CHAPTER 1 INTRODUCTION

1.1 Authority

This report is prepared in accordance with the "Implementing Arrangement on the Technical Cooperation (I/A) for the Feasibility Study on the Upland Irrigation and Rural Development Project in Southern Luzon (the Study)", agreed upon between the Government of the Philippines through the National Irrigation Administration (NIA) and the Japan International Cooperation Agency (JICA), the Government of Japan on February 3, 1993. The I/A is incorporated in this report as Attachment-5.

The report presents the final results of the Study on the basis of Phase 1 field/home office works and Phase 2 field/home office works, mainly containing findings of present conditions in and vicinity of the Study area, basic development concept based on development potential and constraints of the area, project formulation and prospective project works including operation and maintenance plan. The report consists of three volumes, namely Main Report, Appendixes and Drawings. The Appendixes support the main Report following to the chapter arrangement in the table of contents comprising details and supplements.

1.2 Objectives of the Study

(1) Objectives of the Study

The objective of the Study is to formulate the irrigation and rural development in the area along the foot of Mt. Banahaw in the Province of Laguna, for the improvement of agricultural productivity and rural welfare. The Study also aims to undertake transfer of technology to the Philippine counterpart personnel concerned in the course of the Study.

(2) The Study Area

The Study area covers an area of about 3,000 ha along the foot of Mt. Banahaw in the Municipalities of Nagcarlan, Liliw and Majayjay, the Province of Laguna, and the adjoining areas relevant to the Project (see Location Map).

1.3 Scope of the Study

The Study undertook Work II of the two works agreed in the I/A; Work I (Preparation of topographic map covering the Study area on a scale of 1/4,000) and Work II (Feasibility Study). The Study was carried out in the two phases, and Phase 1 and 2 were comprised of field work in the Philippines and home office work in Japan. The Study covered the following work items:

1) Collection, review and analysis of existing relevant data and information concerning:

   a) natural conditions
   b) socio-economic conditions
   c) agricultural conditions
   d) rural and social infrastructure
   e) environmental conditions

2) Execution of the following surveys:

   a) groundwater investigation
   b) soil survey
   c) water quality test
   d) farm household survey
   e) topographic survey
   f) public consultation survey
   g) geotechnical investigation

3) Preparation of a plan for upland irrigation and rural development

4) Estimate of project costs and benefits

5) Project evaluation

6) Recommendations

1.4 Activities of the Study Team

(1) Work of the Study

The Work I (preparation of the topographic map) had been completed before the commencement of the Feasibility Study in January 1994. The Study was commenced in January 1994 and completed in February 1995 with a total period of 13 months.

(2) Assignment schedule

Assignment schedule of the Work II is illustrated in Attachment-3. Assignment schedule of each team member was scheduled in line with scope of the Study. The Study is executed jointly by the Study Team comprising ten experts, and the counterpart personnel despatched from NIA. The personnel participated and/or interviewed during the Study period is listed in Attachment-1.

(3) Activities during Phase 1

The Study Team submitted the Inception Report to NIA on January 25, 1994, and discussion was made between the concerned NIA officials and the Team. The Inception Report was mutually agreed on between both parties, as mentioned in the Minutes of Meeting on the Inception Report (see Attachment-6).

In accordance with the "Plan of Operation" given in the Inception Report, the Team made the following activities, together with the counterpart personnel, during the initial two months and prepared the Progress Report No. 1:

1) Field reconnaissance

2) Collection of data and reports relevant to the project

3) Field surveys and investigation including:

   a) Meteorological and hydrological investigation
   b) Hydro-geological investigation for groundwater exploitation
   c) Soil and land use survey
   d) Investigation on irrigation and drainage
   e) Agro-economic and marketing survey
   f) Agriculture and vegetable production
   g) Rural infrastructure survey
   h) Environmental survey
   i) Construction materials and cost survey

4) Supervision of the field investigation sublet to local contractors:

   a) Test boring for groundwater investigation
   b) Laboratory analysis of soil samples
   c) Laboratory analysis of water samples (water quality analysis)
   d) Farmer's household survey

5) Review of the existing development plans and programs

6) Determination of "basic development concept" and "planning criteria" for the Study

7) Preparation of the Progress Report No. 1

Some of the field investigations were sublet to local contractors. Major activities of the sublet works are summarized in Attachment-4. The discussion meeting on the Progress Report No. 1 was first held on March 16, 1994 between the Study Team and NIA officials from Region-IV office at Pila together with the representatives from the concerned Municipalities, and another meeting was held on March 18, 1994 between the Team and the NIA officials from Central office at Manila. The initial findings and the basic concept of the project planning was accepted by NIA (see Attachment-7). The Study Team completed the field work of Phase 1 on March 23, 1994.

The Study Team re-started the further studies in Japan from May 17, 1994. The following activities were made in May and June, 1994:

1) Analysis of data and information collected during the field work of the Phase 1

2) Preliminary assessment of the endowed resources

3) Establishment of basic development plan

4) Preliminary studies on the following:

   a) Irrigation development
   b) Improvement of marketing activities
   c) Agricultural research and extension
   d) Soil conservation
   e) Rural water supplies
   f) Environmental impact analysis

5) Preliminary layout and designs of major facilities

6) Preparation of the Interim Report

(4) Activities during Phase 2

The JICA Study Team started Phase 2 field work in the Philippines on July 16, 1994. The Team submitted the Interim Report to NIA and held discussion meetings on the report at NIA Central Office and Regional Office-IV, among the Study Team, NIA officials, Municipal government officials and personnel of concerned agencies. The basic development concept of the Project given in the Interim Report was mutually agreed on in the lively discussions (see Attachment-8).

The Team then conducted the study works together with the counterpart personnel during the three months. As a technology transfer to the concerning NIA engineers and

Municipal officials, the Study Team held a workshop on upland irrigation engineering with cooperation of the Diversified Crop Irrigation Engineering Project (DCIEP) officials on August 16, 1994. At the end of the field work, the Study Team prepared the Progress Report No. 2. The major activities during Phase 2 field work period are itemized as follows:

1) Field reconnaissance

2) Collection of supplemental data and information relevant to the Project

3) Field surveys and investigation including:

   a) Meteorological and hydrological investigation
   b) Geological investigation
   c) Soil and land use survey
   d) Agro-economic and marketing survey
   e) Agriculture survey
   f) Investigation on irrigation and drainage
   g) Rural infrastructure survey
   h) Environmental survey
   i) Construction materials and cost survey

4) Supervision of the field investigation sublet to local contractors:

   a) Topographic survey
   b) Geotechnical investigation
   c) Public consultation survey

5) Determination of the development plan

6) Determination of Project components

7) Preliminary Project evaluation

8) Preparation of the Progress Report No. 2

9) Implementation of Workshop on upland irrigation engineering

The discussion meetings on the Progress Report No. 2 were held at NIA Region-IV office on September 5 and at NIA Central office on September 6, 1994. The various discussions were made between the Study Team and NIA Regional office at Pila together with the representatives from the concerned Municipalities on the first meeting, and between the Team and the NIA Central office on the second meeting. The basic development concept and the proposed project plan were appreciated and accepted by NIA and the concerned Municipalities (see Attachment-9). The field work of Phase 2 was completed on September 13, 1994.

The Study Team continued the further studies in Japan for two months from September 14, 1994. The following activities were made up to November 12, 1994:

1) Analysis of data and information collected during the field work of the Phase 2

2) Assessment of development potential and constraints

3) Establishment of basic development concept

4) Preliminary layout and designs of major facilities

5) Project implementation plan

6) Estimate of project costs and benefits

7) Project evaluation

8) Preparation of Draft Final Report

The Study Team were dispatched to the Philippines for ten days from December 12, 1994, and made explanation and discussion meetings with the NIA and othe agencies concerned at NIA Central office and Regional office (see Attachment-10). In consideration of some comments from the Philippine side, this Final Report was completed.

CHAPTER II BACKGROUND OF THE PROJECT

2.1 General Economic Situations of the Philippines

(1) Socio-economic situations of the Philippines

The Philippines has a total land area of 279,000 sq.km. The total population as of 1990 is estimated at 60.7 million. The population density is about 220 persons per sq.km. The population growth rate is about 2.3 % per annum on the average during the decade 1980-1990. Future population is projected for the year of 2000 to be 75.2 million. The total labor force as of 1990 is estimated at about 24.3 million or 64 % of working-age population. Unemployment rate is officially estimated to be about 11 % of the total labor force, while under-employment is put at over 30 %. Poverty incidence level stands at 41 %.

Despite its vast resource potentials and a relatively high literacy rate of its labor force, the Philippine economy has tended to lag behind the other middle income countries of Asia. The Government originally projected an average annual growth of 7.6 % in GNP for the period 1978-1982, but the performance was below this target and has worsen in each of these years. The economic growth rate in 1983 was the lowest for over two decades, and over the next two years the economy went into sharp decline, to the point that by March 1986 it was officially estimated that two-thirds of the population were living below the poverty line.

There were some improvements in national economic performances during the initial period of the Aquino administration. This resulted in a GDP growth of 4.2 % in 1987 peaking at 7.2 % in 1988. This recovery was, however, not sustained and a GDP growth decelerated again from 5.7 % in 1989 to 4.0 % in 1990. It then remained flat in 1991 and barely grew 1.0 % in 1992. The GDP amounted to ₱ 1,338 billion (equivalent to US$ 52.3 billion) at current prices or ₱ 20,800 (US$ 813) per capita in 1992.

The Philippine economy is now facing the difficulties of external debt payment due to a higher import bill, lower remittances from overseas workers and stagnant export growth. The current payment deficit has brought about a major cut in government budget for public investment including agricultural and irrigation sectors. The government agencies are directed to improve their operating efficiency levels.

(2) Medium-Term Philippine Development Plan for 1993-1998

The Government of the Philippines set forth the Medium-Term Philippine Development Plan (MTPDP) for 1993-1998. This six years plan would enable the Philippines to progress from the initial process of stabilization and restructuring to economic recovery and growth. The plan is directed toward the following development targets in macro economy:

Overall Development Targets in MTPDP for 1993-1998

Indicator	Basement	(year)	Target	(year)
Poverty incidence	39.2 %	(1991)	about 30 %	(1998)
Unemployment rate	9.1 %	(1994)	6.6 %	(1998)
GNP growth rate	3.5 - 4.5 %	(1994)	8.5 - 10 %	(1998)
GDP growth rate	3.4 - 4.4 %	(1994)	8.1 - 9.8 %	(1998)
Inflation rate	9.0 - 10.0 %	(1994)	4.0 %	(1998)
Investment/GNP rate	24.5 %	(1994)	29.5 %	(1998)
Population growth rate	2.36 %	(1990)	less than 2 %	(1998)

Sources: Medium-Term Philippine Development Plan 1993-1998

The MTPDP emphasizes, among others, the following policies and strategies to realize sustainable economic growth as well as to attain the above targets:

1) attainment of international competitiveness in productive sectors,
2) promotion of countryside agro-industrial development,
3) market liberalization and economic deregulation,
4) human resources development,
5) institutional/administrative reforms, and
6) participation of local government and rural people.

The above strategies are apparently focusing on reducing unemployment and poverty in rural areas, and are directing to active participation of the farmers in investment programs with efficient and complementary assistances of the government services.

2.2 Fundamental Issues on Upland Development

(1) Upland development issues in the Philippines

Uplands is defined as the lands with more than 18 % slope. There is about 15.5 million ha of uplands in the Philippines, equivalent to about 52 % of the land area. The uplands was thought to be unsuitable for farming partly because soil erosion starts to become excessive when lands above 18 % slope are cultivated, and to be suitable only for forests and pasture. Contrary to Alienable & Disposable (A&D) lands that constitutes public lands with less than 18 % slope, the uplands are classified as public Forest Lands and reserved for

perpetual public ownership. The utilization is, therefore, restricted under the national law, although many upland farmers have used the lands without permissions for decades.

Due to limited arable land in lowland and population pressure on land, large tract of the uplands in the Philippines, which were once recognized unsuitable for agriculture due to erosion hazard, are now put under cultivation. It was estimated that, as of 1987, forests cover only 36 % of the uplands, while 7.9 million ha or 51 % of the upland are covered by grassland/bushland and other extensive land use. Intensive land use like croplands occupies 2.0 million ha or 13 % of the uplands. It is estimated that 8 - 10 million of the population are farming on the uplands.

Land Use in Uplands

Land use	Area (million ha)	Proportion (%)
Forest	5.61	36.1
- Virgin forests	1.06	7.1
- Residual forests	2.92	18.7
- Mossy forests	1.39	9.0
- Pine forests	0.24	1.3
Grasslands/Bushlands	7.91	51.0
- Large grasslands	1.05	6.5
- Mixed with other uses	6.86	44.5
Croplands	2.00	12.9
Total	15.52	100.0

Source: The Master Plan for Forestry Development, DENR, 1990

The farmers in the uplands mainly employ traditional farming practices characterized by up-and-down slope tillage. With high rainfall intensities, steep slope and lack of soil protection, soil erosion rates are very high. Erosion leads to abandonment of fields and compensatory conversion of further forest areas to cultivation. In the downstream, erosion and unchecked rainfall runoff contributes to siltation in rivers and lakes, causes alternate floods and water shortages. In addition, many farmers cultivate crops in the uplands without legal rights of doing so. This lack of secure tenure or titling in the uplands provides the farmers no incentive for land improvement or nutrient maintenance.

The socio-economic conditions in the upland are worse than the lowland. The agricultural production depends on rainfall and productivity remains still low level. The cost of farm inputs is high due to poor accessibility. Access to credit is hardly available. Infrastructures are very limited and the delivery of basic services is difficult. Marketing of farm produce is inadequate and this puts the farmers at a disadvantage since they do not have good price offers from dealers. Consequently, their economic condition remains at the subsistent level.

The country has implemented the Integrated Social Forestry (ISF) program since 1983 in order to improve the socio-economic condition of the upland farmers as well as to preserve the natural environment. The major features of the program include the provision of the security of land tenure, planting stock for contour hedgerow and agroforestry, training of participant farmers, and infrastructure such as roads and irrigation facilities. Instead, the farmers are prohibited to expand their clearings and encouraged to protect the environment.

The ISF program is a banner program of DENR. Nevertheless, the activities have been hampered by shortage of budget. In addition, since the Local Government Code was implemented in 1991, the local government offices (municipalities) have to implement many activities of the program. However, the local government offices can hardly afford to finance such activities as roads and irrigation and, therefore, the objectives of the program have not been attained as expected.

(2) New national policy on protected area management

In the Philippines, National parks and other protected areas such as bird and wildlife sanctuaries, watersheds, etc. have been subject to conflicting land uses: many were partially settled, logged or have been subject to illegal exploitation. Little information is available on the condition of the most protected areas, however.

In order to update data on protected areas in the Philippines and reclassify and administer all designated protected areas for the purposes of biodiversity conservation, protected area management and sustainable development, the Congress of the Philippines enacted "National Integrated Protected Area System Act of 1992", so-called NIPAS Act. The DENR subsequently issued Administrative Order No. 25 which further set forth the rules and regulations governing implementation of NIPAS Act.

The NIPAS Act requires the DENR to evaluate the suitability of all the designated protected areas for inclusion in the NIPAS Act. After the evaluation and public hearings, the DENR will prepare final recommendations for the President and the Congress on the areas for inclusion as initial components under the NIPAS Act. The disestablishment of protected areas from the initial components will likewise be recommended to the President. The Congress will enact a law declaring such recommended areas as part of the integrated protected area system. Additional areas might afterward be included in the system if the areas have outstanding physical features valuable to protect. The component areas of the NIPAS will be administered by the DENR to protect and enhance the permanent preservation of its natural condition. Nature-destructive activities will be strictly controlled within the protected areas. Fines and

penalties will be imposed for those who violate this Act or DENR's rules and regulations pursuant to this Act in addition to the requirements of restoration or compensation to the damage.

The Study area covers a part of Mts. Banahaw-San Cristobal National Park. The National park was once selected as priority protected areas by DENR-NGO sponsored technical workshop on NIPAS due to its valuable biodiversity.

2.3 Agricultural Development Policies

The agricultural sector still remains as a major pillar of the Philippine economy. It accounts for about 23 % of the GDP, more than 21 % of export earnings and about 50 % of the total employment. About 55 % of the population reside in the rural areas and are dependent, either directly or indirectly, on agriculture for their main source of livelihood.

However, majority of the rural residents, especially the small farmers, remain under poverty. The rural area has a higher incidence of poverty (53 %) compared with the urban areas (32 %). The rural-urban inequality has worsen over time as the ratio of average rural family income to average urban family income has declined from 0.67 in 1975 to 0.46 in 1985. In recent years, more than 80 % farm families are classified as belonging the lower 30 % income bracket.

In view of these, the Philippine Agricultural Development Plan 1991-1995 is designed to increase the agricultural GVA by an average rate of 4.27 % per year in real terms through the following major strategies:

1) Institutionalization of small farmer 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, and 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 for the agricultural products.

In consonance with the targets and strategies adopted in the MTPDP, the Department of Agriculture (DA) emphasizes to increase the productivity and real income of small farmers, especially in upland, coastal areas and other poverty-stricken areas.

2.4 Overview of Irrigation and Horticulture Sectors

2.4.1 Irrigation development in the Philippines

In support of the efforts to revitalize the agricultural economy, irrigation development shall be strongly pursued by NIA. Much can be accomplished on this aspect, considering the size of unirrigated lands scattered throughout the country, untapped sources of irrigation water, generally favorable climate and fertile soils as well as abundant unemployed and/or under-employed labor force.

The irrigation systems in the Philippines are classified into three types:

1) National Irrigation System (NIS)

   a) The systems are constructed and operated/maintained by NIA.

   b) The systems are irrigated by direct diversion (run-of-river) and/or by pumps either with or without storage dams.

   c) The beneficiary farmers are required to pay the irrigation service fee (ISF).

2) Communal Irrigation System (CIS)

   a) The systems are constructed by NIA. After completion of the construction works, the systems are turned over to the Irrigators' Associations (IAs) and the irrigators are required to operate/maintain their own systems with minimal government assistance.

   b) The systems are mostly of run-of-river type. The systems also include pump systems and storage dam type systems.

   c) The beneficiary farmers are required to pay 10 % of the chargeable cost during the construction stage, and the remaining 90 % are to be repaid without interest for a period not exceeding 50 year.

3) Private Irrigation System (PIS)

   a) The systems are constructed by private organizations and are privately owned and operated/maintained without assistance of NIA.

   b) The systems are mostly irrigated by pumps.

c) NIA has stopped its development in 1981, due to high cost of energy to operate these systems.

The Philippines has a potential irrigable area of 3,126,000 ha in total. As of 1992, about 1,532,000 ha or 49 % of the potential irrigable area is irrigated:

Annual Status of Irrigation Development 1987-1992

Year	Actual Increment of Irrigation Area				Irrigation
	NIS	CIS	PIS	Total	Development (%)
1987	616,072	673,119	152,128	1,441,319	46.1%
1988	616,392	684,639	152,128	1,453,159	46.5%
1989	620,964	695,944	152,128	1,469,036	46.9%
1990	637,318	714,814	152,128	1,504,260	48.1%
1991	645,789	724,475	152,128	1,522,392	48.7%
1992	646,519	734,104	152,128	1,532,751	49.0%

Source : NIA Corporate Plan 1993 - 2002

In conformity with the national development policies, NIA has accorded its priority to the communal type irrigation development, mainly because such small projects:

1) can be implemented faster; therefore benefits can be realized earlier;

2) can be implemented at cheaper unit cost per ha; therefore beneficiary farmers can afford to pay amortization costs;

3) can be implemented simultaneously over the country, therefore a larger number of small farmers can benefit despite the limited funds;

4) can be operated and maintained by the Irrigator's Associations (IAs), therefore continuous government assistance for O&M will not be required; and

5) will easily trigger farmers' potential because the projects are constructed through the farmers participatory approach and the constructed irrigation facilities are owned/operated/maintained by farmers themselves.

Irrigation component in the Study area will be small in size and be of the communal type, and the present NIA's regulations and rules for the implementation of communal type projects shall therefore be applied for the irrigation planning under the Study.

2.4.2 Horticulture development in the Philippines

Statistics clearly indicate the important place of vegetable production in the Philippine agriculture. In 1992, vegetables inclusive of beans and root crops, accounted for 11 % of GVA in agricultural, contributing 2.4 % of GDP and 0.3 % of total exports.

The vegetable production levels have however not increased over the last 10 years, and domestic per capita availability of vegetables has actually declined from 103 kg in 1982 to 86 kg in 1992 (see Table 2.4.1). Nutrition surveys carried out in 1978 and 1987 indicates remarkable inadequacies of the essential nutrient levels in diet. Of particular significance is the decline in ascorbic acid, which is generally derived from fruit and vegetables, from 98 % of the recommended daily allowance in 1978 to 78 % in 1987.

It is widely recognized that low production of vegetables has been resulted from the insufficient levels of the government supports required to encourage increased production and investment. In order to seek the possibility to enhance the vegetable production, the Department of Agriculture (DA) made an overall study on horticulture sector in 1991 through the Bureau of Plant Industry (BPI) with the technical assistance from Asian Development Bank (ADB). This study forecasts the domestic demand of vegetables as follows:

Domestic Demand of Vegetables

Year	Fruits and Nuts	Vegetables
1990	2.5 million tons	3.3 million tons
1995	2.8 million tons	3.7 million tons
2000	3.2 million tons	4.2 million tons
Annual Growth Rate (%)	2.6 %	2.5 %

Source: Horticulture Sector Project, BPI/ADB, September 1991

This study classified target systems of vegetable production into three categories; 1) backyard garden for home consumption, 2) upland and/or highland for massive production of sub-tropical and temperate type vegetables, and 3) lowland mixed cropping for seasonal cropping of tropical vegetables after the rice/corn harvest, and accorded the first priority to the upland/highland vegetable production.

In January 1992, the Department of Agriculture (DA) set forth the "Fruit and Vegetable Development Plan for 1992-1995" for achieving the increased vegetable production in the medium term. The Plan is directed towards the following targets:

1) Categorization of vegetable producing areas and proper guidance on location-specific technologies (varieties, cropping calendar, farming technologies, etc.),

2) Provision of infrastructures and support services (irrigation, farm-to-market road, extension services, low-cost credit, etc.),

3) Development and promotion of more superior varieties (production and distribution of good quality seeds),

4) Promotion of post-harvest facilities at the farm level (improvement of grading, packaging and storage at the farm level),

5) Improvement of marketing and distribution systems (establishment of trading posts and improvement of market information systems),

6) Strengthening of research, training and extension efforts (mobilization of the existing agricultural extension service network for vegetable production, and intensive training of extension workers), and

7) Strengthening of institutional linkage among the government offices concerned.

These proper targets and concepts for the holticulture development in the Philippines have supported the formulation of the development concept and plan in the Study area.

2.5 Importance of the Study Area as a "Vegetable Production Area"

The Study area has been acknowledged by various agencies to be suited for the production of sub-tropical and/or temperate type vegetables.

1) The Study area was identified as one of the highest priority area for highland horticultural development by the JICA master plan study team for the project "CALABARZON" in 1991. The team suggested the following strategies for development:

   a) Production of fresh vegetables such as cabbage, tomato, lettuce, Chinese cabbage and radish,

   b) Construction of farm-to-market roads and irrigation facilities,

   c) Promotion of research and extension services for vegetable cultivation and irrigation practices, and

   d) Introduction of soil conservation measures.

2) The Study area was selected by ADB/BPI horticulture sector project in 1991 as the most promising alternative area of Baguio for the production of sub-tropical and/or temperate type vegetables. The following strategies and investment actions were recommended in the study:

   a) Increased investment in rural infrastructure such as farm-to-market roads and irrigation facilities,

   b) Improvement of inter-regional transportation systems,

   c) Promotion of rural cooperatives and NGO development in horticultural sector,

   d) Strengthening of government support services to horticulture sector, particularly extension and training,

   e) Increased government expenditure on horticulture research, in line with the NEDA's guideline (up to 0.8 % of agriculture's GVA),

f) Strengthening of conservation policies to combat environmental degradation,

g) Review of the imperfection in the CARP that are currently constraining horticultural development on land subject to CARP provisions, and

h) Arrangement of adequate market-oriented credit system to small farmers.

3) University of the Philippines, Los Baños (UPLB) has established and operated a pilot demonstration farm since 1988 in the Study area (Barangay Bukal, Municipality of Nagcarlan) for research and demonstration on new vegetable production. The farm is now managed jointly by NIA and Municipality office of Nagcarlan with technical assistance of UPLB. The reasons why the pilot demonstration farm was selected at Bukal are given as follows:

a) Northern slopes of Mt. Banahaw have been long recognized as one of the promising area for temperate type vegetable production, being blessed with favorable climate and soils as well as good location near to large market in Manila;

b) Strong request was made from the Municipality office of Nagcarlan and the required land was donated for its establishment;

c) Irrigation water is available from the spring; and

d) Easy access between UPLB and the site.

2.6 Institutional Framework for the Project

The Project aims to increase vegetable production by means of irrigation and rural development, and thereby to improve the rural income and welfare. National Irrigation Administration (NIA) will be a lead executing agency for the Project, but such objectives of the Project can be achieved only with full supports from the related Government organizations. There are a number of related organizations; at least, the following government agencies seem to be either directly or indirectly related to the Project:

1) National Irrigation Administration (NIA)

a) Project Development Department, NIA Central office
b) Diversified Crops Irrigation Engineering Project (DCIEP)
c) NIA Region IV office
d) NIA Provincial office, Laguna

2) Department of Agriculture (DA)

a) DA Region IV office
b) Bureau of Plant Industry (BPI) / Institute of Plant Breeding (IPB)
c) Bureau of Agricultural Research
d) Marketing Assistance Services (MAS) / DA Central office

3) Department of Environmental and Natural Resources (DENR)

a) Ecosystem Research and Development Bureau
b) DENR Region IV office
c) Provincial Environmental and Natural Resources Office (PENRO), Laguna
d) Community Environmental and Natural Resources Office (CENRO), Los Baños

4) Department of Agrarian Reform (DAR)

a) DAR Central office
b) DAR Region IV office

5) Provincial Government of Laguna

6) Municipality Offices of Nagcarlan, Liliw and Majayjay

7) Department of Public Works and Highway (DPWH)

8) Laguna Lake Development Authority (LLDA)

9) University of Philippines, Los Baños (UPLB), Department of Horticulture

10) Cooperative Development Authority (CDA)

11) Non-Governmental Organization (NGO)

a) Philippine Uplands Resources Center (PURC)
b) Cooperative Foundations

CHAPTER III THE STUDY AREA

3.1 Location

The Study area is located approximately 70 km southeast of Manila, the Capital of the Philippines. It extends south of Sta. Cruz City, the Provincial Capital of Laguna in Southern Luzon. It covers parts of Municipalities of Nagcarlan, Liliw and Majayjay in the Province of Laguna with an approximate area of 3,000 ha. It lies at north latitude 14°04' - 08' and east latitude 121°25' - 28' between the northeast foot of Mt. Banahaw and northeast foot of Mt. San Cristobal. Its elevation ranges from El. 300 m to El. 1,300 m. Transportation between Manila and the Study area is served by the South expressway (Metro Manila - Calamba, Laguna) and a National highway which connects San Pablo City with Sta. Cruz City. The major cities, Nagcarlan, Liliw and Majayjay are situated on the said National highway.

3.2 Topography and River System

In the Province of Laguna, alluvial plains extend mainly in the lowlands along the southern and eastern lake shore of Laguna de Bay, accounting for 25 % of the whole area of the Province. Hills (high relief), mountains and volcanic combined occupy 34 % of the total land area. Terraces and foot slopes consisting 41 % of the whole area of the Province are found between the mountainous areas and the alluvial plains.

The Study area is located in such terraces and foot places, and characterized by an undulating topography. The lowland area (lower than El. 300 m) faces generally northwest with rather gentle slope of 3 % to 8 %. The upland area (between El. 300 m and 700 m) is much undulating with rather steep slope of 8 % to 18 %. The slope of highland, Mt. Banahaw mountain side (higher than El. 700 m) is more than 18 %.

Several rivers originated from Mt. Banahaw flow down to the directions of northwest. They join the Santa Cruz and the Balanac rivers and flow into Laguna Lake. Their major tributaries flowing down in the Study area are the Nagcarlan, the Liliw, the Maimpis and the Olla rivers. There are several springs in various size along the rivers. Since they are perennial, water is used for domestic supply and irrigation. On the contrary, there is no notable river originated from Mt. San Cristobal except the San Diego river which dries up during the month of March to May.

3.3 Demography and Socio-economic Situations

According to the census and Municipal Profiles, the population of Municipality of Nagcarlan, Liliw and Majayjay were 30,637, 17,436 and 13,699 in 1980 and 37,696, 21,911 and 15,875 in 1990, respectively. Population increased 23 %, 26 % and 16 % respectively for 10 years. The number of households of each Municipality in 1990 was 7,582, 4,470 and 3,180 resulting in average household size of 5.0, 4.9 and 5.0 (see Table 3.3.1).

Though these areas are typical agricultural town and gross population density is about 3-4 persons per ha, most of residential area is concentrated within the town and its vicinity barangays where most of the facilities can be found, thus the density of urban area is 200-350 per ha.

Tagalog is the most widely spoken dialect (more than 99 %) in this region, and most of the people are Roman Catholic.

There are 16 elementary schools and six high schools in Nagcarlan, eight elementary schools and two high schools in Liliw and seven elementary schools and three high schools in Majayjay. There are no tertiary schools in these areas.

Health service is provided in Nagcarlan by one emergency hospital, two rural health units and 15 Barangay health stations, in Liliw by one rural health unit, one clinic and some Barangay health stations, in Majayjay by one hospital, one rural health center, one family planning clinic and nine Barangay health stations.

Main income source of the people in these Municipalities is agriculture, and as other income sources there are agro-industries, manufacturing, commerce and other services. Especially small cottage industries such as basketry, candy-making, shoes and slippers making contribute to the source of income of the urban people. Depending on cool climate, beautiful landscape and many springs in highland, tourism is also an income source in these districts.

The Study area can be divided into total of 15 Barangays in which eight are in Nagcarlan, four in Liliw and three in Majayjay. According to the basic data for the Farmers' Household Survey conducted in 1994 showed that population, households and farm household are as shown in Table 3.3.2. Total population and households are 8,044 and 1,727 in which 1,340 households are farm households. Average household size is 4.7.

3.4 Climate

The Study area is located at the northern hilly area of Mts. Banahaw and San Cristobal in the southern - most part of the Laguna Lake basins. The Laguna Lake basins exhibit two types of climate as shown in Fig. 3.4.1. In the eastern-most part of the basin, which is classified climate Type IV by the Philippines Atmospheric Geophysical and Astronomical Services Administration (PAGASA) based on the rainfall distribution, rainfall is more or less evenly distributed throughout the year. The rest has two pronounced seasons of the dry season from November to April and the wet season during the rest of the year, classified in Type I.

The Study area ranges from El. 300 m to 1,300 m of the northern slopes of Mts. Banahaw and San Cristobal. The climate of the Study area is broadly categorized in the Type I. However, the rainfall pattern shows the intermediate types of Type I and IV at eastern part of the Study area for the reasons that the Study area is located close to the boundary of Type I and IV, which is topographically divided by the Sierra Madre range and also its elevated location of the northern slopes of Mts. Banahaw and San Cristobal as indicated in Fig. 3.4.1 and Fig. 3.4.2.

Meteorological observation station in the vicinity area of the Study area are shown in Fig. 3.4.3. The rainfall data and other meteorological data, such as temperature, relative humidity, and pan evaporation data in the Study area have been observed at three stations in Nagcarlan and Liliw. It is, however, not available for a statistical data analysis due to its considerably short observation periods. The reliable meteorological data in the vicinity area have observed at the stations of Sta. Cruz and Los Baños (University of the Philippines (UPLB), International Rice Research Institute (IRRI)), Cavinti, Tayabas and Caliraya. The observation periods of these meteorological observation data are referred to in Fig. 3.4.4.

The general observation data are listed below:

Mean Monthly Rainfall

(Unit: mm)

Station	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Los Baños	46.2	20.9	29.9	35.1	160.7	237.6	267.7	254.8	242.1	274.8	251.0	159.3	1,980.2
Sta. Cruz	42.9	18.4	27.3	39.3	128.5	212.5	247.6	258.8	243.5	265.1	225.1	123.9	1,832.9
Cavinti	274.9	180.5	111.6	172.8	119.8	371.7	440.2	391.7	301.6	670.5	597.1	434.4	4,195.8
Tayabas	156.2	90.0	93.0	101.0	215.0	266.2	272.7	188.3	275.3	476.5	520.0	364.7	3,018.9
Liliw	67.2	31.0	33.2	121.8	219.6	327.3	276.1	134.4	279.2	368.8	321.2	204.5	2,384.3
Caliraya	107.0	51.1	86.8	104.1	241.4	306.6	284.5	262.4	280.7	390.2	547.5	455.1	3,117.6

Source: PAGASA (rainfall data of Caliraya were observed by Kaliraya hydraulic electric plant office)
Remarks: Observation period of Liliw is 3 years (1979 to 1981)

Mean Monthly Temperature

(Unit: °C)

Station	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Los Baños	25.1	25.6	26.8	28.4	29.0	28.3	27.7	27.5	27.4	27.1	26.5	25.5	27.1
Cavinti	22.4	22.7	23.9	25.6	26.4	25.9	25.3	25.2	25.0	24.6	23.8	22.4	24.4
Nagcarlan (Barangay Poblacion)	24.2	24.6	25.4	27.0	28.5	27.8	27.3	27.2	27.0	25.4	25.3	24.0	26.1
Nagcarlan (Barangay Bukal)	20.6	20.6	21.2	22.2	23.6	23.0	22.0	22.8	22.5	22.2	22.0	21.0	22.0

Source: UPLB, IRRI (Los Baños), Comparing of Weather Data: IRRI (Cavinti), JICA Study Team (Nagcarlan)

Mean Monthly Relative Humidity

(Unit: %)

Station	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Los Baños	82	79	75	74	76	80	82	83	83	84	83	83	80
Cavinti	93	93	92	90	90	91	92	93	93	93	93	93	92
Nagcarlan (Barangay Poblacion)	84	78	77	73	76	82	79	73	79	81	84	90	80
Nagcarlan (Barangay Bukal)	89	82	82	81	87	88	85	85	85	85	n.a.	91	85

Source: UPLB, IRRI (Los Baños), Comparing of Weather Data: IRRI (Cavinti), JICA Study Team (Nagcarlan)
n.a.: not available

Mean Monthly USWB Pan Evaporation

(Unit: mm)

Station	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Los Baños	119.6	143.8	195.4	218.0	195.5	146.7	130.2	127.7	116.6	117.9	101.3	100.2	1,712.9
Cavinti	105.4	115.6	161.0	173.4	178.0	145.0	136.9	130.2	118.0	110.8	98.3	92.8	1,565.4
Nagcarlan (Barangay Bukal)	n.a.	93.2	79.1	100.8	88.4	86.1	70.4	82.2	n.a.	83.1	114.6	n.a.	n.a.

Source: UPLB, IRRI (Los Baños), Comparing of Weather Data: IRRI (Cavinti), JICA Study Team (Nagcarlan)
n.a.: not available

Distribution of the rainfall in the catchment area of the Laguna Lake basins is shown in Fig. 3.4.5. The Laguna Lake basins shows pronounced differences in the annual rainfall amount. The distribution ranges from 1,950 mm in the west area to 2,450 mm in the east area. Annual average rainfall amount of 4,200 mm was observed at Cavinti which is located at the eastern-most boundary of the Laguna Lake basins.

Annual rainfall in the Study area is around 2,350 to 2,400 mm on the basis of the observation data for three years from 1979 to 1981 at the Municipality of Liliw. Mean monthly temperature ranges from a minimum of 20 °C to a maximum of 24 °C at the elevation of 700 m in the Study area. The coldest months are from December to February while the warmest

months are April and May.

Monthly relative humidity, on the average, ranges from a maximum of 91 % to a minimum of 82 %. Average wind velocity observed at Los Baños ranges a minimum of 2.8 kph to a maximum of 4.7 kph.

Monthly percent possible sunshine were observed at Los Baños. The average high possible sunshine was 72 % in April and low possible sunshine was 38 % in August. However, it is assumed that the percent possible sunshine is certainly small in the Study area comparing with that of at Los Baños because of the difference of the elevation and influence of the monsoon wind direction throughout the year.

3.5 Geological Condition

Mt. Banahaw (El. 2,165 m) situated behind the Study area is the tallest active volcano of the Macolod Corridor and surrounding volcanic fields. It has secondary lava cones of Mt. San Cristobal (El. 1,470 m) on the west and Mt. Banahaw de Lucban (El. 1,850 m) on the east. The summit caldera is 600 m deep and has a diameter of 2 km. The caldera opens southward in a 4 km long canyon. Mt. San Cristobal is a complex doming structure with two small crater lake at its summit. Mt. Banahaw de Lucban is the only dome on the east side. It is reported that the activity of Mt. Banahaw is from 1.6 Ma to 1743, and after last eruption in 1743, no remarkable volcanic activity has been recorded. Although debris avalanche occurred at the southern side in 1982 has been reported (Barcelona et al. 1982), the northern side including the Study area seems to be stable against future debris avalanche controlled by the topographical shape of the summit caldera.

Geologically, the Study area is underlain by Quaternary volcanic products of Mt. Banahaw, which consist of andestic lava flow, tephra (fallen pyroclastic materials) deposits, ash flow and lahar deposits. According to the Geological Map of the Macolod Corridor (see Fig. 3.5.1), published by Philippine Institute of Volcanology and Seismology, et al. 1991, Mt. San Cristobal and Mt. Banahaw de Lucban were built up on the secondary andestic lava cones of Mt. Banahaw. The upper regions of Mt. Banahaw are covered with lava flows and extrusive lava breccias. Steep slopes between El. 800 m and 700 m, pyroclastics and lahar deposits are predominant. Below El. 700 m, ash flow and lahar deposits extend northward to the Laguna de Bay. The steep slopes at upper part of Mt. San Cristobal consist of andestic lava of secondary cone. In addition, small-scale mounds formed by andestic lava dome and basaltic andesite lava are distributed on the north to northeastern part of Mt. San Cristobal in the Study area.

Greater part of the Study area is moderately to gentle sloping hilly area except the riverside cliffs, and is covered with pyroclastics such as tephra deposit, ash flow, and lahar deposits of Mt. Banahaw and Mt. San Cristobal. The lahar deposits observed along the Abo-Bukal Barangay road contain a large quantity of big andesite boulders of more than 1 m in diameter.

Geological investigation was made during both Phase 1 and Phase 2 field works. In order to get hydrogeological information for groundwater irrigation, test well drillings including electric logging and geoelectric survey were carried out during the Phase 1, and to clarify geotechnical condition for foundation design of proposed farm ponds, core borings with standard penetration test (SPT) were made during the Phase 2 stage as shown below:

Work Quantity and Location of Geological Investigation

Phase 1 : Hydrogeological investigation			
Test well drillings with electric logging		:	3 holes
TW-1 :	Abo	:	125 m
TW-2 :	Silangan Lazaan	:	50 m
TW-3 :	Malinao	:	125 m
Geoelectric survey		:	48 points
Bukal		:	8 points
Abo		:	25 points
Silangan Lazaan		:	10 points
Malinao		:	5 points
Phase 2 : Geotechnical investigation			
Core borings with SPT of 1 m interval		:	2 holes
CB-1 :	Bukal	:	25 m
CB-2 :	Novaliches	:	25 m

Locations of the geological investigation are shown in Fig. 3.5.2. Details of each geological investigation including its analysis results were described in the Appendix-II, of which field surveys conducted by local contractor were summarized as shown in Attachment-4.

By execution of three test well drillings in the Phase 1 and two core borings in the Phase 2, thick andestic to basalt lava layers, tuff, and superficial silt and loam were observed. The andestic lava observed at every sites is thick but generally highly fissured except the borehole CB-1. The basalt lava was observed only borehole of CB-1 overlying the andesite lava with thickness of around 3 m. The tuff formation is intercalated within the andestic lava in the TW-1 and TW-3 with thickness of around 20 m. The uppermost silty and loamy layers with pebble are distributed with the thickness of 6 to 10 m from the ground surface. Typical geological condition of the test well and core boring are shown in Fig. 3.5.3 to 3.5.5, and Fig. 3.5.6 to 3.5.7, respectively.

Although, water bearing formations due to fissure water in the andestic lava were found at deep sections by electric logging, groundwater level in the area is generally low. It exists around 50 m from the ground surface or more. Resistivity structure in the Study area obtained from geoelectric survey in the Phase 1 is divided into two to five layers, however, it is fairly difficult to follow the continuity of resistivity layer. It indicates poor continuity of the aquifer. Typical resistivity profiles in the area are shown in Fig. 3 5 3 to 3.5.5.

Based on the above mentioned hydrogeological conditions, the groundwater in the Study area is deep due to fissure water in the andestic lava and its continuity is assumed to be poor. Therefore, it suggests that the good aquifer suitable for the groundwater irrigation purpose is absent.

Remarkable leakage of drilling water which indicates porous and permeable of the strata was observed through the drilling works in the Phase 1 and Phase 2 stages. In order to grasp the permeability of the ground, more than 500 lit. of water was injected into boring hole in the Phase 2 stage. However, the permeability coefficient could not be measured due to no rise up of water level resulting from a sudden leakage. According to this permeable condition, special protection against leakage such as vinyl sheeting or water-proof mat shielding will be required if reservoir type irrigation system is adopted.

The N-values of the uppermost stratum of clayey loam layer at the core boring sites vary from 7 to 31 with an average of N=8, of which the layers with N-values of more than 10 contain pebbles or rock fragments. Based on the average N-value, bearing capacity of foundation bed was calculated in order to judge the suitability of foundation for construction of heavy structures such as farm pond. Allowable bearing capacity calculated is more than double capacity compared with the design load of farm ponds. Therefore, simple and economical mad foundation will be recommended as the optimum foundation type of the farm ponds.

3.6 Water Resources

3.6.1 Surface water

Annual rainfall amount in the Study area ranges from 2,350 mm to 2,400 mm. Around 80 % of the annual rainfall is observed in seven months, from May to November. Monthly rainfall of more than 400 mm has scarcely observed in the Study area due to infrequent influence of typhoons. Monthly rainfall amount of 200 mm to 350 mm is more or less evenly distributed during the wet season. From the geological point of view, permeable volcanic deposits that thickly mantle the mountainsides of Mts. Banahaw and San Cristobal accelerate

recharge of groundwater by runoff percolation. In relation to the fact, stable spring yield and surface water originated from springs are perennially observed in the Study area. Regarding water quality, it is concluded that the watershed designated as a National park is protected from any development activity, such as dwelling, logging and farming, so that water contamination has not been occurred at this time. In addition, protection of vegetative condition in the watershed also contributes for stable recharge of ground water (see Appendix-I).

Major rivers and springs in the Study area are illustrated on Fig. 3.6.1. There are seven rivers, namely, the San Diego and the Nagcarlan rivers in Nagcarlan Municipality, the Oplas, the Liliw and Bancal rivers in Liliw Municipality, and the Maimpis and the Olla rivers in Majayjay Municipality. Out of these rivers, three the San Diego, the Oplas and the Bancal rivers dry up in the dry season, where as the Nagcarlan, the Liliw the Maimpis, the Olla rivers are perennial. During the dry season, discharge of 0.23 to 0.25 cum/sec in the Liliw river, and 0.30 to 0.35 cum/sec in the Maimpis river were observed at the observation stations shown in Fig. 3.6.2. Specific discharges of mean discharge of these rivers were 0.034 cum/sec and 0.037 cum/sec, respectively. Run-off ratio was estimated at around 50 to 60 % for both rivers.

In this survey period, four springs with considerable yield were confirmed. Bukal spring in Nagcarlan yields 0.040 to 0.045 cum/sec at El. 890 m. Two springs, lower Luquin and upper Luquin springs yield 0.200 cum/sec and 0.070 cum/sec at El. 560 m and El. 610 m, respectively. Maimpis river spring in Majayjay yields as large as 0.200 cum/sec at El. 600 m. The yield frequency of Bukal spring are listed below for one year observation period from May 1993 to April 1994.

Spring Yield of Bukal Spring

(Unit: cum/sec)

Year	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1993					0.041	0.054	0.046	0.042	n.a.	0.042	0.041	0.048
1994	0.075	n.a.	0.043	0.055								

n.a.: not available

Spring yields in December 1993 and January 1994 were remarkably abundant due to the rainfall as the end of the wet season. Despite the short observation period of the spring yields, it is estimated that the spring yield is not less than 0.040 cum/sec. Few observation data in the dry season at the springs of the Luquin and Majayjay were useful to estimate their spring yield assuming a spring yield in the dry season to be constant.

3.6.2 Groundwater

A study on Rapid Assessment of Water Supply Sources at the provincial and municipal levels had been carried out by the National Water Resources Council (NWRC) in May 1982. According to the report, there were 587 developed and operational water resources as of 1980 in the Province of Laguna. Of this total, 7 % were springs, 8 % were shallow wells and 85 % were deep wells.

The study had also included an assessment of groundwater resources and the preparation of a provincial base groundwater map. From the viewpoint of groundwater availability, each Province had been divided into three categories as follows:

1) "Shallow Well Areas" are suitable for construction of wells with depths of within 20 m below ground surface. The static water level in these areas are generally within 6 m.

2) "Deep Well Areas" are characterized by aquifer of water bearing formation generally located at a depth of more than 20 m below ground surface. Therefore, deep wells with depths of more than 20 m are recommended in these areas.

3) "Difficult Areas" where groundwater supply is minimal and the probability of encountering non-productive boreholes is very high. Groundwater replenishment in these areas are only through rock fissures, cracks and crevices, which predominantly exist in place where there are faults and other geologic discontinuities.

Based on the above classification, the Province of Laguna consists of 15 % shallow well areas and 85 % difficult areas. The shallow well areas in the Province are only located at the alluvial flat plain along the shore of Laguna Lake. All of the hilly and mountainous areas including the Study area are classified as the difficult areas for groundwater development.

The number of wells constructed as of 1980 was 13 wells in the Municipality of Nagcarlan and 6 wells in Municipality of Liliw. However, no water wells had been recorded in any barangay concerning to the Study area.

During the field work in Phase 1 Study, present groundwater use was surveyed through the site reconnaissance, review of existing data and hearing survey. There are no groundwater facilities such as dug well, shallow well and deep well in the Study area at present, because both of the water resources for domestic and irrigation water in the Study area are springs.

On the other hand, there are five mineral water factories including suspending ones,

Pagoda, Ligo, Hidden Spring, Cosmic, and Klear Water, near the lower boundary of the Study area along the National highway connected from Nagcarlan to San Pablo. According to the information obtained from the biggest company of Hidden Spring located at just outside the Study area, the factory has two deep tube wells with depths of 60 m and 9" in diameter. The groundwater at the factory site has been pumped up with the ratio about 1.0 to 1.3 lit/sec by using 2" diameter jet pump.

According to the hydrogeological investigation consisting of the test well drillings including electric logging and geoelectric survey, the Study area is mainly underlain by andestic lava and surface soil layer. The groundwater level was around 50 m below or more from the ground surface. The water bearing formations due to fissure water from the andestic lava are generally thin. The resistivity structure indicates the poor continuity of the aquifer.

Based on the previous assessment of groundwater resources of the Province and field reconnaissance concerning hydrogeological conditions of the Study area, groundwater development for irrigation use will not be recommended due to its technical and economical difficulty of pumping up from the deep aquifer and its uncertain yield of groundwater. Therefore, springs or river water will be recommended for the optimum water sources for the upland irrigation.

3.7 Soil and Land Resources

3.7.1 Soil

The soils in the Province of Laguna investigated by Bureau of Soil are presented in soil map of Laguna Province as shown in Fig. 3.7.1. Accordingly, soil of the Study area is dominated by undifferentiated Mountain Soils.

The soils of the Study area are formed on a slightly to highly dissected volcanic footslopes consisting of pyroclastic and volcanic tuffaceous materials. The soils of the volcanic footslopes are classified into three soil series, namely, Abo, Alipit and Bukal soil series. Those series can be distinguished from one another in accordance with differences in physiography, parent material, texture, depth, drainage and chemical characteristics. The lands of residential area, rivers/creeks and river terrace escarpments are categorized into the miscellaneous land types. The area of each soil series is shown in the following table and the soil map of the Study area is shown in Fig. 3.7.2.

Soil Classification of the Study Area

(Unit: ha)

Soil Series	Nagcarlan	Liliw	Majayjay	National Park	Total
Abo Series	410	73	0	222	705
Alipit Series	69	434	167	40	710
Bukal Series	472	0	0	503	975
Total	1,182	772	250	796	3,000

Source: Soil survey carried out under Phase 1 period by the JICA Study Team.
Remarks: Miscellaneous Land includes settlement area, river/creek and river terrace escarpment.

The Abo soil series belongs to fine loamy mixed isohyperthermic family of moderately deep and well drained soils of Typic Eutropepts with udic moisture regime. The soils occur on highly dissected gently sloping to steep slopes associated with a dentritic drainage pattern, derived from pyroclastic, volcanic tuffaceous materials. This soil series is concentrated along the Nagcarlan river on upper footslopes of Mt. Banahaw.

The Alipit soil series is a number of the fine clayey mixed isohyperthrmic family of Typic Hapludalfs. The soils are moderately deep and well drained, and occur on moderately dissected, nearly level to very steep volcanic footslopes. This soil series is characterized by an orchric epipedon and argillic B horizon with udic moisture regime.

The Bukal soil series is a number of the coarse loamy mixed isohyperthermic family of Typic Udorthents. The soils are moderately deep and well drained, and formed on slightly dissected and nearly level to very steep volcanic footslopes on the middle and upper portion of Mt. Banahaw. The soils are derived from volcanic tuff that have udic moisture regime.

The fertility of these soils is generally classified into medium by the soil survey results. Soil depth ranges from 50 cm to more than 100 cm. Soil reaction varies from 5.0 to 6.5. Organic matter content is notes as medium. Available Phosphate is medium to high. Exchangeable Potassium content is also high. While, total Nitrogen is medium and Cation Exchange Capacity (CEC) varies low to high.

3.7.2 Land resources

The Study area lies on the lands with the elevation of about 300 m to 1,300 m. Most of the lands are located in higher elevated area where the suitability of sub-tropical vegetable cultivation is high, as shown in the following table.

Land Elevation Classification

(Unit: ha)

Elevation (m)	Nagcarlan	Liliw	Majayjay	National Park	Total
< 300	50	0	0	0	50
300 - 400	258	105	10	0	373
400 - 500	220	234	145	0	599
500 - 600	322	205	80	0	607
600 - 700	253	103	15	90	470
700 - 800	76	106	0	140	322
800 - 900	3	19	0	245	267
900 <	0	0	0	312	312
Total	1,182	772	250	796	3,000

Source: Topographical maps (1/4,000) prepared by the JICA Study Team

The distribution of lands by slope classes is tabulated below. The table shows more than 60 % of lands in the Study area have more than 18 % slope. Considering the present agricultural activities in the Study area, not only the lands with less than 18 % slope but also the highly slope lands are suitable for vegetable cultivation if proper soil conservation measures are applied.

Land Slope Classification

(Unit: ha)

Land Slope	Nagcarlan	Liliw	Majayjay	National Park	Total
3 - 8%	186	0	0	4	190
8 - 15%	318	178	164	55	715
15 - 18%	113	197	0	40	350
18 - 25%	170	48	3	89	310
25% <	164	84	0	577	825
Miscellaneous Land	231	265	83	31	610
Total	1,182	772	250	796	3,000

Source: Topographical maps (1/4,000) prepared by the JICA Study Team

The land suitability classification for diversified crops cultivation was carried out in accordance with FAO framework. The land qualities and soil characteristics used in the assessment of suitability classes are slope, erosion hazard, texture, soil depth, drainage and major soil chemical characteristics. The lands under "moderately suitable" class have moderately severe limitations of steeper slope and imperfect soil fertility for sustained cultivation. The "marginally suitable" lands is identified mainly by steep slope at 15 to 25 %, while the lands have similar soil characteristics to the moderately suitable lands. The "not suitable" lands occur the upper footslopes with a slope of more than 25 %. Rock outcrops with 25 to 50 % intensity are scattered in all the not suitable area. The results of the land suitability classification on the Study area are summarized in the following table and the land suitability map is shown in Fig. 3.7.3.

Land Suitability Classification for Diversified Crops Cultivation

(Unit: ha)

Land Suitability Class	Nagcarlan	Liliw	Majayjay	National Park	Total
Moderately Suitable	504	178	164	59	905
Marginally Suitable	283	245	3	129	660
Not Suitable	164	84	0	577	825
Miscellaneous Land	231	265	83	31	610
Total	1,182	772	250	796	3,000

Source: The JICA Study Team

In conclusion, the suitable area for vegetable production is estimates at around 1,570 ha in the area from the land suitability analysis. As the present vegetable cropped area is about 760 ha (gross area, while net area is 720 ha), the potential area for vegetable cropping extension in future is estimated at about 800 ha. Taking the nature reservation in the National Park and the Public Forest lands into account, the actual potential area is considered as about 600 ha in the Study area.

An upland area on a steep slope of the mountains was significantly suffered from erosion of fertile surface soils. The steeper slope is a dominant constraint for cropping related to the land suitability assessment. For the Abo and Alipit series, the lands sloping at more than 8 % are observed to be slightly suffered from erosion. The lands of the Bukal soil series face to relatively strong soil erosion because of its course soil texture, where the erosion intensity is "slightly" at a slope of 8 to 18 % and "moderately" at more than 18 %. As shown in the following table, most of the Study area are classified into slightly or moderately eroded area. Some of such lands are actually used as upland or multi-stories cropping for vegetables in the higher portion of the Study area. Adequate countermeasures to moderate severe soil erosion should be introduced and extended for sustainable crop cultivation.

Erosion Hazard Class in the Study Area

(Unit: ha)

Erosion Hazard Class	Nagcarlan	Liliw	Majayjay	National Park	Total
None	186	0	0	4	190
Slightly eroded	556	507	167	350	1,580
Moderately eroded	209	0	0	411	620
Miscellaneous land	231	265	83	31	610
Total	1,182	772	250	796	3,000

Source: The JICA Study Team

3.8 Rural Infrastructure

3.8.1 Road network

The road network in the Province covers a total length of 1,641 km, of which 610 km is National roads, 335 km is Provincial roads, 133 km is Municipal roads, and 563 km is Barangay roads. South expressway connecting Manila and Calamba is located in the western part of the Province. The road network is illustrated in Fig. 3.8.1 and road length of each road is tabulated in Table 3.8.1. The road density in the Province is 0.93 km/sq.km of land area, which is fairly extensive based on that of national average. Road pavement condition is still poor. Concrete and asphalt pavements of the total road length are only 19 % and 13 %, respectively, and remaining 68 % is gravel pavement roads. For the Barangay roads, only 3 % is paved with concrete or asphalt in the Province.

The road network within three Municipalities, Nagcarlan, Liliw and Majayjay is 147.35 km in total, consisting of 32.76 km National roads, 40.61 km Provincial roads, 7.71 km Municipal roads, and 66.27 km Barangay roads. The Calauan - Nagcarlan - Liliw - Majayjay National road passes the north of the Study area, connecting the central core of each Municipality. This road is recognized as a west - east road network in the Province, and its rehabilitation work with concrete or asphalt pavement is being proceeded.

The features of the major roads in the Study area are identified through the field reconnaissance and topographic survey as shown in the following table.

Major Roads in the Study Area

(Unit: km)

Route	Road Length			Average Slope (%)
	Gravel/Earth	Concrete	Total	
Nagcarlan				
San Francisco-Bukal	6.0	0.6	6.6	5.4
Sinipian-Silangan Lazaan	0.8	5.2	6.0	5.4
Malinao-Kanlurang Lazaan	1.5	0.2	1.7	6.6
Kanlurang Lazaan-Bukal	2.1	0	2.1	5.4
Liliw				
Ibabang Sungi-Ilayang Sungi	1.0	3.4	4.4	8.3
Novaliches-Luquin	3.2	2.5	5.7	8.6
Majayjay				
Pangil-Bukal	3.9	0.4	4.3	7.3
Total	18.5	12.3	30.8	

Source: Topographic survey during Phase 2 field survey period.

Total length of the road improvement is 30.8 km, in which 18.5 km was earthfill/ gravel road and remaining 12.3 km was paved with concrete. Present condition of the unpaved earthfill road is poor, and only horses are utilized as the most effective means for farm

products transportation in the wet season. Existing concrete paved road has no drainage gutter, so that flush water caused by rainfall erodes road shoulders, as well as earth surface of gravel roads. Since the average slope gradient of roads ranges from 5 to 9 %, all traffic are allowed to smoothly pass these roads although steep gradient portions of 15 to 20 % are partially exist. Present road specifications of the concrete roads, i.e., road width and pavement thickness of the concrete road has sufficient tolerance for further traffic loads in the proposed project, as long as additional drainage works such as drainage gutters and culverts will be provided under the Project.

3.8.2 Rural water supply

In general, water supply coverage at three different levels of services, viz., levels I (point source), II (communal faucet system or stand posts), and III (waterworks system on individual house connections) are classified according to the degree of urbanization.

In the Province, some 566,583 or 41 % of the population do not have potable water supply as of 1990. Unserved areas have prevailed 46 % and 36 % in the urban areas and rural areas, respectively. The Provincial and Municipal governments are fully aware of the problems associated with inadequate water supply facilities, and have a plan to facilitate water supply systems covering 77 % by level III, 98 % by level II in urban areas, and 94 % by level I or upgrading level in rural areas by the year 2010. At present, responsibilities for the operation and maintenance of water supply facilities in the Province are vested in the Water Districts, Barangay Water Works and Sanitation Associations (BWSAs) sponsored by the Local Water Utilities Administration (LWUA) under DPWH and the Provincial or Municipal governments.

Water supply systems in the relevant Municipalities have been well developed principally for the populated area of these Municipalities. Populated areas in the Municipalities of Nagcarlan and Liliw have been facilitated in level III, and rural areas in the Study area have been, in principle, in level I or II. At present, the Nagcarlan Water Works System serves households at the Barangay Poblacion and adjacent Barangays. Majority of the rural barangays has their own water systems (Barangay Water Works and Sanitation Associations, BWSAs) in Nagcarlan. The Liliw Water Works System serves households at the Barangay Poblacion and adjacent Barangays in Liliw. However, pipe leakage, inadequate pipe flow capacity are also contributing to the inadequacy of water supply for some residents in the populated area of both Municipalities.

In the Study area, water supply systems are well maintained by levels I and II.

Table 3.8.2 and Table 3.8.3 give service coverage of water supply and water sources in the Municipalities of Nagcarlan and Liliw. Location of water sources and spring yield in the Study area are indicated in Fig. 3.8.3. BWSAs are responsible for the operation and maintenance of the water systems. Distribution of the water relies on gravity because of favorable geographical conditions, however, wastage of water use caused by pipe leakage and insufficient flow control device has been observed.

With regards to those water supply systems, two systems were observed to be urgently rehabilitated. Intake of the Abo rural water supply system is located at the downstream of the proposed irrigation intake site in Nagcarlan. Because of primitive structure of the existing intake weir fabricated by bamboo, repair works has been occasionally required after floods. Another is Gawanan rural water supply system in Liliw, which intake facilities composed of two concrete boxes, Gawanan #1 and Gawanan #2 and water conduits have been entirely deteriorated due to aging since the year of 1926. In addition, hydraulic engineering defect between existing intake concrete boxes has been observed.

3.8.3 Other rural infrastructures

(1) Power

Electric power in the Municipalities concerned is supplied by MERALCO. There are three hydro electric power plants at the Municipality of Kalayaan located at the north of Sta. Cruz, Barangay Palina in Nagcarlan and Barangay Baquia in Majayjay in and vicinity of the Study area. The power supply in the dry season falls at about 50 % of that of in the wet season.

Some 55 % of residents are energized in Nagcarlan in 1980, and 69.7 % in Liliw in 1991. The remaining unenergized areas are those in the outskirts and interior areas. This is due to the high cost of the distribution line construction.

The Municipal governments aim at 1) providing adequate, dependable low cost power to all Barangays, 2) expansion of power services to unserved portions, 3) encouragement of upgrading/maintenance of existing power facilities with effective coordination between MERALCO and them.

(2) Communications

Telephone services in the Municipalities are being provided by the Philippines Long Distance Telephone Company (PLDT). Telephone service system in the Municipalities both for local, long distance and overseas commutations are available.

On the other hand, expansion of the existing communication services/facilities and effective, reliable facilities are also required in the Study area. Postal service has already been facilitated in these Municipalities.

(3) Public health and sanitation

Deficiency of sewerage system deteriorates environmental health and sanitation conditions in the Province, especially at populated areas. The storm drainage system is the recipient of the effluent from outlets of septic tanks, surface run-off, rain water, flood water, and some direct waste water discharges from residences. Flooding in the town proper has been of a localized nature, frequently on account of drains clogged by plastics, papers, sand or street sweepings and other solid waste objects.

Sewerage system as a means of preserving the health against contamination and pollution of water sources is a priority at this time in view of the numerous private and public wells as well as waste water contributions from various domestic household, commercial and industrial establishment rising in the urban and rural areas.

The following are the existing condition and constraints regarding the environmental health and sanitation in the related Municipalities.

1) Solid waste management

Garbage collection service is being undertaken by the Municipal governments. However, the dumping yard is located at the bank of the San Diego river in Nagcarlan, instead it is properly located at the Municipal dump site in a lowland area in Liliw. Majority of the households still dumps their domestic garbage in open canals or rivers.

In this connection, a gradual deterioration of water quality has occurred in the populated areas because of the inadequate waste disposal system and liquid waste from domestic as well as commercial and industrial activities. Agro-industrial establishments as piggeries and poultries also contribute to the water contamination due to the absence of a proper waste disposal devices.

An appropriate measures shall be indispensable in order to cope with the future increase in the volume of garbage and water contamination as a consequence of

the future urbanization, especially in the populated area of each Municipality.

2) Drainage system

Any drainage problems was not recognized in the Study area due to its steep, well drained topographical conditions. However, improper disposal of solid waste causes clogging of drainage canals even during low intensity rainfall in the populated areas of the Municipalities.

3) Sewerage system

The Municipalities do not have centralized sewerage system. Instead, domestic sewerage is disposed through the use of individual septic tank, pit privies or through the open canals. Waste water affluent from these disposal system are simply absorbed in the sub-soil.

(4) Education

In the Province, there are 742 schools, of which 558 are primary schools and 184 are secondary schools. The 572 private schools have 6,390 classrooms and rest 170 private schools have 873 classrooms. The pupil-classroom ratio in public schools is 41:1 for elementary school and 66:1 for secondary school. The ratio in private secondary schools is 62:1. In the three Municipalities, there are 31 elementary schools and 11 secondary schools.

(5) Commerce and Industry

The establishments of industries are 12,105 in the Province as of 1989. The most of the industries are manufacturing, wholesale and retail trade, and community, social and personal services. Those around the Study area are 369 in Nagcarlan, 123 in Liliw and 78 in Majayjay. Public markets are facilitated at the Barangays Poblacion of the three Municipalities.

3.9 Present Condition of Agriculture

3.9.1 Land use

The Province of Laguna has a total land of about 176,000 ha which consist of about 127,000 ha of lowland including agricultural, industrial and residential lands, and about 49,000 ha of forest land including forest reserves, National parks, timber license areas. Agricultural land accounts for about 86,000 ha equivalent in 49 % of the total land.

Total land area of the three Municipalities are 26,300 ha, in which agricultural land occupies the largest share of 21,000 ha or 80 %. In the Study area having 3,000 ha in total, agricultural land is limited to 2,060 ha or 69 % of the total area. The Study area is still having a larger area of grassland and forest (28 %). Most of the forest extends in higher elevation on the mountain slopes of Mt. Banahaw. Grassland is mostly observed in Municipality of Nagcarlan at the higher slopes of Mt. San Cristobal. The forest and grassland above around 800 m in elevation of these mountain slopes belong to the National Park, and some groups of farmers illegally occupy a part of these grassland and forest for vegetable production. Such illegal squatters are likely to increase due to favorable climate for vegetable production in highland. The present land use in the concerned Municipalities and the Study area is summarized as follows (see Fig. 3.9.1):

Present Land Use

(Unit: ha)

Land use	Nagcarlan	Liliw	Majayjay	Total	%
Whole Municipalities					
Agricultural land	10,020	4,340	5,930	20,290	77.1
Open grassland	260	0	0	260	1.0
Forest	880	1,110	2,630	4,620	17.6
Towns/villages	280	180	120	580	2.2
Others	50	50	450	550	2.1
Total	11,490	5,680	9,130	26,300	100.0
Study area					
Agricultural land	1,160	680	220	2,060	68.7
Open grassland	200	0	0	200	6.7
Forest	340	210	0	550	18.3
Towns/villages	40	10	5	55	1.8
Others	40	70	25	135	4.5
Total	1,780	970	250	3,000	100.0

Source: Municipal offices of Nagcarlan, Liliw and Majayjay
Present land use survey and farmer's household survey carried out by the JICA Study Team
Remark: The acreage of vegetables is shown in gross

The following table shows the present conditions of agricultural land use both in the concerned whole Municipalities and the Study area.

Agricultural Land Use

(Unit: ha)

Land use	Nagcarlan	Liliw	Majayjay	Total	%
Whole Municipalities					
Coconuts/Tree crops	8,910	3,500	4,480	16,890	83.2
Vegetables	390	370	290	1,050	5.2
Rice	620	410	1,010	2,040	10.1
Others	100	60	150	310	1.5
Total	10,020	4,340	5,930	20,290	100.0
Study Area					
Coconuts/Tree crops	790	300	130	1,220	59.2
Vegetables	340	360	60	760	36.9
Rice	5	10	25	40	1.9
Others	25	10	5	40	1.9
Total	1,160	680	220	2,060	100.0

Source: Municipal offices of Nagcarlan, Liliw and Majayjay
Present land use survey and farmer's household survey carried out by the JICA Study Team

As seen in the table above, coconuts plantation is dominant, occupying 83 % of the total agricultural land in the whole concerned Municipalities and 59 % in the Study area. Coconut plantation mainly extends in lower areas of the mountain slopes. In most cases, coconut trees are very old (mostly more than 50 years). The farmers have seldom renewed the coconuts plantation due its low productivity, and rather accelerated inter-cropping with other crops such as vegetables, lanzones, banana, coffee and citrus instead of planting new young coconuts. Such farming pattern of inter-cropping under coconut trees is referred to "multi-storied cropping".

Vegetables are cultivated in a total area of 1,050 ha in the whole concerned Municipalities and 760 ha in the Study area, which is equivalent to 72 % of the total area mentioned above. According to this fact, the vegetable cultivation areas in the relevant Municipalities are concentrated in the Study area located along the foot slopes of Mts. Banahaw and San Cristobal. In recent years, vegetable cultivation under coconuts plantation (multi-storied cropping) has been expanding in the Study area.

The farmers generally prefer to plant vegetables in mountain side due to its blessed climate for vegetable cultivation. Vegetables are mostly planted on the mountain slopes between El. 500 m and El. 800 m in the Study area as shown below.

Vegetable Cultivation by Elevation in the Study Area

(Unit: ha)

Elevation	Nagcarlan	Liliw	Majayjay	Total	%
less than 300 m	2	0	0	2	0.3
300 m - 400 m	34	13	0	47	6.5
400 m - 500 m	20	43	40	103	14.3
500 m - 600 m	84	112	19	215	29.9
600 m - 700 m	94	90	1	185	25.7
700 m - 800 m	62	46	0	108	15.0
800 m - 900 m	22	23	0	45	6.3
more than 900 m	2	13	0	15	2.0
Total	320	340	60	720	100.0

Source: The JICA Study Team
Remark: The areas are shown in the term of "net" planted area.

The paddy field is very few in the Study area. Meanwhile, percentage of paddy field is slightly high in the Municipality of Majayjay comparing with other two Municipalities because of the abundant water source for paddy cultivation.

The Public Forest lands and National Park are located at the elevated portion in the Study area. Approximately 11 % and 18 % of the total vegetable planted area are located inside the National Park area and the Public Forest lands, respectively.

3.9.2 Land tenure and holding size

The results of farmers' household survey reported that about 60 % of the respondents have owned the farm land. However according to the further investigation, it was revealed that almost of the land in the Study area are still owned by the government, i.e., the Public land. Meanwhile, these lands are currently claiming to be distributed to the claimants/farmers with submission of the patent applications under the Public Lands Act. At the local government level, actual ownership of the present users, but limited to agricultural use of land, has been recognized from virtue of tax declaration, length of residency and individual land plots, etc. Accordingly, applicants have already been identified by the governments, so that the lands would be re-distributed to the patent applicants.

Agricultural land in the Study area is estimated at 2,020 ha in total. Total number of the farm household is 1,340 as of March 1994. Average farm size in the Study area is calculated to be 1.5 ha, comprising 0.9 ha of coconuts, 0.5 ha vegetables and 0.1 ha other crops as shown below:

Average Farm Size in the Study Area

(Unit: ha)

Items	Nagcarlan	Liliw	Majayjay	Total
Agricultural land (ha)	1,140	660	220	2,020
- Coconuts plantation	790	300	130	1,220
- Vegetables	320	340	60	720
Nos. of farm household	812	401	127	1,340
Average farm size (ha)	1.4	1.6	1.7	1.5
- Coconuts plantation	1.0	0.7	1.0	0.9
- Vegetables	0.4	0.8	0.5	0.5
- Others	0.0	0.1	0.2	0.1

Source: Present land use survey and farmers' household survey carried out by the JICA Study Team

Distribution of land holding size in the Study area was investigated through the farmers' household survey. The result indicates that landless farmers are scarce and 70 % of the farmers belong to the clusters of 0.5 - 2.0 ha as shown below:

Distribution of Land Holding Size in the Study Area

(Unit: %)

Farm Size (ha)	Nagcarlan	Liliw	Majayjay	Total
> 0.49	8	15	8	9
0.5 - 0.99	31	30	28	30
1.0 - 1.49	36	27	33	33
1.5 - 1.99	8	17	10	10
2.0 - 2.49	9	6	9	9
2.5 - 2.99	1	2	2	2
< 3.0	7	4	10	7
Total	100	100	100	100

Source: Farmers' household survey carried out by the JICA Study Team

3.9.3 Crops and cropping pattern

Cultivated area and production of main crops in the Province of Laguna are shown in Table 3.9.1.

The present cropping pattern for whole of the Study area is broadly illustrated in Fig. 3.9.2. Coconut is dominant crop in the Study area especially in lower-elevation areas. Vegetables are relatively new crops and the share of vegetables is not yet so large, but it is being increased recently because of the relative profitability of the vegetables in the Study area. Historically vegetables were first introduced in Majayjay where has comparatively favored with physical conditions like water source and soil texture. In 1990s, the vegetable cultivation was expanded gradually to the eastern areas, especially to the mountain slopes in the Liliw and Nagcarlan.

The major kinds of vegetables in the Study area are tomato, cabbage, radish, beans (snap beans, string beans, etc.), sweet potato, in which tomato and cabbage are dominant crops in the dry season. Because of the excessive amount of the rainfall in the wet season from May to October, farmers generally cultivate only sweet potato and cabbage, and rarely cultivate other ordinal vegetables which are adversely affected by excessive rainfall in both of quantity and quality. Therefore, fallow lands are considerably observed during the wet season and as the result, cropping intensity through the year is kept as low as 130 % on an average (100 % in the dry season and 30 % in the wet seasons).

For tomato cropping, most of the seedlings are transplanted from January to March, especially in February, and most of the fruits are harvested from April to May, with a few cases harvested in June. Most of cabbages are also transplanted from January to March, and harvested from April to May, however some of them are planted in July and harvested in September.

Cropping pattern of the vegetables in the Study area is generalized as illustrated in Fig. 3.9.2. In the Municipalities of Majayjay and Liliw, tomato is planted in a larger area compared with Nagcarlan, while the farmers relatively plant cabbage in Nagcarlan. Radish is planted especially in the upper foot of Mt. San Cristobal in Nagcarlan. Cultivation area by crops is estimated as follows:

Cultivation Area by Crops

(Unit: ha)

Crops	Dry season	Wet season	Total
Coconuts/tree crops	-	-	1,220
Vegetables	720	215	935
- Tomato	435	-	435
- Cabbage	145	70	215
- Radish	70		70
- Sweet potato	-	145	145
- Others*	70	-	70
Cropping intensity of vegetable farm (%)	100	30	130

Source: Based on the farmers' household survey carried out by the JICA Study Team and information from MAOs

Remarks: *Beans, Pechay, etc.

3.9.4 Current status of irrigation practices

In the Study area, no systematic irrigation is practiced at present due to lack of irrigation water, steep and undulating topography and poorly prepared farmlands. Farmers in the area practice irrigation in a primitive method using such tools as hand-carried watering pot, sprayer

and small bucket. Farmers subsidiarily utilize rural water which is supplied by pipelines for irrigation purpose.

Recently NIA and the Municipal government of Nagcarlan established a pilot demonstration farm with an approximate area of 0.7 ha located at Barangay Abo, to introduce upland irrigation technique to farmers. Sprinkler and spray (with nozzle) irrigation systems with pump were delivered to the site.

Water to be used for irrigation is practically minimized at where no rural water system is facilitated. Farmers are utilizing rain water impounded in concave covered with vinyl sheet, for example, at the elevated area in Barangay San Francisco. On the other hand, some farmers in Barangay Luquin, Liliw also tried to irrigate approximately 2 ha by means of pump irrigation using water of a tributary of the Liliw river. However, their trials have not been practiced yet owing to lack of capacity of the pump, etc.

Approximately 37 ha for paddy fields is successfully irrigated by gravity in Majayjay. Irrigation water is diverted through the earth lining canals from the Olla river. In this fact, it was recognized that farmers in this area already had highly practicable skills regarding agricultural management, e.g., maintenance of paddy terraces, etc.

3.9.5 Crop yield and production

Because of newly developed area for vegetable production, there are no available statistic data on crop yield and production in the Study area. The result of the farmers' household survey shows that the unit yield of vegetables per ha fluctuates considerably from farm to farm because of different farm conditions and cultivation techniques. Unit yields and production of major vegetables in the Study area are estimated on the basis of the farmers' household survey as well as the information given by MAOs as follows:

Vegetable Production in the Study Area

Crops	Cultivated Area (ha)	Unit Yield (ton/ha)	Production (ton)
Tomato	435	10	4,350
Cabbage			
- dry season	145	7	1,020
- wet season	70	5	350
Radish	70	9	630
Sweet Potato	145	10	1,450
Others (Beans)	70	6	420
Total	935	-	8,220

Source: Based on the farmers' household survey carried out by the JICA Study Team

Crop unit yields are generally low mainly due to; 1) lack of irrigation facilities, 2) low level of fertilizer use, 3) inadequate control of pests and diseases, and 4) use of poor quality seeds (self produced seeds). However, according to the farmers' household survey, some farmers already attained higher unit yields, for example, 20 ton/ha for tomatoes and 12 ton/ha for cabbages. Accordingly, it is expected that the Study area has enormous potentialities converting to highly productive area of vegetables, corresponding to abundant land and human resources, and blessed climate.

3.9.6 Crop production cost

According to the farmers' household survey, average production costs of the major vegetables are estimated as follows:

Production Costs of Major Vegetable in the Study Area

(Unit: ₱/ha)

Crops	Tomato	Cabbage	Radish	Sweet Potato	Beans
Farm Inputs	12,095	8,603	3,845	5,100	10,779
- Seeds	800	800	960	3,300	2,000
- Fertilizers	5,318	4,830	2,016	1,800	1,440
- Agro-chemicals	3,207	2,973	869	-	1,069
- Other farm materials	2,770	-	-	-	6,270
Labor	10,270	9,820	7,750	8,740	9,820
- Hired labor	2,410	2,070	1,530	2,070	2,520
- Family labor	7,860	7,750	6,220	6,670	7,300
Transportation	3,250	2,250	2,750	3,250	2,000
Others	1,000	1,000	1,000	1,000	1,000
Total	26,615	21,673	15,345	18,090	23,599
less family labor	18,755	13,923	9,125	11,420	16,299

Source: Based on the farmers' household survey carried out by the JICA Study Team

Crop production costs are comprised of farm input costs and labor costs. Farm input costs largely fluctuate by kind of crops ranging from ₱ 3,845 per ha for radish to ₱ 12,095 per ha for tomato. Fertilizer ranks first followed with agro-chemicals in the farm inputs, but in case of sweet potato the largest is seedling cost, and agro-chemicals are hardly used. In addition, in case of tomato and beans, some stalks and strings are used for supporting and training plants. Most of the vegetable farmers employ casual laborers occasionally during the planting and harvesting seasons. Labor cost is the largest item of the vegetable production costs. Transportation cost is estimated as the labor cost of man and horse carrying products from farm to trading point.

3.9.7 Marketing and prices

(1) Marketing

Domestic marketing system of the vegetables produced in the Study area is illustrated on Fig. 3.9.3. The vegetable farms are scattered over the area and road network connecting between farms and main roads is lacking. The harvested vegetables are therefore transported by using horse from farm to main road where trading post exists. There are several trading posts in the Study area. It is merely a simple wooden structure with shade. Necessary tools and facilities, such as for weighing, washing, bagging and storage are not equipped in the trading posts.

Domestic marketing system is characterized by a wide range of intermediaries performing different functions. During the harvesting season, more than 100 buyers show up at the trading posts to buy and collect the vegetables. They are generally classified into; 1) primary wholesalers who sell the products to other wholesalers in Manila and elsewhere, 2) local wholesalers-retailers who sell to other traders and/or directly to the end-consumers at major towns in Laguna, and 3) local retailers who buy in smaller quantities and sell to the end-consumers locally. The primary wholesalers from Manila handle 70-80 % of the total products, local wholesalers-retailers 15-20 %, and local retailers 5-10 %.

In general, there may be 1-4 middlemen operating between the farmers and the retailers. At the trading post, the existence of local brokers, who act as an intermediary between the farmers and buyers for a commission, is common. The buyers from Manila are not only primary wholesalers, but also include assemblers who collect purchases and assemble for shipment to distant markets, wholesalers-retailers and simple collecting agents (truckers) for the primary wholesalers.

The Bureau of Standards under the Department of Trade and Industry (DTI) has formulated a number of grading standards for fruit and vegetables; however, these have not been accepted or used by the traders. In the Study area, an informal quality grading, which is usually on purely visual ground, is practiced and provides the basis of pricing on the spot. The products are usually graded into three classes; "A" (first class), "B" (second class) and "C" (third class). About 60 % of the prices paid to "A" class products is generally paid to "B" class products, 40 % prices to "C" class products.

Vegetables purchased by the dealers from Manila are transported, using unrefrigerated trucks, directly to Divisoria market, Manila. More than 200 wholesalers are carrying on vegetable business at Divisoria. The wholesalers at Divisoria do business generally with

regular partners (secondary wholesalers, wholesalers-retailers and retailers). There is no auction market at Divisoria. Prices are determined on the spot through negotiations, making reference to the purchasing prices in the vegetable producing areas.

The existing marketing system is not entirely inappropriate, and the fact that similar marketing systems continue to operate elsewhere suggests that it may be the most efficient domestic marketing system.

(2) Prices

The lowland vegetable production pattern, which is highly seasonal, is reflected in the wholesale prices of the vegetables in Metro Manila. Table 3.9.2 gives the monthly average wholesale prices of major vegetables for the years 1989 - 1994 at Divisoria market, Manila. Fig. 3.9.5 shows the seasonal pattern of wholesale prices at Divisoria market for tomato and cabbage which is derived from the monthly average wholesale prices for the years 1988-1994. These data clearly show that vegetable prices rise from June/July to reach a peak in November/December and then fall again during January to May when lowland production become available. The vegetable production pattern in the Study area is similar to those in lowland. Almost no vegetables, except sweet potato, are produced in the Study area during the high price period of June/July - November/December mainly due to low technologies applicable to the wet season cultivation and poor accessibility to the market.

The wholesale prices at Divisoria market and ex-trading post prices at La Trinidad (Benguet) were compared in order to check the margins between two different data series of prices. Margins are around 75 - 85 %, depending upon the kinds and quality grades of vegetables which affects the selling prices as well as the product shelf life and transportation/storage losses (see Table 3.9.3 and Fig. 3.9.4). In the Study area, the prices at the trading posts are much lower than 75 % of the wholesale prices at Divisoria mainly because, compared to Baguio, the Study area has such disadvantages as; 1) poor quality of production, 2) higher risk of post-harvest losses during transportation due to poor road condition, and 3) low bargaining power of the farmers during the negotiation with the dealers.

Such disadvantageous situations will be gradually improved under the proposed Project through the irrigation development, proper training of the vegetable farmers, improvement of the existing farm-to-market roads, construction of well-equipped trading posts and organization of market cooperatives, etc. It is therefore anticipated that the prospective prices at the trading posts in the Study area will be much improved, being not less than 75 % of the wholesale prices at Divisoria. The anticipated ex-trading post prices of vegetables in the Study area are

shown in Table 3.9.4.

No price reporting service is available in the Study area. The farmers have no idea about the wholesale price in Manila; therefore the farmers are rather in a disadvantageous position during the price negotiations with the dealers at the trading posts. In Baguio, the prices agreed between producers and wholesalers and those reported to the price collection officers become the fixed prices for all transactions in Baguio market on that day. If this kind of price information services will become available in the Study area, the farmers will be able to avoid unfair price offer by the dealers.

3.9.8 Present agricultural production values and farm income

(1) Present agricultural production values

Net production values and farm income of vegetables in the Study area are estimated on the basis of gross production values and total production costs as shown below:

Gross Production Values

Crops	Production (tons) (A)	Average Price (₱/kg) (B)	Gross Value (₱ million) (A) x (B)
Tomato	4,350	4.2	18.3
Cabbage			
- dry season	1,010	7.9	8.0
- wet season	350	9.9	3.5
Radish	630	4.9	3.1
Sweet Potato	1,450	4.8	7.0
Others(Baguio beans)	420	8.4	3.5
Total	8,220		43.4

Source: Based on the farmers' household survey carried out by the JICA Study Team

Total Production Costs

Crops	Harvested Area (ha) (A)	Unit Production cost (₱/ha) (B)	Total Production cost (₱ million) (A) x (B)
Tomato	435	26,615	11.6
Cabbage			
- dry season	145	21,673	3.1
- wet season	70	23,245	1.6
Radish	70	15,354	1.1
Sweet Potato	145	18,090	2.6
Others	70	23,599	1.7
Total	935		21.7

Source: Based on the farmers' household survey carried out by the JICA Study Team

Net Production Values and Farm Income

Crops	Gross Production Value (₱ million) (A)	Total Production Cost (₱ million) (B)	Net Production Value (₱ million) (A) - (B)	Farm Income (₱ million)
Tomato	18.3	11.6 (8.2)*	6.7	10.1
Cabbage				
- dry season	8.0	3.1 (2.0)	4.9	6.0
- wet season	3.5	1.6 (1.1)	1.9	2.4
Radish	3.1	1.1 (0.6)	2.0	2.5
Sweet Potato	7.0	2.6 (1.7)	4.4	5.3
Others(Baguio beans)	3.5	1.7 (1.1)	1.8	2.4
Total	43.4	21.7 (14.7)	21.7	28.7

Source: Based on the farmers' household survey carried out by the JICA Study Team
Remark: Less family labor

Gross production values, production costs and net production values of major vegetables are estimated to be about ₱ 43.4 million, ₱ 21.7 million and ₱ 21.7 million on financial price basis, respectively. Since there are 1,340 farm household in the Study area, these values are equivalent to ₱ 32,390, ₱ 16,190 and ₱ 16,190 per farm, respectively. The average farm income, which is indicated as the value reduced the production cost without family labor from the gross production value, is equivalent to ₱ 21,420 per farm.

(2) Average family income

According to the farmers' household survey, the average family income is estimated at about ₱ 50,000 per annum as follows:

Average Family Income

Source of Income	Average Income per Family (₱)	(%)
Vegetables	21,420	43
Coconuts / Tree crops	6,100	12
Livestock / Poultry	1,500	3
Off-farm income	20,980	42
Total	50,000	100

Source: Based on the farmers' household survey carried out by the JICA Study Team

Taking the estimated family income and average family size (4.65 persons/family) in the Study area, per capita net income is calculated at ₱ 10,700 per annum.

3.10 Agricultural Support Services and Cooperative Movement

3.10.1 Agricultural research

As the dominant crops in the Philippines are rice, corn, sugarcane and coconut, the agricultural research in the Philippines has put a strong emphasis on these crops, while it has poorly supported on fruit and vegetables. The major constraints to horticultural research activities are the limited research station resources, insufficient training for the staff, too low staff rewards, delay of project formulation, evaluation and approval, lack of funds for experimental work, etc. Despite these constraints, numbers of staff have made their efforts to agricultural research and development.

The Philippine Council for Agricultural Resource Research and Development (PCARRD) in the Department of Science and Technology (DOST) has the overall sectional planning role for agricultural research, and is responsible for evaluating research proposals, monitoring research progress and allocating government fund. It has established the National Research and Development Network (NRDN) which is comprised of 12 National research centers, 83 cooperating stations and 15 specialized agencies. As the Regional research centers, eight institutions are designated.

Bureau of Agricultural Research (BAR) in DA has a responsibility for all agricultural research of DA and is establishing close cooperation with PCARRD, the State Colleges and Universities (SCUs) and non-government organizations (NGOs). It has four National Crop Research Development Centers and there are one or more research stations in each region. Generally, it is said that the DA focuses its research on technology verification and demonstration, while state colleges and universities focuses their research in technology

generation. However, in practice the distinction between both research activities is not so clear.

The University of the Philippines at Los Baños (UPLB) is well known as one of horticulture research centers and has the Institute of Plant Breeding, Institute of Biotechnology and Post-harvest Horticulture Training and Research Center.

From 1988 to 1992 in the Study area, a pilot demonstration farm for high land vegetable cropping had been experimented by UPLB, and several kinds of vegetables were tried to grow under irrigation. As a result of the experiment, it was confirmed that almost all kind of subtropical vegetables can grow in this area. At present the demonstration farm has been taken over to the Laguna State Polytechnique College and used as the agricultural training farm for the students. At the next site of this farm, NIA and the Municipality of Nagcarlan are, in close cooperation, going to start the new irrigation farm for vegetables assisted by the JICA and supervised by UPLB.

"The Economic Garden National Crop Research and Development Center" of DA is also located at Los Baños. In this Economic Garden several new varieties and strains of legumes and other vegetables have been evaluated and selected for the development of improved varieties and seed production. Some new varieties have been sent to the Study area to check their suitability for middle highland.

3.10.2 Agricultural extension services

The reorganization of DA in 1987 brought about significant structural and policy changes on the agricultural extension and training. As the result of structural changes, the former line bureaus performing specialized line functions changed to staff bureaus where program and project implementation are undertaken, and their field staffs were absorbed by Regional offices. In addition, the Philippine Training Center for Rural Development, the Philippine Agricultural Training Council and the Bureau of Agricultural Extension was merged into Agricultural Training Institutes (ATI) as a training section of DA.

In each administrative region, there is a Regional office of DA headed by a Regional Director who is assisted by three Assistant Directors for operations, research and support services. Under the Assistant Director for Operations, there are the Provincial Agricultural Officers (PAOs).

Region IV office of DA in Quezon City is charged with implementing extension at the

regional and provincial levels. Laguna Provincial Agricultural Officer implements policies, plans, laws, regulations of DA.

However, based on the new policy of the extension that agricultural extension should be location specific, the former Municipal Agricultural Office (MAO) of DA in each Municipality was transferred to the Municipal government as the Office of the Municipal Agriculturist headed by MAO assisted by Agricultural Technologists (ATs). Therefore, each Municipality is now the base of agricultural extension. MAO has the responsibility for agricultural extension in the Municipality and each AT, who is assigned for agricultural extension in each territory including some Barangays, is most directly in contact with the farmers. Generally an AT visits farmers weekly and holds monthly meeting for extension. The number of AT is about 7 - 9 persons in each Municipality.

In Nagcarlan eight demonstration farms sized in maximum 5,000 sq.m have been provided at the advanced farms that are managed by farmers with seeds sent from MAO to confirm the adaptability of new varieties of vegetables and to extend them to the neighborhood. In Liliw, the government has established the "Plant Pest Clinic in Liliw" project to empower the extension workers and farmers on matters related to crop protection.

However, the finances for agricultural extension in the Municipalities are very limited to conduct the proper extension service, and despite the technical support to MAO provided by the Regional office and PAO, a number of limiting factors has hampered the effectiveness of the service.

3.10.3 Farm input supplies

Major farm inputs for growing vegetables are seeds, fertilizers and agrochemicals. Member farmers of the agricultural cooperatives usually procure their farm inputs through the cooperatives, and other farmers buy these materials from the agricultural supplies dealers whose shops are three in Nagcarlan and three in Liliw.

Most of farmers use home rising seeds in the case of tomato seed, but generally they purchase seeds for growing cabbage, radish, etc. As the chemical fertilizer, compound fertilizer such as 14-14-14 (figures are percentage of N, P and K included), urea and ammonium sulfate are commonly used, and the application of chicken manure is most popular. Insecticides like Decis or Sumicidine, and Fungicides like Dithane are commonly used, but the application frequency and volume may be not so much. Besides stalks, nylon lope, tying materials are used for tomato and beans.

In the Study area, because of the bad road condition, and strongly undulating and small plots of the upland fields, farmers hardly use agricultural machinery. Horses are used for transportation of farm inputs and products.

Due to the small scale of farming, most of the farming labor depends on family labor, but some hired labor mainly for land preparation and transplanting are applied. Generally average hired labor cost for farming is about (₱ 100) for a man a day and (₱ 250 for a set of man and horse a day. These hired labors are supplied smoothly on the whole.

3.10.4 Agricultural credit

There are various formal credits available for agriculture production in the Philippines. Main credit channels are the Philippine National Bank (PNB), Development Bank of the Philippines (DBP), the Land Bank of the Philippines (LBP) and Rural Bank. These credits are not meeting necessarily rural farmers' needs because they need long administrative procedure, and require securities, while finances are limited and interest rate is high. However, some members of agricultural cooperatives ask their cooperatives the loan for agricultural production.

According to the farmers' household survey, about 70 % of the farmers in the Study area use agricultural credit for mainly purchasing farm inputs. About 50 % of them apply to the Provincial government the short term loan (interest of 6 % per 6 months, maximum ₱ 5,000 per ha). This loan is financed mainly for vegetable growing farmers based on the program called KAUNCARAN SA LAGUNA (KSL) specialized only in the Province of Laguna. About 25 % of farmers used credit borrow money from private persons and about 13 % from cooperatives. The rest of the farmers operate their farming by their own funds. However, 70 % of the farmers interviewed strongly complained shortage of capital for farming.

3.10.5 Activities of cooperatives

(1) Primary cooperative

In 1991, Cooperative Development Authority (CDA) was established as the implementing agency of the Cooperative Code to accelerate the cooperative's activity and strengthen their organization. Then the number of registered cooperatives rapidly increased. In the Province of Laguna, there are total of 548 cooperatives as of June 1994, out of which

more than 80 % have multi-purpose (more than 80 % are agricultural cooperatives) (see Table 3.10.1).

Fifteen (15) or more natural persons can organize a primary cooperative and submit the registration in accordance with the cooperative law and ordinances. The primary cooperative is run on the basis of its own article and is mainly composed of general assembly, board of directors, some committees and manager's office. The members of board of directors are elected by general assembly and are unsalaried. The manager and his staff are salaried.

In related three Municipalities, there are 21 cooperatives in Nagcarlan, seven in Liliw and 14 in Majayjay, respectively. Almost of which are multi-purpose cooperatives newly registered since 1991 (see Table 3.10.2). In the Study area, nine cooperatives are established out of which some cooperatives cover only a barangay while some have the members come from some barangays. Their main activities are to supply farm inputs like seeds, fertilizers, agro-chemicals, feeds, etc., to make the loan, education and training for member farmers. The activities of some cooperatives include hog fattening, passenger transportation by jeepney, etc.

Generally primary cooperative borrows money from the Land Bank of the Philippines (LBP), Cooperative Rural Bank Laguna (CRBL), etc., and make loan them to the member farmers. In this loan, farm inputs are usually supplied in kind based on the farm plan and budget prepared by production technician (PT) from DA and the credit for wages to hired labors are paid by cash. The expenses of member farmers to the cooperative are the admission fee and monthly or yearly dues both of which are generally very cheap.

Generally the member scale of primary cooperatives in the Study area is very small ranging from 30 to 120. According to the farmers' household survey, approximately half of the farmers join any of these cooperatives, however, as interviewed farmers were relatively advanced, the portion of member farmer in whole Study area is estimated lower than this. Most of the cooperatives are subject to face lack of capital, lack of competent management staff and auditors, and inadequate bookkeeping.

(2) Federation of Cooperatives

There are only seven cooperative federations in the Province of Laguna, and the Municipalities concerned in the Study area have no registered cooperative federation yet. However in Nagcarlan, there is the movement to organize a federation of cooperative aimed at marketing activity, named KASAMA KANA consisting of nine primary cooperatives, of which five cooperatives are from the Study area.

Municipal government of Nagcarlan has organized the Cooperative Development Council (CDC) headed by mayor to assist the operation of existing cooperatives in the Municipality. The main activities of CDC are to promote the organization of multi purpose cooperatives, to identify problems of existing cooperatives, to coordinate with the different existing cooperatives, to monitor and evaluate cooperative activities, and to recommend possible solutions to the problems of cooperatives.

Apart from that, a cooperative federation named the CRISBASIERRA Federation of Laguna Cooperatives Inc., including some cooperatives in Nagcarlan and Liliw, has been organized. After a strong earthquake hit Baguio City from where most of the vegetables are supplied to Metro Manila, the National government paid attention to the Province of Laguna as one of alternative vegetable sources to Metro Manila. In response to this movement, this federation was organized and registered in 1992. Presently this federation has 25 members of the primary cooperatives from nine Municipalities. Six primary cooperatives located at the Study area have joined into the federation. Although the main objective of the federation is to promote the vegetable production in mount foots of Mts. Banahaw, San Cristobal and Sheramadre mountain range, the actual activity of the federation is only limited to the education and preparation of saving program for member farmers at present.

3.11 Environmental Condition

3.11.1 National Park and Public Forest lands in the Study area

The lands of the Study area are public lands. The lands are classified into two categories: Public Forest lands and A&D lands. The Public Forest lands include a part of Mts. Banahaw-San Cristobal National Park.

The Study area includes a part of Mts. Banahaw-San Cristobal National Park, which covers about 800 ha of the Study area, as shown in Fig. 3.11.1. The National Park has an area of 11,133 ha. It had been managed by DENR until 1987. However, Executive Order No. 224 (July, 1987) gave the National Power Corporation (NAPOCOR) the complete jurisdiction, control and regulation over the Makiling-Banahaw Geothermal Reservations, which covers about 70 % of the National Park area including the whole Study area. This implies, at present, about 30 % of the National Park area is under DENR, the remaining 70 % under NAPOCOR. The National Park within the Study area is currently under jurisdiction of NAPOCOR.

A national law prohibited any development activities within the National Parks without

a permission. Nevertheless, the land of the National Park within the Study area have been partly cleared and used for vegetables and tree crop cultivation by illegal occupants coming from the downstream area. The number of the occupants, the area occupied and average length of occupancy by related Barangays are tabulated below:

Forest Occupants

Barangay/Municipality	No. of occupants	Total occupied area (ha)	Ave. occupied area (ha)	Ave. length of occupancy
Illayang Sungi, Liliw	19	49.1	2.6	12.8 yrs
Luquin, Liliw	27	26.1	1.0	11.0 yrs
Novaliches, Liliw	17	12.5	0.7	8.4 yrs
Bukal, Nagcarlan	87	122.5	1.4	21.1 yrs

Source: Census/Inventory of Forest Occupants within Mts. Banahaw-San Cristobal National Park, CENRO, Los Baños, Laguna, 1991
Remarks: It is not clear if all of these areas are located within the Study area.

The land use survey in this Study estimates that there are about 95 ha of farm land in the national park within the Study area.

3.11.2 Vegetation

The Public Forest lands on the slope of Mt. San Cristobal, south-western part of the Study area, are covered with grass and shrubs. The lower portion of the Public Forest lands on the foot of Mt. Banahaw (approximately between El. 650 m and 900 m) is denuded by forest occupants. Some area is used for vegetables and tree crops production while others are abandoned, according to the field survey. The mossy and old-growth dipterocarp forests are observed in Mt. Banahaw with the elevation beyond about 900 m. It covers about 5 % of the Study area. The major species in the forests are red lauan, white lauan, marave, tanguile, and mayapis. According to DENR, there is no rare, endangered, or threatened flora in and around the Study area.

In A&D lands, coconut farms are dominant land use. Banana, lanzones, coffee and vegetables are inter-cropped with coconut.

Two reforestation projects and one agro-forestry projects have been planned or implemented in and around the Study area as shown in Fig. 3.11.1. They are all small-scale projects with the targeted areas of between 30 and 50 ha.

3.11.3 Wild animals

Wild animals are rarely observed in the lower portion of the Study area because the most of them inhabits within the forest of Mts. Banahaw-San Cristobal National Park. The major species inhabited are round lizard, wild pig, wild owl, and wild pigeon. Wild deer widely inhabited in the area was almost cleared out due to hunting. At present, there is no endangered or threatened wild animals in and around the Study area.

3.11.4 Soil erosion

From the field reconnaissance and interviews to farmers, it is speculated that vegetable farms located in denuded steep slopes (between El. 650 and 900 m) are the most susceptible to soil erosion because the farms, not all the farms, are not protected by vegetation covers or soil conservation measures and thus exposed to heavily intensified rain in the wet season. Actually the evidences of gully erosion are observed in some areas. On the contrary, it is also speculated that the soil loss from the coconut farms and vegetable farms under coconut trees is not high due to the vegetation covers.

No soil loss measurement has been undertaken in the Study area. However, the soil loss measurements done by UPLB under the conditions similar to the Study area can be referred to in order to understand the relationship between soil loss and farming practices. They were carried out on the sites with 15 to 29 % in slope and with the soils of Lipa Clay Loam. Cropping treatments of four alternatives including a traditional practice of upland farmers were tested. The results are as follows:

Results of Soil Loss Measurements

(Unit: ton/ha)

Treatment	1989	1990	1991
T1	124	198	99
T2	40	25	4
T3	3	5	0.4
T4	0.2	5	0.1
Rainfall (mm/yr)	2,220	2,769	2,072

Remarks:

T1: Farmers' practice involving up-and-down slope tillage operation and clean or weed free culture

T2: Alley cropping with contour tillage, and the crop and weedresidues were removed from the soil

T3: Alley cropping with contour tillage, and the hedgerow trimmings and crop residues were used as mulch

T4: Alley cropping with no tillage, and the hedgerow trimmingsand crop residues were used as mulch

The results show that soil loss is markedly reduced when conservation tillage and surface cover are combined. Adoption of soil conservation measures is overemphasized from the results.

3.11.5 Water pollution

There is an increasing concern, particularly in vegetable producing area, that the overuse of agro-chemicals and fertilizers could affect water quality. However, farmers in the Study area have been advised to use more organic fertilizer such as chicken manure than chemical ones, or apply less agro-chemicals. Therefore, it is unlikely that the use of agricultural inputs causes serious water pollution in the Study area.

3.11.6 Pesticide residues in vegetables

Over application of pesticides pose health risks to consumers in the form of high accumulation of pesticide residues in food. A study by the National Crop Protection Center in Laguna and Calamba (1987) shows that occasionally vegetables (string beans) sold in market may contain residue level that are higher than maximum residue levels set by FAO/WHO. It happens because farmers tend to apply more frequently when harvesting neared. This indicates the necessity of extension services teaching vegetable-producing farmers proper farming practices.

CHAPTER IV BASIC DEVELOPMENT CONCEPT AND PUBLIC CONSULTATION

4.1 Basic Development Concept

4.1.1 Necessity of upland development

Issues on upland development in the Philippines described in section 2.2 are commonly observed in the Study area. They are:

1) Destruction of forest resources,

2) Unsecured land tenure that limits access to credit and discourages land improvement and environmental preservation by farmers,

3) Land degradation due to the combination of high erosion potential of the lands and prevailing farming practices that are not oriented to soil conservation, and

4) Socio-economic disadvantages due to lack of infrastructure and unfavorable natural conditions.

Regarding forest destruction within the Study area, about 100 ha of primary virgin forest were already destructed and converted to agricultural land or abandoned under shifting cultivation. In addition, out of 390 ha of the Public Forest lands, 330 ha or 85 % have been converted to agricultural land. In A&D lands extending below El. 600 m, no natural forest has remained any more.

Present Status of Forest Destruction in the Study Area

Land use	Area (ha)	Proportion (%)
A&D land (below 600 m)	1,820	60.7
- Vegetable farm	530	17.7
- Coconuts	1,100	36.7
- Others	190	6.3
Public Forest land (600 m - 800m)	390	13.0
- Vegetable farm	150	5.0
- Coconuts	180	6.0
- Forest/Scrub	60	2.0
National Park (above 800 m)	790	26.3
- Vegetable farm	80	2.6
- Coconuts	20	0.7
- Forest	690	23.0
Total	3,000	100.0

Source: Based on the present survey carried out by the JICA Study Team

Soil erosion problems are obvious everywhere in the cultivation areas and general

impoverishment resulted from the prevailing subsistence-dominated farming practices causes further destruction of the forests for their livelihood. It is anticipated that, if no measures are taken, the present forests of Mts. Banahaw and San Cristobal will be completely destructed within a few decades.

There are many discussions on the issues and manifold measures such as ISFP and reforestation programs are executed. However, in parallel with these on-going programs, the fundamental issue that general poorness of the farmers causes the above-mentioned problems in the uplands should be considered. Security of land tenure that the ISF program provides is needed, but it alone can not solve various problems of the uplands. Provision of various infrastructures such as farm-to-market roads and irrigation facilities is also needed for uplifting the upland rural incomes so that the farmers can live on within the limited farmland, without further destruction of the forests. Ancillary works and services for supporting the farmers to realize the improved farming and marketing are also needed at the same time. In other words, an integrated all-in-one project including all the necessary components is needed in order to improve the welfare and livelihood of the upland farmers and thereby to preserve or even enhance the quality of the natural environmental resources in the area.

4.1.2 Development potential of the Study area

The Study area has been acknowledged to be highly suited for the production of highland vegetables by; 1) an overall study on horticultural sector in 1991 made by BPI/ADB and 2) the master plan study for the Project "CALABARZON" by the JICA. The proposed project will therefore be formulated centering the promotion of vegetable production as well as paying attention to the possible environmental preservation.

In particular, the Study area has the following advantages and potential for integrated development for the production of highland vegetables:

1) The area is blessed with favorable climate (slightly cooler temperature) and soils (soft, fertile and deep) suitable for the production of sub-tropical vegetables.

2) Destructive typhoons are rare due to the protection afforded by the Sierra Madre mountain ranges which are situated to the east of the area.

3) There are about 1,600 ha potential land for vegetable production (although most of the potential lands are currently coconut plantation, vegetables can be grown even under coconuts - multi-stories cropping).

4) There are some sources of irrigation water (river flows and springs), though they have been untapped.

5) Major crops in the area are tomato and cabbage, and most of the farmers are already familiar with the vegetable cultivation.

6) The Municipal office of Nagcarlan already established a pilot demonstration farm at Bukal with a technical assistance from UPLB and NIA. New varieties of traditional crops (tomato) and new vegetables such as Chinese cabbage, carrot and broccoli were introduced for testing.

7) The area is located near to the large market in Manila, being connected by well maintained National roads (only 2 hour drive distance). The area is much closer to Manila than Benguet.

8) The area can be considered as a pilot demonstration area for a large highland vegetable zone which extends along the foot of Mt. Banahaw.

4.1.3 Current problems and constraints for development

The following are the current problems and constraints for development in the Study area. The development plans will therefore be formulated keeping these constraints in mind.

1) Lack of irrigation system

Vegetables are grown only during the dry cool season from December to April. In this main cropping season, serious drought damages of crops are observed due to lack of irrigation facilities. Most of farmers have very small farm ponds or water tank and use the limited water for irrigation only during the time of transplanting. Availability of water for irrigation is very limited.

2) Poor farm-to-market road network

Farm-to-market road network in the area is poor. Most of the existing main roads in the area are ragged (not cemented), and are not passable by jeep during the wet season. There is no secondary road connecting farms and main roads. Only very limited number of narrow and steep foot paths exist in the Study area.

3) Low cropping intensity during the wet season

Vegetable cultivation during the wet season is very limited. Only sweet potato and other water-resistant crops are grown under the prevailing technologies. Major reasons for low cropping intensity are; 1) lack of suitable varieties of vegetables for the wet season, 2) lack of appropriate technologies for pests and diseases control, 3) lack of appropriate structure to present the crops from rainfall, and 4) lack of soil erosion control measures in case that farmers grow vegetables during the wet season.

4) Predominance of steep land with a slope more than 18 %

More than 60 % of land in the area have steep slopes more than 18 %. However, any erosion control measures have not been taken so far. Soil erosion during the wet season is serious.

5) Low crop yield

Despite the endowed favorable natural conditions, crop yields are generally low. Reasons for the present low yields are manifold, however, decisive factors are; 1) lack of irrigation facilities, 2) high cost of farm inputs and thereby low level of input use, and 3) use of low quality seeds.

6) Low farm-gate prices of vegetables

Vegetable production in the Philippines is highly seasonal, because most of marketable vegetables come from seasonal cropping in lowland after rice/corn harvest during the period from January to May. The prices of vegetables are low during this main harvesting season and become high during off-season from June to December. Main harvesting season of vegetable in the area coincides with low price season.

7) Poor marketing system

During the harvesting season, vegetables are carried by farmers from farm to the nearest trading posts, and sold directly to the wholesalers and/or their agents who come from outsides mainly from Manila at the trading posts. Prices are determined solely by the buyers. Farmers are very weak in position for determining the prices, because they have no facilities to store their products and are isolated from the latest information on wholesale prices in Manila. Farmers have no transportation means to carry their products to Manila.

4.2 Basic Strategies of the Project Formulation

4.2.1 Consistency with environmental preservation policies

The Cabinet of the Philippines approved the conceptual framework of the "Philippine Strategy for Sustainable Development (PSSD)" in its Resolution No. 37 in 1989. Since then, the PSSD has been a backbone strategy for any development in the country and all the governmental agencies have been directed to review and modify their development programs and projects for consistency with the PSSD framework.

In the light of the PSSD, the strategies for project formulation should be as follows:

1) Economic and environmental concerns should be addressed simultaneously in the process of project formulation.

2) Remaining natural forest in the area should be untouched. Restoration must be thoroughly carried out if it is damaged by the Project.

3) The agricultural development potential of the area should be maximized through combination of the extension of appropriate farming practices, provision of infrastructure, and establishment of institutional support.

4) Extension and demonstration of soil conservation practices should be included in the Project to enable farmers understand the importance and the effectiveness of the practices.

5) Farmers' participation in project formulation should be promoted to enable them recognize problems and the solutions and to ensure their active cooperation to project implementation.

4.2.2 Consistency with agricultural and rural development policies

In order to keep consistency with the national agricultural and rural development policies, the development strategies for the Project are envisaged as follows:

1) The proposed project should be economically viable. The project facilities should be location-specific ones which could be maintained by local resources at cheap cost in due consideration of their sustainability.

2) Target group of the Project should be small farmers. The Project should aim to uplift their farm income as a whole.

3) Participation of small farmers should be ensured in planning, implementation and O&M of the Project.

4) Minimum requirement for infrastructures such as irrigation facilities and farm-to-market roads should be included as major components in the Project.

5) Promotion of cooperative movement should be examined and included in the Project as one of major components.

6) Special attention should be paid to environmental preservation, particularly those for Mt. Banahaw.

7) Minimal post-harvest facilities should be considered in the Project in order to stabilize the farm-gate prices and to minimize the marketing losses.

8) Requirement for enhancement of training and extension works should be identified and included in the Project as one of major components.

4.2.3 Consistency with irrigation sector policies

In the light of the strategies given in the NIA Corporate Plan 1993-2002, the strategies for the Project would be envisaged as follows:

1) Irrigation component should be of communal type. Therefore, the existing rule and regulations for the communal irrigation project will be applied to planning of irrigation component of the Project.

2) Farmer participatory approach should be ensured during the all process of