REPUBLIC OF THE PHILIPPINES

FEASIBILITY STUDY ON THE HIGHLAND INTEGRATED RURAL DEVELOPMENT PROJECT IN LA TRINIDAD PROVINCE OF BENGUET

MAIN REPORT

OCTOBER 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

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

JICA sent to the Republic of the Philippines a study team headed by Mr. Masaharu Matsui, Nippon Giken Inc., two times in the period from July 1987 to March 1988.

The team exchanged views with the officials concerned of the Government of the Republic of the Philippines and conducted a field survey in La Trinidad, Province of Benguet.

After the team returned to Japan, further studies were made and the present report was prepared.

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

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

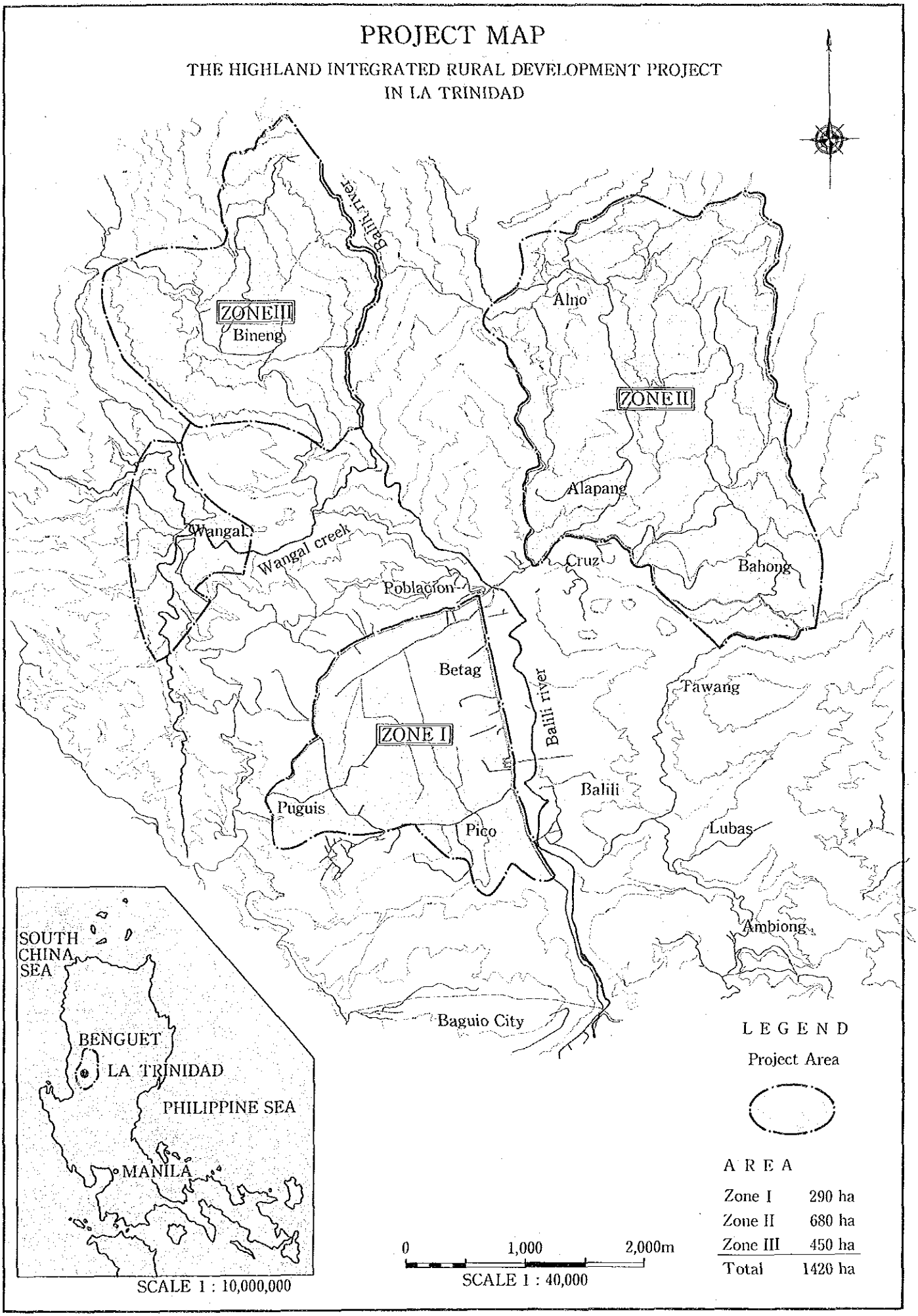
October 1988

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

PROJECT MAP

THE HIGHLAND INTEGRATED RURAL DEVELOPMENT PROJECT
IN LA TRINIDAD



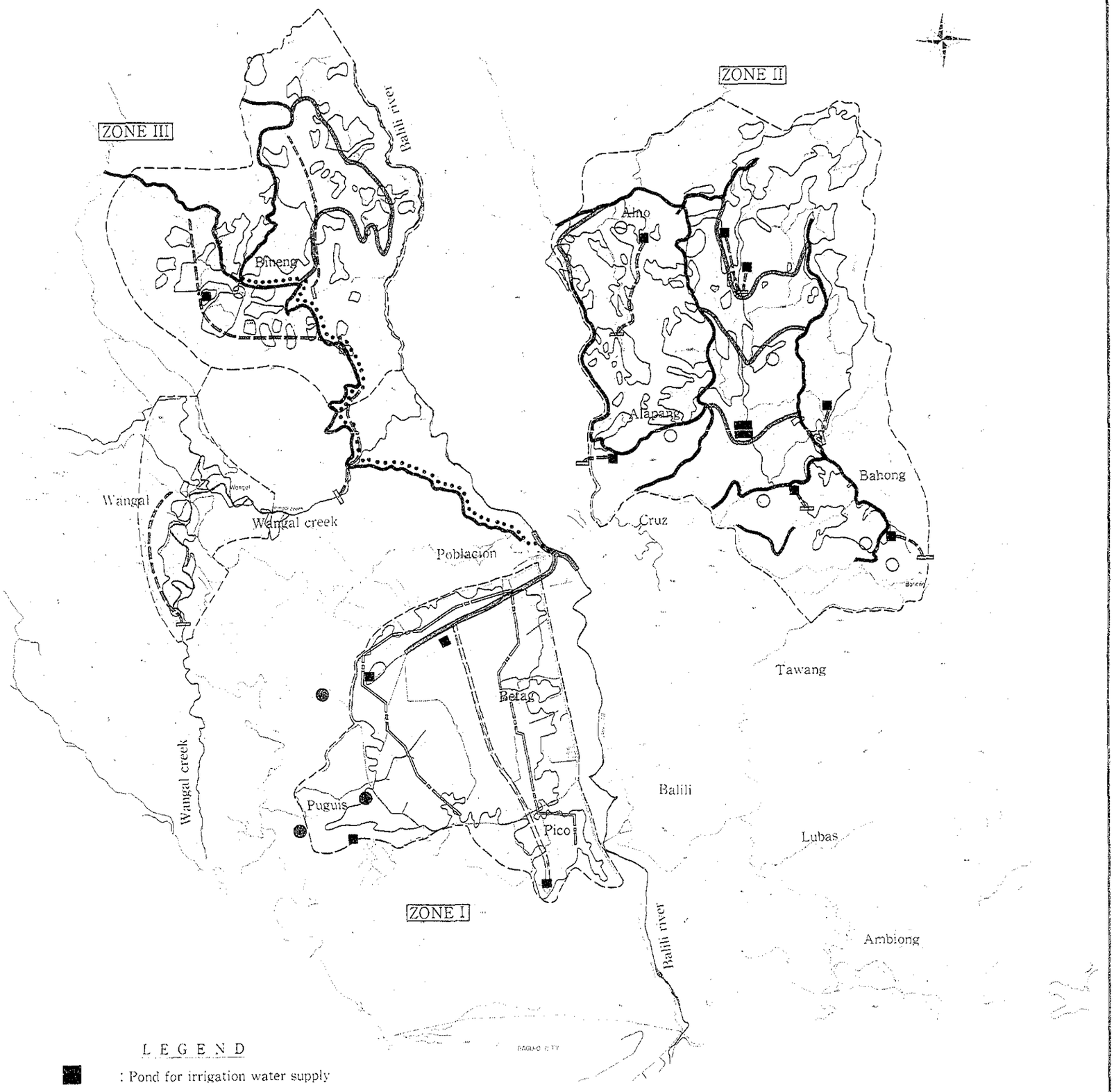
LEGEND

Project Area

AREA

Zone I	290 ha
Zone II	680 ha
Zone III	450 ha
Total	1420 ha

GENERAL PLAN OF THE PROJECT



LEGEND

- : Pond for irrigation water supply
- : Weir
- : Well for irrigation water supply
- : Irrigation canal (pipe)
- : Rehabilitation of road
- : Construction of road
- : Well for drinking water supply
- : Improvement of river
- : Improvement of creek
- : Sewage canal
- : Extension of electric wire
- : Agricultural land

Note : Seven Rural Community Centers are proposed in the Project Area.

Zone I : Puguis, Pico
Zone II : Bahong, Alapang, Alno
Zone III : Bineng, Wangal

0 500 1000 2000m

Scale 1:30,000

SUMMARY

INTRODUCTION

(1) This report is the "Final Report" on the "Feasibility Study (The Study) of the Highland Integrated Rural Development Project in La Trinidad, Province of Benguet".

(2) The Implementing Arrangement on the Technical Cooperation (I/A) for the Highland Integrated Rural Development Project in La Trinidad (HIRDP or the Project) was agreed between the Provincial Government of Benguet (PGB) and the Japan International Cooperation Agency (JICA) on March 13, 1987. In conformity with I/A, the Feasibility Study on HIRDP was carried out from July 1987 through August 1988.

(3) The objective of the Study is to formulate the Highland Integrated Rural Development Plan in La Trinidad for promoting highland agriculture and improving the living standards for the inhabitants in the rural areas in and around Municipality of La Trinidad (the Municipality) , Province of Benguet (the Province), the Philippines.

(4) The Study area covers about 5,000 hectares in and around La Trinidad Municipality, Province of Benguet, besides the Project area is 1,420 hectares of land in the Municipality.

BACKGROUND

(5) The Philippines has a total land area of about 300 thousand km^2 comprising approximately 7,000 islands and islets, extending geographically between 5° to 20° of Northern Latitude and 117° to 127° of Eastern Longitude. The total population was estimated in 1987 at about 57.4 million, and the average population density is 190 persons/km^2, the population growth rate in the five years from 1982 to 1987 is estimated at 2.5 percent. The total labor force in 1986 was 20.59 million persons while its employed ratio was 93.3 percent, of which 10.29 million persons or 50 percent were

engaged in the agricultural sector. The Gross National Product (GNP) in 1986 was 614.3 billion pesos (the per capita GNP was 10,982 pesos) with a growth rate of 3.3 percent over the previous year. The agricultural sector plays a dominant role in the Philippine economy, sharing 30 percent of the Gross Domestic Product (GDP), while the manufacturing sector has a share of 24 percent, the commercial sector of 16 percent, the service sector of 13 percent, and the other sectors of 17 percent, respectively.

(6) According to 1987 Year Book, the agricultural production in the Philippines is mainly as follows :

Crops	Harvested area (1,000 hectares)	Production (1,000 tons)
Rough rice	3,402.6	9,097.1
Shelled corn	3,544.7	3,922.0
Root crops	422.6	2,668.5
Beans & Peas	49.6	37.7
Vegetables	66.8	487.3
Sugarcane	355.9	2,135.3
Coconut	3,261.5	3,162.4

Although the demand and supply on rice production in the provincial level is in imbalance, self-sufficiency in rice production has been achieved at the nation-wide level. On the other hand, there exists a shortage in vegetable production in the country.

(7) In the Medium Term Philippine Development Plan (1987 - 92), four goals of the Philippine development efforts have been indicated. That is, (a) alleviation of poverty, (b) generation of more productive employment, (c) promotion of equity and social justice, and (d) the attainment of sustained economic growth. Agricultural and rural development has been given the highest priority in keeping with the goals. Development strategy of GOP is particularly insistent upon the implementation of the regional development projects, including the construction of small-scale, labor-intensive infrastructures such as rural road, communal irrigation system, school buildings and rural water supply.

(8) Based on the development strategy of GOP, PGB has identified that the need for the urgent formulation of the Highland Integrated Rural Development Project in the main vegetable producing area of La Trinidad. The Project area has a high agricultural development potential but remains less developed. The Project is aimed at the improvement of the infrastructure with the views to raising and stabilizing small-scale farmer's income, improving living standard and activating rural economy in the Project area. Since the Project area locates at the gateway to the prevailing highland agricultural region, the Project will contribute to the agricultural economy and the rural society in serving as a pilot model program to easily extend its valuable demonstrative effects over the entire areas in the Province.

(9) The total population of the Province was 408,973 in 1985, distributed in such a manner that 147,052 in the urban area and 261,921 in the rural area. The population density of the Province stood at 154 persons/km^2. The annual natural growth rate of 2.5 percent and immigration rate of 1.3 percent produced a 3.8 percent annual population growth rate in the Province. The monthly family income was 5,895 pesos and 2,600 pesos for the urban and the rural areas, respectively. The monthly family expenditure was 4,966 pesos and 2,432 pesos for the urban and the rural areas, respectively. The proportion of the income spent on food was 42.5 percent and the unemployment rate was 6 percent.

The 1985 population of the Municipality is estimated at 32,590. The total number of households in the Municipality is estimated at 5,149. The annual population growth rate between 1975 - 85 was estimated at about 3.7 percent. The number of farm household is estimated at 2,203 or 41.2 percent of the total households. The total land is 8,274 ha, and agricultural land is 1,839 hectares in the Municipality. The total planted area under vegetable and cut-flower cultivation is 1,844 hectares and 203 hectares, respectively.

PRESENT CONDITION OF PROJECT AREA

(10) The Project area is located in the Municipality of La Trinidad, Province of Benguet, comprising the southern part of the Cordillera Mountainous area, being connected to Manila (250 km) by the national highway network. The Municipality is the administrative capital of the Province. The Project area stretches between latitudes 16°27' N and 16°30' N and longitudes 120°34' E and 120°37' E, ranging from about 600 meters in the northern part of the area to 1,330 meters in the south. The Project

area with a total area of 1,420 ha comprises three (3) zones as : (i) the La Trinidad Valley as Zone I covering 290 ha ; (ii) the right bank of the Balili river as Zone II covering 680 ha ; and (iii) the left bank of the Balili river as Zone III covering 450 ha. The Project area covers 1,420 ha with gross agricultural land at 534 ha. The population of barangays concerned with the Project is 21,978. The members of the total household and farm household are estimated at 3,370 and 1,246.

(11) Zone I located in the Trinidad Valley is an intermountainous basin circumscribed by mountain ranges in the 1,500 meters class. The Balili river takes its course at the eastern edge of the basin, flowing in the south - north direction. The foot of Mt. Pico is drained by springs that give rise to the Bayabas, Pico, and Puguis creeks. These creeks eventually merge to form the Bolo creek which, in turn, empties into the Balili river, at national road bridge. The basin has an elevation of about 1,320 meters and slopes at a gradient from nought to three (3) degrees.

Silty loam and loamy sand of the La Trinidad Series extend over the flat to gently flat lands located on the lower portion of La Trinidad Valley. The soils are deep and well drained, but the lower elevated area is sometimes affected by flood in the wet season. The soils generally have high inherent soil fertility and are suitable for a vegetable growing. Vegetables are being cultivated using the water drawn from mountain streams, springs and the Balili river.

(12) Zone II is a area in a stretch of comparatively gentle slopes extended from Cruz - Alapang - Bahong to the Alno area, with an average gradient of about 18 degrees. The creeks in Zone II have a mountain range as their east - west divide. In the west , the Peril creek runs through the Alno Valley and eventually empties into the Balili river. The three creeks in the east, i.e., the Alno, Alapang, and Bahong creeks, are tributaried to the Payung river.

Silty loam and loamy sand of the Tacdian Series are found on gently slope and areas in Zone II. The land of these soils is moderately drained and is suitable for vegetable and cut-flower growing. Vegetables and cut-flowers are being cultivated using water drawn from mountain streams, springs and the Balili river.

(13) The topographic features of Zone III are the steep-sloping formations of the Bineng terrace. The Bineng terrace plains (El.920 - 980 m) consist of hilly areas and paddy fields oriented in the north-south direction. The Wangal terrace plains (El.1,200 - 1,300 m) located in the south of Zone III consist of hilly area and upland crop fields.

Loamy sand of the Puguis Series are found in hilly and mountainous areas in the Wangal area. The soil in this part has good drainage conditions and is suitable for vegetable and cut-flowers growing. Silty loam, loam and loamy sand of the Bineng Series extend over gently sloping land in the Bineng area. The soils here are terraced and planted with rice and vegetables.

(14) Meteorologically the Project area falls under Type I which is characterized by two pronounced seasons, the dry season from November to April and the wet season from May to October. It is a highland area of the Central Cordillera, frequently attacked not only by the northeast and southeast monsoon but also by annually around two typhoons.

Meteorological data (1951-1985) measured at Baguio PAGASA station are averaged as follows : Mean air temperature (Jan. : 17.8°C, May 20.5°C, Annual mean 19.3°C), Rainfall (Jan. 12.1 mm, Aug. 847.9 mm, Annual 3,562.9 mm), Rainy days (Jan. 4 days, Aug. 27 days, Annual 169 days), Relative humidity (Feb. 78%, Aug. 92%, Annual mean 84%), Annual mean atmospheric pressure 1,009 mbs. 89% of annual rainfall concentrates in the wet season from May to October, and monthly average rainfall in August goes up to 897 mm.

(15) Probable flood discharge of the Balili river (catchment area: 31.4 Km^2) was estimated at 254 m^3/sec by two(2)-year return period, 349 m^3/sec by five (5)-year return period and 498 m^3/sec by ten (10)-year return period. Monthly average discharge was estimated at 0.25 m^3/sec as minimum value in February and March and 8.51 m^3/sec as maximum value in August. Annual mean discharge was estimated at 2.74 m^3/sec.

(16) As the results of water quality tests on irrigation water, it was found that almost all creek water and groundwater has been contaminated by bacilli, but is quite harmless for irrigation use. The Balili river water was judged to be unsuitable for irrigation use

due to the high BOD, COD value above the limited content of crop growth even in the wet season. The surface active agent content showed maximum value permitted for crop growth, the more the river water will be contaminated by the domestic sewage in the upper reaches of the Balili river basin.

(17) Geologically, the Project area consists of tertiary sedimentary rock of meso- to neocene origin overgrown by a quarternary deposits of neocene origin and limestone rock formations. The sedimentary rock has conglomerates, sandstone, shale, and tuff. The quarternary deposits in the Trinidad Valley of Zone I reaches a thickness of 10 - 20 meters. The limestone rock formations can be found in Zone II and the conglomerates in Zone III. The Project areas also has a number of geological faults.

(18) Three (3) holes have been drilled to a total depth of 305 meters to investigate the possibility of groundwater development. Judging from the analyses of the well pumping tests, the yield capacity of one deep well was estimated as follows, by allowing for a safety margin in the evaluation:

1.	Zone I :	Kennon formation, Stockfarm (DZ-I)	: Q = 4.8 litter/sec
2.	Zone II :	Zigzag formation, Bahong (DZ-II)	: Q = 7.5 litter/sec
3.	Zone III :	Zigzag formation, Bineng (DZ-III)	: Q = 13.0 litter/sec

Based on the above, the required number of wells to meet the water demand in each Zone was determined.

(19) The temperature conditions of these areas are suitable for all-the-year round cultivation of temperate vegetables. The cropping calendar and cultivated zones in the Study area are mainly affected by excessive rainfall, strong wind, damage due to typhoons in the wet season, and shortage of irrigation water in the dry season.

In Zone I, strawberry occupies about 33% of the area. Roses are introduced with about 39% of the area in Zone II. In Zone III, wetland rice is cultivated about 43% in the wet season. Most of the other field is used for vegetables cultivation which is limited within 2-3 croppings a year due to the shortage of irrigation water.

(20) The main vegetables being grown are legumes such as string beans known as Baguio beans, garden peas, leafy vegetables such as Chinese cabbage, pechay, cabbage, lettuce, celery, green onions, cauliflower, broccoli, asparagus, fruit vegetables such as cucumber, eggplant, tomato, sweet pepper, strawberry, and tuber crops such as white potato, radish, taro, sweet potato, and carrots. The main cut-flowers produced in the Project area are roses, gladioli, chrysanthemums, dahlias, etc. Anthlium has also been introduced recently.

(21) The average annual total planted area and production of vegetables in La Trinidad for 1984 to 1987 is estimated at about 1,700 ha and 17,000 tons. The average annual cultivated area and production of rice is about 110 ha and 210 tons, respectively. Area and production of cut-flowers are 405 ha and 4500 thousand dozens in total. Prices of vegetables show a distinct seasonal pattern, higher from September to November and lower from January to April due to the relative seasonal availability of the products.

(22) Farm size in La Trinidad is mostly ranged from 0.70 to 0.91 ha. Amount of annual income is ranged from 24,800 to 41,200 pesos of which about 87% is derived from farm income. Expenditure for food accounts for about 50% of the total expense ranged from 21,600 to 33,600 pesos.

Net reserve, excluding total expenditure from total income, is ranged from 3,200 to 7,600 pesos/family. The poverty line of the income in the Philippines accounts for 28,600 pesos / family.year.

(23) The net land area of 343 ha under the beneficial area of 381 ha is being irrigated at a low level by drawing water from the nearby mountain streams, wells and springs, and from the Balili river.

Only approximately 45 percent or 155 ha (Zone I 90 ha, Zone II 65 ha) of the above land area is supplied with Balili river water while the remainder of 55 percent is topographically incapable of being supplied with river water from the Balili river.

In the wet season, the entire area is under cultivation with the surface irrigation due to abundant rainfall. In the dry season, however, natural water supplies run

extremely low so that water saving irrigation methods are applied aimed at maximum water conservation, even in the limited irrigable areas.

(24) Annual flooding of the Trinidad Valley in the wet season is a serious problem. It is caused by the inadequate Balili river's flow capacity in conveying a flood discharge so that it will inundate La Trinidad Valley's flat lands which are themselves not provided with adequate inland drainage systems.

(25) The existing rural roads in Zone II and III pass mainly along hilltop ridges and steep slopes. The steep road section with gradients more than 15 percent is 6.5 km which corresponds to 25 percent of the total road length 26.5 km. Every year, heavy rainfall in the wet season often causes serious damage to the rural roads and related facilities. For their maintenance work, roads on steep slopes, in particular, are surfaced with limestone materials which are easily near at hand. This invites problems of water erosion caused by rainfall, with resulting wheel slippage and skidding as the limestone dissolves and becomes slippery. Rural roads built on flat terrain are also inadequate for the traffic needs in the wet season due to insufficient drainage and a totally inadequate depth of the gravel paving.

(26) The authority responsible for the drinking and domestic water supply in La Trinidad is the La Trinidad Water District (LTWD). LTWD draws its water from a deep well of some 145 meters in depth. Only 34 percent of the total inhabitants (5,149 houses) of the La Trinidad Municipality are supplied from LTWD. This shortage of drinking and domestic water supply in the rural areas in the Project area is bound to create serious problems for solution.

(27) Many barangay communities still lack the proper facilities to permit the implementation of activities designed to expand the introduction of agricultural technology on a broader scale, improve health measures, and create opportunities for better social communication, including farmer assemblies. Nor is the supply of electricity assured for some rural areas of the Project area. This generates the urgent need to improve the inadequate socio-environmental living conditions and to activate the

rural economies by creating a better social infrastructure and upgrading the general socio-economic framework of these communities.

(28) In the surrounding residential areas in Zone I, stagnating waste water discharged by the residents considerably detracts from the living environment. Irrigation water and shallow ground water are also contaminated with the waste water. Constant garbage dumping has been found at several creeks in the Project area. This hinders the flowing function as well as living environment, and generates an urgent need to improve the environmental living conditions.

DEVELOPMENT PLAN

(29) The primary objectives of the Development Plan can be summed up as follows :

a. to promote agriculture based on the vegetable and cut-flower production as the principal type of crop best suited to the highland climate, land and soil conditions.

b. to increase the land productivity and enhance the labor productivity by providing agricultural infrastructure development for irrigation and drainage facilities, flood protection facilities, and rural road networks.

c. to raise the level of the farm income by way of ameliorating the farming system fitted with the provision of a better agricultural infrastructure and to achieve a greater stability of farm management through the strengthening and expanding of the support and service backup systems for the agricultural communities.

d. to improve a living environment base of the rural area through measures that will provide a more effective infrastructure with the establishment of more efficient drinking and domestic water supply systems, rural electrification facilities, sewage disposal systems, waste and refuse collection, etc. so as to rise the living standard in the rural area.

e. to adopt measures designed to develop high-quality water sources for irrigation purposes to benefit vegetable production. These measures should result in a higher quality of agricultural produce in the La Trinidad area so that the farmer can achieve a higher added value after

establishing a brand image of clean vegetables and thereby improve the family income. In particular, these measures should include the substitution of the current irrigation water supply from the Balili river by some alternative sources yet to be developed. This is of particular importance in view of the poor quality of the current water supply which is badly contaminated by sewage and drainage wastes from the Baguio City catchment area and the industrial wastes that are discharged into the Balili river from the factories and commercial enterprises in the Municipality of La Trinidad.

f. to create a sound socio-economic framework for the rural society though the provision of rural community centers (Barangay Halls) as a means of expanding the health and hygiene care services and promoting the introduction of more advanced agricultural and irrigation techniques and strengthening the communal irrigation organization, farmers' school and farmers' cooperative activities.

(30) It is proposed that the following components of the plan should be practically implemented to solve those problems that are impeding the development of the rural areas in the Project areas and to overcome major existing constraints.

1) Drainage improvement works (Zone I)

2) Irrigation improvement works including ponds, water tanks, wells & pumps and on-farm irrigation facilities (Zones I, II, III)

3) Sewage canal construction works (Zone I)

4) Rural road improvement works and new construction of farm-to-market roads (Zones II, III)

5) Drinking and domestic water supply facilities works (Zones II, III)

6) Rural community center construction works (Zones I, II, III), and

7) Rural electrification works (Zone III)

(31) Beneficial area concerning the agricultural development plan is estimated as follows :

(Unit : ha.)

Land category	Zone I	Zone II	Zone III	Total
Upland crop field	199 (159)	235 (152)	60 (40)	494 (351)
Lowland rice field	0 (0)	0 (0)	40 (30)	40 (30)
Total	199 (159)	235 (152)	100 (70)	534 (381)

Note) These figures exclude land acquisition for proposed roads and irrigation facilities. Figure in parentheses are net beneficial areas.

(32) The proposed cropping pattern has been carefully adjusted to obtain the maximum benefit without a big substantial change from the present cropping pattern prevailing in the Project area.

In Zone I, the main crops are strawberries and vegetables and an expansion of the planted area for vegetables has been planned as a result of the irrigation system improvement as well as the drainage improvement work. In Zone II, however, the main crop are roses and vegetables, and a larger planted area for vegetables has been projected due to the provision of a better irrigation system. Again, in Zone III, the main crops are rice and vegetables, and the planted area for vegetables has been expanded owing to the implementation of an improved irrigation network. The planted area is expected to increase to 301 ha after the completion of the Project.

(33) The average consumptive use in the cropping season has been calculated for the various crops, and the results indicate that strawberries consume water at a rate of 2.8 mm/day, vegetable 2.6 mm/day, and roses 3.2 mm/day in average. The paddy field water requirement was established at 6.4 mm/day in the wet season and 7.4 mm/day in the dry season. The water requirement for paddling the rice field has been estimated as 100 mm. The designed irrigation system efficiency has been given as 65 percent for dry fields and 85 percent for wet fields.

(34) To achieve the above proposed cropping pattern, it is proved technically and economically appropriate that the irrigation plan should be a combination of measures involving the following facilities :

Item	Quantity of proposed facilities
Intake facilities	8 intake weirs
	2 diversions
Diversion conduit	3,000 meters
Pond	11 nos. (68,500 m^3)
Lateral conduit	25,050 meters
Division box	120 nos.
Delivery conduit	30,000 meters
Water tank	595 nos.
Others	3 deep wells in Zone I
	1 regulating pond in Zone III
	Rehabilitation of Bineng CIS canal with intake weir

(35) It is considered appropriate that the improvement plan for the drainage system should involve excavation work on the Balili river and the Bolo creek and dredging work to normalize the cross-section of the Bayabas creek. For design purposes, the design discharge should be calculated on a probability with the scale of a five year return period.

The design discharge for the Balili river is given as 282.2 m^3/s prior to its confluence with the Bolo creek (with the drainage area of 26.6 km^2) and 349 m^3/s after its confluence with the Bolo creek. The design discharge for the Bolo creek is taken as 85.8 m^3/s (with the drainage area of 6.8 km^2). In he vicinity of the national road bridge over the Balili river, it will therefore be necessary to dig down the river bed by approximately 2 meters.

The Balili river required improvement work over a total length of 425 meters and a river bed width of 16 meters, with the side gradient of 1 : 2. The Bolo creek requires improvement work over a length of 1.4 km and a river bed width of 10 meters, the side gradient being 1 : 1.

(36) The plan for the rural road system is to improve the existing rural roads and to construct the farm to market roads in Zone II and Zone III where the maintenance work is not sufficient and the deterioration of the rural road is particularly bad in the Project area and to finally provided an organic whole of road network. Basically, it contributes to synthetically improve regional agricultural productivity and to accelerate the activation of social communication. The proposed road section is basically of a roadway width of 3 meters with a 0.5 meter shoulder on either side. The longitudinal profile form of the existing roads shall not be changed and be retained in its present form. With considerations of a serious constraint on a steep road route in the heavy rainfall region, the road has been designed with a durable concrete pavement and included the rehabilitation or upgrading of the related road drainage facilities.

The total road length due for improvement in Zone II is given as 13.9 km and the total length of new farm to market road is 5 km, the total being 18.9 km. The rehabilitation road length in Zone III is 8.7 km, the new farm to market road length 2.8 km, giving a total of 11.5 km.

(37) The development plan of drinking and domestic water supply has been established with the final target year being 1998 i.e., ten years hence for Zone II and Zone III where LTWD has no extension plan for the water supply. The planned total service population is estimated at 11,000. The average water consumption is 120 litters/capita.day for residences, 24 litters/capita.day for schools, and 1,000 litters/place.day for public facilities. In addition to these supply liabilities, the plan provides for water requirements for livestock, washing of agricultural produce, and spraying fungicide. Total water consumption was estimated at 1,670 m^3/day. Consequently, six(6) deepwells and one (1) deepwell with pumps have been proposed in Zone II and Zone III. respectively.

(38) The erection of transmission lines (6kms) has been planned to extend the electric power supply network from the existing power grid (Zone I) to Zone III which has no electricity supply at present.

(39) The plan envisages the operation of two garbage trucks to be stationed in the Municipality. These trucks are to provide a greater refusing handling capability in the Project area. The plans also tries to deal with the problem of sewage water being

discharged from the communities in Zone I and proposes the installation of a sewage canal of approximately 5 km length which is to empty into the Bolo creek. The Project assumes that the sewage canal is of a concrete drainage culvert type with a sewage handling capacity of 0.1 m^3/s.

(40) The development plan provides for the construction of seven (7) rural community centers in Pico, Puguis, Alapang, Alno, Bahong, Bineng, and Wangal to meet the requirement for multi-purpose buildings that can be used as a general forum for the community activities of the barangays, the propagation of a knowledge of public health care and hygiene education, and the extension service of appropriate technology on irrigated agriculture and training of farmers.

(41) It is envisaged under the plans that two four-wheel drive jeeps, one pickup, three motorcycles, audio-visual aids, and office machines and equipment will be allocated to the Project Office (HIRDP) which will be responsible for the execution of the Project in the future. The plan also includes the provision of meteorological observation and water quality test equipments at the above Project Office to ensure a more effective monitoring system for the gathering of meteorological/climatic data and the watching of the water quality of rivers, springs, and groundwater.

(42) A special HIRDP Project Section (HIRDP Office for the Agricultural Extension) shall be established within the Department of Agriculture of the Province for strengthening of the agricultural extension service. To help this Section to be more efficient and effective in its extension activities of agricultural technology, one four-wheel drive jeep, one pickup, three motorcycles, audio-visual aids, and agricultural implement will be provided.

(43) The main construction works laid down under the development plan can be summed up as follows on a zonal basis:

(1) Zone I		
a)	Drainage improvement works	
1)	Improvement of Balili river	425 ms
2)	Improvement of Bolo creek and Bayabas creek (Regulation gate : 1 place)	1,400 ms
3)	New flood canal of Bayabas	500 ms
4)	Road crossing box culvert No.1 & No.2 at Bayabas	2 sites
5)	Construction of a consolidation dam (CL = 20 m) and refuse inflow protection screen in front of Dinog Cave	1 set
b)	Irrigation facilities works	
1)	Improvement of Bayabas pond	1 site
2)	Construction of Puguis pond	1 site
3)	Construction of Buyagan pond	2 sites
4)	Construction Puguis (Gayadan) deep well works	
	(Q = 0.6 m^3/min)	1 site
	(Q = 0.3 m^3/min)	1 site
5)	Construction of Stockfarm deep well works (Q = 0.3 m^3/min)	1 site
c)	Inland pollution protection works	
1)	Construction of sewage canal	5,000 ms
2)	Provision of refuse dumping truck	2 units
d)	Rural community center works	
	Puguis Barangay	1 house
	Pico Barangay	1 house
(2)	Zone II	
a)	Irrigation facilities works	
1)	Construction of distribution facilities at outlet of Dinog Cave	1 set

2) Construction of ponds — 8 sites

Bahong No.1	Alapang No.2
Bahong No.2	Alapang No.3
Bahong No.3	Peril
Alapang No.1	Alno

3) Construction of intake facilities

Bahong intake weir	3 sites
Alapang intake weir	1 site
Alno intake weir	1 site

b) Drinking and domestic water supply system works

Bahong deep well and pump works	200 litters/min x 4 pump stations
Alapang deep well and pump works	200 litters/min x 1 pump station
Alno deep well and pump works	200 litters/min x 1 pump station

c) Improvement of rural road

Samuyao - Peril route	2.0 kms
Samuyao - Alapang route	1.1 kms
Camp Dangwa - Alno route	3.8 kms
Camp Dangwa - Sadag route	3.4 kms
Tomay - Bahong route	1.3 kms
Camp Dangwa - Mae Bahong route	0.7 kms
West Alno - East Alno route	1.6 kms

d) Construction of rural road (Farm to market road) works

North Sadag - East Alno route	1.5 kms
Sadag - East Alno route	1.6 kms
North Bahong - Alapang route	0.9 kms
West Alno - Peril route	1.0 kms

e) Rural community center works

Bahong Barangay	1 house
Alapang Barangay	1 house
Alno Barangay	1 house

(3) Zone III

a) Rural road improvement works

Capitol - Bineng - Japos	6.2 kms
Bineng - Boleweng	2.5 kms

b)	Construction of rural road (Farm to market road) works	
	Boleweng - Lower Bineng route	2.8 kms
c)	Irrigation facilities works	
1)	Bineng CIS improvement	
	Intake	1 site
	Existing canal	3.8 kms
	New canal	2.2 kms
	Division box	6 sites
2)	New intake facilities works	
	Wangal intake	1 site
	Bineng intake	1 site
3)	Regulating pond	1 site
d)	Drinking and domestic water supply system works	
1)	Bineng deep well and pump	200 litters/min x 1 pump station
e)	Rural community center works	
	Bineng Barangay	1 house
	Wangal Barangay	1 house
f)	Rural electrification works	
	Extension transmission line	6 kms
(4)	Equipments	
1)	Agricultural-extension equipments	Lump sum
2)	Agro-meteorology equipment	Lump sum
3)	Water-quality-test equipment	Lump sum
4)	Office equipments	Lump sum
	(vehicle, office machine, and so on)	

(44) For the implementation of the Project works hereunder, a Project Office shall be established under the organizational direction of the Provincial Governor. The Project Office shall undertake the responsibility for the practical execution of the construction of the Project.

The construction works under the Project shall be carried out on a three year time scale. In the first fiscal year, the detailed design shall be drawn up and construction works shall be executed in the second and third fiscal years.

(45) The total costs for the construction works amount to 301.3 million pesos (equivalent to 1,870 million yen on the basis of an exchange rate of 1 peso = 6.2 yen). The foreign currency portion is 175.2 million pesos (58.1 %) and the local currency portion 126.3 million pesos (41.9 %).

(46) After the completion of the construction works, the Project Office shall be re-organized to assume responsibility for the coordination of the operation and maintenance activities for the Project works. It shall also harmonize the activities between the operation and maintenance units responsible for the actual operation and maintenance tasks.

PROJECT EVALUATION

(47) The evaluation of the Project as a whole has been performed on the basis of a evaluation of the three productive project components directly generating benefits as a result of the provision and improvement of 1) irrigation, 2) drainage and 3) rural road. The proportion of the total costs of these three productive components to the overall Project costs amounts to approximately 70 percent. The economic benefit generated by them is estimated at 26.248 million pesos.

Breakdown of the above economic benefits is given below :

	(unit : million pesos)
Irrigation benefits	17.325
Drainage benefits	7.335
Rural roads benefits	1.588
Total	26.248

(48) The economic costs have been estimated as breaking down into an initial investment cost of 178.900 million pesos, operation/maintenance costs of 1.236 million pesos, and replacement costs of 8.925 million pesos.

Given a Project life of 35 years, the Economic Internal Rate of Return (EIRR) has been calculated from the above economic benefits and the economic costs as being

10.2 percent. The benefit/cost ratio (B/C) for the Project amounts to 1.25 at a discount rate 8 percent and the benefit-costs difference (B-C) as being 41.5 million pesos.

(49) Sensitivity analysis has shown that if the costs escalated by 10 percent, the result would be a EIRR = 9.4 percent and if the benefits were 10 percent less, the EIRR would fall to 9.3 percent. The impact of an overrun on the scheduled construction time by one year would be an EIRR of 9.7 percent.

(50) The above results substantiate the conclusion that the present plan is economically sound and feasible.

(51) Calculations of the farm households' financial ability to pay their liabilities have demonstrated that for an average farm household with farm size of 0.87 ha each in Zone I, the net reserves after the Project would be 48,400 pesos/year. For a typical farm household with farm size of 0.7 ha in Zone II, the post-project net reserves would be 29,800 pesos and for a farm household with farm size of 0.91 ha in Zone III, the net reserves would be 29,200 pesos. In view of this significant increase in net available income, it may be assumed that the farm household will be capable of meeting its financial obligations arising in connection with the water utilization works. It can therefore be anticipated that the present project will contribute to a major improvement in the economic position of the farm households in the Project area.

(52) The benefits accruing from the implementation of the Project will not only be directly measurable ones that show up in an economic evaluation. Rather, the Project is likely to result in various secondary or intangible benefits in terms of the favorable socio-economic impact which is bound to generate among the rural population and their economy. The principal spinoff effects of the Project may be described as follows.

1) increased supply of vegetables and cut-flowers to the Metro Manila and the other consumer market,
2) greater employment opportunities associated with the execution of the Project and job training effect,

3) rising in a farmer's feeling of happiness and stabilization of rural society as a results of the increased farm household income and increased valuation of the land,
4) improvement and expansion of existing local transport systems,
5) more convenient transportation and shorter commuting times for junior and middle school children due to the improved rural roads,
6) improved standards of public health and cost savings on the health services as a result of the secured provision of drinking and domestic water supply,
7) activation of the rural economies as a result of the electrification,
8) creation of a healthy, sanitary environment resulting from the installation of sewage canals and regular refuse collection, and
9) activating of rural society due to the provision of local community centers, reinforcement of the farmers' organization, advancement of rural cultural activities, enlightenment of the rural women to enhance their social standing.

CONCLUSION AND RECOMMENDATION

(53) Conclusion

The Highland Integrated Rural Development Project in La Trinidad outlined in this document has been drawn up on the base that the project should be implemented to meet the minimum improvement requirements in terms of providing a sound basis for agricultural production, rural life, and social organization as the essential pre-requisites to the development of the Project area.

The present Project therefore envision a bored variety of measures, including the provision of irrigation systems, the improvement of drainage facilities, the rehabilitation and upgrading of existing inadequate rural roads and the construction of new farm to market roads, the construction of drinking and domestic water supply facilities, the electrification of those rural areas which are not yet connected to the public grid, and the building of community centers.

As these components constitute organic related parts as a whole, the viability and effectiveness of the project will not be attained unless all of the above components are put into practice as a package.

It has been demonstrated that there are no particular technical problems preventing the execution of the construction works mentioned above and that the economic internal rate of return (EIRR) attains a level of 10 percent. In view of these findings it can be concluded that the Highland Integrated Rural Development Project in La Trinidad is technically sound and economically viable and therefore feasible.

It is therefore recommended that the preparation for the survey falling within the scope of the next phase of the Project should be commenced at the earliest possible opportunity.

(54) Recommendation Concerning the Next Phase Survey

The following important considerations should be borne in mind with respect to the design activities and construction works to be carried out under the next phase.

1) The Principal in connection with the execution of the present Project is the Provincial Government (Governor) of Benguet, and to ensure the smooth execution of the construction projects hereunder, a Project Office should be established and organized under the competence of the Provincial Authorities . Moreover, the scope of the construction works under the Project will encompass a multiplicity of tasks, including the establishment of irrigation systems, drainage facilities, construction of deepwells and pumping stations, improvement of poor existing rural roads and construction of new farm to market roads, as well as the building of rural community centers. It will therefore be of importance to enlist the full cooperation of the various administrative authorities concerned.

2) One of the most essential tasks of the above Project Office shall be the procurement of the land required for the construction and provision, and compensation of the land thus acquired. The Project Office will therefore be called upon to conduct and mediate consultation meetings and negotiations on the land acquisition and land compensation between the land owners and the representatives of the rural communities concerned.

3) The preliminary design work for the facilities and system proposed under the present Project plan has been carried out on the basis of a topographic map on a scale of 1/5,000. Consequently, the survey to be carried out in the next phase will involve the implementation of more accurate topographical

surveys for the civil engineering and designing, and of additional underground water investigations so that the detailed design can be completed.

(55) Recommendations for the Agricultural Support and Agricultural Extension Services

In order to ensure that the rural facilities to be provided under this Project exercise their beneficial effect at the earliest time, it is considered essential that organized steps should be taken in the manner detailed hereinbelow to reinforce the agricultural support and agricultural extension services.

1) Making every effort to keep in close mutual cooperation between the authorities responsible for the project execution and testing/ research, thereby assuring the smooth transmission information.

2) Establishment of Farmers' Irrigation Associations and Agricultural Cooperatives and strengthening their organization.

3) Expansion of credit service activities of the Agricultural Cooperatives.

4) To ensure that prices of agricultural produce are maintained at an appropriate level, production adjustments may have to be implemented on the basis of considerations concerning the supply and demand positions for agricultural crops at any given time.

REPUBLIC OF THE PHILIPPINES

FEASIBILITY STUDY

ON

THE HIGHLAND INTEGRATED RURAL DEVELOPMENT PROJECT

IN

LA TRINIDAD, PROVINCE OF BENGUET

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

(1) Acronyms

ACD	:	Agricultural Coordination Division
ADB	:	Asian Development Bank
BAI	:	Bureau of Animal Industry
BAS	:	Bureau of Agricultural Statistics (former BAE con)
BBEC	:	Baguio Buguias Experiment Center
BES	:	Baguio Experimental Station
BENECO	:	Benguet Electric Cooperative, Inc.
BFD	:	Bureau of Forest Development
BL	:	Bureau of Lands
BMGS	:	Bureau of Mines and Geo-Sciences
BSU	:	Benguet State University
BPI	:	Bureau of Plant Industry
CIDP	:	Communal Irrigation Development Project
CIDIP	:	Communal Irrigation Development and Implementation Program
CIP	:	Communal Irrigation Project
CIS	:	Communal Irrigation System
DA	:	Department of Agriculture
DBM	:	Department of Budget and Management
DOH	:	Department of Health
DLG	:	Department of Local Government
DNR	:	Department of Natural Sciences
DPWH	:	Department of Public Works and Highways
GOJ	:	Government of Japan
GOP	:	Government of Philippines
HARRC	:	Highland Agriculture and Resources Research Consortion
HIRDP	:	Highland Integrated Rural Development Project
HADP	:	Highland Agricultural Development Project
ICO	:	Irrigation Community Organizer
IOPS	:	Irrigation Organization Program Supervisor
JICA	:	Japan International Cooperation Agency
LTWD	:	La Trinidad Water District
LWUA	:	Local Water Utilities Administration
MA	:	Ministry of Agriculture
MAO	:	Municipal Agricultural Office

NCSO	:	National Census and Statistics Office
NFA	:	National Food Authority
NEDA	:	National Economic Development Authority
NIA	:	National Irrigation Administration
NPC	:	National Power Corporation
NPCC	:	National Pollution Control Commission
NPRCRTC	:	Northern Luzon Root Crops Research and Training Center
NWRC	:	National Water Resources council
OECF	:	Overseas Economic Cooperation Fund
PAGASA	:	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAO	:	Provincial Agricultural Office
PD	:	Presidential Decree
PGB	:	Provincial Government of Benguet
PIE	:	Provincial Irrigation Engineer
PIO	:	Provincial Irrigation Office
SEC	:	Securities and Exchange Commission
UPLB	:	University of the Philippines, Los Banos, Laguna
USDA	:	United States Department of Agriculture

(2) Abbreviations

mm	:	millimeter	kV	:	kilovolt
cm	:	centimeter	kW	:	kilowatt
m	:	meter	kWh	:	kilowatt-hour
km	:	kilometer	MW	:	megawatt
MSL	:	mean sea level	MWh	:	megawatt-hour
EL	:	elevation above MSL	GWh	:	gigawatt-hour
cm^2	:	square centimeter	%	:	percent
m^2	:	square meter	PS	:	horse power
km^2	:	square kilometer	C	:	centigrade
ha	:	hectare	m^3/sec, m^3/s	:	cubic meter per second
MSM	:	million square meter	pcpd	:	per capita per day
lit, l	:	liter (= 1,000 cm^3)	cm/sec, cm/s	:	centimeter per second
m^3	:	cubic meter	t/ha	:	ton per hectare
MCM	:	million cubic meter	ppm	:	part per million
GPM	:	gallons per minute	No(s), no(s)	:	number(s)
			SPT	:	standard penetration test
			ET	:	evapotranspiration
mg	:	milligram	P	:	percolation
g	:	gram	M & E	:	monitoring & evaluation
kg	:	kilogram	MFD	:	main farm ditch
t (ton)	:	1,000 kg	O & M	:	operation and maintenance
sec	:	second	US$	:	US dollar
min	:	minute	P	:	Philippine Peso
hr	:	hour	BCR	:	benefit cost ratio
yr	:	year	CIF	:	cost, insurance and freight
CY	:	calendar year	FOB	:	free on board
			IRR	:	internal rate of return
			NPV	:	net present value

CHAPTER I INTRODUCTION

1.1 Authority

This report is the Final Report on the Feasibility Study (The Study) of the Highland Integrated Rural Development Project in La Trinidad, Province of Benguet, drawn up in compliance with the Implementing Arrangement for the Technical Cooperation agreed between the Provincial Government of Benguet as the acting counterpart agency of the Government of the Republic of the Philippines and the Japan International Cooperation Agency, the Government of Japan, dated March 13, 1987. This report consists of three volumes ; Main Report, Appendixes and Drawings.

1.2 Background of the Study

The Government of the Philippines (GOP) has formulated its Medium-Term Philippine Development Plan (MTPDP) covering the period from 1987 to 1992 with the ultimate aim being to eradicate poverty and attain a better life for each and every philippino in an equitable and just society under the national development strategies, target and policies in various sectors. It has been decided that the goal should be to attain the development objectives, so that the GOP has exercised much greater efforts to execute these, by giving the highest priority to the promotion of agriculture and rural development to increase employment opportunities and incomes in the rural area.

The Provincial Government of Benguet (PGB) has thus decided to formulate an integrated rural development project for the main vegetable production base of La Trinidad near Baguio which has a high agricultural development potential but is still less developed. PGB subsequently made a request through GOP to the Government of Japan (GOJ) for technical cooperation for the envisaged project at the Annual Consultation Meeting in 1986.

As a result, the Implementing Arrangement on the Technical Cooperation (I/A) for the Highland Integrated Rural Development Project in La Trinidad (HIRDP or the Project) has agreed between PGB and JICA on March 13, 1987. The I/A is composed of the following three items :

Work I : Topographic mapping of the Study area on a scale of 1 : 5,000 with 1 meter contour line,

Work II : Data collection and field survey, and

Work III : Formulation of the Highland Integrated Rural Development Plan.

In conformity with I/A, the Feasibility Study on HIRDP was carried out from July 1987 through August 1988.

1.3 Objective of the Study

The objective of the Study is to formulate the Highland Integrated Rural Development Plan in La Trinidad for promoting highland agriculture and improving the living standards for the inhabitants in the rural areas in about 5,000 hectares land in and around La Trinidad, Province of Benguet, the Philippines.

1.4 Study Area

The Study area is about 5,000 hectares in and around La Trinidad, Province of Benguet, besides the Project area is 1,420 hectares land in La Trinidad Municipality.

1.5 Implementation of the Study

The topographic map by Work I was completed in December 1987 and fully utilized in the subsequent survey and study.

Work II was conducted in a series of (1) the 1st field survey in the wet season from June to September 1987 (2) home office work for data analyses and studies on survey results and preparation of the 2nd field survey and (3) the 2nd field survey in the dry season from January to March 1988.

The 1st field survey was carried out with a team consisting of 8 members with a leader and members in charge of Irrigation & Drainage, Meteo-hydrology, Geology & Hydrogeology, System design, Agriculture, Agroeconomy & Organization and Survey supervision, with the objectives of establishing what local conditions are like in the wet season and defining existing problem areas in term of agricultural, rural and social

development, in a fact-finding mission that took 72 days from July 21 to September 30, 1987.

The team prepared and submitted a progress report to PGB at the end of the field survey and discussed the necessary field survey to be continued by the counterpart team up to the 2nd field survey on September 25, 1988.

The analyses and studies on the collected data in the 1st survey period were conducted up to December 1987.

The 2nd field survey was carried out by a team consisting of 10 members with a leader and members in charge of Irrigation & Drainage, Meteo-hydrology, Geology & Hydrogeology, System design, Soil, Agriculture, Agroeconomy, Project evaluation, Survey supervision, with the objectives of establishing what local conditions are like in the dry season and defining problem areas in terms of agricultural, rural and social development, in a fact-finding mission that took 60 days from January 16 to March 15,1988.

The Study team prepared the Interim Report at the end of the 2nd field survey and submitted it to BPG for discussion on March 10,1988. With receipt of the comments on the said report, the Study team returned to Japan to complete the 2nd survey on March 15, 1988.

Work III was commenced by 9 team members with a leader and members in charge of Irrigation & Drainage, Meteo-hydrology, Geology & Hydrogeology, System design, Soil, Agriculture, Agroeconomy & Organization, Project evaluation and the draft final report was prepared as a result of the home office work. The draft final report was submitted to PGB by a team consisting of 4 members with a leader and members in charge of Irrigation & Drainage, Agriculture and Coordinator at the explanatory and discussion meeting which was held at the conference room of PGB on August 31 through September 2,1988. As a result of the meeting, the contents, proposals and recommendations of the draft final report have been agreed by PGB.

The final report was prepared by means of the refinement of the said draft final report and printed in October 1988.

1.6 Study Team

The composition of the Study team is shown in the following Table :

Composition of Study Team for HIRDP

Speciality	Name	1st Fiscal Year WorkII survey		2nd Fiscal Year Work III survey	
		the 1st Field Survey	Home Work	the 2nd Field Survey	Home Work
Leader	Masaharu Matsui	*	*	*	*
Irrigation & Drainage	Yoshimitsu Yukawa	*	*	*	*
Meteo-hydrology	Shuichi Matsushima	*	*	*	*
Geology & hydrogeology	Masao Okamoto	*	*	*	*
System design	Takahiro Kato	*	*	*	*
Agriculture	Akio Maeda	*	*	*	*
Agroeconomy & Organization	Akihiko Sasaki	*	*	*	*
Soil	Fumihiro Nagao	-	-	*	*
Survey supervision	Ryuichiro Watanabe	*	-	*	-
Project evaluation	Kenichiro Kondo	-	-	*	*

1.7 Counterpart Team and Local Government Personnel

PGB organized a counterpart team for FS / HIRDP for the 1st field survey period as follows :

1) Regular Counterpart Personnel

Position	Name	Organization
Team Leader	1. Atty. Gabriel Pawid Keith	Provincial Administrator
Coordinator	1. Bial Palaez	PPDO
	2. Teresita A. Fianza	PGO
Irrigation	1. Borromeo Melchor	PIE, NIA Benguet
	2. Patrick Concepsion	NIA, Benguet
	3. Leonardo Dimacje	NIA, Benguet
	4. Manolo G. Villano	BSU
Geologist	1. Guillermo G. Estabillo, Jr.	BMGS
Agronomist	1. Avelino Pistula	DA
Surveyor	1. Orlando Oidi	PASSO
Civil Engineer	1. Tuho Chapdian	PPDO
	2. Benedicto Abastilla	LTWD

	Position	Name	Organization
2)	Special Personnel		
	Agro-Economist	1. Mar Rondon	BAS
	Agronomist	1. Ben Ladilad	BSU
		2. Elmo Sano	BSU
		3. Macario Cadatal	BSU
	Meteorology	1. Carlito Montes	PAGAS
	Forestry, Land Tenure	1. Leonardo Acosta	BFD
	Marketing	1. Felipe Darang	NFA
	Civil Engineer	1. Richard Pacalso	Municipality of La Trinidad
		2. Leo Alhambra	DPWH
		3. Alex E. Balangcod	BPDO
	Drainage	1. Joseph Sage	U.S.PCV
3)	Secreterial Services		
		1. Daisy Leano	MMO
		2. Marilyn Cosalan	PGO
		3. Catherine Andrade	MMO
4)	Local Government Personnel		
		1. Late Hon. Bantas W. Suanding	Governor, POB
		2. Hon. Thomas B. Dampac	Vice Gonernor, POB
		3. Hon. Michael Cosalan	Board Member, POB
		4. Hon. Peter Fianza	- do -
		5. Hon. Leonardo Mayao, Jr.	- do -
		6. Hon. Pablo Guzman	- do -
		7. Hon. Pedro Depaynos	- do -
		8. Hon. Oswald Alvaro	- do -
		9. Hon. Geronimo Sales	- do -
		10. Hon. Lomino Kaniteng	- do -
		11. Mr. Cecil Digman	La Trinidad Mayor

PGB reorganized a counterpart team for FS / HIRDP for the 2nd field survey period as follows :

1) Regular Personnel

Position	Name	Organization
Team Leader	1. Atty. Gabriel Pawid Keith	PGO
Coordinator	1. Bial A. Palaez	PPDO
	2. Teresita A. Fianza	PGO
Irrigation	1. Borromeo Melchor	NIA, Benguet
	2. Patrick Concepsion	NIA, Benguet
	3. Manolo G. Villano	BSU
	4. Jubert Santos	NIA, Benguet
Geologist	1. Guillermo G. Estabillo, Jr.	BMGS
Agronomist	1. Avelino Pistula	DAF
	2. Paulino Santos	PAO
Agro-Economist	1. Lolita Bentres	BSU
	2. Julia Solimen	PAO
Surveyor	1. Orlando Oidi	PASSO
Civil Engineer	1. Tuho Chapdian	PPDO
Economist	1. Lolita Austria	PPDO
Soil Technologist	1. Roger Colting	BSU
	2. Magdalena Pandusen	BSU
Draftsman	1. Sonny Aluyao	MMO

	Position	Name	Organization
2)	Secreterial Services		
		1. Marilyn D. Cosalan	PGO
		2. Victoria B. Akia	PGO
		3. Lolita P. Sabo	PGO
		4. Meriam C. Eustaquio	PGO
		5. Clarita D. Prudencio	SPO
3)	Local Government Personnel (inaugulated local election on January 18, 1988)		
		1. Hon. Dr. Andres R. Bugnosen	Governor, PGB
		2. Hon. Robert Tinda-an	Vice Governor, PGB
		3. Hon. Cipriano Abalos, Jr.	Board Member, PGB
		4. Hon. Raul Molintas	- do -
		5. Hon. Jaime Paul B. Panganiban	- do -
		6. Hon. Manuel C. Cuilan	- do -
		7. Hon. John Haight	- do -
		8. Hon. Walter Carantes	- do -
		9. Hon. Balbalio Acay	- do -
		10. Hon. Leoncio Alangdeo	- do -
		11. Mrs. Edna Tabanda	La Trinidad Mayor

CHAPTER II BACKGROUND OF THE PROJECT

2.1 General Situation of National Socio-Economy

(1) The Philippines has a total land area of about 300 thousand km^2 comprising approximately 7,000 islands and islets, extending geographically between 5° to 20° of north latitude and 117° to 127° of east longitude. The total population was estimated in 1987 at about 57.4 million and the average population density is 190 persons/km^2, the population growth rate in the five years from 1982 to 1987 is estimated at 2.5 percent. The total labor force in 1986 was 20.59 million persons while its employed ratio was 93.3 percent, of which 10.29 million persons or 50 percent were engaged in the agricultural sector.

(2) The Gross National Product (GNP) in 1986 was 614.3 billion pesos (the per capita GNP was 10,982 pesos) with a growth rate of 3.3 percent over the previous year.

The agricultural sector plays a dominant role in the Philippine economy, sharing 30 percent of the Gross Domestic Product (GDP), while the manufacturing sector has a share of 24 percent, the commercial sector of 16 percent, the service sector of 13 percent, and the other sectors of 17 percent respectively.

As for the family income and expenditures in the year of 1985, the average for the country's total number of families of 9,847 thousand in 1985 was 31,052 pesos (US$ 1,678) of family income, 26,865 pesos (US$ 1,452) of family expenditures, and 4,187 pesos (US$ 226) of surplus.

In comparison with the rural and the urban family terms, the average amount of the total rural family number of 6,121 thousand was 21,875 pesos of family income, 19,397 pesos of family expenditures, while the average for the total number of urban families of 3,762 thousand was 46,127 pesos of family income and 39,134 pesos of family expenditures. Thus, the rural families have a living standard half or less that of the urban families.

In the Philippines that the poverty line is defined in terms of a monthly income required to satisfy almost 100 percent of the nutritional requirements and basic needs of a family of six. In value terms, the poverty line is estimated at 2,382 pesos for nation-wide families, 3,282 pesos for the National Capital Region (NCR), and 2,285 pesos

for the outside of NCR, or 2,912 pesos for the urban area, 2,066 pesos for the rural area.

The total number of families below the poverty line is estimated at 5,676 thousand which is about 59.3 percent of the Philippines families, comprising 44.1 percent in the NCR and 61.6 percent in the Outer NCR.

(3) According to 1987 Year Book, the agricultural production in the Philippines is mainly as follows :

Crops	Harvested area (1,000 hectares)	Production (1,000 tons)
Rough rice	3,402.6	9,097.1
Shelled corn	3,544.7	3,922.0
Root crops	422.6	2,668.5
Beans & Peas	49.6	37.7
Vegetables	66.8	487.3
Sugarcane	355.9	2,135.3
Coconut	3,261.5	3,162.4

(4) Agricultural production amounts to about 30 percent or more of gross export earnings, and is an important source of foreign exchange. Main exported agricultural products are coconut products, banana, pineapple, sugar and onions. On the other hand, imports of agricultural products are mainly cereals and cereal preparations, dairy products and some fruits and vegetables.

Also, the poverty reduction targets have been laid down in such a manner that the national poverty incidence will fall to 45.4 percent of total the number of families in 1992, especially, the rural poverty incidence is to decline from 63.7 percent in 1985 to 48.1 percent in 1992.

Annual average growth rates for the period from 1987 to 92 under the Plan are targeted to be GDP 6.9 percent, Agricultural sector 5.0 percent, Manufacturing sector 7.6 percent, Mining and quarrying sector 4.2 percent, Construction sector 16.5 percent, Electricity, gas, water sector 8.4 percent and Services 6.6 percent.

2.2 General Socio-Economic Situation of Region I (Ilocos)

(1) The Study area is within the jurisdiction of Region I, covered mostly by the mountainous area of North West Luzon, and composed of six provinces : Abra, Benguet, Ilocos Sur, La Union, Mountain Province, Pangasinan, and four Cities : Baguio, Dagupan, Laoag, and San Carlos.

(2) The total land area of Region I was about 21,568 km^2 with a regional population totaling 3,976 thousand in 1986. The annual population growth rate was 2 percent and the population density was counted as 185 persons/km^2. About 73.1 percent of the population was living in the rural area and the remainder in the urban area.

(3) The labor force was 1,446 thousand people, with a rate of employment of 96.4 percent, 57.1 percent of this employment level being accounted for by the agricultural sector.

The Gross Domestic Product of the Region I in the year of 1985 was 3,859 million pesos to which the agricultural sector contributed shared as high as 44 percent, the other industries 19 percent, the service sector 38 percent, and the trade sector 11 percent, respectively.

The average family income in Region I was 2,622 pesos per month in 1985 slightly higher than the nation average of 2,588 pesos per month.

The poverty line of the Region I was estimated at 2,376 pesos per month in 1985, and the number of poverty families was estimated as being 52 percent of all families (365 thousand) in the Region I. It is indicative that the proportion of poverty families in the urban area is 56 percent of the total of 90 thousand families but that in the rural area is 51 percent of the total 275 thousand families.

(4) The major areas of agricultural production (1985) in Region I were as follows:

Crops	Harvested Area 1,000 hectares	Production 1,000 tons
Rice	390.4	1,220.9
Corn	32.4	80.6
Vegetables	72.4	733.5
Beans and Peas	23.7	224.5
Root crops	14.6	151.0
Fruits	32.1	333.9
Tobaccos	28.8	31.4
Cotton	1.2	1.4

Source: Medium Term Ilocos Region Development Plan; (1987-1992)

One of the characteristics of agricultural production in Region I is the extensive vegetable cultivation that takes advantage of the cooler mountainous climate. Especially, productions of mustard, potatoes, cabbage, Chinese cabbage, and garlic have occupied more than 50 percent of all the Philippines output.

Among the Provinces in Region I, the Province of Benguet is regarded as a relatively advanced vegetable production base conveniently located near to the big consumption city of Metro Manila.

(5) Within the entire regional farmland of 691.5 thousand hectares, the cropped area was 549.9 thousand, with the irrigated land being 191.3 thousand hectares, including 56.4 thousand hectares under the National Irrigation System, 123.8 thousand hectares under communal irrigation systems and 11.1 thousand hectares under pump irrigation systems. The rainfed rice field area was 231.9 thousand hectares and the rainfed upland field area was 126.7 thousand hectares. (source : the same in (4))

(6) The strategies adopted for the agricultural development of Region I indicated in the Medium-Term Regional Development Plan (1987 - 92) are as follows:

1) Intensified and expanded land cultivation and crop production through the maximum utilization of the given pieces of land and potentially productive idle land to increase the agricultural productivity and farm family income,

2) Improved and expanded livestock production through the improvement of breeding stocks and the development of pasture areas,

3) Improved and expanded fishery production,

4) Forestry resources development,

5) Improved cropping mix and farming system,

6) Equitable and simultaneous agricultural development of lowland and highland Provinces,

7) Improved land ownership and land management system,

8) Improved marketing and pricing policies,

9) Improved extension and research,

10) Improved delivery and utilization of credit resources and other farm inputs,

11) Irrigation development, and

12) Institutional development

Under the said Plan, the average farm income level is due to be raised to 3,902 pesos on a regional basis and 5,538 pesos on a provincial basis for the whole of the Province of Benguet.

2.3 General Socio-Economic Situation in the Province of Benguet

(1) The Project area is located in the administrative area of the Province of Benguet (the Province) comprising the southern part of the Cordillera Mountainous zone in the North Luzon Island, situated within an area between 16°11' to 16°56' in the north latitude and 120°12' to 120°54' in the east longitude.

The Municipality of La Trinidad, where the Provincial Government is founded, geographically located on the north latitude 16°28', the east longitude 120°35', EL. 1310 m above sea level, with Baguio City on the north latitude 16°25', the east longitude 120°35' and EL. 1,500 m above sea level, bordering in the south.

(2) The Province has a total land area of about 2,550 km^2, surrounded by the provinces of Mountain Province and Ilocos Sur in the north, Ifgao and Nueva Viscaya on the east, Pangasinan on the south.

There are 13 municipalities in the Province, that is, Atok, Bakun, Bokod, Pugius, Itogon, Kabayan, Kapangan, Kibungan, La Trinidad, Mankayan, Sablan, Tuba, Tublay. The municipalities are subdivided into 138 barangays.

(3) The Province is characterized by an undulating and irregular topography in the mountain range zone with elevations from 300 m to 2,700 m, and farming activities are conducted on the terraced fields supported by stone masonry works on the sloped terrain or in the valleys. About 70 percent of the total land is covered by forests. The gentle land with slopes up to 18 percent (10.2°) which is suitable for agriculture is only 1.8 percent. The sloped land more than 30 percent (16.7°) occupies 93 percent of the total area.

(4) The agricultural land area is 47,167 hectares in the Province. The arable land area is equivalent to 98 percent of the agricultural land. The irrigated land is 5,184 hectares with 5,024 hectares of the communal irrigation area and 160 hectares of the pump irrigation area, the rainfed rice field area is 14,179 hectares, the rainfed upland field area is 26,889 hectares, respectively.

(5) Agricultural production in the Province as of 1985 was as follows:

Crops	Cultivated Area hectares	Production tons
Rice	7,694	12,822
Corn	200	200
Vegetables	21,675	297,597
Beans and Peas	200	134
Root crops	3,500	60,025
Fruits	732	5,713

Source: Medium-Term Ilocos Region Development Plan 1987 - 1992

(6) The total population of the Province was 408,973 in 1985, distributed in such a manner that 147,052 in the urban area and 261,921 in the rural area. The population density of the Province stood at 154 persons/km^2. The annual natural growth rate of 2.5 percent and in-migration rate of 1.3 percent produced a 3.8 percent annual population growth rate in the Province. The monthly family income was 5,895 pesos and 2,600 pesos for the urban and the rural areas, respectively. The monthly family expenditure was 4,966 pesos and 2,432 pesos for the urban and the rural areas, respectively.

The proportion of the income spent on food was 42.5 percent and the unemployment rate was 6 percent.

The titled private land was 493.57 km^2, while about 81 percent of the land surface area was under public forest land in 1985.

(7) The level of food production to meet the food requirements for the forecast population of the entire Benguet in the year 2000 is 428.8 thousand, estimated on the basic unit nutrient requirements (kg/year) as the target as follows:

Food	kg/y	tons	Food	kg/y	tons
Grain	(109.20)	46,829	Sugar	(30.66)	13,148
Root crop	(60.59)	25,983	Vegetables	(54.75)	23,478
Citrus	(76.65)	32,870	Meats	(33.13)	14,207
Milk & Dairy P.	(24.42)	10,472	Eggs	(3.98)	1,700
Fish	(30.66)	13,148	Legumes	(6.3)	2,701

Source: Benguet Provincial Multi-year Human Settlement Plan (1984 - 2000)

It is expected that the Province will be self-sufficient in the production of root crops and vegetables while grains, sugar and fish will fall short of the above figures because of the existing constraints such as rice field availability, the cold water from the spring, low temperature, low light intensity, etc.

(8) In order to upgrade the physical, intellectual and economic conditions of the Benguet populace, the following development objectives to ensure sufficient food supplies have been envisioned:

a. Increase the productivity level for all crops,

b. Maintain self-sufficiency in root crops and vegetable output,

c. Attain self-sufficiency in the cereal, fruit and meat production, and

d. Encourage production of non-traditional export products, i.e. citrus products.

The detailed targets have been indicated as listed as below:

a. To increase the productivity factor in all areas of food production from 36 - 88 percent in 1984 to 65 - 95 percent in 1990 and 85 - 100 percent in the year 2000, the standard production factors given as 100 percent level are shown in terms of unit production per hectare: i.e. irrigated rice 90 cavans; rainfed bunded rice 60 cavans; rainfed unbunded rice 41 cavans; rainfed unbunded corn 28 cavans; root crop 16 tons; leafy vegetables 25 tons; root vegetables 18 tons; fruit vegetables 30 tons; legumes 8 tons; citrus 8 tons; rainfed unbunded banana 10 tons,

b. To double the 1984 livestock production in 1990 and to double the 1990 livestock production in the year 2000,

c. To aim for and maintain a lined rate of increase of 38.3 tons per annum from 1984 to 2000,

d. To shift 2,182 hectares of the root crops area to rice production in 1990 and additional 500 hectares in the year 2000,

e. To convert 1,652 hectares of root crop areas and 500 hectares allotted to legumes to citrus production for export i.e., Washington label seedless oranges, Satsuma lemon, Kalamansi, and Kalamandarin in 1990 and additional 343 hectares from the rootcrop areas in the year 2000,

f. To construct more irrigation facilities in agricultural areas and to rehabilitate all existing irrigation systems as the need arises,

g. To provide loan assistance to the livestock and poultry raisers;

h. To call upon the Ministry of Agriculture and Food to provide farmers' development instruction sessions training / classes on technology dissemination / transfer to upgrade skills, knowledge and attitudes; and

i. To coordinate with the Benguet State University in La Trinidad, regarding the propagation of technology as well as input requirements for citrus production for the export market.

(9) The PGB has recognized the need for improvement and development of both the agricultural-production-infrastructures and the rural-life-infrastructures as the fundamental and essential means to achieve the objectives and targets by the year 2000, and formulate the necessary development investment programs for six years from 1987 to 1992, requesting the procurement of funds to the Central Government through the offices of Region I.

The main components of the programs are, (a) the improvement of the road network through the rehabilitation or construction of rural roads, (b) the development of irrigation water sources and the improvement of the irrigation systems, (c) the construction of drinking and domestic water supply facilities, (d) the expansion of the communication service networks, (e) the electricity development, (f) the expansion and construction of the public facilities. The total budget amounts to be made available under the program was given as an impressive 2.25 billion pesos. The infrastructures allowed for in the budget is 97.57 percent, which is expected to be supported mostly by the Central Government's development fund.

The PGB routine budget was very small, amounting to only 34.60 million pesos and covering the administration cost, the operation and maintenance costs for the Provincial properties, the education costs, etc. in 1986. The O & M costs for the provincial roads was 570 thousand pesos.

(10) The PGB identified the Project area as an important highland vegetable production base and recognized the necessity for the enhancement of agricultural productivity and farming income through the alleviation of the existing damage due to poor drainage, improvement and construction of rural roads, irrigation development, and expansion of dry season cropping, construction of drinking and domestic water supply facilities, construction of social facilities for multi-purpose use on the Barangay level, etc.

The Project will also contribute to the provision of a greater and more significant impetus to activate the agricultural and rural economy in serving as a pilot development program that, hopefully, will spin off into other value-creating activities to benefit the Province as a whole.

CHAPTER III PRESENT CONDITION OF THE PROJECT AREA

3.1 Location

The Project area is located in the Municipality of La Trinidad, Province of Benguet, with a total area of 1,420 ha (see PROJECT MAP). La Trinidad is the administrative capital of the Province of Benguet being connected to Manila (250 km) and San Fernando, La Union (50 km) by the national highway network. The Project area stretches between latitudes 16°27' N and 16°30' N and longitudes 120°34' E and 120°37' E. Elevations, which range from about 600 meters in the northern part of the area to 1,330 meters, have a major influence on climate and make the Project area as a temperate climate vegetable producing area. The Project area comprises three Zones as : (i) the La Trinidad Valley as Zone I covering 290 ha ; (ii) the right bank of the Balili river as Zone II covering 680 ha ; and (iii) the left bank of the Balili river as Zone III covering 450 ha.

3.2 Administrative Jurisdiction and Population

The Project area of Highland Integrated Rural Development Project (HIRDP) falls under the administrative jurisdiction of La Trinidad Municipality (the Municipality), Province of Benguet (the Province). Provincial Governor, Provincial Board Member, Municipal Mayor, etc. are elected by the local election. Barangay is the individual unit of an administration and is subdivided into sitios. The Project area comprises ten (10) barangays and 93 sitios as follows :

Project Area	Barangay	Number of Sitios
1) Zone I	Poblacion	4
	Puguis	8
	Pico	12
	Betag	4
2) Zone II	Alapang	12
	Alno	25
	Bahong	9
	Tawang	7
3) Zone III	Bineng	6
	Wangal	6
Total	10 Barangays	93 Sitios

The 1985 population of the Municipality (8,270 ha) is estimated at 32,590 comprising 50.5 percent of male and 49.5 percent of female. As for the age distribution in 1985, the young-age group population (age 0 - 29 years old) is the biggest age group and accounts for 70 percent of the total population. The number of families and households in the Municipality is estimated at 6,160 and 5,149, and the average family size at 5.3 persons. The annual population growth rate between 1975 - 85 was estimated at about 3.7 percent. Population density is 394 persons per square kilometer which is higher than that of the Province (153 persons per square kilometer). The number of farm household is estimated at 2,203 or 42.8 percent of the total households. Basic socio data i. e. , land area, farm area, population, etc. on 10 barangays in the Project area are given in the following table.

Barangay	Land Area	Farm Area	1985					
			Population	Family	House -hold	Farm Family	Farm Household	Farm Size per Farm Household
Zone I								
Poblacion	197.6	51.1	3,663	704	607	100	86	0.59
Puguis	940.8	171.9	2,403	436	402	145	134	1.29
Pico	733.0	52.5	5,457	1,091	815	297	222	0.24
Betag	167.5	4.1	2,505	531	261	125	61	0.07
Sub-total	2,038.9	279.6	14,028	2,762	2,085	667	503	0.56
Zone II								
Alapang	143.8	49.7	1,697	265	229	146	126	0.39
Alno	1,012.8	232.2	1,043	190	169	152	135	1.72
Bahong	410.0	60.0	2,010	372	348	186	174	0.34
Tawang	855.9	30.9	1,589	275	261	124	118	0.26
Sub-total	2,422.5	372.8	6,339	1,102	1,007	608	553	0.67
Zone III								
Bineng	693.1	183.5	718	156	125	109	87	2.10
Wangal	1,113.4	64.1	893	187	153	126	103	0.62
Sub-total	1,806.5	247.6	1,611	343	278	235	190	1.30
Total	6,267.9	900.0	21,978	4,207	3,370	1,510	1,246	0.72

3.3 Topography

3.3.1 General

The topography of the Project area is characterized by the presence of plains, gentle slopes, and terrace plains. Agricultural land areas have been developed in the reclaimed mountain parts located mainly along the Balili river

The Balili river rises from the Baguio District and flows through the Project area. After the Balili river has merged with the Payung river, it assumes the new name of the Trinidad river which later becomes the Naguilian river farther downstream. The Naguilian river finally empties into the Lingayan Gulf facing the South China Sea.

The Project area is totally encircled by mountain ranges : the Longlong-Pico-Mt. Busol (El. 1,500 - 1,700 m) mountain range in the south, the Mt. Busol-Tomay-Talingtin range in the east, the Longlong-Timay-Sadiatan range in the west, and the Alno-Boleweng slopes (El. 600 - 900 m) in the north.

Topographically, the Project Area can be divided into three (3) zones : Zone I located in the Trinidad Valley (El. 1,310 - 1,320 m), Zone II constituted by the Bahong-Alapang slopes (El. 1,100 - 1,230 m), and Zone III formed by the Bineng and Wangal terrace plain (El. 920 - 980 m).

3.3.2 Topography of each zone

(1) Zone I

The Trinidad Valley is an intramountainous basin circumscribed by mountain ranges. The Balili river takes its course at the eastern edge of the basin, flowing in the south - north direction. Zone I has a surface area of approximately 2.9 Km^2 and slopes at a gradient from nought to three (3) degrees. The upland areas along the national road circumfusing Zone I have seen a gradual conversion to residential development.

Mt. Pico Chain (El. 1,571 m), sloping at a steep gradient, are a limestone formation and extend from the east to the west of the valley. The foot of Mt. Pico is drained by springs that give rise to the Bayabas, Pico, and Puguis creeks. These creeks eventually merge to form the Bolo creek which, in turn, empties into the Balili river. The western part of the valley is flanked by an elevated formation known as the Ampasit Hills (El. 1,370 - 1,450 m) which form the watershed of the Wangal creek.

The eastern part of the valley is contoured by the mountain slopes of Mt. Busol (El. 1,715 m) drained by three (3) creeks, known as North Ambiong, Lubas, and Tawang. Embedded in a limestone formation, these creeks dry up and vanish completely in the dry season. In the northern part of the valley, three (3) mountains, i.e., Mt. Buyagan (El. 1,462 m), Mt. Bagto (El. 1,439.4 m), and Mt. Bagto (El. 1,439.4 m), force the Balili river to change course.

(2) Zone II

Zone II is marked by a stretch of comparatively gentle slopes extending from Cruz - Alapang - Bahong to the Alno area, with big limestone formations, rock erosion, and cliff in certain parts. The average gradient of these slopes is about 18 degrees. Those areas which dip at a steeper angle of 24 degrees account for roughly 30 percent of this zone.

The creeks in Zone II originate in a mountain range located at the south of Zone II. In the west, the Peril creek runs though the Alno Valley and eventually empties into the Balili river. The creeks in the east, i.e., the Alno, Alapang, and Bahong creeks, are tributed to the Payung river. The Alapang creek takes its origin from the Dinog Cave, a creek in huge limestone formation that is fed with the overspill from the Balili river. This cave firms the only water source available in Zone II during the dry season. The area along these creeks presents land slide and surface erosion problems in certain parts.

(3) Zone III

The topographic features of Zone III are the steep-sloping formations of the Sadiatan and Bineng (El. 920 - 980 m). The sloping terrains having an angle over 24 degrees account for 55 percent, and the terrains inclined at angles between 12 to 24 degrees account for 30 percent of the land area of Zone III. The terrace plains consist of hilly areas and paddy fields oriented in the north-south direction.

The Boleweng creek cuts its way though the western edge of the terrace and turns toward the north. The Wangal creek rises from Mt. Longlong (El. 1,450 m), and initially takes a northbound course. The Wangal creek is joined by the Sadiatan creek, its tributary, in the lower Wangal reaches. From this point, the river changes course toward the east and changes its name to become the Gayasey creek which eventually empties into the Balili river.

3.4 Meteorology and Hydrology

3.4.1 Climate

Meteorologically the Project area falls under Type I which is characterized by two pronounced seasons. One is the dry season affected by the northeast monsoon from November to April and the other is the wet season affected by the southwest monsoon from May to October. It is in a highland area of the Central Cordillera, and frequently attacked by typhoons. Generally during the wet season, annual rainfall on the area is very high and reached above 3,500 mm on an average, so that this is a high-rain region well-known in the world in meteorological terms.

3.4.2 Meteorology

Meteorological stations in and around the Project area are the Baguio station (EL.1,501m) and BSU station (EL.1,344m), which are being operated by the National Institute of Climatology : PAGASA. The Baguio Station was established in 1949, and its observed data are available for the most of general climatic elements. The BSU station was established in 1977 and mainly deals with the observation of the agrometeorological elements. Annual mean temperature at the Baguio Station is 19.3°C, considerably lower than 27.3°C of the Manila Station. Hence, its cooling rate is estimated at 0.54°C per 100 m rising of the altitude.

According to the average of observed data at the Baguio Station for 1951-1985 period, mean air temperature : °C(Jan.=12.1, May=20.5, Annual=19.3), rainfall : mm(Aug.=847.9, May-Oct.=3,175, Nov.-Apr.=387.8, Annual=3,562), rainy days (Jan.=4, Aug.=27, Annual=169), thunderstorm days (May-Oct.=79, Nov.-Apr.=15, Annual=94), relative humidity : %(Feb.=78, Aug.=92, Annual mean=84), mean atmospheric pressure : mbs(Jan.=1012.1, Aug.=1006.2, Annual=1010.9)

Correlation coefficients of rainfall among twelve stations located adjacent to the Project area were computed. According to the result, only the Baguio station shows a significant correlation with the BSU station in La Trinidad (r=0.97). The comparison of rainfall data observed at the stations installed by JICA in 1987, shows a good correlation with rainfall occurrence, but rainfall quantity varies locally.

Annual evaporation measured by the open pan is 1,080 mm at the Baguio station. The potential evaporation estimated by the Penman method gives a good approximation to the measurement.

Data of both stations have outlined in Table 3.4.1.

3.4.3 Hydrology

Only runoff data from the Mamatling station on the Naguilian river among the existing five stations concerning with the Project area, have been hydrologically correlated with rainfall data at the Baguio station. Runoff data at the station are summarized as follows:

(Averaged for the period from 1949 to 1970)

River name	Gagging Station	Established year	Catchment area (km^2)	Annual average (m^3/s) Peak Dis.	daily max.	daily mean	daily min.
Naguilian	Mamatling	1946-1972	304	1,321.66	719.37	29.76	1.95

Two automatic water stage gages and five water stage staffs were installed in the creeks flowing into the Project area, and observation of water stage and current measurements were continuously carried out.

Runoff analysis for the Balili river was conducted in accordance with the observed data. The results analyzed with the Tank model method are summarized below:

(Averaged for the period from 1977 to 1987)

Annual average ($m^3/s/Km^2$) daily max.	daily mean	daily min.	Annual runoff (MCM)	Annual runoff ratio (%)
1.585	0.088	0.0064	2.776	77.3

Monthly average of estimated runoff by the analysis is shown as follows :

(Averaged for the period from 1977 to 1987)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
0.010	0.008	0.008	0.014	0.082	0.119	0.182	0.271	0.195	0.081	0.063	0.017

No flood records for the Balili river have been obtained so far. Flood analysis by the Kinematic Wave method was carried out with probable rainfall intensity curves, with the reference observed hydrograph at the tributary of the Balili river.

According to the analysis, probable flood discharge of the Balili river at 31.4 km^2 catchment area was decided as follows :

(Unit : m^3/s)

Return period	Provable flood discharge of Balili river
2 years	254
5 years	349
10 years	498
20 years	577
30 years	612
50 years	679
100 years	771

3.5 Water Quality

Sixteen sampling sites, i.e., two at the Balili river, seven at small streams, seven at springs and existing wells, were specified in the Project area, and water quality tests were carried out essentially once a month.

Results for major components are summarized as follows :

Subject	BOD	COD	T - N	Heavy metals	Bacilli
Balili river	16 - 34 16 - 55	19 - 23 19 - 53	10 - 18 8 - 10	Undetected	Contaminated
Bolo creek	19 - do -	5 - 15 - do -	1 - 3 4	Undetected	Contaminated
Creeks in the Study area	2 - 5 - do -	2 - 6 - do -	0 - 0.8 - do -	Undetected	Contaminated
Springs and wells	0 - 5 - do -	0 - 3 - do -	0 - 2 - do -	Undetected	Partly contaminated
Dinog cave	12 - do -	1 - 8 - do -	- -	Undetected	Contaminated

Upper : Wet season
Lower : Dry season

According to an authorized water quality guideline, irrigation water had levels above 6 ppm of BOD or COD, and above 5 ppm of T-N, thus constituting a growth impediment for crop plants.

The Balili river water is judged to be unsuitable as an irrigation and domestic water source on the basis of the results observed even in the wet season.

In the upper reaches of the Balili river from La Trinidad, a sewage plant constructed in 1986 by a grant aid project from the Japanese government, has been in operation. The sewage plant will have a certain effect. However, improvement of water quality of the Balili river due to the plant is not intensive enough to permit the river water to be used for irrigation.

As for the Dinog cave, which is a major irrigation water source in Zone II, the water in this site is somewhat contaminated because of seepage of the Balili river water.

Almost all creeks in the Project area have been contaminated by bacilli. This has therefore been disqualified for domestic use, but is quite harmless for irrigation use.

3.6 Geology and Hydrogeology

The Project area comprises three zones, namely, Zone I, Zone II and Zone III. Zone I is the flat land of the Trinidad Valley surrounded with bare or rocky hills, Zone II is located on the steep sloping land northwest of Zone I. Zone III is composed of the sloping land along the Wangal creek and the gently sloping land in the left bank area of the Balili river to the northwest of Zone I.

The major river is the Balili river which is flowing along the east margin of the Trinidad Valley and the Gayasey creek (the downstream of the Wangal creek) which merges into the Balili river 2 kms north of Zone I. The Alapang creek runs to the north and conveying the Balili river water through the Dinog Cave (Dinog Tunnel). It merges into the Payung river flowing along the northern outskirts of the Study area, and after its confluence with the Balili river, flows west into the South China Sea.

The Study area consists of Quaternary deposits and the Teritiary sedimentary rock. The Quaternary deposits in the Study area can be classified into the alluvium forming the Trinidad Valley and the Talus deposits distributed on the marginal parts of the limestone zone. Geological map in the Study area is shown in Fig.3.6.1.

Regarding the Alluvium in the Trinidad Valley, its thickness ranges from 10 to 20 meters, and the permeability of the Alluvium is generally impermeable to semi-permeable. The free groundwater table varies within a range less than 7 meters depth from the ground surface. There are two flow line patterns i. e., one runs directly to the Balili river, and the other gathers at the free Swamp and finally runs out to the Balili river.

The Talus deposits developed from the limestone is mainly distributed with a thickness of more than 5 meters on the foot of the hills in Zone II. Its permeability is high and water is not stored inside the rock in the dry season.

The Tertiary sedimentary rock comprises the Kennon formation of the Upper Miocene, which is mainly composed of limestone, and the Zigzag formation, which is composed of sandstone, conglomerates, shale, and tuff. The Kennon formation covers the Trinidad Valley and its southern and eastern hills including the high elevation area in Zone II. It overlies the Zigzag formation with some disconformity and its thickness is assumed to be more than 150 meters maximum. At the observation well (DZ-II) site, its thickness was found at 33 meters.

The limestone in the Study area has a structure which is rich in fractures and joints, resulting high permeability and involves the possibility of forming a solution cavity, while the Trinidad Valley contains much shale, marl and limestone sand and has low permeability.

On the limestone slope, the seeped water flows down to the boundary of the impervious layer. The groundwater springs out at some end sites of the slopes in Zone I, Zone II and Zone III. Many springs in the Study area are found on the contour lines of about EL. 1,200 meters in Bahong to Alapang areas, about EL. 1,100 meters in Sadag to Alno areas in Zone II, about EL. 950 meters in Bineng area, and about EL. 710 meters in Boleweng area in Zone III. Major springs are Pico spring, Jaqao spring, Bahong spring, Dinog cave, Alapang spring, Sadag spring, Alno spring, Bineng spring and Boleweng spring.

Most of the above-mentioned spring water is utilized as the source of the drinking, domestic and irrigation water uses.

The Zigzag formation is an impermeable basement, and the groundwater table forms on the basement at the end of the wet season. Inside the cracks of the groundwater table, water may be stored even in the dry season. Generally, collection of groundwater is inferred to occur at the geographical lineation portions where the cracks are concentrating, namely at fault sites.

Faults which have been inferred from readings showing sharp lineaments on aerial photographs are mainly the following four faultlines : Tawang to Mt. Pico faultline, Wangal faultline, Tacdian to Alno faultline and Bagto block crossing faultline.

The characteristic and the scale of the faults may be difficult to determine because the faults are covered with residual deposit material. However, it can be considered that there are relatively wide sheared fracture zones along the faultlines.

The groundwater is mostly concentrated and flowing in the sheared zones or the breccia zones along the faultlines.

One fault along the North Ambiong creek may be on a discontinuous lineament and composed of the sheared zone.

Hydrogeological map is shown in Fig.3.6.2.

According to the results of analyses of the electric resistivity survey, it is assumed that the profile portion showing a resistivity value ranging from 40 to 60 Ω-m or more in the Zigzag formation may be due to the cracks concentrated zone with a high crack concentration and permeable traps.

Judging from the analyses of the well pumping tests, the yield capacity of one deep well is estimated at the following with safety side evaluation :

1. Kennon formation, stock farm (DZ-I) : Q = 4.8 litters/sec
2. Zigzag formation, Bahong (DZ-II) : Q = 7.5 litters/sec
3. Zigzag formation, Bineng (DZ-III) : Q = 13.0 litters/sec

Based on the above, the required number of wells to meet the water demand in each zone has been determined as follows :

Zone	Place	Formation	Purpose
1. Zone I	• Stockfarm	Kennon for.	Irrigation use
	• Puguis No.1	Zigzag for.(Bahong type)	- do -
(Total 3 wells)	• Puguis No.2 (for Puguis)	- do - (Bineng type)	Drinking & domestic use
2. Zone II	• Bahong No.1 (east side)	Zigzag for. (Bahong type)	- do -
	• Bahong No.2 (for Tacdian)	- do -	- do -
	• Bahong No.3 (west side)	- do -	- do -
	• Bahong No.4 (for Sadag)	- do -	- do -
	• Alapang	- do -	- do -
(Total 6 wells)	• Alno	- do -	- do -
3. Zone III	• Bineng	Zigzag for. (Bineng type)	- do -
(Total 1 well)			

As for the foundation and embankment materials, special attentions are required for the following matters :

1. Stability analysis on the embankment slope of the swamp reservoir site due to the gray soil formed by alluvial deposit.

2. Protection works for the underseepage or leakage at the limestone foundation sites in Zone I and Zone II.

As for the potential dam sites on the Wangal creek, the foundation is of the Conglomerates and good for the construction of a concrete gravity dam, especially at the No. 2 site.

As for the geology of the Balili river, the river bed rock in the downstream Balili river from the National road bridge is of tuff, and in the upstream of limestone. The drainage improvement works mostly consist of the excavation of the above rocks.

3.7 Soils and Land Classification

3.7.1 Soils

The soils in the Project area are classified into following 4 series according to the soil classification system of the Bureau of Soils, Philippines.

1) La Trinidad Series	:	Zone I
2) Tacdian Series	:	Zone II
3) Puguis Series	:	Zone III (Wangal)
4) Bineng Series	:	Zone III (Bineng)

Soils of La Trinidad Series extend over the flat to gently flat lands located on the lower portion of La Trinidad Valley in Zone I. The soils are deep and are well drained, but the lower elevated areas are sometimes affected by flood in the wet season. The soils generally have high inherent soil fertility, although the acidity of the soils is strong.

Soils of Tacdian Series are found on gently slope and steep areas in Zone II. The land of these soils is moderately drained and is all terraced for crop production. In general, these soils have high inherent fertility and a almost neutral pH value.

Soils of Puguis Series are found in hilly and mountainous areas in barangays Puguis and Wangal. The land of this soil has good drainage condition. The soils are very strongly acid throughout their profile.

Soils of Bineng Series extend over gently sloping land in barangay Bineng with an area of 350 ha. The land of the soils is terraced and planted with rice and vegetables.

3.7.2 Land classification

Land suitability class has two orders: Suitable (S) and Not Suitable (NS). The definitions of these land classes are as follows:

S : S_1 ; Highly suitable class
S_2 ; Moderately suitable class
S_3 ; Marginally suitable class
NS : NS_1 ; Currently not suitable class
NS_2 ; Permanently not suitable class

The land classification for the Project area was made in accordance with the above mentioned specifications, and the following land classes were identified.

(Unit : ha)

Zone	Land Class	For Vegetables & Flowers	For Plantation Crops
Zone I	S_1	82	82
	S_2	128	47
	S_3	0	81
	NS_1	4	4
	NS_2	76	76
	Sub-total	290	290
Zone II	S_1	0	6
	S_2	193	310
	S_3	123	0
	NS_1	65	65
	NS_2	299	299
	Sub-total	680	680
Zone III	S_1	0	44
	S_2	47	40
	S_3	54	17
	NS_1	63	63
	NS_2	286	286
	Sub-total	450	450
The Project Area Total		1,420	1,420

The results of land classification show that most lands defined suitable for vegetables and cut-flowers are presently used for agricultural purpose. No lands are available for further development.

3.8 Agriculture

3.8.1 Land use

The land use in each Zone is classified into five categories i.e.,upland crop field, lowland rice field, swamp, residential/commercial area, forest/grass land and others. The areas in each Zone are estimated as shown below:

(Unit: Ha)

Land use	Zone I	Zone II	Zone III	Total
1. Agricultural Land				
Upland field	210 (73%)	310 (46%)	60 (13%)	580 (41%)
Lowland rice field	0 (0%)	0 (0%)	40 (9%)	40 (3%)
2. Swamp	4 (2%)	6 (1%)	0 (0%)	10 (0%)
3. Residential/Commercial	67 (23%)	30 (4%)	5 (1%)	102 (7%)
4. Forest/grass	0 (0%)	264 (39%)	295 (66%)	559 (40%)
5. Others	9 (2%)	70 (10%)	50 (11%)	129 (9%)
Total	290 (100%)	680 (100%)	450 (100%)	1,420 (100%)

The land in Zone I is characterized by large occupation ratios of upland crop field (73%) and resident/commercial area (23%). The upland crop field is mainly utilized for production of vegetables and flowers. Zone II is the second most developed area following Zone I, upland crop field and residential/commercial areas occupy 46%, 4% respectively, and the rest is mostly forest/grass land. In Zone III, lowland rice field and upland crop field occupy about 9%, 13% of the area respectively, and the rest is mostly forest/grass land on steep slope.

The proportion of the net agricultural land area in the gross agricultural land area were estimated below on the basis of the field survey results.

Upland field	:	Zone I	80%
	:	Zone II, III	65%
Lowland rice field	:	Zone III	80%

The following table shows the net agricultural land area in each zone.

(unit:ha)

Land use	Zone I		Zone II		Zone III		Total	
	G	N	G	N	G	N	G	N
Upland field	210	170	310	200	60	40	580	410
Lowland rice field	0	0	0	0	40	30	40	30
Total	210	170	310	200	100	70	620	440

Remarks: G:Gross agricultural land area N:Net agricultural land area

3.8.2 Land tenure and land holding system

Presidential Decree 705 launched in 1975 classifies land with 18° slope and over as non-alienable and prohibit private ownership of the land in order to reserve the country's land area as forest for ecological purposes. At present about 70% of the farmers in the Study area is supposed to have the land titles while about 95% of the farmers are owner-operators based on the results of the farm economic survey and interview with provincial assessor.

Average farm size in La Trinidad is estimated at 0.83 ha as shown in Table 3.8.1, while they are estimated at 0.87 ha, 0.70 ha and 0.91 ha for Zones I, II, III respectively, based on the result of the farm economic survey. They are summarized as below :

(Unit : No.)

Farm size	Zone-I	Zone-II	Zone-III	Total
Below 0.5 ha	10	10	4	24
0.5 - 1.0 ha	2	21	7	30
1.0 ha and over	5	16	17	38
Total	17	47	28	92
Average farm size (ha)	0.87	0.70	0.91	0.80

Source : Results of farm economic survey

3.8.3 Cropping pattern

(1) Kind of crops being grown

The main vegetables being grown are legumes like string beans which is called Baguio Beans, garden peas, leafy vegetables like Chinese cabbage, pechay, cabbage, lettuce, celery, green onion, cauliflower, broccoli, asparagus, fruit vegetables like cucumber, eggplant, tomato, sweet pepper, root crops like white potato, radish, taro, sweet potato, carrot. The main cut-flowers produced in the area are roses, gladiolus, chrysanthemum, dahlia, etc. Anthlium has been also introduced recently.

Banana, mango, coffee, avocado, and guava are mostly planted in home garden, and large scale plantation of these kinds of crops are not common in the area. Rice is cultivated only in Bineng and Alno barangays in the Study area, rice cultivation including upland rice is not found in any other place in the area. Strawberries, introduced recently, are cultivated mainly in Zone I including the production farm of BSU.

(2) Cropping pattern

The temperature condition of the Study area is suitable for year round cultivation of temperate vegetables. The cropping calendar and cultivated area in the Study area are mainly affected by excessive rainfall, strong wind, damages of typhoon in the wet season, and shortage of irrigation water in the dry season.

The present cropping pattern in the Project area is generalized by each Zone as illustrated in Fig. 3.8.1.

In Zone I, strawberry occupies about one third of the area, and the rest is used for vegetables cultivation. In Zone II, roses are introduced with about 40% of the area, most of the other field can possibly be used for vegetable production for five times of croppings a year. In Zone III, lowland rice is cultivated over 40 ha in the wet season while in the dry season, rice cultivation area decreases to about 25 ha mainly due to shortage of irrigation water. Upland crop fields cover about 60 ha in Zone III.

On the basis of the presented cropping pattern, cropping intensity in each zone is estimated as follows :

(Unit : ha)

Crops	Zone I	Zone II	Zone III	Total
(Net farm area)	(170)	(200)	(70)	(440)
Net Cultivated area				
Vegetables	269	366	96	731
Strawberry	56	0	0	56 #1
Rose	0	78	0	78 #1
Rice	0	0	50	50
Intercropping	0	78	0	78
Total	325	444 #2	146	915 #2
Cropping intensity (%)	191	222	208	

#1 : Crop area of strawberry and roses are judged to be more than the value mentioned in the statistics, based on the results of the field survey.
#2 : Crop area of intercrop is excluded from the total.

3.8.4 Farming practices

Rice is cultivated with the ordinary transplanting method. The nursery period is about 30 days. After ploughing and paddling the main field by buffalo, transplanting of seedlings is done by manpower. Usually no fertilizer is applied to rice. Mostly local varieties are dominated in the Study area.

The advanced farming practices of vegetables and flowers have become wide spread in the Project area, cultivation methods like planting density, fertilization, etc. are mostly in a uniform manner all over the area. Most vegetables and flowers are cultivated on ridge. Cabbage, celery are usually grown in transplanting method while Chinese cabbage, pechay are in direct sowing method. Organic manures like chicken manure, mushroom compost, Sagana 100, chemical fertilizer like 14-14-14, urea, ammonium sulfate are applied commonly. Most of farm management work is carried out by manpower. Pests and diseases control is done with knapsack type sprayer.

Irrigation is required for about 6 months from November to April. Irrigation water is drawn with channel or hose by gravity, the water is usually kept in a pit in the field or water tank and applied to the crops by using watering cans or by furrow method. Sprinklers are used by some farmers. Irrigation by pumps is found in Alno and Zone I areas.

3.8.5 Agricultural production

The crop area, unit yield and production of the main crops in La Trinidad for 1984 to 1987 are as shown in Table 3.8.2. The unit yield of vegetables in the area fluctuate year by year and has not reached a sufficient high level. The main factors causing the stagnated and fluctuating level of the unit yield are assumed as damage by typhoon and unstable rainfall patterns. The average annual total area and production of vegetables in La Trinidad is estimated at about 1,700 ha and 17,000 tons, respectively. The cultivated area of vegetables has slightly expanded at a rate of 10% a year and the total production of vegetables increased from 18,600 tons to 22,400 tons during the last three years from 1985 to 1987. The average annual cultivated area and production of rice is about 110 ha and 210 tons, respectively. Area and production of cut-flowers are 43 ha and 480 thousand dozen for roses, 198 ha and 2,920 thousand dozen for gladiolus, 164 ha and 1,100 thousand dozen for the other flowers.

Besides the above mentioned crops, citrus trees have been recently introduced but the planted area is only about 10 ha. The planted area of coffee has decreased to about 10% during the last four years.

Most households in the area keep livestock for their own use or consumption except for some commercial poultry farms. Cattle, buffalo and goats are usually fed with natural grass in bush and grass lands. Livestock raising is not the mainline industry but it is somewhat important in the Study area.

3.8.6 Marketing and prices

There are basically two marketing channels for the disposal of farm products. The first is through traders. The traders visit farmers, make an estimate of the products and procure them before it is harvested. The second is by farmers themselves.

The bulk of vegetables produced in the area goes to Metro Manila directly or through Baguio wholesale market, while some go to Central Luzon such as Pangasinan, Tarlac, Pampanga, Cabanatuan City and Olongapo City. But before vegetables reach these areas, the products pass through several tiers of middlemen. (Fig. 3.8.2) Strawberry produced in the BSU compound is delivered to the collection center for packing before distribution to processing centers and markets.

Prices of vegetables show a distinct seasonal pattern, higher from September to November and lower from January to April due to the seasonal availability of products

as dictated by climatical conditions and occurrence of typhoons which prevent planting or make it hazardous during certain months of the year. They also change from year to year depending on weather conditions and the area planted. In some cases , the prices are manipulated in Manila by some wholesalers.

With regard to farm input supplies, the private sector handles the sale. There are about ten dealers of farm inputs in La Trinidad. Most of fertilizer, agro-chemicals and vegetable seeds are imported from USA, Indonesia, Korea, Japan, etc.

The present farmgate price of agricultural inputs and outputs are given in Table 3.8.3.

3.8.7 Agricultural support system

(1) Research institutes

La Trinidad is the capital municipality of Benguet Province. Many research institutes are located around the municipality. HARRC (Highland Agricultural Research and Resources Center) coordinates agricultural research works in the Study area. There are now the following 8 regular member institutions in HARRC:

- Baguio Experiment Station (BES) of the Bureau of Plant Industry (BPI)
- West Central Luzon Forest Research Center (WCLFRC) of the Forest Research Institute (FORI)
- Baguio Dairy Farm (BDF) of the Bureau of Animal Industry (BAI)
- Cordillera Studies Center (CSC) of the University of the Philippines College Baguio City (UPCB)
- The Northern Philippines Root Crops Research and Training Center (NPRCRTC)
- Sericulture Research and Training Center (SRTC) of the Philippines Textile Research Institute (PTRI)
- Department of Agriculture (DA) Region I
- Benguet State University (BSU)

HARRC, through the consortium, has the primary responsibility for research on fruit crops, ornamental horticultural crops, root crops, vegetable crops, farming systems, soil resources, macro-economics, and applied rural sociology. The primary function of HARRC includes planning, coordinating, implementing and monitoring of

agricultural research programs designed in support of development of the highland area in the country.

(2) Agricultural extension

At present, two agencies have conducted agricultural extension services. The Municipal Agricultural Office (MAO) of La Trinidad under the Department of Agriculture has the responsibility for agricultural extension in the Study area. The number of the staff is eight consisting of a municipal agricultural officer and seven Agriculture and Food Technicians (AFTs). They extend extension services which are aligned to the national program. On the other hand, Office of the Provincial Agriculturist under the Benguet Provincial Government also extends extension services and has the function of planning, supervising and coordinating all agricultural projects and activities of the Provincial Government which are not totally aligned to the national programs.

Technical assistance of the both offices were extended to individuals and groups of farmers through such activities as farm visits as resource person or lecturer, office consultations, distribution of technical bulletins, pamphlets and leaflets on agricultural and social development, etc. The offices have also conducted nursery/seedling production and distributed them to farmers. However, the effectiveness of the extension services has been hampered by a number of factors which include : (a) shortage of equipments and facilities for training and demonstration ; (b) insufficient capacity of extension staff, etc.

(3) Agricultural credit

There are a number of formal credit channels in and around the Study area which extend agricultural loans. They are the Philippine National Bank (PNB), Development Bank of the Philippines (DBP), the Land Bank of the Philippines (LBP) and Rural Banks. The formal credit, however, is not an important source of funds in meeting rural farmers' needs because (a) the credit needs long administrative procedure, (b) most of bank lending has to be secured by land title, tax declaration, survey plan, chattel mortgage, etc., (c) the banks finance the limited portion of the production costs and (d) the interest rate is high (20 - 30% per annum).

The farmers, in many case, rely on traders or middlemen for the supply of their farming credit needs. This informal credit system is linked closely with the marketing system, and most often involves provision of agricultural inputs and even consumption credit against crop failure.

The Tomay Credit Union has been operated in Tomay area in Zone II from 1965 by the farmers' investment. The union members can be financed to a maximum amount of twice of their investments. The interest rate is 1% per month for the first 6 months and 3% per month afterward.

The results of the farm economic survey show that about 20% of farmers availed of loans. Their sources are trader/middlemen (55%), relatives (20%), Rural Banks (15%), credit union (5%) and PNB (5%). The farmers use the credit for procurement of farm inputs.

3.8.8 Farmers' organization

The Government has stepped up efforts to organize farmers into cooperatives or associations. Samahan Nayons were organized in 15 barangays in La Trinidad under the guidance of the provincial or municipal agricultural office. However, almost all of the Samahan Nayons are inactive due to shortage of funds, despite the fact that farmers felt the need for mutual support organization.

The Benguet Farmer's Development Cooperative (BFDC) is the only active farmers' cooperative in the Study area. Products from the members are packed and sent to Metro Manila through a joint marketing system.

3.8.9 Farmer's economy and intention

In order to grasp economic condition of farmers in the Project area, farm budget analyses were made on typical farmers with average farm areas in each zone based on the results of the farm economic survey. The results are presented below :

(Unit : Peso)

Farm Income	Zone-I	Zone-II	Zone-III
Farm Size (ha)	0.87	0.70	0.91
Family size (persons)	5.8	6.0	5.6
Income	41,200	30,500	24,800
Farm income	37,000	27,400	19,200
Non-farm income	4,200	3,100	5,600
Expenditure	33,600	24,700	21,600
Food	15,600	10,800	11,200
Non-food	18,000	13,900	10,400
Net Reserve	7,600	5,800	3,200

Source : Farm economic survey

The characteristics of the farmer's economy are summarized as follows :

i) In Zones I and II, a considerable amount of income is derived from farm income which accounts for about 90% of the total income. Non-farm income mainly consisting of salary from private and government employment, remittance from families working in other cities, etc...

ii) In Zone III, farm income is considerably lower than Zone-I and II, because existing rice field is not suitable for profitable vegetable farming due to poor drainage and the farmers prefer rice cultivation only for home consumption. Non-farm income accounts for about 20% of the total income. Net income of the farmer in Zone III is 24,800 pesos. This is lower than the poverty line of the Philippines (28,600 pesos/family/year).

iii) According to the results of Family Income and Expenditures Survey by NEDA in 1985, the average annual income and expenditure of a family in Benguet Province are 48,200 pesos and 39,600 pesos, respectively. Comparing with these, economic condition of farmers in the Project area is poor.

iv) Food expenses account for some 50% of total living expenses

In order to achieve an effective development plan, the farmers' intentions were inquired through the farm economic survey. The results of the survey show that farmers consider the availability of irrigation and drinking water to be most important. Also, but to a lesser extent, they would need more assistance with regard to road improvement and technical advice on agricultural matters. With regard to kinds of crops, farmers preferred to cultivate existing vegetables and flowers even after completion of the Project, mainly due to easiness of the farming, high profitability and soil suitability.

3.9 Irrigation and Drainage

3.9.1 Irrigation

(1) Irrigated area

The gross land area under cultivation in the Project area amounts to 620 hectares during the dry season, and approximately 475 hectares, 77 percent of this surface area is being irrigated at a low level by drawing water from the nearby mountain streams, springs, and from the Balili river.

Only approximately 45 percent of the above land area is supplied with Balili river water while the remainder of 55 percent is topographically incapable of being supplied with river water from the Balili river.

While in the wet season, the entire area is under cultivation owing to the abundant rainfall, however, the area is supplementary irrigated by diverted water from small stream or spring when the dry weather lasts for 3 to 4 successive days.

(2) Irrigation water sources

In Zone I, water resources are present in the form of the Bedecewcew and Ovulan springs as well as the creeks Pico, Puguis, Bayabas, Betag, and Bolo. At those days of the year when irrigation water supplies are short, the Balili river is resorted to as a supplementary source. The land area supplied with water from the Balili river has been estimated to gross about 113 hectares, that is, 54 percent of the total gross farmland area. The use of the Balili river as a supply source for irrigation is not appreciated by the farming population in view of the serious level of pollution of the river water.

In Zone II, the main water supply sources are the escape water flowing from the Dinog cave and representing infiltration water that has penetrated from the Balili river, as well as the creeks Bahong, Alapang, and Peril. In addition, a number of active wells is shown in the upper mountainous parts. At those days of the year when irrigation water supplies run low, a temporary weir is constructed at the entrance to the Dinog cave with its water overspill from the Balili river to make a deliberate effort to harness these river water resources for irrigation purposes. Estimates have given the land surface area depending on the Balili river for irrigation water as being 100 hectares, that is, as being 32 percent of the total gross farmland area.

In Zone III, the principal sources of irrigation water are the Wangal creek and Bineng creek as well as numerous mountain springs. If water supplies run short, the Balili river is tapped as a last resort, but the amount of water drawn from the Balili river for irrigation in Zone III has been estimated as being extremely minor.

(3) Irrigation methods

In the wet season, nature offers abundant water resources so that surface irrigation (in the form of furrow) is resorted to only when necessary (in occasional interspersed dry spells). In the dry season, however, natural water supplies run extremely low so that low-water consumption irrigation methods are applied aimed at maximum water conservation. These methods involve the carrying, by humans, of can sprinklers on balance poles to sprinkle the water on the crop plants. As an alternative, water may be spread with hoses.

(4) Water utilization for irrigation in the dry season

In Zone I, water from mountain streams and springs is drawn at a rate of approximately 0.03 - 0.04 m^3/sec and the make-up supplies from the Balili river are run off at a rate of 0.02 m^3/sec.

In Zone II, water from the mountain streams and springs is drawn at a rate of 0.03 - 0.04 m^3/sec. Water from the Balili river is drawn on an intermittent basis at a rate of 0.02 m^3/sec to make up for water shortages as and when they occur.

In Zone III, water supplies from the mountains, including mountain streams and springs, account for the majority of the irrigation water requirement. These water supplies are drawn at a rate on 0.02 m^3/sec.

(5) Communal irrigation systems

In the Project area, a total of five communal irrigation systems (CIS) are being operated. These are the Pico, Bahong, Alapang, Alno, and Bineng irrigation systems, covering a total gross farmland area of 525 hectares and run by 473 subscriber farms.

The Pico CIS has a water catchment weir on the Balili river some 850 meters downstream from the Baguio Sewage Treatment Plant and operates waterways that bring in the irrigation water from the weir to the Zone I. Previously, this used to be one of the most important water resources for irrigation, but its significance has declined with the progressive water pollution of the Balili river. As a result, water from the Balili river catchment the weir is currently used only on a limited scale for drought

relief. Officially, the irrigated land surface area spans a total of 200 hectares, with 103 registered subscriber farms benefiting from the scheme. In practice, however, only 136 hectares are irrigated under this communal irrigation system, with 116 hectares of these 136 hectares being land falling within the supply range of the Balili river.

The Bahong CIS is operated by 300 member farms, covering a gross farmland area of 250 hectares in Zone II. The principal water source for the running of this scheme is the escape water from the Dinog cave. In addition, the systems has two water catchment facilities on the Bahong creek and seven on the Alapang creek. In the dry season, one of the main tasks of the community is to ensure water supplies by measures such as the erection of a temporary weir at the entrance to the Dinog cave and the harnessing and allocation of the outflow water from the cave.

The Alapang CIS has a relatively small scale of operation, with only 20 subscriber farming households benefiting from the scheme that covers only 10 hectares of irrigable land.

The Alno CIS is the smallest in the scale within the region, consisting of only 15 member farms with a mere irrigable land area of 5 hectares.

The Bineng CIS has a water catchment facility at Gayasey on the Wangal creek. From this location, the water supply is brought into Bineng through a trench system stretching over 3.5 km.

The Bineng CIS was completed in 1976 under a joint project with the cooperation of FSDC. It has a total of 35 registered member farms benefiting from the scheme that covers an irrigable land area of 60 hectares. At present, however, the scale of the irrigated land area has been reduced to only around 40 hectares. The Bineng irrigation system was established under the directives issued by the NIA and operates on the basis of clearly defined statutory regulations so that it now functions as the most coherently organized CIS entity.

(6) Private irrigation systems

The Project area also has a small number of private irrigation systems.

In those areas in which mountain springs are available, these private entities utilize the spring water, and in areas amenable to river water utilization, they make use of the existing river water supplies and draw the water by pumping it up.

These private schemes are considered to cover a total land area of approximately 19 hectares, which on a zonal basis is broken down as follows :

- Zone I Guadayano spring (approx. 1 ha)
- Zone II Left bank of the Peril creek (approx. 8 ha)
- Zone II Left bank of the Alno creek (approx. 5 ha)
- Zone II Pumped-water irrigation area along the Peril creek (approx. 1 ha)
- Zone III Northeast and elevated region below 900 meters above sea level (approx. 4 ha)

3.9.2 Drainage

Zone I has a plain known as the Trinidad Valley which presents serious drainage problems during the heavy rainfalls brought with the typhoons and causing the Valley to swamp.

(1) Present condition

Zone I, representing a 6.8 km^2 valley, forms a large plain in the shape of a basin with a sloping topography inclined at a 1/150 - 1/200 gradient (El. 1,310 - El. 1,318 m). Drainage water in the area flows down to the low-lying areas located in the norther part of the plain through a multiplicity of drainage-cum-supply water ducts and as it feeds the Bolo creek, it utimately enters the northbound Balili river winding its way through the eastern part of the region.

The drainage water routes within the region are trench-ways above the ground, and since the area has a very irregular profile, these routes have many strictures. This is particularly true of the Bolo creek which forms a principal water drainage course in the National Highway bridge point.

The Balili river, the major drainage course in Zone I, rises from the mountain region in the southern part of Baguio to form a medium river with an average bed width of around 40 m. Its drainage plain area in which the tributaries empty into the Balili river totals some 30 km^2. Measurement of the flow rate quantities of the Bolo creek and the Balili river has formed the basis of a detailed flooding analysis which has yielded the following results :

i) During the flooding periods, the Balili river has a high water level so that the flowing capacity of the Bolo creek is substantially reduced, thereby

giving rise to backwater from the Balili river to the Bolo creek in accordance with the extent of precipitation.

ii) The small rivers and streams in the area have only a small flowing capacity so that they will rise above the river banks, thereby creating flood plains in certain parts.

(2) Current status of flood damage

The Trinidad Valley is composed of five barangays known as the Poblacion, Betag, Pico, Puguis, and Balili barangays. The topography is graded at a gentle incline as it descends from Pico and Puguis in the south to Betag, Poblacion, and Balili in the north. The actual flooding conditions are due to the inadequate drainage capacity in the area. Both the Bolo creek and the Balili river after the confluence with the Bolo creek, which transport the Trinidad Valley's drainage water, have not been provided adequate flood passing capacity so that the surrounding areas have recorded flood damage with inundation levels of 1.0 - 1.8 meters in depth and 1.5 - 1.8 meters on farmland during the five-year period preceding the time of this survey. In the swampy area on the upper reaches of the Bolo creek, in particular, floods may reach a level of 3.0 - 4.0 meters (on farmland). At the time of the GADING typhoon (1986), the flooded area in Zone I extended a total of 110 hectares, about half of the entire land area of this Zone. Similarly, the smaller streams (Betag creek, Puguis creek, and Bayabas creek) that join into the upper reaches of the Bolo creek have an inadequate flowing capacity to drain the area so that flood damage is caused to farmland even in areas located at a relatively high elevation level.

In the low-lying parts of Zone I, the farming population is currently deterred from growing crops for fear of flood damage so that the inadequate drainage capability in this area is a major impediment to increasing agricultural production in Zone I.

At the time of the GADING typhoon in 1986, the flood level in Zone I was estimated to have been El. 1,311.29 meters. Fig.3.9.1 compares the scale of inundation in the high-risk years with the flooded land areas in Zone I to give a clear idea of the seriousness of the flood problems.

3.10 Rural Road

3.10.1 The present conditions of the roads

The Baguio - Bontoc national road passes through the center of La Trinidad City where the Study area comprises provincial roads and barangay roads branching off from the national road to communicate with each peripheral village. (see Fig.3.10.1)

In Zone I, national and provincial loop roads are laid out around the agricultural land of some 200 ha. in area distributed in the center of the Trinidad basin, so that road maintenance and improvement have properly advanced.

On the contrary, in Zones II and III, most of the roads are constructed along the ridge or the side of the mountains, and connecting roads with villages are scarce.

Gradients of the roads are very steep in Zones II and III. The total length of relatively flat sections with gradients of 0 - 5 percent is 7.6 kms (28.6 percent) out of the total length of the roads surveyed, 26.5 kms, and those of steep sections with gradients more than 15 percent is 6.5 kms (24.6 percent).

Although the Study area has much precipitation, more than 3,500 - 4,000 mm per year, road drainage facilities are not well equipped. Therefore, the road surfaces are paved with calcareous stone for erosion control, but this causes wheel slip on the road and consequent traffic inexpediency.

3.10.2 Administrative classification of the roads

Roads in the Study area are classified on the basis of the organizations for maintenance and administration as follows :

1)	National Road	:	DPWH (Department of Public Works and Highways)
2)	Provincial Road	:	Provincial Governor
3)	Barangay Road	:	DPWH, Barangay

Maintenance and repair works are usually carried out for only the steep gradient sections by means of concrete pavement and shoulder repair. No drastic plan for road pavement and repair works is envisaged except in Zone I.

The actual conditions of the pavement of the provincial and barangay roads in the Study area are as follows :

Road	Total Length (km)	Concrete/Asphalt pavement		Gravel pavement		Earth pavement	
		Length (km)	Width (m)	Length (km)	Width (m)	Length (km)	Width (m)
Provincial road	55.3	3.0	3.5 - 6.0	20.2	3.0	31.3	2.6
Barangay road	42.0	1.5	2.5	14.8	3.0	25.7	3.1

* road widths are mean values.

As mentioned above, the paved road ratio with respect to the concrete and asphalt roads is very low, with most of the roads left unpaved or lightly paved with gravel. Widths of the roads range from 2.5 to 3.0 meters on an average. Many road sections have widths less than 3.0 meters.

3.10.3 Traffic volume survey

A traffic volume survey was carried out on the main roads in the Project area. The survey points and the traffic volumes surveyed are shown in Fig. 3.10.2 and Table 3.10.1.

The traffic volume on the national road in Zone I marked 7,300 vehicles per day, including big buses and trucks counted as 620 vehicles per day. At the west end of the loop road (see point No. 1 in Fig. 3.10.2), the traffic volume attained 500 vehicles per day.

The traffic volume on each road in Zone II was 100 to 300 vehicles per day. As for the Camp Dangwa-Alno line, a seasonal variation of the traffic volume was shown. This may be attributable to seasonal fluctuation of harvest transportation volume.

The traffic volume on a main road from Zone I to Zone III was small at only 30 vehicles per day due to bad road conditions.

3.11 Drinking and Domestic Water Supply

3.11.1 General

Water sources in the Municipality of La Trinidad can not be relied upon to adequately support the water need for the development of local consumption now and in the future. The water of the Balili river, which flows in the center of the Study area, is not suitable for potable water from the viewpoint of its water quality. The domestic water supply sources in La Trinidad city are shown below. Only 20 percent of the total inhabitants are supplied from the waterworks systems operated by La Trinidad Water District, the remaining 80 percent are still in want of a continuous and safe water supply.

Water sources	Families served	%
Waterworks *1	1,221	19.8
Public Deep Well	491	8.0
Public Shallow Well	181	2.9
Private Deep Well	976	15.8
Private Shallow Well	154	2.5
Public Spring	1,170	19.0
Stream Flow	1,967	32.0
Total	6,160	100%

Source: Rural Health Unit La Trinidad 1985

*1 : La Trinidad Water District

In addition to the scarce water sources and water supply facilities, its quality is a serious problem. Majority of the water sources are open springs which are open to waterborne viruses/organisms which affect the respiratory tract and gastro-intestinal parts of the human body, so that adequate water treatment is required. Ingenious water treatment being practiced by a minority of the residents is boiling the water before drinking. The majority takes the risk of drinking directly from the sources.

3.11.2 Water supply by La Trinidad Water District

(1) Water sources

LTWD (La Trinidad Water District), which is the public corporation for the water supply service in La Trinidad municipality , is operating three (3) water sources, deep well facilities located in the BSU compound and intake weirs in Ampasit and

Lubas areas. Daily production of water sources and service connections are as following :

a) Production

- Deep well	- 760 lit./min.
- Ampasit intake weir	- 150 lit./min. (average)
- Lubas intake weir	- 340 lit./min. (average)
Total	- 1,250 lit./min.

b) Service connection - 1,756 nos. (as of May 1987)

(2) Service area

LTWD serves the water to the densely built-up area along the national and provincial loop roads, and Barangay Balili. Service area and principal water supply facilities are shown in Fig. 3.11.1 and Fig. 3.11.2.

3.11.3 Present conditions in the Project area

In Zone I, the water supply system is well equipped. The production, however, can not be relied upon to adequately support the need for increasing water consumption. Water supply to the high elevation area is not attained because of the lack of water capacity and pressure in the dry season.

Meanwhile, Zone II and Zone III areas are out of the water service area by LTWD, majority of inhabitants secure the water from the springs and groundwater. As the land of Zones II and III descends steeply toward the north, only few springs provide a stable water yield through the year in the low elevation area. Nevertheless, in the high elevation areas, springs have no water yield in the dry season because of the drawdown of the groundwater surface.

In respect of the above, the development of the water supply facilities is highly required in Zone II and Zone III.

3.12 Electric Power Supply

Electric power is most essential to daily life and has to be available on a twenty four (24) hour basis. The energy resources available for lighting and fuel purposes in

the Municipality of La Trinidad are electricity serving 4,082, kerosene serving 995, GAS/LPG serving 600 and others (candles, gas lamps, pine wood) serving 483 families. In the remote area of the Municipality, the main power source is the "Saleng", a kind of pine wood used for lighting and cooking purposes.

Electric power in the Province is being supplied by the National Power Corporation (NPC) Luzon Grid through the hydro-electric plants (dams) of Ambuklao with a rated capacity of 75,000 kW and Binga with the rated capacity of 100,000 kW. both of which have variable generating capacities. Another distributor fed with power from the same grid is the mini-hydro electric plant operated by the Baguio Water District (BWD) at Asin, Tuba, which has an approximate capacity of 1,700 kW. The only authorized electric service distributor is the Benguet Electric Cooperative Inc. (BENECO) which has a total demand of 23,000 kW from the NPC and 700,000 kW hrs./month from BWD.

Power cuts occur during summer periods usually in the months of March, April, May and June due to low water level thus low power generation. This also occurs during load shedding which affects other areas including Metro Manila and suburbs and during typhoons causing damage on distribution to transformers, lines and electric poles.

4,082 or 66 percent of the total number of families are supplied power in the Municipality of La Trinidad in 1985. This leaves more than 30 percent of the Municipality without regular power supply. In absolute terms, this means that around 2,078 of families are still wanting the luxury of electric power delivered into their homes. As for the Project area, there is no electric power supply in Zone III.

Power Source, Municipality of La Trinidad

TYPE	FAMILY SERVED	%
Electricity	4,082	66
Kerosene	995	16
Gas/LPG	600	10
Candle, gas lamps pine wood	483	8
Total	6,160	100

Source : RHU La Trinidad 1985