>2</sup> )	783	1,720	-	-	
- Equipment cost (P 1,000)	245	427	-	-	
b) Nucleus Facilities					
- Facilities Area (m <sup>2</sup> )	-	-	720	685	
- Equipment cost (P 1,000)	-	-	270	865	
(4) <b>Institutional Development</b>					
a) Farmers Organizations	ISA and IBA	ISA and IBA	Magogon Farmers Multi- Purpose Cooperative	CARP Beneficiaries and Landless Associations	
b) Agricultural Extension					
1. Training facility	FTC/MAS/PAS	FTC/MAS/PAS	FTC/MAS/PAS	FTC/MAS/PAS	
2. Demonstration farm	ISA facility	ISA facility	Nucleus farm	Nucleus and Production farms	
3. Trainers	MEA/BEA	MEA/BEA	MEA/BEA	MEA/BEA	
c) Agricultural Credit	LBP	LBP	LBP	LBP	
d) Water users associations	Gm-F-RWSA	Inarado RWSA	-	-	
(5) <b>Project Cost</b>					
i) Construction Cost (P 1,000)	32,192	116,031	26,871	26,237	
a) Irrigation and drainage facilities	(13,531)	(96,530)	-	-	
b) Rural infrastructure facilities	(17,632)	(17,569)	(25,020)	(23,366)	
c) Production and marketing centers	(1,029)	(1,932)	-	-	
d) Nucleus facilities	-	-	(1,851)	(2,871)	
ii) O & M Equipment (P 1,000)	120	180	-	-	
iii) Engineering Cost (P 1,000)	3,219	11,603	2,687	2,624	
iv) Administration Cost (P 1,000)	644	2,321	537	525	
v) Land Acquisition Cost (P 1,000)	2,494	4,663	38	37	
vi) Physical Contingency (P 1,000)	3,867	13,480	3,013	2,912	
vii) Price Escalation (P 1,000)	5,281	18,720	3,717	3,614	
viii) GRAND TOTAL (P 1,000)	47,817	166,998	36,863	35,979	
GRAND TOTAL (US\$ 1,000)	1,839	6,423	1,418	1,384	
(6) <b>Evaluation</b>					
EIRR					
Total Project	19.9%	9.9%	24.0%	34.2%	
a) Irrigation and drainage facilities	25.8%	10.1%	-	-	
b) Rural infrastructure facilities					
- Rural Road	14.3%	6.3%	15.8%	15.2%	
- Rural Water Supply	5.9%	5.2%	3.4%	3.7%	
c) Production and marketing centers	13.6%	27.1%	-	-	
d) Nucleus facilities	-	-	62.4%	64.0%	

The Feasibility Study on The Western Legazpi Irrigation and Rural Development Project

Project Description (4/5)

Project	Rural Road Upgrading and Water Supply Rehabilitation Projects		
	Rural Road Upgrading Project	Water Supply Rehabilitation Project	
Items			
(1) Constraints to Development	1) Limited funding support leads to poor maintenance	1) Inadequate skills and knowledge on O&M 2) Lack of government support to monitor and render technical assistance on O&M 3) Lack of discipline among members	
(2) Development Concept	1) Proper design 2) Structure consistent with maximum standard 3) Strict enforcement of periodic maintenance system	1) Minor rehabilitation and some additional construction with proper design to maximize water users 2) Introduction of water meters for accurate pricing system 3) Organization and strengthening of RWSAs particularly on operation, maintenance and management for long-term sustainability of the system	
(3) Sectoral Development Plan			
a) Rural Road Upgrading			
- Location	1) Comun-Cotmon - Del Rosario-Panoyopy 2) Orob-Taladong 3) Anislag-Maopi 4) Basearan-Burgos-Mabini - Kinawitan-Panoyopy 5) San Ramon-Bigao - San Vicente Grande		
Length (km)	19.8		
b) Rural Water Supply Rehabilitation			
Level-II rehabilitation			
- Location		Taladong	Ogbanan
- Present no. of beneficial HH	-	52	17
- Present no. of beneficial population	-	286	94
- Expansion & replacement pipe (km)	-	1.9	2.0
- New communal faucets (nos.)	-	13	5
- Additional no. of beneficial HH	-	65	25
- Additional no. of beneficial population	-	364	140
- Total no. of beneficial HH	-	117	42
- Total no. of beneficial population	-	650	234
(4) Project Cost			
i) Construction Cost (P 1,000)	89,786	1,079	
a) Rural Road Upgrading	(89,786)		
b) Rural Water Supply Rehabilitation		(1,079)	
ii) O & M Equipment (P 1,000)	-		
iii) Engineering Cost (P 1,000)	8,979	108	
iv) Administration Cost (P 1,000)	1,796	22	
v) Land Acquisition Cost (P 1,000)	111	0	
vi) Physical Contingency (P 1,000)	10,068	121	
vii) Price Escalation (P 1,000)	14,713	168	
viii) GRAND TOTAL (P 1,000)	125,453	1,498	
GRAND TOTAL (US\$ 1,000)	4,825	57	
(5) Evaluation			
EIRR	18.8%	6.7%	3.4%



The Feasibility Study on The Western Legazpi Irrigation and Rural Development Project

Project Description (5/5)

Project		Integrated Support Service Project
Items		
Development Plan	(1) <b>Constraints to Development</b>	1) Inadequate training and extension facilities of the ATI/FTC/BUCAF, PAS and MAS. 2) Lack of coordination on extension between the MAS and other agencies. 3) Absence of barangay-wide extension services.
	(2) <b>Development Concept</b>	1) Establishment and upgrading of extension facilities of the municipal and provincial agricultural services. 2) Strengthening the linkage between research and extension. 3) Deployment of barangay extension agents. 4) Training the skills of the municipal and barangay extension agents.
	(3) <b>Sectoral Development Plan</b>	
	i) <b>Upgrading ATI/FTC/BUCAF Training Center</b>	
	a) Equipment (P 1,000)	3,449
	ii) <b>Upgrading Provincial Agricultural services</b>	
	a) Equipment (P 1,000)	851
	iii) <b>Municipal Agricultural Services</b>	
	a) Municipal Training Center (ha)	140
	b) Equipment (P 1,000)	2,874
	(4) <b>Project Cost</b>	
	i) <b>Construction Cost (P 1,000)</b>	532
a) Municipal Training Center	(532)	
ii) <b>Procurement of Equipment (P 1,000)</b>	7,174	
iii) <b>Engineering Cost (P 1,000)</b>	53	
iv) <b>Administration Cost (P 1,000)</b>	11	
v) <b>Land Acquisition Cost (P 1,000)</b>	1	
vi) <b>Physical Contingency (P 1,000)</b>	777	
vii) <b>Price Escalation (P 1,000)</b>	492	
viii) <b>GRAND TOTAL (P 1,000)</b>	9,040	
<b>GRAND TOTAL (US\$ 1,000)</b>	348	



**THE FEASIBILITY STUDY ON  
THE WESTERN LEGAZPI IRRIGATION AND  
RURAL DEVELOPMENT PROJECT IN THE PHILIPPINES**

**MAIN REPORT**

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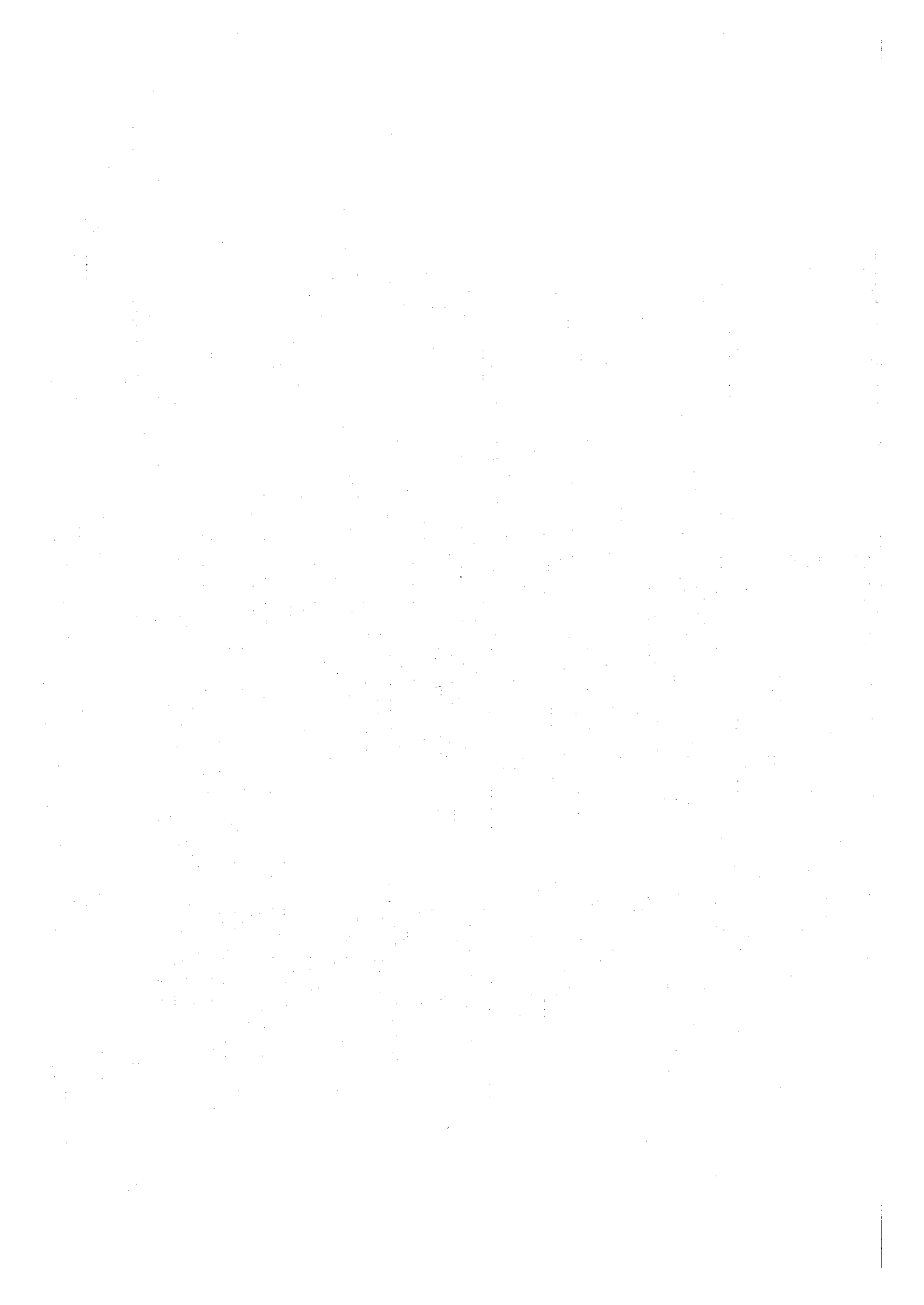
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## I. ABBREVIATIONS

(A)	ABS	Albay Breeding Station
	ADB	Asian Development Bank
	AES	Albay Experiment Station
	AIDAB	Australian International Development Assistance Bureau
	ALECO	Albay Electric Cooperation INC.
	ALINDECO	Albay Industrial Development Corporation
	ARBs	Agrarian Reform Beneficiaries
	ARCs	Agrarian Reform Communities
	ASC	Agriculture Service Center
	ATI	Agricultural Training Institute
	AWSP	Accelerate Water Supply Program
(B)	BCDC	Bicol Cooperative Development Center
	BAS	Bureau of Agricultural Statistics
	BEA	Barangay Extension Agent
	BHS	Barangay Health Station
	BIARC	Bicol Integrated Agricultural Research Center
	BIDANI	Barangay Integrated Development Approach for Nutrition Improvement
	BPI	Bureau of Plant Industry
	BRS	Bureau of Research and Standards, DPWH.
	BU	Bicol University
	BUA	Barangay Users Association
	BUCAF	Bicol University College of Agriculture and Forestry
	BWSA	Barangay Waterworks and Sanitation Association
(C)	CA	Compulsory Acquisition
	CARP	Comprehensive Agrarian Reform Program
	CBU	Capital Build-Up
	CDA	Cooperative Development Authority
	CDF	Countryside Development Fund
	CIS	Communal Irrigation System
	CLOA	Certificate of Land Ownership Award
(D)	DA	Department of Agriculture
	DAR	Department of Agrarian Reform
	DBP	Development Bank of the Philippines
	DECS	Department of Education, Culture and Sports
	DIENR	Department of Environment and Natural Resources
	DEO	District Engineers Office, DPWH
	DILG	Department of the Interior and Local Government
	DOH	Department of Health
	DOST	Department of Science and Technology
	DPWH	Department Public Works and Highways
	DTC	Department of Transportation and Communications
(F)	FAO	Food and Agriculture Organization
	FIDA	Fiber Industrial Development Authority
	FTC	Farmers Training Center
	FW4SP	First Water Supply, Sewerage and Sanitation Sector Project
(G)	GFI	Government Financial Institutions
	GPEP	Grains Production Enhancement Program

(I)	IA	Irrigators Association
	IAPCC	Inter-Agency Project Coordinatory Committee
	IBA	Irrigators Beneficiaries Association
	IMU	Implementing Management Unit
	IPM	Integrated Pest Management
	IRA	Internal Revenue Allotment
	ISA	Irrigator Service Association
	ISF	Irrigation Service Fee
(J)	JICA	Japan International Cooperation Agency
(K)	KPA	Key Production Area
(L)	LBP	Land Bank of the Philippines
	LGU	Local Government Unit
	LTFRB	Land Transportation, Franchising and Regulatory Board
	LWUA	Local Water Utilities Administration
(M)	MAO	Municipal Agricultural Officer
	MAS	Municipal Agricultural Services
	MATELCO	Mayon Telephone Corporation
	MCM	Million Cubic Meter
	MEO	Municipal Engineer Office
	MGCD	Municipal Government of Camalig and Daraga
	MGC	Municipal Government of Camalig
	MGD	Municipal Government of Daraga
	MHC	Municipal Health Center
	MHO	Municipal Health Office
	MTPDP	Medium Term Philippine Development Plan
(N)	NEDA	National Economic Development Authority
	NGO	Non-Government Organization
	NHWL	Normal high water level of reservoir
	NIA	National Irrigation Administration
	NIS	National Irrigation System
	NPC	National Power Corporation
	NWRC	Natural Water Resources Council
(O)	OECE	Oversees Economic Cooperation Fund
	OLT	Operation Land Transfer
(P)	PAGASA	Philippine Atmospheric Geophysical and Astronomical Service Administration
	PAL	Philippine Airlines
	PAO	Provincial Agricultural Officer
	PAS	Provincial Agricultural Services
	PCA	Philippine Coconut Authority
	PGA	Provincial Government of Albay
	PEO	Provincial Engineer Office
	PES	Provincial Environment Services
	PHN	Public Health Nurse
	PMU	Project Management Unit
	PNR	Philippine National Railways
	PPDO	Provincial Planning and Development Office
	PVS	Provincial Veterinary Services

(R)	RA	Republic Act
	RDC	Regional Development Council
	RFU	Regional Field Unit
	RHM	Rural Health Midwife
	RHU	Rural Health Unit
	ROS	Research Outreach Station
	ROW	Right-of-Way
	RSI	Rural Sanitary Inspector
	RWSA	Rural Waterworks and Sanitation Association
	RWSPMO	Rural Water Supply Project Management Office
(S)	SALT	Sloping Agricultural Land Technology
	SADOPECO	Santo Domingo Peoples Cooperative
	SCFO	Small Coconut Farmers Organization
	SFCDP	Small Farms Coconut Development Project
	SMSs	Subject Matter Specialist
	SWIM	Small Impounding Management Projects
(T)	TEV	Training-Extension cum Visit
(V)	VOS	Voluntary Offer to Sell
(W)	WB	World Bank
	WLIRD	Western Legazpi Irrigation Rural Development Project

## 2. ABBREVIATION OF MEASUREMENT

### Length

mm	=	millimeter	
cm	=	centimeter	
	=	0.39 in.	
m	=	meter	= 1.09 yd
	=	3.28 ft.	
km	=	kilometer	= 0.62 ml

### Area

cm <sup>2</sup>	=	square centimeter	
m <sup>2</sup>	=	square meter	
km <sup>2</sup>	=	square kilometer	
	=	100 ha	
ha	=	hectare	= 0.01 km <sup>2</sup>
	=	2.5 ac	

### Electrical Measures

kW	=	kilowatt	=	1,000 watt
MW	=	megawatt	=	1,000 kW
GW	=	gigawatt	=	1,000 MW
kV	=	kilovolt	=	1,000 Volt

### Other Measures

%	=	percent
°	=	degree
'	=	minute
"	=	second
°C	=	degree in Celsius
Hp, PS	=	horse power

### Volume

lit.	=	litter
cm <sup>3</sup>	=	cubic centimeter
m <sup>3</sup>	=	cubic meter
	=	1,000 lit.
MCM	=	million m <sup>3</sup>
	=	1x10 <sup>3</sup> m <sup>3</sup>

### Weight

g	=	gram
kg	=	kilogram
t	=	metric ton = 1,000 kg
ppm	=	part per million
ug	=	micro gram
cavan	=	50 kg.

### Time

sec	=	second
min	=	minute = 60 seconds
hr	=	hour = 60 minutes
	=	3,600 seconds
day	=	24 hrs = 1,440 minutes
	=	86,400 seconds
yr	=	year

### Derived Measures

m <sup>3</sup> /sec	=	cubic meter per second (Cumec)
---------------------	---	--------------------------------

### Monetary

US\$	=	US dollar
¥	=	Japanese yen
P	=	Philippine peso

## 3. EXCHANGE RATE

US\$1 = P 26.0 = ¥ 108 (As of Mid-1996)



## CHAPTER 1 INTRODUCTION

### 1.1 Authority

The agricultural sector still remains a major pillar of the Philippine economy. It accounts for about 23% of the Gross Domestic Product (GDP), more than 21% of export earnings and about 50% of total employment. About 55% of the population lives in rural areas and depends either directly or indirectly on agriculture for the main source of livelihood. However, the majority of rural residents, especially the small farmers remain under the poverty line. The rural areas have a higher incidence (53%) of poverty compared with 32% of the urban areas. The rural-urban inequality has worsened over time as the ratio of average rural family income to average urban family income declined from 0.67 in 1975 to 0.46 in 1985. In recent years, more than 80% of the farm families are classified in the lower 30% income bracket.

In view of the above conditions, the Philippine Agricultural Development Plan (1991-1995) has been designed to increase the agricultural Gross Value Added (GVA) at an average rate of 4.27% per year in real terms through the following major strategies:

- 1) Institutionalization of small farmers' participation in policy making, planning, implementation, monitoring and evaluation of government programs;
- 2) Increase in government investments in basic infrastructure, especially irrigation and drainage, farm-to-market roads, farm mechanization, power, and communication infrastructure;
- 3) Enhancement of research and extension works to improve the agricultural production;
- 4) Reduction of government interventions in the production, marketing, and processing of agricultural inputs and outputs;
- 5) Improvement of rural credit systems; and
- 6) Reforms in marketing and transportation of agricultural products.

In consonance with the targets and strategies adopted in the Medium-Term Philippine Development Plan (MTPDP, 1993-1998), the Department of Agriculture (DA) has now put great emphasis on the increase of productivity and real income of small farmers, especially in poverty-stricken areas.

The Region V so-called the Bicol Region, including Albay Province, is agriculture based and categorized as the second poorest region in the Philippines in terms of family income. The proportion of families below the poverty level in the Region is the highest in the country. Therefore, the overall development strategies of the Region have been geared to

increase rural employment opportunities and family income primarily from the agricultural sector.

Against such background, the Government of Philippines (GOP) requested the Government of Japan (GOJ) in September 1994 to carry out the Feasibility Study on the Western Legazpi Irrigation and Rural Development Project in Albay Province. In response to the request, the GOJ dispatched a preliminary survey team through the JICA and the Implementing Agreement for the Study (I/A) was signed between the NIA and JICA in March 1995 (Ref. Attachment 1).

## **1.2 Objective of the Study**

### **(1) Objective of the Study**

The objectives of the Study are:

- 1) to conduct a feasibility study and formulate the irrigation and rural development project on the area west of and adjacent to Legazpi City, the capital of Albay Province, and
- 2) to carry out technology transfer to the Philippine counterpart personnel in the course of the Study.

### **(2) The Study Area**

The Study was initiated for the mapping area of around 6,000 ha according to the I/A. Through the course of the Study, some areas outside the mapping area need to be covered for formulation of water resources and rural infrastructure development. In addition, the statistical analyses were made on the administrative area of 41 barangays as the Study area covering 10,610 ha in order to increase the accuracy of the Study.

## **1.3 Scope of the Study**

The Study consisted of two main activities agreed in the I/A: Work I which involved the preparation of topographic map covering around 6,000 ha on a scale of 1/4,000; and Work II which involved the conduct of feasibility study. The Study was carried out in two phases with Phases I and 2 comprising of field and office work in the Philippines and Japan respectively. The Study covered the following activities:

- 1) Collection, review and analysis of existing relevant data and information concerning:
  - a) natural conditions

- b) socio-economic conditions
  - c) agricultural conditions
  - d) agricultural and rural infrastructure
  - e) environmental conditions
- 2) Execution of the following surveys:
- a) groundwater investigation
  - b) water quality test
  - c) geotechnical and soil mechanics investigation
  - d) soil survey
  - e) farmers' economy survey
  - f) farmers' intention survey
  - g) topographic survey
- 3) Preparation of a plan for irrigation and rural development
  - 4) Estimate of project costs and benefits
  - 5) Project evaluation
  - 6) Recommendation

#### **1.4 Activities of the Study Team**

##### **(1) Activities during Phase I**

The Study Team submitted the Inception Report to the NIA on September 17, 1995, and discussions were made between the concerned NIA officials and the Study Team. The Inception Report was mutually agreed on between both parties (Ref. Attachment 2).

In accordance with the "Plan of Operation" given in the Inception Report, the Study Team together with the counterpart personnel, made the various activities during the initial four months. This activity ended with the preparation of the Progress Report No. 1.

The discussion meeting on the Progress Report No. 1 was first held on January 4, 1996 between the Study Team and NIA officials, and another meeting was held on January 9, 1996 between the Study Team and Steering Committee at Legazpi city. The initial findings and the basic concept of the project was generally accepted by the NIA. The Study Team completed the field work of Phase I on January 14, 1996.

The Study Team re-started further studies in Japan from January 16, 1996, and finally prepared the Interim Report. The report included the basic development plan for the project.

(2) Activities during Phase 2

The Study Team started Phase II field work in the Philippines on June 17, 1996. The Study Team submitted the Interim Report to the NIA and held discussions on the report. The basic development concept of the Project given in the Interim Report was mutually agreed on by both parties (Ref. Attachment 3).

The Study Team together with the counterpart personnel conducted the field work for two months. At the end of the field work, the Study Team prepared the Progress Report No.2. Meetings on the Progress Report No. 2 were held at Provincial Government of Albay on August 9 and at the NIA Central Office on August 12, 1966. The proposed project plan was accepted by the NIA and Steering Committee. The field work of Phase 2 was completed on August 15, 1966.

The Study Team continued further studies in Japan for two months from August to October 1966, and prepared the Draft Final Report. Meetings on the Draft Final Report were held at Legazpi on October 31, 1996, and at NIA central office on November 4, 1996 (Ref. Attachment 4). The Study Team prepared and submitted the Final Report reflecting the comments from the Philippine side in December 1996.

## CHAPTER 2      BACKGROUND OF THE PROJECT

### 2.1      National and Regional Economy

#### 2.1.1      Facts on the Philippines

The Philippines has about 7,107 islands spread out over a total land mass of roughly 300,000 square kilometers. The country's islands are grouped into 15 regions which are further divided into 76 provinces, 64 cities, 1,532 municipalities and 41, 153 barangays. These groupings represent the hierarchical structure of the LGUs. Region V and the province is located in Albay. Total population of the country as of 1995 is placed at 70.3 million or an equivalent population density of 234 persons/km<sup>2</sup>. The current labor force is 27.5 million persons with a labor force participation rate of 64%. Alienable and disposable land currently stands at 14.1 million ha, while forest land measures at 15.9 million ha. Total length of road network is about 161,000 km, 83% of which are local roads.

#### 2.1.2      The Philippine Economy, 1990-94

Real economic growth expanded by an average of 2.4% during 1990 and 1994. Per capita GNP in real terms stood at \$482 in 1994, a slight decline from the \$483 posted in 1990 mainly due to the depreciation of the peso vis-a-vis the U.S. dollar. During the same period, inflation averaged at 11.7% annually, although single digit inflation rates were recorded beginning 1992 until 1994. There was indeed a remarkable improvement made by the government in containing price increases when it brought down inflation from 14.2% in 1990 to 9.0% in 1994. The unemployment rate averaged at 8.6% annually, while the population growth rate has been estimated to be growing at 2.6% annually. The high population growth rate exerted tremendous pressure on the economy relative to the provision of basic services to a growing population.

The period under review can be classified into two dimensions. First, the beginning of the 90s brought disasters of megascale that have devastated several regions of the country. These included several earthquakes and more importantly the eruption of Mt. Pinatubo which have significantly damaged the land resources of Region III (Central Luzon). These calamities constricted tremendously the growth of the economy as evidenced by the sudden decline of GDP in 1991. The agriculture sector suffered the greatest setback among the sectors. The real growth of the GVA for agriculture grew by a measly 1.4% between 1990 and 1991 and slightly increased to 0.4% between 1991 and 1992. Over the last 5 years, the real growth of the sector stood at 1.6% annually.

Second, the middle of 1992 began the term of the Ramos Administration which instituted several policy reforms based on privatization, liberalization and deregulation. Towards the end of 1992, the economy started to accelerate its momentum and by the end of 1994, real GNP growth was posted at 5.2% and inflation was maintained at a single digit. For the first time in the 90s, real GNP growth rate outpaced the population growth rate. The incidence of poverty among families also declined, from 39.9% in 1991 to 35.7% in 1994. In terms of population, there was also a corresponding reduction from 45.3% in 1991 to 41.3% in 1994.

Indicators	1990	1991	1992	1993	1994	Growth 1990-94(%)
GNP at constant 1985 prices(million pesos)	724	726	737	756	795	2.4
GDP at constant 1985 prices(million pesos)	721	717	719	734	766	1.5
Per capita GNP(\$)	483	418	445	452	482	-0.1
Inflation Rate(%)	14.2	18.7	8.9	7.6	9.0	11.7*
Unemployment Rate(%)	8.1	9.0	8.6	8.9	8.4	8.6*
Gross savings as ratio to GNP(%)	18.6	18.3	19.0	18.0	20.0	19.0*
Population(million)	62.0	63.7	65.3	66.9	68.6	2.6

Source: 1995 Philippine Statistical Yearbook (Ref. Table 2.1.1)

\* Average

Sustainable development culminated the overriding goal of the Ramos Administration. A demand-led, employment-oriented and rural-based strategy" was vigorously implemented to sustain the momentum of growth being achieved. This situates very well the context of WLIRD relative to complementing the rural-based strategy of the government to propel economic prosperity in the rural areas.

### 2.1.3 The Economy of Region V

Some selected economic indicators about the economy of Region V is discussed as follows. The real GRDP increased from 21.7 million pesos in 1990 to about 23.35 million pesos in 1994 or an average annual growth of roughly 1.9%. Agriculture and services contribute about 40% each to the GRDP and the balance to industry.

Total population of Region V also significantly increased from 3.9 million in 1990 to about 4.4 million in 1994. The population growth rate in 1990-94 was posted at 2.4%, one of the lowest among the 15 regions and even lower than the national average of 2.6%. The labor force in 1994 was about 2 million people with a labor force participation rate of 70% which

was relatively impressive by regional standards. However, the employment rate between 1990 and 1994 was slightly decreasing, and thus the unemployment rate increased from 3.50% in 1990 to 4.34% in 1994. In terms of poverty among the 15 regions, Region V registered the highest incidence of poverty at 54.2% in 1994. This was equivalent to about 461,000 families deprived of basic economic services. In terms of population, however, the incidence of poverty is placed at 60.4% of the total population. The annual per capita poverty threshold was estimated at 8,421 pesos. In view of this situation, Region V has been a priority area for rural development projects.

## **2.2 Agriculture and Rural Development Policies**

### **2.2.1 Philippines 2000 and the Medium-Term Philippine Development Plan**

The Ramos Administration defined a vision of development that is called Philippines 2000. This vision envisages the country by the year 2000 as "having properly addressed its internal problems and being fully capable of handling and benefiting from its international relations". It projects an image that by the year 2000, the Filipinos have "adequate food, clothing, shelter, and dignity".

The structural framework of Philippines 2000 is the MTPDP. The MTPDP sets the broad economic developmental targets of the country between 1993 and 1998. It essentially hinges on two fundamental strategies, namely: people empowerment and global competitiveness. People empowerment stresses direct and combined efforts of people initiatives to solve the chronic problem of poverty. Global competitiveness, on the other hand, emphasizes greater leverage for domestic producers, particularly small farmers to produce for the world market or compete against imports in the domestic market.

Congruent with the Philippines 2000 and MTPDP is a package of intervention and strategies aimed at uplifting the most disadvantaged sectors in Philippine society. This is the so-called Social Reform Agenda (SRA). The SRA highlights economic development through advancement of social equity in terms of asset reforms; just sharing of the benefits of growth; and peoples participation in the political and economic milieu.

For the above-mentioned strategies to proceed successfully, the MTPDP espouses policies that are congruent and consistent with sound economic principles. These principles are decentralization or devolution; reliance on non-government initiative and democratic consultation; full cost recovery; social equity; and macro-economic stability.

Indicators	(Unit :%)	
	1994	1998
Poverty incidence among families	39.2*	30
Unemployment rate	9.1	6.6
Real GNP growth rate	3.5-4.5	8.5-10.0
Real GDP growth rate	3.4-4.4	8.1-9.8
Inflation rate	9.0-10.0	4.0
Investment proportion to GNP	24.5	29.5
Domestic Savings ratio to GNP	19.8	27.8
Population growth rate	2.36	<2.0

Source: Medium-Term Philippine Development Plan, 1993-1998

\* Base year is 1991.

## 2.2.2 Sustainable Agri-Industrial Development

The MTPDP subsumed a common framework between agriculture and industry to stress the links between these two sectors. Under this framework, a productive agriculture sector composed of viable farm enterprises of strong production and marketing linkages with industry is envisaged as the core of rural development. The linkage is also aimed to create a strong and competitive manufacturing sector utilizing mainly local raw materials and providing employment to majority of the population. This shift in policy virtually eliminates the traditional system of developing agriculture independent of the industry sector.

To reflect the above shifts in policies, the targets for both the agriculture and industry have also been correspondingly adjusted. The share of agriculture in GDP will decline from 22.5% in 1994 to 19.8% in 1998. Industry's share in GDP will, however, increase from 34.8% in 1994 to 36% in 1998. This trend is indicative of the transformation of the economy as it gradually shifts to greater agri-industrialization.

## 2.2.3 Water Resources Development

Irrigation and potable water supply are two of the most fundamental components of the water resources sub-sector of the MTPDP. As regards irrigation, roughly 1.55 million ha or 50% of the potential irrigable area of 3.1 million ha nationwide are currently provided with irrigation water. The government plans to increase the irrigable areas by 1.93 million ha in 1998.

Moreover, the government has also put priority in the construction of communal irrigation systems over the big and multi-purpose system. This is in line with the principles of full cost recovery and decentralization and/or devolution. Under this policy, it is now the responsibility of the LGUs to implement such systems with NIA providing assistance in community participation, construction, supervision and operation and maintenance.



With reference to water supply, the demand is relatively high. In other urban areas (outside of Metro Manila), only 47% of the households are currently provided with Levels II (public faucets) and III (household connections) water systems. On the other hand, only 72% of the rural households have access to Level I (point source) water system. It is the plan of the government to increase the access to potable water supply by 71% of the households in other urban areas and 85% of the rural households in 1998. The LGUs have been given authority to implement these type of water systems by virtue of the local government code.

#### 2.2.4 Integrated Area Based Programs

A basic approach being pursued by the government is the implementation of projects in an intersectoral manner. This is to maximize scarce resources and stimulate growth in the rural areas. A number of these programs (e.g. agricultural extension, maintenance of basic facilities, etc.) have already been devolved to the LGUs. As such, the local chief executives play a critical role in ensuring that these projects are implemented under their direct supervision. To further ensure that the concerns of the national agencies are forged by the LGUs, a memorandum of agreement is normally signed by the concerned department and local chief executive, with additional resource allocation extended by the national agency.

### 2.3 Fundamental Issues on Rural Development

The fundamental issues of rural development in the Philippines today can be broadly classified in three areas, namely: technical; institutional; and financial.

The technical issues pertain on the lack of synergy and complementarity of project components being pursued. Most rural development projects are still biased towards sectoral concerns. On the one hand, if the components are not sectorally biased, they are either incomplete to warrant successful integration. The other technical issue is on sustainability of facilities being implemented because of the apparent neglect to address critical environmental concerns such as watershed rehabilitation.

The institutional issue, on the other hand, is still the coordinative mechanism among the major project implementors, particularly the LGUs. While the lead agency concept, including the autonomy given to the LGUs are being espoused to address this issue, functional coordination remains a critical problem. In addition, participatory mechanisms of farmer beneficiaries are not yet established. There is shortage of understanding on beneficiaries' obligations or duties such as provision of the right-of-way for the project facilities,

amortization of investment costs, payment of irrigation water fees, and operation and maintenance of facilities.

The financial issue refers to the inadequacy of funding support. It is to be noted that because of competing funds for government projects, financial resources are inherently subject to prioritization.

## CHAPTER 3 THE STUDY AREA

### 3.1 Location

The province of Albay is lying at the southern tail of Luzon island and approximately 550 km southeast of Manila. The province comprises 17 municipalities and one chartered city of Legazpi.

The Study area is located within the municipalities of Camalig and Daraga, and covers 41 barangays, 20 in Camalig and 21 in Daraga, with around 106.1 km<sup>2</sup> or 43% of the area of two municipalities. The Study area extends to northwestern part of Legazpi City as shown in the Location Map.

### 3.2 Demography and Socio-economic Situation

The population of 41 barangays was around 49,000 in 1990. This translates to a population density of 4.7 persons/ha. The population growth rate of the Study area between 1980 and 1990 was 0.74%/year. The total population and number of household in the Study area in 1995 were estimated at around 51,560 and 9,640, respectively. This means an average family size of 5.3 (Ref. Table 3.2.1, Fig. 3.2.1 and 3.2.2). The illiteracy rate of the household population of more than 10 years old was estimated at 4.9% in 1990.

Item (1990 Data)		Study area	Albay Province	Region V	Philippines
Area	('000 ha)	10.6	255	1,763	30,000
Population	('000)	49	903	3,910	60,703
Population Density	(Person/ha)	4.7	3.5	2.2	2.0
Population Growth	(%/year, 1980-90)	0.74	1.11	1.18	2.35

The economy of the Study area is generally dominated by agriculture with the prevalence of coconut mono-cropping. The economic situation of the Study area is similar to Albay and Region 5 because of the dominance of the coconut industry. The economic indicators are summarized as follows:

Item		Albay	Region V	Philippine
Labor Force	('000)	452	2,005	27,479
Employed population	('000)	433	1,918	25,171
(Share of Agri. Sector)	(%)	-	(55.8)	(44.7)
Employment Rate	(%)	95.8	95.7	91.6
Unemployment Rate	(%)	4.2	4.3	8.4
Underemployment Rate	(%)	-	39.4	20.9
Household Classification*				
Share of Agri. Household	(%)	33.4	48.2	36.3
Average Income*	P	39,323	39,823	65,186
(Rural)		-	(34,851)	(41,199)
(Urban)		-	(51,219)	(89,571)
Average Expenditure*	P	32,862	33,911	51,991
(Rural)		-	29,873	33,733
(Urban)		-	(43,165)	(70,551)

\* ; 1991 Family Income and Expenditures Survey, Others are in 1994

### 3.3 Climate

#### (1) General Overview

The Northeast Monsoon prevails over periods from October to March, bringing in significant amount of rainfall to southern Luzon where the study area is located. The Southwest Monsoon prevailing from May to October originates in the Indian Ocean and affects the area. During this period, the Study area is warm and very humid with increasing rate of rainfall. The Study area belongs to Type II climate which has no significant dry season and a very pronounced maximum rainfall under the influence of the Northeast Monsoon prevailing from November to January.

Most tropical typhoons hit the Study area any month of the year, especially from June to December. The months of November followed by October and June show high frequency of typhoons in the Study area.

The monthly temperatures, other climatic parameters, evaporation rates and rainfall data are shown below.

Month	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature <sup>1)</sup>														
Max	°C	28.6	29.1	30.1	31.3	32.3	32.2	31.7	31.6	31.5	31.0	30.1	29.1	30.7
Mean	°C	25.4	25.7	26.4	27.5	28.3	28.2	27.7	27.8	27.6	27.2	26.7	26.0	26.9
Min.	°C	22.3	22.2	22.8	23.7	24.3	24.1	23.8	23.9	23.7	23.3	23.3	22.9	23.4
Other Climatic Parameters <sup>1)</sup>														
Relative Humidity	%	84	83	82	82	81	83	84	84	85	85	86	86	84
Cloudiness	Oktas	5.8	5.5	5.1	4.9	5.1	5.8	6.3	6.4	6.3	6.0	6.0	5.9	5.8
Wind speed	m/hr	3.6	3.4	3.3	3.1	2.8	2.7	2.8	3.0	2.5	2.4	3.0	3.3	3.0
Evaporation Rates <sup>2)</sup>														
	mm/day	4.2	4.9	6.0	6.5	6.9	5.4	4.9	4.8	4.3	4.1	3.6	3.9	1,805
Rainfall <sup>3)</sup>														
Legazpi	mm	301	185	186	156	176	241	254	264	263	334	485	484	3,330
Guinobatan	mm	155	81	73	88	160	249	310	269	318	294	267	325	2,590

Sources : 1) Legazpi PAGASA (1961 - 1993)

2) Bicol River Basin Flood Control and Irrigation Development Project

3) Legazpi, PAGASA (1961 - 1993) Guinobatan, PCA (1956 - 1983)

### 3.4 Topography

Topographical conditions are broadly separated in 3 categories: (i) flood plain of Ligban rivers; (ii) flat terrace expanded southward from hills of Camalig - Daraga towns; and (iii) rolling hills. The flood plain of Ligban river is located in the south eastern area of Camalig town, and the flood plain has a gentle slope ranging from 1/100 to 1/400 from north to southwest. The elevation of flood plain ranges from 110 m to 99 m above mean sea level. The flood plain is generally covered by rainfed paddy field of about 160 ha, and majority of the soils are sandy loam to clay.

The flat terrace located in the south area from the hills of Camalig - Daraga towns is covered by rainfed paddy field and some isolated small hills. The elevation of the terrace area ranges from 96 m to 86 m above mean sea level, and the rainfed paddy fields are estimated at about 620 ha. The majority areas of the terrace are covered by rainfed paddy field, and soils are loam to clay. The hills surrounding the terrace area are mainly covered by coconut lands.

### 3.5 Geological Condition

The regional geology in the Study area is mainly classified as Daraga, Bicol, Albay and Ligao formations of Miocene to Plio-Pleistocene epoch and volcanic clastics of Quaternary period (Ref. Fig. 3.5.1). An active fault, namely, San Vincent-Ligao fault is located in northern areas from the national highway of Camalig - Daraga and extending WNW-ESE direction.

The Daraga formation consists mainly of lava flow, agglomerate, volcanic breccia, tuff with interbedded elastic sedimentary rocks of Miocene epoch. The formation are moderately consolidated and are cropped out as soft to hard rocks. The formation is extended on the hills

located in northern part of the Study area. The Bicol and Albay formations are composed of sandstone, shale and conglomerate alternation of Miocene to Pliocene epoch. They are moderately consolidated soft to moderately hard rocks. The Albay formation overlays with the Bicol formation in eastern part from national road of Daraga - Sorsogon. The Ligao formation consists of limestone of Plio-Pleistocene epoch, and located in the isolated hilly areas of central and western parts of the Study area. The Volcanic clastics of Quaternary period is Mayon volcanic. The area comprises of lava flows, scoria and volcanic ash in higher slope areas of the volcano, and predominantly mud flows in lower slope of the vast mountain skirt. The alluvial plain has formation consisting of fine sediments.

### 3.6 Water Resources

#### 3.6.1 Surface Water

##### (1) River Basin

The Study area is covered by parts of the Bicol and Albay-Sorsogon river basins. The northern part of the study area belongs to the upstream area of the Bicol River Basin bordered administratively by Daraga and Camalig in the east, and by the Kikuinan Mountain Range which lies south of Camalig. The remaining portion belongs to the Albay-Sorsogon river basin.

The Ligban river is the major stream in the Bicol River basin, and has two tributaries, namely: Iraya and Tinago rivers. The discharge measurements of the Ligban river conducted by the NIA at abandoned weir site in 1988, where its drainage area is 13 km<sup>2</sup> are shown below.

(Unit : m <sup>3</sup> /sec)													
Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Ligban River	1.47	1.16	0.75	0.99	0.91	0.58	0.72	0.79	0.88	1.01	1.45	1.42	1.01

Source : NIA PIO, Ligao, Albay (1988)

The Albay - Sorsogon river basin consists of four sub river basins relevant to the Study area. They are the Yawa river, Donsol river, Ogod river, and Kapantaran river. There is no gauging station established within the portions of these rivers. However, four stream flow data near the Study Area are available. The mean monthly runoff are shown below.

Name of River	Location		Drainage Area (km <sup>2</sup> )
	Barangay	Municipality	
Cumadcad River	Cumadcad	Castilla	13
Malbog River	Cumadcad	Castilla	8
Pili River	San Isidro	Castilla	18
Cawayan River	Basud	Sorsogon	15

Source : Philippine Water Resources Summary Data, NWRC & BRS

(Unit : m<sup>3</sup>/sec)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Cumadcad River	1.43	1.02	0.57	0.33	0.34	0.47	0.90	0.76	1.07	1.35	1.74	1.77	0.98
Malbog River	0.98	0.38	0.31	0.15	0.14	0.21	0.47	0.46	0.64	0.76	1.37	1.09	0.58
Pili River	2.41	1.15	0.97	0.32	0.25	0.18	0.30	0.40	0.52	0.78	2.08	2.80	1.01
Cawayan River	2.59	1.79	1.41	0.86	0.74	0.69	0.99	0.63	0.69	1.02	2.20	2.80	1.37

Source Philippine Water Resources Summary Data, NWRC & BRS  
Cumadcad (1957 - 1989), Malbog (1955 - 1968), Pili (1953 - 1972), Cawayan (1954 - 1982)

## (2) Runoff Analysis at Camalig Diversion and Dam No. 2

Runoff analyses were made at Camalig diversion and Dam site No. 2 to analyze the runoff conditions of both dams. The annual runoff at both dams are shown below.

(Unit: 1,000 m<sup>3</sup>/sec)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Camalig diversion dam	1,131	625	629	610	765	1,211	1,420	1,292	1,405	1,509	1,851	1,928	14,356
No. 2 Dam	300	167	168	161	203	317	371	337	366	396	488	515	3,794

Source NIA PIO, Ligao, Albay (1988)

### 3.6.2 Groundwater

#### (1) General Hydrogeology

The hydrogeology in the Study area is broadly divided into four zones: pyroclastic rocks zone in northern part of the Study area; limestone zone expanding westward from barangay Del Rosario area; clastic sedimentary rocks zone in the southern to eastern parts of the area; and alluvium zone in lower slopes of Mayon volcano and in the southern lowland from Kikuinan mountains.

#### (2) Potential Yield of Limestone and Clastic Sedimentary Rocks

As a result of aquifer tests at three sites of the Study area, namely, barangays San Ramon and Anislag in clastic sedimentary rocks zone and Del Rosario in limestone zone, both zones have low transmissibility of less than 42 m<sup>2</sup>/day, and potential yield is less than 0.5 lit./sec. The potential yield is judged to be too low. In line with this analysis, since the permeability of boring holes at 2 dam sites, namely dam No.2 (barangay Inarado) and dam No.5 (barangay San Ramon) also shows low magnitudes of  $K = 10^{-5}$  cm/sec., the potential yield of clastic sedimentary rocks is foreseen to be low.

#### (3) Groundwater Development

In accordance with the DPWII's data on ground water development in the Study area, shallow wells which normally have the well depth of 7.5 m to 10 m, can generally produce ground water in whole areas. The ground water table ranges from 4 m to 6 m below ground

surface, and production yield ranges from 0.3 lit./sec. to 0.5 lit./sec. In case of deep wells with a well depth of 15 m to 24 m, the ground water table ranges from 6 m to 18 m below ground surface and seasonally varies from 1m to 4 m. The production yield ranges from 0.3 lit./sec. to 0.5 lit./sec.

### 3.7 Soil and Land Resources

#### 3.7.1 Soils

The Study area is classified into four series: (a) Legazpi Soil Series (Entisol); (b) Bascaran Soil Series (Alfisol); (c) Libon Soil Series (Inceptisol); and (d) Tigaon Soil Series (Alfisol). (Ref. Fig. 3.7.1).

#### 3.7.2 Land Resources

The slope is a major factor in determining the land suitability for different land use. The slope classes of land in the Study area as shown below were determined using the topographic map of scale of 1: 4,000.

Land Slope Range (%)	Area	Percent of total
0 to 3	4,090	38.6
3 to 8	1,325	12.5
8 to 18	2060	19.4
18 to 25	2505	23.6
25 to 40	185	1.7
Others	445	4.2
	10,610	100.0

About 5,766 ha are classified as moderately suitable (S2) for rice cultivation either under rainfed or irrigated condition. For growing diversified annual crops, some 4,267 ha are classified as moderately suitable (S2) and approximately 5,202 ha are classified as marginally suitable (S3). The main factor reducing the suitability for growing diversified crops is poor drainage condition of lands with clay soil and slopes less than 8%. For tree crops, about 4,470 ha are classified as moderately suitable (S2) and about 5,563 ha are marginally suitable (S3). The main limiting factors which inhibit the growing of tree crops are soil internal drainage condition and soil depth. The land suitability classification is summarized below (Ref. Table 3.7.1 and shown in Fig. 3.7.2).



(Unit: ha)

Suitability Class	Land Utilization Type		
	Rice	Diversified Annual Crops	Tree Crops
Highly Suitable (S1)	0	0	0
Moderately Suitable (S2)	5,770	4,270	4,120
Marginally Suitable (S3)	0	5,200	5,350
Not Suitable (N)	4,420	720	720
Residential/Others	420	420	420
Total	10,610	10,610	10,610

### 3.8 Agriculture

#### 3.8.1 Land Use

The Study area comprises about 10,610 ha. The present land use is summarized below Table 3.8.1 and Fig. 3.8.1).

Land Use	Area (ha)	Per cent of Total
Paddy Field	1,350	12.7
Coconut	7,080	66.7
Upland crop area/Open	420	4.0
Shrubs & Grass	1,340	12.6
Build-Up Areas	220	2.1
Others	200	1.9
Total	10,610	100.0

Land slope is a major factor to be considered for appropriate management of soils in the uplands. The study area is characterized by intensive and continuous rainfall pattern. There is a possibility that soil erosion and land degradation occur on steep slopes unless proper land management practices are introduced. The present land use by slope range in the upland of the Study area is summarized as follows:

Slope Range (%)	Coconut Land		Annual Crop Land		Shrub and Grass		Total	
	ha	%	ha	%	ha	%	ha	%
0 - 3	2,180	30.8	205	48.8	385	28.7	2,770	31.3
3 - 8	1,025	14.5	120	28.6	175	13.1	1,320	14.9
8 - 18	1,440	20.3	95	22.6	525	39.2	2,060	23.3
18 - 25	2,330	32.9	-	-	170	12.7	2,500	28.3
25 - 40	105	1.5	-	-	85	6.3	190	2.1
Total	7,080	100	420	100	1,340	100	8,840	100

#### 3.8.2 Land Holding and Tenure

The agricultural land holding data as provided in the Census of Agriculture in 1991 indicates a large occupancy of small farms below one ha as well as tenanted and leased farms in Camalig and Daraga municipalities. The regional comparison on agricultural land holding is summarized as follows:

Item (1991 Data)	Camalig Municipality	Daraga Municipality	Atbay Province	Region V	Philippines
Average farm area (ha)	1.67	1.36	1.76	2.48	2.16
Number of farms by size (%)					
Below one ha	45.2	54.7	46.4	35.9	36.6
1.00 - 2.99 ha	37.7	33.9	40.5	39.1	42.7
More than 3.00 ha	17.1	11.4	13.1	25.0	20.7
Area by tenurial status (%)					
Owned/partially owned	49.3	58.6	71.0	74.2	81.0
Tenanted/leased	39.4	29.4	26.0	24.2	15.4
Others	11.3	12.0	3.0	1.6	3.6

In the Study area, an owner has an average of around 1.5 land parcels. The parcels of paddy land below one(1) ha are roughly 90% in number or around 61% of the total area of paddy. The coconut land parcels below one(1) ha are 69% in number or 30% of the area. The average land holding sizes are 0.62 ha for paddy, 1.41 ha for coconut and 1.30 ha for total land. The median sizes of land holding are: 0.36 ha for paddy land; 0.74 ha for coconut land; and 0.62 ha for total land. In general, the agricultural land holding in the Study area is relatively small, especially for paddy land. This is further unevenly distributed among the land owners (Ref. Fig. 3.8.2).

Item		Paddy Land	Coconut Land	Total Agri. Land
Registered Area	(ha)	1,562	7,603	10,177
Registered No. of Parcel	(No.)	3,151	7,468	11,578
Registered No. of Owner	(No.)	2,519	5,396	7,831
Average Holding Size	(ha/owner)	0.62	1.41	1.30
Median Holding Size	(ha/owner)	0.36	0.73	0.62
Share of Cumulative Area to Median	(%)	15.8	12.7	11.7

Furthermore, the Household Survey completed by the NSO in 1990, indicates that around 82% of the total residential households in the Study area, excluding Camalig poblacion, do not own agricultural land. The number of households in the Study area, excluding Camalig poblacion, was estimated at around 9,000 in 1995. On the assumption that non-agricultural household occupancy covers 10% of the total household, the number of landless agricultural households is estimated at around 6,500. This accounts for 72% of the total households in the Study area. On the other hand, the land owner households are estimated at 1,600 which accounts for 18% of the total household. Based on the registered number of land owner (7,831) and the number of land owner household (1,600), the number of land owners per owner household is estimated at 4.9 which is similar to the average family size of 5.3. This means that most agricultural lands in the Study area were already fragmented by family members.

### 3.8.3 Cropping Pattern and Farming Practices

#### (1) Cropping Pattern

The agriculture production in the Study area is generally rainfed, with the exception of about 125 ha of irrigated rice. The normal present cropping pattern of paddy fields is given below. The cropping intensity based on the harvested area varies between 139 to 165% in rainfed areas and between 170 and 180% in irrigated areas.

A large percentage of corn growing farmers make two harvests per year. The first cropping season is planted between May and June. The harvest is made between August and September. The second cropping season of corn is planted between December and January, after the heavy rains. The second harvest of corn is between March and April. The average cropping intensity in corn areas based on the harvested area is in the range between 130 and 160%.

Cassava and sweet potato are planted throughout the year, except in the months of excessive rainfalls or drought spell.

	First Cropping Season		Second Cropping Season	
	Planting	Harvesting	Planting	Harvesting
Irrigated	May to August	Sept. to October	Nov. to Dec.	March to April
Rainfed	June to August	October to Nov.	Nov. to Dec.	March to April

#### (2) Farming Practices

Inadequate farming practices coupled with the lack of irrigation facilities are the main causes of low yield in rainfed paddy rice. A comparison of the recommended farming practice with the actual level of crop husbandry commonly done in the Study area is given in Table 3.8.2. Farmers in rainfed paddy fields normally use low level of input to minimize the risk of economic losses due to inadequate rainfall. Most farmers in the rainfed paddy fields use rice kept from their previous harvest as source of seed material. Only about 11% of rice farmers mainly in irrigated areas use certified seeds, notably the IR series.

Plowing and harrowing in paddy fields are mostly done using animal traction. Small hand-tractors are used by farmers, mostly in Camalig area, to do the last harrowing. Transplanting is the common method of growing rice. Farmers on irrigated rice fields apply medium level of fertilizers.

Corn is planted twice a year both in open lands and inter-cropped coconut areas of low tree density. The land preparation is made by plowing using draft animals. Many farmers

plow the land in the direction of the slope, causing erosion in some areas. The average amount of fertilizer applied is in the range of 30 kg/ha of N, 10 kg/ha of P, and 12 kg/ha of K, which do not satisfy the requirements for the type of soil in the area. Organic fertilizer, such as compost and green manure are not being used. However, corn production of farmers supported through the GPEP are provided with hybrid seeds, fertilizers, and technical assistance.

The husbandry on coconut plantations is normally inadequate. Most coconut farmers limit their activity to periodic harvesting. The application of fertilizers to coconut trees is virtually negligible, except for the small number of farmers that receive fertilizers from PCA's coconut improvement program. There are about 2,300 ha of unproductive coconut trees that need to be replanted. Inter-cropping is limited to about 10% of the coconut farms in the Study area.

### 3.8.4 Crop Yield and Production

A comparison of the average yield of main crops in the 41 barangays related vis-a-vis national, regional and provincial is presented below. In general, the yields obtained are rather low. This is reflected in the table showing the average annual production.

#### (1) Yield

Crop	(Unit : ton/ha)			
	Philippines	Region V (Bicol)	Albay Province	Study Area
Coconut	3.7	2.0	4.2	1.0
Irrigated Rice	3.3	2.9	2.7	3.2
Rainfed Rice	2.1	1.7	1.7	1.9
Corn	1.4	0.8	1.0	1.2
Abaca	0.8	1.0	0.9	0.8
Cassava	8.7	8.1	10.2	7.0
Sweet potato	4.8	5.8	6.9	5.4
Eggplant	6.9	4.5	5.5	4.9
Tomato	9.0	5.3	5.3	5.3

#### (2) Production

1) Paddy Rice		(Unit : ton/ha)			
	Physical Area (ha)	Planted Area (ha)	Harvested Area (ha)	Production (tons)	Yield (tons/ha)
Irrigated					
1st Cropping	125	125	115	380	3.3
2nd Cropping	125	115	98	300	3.0
Rainfed					
1st Cropping	1,225	1,225	1,100	2,570	2.1
2nd Cropping	1,225	985	570	1,670	1.7

## 2) Corn

	Physical Area (ha)	Planted Area (ha)	Harvested Area (ha)	Production (tons)	Yield (tons/ha)
Open areas					
1st Cropping	400	400	380	600	1.5
2nd Cropping	400	380	270	380	1.0
Inter-cropping					
1st Cropping	240	240	220	290	1.2
2nd Cropping	240	190	130	190	1.0

## 3) Others

Crop	Planted Area (ha)	Production (ton)	Yield (ton/ha)
Coconut	7,080	7,000	1.0
Sweet potato	120	660	5.4
Cassava	50	350	7.0
Abaca	60	50	0.8
Eggplant	20	100	5.0
Tomato	10	50	5.0

### 3.8.5 Livestock

Livestock production in the study area is a minor economic activity with farmers having few heads of different animals. The livestock population in Daraga and Camalig municipalities from 1990-1994 is presented below. The limiting factors that inhibit production of livestock and poultry are difficulty in acquiring good animal stock, reduced introduction of forage production, high costs of commercial feeds and medicines, incidence of parasite diseases, etc.

Year	Daraga		Camalig	
	1990	1994	1990	1994
Cattle	2,932	2,984	2,155	2,925
Carabao	2,675	3,039	1,892	1,757
Swine	7,393	5,579	6,032	5,836
Chicken	18,675	22,410	37,041	30,763
Duck	1,087	1,205	770	1,519
Goat	340	280	598	486

### 3.8.6 Post Harvest and Marketing

#### (1) Post Harvest Practices at Farm Level

Paddy rice is harvested by sickle and threshed manually or mechanically. In the Study area, around half of the harvest is threshed by beating. Mechanical thresher is used under custom threshing, the share of which is around 4% of the total threshed paddy rice. Matured coconut is harvested using a bamboo pole with a scythe at the top. Coconuts dropped from the trees are collected, piled and dehusked. The dehusked coconut (copra with shell) is dried. Abaca is stripped by hand using a Benito knife. No spindle-stripping machine is being introduced. The stripped fibers are brought to an open area for sun-drying or air-drying. The

quality of the fibers depend on the number of serrations and the pressure exerted by the stripper on the knife.

Each barangay has a concrete sun-drying floor for drying paddy rice, copra and corn. The capacity of sun-drying floor in the barangays producing paddy rice is normally insufficient to meet all the output.

## (2) Marketing Conditions of the Study Area

The Study area is favorably accessible to the public markets in Camalig, Daraga and Legazpi city. Agricultural products are locally assembled or traded in Camalig and Daraga public markets. The other barangays' products are traded in the respective public market.

The current marketing channel for practically all the crops is dominated by private dealers. Farmers are forced to sell wet paddy rice at lower price, especially farmers who are indebted to dealers. The dealers usually process paddy rice mainly in the cono-mills in Ligao, Polangui and Libon and sell the rice mainly to retailers in the public markets. Locally produced vegetables such as tomato, eggplant, ampalaya and okra are also traded through the private dealers and sold mainly in the public markets. Onions from Nueva Ecija, garlic from Pangasinan and Nueva Ecija, and cabbage, irish potato and sweet peas from Benguet are regularly supplied to the public markets throughout the year by outside dealers from Nueva Ecija, Pangasinan, and Metro Manila.

Copra is assembled by the copra brokers who directly trade with Legazpi Oil Company, a coconut oil manufacturer. Around 90% of the copra in Region V goes to Legazpi Oil Company in Legazpi city, which directly exports crude coconut oil or ships them to the factory in Batangas for further refining. This is in anticipation for better world market prices.

Abaca is generally bought by processors and exporters of abaca products in Albay. The devastation brought by the bunchy top and abaca mosaic disease infestations on the abaca plantations has caused the province to regularly import abaca fiber from nearby provinces, i.e. Samar, Leyte, Davao and Zamboanga. Cattle and swine fattening are common sources of additional income among farmers. The trading of livestock is also dominated by private dealers which sell them to retailers mainly in the Camalig, Daraga, Guinobatan and Legazpi public markets.

### (3) Local Agro-Industry

#### (a) Rice Mill

There are 20 operating rice mills in the Study area (14 in Camalig and six in Daraga. Most existing rice mills are classified as kiskisan and semi-cono. The milling recovery rates of existing rice mills range from a low of 55% to a high of 70%, while the milled rice contains a lot of small broken rice. The rice mills are operating mainly for custom milling at the rate of ₱ 0.5 to 0.6/kg of rice.

#### (b) Handicraft

Daraga is a main trading center of handicraft products in Albay province. Nine handicraft manufacturers in Daraga municipality and one in Camalig municipality are registered by the Fiber Industry Development Authority (FIDA). In addition, 26 handicraft exporters in Daraga and two in Camalig are registered by the Board of Investment, Department of Trade and Industry. Manufacturers and exporters supply abaca fibers and other raw materials to contract farmers in general.

### (4) Marketing Prices

The average retail prices of major products are generally stable. These are reflected in their standard deviations. In addition, the prevailing farmgate prices of agricultural inputs and outputs in the Study area, collected through the farm survey in 1995 are summarized as follows:

Item	Unit	Farmgate Price
<b>Inputs</b>		
Fertilizer	(P/kg)	7.0
Urea		4.4
Ammonium Sulfate		6.4
Muriate of potash (KCl)		5.6
14-14-14		7.6
Agro-chemicals		
Insecticide	(P/lit.)	
Decis		550
Labor	(P/man-day)	90
Man/Animal power	(P/day)	180
<b>Outputs</b>		
	(P/kg)	
Paddy		6.4
Corn grain		5.7
Copra		8.4

#### 3.8.7 Farmers' Economy

The family income and expenditure by household group were analyzed based on the results of the farm household survey. The annual farm incomes of rice farmers with an average

operating size of 1.3 ha were estimated at ₱ 30,400 for owner operators and ₱ 22,700 for tenants. The annual incomes of the coconut farmers were ₱ 17,000 for owners (operating size of 2.3 ha) and ₱ 12,900 for tenants (2.4 ha). The livelihood of small and medium scale farmers below one (1) ha depends on non-farm income accrued mainly from occasional and permanent employment. The annual net reserves of rice farmers were ₱ 5,400 for owners and ₱ 1,900 for tenants. The incomes of the coconut farmers were ₱ 2,800 for owners and ₱ 700 for tenants.

### **3.9 Irrigation and Drainage**

#### **3.9.1 Existing Irrigation and Drainage Schemes**

In Barangay Inarado, 3 existing small irrigation schemes of concrete diversion dams and canal network are functional. The irrigable areas of these 3 systems are estimated at about 31 ha, and about 35 households are using the systems. Concrete diversion dams are simply constructed to get irrigation water from small river, and the irrigation canals are mainly earth canals. Farm ditch and drainage canals are not constructed. In Barangay Taladong area, one (1) pump irrigation scheme was constructed to irrigate about 5 ha. The water resource of this scheme is Taladong creek. Furthermore, few small irrigation systems which have small temporary brush dams were found out in the paddy fields of Barangays Ligban, Taladong, Cotmon and Inarado.

#### **3.9.2 Flood and Sedimentation**

##### **(1) Flood and Inundation Areas**

The flooding of the Ligban river occurs at the flood control dikes located near the abandoned diversion dam of Barangay Ligban mainly due to sand sedimentation and raising of the river bed. The residential areas and paddy fields located near the river course, including those at the upstream from the abandoned weir diversion dam are always flooded. This also happens under the bridge of barangay Tagaytay. The flooding is estimated to last about half-day. Water logging expands along the old river course of Ligban near Barangay Tagaytay. This inundation is caused by the raising of the river bed at Tagaytay bridge after the river changes its course. The water logged area is estimated at about 12 ha.

The flooding of the Abagao river extends to as far as the paddy fields located at the depression areas along the river course. This is because of backwater occurring at the crossing structures such as cross drains and bridges. The flooding of the other rivers and streams are not as critical as the floods mentioned above.



## (2) Sabo and Lahar Flows of Mayon Volcano

The mud flows in the Study area are old lahar flows located at the northern area in Camalig. The inactive lahar flows, and some quantities of volcanic sand, gravel, cobble stones and boulders are always flowed down to the main course of Ligban river when heavy rains and flood occur. Sabo dam facilities such as mud flow control dikes along the old lahar courses have been constructed by the DPWH. The mud flows are well controlled and flushed out into the Ligban river during occurrence of flood.

The Tinago river, tributary of the Ligban river, has a good vegetation composed of coconut trees and small scale of bush areas. Mud flows are not significant, but soil erosion appears evident during occurrence of heavy rains. The sediments are normally brought to Tinago.

### 3.10 Rural Infrastructure

#### 3.10.1 Road Network

##### (1) National Road

The Study area is mainly traversed by a national primary road (Daan Maharlika). To the north it leads to Manila, and to the south it goes to the southern portion of Sorsogon which is the last province at the southern island of Luzon. The national secondary road that leads to Legazpi City and follows the eastern shoreline of Albay province north to Tiwi originates in Daraga. This goes through the center of the poblacion and serves as the main street on its way to neighboring Legazpi City. The Camalig - Comun - Inarado - Gapo - Penafrancia road traverses the northern part of the Study area.

The present conditions of these national roads are summarized below.

Road Name	Surface	Length (km)	Width (m),*/
1. Daan Maharlika (Guinobatan/Camalig Bdry. to Daraga/Sorsogon Bdry.)	Concrete	27.0	10.0
2. Camalig - Comun - Inarado - Penafrancia	Asphalt	14.6	8.0
3. Daraga - Legazpi City Bdry.	Concrete	1.4	10.0

Note : \*/ width with both shoulders

##### (2) Provincial Road

The provincial roads in the Study area connect several barangays via the national road. Most barangays can be reached by these provincial roads, but these roads in many cases are made of gravel and in poor condition. There are 18 major routes of the provincial road in the

municipalities of Camalig and Daraga with a total length of 65.7 km. Camalig has 11 routes with a total length of 48.9 km while Daraga has 7 routes of 16.8 km.

### (3) Municipal Road

The municipal roads are connected within the poblacions (the centers of both municipalities of Camalig and Daraga). Almost all of these roads are asphalt or concrete-paved and well maintained. The total length of the municipal roads are 4.2 km and 28.9 km in Camalig and Daraga, respectively.

### (4) Barangay Road

A barangay road is defined as a road outside of the poblacion. It connects two or more barangays or to an existing trunk line. Almost all barangay roads are earth fill (dirt) roads and in very poor condition. They are only traverseable by foot, especially during the rainy season. There are 46 major routes of barangay roads in the municipalities of Camalig and Daraga with a total length of 122.1 km. Camalig has 21 routes with a total length of 50.5 km and Daraga has 25 routes involving 71.6 km.

## 3.10.2 Rural Water Supply

### (1) Inventory of Water Supply Facilities

The number of Levels-I and II water supply facilities in the Study area is summarized in the table below. One (1) Level-III water supply facility serves the population in the poblacion and barangays Gapo and Ilawod in Camalig municipality. The total population served by the system is about 3,600 in the Study area and about 1,000 outside of the Study area. The present population served by these water supply facilities in the Study area is 31.1%, with a variation of 5% in barangay Penafrancia to 95% in barangay Dinoronan. The unserved portion is about 69% of the population (Ref. Table 3.10.1).

#### 1) Level I

Municipality	Private Facilities			Public Facilities		
	Shallow well	Deep well	Spring Dev.	Shallow well	Deep well	Spring Dev.
Camalig	211	0	2	63	27	1
Daraga	162	0	2	61	31	3
Total	373	0	4	124	58	4

#### 2) Level II

No.	Location of the System		Population		No. of Faucets	
	Barangay	Municipality	Total	Served	Communal	Individual
1	Gotob	Camalig	515	260	4	10
2	Taladong	Camalig	1,420	203	2	25
3	Inarado	Daraga	1,488	255	4	29
4	Gabawan	Daraga	1,303	374	5	2

### 3.10.3 Other Rural Infrastructure

#### (1) Electric Power Supply

The ALECO distributes and supplies the electric power requirements of the province. The Legazpi sub-station (15.6 MVA) covers the Study area with a total length of about 90 km of 13.2 kv distribution lines. Of the 41 barangays in the Study area, 30 barangays or 73% are already energized as of December, 1995. However, the total number of house connections is only 3,344 or 35% of the total households in the Study area.

#### (2) Public Transportation and Telecommunication

Road transport, notably jeepneys and tricycles provide the most common public transportation services in the Study area. There are 87 units of jeepneys registered and operating on 17 routes related to the Study area. Tricycles are mainly operated around the poblacions. There are 69 units of tricycles registered in Camalig and 458 units in Daraga as of December 1995. On the other hand, the rail service has not been available since the end of 1975, when floods washed out the major portions of the track on the southern end of the line. Air transportation, however, is provided through the airport located in Legazpi City. This is a trunk line airport equipped with all the necessary facilities.

Telephone service is only available in the Daraga poblacion served by MATELCO, a privately-owned public utility which operates in Legazpi City and Daraga. There is only one government telegraph station and postal services are available in Camalig and Daraga poblacions.

#### (3) Schools, Health Centers and Barangay Halls

There are fifteen (15) elementary schools and two (2) secondary schools covering twenty (20) barangays in Camalig, and twenty (20) elementary schools and one (1) secondary school involving twenty-one (21) barangays in Daraga. The government health service is provided by the Rural Health Units (Municipal Health Centers) located in both Camalig and Daraga poblacions. About 9 BHS and one (1) MHIC distributed in 41 barangays in the Study area are, utilized for rural health services. These are staffed by the municipal health offices, mainly rural health midwives. Around 31 or 76% of the barangays have no permanent BHS. Most barangays have barangay and multi-purpose halls.

### **3.11 Agricultural Support Services and Institutions**

#### **3.11.1 Local Government Units**

The local autonomy act (RA7160) has given broad powers to the LGUs with respect to control and authority over execution of public infrastructure projects as well as delivery of basic services, including regulatory functions. Among other things, such transfer of responsibilities from the national line agencies to the LGUS essentially covers: (a) provision of basic services and facilities; (b) transfer of regulatory functions; (c) institutionalization of linkage between GO and NGO; and (d) increased fiscal powers. This mandate, however, in no way rules out the intensive participation of the national agencies in the execution of vital infrastructure projects at the local level.

#### **3.11.2 Existing Central and Local Organizations**

In terms of local governance, the PGA and MGCD are practically the premier agencies performing the delivery of basic services. Within the MGCD, there also exists the respective barangay governments. The PGA has a provincial development plan coupled with a public investment program. The PGA is also responsible for executing inter-municipal project. The 41 barangay governments rely on their IRA as the funding source for projects in their community.

In the area of agricultural support services, the existing agencies providing direct services can be divided into 5 classes: (a) offices directly affiliated to the PGA and MGCD; (b) specialized agencies attached to the DA, notably PCA, FIDA and ATI; (c) academe, mainly the BUCAF; (d) banking institution, primarily the LBP; and (e) cooperatives and NGOs (Ref. Table 3.11.2). On agrarian reform, the DAR maintains its regional, provincial and municipal offices in the Study area. It has likewise established several committees up to the barangay level to mediate agrarian conflicts. On environmental matters, the DENR which has offices at the provincial and municipal levels is the premier agency dealing on natural resource conservation. Some of the regulatory functions of DENR, however, have already been devolved to the PGA and MGCD, particularly on pollution control laws.

On public infrastructure, the PGA and MGCD through the PEO and MEO, are modestly staffed to carry out the construction of facilities such as provincial and barangay roads and bridges, water supply, health stations, etc.

The national agencies also maintain their offices with main responsibility in the execution of national policies.

### 3.11.3 Agricultural Research and Extension

With the effectivity of the local government code in early 1992, the region 5 office of DA became the RFU and its main functions are basically on-station research and regulatory. The provincial government retained the SMSs, but the structure was made functional and thus three (3) entities were created, namely: the PAS; PES; and PVS. These 3 entities have responsibilities over extension, although their orientations are province-wide and generally staff support to the municipal local government units.

The MAS are the premier agricultural extension institutions. Despite the devolution, however, the specialized agencies attached to DA such as the PCA and FIDA and even ATI/FTC have their own extension activities apart from the MAS. These include the on-going coconut and abaca rehabilitation programs. The MAS is ill-equipped and ill-prepared, and this has stifled its capability to directly supervise and deliver extension services at the barangay level. The other agencies mainly PCA and FIDA have their own priorities and agenda. Their capacity to provide extension services is restricted by the availability of funds which are either externally or nationally funded. The training of farmers is on a need basis and priority is given on nationally-funded projects such as GPEP. Only a few of the farmers have benefited from this activity.

### 3.11.4 Comprehensive Agrarian Reform Program (CARP)

The scope of lands to be transferred under CARP in the Study area is about 3,200 ha or 38% of the total agricultural lands in the Study area. About 75% of the total scope or 2,400 ha are coconut lands. Most of these coconut lands have not yet been transferred by the DAR because it is still within the timeframe set under the CARP law. The DAR expects to distribute these lands beginning in 1996 (Ref. Tables 3.11.1 and 3.11.2). This situation implies that tenurial security among coconut farmers is still quite uncertain. The incentive to improve farm productivity and income by applying modern inputs and growing of other high value crops is certainly curtailed. The critical issue is no one among the institutions, including the DAR and PCA are monitoring the status of tenurial relationship prevailing in these coconut areas.

### 3.11.5 Cooperatives and Farmers' Organizations

The cooperatives in the Study area are generally classified as primary. The cooperatives started either as small farmers' coconut organizations or simply organized to undertake small relending and other marketing and consumer operations. There are only 16 cooperatives and are duly registered with CDA and thus they have juridical status.

The cooperatives are generally weak. Financially, they have very low capital base and suffer from liquidity problem. Technically, they are likely bound to disintegrate because of leadership, conflict and loose organizational problems. Only 60% of the current membership can be considered active. With this status, most of these cooperatives will not be eligible for financial support, especially under the small farmer financing program of LBP.

### 3.11.6 Agricultural Credit

The important suppliers of credit to farmers are still LBP through the cooperatives, rural banks and traders. The traders have been reportedly providing mostly short-term credit needs of the farmers through a special arrangement where farmers consign their produce to the traders in exchange for loans. The demand for short-term agricultural credit is perceived to be high. But given the high credit risk among the farmers and low absorptive capacity of the cooperatives, it is likely that actual demand from formal credit institutions is very low. Indicative of this is the declining trend of loan releases of LBP and the cooperative rural bank in Camalig, beginning 1993 until the last quarter of 1995. To close this gap, the need to improve the viability of borrowers, particularly the cooperatives becomes imperative.

## 3.12 Environment

### 3.12.1 Environmental Condition

#### (1) Biological Environment

The lands in the Study area were converted from their original land use of natural forest to coconut farm, paddy field, upland crop field, grassland and miscellaneous areas including residential areas. Forest with certain ecological and commercial values does not exist in the area. Due to the human interventions wildlife, particularly mammals are rarely observed. Even in Mayon Volcano national park, it is reported that only wild pig and deer habitate the area. On the contrary, avifauna (birds) are relatively diverse in species and population. However, it is reported that the composition of avifauna species has changed over time due to the changes in the ecosystem caused by natural calamity, change in cropping system and the use of pesticide.

#### (2) Environmental Concern

The topography of the Study area ranges from flat to rolling and moderately steep. Moderately steep topography of more than 50% in slope is found in the southern area and in Kituinan mountain range located in the south of Camalig town proper. Because of the high intensity of rainfall in the rainy season, the rolling and steep lands are susceptible to soil erosion. Though most of the rolling and steep lands are currently protected by the vegetation cover of coconut and tree crops, some lands are used for the cultivation of corn and sweet

potato without tree cover and soil conservation measures. It is believed that the land productivity in these areas is declining due to soil erosion. Soil conservation measures are limited due to lack of funds.

### 3.12.2 Risk of Volcanic Hazard

The northern edge of the Study area is located in the lower foot of Mayon volcano. The Mayon volcano is an active volcano and caused devastating damages on properties and human lives in the past. It erupts every eight to ten years and the latest eruption took place in February 1993. The hazards from Mayon can be classified as flowage (ground huggon) and non-flowage hazards (air fall). In general, flowage hazards are more dangerous to people and property than non-flowage. According to the volcanic hazard map, the hazard zone of lava and pyroclastic flows does not extend to the Study area. However, the areas around the Camalig town proper are within the lahar hazard zone and thus highly vulnerable to lahar encroachment and floods.

## **CHAPTER 4 BASIC DEVELOPMENT CONCEPT**

### **4.1 Current Problems and Constraints**

#### **4.1.1 Agriculture**

The upland agriculture land is characterized by monocropping coconut-based agriculture with low inter-cropping intensity of about 10%. The major reasons of this low intensity are: lack of appropriate farming systems and technology; limited investing power coupled with farmers' subsistence level of income; and land tenure system. The incidence of tenancy is fairly high at about 72% of the total households. Under this circumstance, the incentive for the farmers to improve their farms in terms of application of modern farm inputs and intensifying production is rather restricted.

#### **4.1.2 Irrigation and Drainage**

In the Study area, the water resource potential for irrigation purpose is very limited. Furthermore, the lack of irrigation facilities prevents intensive cultivation of paddy rice. Roughly 85% of the total paddy land are currently under rainfed condition. This is the main reason for low and unstable yield.

#### **4.1.3 Rural Infrastructure**

The condition of provincial, barangay and farm roads' network in the area is far from satisfactory. Provincial and barangay roads are inadequate to permit better mobility and ease in the transport and farms produces. The farm roads are even in worse condition because they are almost in footpath level. This poor road system inhibits mobility of farm produce thus transport cost is very prohibitive.

#### **4.1.4 Agricultural Institutions**

The current state of agricultural support services is constrained by the following: i) inadequate extension services; ii) weak cooperatives and non-viable farmers organizations; iii) lack of credit access to formal institutions; and inadequate marketing system, particularly in post-harvest handling.



## **4.2 Basic Development Concept**

### **4.2.1 Overall Development Concept**

The development concept for the WLIRDP envisages a careful selection of project components vis-a-vis various limitations and constraints which have been earlier identified. The overriding concern is to ensure that there is successful realization of the major objectives of the project with respect to: integrating rural development with the other components of development; empowering the beneficiaries and establishing local-based institutions to assume critical roles of development management; and eventually increasing productivity and farmers' income. In view of these important objectives, a focus, as a matter of strategy, was made as the basic parameter in defining the scale and configuration of the project components, including the beneficiaries. The following were considered as the planning rationale:

#### **(1) Initiation of Complementary and Critical Project Components**

It is envisioned that only the major components of development will be recommended and pursued. Broadly these include: (i) construction of irrigation facilities; (ii) rehabilitation of priority rural road network; (iii) improvement of Level-II potable water supply facilities; and (iv) development of agriculture cum provision of necessary support services. A number of criteria were used to select the priority infrastructure facilities. The main consideration is that the irrigation, other infrastructure facilities and institutional support are in synergy with the development of the rural area to ensure that integration is effectively carried out. Irrigation, rural roads, post-harvest and other facilities are intertwined with the development of the lowland. Where irrigation is not possible, only rural roads, small water body, nursery, etc. will be pursued in the development of the upland. Health and sanitation through the improvement of potable water supply, no matter how small, relative to the other infrastructure components is given importance due to its fundamental significance as a basic need. For both lowland and upland areas, production and marketing and formation/strengthening of farmers' and rural organizations are also intensified to complete the process of integration.

#### **(2) Recognition of the Participation and Duty of the Beneficiaries**

The success of any viable farming community and rural development in general is contingent on the active participation of the beneficiaries. The beneficiaries will form the core of institutional and hardware support under the WLIRDP. Over the long-term, the beneficiaries are expected to be the agents of change in the project area. There are also other activities where participation of the beneficiaries is deemed urgent. These include the operation and maintenance of facilities constructed under the project, notably irrigation facilities, water supply and post-harvest equipment and facilitating the delivery of agricultural extension. To effectively

carry out these activities, the beneficiaries should bond themselves into strong and viable farmers' organizations. The duties of the beneficiaries such as providing the right-of-way for project facilities, amortization of investment costs, payment of irrigation water fees, and operation and maintenance of facilities, could be realized under successful management of their organizations.

(3) Recognition of the Role of Central and Local Government Units

The central and local government units have distinct responsibilities to perform in the project. This is more important for the LGUs in Albay where practically the major components of the project are part and parcel of the devolved services. Under this circumstance there should be a mechanism where both the central and local governments can work harmoniously for the successful execution of the project components. To the extent that the authority clearly belongs to the LGUs, the central or national agencies should lend technical support to the former. This is the principle being espoused in the local government code.

(4) Establishment of Model Rural Development Projects

The essence of establishing a model project is to ensure that success can be realized, particularly in agriculture and in the promotion of livelihood or income generating endeavors. There are strong arguments in favor of establishing the model projects in the project area. For one, there are limited experiences and resources of the beneficiaries and as such do not warrant the execution of huge development activities. It will take a learning process before the beneficiaries and even the institutions can effectively and efficiently manage their activities. Second, it is easier to replicate successful activities of a small scale given the current absorptive capacity of the beneficiaries and local institutions.

The model projects were formulated and designed based on (a) priority sites for irrigation development; (b) priority sites for corn and coconut upland development; and (c) priority sites for rural roads and rural water supply taking into consideration equitable distribution of model sites between the municipalities of Camalig and Daraga. The selected sites for the model rural development projects through the analysis for the Basic Development Plan in the Study area described in Chapter 5 are summarized as follows:

Item	Covering Barangay	
	Camalig	Daraga
<u>Lowland Model Rural Development</u>		
(1) Camalig Diversion Area	C-6 Ilawod C-8 Ligban C-10 Gotob*	C-7 Libod C-9 Tagaytay
(2) Dam No. 2 Area (Rural Road)	(Ligban-Gotob-Taladong)	
(2) Dam No. 2 Area (Rural Road)	C-14 Binitayan C-15 Comun C-17 Cotmon	D-1 Inarado* D-11 Burgos D-6 Aloba D-7 Tabon-Tabon (Inarado-Aloba-Mabini)
(2) Dam No. 2 Area (Watershed Area)		(Lacog)
<u>Upland Model Rural Development</u>		
(1) Upland Corn Based Development Area (Rural Road)	C-20 Magogon (Anislag-Maopi-Magogon)	
(2) Upland Coconut Based Development Area (Rural Road)		D-19 San Ramon (Mayon-San Ramon)

Note : \* Sites covered by Level II rural water supply project

#### 4.2.2 Sectoral Development Direction

##### (1) Agriculture

The main objective of agricultural development is to improve the current farming systems in the Study area. The basic guidelines in planning the agriculture component are: (a) increase the production of paddy rice through the introduction of high yielding varieties and improved farming practices; (b) increase the productivity and total production of upland crops through the replanting of unproductive coconut trees and promotion of inter-cropping farming systems in the coconut lands; (c) increase the income of farmers and reduce the risk of economic failure due to crop damages caused by natural calamities; (d) promote a suitable and optimum utilization of the land resource, including the introduction of farming practice for conservation of soil and water resources; and (e) promote the development of agro-processing, handicraft, and marketing activities.

##### (2) Irrigation and Drainage Development

The main purpose of developing the water resource potential is to harness surface water for irrigation development, and provide the necessary facilities for tapping the water resource potential. The basic guidelines in planning the water resource development are defined as follows: (a) provide gravity off-taking method of irrigation water by constructing head work and intake gates, if reliability of river discharge is high, (b) provide small impounding ponds as supplemental water for irrigation development, if reliability of river discharge is low.

The main aim of lowland irrigation development is essentially to provide irrigation facilities on existing rainfed paddy fields in the Study area. The basic guidelines in planning the irrigation and drainage component are: (a) provide irrigation system only on existing rainfed paddy fields to minimize capital investment on the facilities to be constructed; (b) optimize the use of the irrigable areas by rotating the application of irrigation system; (c) construct simple designs of irrigation and drainage facilities such as systematic farm and drain ditches, discharge measurement, etc.; (d) increase the efficiency of the irrigation facility by constructing canal linings to reduce seepage and more importantly to conserve the scarce water resource; (e) introduce proper water management techniques by establishing on-farm systems (e.g. farm ditches, drain ditches, etc.) and providing appropriate technical assistance to IAs.

### (3) Rural Infrastructure Development

The rural infrastructure component will cover primarily rural road network and potable water supply facilities. The basic guidelines in planning the rural road network are: (a) rehabilitate and upgrade only existing provincial and barangay roads; (b) selected road network will make all barangays accessible by public transport vehicles. They are safely passable anytime of the year; (c) designs will include multi-purpose pavement along the side streets to serve as drying facilities and proper drainage facilities; and (d) maintenance will consider the absorptive capacity of the LGUs.

As regards the water supply facilities, the basic guidelines adopted in planning are: (a) improve the coverage of the water supply facilities consistent with the targets of the provincial master plan with the highest priority given to Level I and II facilities; and (b) strengthen the water users' associations to ensure proper maintenance of existing Level II facilities.

### (4) Institutional Development

The major objective of institutional development is to have efficient systems and structures capable of delivering timely and adequate basic support services to the farmers. The basic guidelines adopted in planning this component are: (a) provide an integrated delivery of agricultural research and extension, credit and marketing to the farmers; (b) provide software and other institutional infrastructure support to such agencies and more importantly to farmers' organizations, notably the cooperatives and other new farmers organizations in order to strengthen their absorptive capacity; (c) encourage the intensive involvement of the beneficiaries through their respective organizations in economic and livelihood income generating endeavors; and (d) accelerate the completion of land transfer and tenurial improvement in coconut lands.

## CHAPTER 5 BASIC DEVELOPMENT PLAN

### 5.1 Lowland Development Plan

#### 5.1.1 Cropping Pattern and Farming Practices

The main objectives of lowland development are to stabilize double cropping and increase the yield of rice. This will be done by adjusting cropping pattern. At present, the harvesting of the first cropping is seriously affected by heavy rains and strong typhoons during the months of October to December. However, improving the supply of irrigation water and introducing earlier maturing varieties can minimize the impact of these damages. The first cropping will be planted in the middle of May to the end of June and is expected to be harvested in the beginning of September to middle of October before the onset of peak typhoons. The second cropping at present needs to be started in November using sufficient rainfall because yield is affected by shortage of rainfall and irrigation water during the month of February. The second cropping in the future could be later started in the beginning of December to prevent plant stress and damages from heavy rains and typhoons.

Under the rainfed condition, advancing the harvesting could increase the production of paddy through decrease in damages by typhoons during the first cropping and shortage of rains during the second cropping. The late maturing varieties such as IR 64 and 68 (115-120 days) need to be replaced with earlier and maturity and rest resistant varieties such as IR 60 (105 days). Timely land preparation is also needed to utilize effectively occasional rainfall. The equipment for land preparation, either draft animals and/or small hand tractors should be made available. The effective procurement and utilization of animal and mechanical powers could be realized through the activation of the farmers' organization and/or cooperatives. The improvement plan for paddy cropping pattern based on probable rainfall with a return period of 5 years is tentatively formulated as follows:

	First Cropping Season		Second Cropping Season	
	Planting	Harvesting	Planting	Harvesting
Irrigated	May/Mid-Jun/End	Sep/Beg-Oct/Mid	Dec/Beg-Jan/Mid	Mar/Mid-Apr/End
Rainfed	Jun/Beg-Jun/End	Sep/Mid-Oct/Mid	Dec/Beg-Jan/Mid	Mar/Mid-Apr/End

Diversified crops such as mungbeans could be introduced in some paddy fields after improvement of drainage condition. The cultivation of legumes will improve soil fertility and minimize crop failures due to drought.

The development of a demonstration farm to demonstrate appropriate farming practice is proposed as a project component. This is essential to carry out the above-mentioned cropping pattern on farm practice.

### 5.1.2 Irrigation and Drainage

#### (1) Recommended Irrigation and Drainage Development

A total of 5 dams were evaluated based on technical soundness and other considerations (Ref. Table 5.1.1) but only Camalig Diversion and Dam No.2 will be recommended for irrigation and drainage development in the lowland areas.

##### (a) Camalig diversion dam plan

The technical soundness of developing the dam for irrigation purpose is very good. There are no serious limitations except for the maintenance work of Ligban river, notably the dredging work of river sediment. This is proposed to be undertaken by appropriate government authorities.

##### (b) Dam No.2 plan

The technical soundness of developing the dam for irrigation purpose is very good. There are no serious limitations on water resources and irrigation and drainage development.

#### (2) Proposed Irrigation Method

Taking into consideration relative ease in maintenance work of facilities and cheaper operation costs, the implementation of gravity irrigation method is proposed as far as practicable. And to increase the effective use of water, canal lining will be applied in the main canal systems. The gravity method will be accompanied with on-farm development facilities such as irrigation farm ditches and drain ditches.

#### (3) Irrigation Water Requirement

The irrigation water requirement for paddy under the two proposed irrigation systems was estimated by computing first the nursery requirement and percolation rates. Combining these two factors, the irrigation water requirement was calculated.

Item	Camalig Diversion Area	Dam No.2 Area
Nursery Requirement		
First Paddy	19	18
Second Paddy	18	17
Type of Soils	Sandy clay to Silt clay	Clay loam to Clay
Designed Percolation (mm/day)	3	2
Seasonal Irrigation Requirement		
First Paddy	713	527
Second paddy	676	472

### 5.1.3 Post-Harvest and Marketing

The marketing channel for rice and mungbean is developed in the study area despite the dominance of dealers and middlemen in the marketing of products. Project support will be necessary to improve post-harvest practices as well as create self-reliant farmers' economy. The supply of institutional credit to organized farmers, mainly for production purposes, is deemed indispensable to create an environment conducive for the development of post-harvest and efficient market system in the Study area. In the lowland, new farmers organizations will be organized for the O&M of irrigation facilities. The farmers in the Study area and rainfed farmers outside of the project area can be potential members for these organizations to provide better post-harvest and market services. In the Model area, it is proposed that the following post-harvest and marketing facilities managed by the farmers organization will be made available based on actual requirements and absorptive capacity of the organization.

- 1) Mechanical threshers
- 2) Sun-drying floor and /or mechanical dryer
- 3) Warehouses for farm inputs and products
- 4) Trucks for transportation
- 5) Rice mill and other processing facilities

### 5.1.4 Farmers' Organizations

The strengthening and/or establishment of farmers' organization stems from the fact that these organizations will render basic agricultural support services, producing and supplying quality seeds, fertilizers, and other farm inputs; processing and marketing of farm products; and operating post-harvest facilities and maintaining the irrigation system.

The matter of strengthening new and existing farmers' organizations will initiate to evaluate the existing cooperatives or related farmers' organizations and see if the current resources permit expansion for activities designed under the model projects. Otherwise new organizations may have to be formed.

For the formation of new farmers' organizations it is envisaged that those farmers who are willing and have enough capital should initially be encouraged to form the core group. The formation should be initiated by and among the beneficiaries, preferably those with inclination to do business endeavors. The landless farmers in the Study area have the potential to be organized as a cohesive group to render service to the landowners. Training should be given based on needs. There are several approaches and modules and this can be adequately handled by reputable and local-based NGOs. The aspect of establishing a new IA will be highlighted

given the unique conditions in the Study area. There should be a plan where a new organization mainly responsible for service be established.

## 5.2 Upland Development Plan

### 5.2.1 Land Use Plan

It is recommended that the present land use pattern for the upland areas be maintained. The present shrubs and grass lands will be utilized for the cultivation of annual crops with the use of proper land and soil management. The opening of coconut land for the cultivation of intensive annual crops, even on slopes of less than 8%, is not recommended. The inter-cropping on the coconut land will be more acceptable compared with open annual crop land. The introduction of soil conservation and improvement of fertility to increase crop productivity will be relatively manageable under the coconut land. And given the predominant tenant and sharing farmers into consideration, inter-cropping has a higher social adaptability than open annual crop. Around 3,435 ha of diversified annual crops and 4,470 ha of tree crops are moderately suitable for cultivation under the future land use plan. The framework of future land use in the Study area is summarized as follows:

Land Use	Present		Future	
	(ha)	(%)	(ha)	(%)
Coconut Land	7,080	80.0	7,080	80.0
Open Land Annual Crop	420	4.8	880	10.0
Open Land Perennial Crop	-	-	760	8.6
Shrubs and Grass Land	1,340	15.2	40	0.4
Protected Marginal Land	-	-	80	1.0
Total	8,840	100.0	8,840	100.0

The present practice on upland management in the Study area is recommended to be improved through the adoption of SALT introduced by DA. The appropriate land management system for the promotion of inter-cropping system and soil management of open annual crop land will be formulated according to the present land use, vegetation coverage and land slope as follows:



Present Land Use	Slope Range (%)	Recommended Management
Open Annual Crop Land (Corn Cultivation)	0 - 8	Crop rotation including legumes Mixed cropping system of corn plus legume crop
Coconut Land Farm Land	0 - 18	Inter-cropping either annual or perennials crops Mixed cropping
	18 - 25	Inter-cropping of perennials crops
	> 25	Inter-cropping of perennials crops, Mulching
Dam Catchment Area	0 - 18	Perennial crops, Soil conservation, Minimum tillage
	> 18	Agro-forestry, Soil conservation, Zero tillage
Shrub and Grass Land	0 - 8	Convert to annual or perennial crops, Mixed crops
	8 - 18	Contour planting, Alley cropping, Mix cropping
	18 - 25	Inter-cropping of perennials crops, Mixed cropping

### 5.2.2 Selection of Upland Crops

Fifty four (54) potential crops commonly grown in the Philippines have been considered for evaluation (Ref. Table 5.2.1). The final evaluation based on financial profitability, marketability, perishability and possibility to contribute to agro-industry development resulted in the consideration of 15 crops as shown below:

Land Use/ (Purposes)	Annual Crop	Perennial Crop
Open Annual Crop Land/ (Commercial Production)	Upland Rice, Corn, Soybean Mungbean, Okra, Sweet Potato	Pili, Papaya
Coconut Land (Commercial Production)	Upland Rice, Corn, Soybean Mungbean, Okra, Sweet Potato, Chili, Eggplant, Cassava, Ginger	Papaya, Pineapple, Abaca Coffee, Black Pepper
Both Land (Soil Conservation)	Soybean, Mungbean	Abaca, Coffee, Pili, Anahaw Bamboo, Pasture

### 5.2.3 Upland Corn Based Development Plan

Barangay Magogon was selected as the site for the implementation of the upland corn-based model project. This was based on the magnitude of suitable corn production area, existing functional multi-purpose cooperative, farmer's desire to involve landless farmers as cooperative member, and farmers' acceptance to introduce new cash crops or business activities. Soil conservation measures, such as contour farming, will be introduced to attain a sustainable farming system for upland corn areas. To increase the productivity of corn and other diversified crops, multi-cropping system and integration of poultry production are recommended. It is necessary to provide or improve infrastructure such as soil conservation work covering contour bunds, drainage, farm to village road, and seasonal irrigation water supply. The following farm investment coupled with improved farm practices such as proper application of fertilizer, planting good seeds, etc. will be introduced based on the requirements of the area.

- 1) Formulation of land use and field layout plan based on the slope, soil fertility, present vegetation, degree of soil erosion,
- 2) Farm bunds, farm drainage and farm road,
- 3) Nursery for diversified crops and soil conservation perennial crop,
- 4) Small water impoundment and shallow tube well at a suitable site for the use of farming activities (washing of farm tools, agro-chemical treatment, etc.), irrigation water supply for the nursery and drinking water supply for livestock,
- 5) Compost producing areas and shed for producing organic manure,
- 6) Workshop and garage for farm tools, farm machinery, etc.

Magogon upland corn-based model area could become an example to be replicated in other areas of Bicol Region with similar characteristics, such as the existence of a functional farmers' cooperative and open upland lands devoted to corn production.

#### 5.2.4 Upland Coconut Based Development Plan

Barangay San Ramon was selected as the site for the implementation of the upland coconut-based model project. This was based on the magnitude of suitable coconut production area, potential farmers' organization i.e CARP beneficiaries association, and farmers' interest to introduce coconut inter-cropping. The development frame to promote appropriate upland coconut-based farming system will include: (a) a gradual replanting of the coconut considered unproductive of about 2,300 ha will be rehabilitated; (b) continue and expansion of the coverage of the Small Coconut Farmers Development Project of PCA; (c) increase the yield of coconut by improving the husbandry practices on the coconut plantations through improvement of extension activities on coconut farming, and (d) gradual increase of the land area devoted to inter-cropping farming system under the coconut plantation preferably with abaca through integrated agriculture support services.

The development of upland coconut-based model area is proposed to be a component to support the development of coconut-based upland agriculture development. The objective of the model area is to provide an example of an integrated delivery of agriculture support services such as improvement of production infrastructure, procurement and distribution of planting material, extension, credit, post-harvesting and marketing.

It is envisaged that San Ramon upland coconut-based model area can become a model for the extensive production of abaca inter-cropping in coconut lands that can be replicated in other upland areas with similar characteristics such as the magnitude of suitable coconut

production, potential CARP beneficiaries association and farmers' interest to introduce coconut inter-cropping in the Bicol region or other regions in the country.

#### 5.2.5 Post-Harvest and Marketing

The post-harvest and marketing systems for upland agriculture consisting of upland corn and coconut-based farming will be emphasized. The organization of farmers and supply of institutional credit will be necessary for the promotion of intensive upland development. The post-harvest and marketing facilities to be managed by farmers' organizations will be given based on actual requirements and absorptive capacity of the farmers organizations.

The processing of agricultural produce to attain added value of the product was considered in the formulation of post-harvest and marketing support facilities. The marketing channels for the recommended crops are already developed, despite the dominance of dealers and middlemen in the marketing of products. The existing market outlets are SADOPECO for corn, Legazpi Oil for copra, ALINDECO, ISALOG Pulp and Paper co., and local handicraft for abaca, Nettles co., for coffee, local processors for pilinuts, and San Miguel co., and Swift co., for poultry .

#### 5.2.6 Farmers Organizations

New dimensions will be introduced in the formation and strengthening of farmers' organizations in the upland project areas to improve their viability and delivery of services. This will involve the participation of the so-called landless (tenants, caretakers, etc.) comprising about 60-70% of the households in the project area. A new organization specializing on providing services will be organized. This will eventually be service cooperatives. About 90% of the respondents in the upland model areas have indicated their willingness to form this association . The involvement of this group will permit opportunities in terms of job generation and specialization of functions in the community. Another aspect is the formation of coconut landowners associations (i.e. absentee and non-cultivator) who will simply assign the cultivation of their farms to a cooperative under a trust agreement. Some 80% of the non-cultivator respondents in the upland model areas have considered this arrangement as acceptable. This will be a positive step towards intensification of coconut farming in the uplands project areas.

The plan for the Upland will first evaluate the existing cooperatives or related farmers organizations such as SCFOs and Magogon Farmers Multipurpose Cooperative to determine if their current resources permit expansion for activities designed under the model projects. Otherwise new organizations may have to be formed. The cooperatives in the project area will

be linked up with the NGOs and existing federations, such as SADOPECO and BCDC, for on-the-job training and acquisition of skills in marketing and management.

### 5.3 Rural Infrastructure Development Plan

#### 5.3.1 Rural Road Development Plan

##### (1) Priority Roads in the Study Area

Five (5) priority roads with a total length of 32.1 km are proposed for rehabilitation and upgrading. Of these road network, 11.4 km are provincial roads and the remaining 20.7 km are barangay roads. All roads categorized in the proposed short-term development program (1996 -2000) and located within the Study area were selected as proposed priority roads. The short-term rural road network improvement program covers a total length of 64.3 km and will cost about P161 million (Ref. Tables 5.3.1). The routes listed below are the priority roads and the illustration is in Figure 5.3.1.

Priority Roads		Length (km)
(1)	Comun - Cotmon - Del Rosario - Panoypoy	7.0
(2)	Ilawod - Ligban - Gotob - Taladong	5.4
(3)	Anislag - Maopi - Magogon - Panoypoy	6.4
(4)	Bascaran - Burgos - Mabini - Kinawitan - Panoypoy	5.7
(5)	Mayon - San Ramon - Bigao - San Vicente Grande	7.6
(Total)		32.1

#### 5.3.2 Water Supply Development Plan

##### (1) Proposed Rural Water Supply Development Plan

Based on the projection of water supply service coverage by the year 2010, the estimated shortfall of wells is about 465, based on new requirement of 783 wells (Ref. Table 5.3.2). Given this demand, the proposed water supply development plan based on the stage-wise time frame is given below (Ref. Table 5.3.3).

Municipality	No. of Brgys.	Required No. of Wells to be constructed			
		1996 - 2000	2001 - 2005	2006 - 2010	(Sub-total)
Canalig	20	152	150	127	429
Daraga	21	127	123	104	354
Total	41	279	273	231	783

##### (2) Improvement of the Existing Level-II Facilities

These facilities were constructed in 1989 and serve about 1,000 people. However, because of limited budget for construction, improper design and poor maintenance activities,

etc., the systems are not being effectively used by the people. In order to maximize and expand the systems, these facilities are proposed for improvement as follows:

No.	Location of the System		Population		No. of Faucets	
	Barangay	Municipality	Total	Served	Communal	Individual
1	Gotob	Camalig	491	149	4	19
2	Taladong	Camalig	1,010	286	2	48
3	Inarado	Daraga	1,503	369	8	20
4	Gabawan	Daraga	1,233	94	2	1

## 5.4 Institutional Development Plan

### 5.4.1 Agricultural Research and Extension

(1) Establishment of a facility for training farmers and extension workers. The supply of technical support involves a mechanism where the beneficiaries and extension agents can hone their technical skills on proper farming techniques; operation and maintenance of post-harvest equipment; production of quality seeds; and water management aspects. This necessitates a modest facility where the farmers can convene and take their practical lessons. Existing facilities will be used as training centers. Such facilities include the AES and FTC, both located in Albay. In addition, technical personnel from BUCAF and other agencies may be tapped as resource persons for training the beneficiaries of WLIRDP.

(2) Organization and Deployment of Barangay Extension Agents. Barangay extension agents (BEAs) are proposed to be drawn and selected from among dynamic farmers and will be trained accordingly to support the cadre' of extension agents of the MAS which are believed to be inadequate and sometimes overworked. The BEAs are voluntary workers. They will be assisted by providing them farm inputs and other demonstration kits which can be used in their farms as showcases for farm trials. The BEAs are expected to be the focal leaders to train and encourage their co-farmers to adopt better farming technologies.

(3) Training of Technical Personnel of the MAS. The technical people belonging to the MAS, including municipal agricultural officers are proposed to undergo further training to familiarize themselves with the activities planned for WLIRDP. More than anything else the training will not be limited to technical but also in developmental planning to hone their skills for better planning and programming of extension activities.

(4) Tightening the Extension Coordination Between and Among Concerned Agencies. The MAS will be relied upon to deliver extension services. For it to be effective, it should be supported technically and financially by the local chief executive. It is proposed that the local

chief executive initiate and activate the local agricultural and fishery councils established to strengthen coordination.

#### 5.4.2 Coordination with DAR on CARP's Land Trust System

The DAR is expected to accelerate the distribution of coconut lands covered under CARP. Meantime that this is not yet completed, it is proposed that DAR places all the coconut lands under the leasehold system. DAR should also come up with a monitoring system to track down tenurial relationships in these areas whether or not there are violations committed by farmer beneficiaries and landlords. This is critical to facilitate the formation of landless farmers associations who will work with coconut landowners under a scheme of land trust system. There are aspects of CARP, particularly in the delivery of support services that are relevant to the project. Foremost is the so-called ARCs being currently promoted by DAR as its flagship program. The concept of the ARCs is patterned after integrated area-based development. The chances of the Study area to get support are expected to be accelerated if DAR declares the model areas ARC in the Bicol Region.

#### 5.4.3 Agricultural Credit

The administration of agricultural credit requirement is proposed to be dovetailed with the current small farmer financing program of LBP. This underscores the importance of having strong and viable cooperatives since LBP courses its financing only to cooperatives. It is proposed that a special lending window be established with LBP as the administration of the fund. In addition, livelihood credit specially to support lower income class of farmers, i.e. share-croppers and caretakers which have limited absorptive capacity for capital investment will be recommended.

#### 5.4.4 Participation of Beneficiaries

Essentially, the proposed activities will include inventory and identification of the target beneficiaries; organization of the selected beneficiaries; and provision of training, primarily on enhancing the technical skills. The organization of beneficiaries will be looked into with existing organizations. Some organizations in the Study area do exist and the possibility of using these organizations as core group should be explored. The only problem with these organizations as assessed is their questionable viability. Enhancing the technical skills of the beneficiaries will cover subjects mainly on agriculture farm techniques, post-harvest handling, water management, etc.

Beneficiaries organization plan for irrigation, upland, and water supply development should be formulated based on their knowledge and maturity level. Without any participation of beneficiaries, the sustainable operation and maintenance of the project facilities could not be

expected to the beneficiaries. The project scope need to be explained to the beneficiaries in order to formulate more sound and sustainable project. Farmers' intention and needs will be clarified through the survey and reflected to the project formulation. The beneficiaries' organization plan will be made taking their socio-economic status, organizational procedures, their functions and support service facilities into consideration.

## CHAPTER 6 THE PROJECT AREAS

### 6.1 Lowland Model Rural Development Project Area

#### 6.1.1 Location

The Camalig Diversion lowland model area is extended in the flood plain of Ligban river located around one (1) km southwest from Camalig Poblacion. The area is located administratively within Camalig municipality consisting 20 blocks (purok) of 5 barangays, i.e. Hawod, Libod, Ligban, Tagaytay and Gotob (Ref. Figure 6.1.1).

The Dam No. 2 lowland model project area is located in flat plain surrounded by small hills which expand about 4 km southwest from Daraga Poblacion. The area is administratively located between the municipalities of Camalig and Daraga covering 21 blocks in 7 barangays, i.e. Binitayan, Comun and Cotmon in Camalig and Inarado, Alobo, Tabon-Tabon and Burgos in Daraga (Ref. Figure 6.1.2).

#### 6.1.2 Demography and Social Status

The rural households in the model project areas were classified into farm and non-farm households. The compositions of the farm households are summarized as follows:

(Unit: %)

Classification	Camalig Diversion Area	Dam No. 2 Area
Owner	28.6	32.7
Non-cultivator	4.8	6.4
Cultivator	23.8	26.3
Tenant	56.2	50.7
Lessee	10.5	5.8
Share-Cropper	45.7	44.9
Care-takers	15.2	16.6
Total	100.0	100.0

The total population and number of households in the Camalig Diversion area were estimated at 5,489 and 1,033, respectively in 1995. In the Dam No. 2 area, the population was estimated at 4,792 while the households was 961. The demographic features are summarized as follows (Ref. Table 6.1.1):



Item	Camalig Diversion Area	Dam No. 2 Area	Study Area (41 barangays)
Area (ha)			
Total*	1,083	2,021	10,613
Irrigation service area	130	395	1,350
Population (1995)			
All related barangays	8,517	8,113	51,563
Related blocks only	5,489	4,792	51,563
Farm	4,885	4,557	46,407
Non-Farm	604	235	5,156
Household Number (1995)			
All related barangays	1,558	1,604	9,638
Related blocks only	1,033	961	9,638
Farm	918	915	8,674
Non-Farm	115	46	964
Population Growth (%/year) 1980-90*	1.89	1.07	0.74
Family Size (1995)	5.3	5.0	5.3
Population Density(/ha, 1995)			
Total population*/total area	7.9	4.0	4.9
Farm population/paddy field	37.6	11.5	34.4

\*: Figures in all related barangays

The economy of both lowland model project areas is generally dominated by agriculture. The Camalig Diversion area is located near the Camalig Poblacion and readily accessible. The non-farm households (11% of the total in 1995) are gradually increasing in parallel with urbanization along the national road to the Poblacion.

### 6.1.3 Topography

#### (1) Camalig Diversion Area

The irrigation area is extended in the flood plain of the Ligban river, i.e. near Camalig Poblacion to barangay Tagaytay area and in the lowest skirt areas of Mayon volcano. The Ligban river has a steep river gradient ranging from 1/30 to 1/200 in the upstream from barangay Ilawod. The river course stretches to down stream with gentle slope of 1/1,000 to 1/2,000. The flood plain expands in the down stream from an abandoned weir, and the lowest area of the flood plain suffers from seasonal flooding during the rainy season. A small swampy area of about 12 ha is existing. The elevation of the rainfed paddy field ranges from 110 m to 99 m above mean sea level, and the slope of rainfed paddy field ranges from 0.2% to 0.5%. The river course is always unstable in the downstream area due to huge sedimentation and flood discharge.

#### (2) Dam No. 2 Area

The area is covered by rainfed paddy field on the flat plain and coconut land on hilly area with small undulation. The Abagao river flows between the hilly area and flat plain. A