CHAPTER 4 CONCEIVABLE IMPROVEMENT PLAN OF COPING CAPACITY

4.1 General Approach for Comprehensive Disaster Prevention

The general approach for the Comprehensive Disaster Prevention and its framework are constructed for this Study, which is illustrated in Figure 4.2.1.

In view of the issues identified in past disaster prevention activities (see Section 2.1 of Main Report) and based on the results of discussions in the Steering Committee meetings, the following basic targets were adopted as basic strategies for formulating a Comprehensive Disaster Prevention Plan around Mayon Volcano in the target year of 2020.

(1) No death at any natural hazards like Mayon eruption, mud and debris flow, typhoon and flood,
(2) No damages to the properties for the hazard of a 20-year probable mud and debris flow and 10-year probable flood, and
(3) GRDP in the Study Area to reach to the national average level in 2020**.**

To achieve these targets above, two direct measures, Mitigation of Hazards and Reduction of Vulnerability, are proposed, which contents are below.

(1) Mitigation of Hazards
    - Sabo System
    - Flood Control
(2) Reduction of Vulnerability
    - Evacuation System
    - Resettlement Plan

Forecasting and Warning System is also set up as the contents of both direct measures.

These direct measures would be effective only with the well organized implementation structure. To improve the present implementation structure and develop the significant and sustainable institutional system, five Supporting Programs are proposed, which are Institutional Strengthening, Human Resources Development, Research & Development and Importation of Effective Equipment & Materials, Development & Execution of Effective Law & Regulation, and Effective and Impartial Application of Funding.

To firm the sustainability of this approach of the multiple plan, the effective implementation system of Operation, Maintenance & Repair should be well planned.

This multiple effectiveness needs the stable supply of a certain amount of the budget based on the firm and stable regional economy, which should be based on the firm and adaptable society and individual daily life as well as stable society especially in the area prone to the natural hazard. As the present situation this Study Area has not enough capacity to recover from the disaster and produce the economic surplus for the sustainable disaster prevention. For this fundamental key issue, Regional Development Plan based on the agro-industry is proposed as well as Disaster Prevention Plan.

4.2 Scenario to Realize the Per Capita GRDP Set at the Target Year of 2020

Under the agreement between the Philippine Government and the JICA Study Team, it was targeted that the Per Capita GRDP of Albay Province will reach the per capita GRDP national average by 2020. The ultimate objectives of this scenario are:

1) The proposed disaster prevention should be sustainable, and
2) The economic development is indispensable and will generate the surplus funds to be sustainable for disaster prevention.

The following is the scenario to achieve the per capita GRDP for Albay Province.

(1) Conceptual Structure of Achievement of Per capita GRDP Target for Albay Province

1) Basic Concept

The basic concept with regard to the scenario for achieving the per capita GRDP for Albay Province includes the following elements:

a) Natural growth
b) Growth to be generated by the projects planned in this Study
c) Growth to be generated by the existing plans including ongoing projects
d) Growth to be accelerated by synergy effect among the projects planned in this Study and the existing development plans
e) Growth by spatially direct effects

By taking account of these basic concepts, the development potentials and necessary infrastructure by industrial origin are studied and the possible growth rates to be achieved are estimated for (a) medium term development by referring

to the investment programs of regional, provincial and city/municipal (LGU) levels and for (b) long-term development by referring to long term development visions for all levels as much as possible.

2) Natural Growth

As shown in schematic Figure "Conceptual Structure of Achievement of GRDP Target for Albay Province and the Study Area", the natural growth is the economic growth to be realized in case of “without-project” which means that no disaster preventive actions will be taken against disasters in future. This category of growth is projected on the basis of historical performance of GRDP for Bicol Region. Furthermore, by taking account of the low economic growth scenario of this Study set up on the basis of nation wide GDP by excluding GRDP of NCR, the projected economic growth of Albay Province in the future.

3) Growth to be Generated by the Projects Planned in This Study

This category of economic growth is considered to be realized by the projects set up by the Master Plan of this Study which are composed of comprehensive disaster prevention plans and economic development plans. The economic development is expected to be achieved in the protected area against mud flow.

4) Growth to be Generated by the Existing Development Plans Including Ongoing Projects

Many varieties of projects have been already planned and implemented in the Albay Province including regional, provincial and municipal level. In this Study, the economic development plans of them will be mainly taken into account and carefully compared with the projects in this Study because both of them are closely related each other.

5) Growth to be Accelerated by Synergy Effect among the Projects Planned in this Study and the Existing Development Plans

It is expected that synergy effects among the projects planned in this Study and the existing development plans will accelerate the economic growth. Both of them are closely related as mentioned above. The synergy effects will be created among the following industries .

a) Agriculture and agro-industry
b) Agro-industry and tourism
c) Trade and transportation

d) Tourism and transportation
e) Quarrying and construction

6) Growth by Spatially Direct Effects

The protected area against mudflow disaster is very limited in Albay Province. But the development effects generated inside protected area will more directly influence the area adjacent to or surrounding the protected area.

7) Integrated Growth

The composition of economic growth mentioned above will not be generated independently but dependently on each other. Then the integrated and mixed economic growth on the basis of composition mentioned above will be actually achieved.

(2) Agricultural Development Potentials

1) Development Performance

Out of 158,312ha of agricultural land, 100,623ha or 63.58% are used for cultivating the perennial/commercial crops and 85,351ha or 53.91% are devoted to temporary/food crop production. In the Province of Albay, agricultural crops such as rice, corn, abaca, vegetables, and coconut are predominantly cultivated.

2) Development Potentials

Productivity in crops, livestock and fisheries remained below their potential in 1998. Low agricultural productivity in the face of high population growth rate explains why farmers and fishermen belong to the lowest income bracket in the province.

Albay is only self sufficient in the production of beef of which sufficiency level is 104%. The sufficiency levels for major crops are: rice (44%), yellow corn (56%), vegetables (35%), fruits such as banana, papaya and pineapple (32%), chicken meat (11%), eggs (41%), fish (62%) and pork (57%).

The major determinants of agricultural production are considered to be (a) productivity of land and (b) land area. But in Albay Province, as already pointed out, the production has been fluctuated by natural condition like calamities and land area for agriculture has decreased by the conversion for other land uses. Then there are many obstacles to overcome the low productivity and reduction of agricultural land.

According to "Regional Action Agenda for Productivity" by Regional Development Council V and NEDA Region V, the most promising agricultural crops are listed up as follows: (a) coconut, (b) abaca, (c) pili, and (d) palay.

3) Impact of Agriculture to Economic Growth

The impact of agriculture to economic growth will be formed by the following process of successive causes and effects:

- Improvement of safety of society around Mayon Volcano by implementing the comprehensive disaster prevention works
- Reduction or mitigation of shrinking effects in investment in fear of natural calamities like typhoon and floods after the comprehensive disaster prevention project.
- Acceleration of investment in agricultural facilities such as irrigation
- Acceleration of agricultural products by promoting the agro- and aqua-tourism
- Increase of farmers' incomes by enhancing the productivity
- Increase of expenditures for foodstuffs and inducement of production increase related to consumed food
- Increase of expenditures in other products and services as a result of higher level of income (raise of Engel coefficient)
- Affordability of tax payment to LGUs
- Increase of investment for disaster prevention and economic development by LGU
- Further acceleration of agricultural products

(3) Agro-industrial Development Potentials

1) Development Performance

Albay accounted for the most number of cottage industry firms among the provinces in Bicol region. This is due to the large number of handicrafts and furniture produced. Among other are gifts, toys, housewares, ceramics, food & beverages, light metals especially cutlery and farm implements.

The most of industrial products in Albay Province are made from agricultural products. So agro-industry is the key industry and the future industry of the province is highly depending on the development of agricultural production.

2) Development Potentials

Albay has several promising resources with regard to agro-industry development. The promising and high potential agro-industrial products include the following: (a) gifts and housewares, (b) handloom weaving, and (c) furniture and woodcraft.

3) Impact of Agro-Industry to Economic Growth

The impact of agro-industry to economic growth will be generated through the following process of successive causes and effects:

- Improvement of safety around Mayon Volcano due to the comprehensive disaster prevention works
- Reduction or mitigation of shrinking effects in investment in fear of natural calamities like typhoon and floods after the comprehensive disaster prevention project
- Acceleration of investment in agro-industry
- Acceleration of agro-industrial products by increasing the demand in agro- and aqua- tourism
- Increase of workers' incomes in agro-industry by enhancing its productivity
- Increase of expenditures for foodstuffs and inducement for production increase related to consumed foods by workers
- Increase of expenditures in other products and services as a result of higher level of income (raise of Engel coefficient)

(4) Tourism Industry Development

1) Development Performance

Among the provinces in Bicol Region, Albay still stands out as the favorite destination of both domestic and foreign visitors. Particularly, its significant landmark is the famous majestic Mayon Volcano. Aside from the clean beaches, which are also ideal for international sea sports, the tourist spots of Albay include caves, falls, and springs.

The volume of tourist arrivals for 1998 registered the highest with 279,449 domestic tourist while the foreign tourist for 1997 recorded the highest with 25,216. The fluctuation trend of tourist arrivals could be attributed to peace and order situation, calamities and other circumstances that beset the region.

2) Potential and Advantages

The potentials and advantages with regard to tourism industry are as follows:

- Presence of the world renowned perfect coned Mayon Volcano
- Presence of prime and potential tourism resources and facilities
- Presence of cultural attractions such as archeological sites, historical attractions and other culture features
- A wide array of handicrafts and Bicol native products and
- Rich Bicol cultural heritage

3) Future Tourist Projection

The tourist arrivals in Region V has increased at 8.8% per annum and those in Albay Province at 6.8% per annum during the period from 1990 to 1998. Assuming these volumes will increase at the same growth rate as the past eight years, the volume of tourist arrivals in Region V will increase from 299,000 in 1998 to 1,903,000 in 2020, which is 6.4 times of 1998. On the other hand, the volume of tourist arrivals in Albay Province will reach to 586,000 in 2020, which is 5.4 times of 100,000 in 1998. The most of tourists are expected to visit the tourism attractions around Mayon Volcano.

4) Eco-Tourism

The Bicol Region Tourism Master Plan was conceptualized and envisioned to improve the tourism industry in the whole Bicol Region for a period of five years (1996-2000). According to this master plan, region's thrust for tourism development and promotion is envisioned in the project "GEMMA" or Grassroots Eco-tourism Management for Mainstream Advancement. Given the natural resources, eco-tourism is one of the most viable enterprises in the region. It helps preserve the environment by mobilizing people in preserving the natural treasures, while at the same time generating livelihood.

5) Agro-Tourism

Agro-tourism is also a viable venture in the Bicolandia given the vast ricefields, numerous lakes and its pastoral ambiance where agricultural activities can be undertaken for both tourism and agricultural purposes.

Possible agro-based tourism projects in the region will concern "pili" culture, animal farms, abaca plantations and its processing into various souvenir products.

6) Impact of Tourism Industry to Economic Growth

Taking these various factors of growth of tourism industry into account, impact of tourism industry to economic growth for Albay Province will be generated through the process of successive causes and effects as follow:

- Improvement of safety around Mayon volcano due to comprehensive disaster prevention works
- Increase of tourism attractions especially around Mayon Volcano
- Increase in tourist arrivals from domestic areas and abroad
- Increase of hotel construction
- Increase of tourists from Albay Province to other regions or to abroad by improvement of standard of living.
- Direct impact on business
- Increase of tourists will directly impact to business such as hotel, restaurant, souvenir shops, transportation, travel agency, and parks. The multiplier effect of economic dependence on tourism relative to the primary local activity can be as high as 200% which is reported in "Master Plan for the Legazpi-Iriga-Naga-Daet Growth Corridor (LINDGC) Project" (Refer to Volume III, Supporting Report (1), XII : Socio-economy, Table XII 5.7.2(5/5)).
- Protection of natural environment
  Promotion of eco-tourism could protect the natural resources and secure the sustainable socioeconomic growth.

(5) Service Industry Development

1) Development Performance

Service industry is classified into six subsectors with regard to GRDP such as (a) transportation, communication and storage, (b) trade, (c) finance, (c) ownership of dwelling and real estate, (e) private services, and (f) government services.

Because of no available GRDP statistics by sector for Albay Province, the direct comparison of GRDP for each subsector mentioned above for Region V is difficult. But the structure and potentialities of service industry of Region V mentioned above are assumed to be more or less reflected on the ones of Albay Province.

Business activities thriving in the province vary from private services which composed of constructions, hotels/resorts/eateries, entertainment establish-ments, auto/machine/appliances, repair shops, clinics and hospitals, insurance companies and others. Trading sector, on the other hand, are stores like sari-sari stores/groceries, general, general merchandising and office supply and others.

Albay is considered as the major exporting province in the region. In 1994-1996, Albay contributed 98.1% (US$2,043.3 million) in the region's export and in 1996, the province contributed 1.52% (US$455.8 million) to the total amount of the

country's export at US$29 billion. Albay Province has a high potentials with regard to service industries.

2) Close Inter-Dependency of Service Industry between Other Industrial Origins

The service industry closely depends on the activities of other industry sectors. For example, the increase of agricultural and industrial products generates directly to increase of GRDP of service industry.

In this respect, both hardware and software connecting the service sector with agricultural and industrial sector are important factors. It is also pointed out that the access roads to firm and storehouse need urgently to be constructed to save the transportation cost of agricultural products.

3) Impact of Service Industry to the Economic Growth

Taking account of the development performance and close inter-relationship among these three sectors, the impact of service industry to economic growth for Albay Province will be produced through the process of causes and effects as follows:

- Improvement of safety around Mayon Volcano due to comprehensive disaster prevention works
- Increase of economic stability especially around Mayon Volcano
- Spread of economic stability at surrounding areas of Mayon Volcano, neighboring area and ultimately the whole area of Albay Province
- Solution of disadvantages in service sector such as poor infrastructure and its insufficient soft management.
- Spontaneous acceleration of economic activity of service sector with acceleration of other sectors for agriculture and industry
- Inducement of demand in industrial and service sector due to raise of Engel coefficient derived by improvement of farmers' income
  This phenomenon indicates that the weight of farmer's expenditure will shift from foodstuffs to more luxurious products and services.

(6) Required Infrastructure and Development Investments

The Province of Albay, considered as one of the potential agricultural and industrial areas in the region, abounds with various resources that can considerably make it into an economic center. But these resources are not utilized to their maximum potential due to lack of infrastructure support facilities.

To maximize the fruits of economic development generated from comprehensive disaster prevention works, the problems and obstacles mentioned above should be overcome as soon as possible.

1) Agriculture

The Local Development Program (LDP) of Province of Albay (2000-2004, Draft) points out the following as major problems in agricultural sector: (a) low agricultural productivity and (b) inefficient marketing system for agricultural commodities.

a. Necessary Infrastructure

Taking account of these major problems in agricultural sector, and on the basis of reviewing (a) Bicol Strategic Plan (1999-2004), NEDA Region V (b) Local Development Program of Albay Province and (c) Regional Action Agenda for Productivity, Bicol Region (1998-2004) prepared by RDC V and NEDA V, the following infrastructures are necessary for supporting the strategies for agriculture sector development.

- Farm to market roads to distribute effectively agricultural products and to save the transportation cost as one factor of agricultural production cost
- Agricultural support facilities like irrigation system to provide adequate supply of water to farm and agricultural land for increased population
- Rehabilitation the railroad network so as to make the province accessible to the railroad system for low cost transportation of agricultural products to the trade center of Metro Manila
- Food terminals/ice plant and cold storage facilities

b. Development Investment

Development investment includes not only the infrastructures mentioned above which are physical infrastructure but also social infrastructure such as institutional matter or software. As to the ongoing and planned projects, refer to the Supporting Report, Chapter XII.

2) Agro-industry

a. Necessary Infrastructure

The agro-industry development is mostly depending on the supporting infrastructure not only for agricultural sector but also for service sector.

The infrastructure specified for agro-industry can be listed as follows:

- Establishment of small-medium scale enterprise/industry(SMED)
- Establishment of Bicol Regional Industrial Center
- Establishment on handicraft industries on abaca, shell crafts, coco-midrib, woodcrafts and coco-furniture

b. Development Investment

Actually planned and ongoing investment plans are as follows:

- Seedling production project
- Provincial industrial cluster promotion center
- Bicol regional agro-industrial center
- Legazpi PEZA (Philippine Economic Zone Authority)
- Malilipot Ecozone
- Product development and promotion of export commodities
- Enterprise development program
- Investment promotion program
- Public employment service

4) Tourism Industry

a. Necessary Infrastructure

The tourism industry does need less initial cost than other sectors of industry because most tourism resources originate from natural assets and do not need much capital cost to develop. But the basic facilities are necessary for tourism development, especially those related to transportation and accommodation of tourists.

b. Development Investment

For the development for tourism industry, not only the infrastructure as hardware but non-infrastructure as the software are important investment. According to "Albay Tourism Development Master Plan (Draft)" in 1999, which was prepared by the Provincial Planning and Development Office of Albay (PPDO), the future development investment for tourism industry is classified into three core tourism development areas as follows: (a) sea-based development, (b) land-based development and (c) ecological based development.

5) Service Industry

a. Necessary Infrastructure

The economic growth of the service sector is basically depending on the other two sectors (agriculture and industry). So the infrastructure for other two sectors will contribute to the service sector. The infrastructure inherently necessary for service sector concerns the transportation, communication, building of school, hospital, water supply system, and so on.

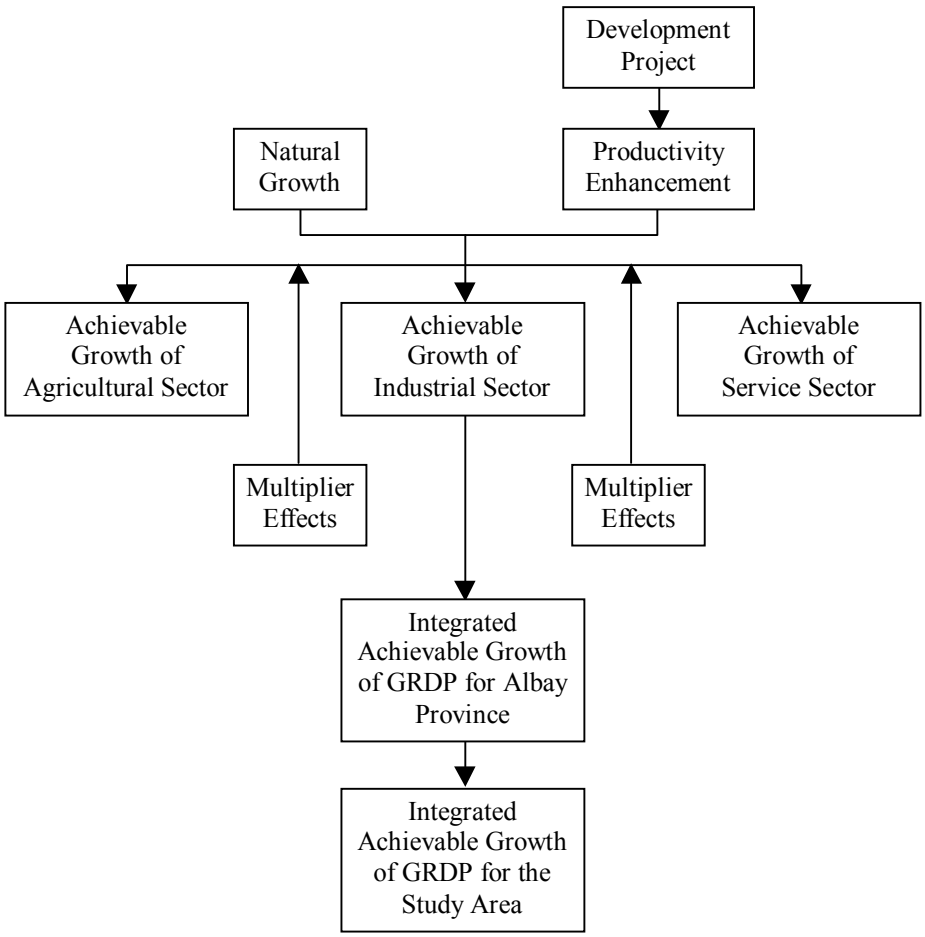
b. Development Investment

The following are important for development of the service sector in Albay Province.

- Development of Pioduan Port as an international port so as to serve as a gateway to the Visayas and the island province of Masbate
- Improvement of Tabaco and Legazpi Ports to upgrade their services/facilities so they can accommodate bigger ships and sea vessels as an international port
- Agricultural support facilities like irrigation system to provide adequate supply of water to farm and agricultural land for increased production
- School buildings in accordance with DECS and LGU to accommodate increasing enrolment and improve delivery of educational services
- Introduction of modern communication technology system so as to ensure more timely and reliable information flows
- Rehabilitation of the railroad network so as to make the province accessible to the railroad system for low cost transportation of goods
- Construction of an international airport with modernized navigation facilities/equipment

(7) Achievement of GRDP Target for Medium-Term Economic Growth

The basic concept for achievement of GRDP target is shown in the figure "Concept of Scenario for Achievable GRDP of Albay Province and the Study Area".



Concept of Scenario for Achievable GRDP of Albay Province and the Study Area

1) Growth in Agricultural Sector

Agriculture sector is a fundamental industry and has high potentials in Albay Province. So study for achievement of GRDP target for agricultural sector is conducted in advance of studying the other two sectors.

The achievable growth rate is predicted on the basis on the following assumptions:

- Natural growth rate is expected to be 0.5%. This growth rate is based on the actual growth rate of agricultural sector in Albay Province, as 0.99% during the period from 1995 to 1998 which was estimated by the Study Team (see the following table).

GRDP Target for Economic Growth Scenario of Albay Province

(Unit: Milli. Peso)

Growth Scenario	Sector	1995	1998	1999	2000	2005	Average Annual Growth Rate (%)		
							1995-1998	1999-2000	2000-2005
Low	Agriculture	3,912	4,030	4,224	4,426	5,613	0.99	4.80	4.86
	Industry	6,869	8,045	8,604	9,202	15,001	5.41	6.95	10.27
	Service	8,073	9,364	10,065	10,818	17,342	5.07	7.48	9.90
	Total	18,854	21,439	22,892	24,446	37,956	4.38	6.79	9.20
Medium	Agriculture	3,912	4,030	4,226	4,431	5,654	0.99	4.85	5.00
	Industry	6,869	8,045	8,608	9,211	15,110	5.41	7.00	10.41
	Service	8,073	9,364	10,070	10,829	17,468	5.07	7.54	10.04
	Total	18,854	21,439	22,904	24,470	38,231	4.38	6.84	9.33
High	Agriculture	3,912	4,030	4,266	4,516	6,040	0.99	5.86	5.99
	Industry	6,869	8,045	8,691	9,389	16,142	5.41	8.03	11.45
	Service	8,073	9,364	10,167	11,038	18,661	5.07	8.57	11.07
	Total	18,854	21,439	23,124	24,943	40,843	4.38	7.87	10.37

- According to Local Development Program (LDP) of Province of Albay (2000 – 2004), one of the development goals is to increase the productivity level of the following commodities by the year of 2004:
  - Rice : from 3.93mt/ha to 4.72mt/ha (+20%)
  - Yellow Corn : from 2.03mt/ha to 3.00mt/ha (+48%)
  - Vegetables : from 7.90mt/ha to 10.27mt/ha (+30%).
  - Rootcrops : from 7.89mt/ha to 10.26mt/ha (+30%)
  - Fruits : from 6.07mt/ha to 7.89mt/ha (+30%)
  - Meat and Eggs : from 8,483mt/ha to 10,180mt/ha (+20%)
  - Fish : from 23,626mt/ha to 28,352mt/ha (+20%)

  The productivity enhancement of these crops will be realized by implementing the local investment programs (LIP) mentioned above. Judging from these figures and the development projects proposed by this Study, it can be expected that total agricultural product in the Study Area will increase by 30% (3.92%/annum) and 40% (4.97% per annum) at least until 2005.
- Taking into consideration the natural growth rate and productivity enhancement mentioned above, an average annual growth rate of 4.4% for Albay province and 5.5% for the Study Area, respectively, is achievable.

2) Growth in Industrial Sector

As already mentioned, the increase of agricultural production will accelerate the production of agro-industrial production. Within the context of sustainable development, the transformation of the production sectors from low to higher

value-added activities will put in place an internationally competitive agro-industrial sector with enhanced and widened areas of competitive advantage.

According to the projects during the medium-term development plans in Albay Province, the most promising investments to accelerate the industrial production are listed below:

- Product development and promotion of export commodities
- Enterprise development program
- Investment promotion program
- Public employment service
- Natural growth (2.7% per annum)
- Multiplier effect

In this Study, the output multiplier coefficient of I-O table was applied to estimate the induced GRDP for industrial sector. As a result of estimation, the average annual growth rate was calculated as 6.2% for Albay Province and 6.7% for the Study Area, respectively. So the most achievable growth rate of industrial sector are set as 8.9% for Albay province and 9.4% for the Study Area, respectively, by taking account of natural growth and output multiplier effect mentioned above.

3) Growth in Service Sector

The service sector has duplicated multiplier effects from agricultural sector and industrial sector. For example, trade business is closely related to agricultural sector and industrial sector, because trade business can exist only in the condition of these sectors' activities. In the Master Plan of this Study, the five core projects are proposed as a priority package. These projects will contribute to growth of service sector. The achievable growth rate of service sector is estimated by the following scenario:

Natural Growth

According to the result of the estimate conducted by the Study Team, the average annual growth of service sector during the period from 1995 to 1998 was 5.07%. The natural growth rate is expected to be 2.5% as around half of 5.07%.

Multiplier Effect

It is also expected that service sector will have multiplier effect in both sector of agriculture and industry. The service sector includes the tourism industry which has multiple impact to many subsectors such as transport, hotel, restaurant, and

agro-industry. So the multiplier effects of service sector are more complex than that of the industrial sector.

In the same way as for the industrial sector, the induced GRDP of service sector was estimated by applying the output multiplier of service sector from agricultural sector and construction works. As a result of estimation, the average annual growth rate will be expected to be 3.6% for Albay Province and 3.4% for the Study Area, respectively. But taking account of the past performance of each sector of Albay Province, the share of service sector has increased year by year. Furthermore, the new kinds of business is expected to be emerged in the future without relating directly to agriculture and industry. Thus, the service sector will grow more rapidly than the industrial sector.

The achievable growth rate is set up as 9.0% for Albay province and 9.4% for the Study Area by taking account of natural growth, output multiplier effects and new types of service or business.

4) The Microscopic Study for Scenario to Achieve the Target

In this study, the microscopic study for achievable GRDP and per capita GRDP with regard to the Study Area was conducted on the basis of scenario mentioned above. The basic assumptions are as follows.

The structure of GRDP including value added

The GRDP is the total of natural growth added to the GRDP in base year of 1998 and the initial and induced increase by development plan in this Study.

Natural growth rate

The average natural growth rate by sector is based on the average annual growth rate during three years from 1995 to 1998: agriculture: 0.5%, industry : 2.7% and service : 2.5% .

Increase by development plan

a) Agriculture

The GRDP of agricultural sector is assumed to increase by three times until 2020 and by 1.4 times (4.9% per annum) until 2005 since 1998. The increase rate by development plan is assumed to be 4.4% per annum (=4.9-0.5; 0.5% per annum is the natural growth rate during the period from 1998 to 2005).

b) Industry

The initial increase of GRDP by the development plan proposed by this study for industrial sector as follows.

Increase by Development Plan

(Unit: Million US$)

Plan	Annual Production
Abaca Handicraft Production	0.6
Pili Nut Processing	1.8
Coco Coir Production	12.4
Hollow Block Production	0.4
Aggregate Production Plant	1.2
Mineral Water Production	2.7
Sabo and Related Projects	20.6
Supporting Projects	2.4

c) Service

The GRDP of service sector is assumed to increase by 1.5 times (6.0% per annum) until 2005 since 1998. The increase rate by development plan is assumed to be 4.0% (=6.5-2.5; 2.5% per annum is the natural growth rate during the period from 1998 to 2005).

The Impact (Induced Production)

a) Natural growth is assumed to include the induced production by itself.

b) The induced value added to the initial increase by the development paln in this study by sector was estimated by taking account of impact on all sectors such as agriculture, industry and service.

5) Achievable Integrated Economic Growth of Albay Province and the Study Area

The achievable GRDP integrated of all sectors is estimated on the basis of the achievable growth rate of three sectors. The estimated achievable GRDP of Albay Province is PHP 37,357 million, which corresponds to 98.4% of low growth scenario and 91.5% of high growth scenario, respectively. With regard to the Study Area, the achievable GRDP of the Study Area is PHP 28,209 million (achievement rate of 99.5% for low growth scenario and 92.4% for high growth scenario).

On the other hand, the per capita GRDP of Albay Province and the Study Area are estimated at PHP30,793 (US$799) and PHP34,402 peso (US$892), respectively. The rates of the achieved to the targeted ones are the same as those of the GRDP, because the population projected does not differ for the achieved and the targeted each other.

According to the scenario on the basis of microscopic study for the Study Area mentioned above, the estimated achievable GRDP by sector is 3,361 million pesos as agriculture, 10,164 million pesos as industry and 12,254 million pesos as service. The total GRDP is 26,173 million pesos which is corresponds to 92.3% of low growth scenario of the Study Area. On the other hand, the per capita GRDP is estimated as 31,896 million peso (916 US$). The rate of the achieved to the targeted is the same as the one of the GRDP.

But the production in the industrial sector and the investment for infrastructure by regional development plan by each LGU are not included in GRDP projection in the microscopic study. Then if these production and investments were included, the targets of GRDP and per capita GRDP of the Study Area in 2005 could be achievable enough.

In this Study, the growth rate of GRDP by sector in the case of "without-disaster prevention policy" was figured out with the following brief assumptions:

- The annual average growth during the period from 1995 to 1998 of Albay province as 4.38% is considered to be the result of integrated economic growth of natural growth, economic development project/plan, disaster mitigation policy, social and natural disaster as negative growth and so on.
- The impact of disaster mitigation policy in the past is not assumed to contribute to accelerate remarkably the economic growth of Albay province.
- Therefore the average growth rate of 4.38% is considered to be reflected by very few contribution of the disaster mitigation/prevention policy.
- If the disaster prevention policy would not be executed in the past, the realized economic growth would not differ so much from the actual growth.
- Then the growth rate without the disaster prevention policy is considered to be slightly less than the one of the actual growth rate.

On the basis of these brief assumptions, the average annual growth rates for three sectors during the period from 1998 to 2005 were set up for Albay province and the Study Area respectively. According to the result of estimates, the total GRDPs of Albay Province and the Study Area are 28,126 million pesos and 21,286 million pesos in 2005 respectively which are about 75.3% and 75.5% of the achievable GRDPs. With regard to per capita GRDP, 23,183 million pesos (601

US $) for Albay province and 25,941 million peso (673 US $) for the Study Area are projected. Their ratios to the achieved per capita GRDP are the same as of the total GRDP.

(8) Achievement of GRDP Target for Long-Term Economic Growth (2020)

1) Growth in Agricultural Sector

The Philippine National Development Plan (Directions for 21st Century) prepared by NEDA, the Regional Action Agenda for Productivity for Bicol region expresses the vision for agricultural sector for the next 25 years and the action plan. This action plan will enhance agricultural productivity through: (a) enhancement of productive assets through capital accumulation, labor force empowerment and resource allocation; (b) enhancing total factor productivity (TFP) through investment in research and development, human resources development and technology development; (c) enhancing total factor productivity (TFP) by attaining economies of scale in agricultural operations; and (d) enhancing total factor productivity (TFP) through favorable policy environment and active service delivery.

The year of 2020 is the final target year of all projects proposed for the Comprehensive Disaster Prevention. The contents of multiplier effects and productivity enhancement of the industrial sector were studied from a long-term view point as follow:

- Natural growth of agricultural sector for long-term development can be assumed to be at the same rate as of the medium-term. So the growth rate is set at 0.5%.
- There is no concrete figurative development plan with regard to productivity enhancement for agriculture. But it can be approved that the increase of more than 200% (3 times) of the productivity enhancement of agricultural production is technically attainable by 2020 (growth rate: 4.7% per annum). So total growth rate of agricultural sector to attain the targeted GRDP for Albay province is achievable enough with a growth rate of 5.2% per annum (including natural growth rate: 0.5%). With regard to the Study Area, it is necessary to grow at 4.6% per annum including the natural growth (4.1% excluding it) to attain the potential productivity.

2) Growth in Industrial Sector

In view of the visions stated in the Regional Action Agenda for Productivity for Bicol Region, the achievable growth rate is set up as follows:

- It is assumed that the same growth rate (2.7%) as that of the medium-term is achievable in the long-term development plan.
- Multiplier effect and productivity enhancement
  The following factors can be the main factors of multiplier effects and productivity enhancement of the industrial sector.
  - Acceleration of incentives to investment
  - Gear up of production of high value added product
  - Expansion of market
  - Reduction of production cost by scale economy
  - Pushing up of productivity by strengthening of disaster coping capacity by comprehensive disaster prevention plans.

Judging from these factors, the industrial sector might grow by the rate of 11.4% per annum for Albay province and 11.7% for the Study Area to achieve the targeted GRDP.

3) Growth in Service Sector

Taking into consideration the prospects and visions set forth in the Philippine National Development Plan and Regional Action Plan Agenda for Productivity, the following are the main factors of multiplier effects and productivity enhancement of the service sector.

- The natural growth is expected to be 2.5% per annum the same as that of the medium-term economic growth.
- The improvement of natural security from disaster will be induced and the incentives of investment from the Government, LGUs and the private sector could be spurred.
- The social infrastructure will increase its share in comparison with the physical infrastructure. As the population will increase and the standard of living will raise after 20 years, then the higher quality of social service will be required.
- The integrated transport network will be established in more complete system between airport, land and sea.
- Tourism industry
- Acceleration of high value added services
- Diversification of business and management
- Enhanced productivity by strengthening of disaster coping capacity by comprehensive disaster prevention plan.

Taking account of the more accelerated growth than that in the industrial sector, the growth rate to achieve the targeted GRDP during the period from 2005 to 2020 is assumed to be 11.7% per annum for Albay province and 12.4% for the Study Area, respectively.

4) Achievable Integrated Economic Growth of Albay Province and the Study Area

The GRDP of all sectors to be achieved is the same as the targeted one. The GRDPs of Albay Province and the Study Area in 2020 will be realized with PHP 176.0 billion and PHP 139.8 billion, respectively. Both amounts are higher than those in the low growth scenario. On the other hand, the per capita GRDP of Albay Province and the Study Area will reach PHP116,921 (US$3,033) and PHP133,250 (US$3,457), respectively.

The summary tables of this section are shown below.

GRDP Target and Achievement for Albay Province
(with Disaster Prevention Policy)

(Unit: Million Peso)

Sector	Agriculture	Industry	Service	Total
1. Actual GRDP				
- Average Growth Rate(1995-1998) (%)	0.99	5.41	5.07	4.38
- GRDP (1998)	4,030	8,045	9,364	21,439
2. Targeted GRDP				
-2005	5,613	15,001	17,342	37,958
-2020	7,609	77,263	84,872	169,744
3. Scenario				
[Average Growth Rate:%]				
-2005				
* Natural Growth	0.5	2.7	2.5	
* This Project				
* Planned/Ongoing	3.9	6.2	6.6	
* Synergy Effects				
* Total	4.4	8.9	9.2	8.3
-2020				
* Natural Growth	0.5	2.7	2.5	
* This Project				
* Planned/Ongoing	4.7	8.7	9.2	
* Synergy Effects				
* Total	5.2	11.4	11.7	10.9
4. Achieved GRDP				
-2005	5,455	14,607	17,295	37,357
-2020	11,682	73,468	90,899	176,049
5. Conditions for Achievement - Increase of incentives for investment by mitigation of disaster - Technology development - Realization of scale economy by effective investment to infrastructure - Acceleration of high value added production - Intensification for agri-industry - Achievement of integrated transportation system - Expansion of market to the world - Diversification of business and management - Intensification for consuming structure - Intensification of eco-tourism				

According to the same assumptions as of the medium-term economic growth, the economic growth without disaster prevention policy for long-term economic growth was estimated. The result shows that the total GRDPs for Albay province and the Study Area are 50,881 million pesos and 40,821 million pesos and per capita GRDPs are 33,792 pesos (US$877) and 38,902 peso (US$1,009), respectively. Their ratios to the achieved GRDP and per capita GRDP are 28.9% and 29.2%, respectively.

The comprehensive disaster prevention will trigger to promote the economic development plans programmed by this Study and the LGUs and to accelerate the

economic growth by the synergy effects (multiplier effects), to increase the per capita GRDP. As the results, the financial revenue will increase the per surplus will be generated. The tentative calculation with regard to the financial affordability of the operating and maintenance cost of the projects in this Study by the financial surplus was conducted for Legazpi City and Daraga Municipality. The result of calculation is shown the following table.

Financial Affordability of Legazpi City and Daraga Municipality
(With Disaster Prevention Policy:Tentative Estimates)

(Unit : Milli. Peso)

1. Revenue of Local Government (Increase of Tax revenue)			
- 2005		Legazpi City	Daraga Muni.
* Total Revenue (IRA+Local Tax)	:	417	94
- IRA	:	327	73
- Tax	:	91	21
* Development Budget(20% of IRA)	:	**65**	**15**
* Flood Control Budget(15% of Dvt. B.)	:	**10**	**2**
- 2020			
* Total Revenue (IRA+Local Tax)	:	2,297	456
- IRA	:	1,798	353
- Tax	:	499	103
* Development Budget(20% of IRA)	:	**360**	**71**
* Flood Control Budget(15% of Dvt. B.)		**54**	**11**
2. Necessary O/M Cost for Priority Projects			
- 2005	:	**13**	**12**
- 2020	:	**13**	**12**

On the basis of assumption that the rate of development budget to the internal revenue allotment (IRA) is 20% and the rate of the flood control budget to the development budget 30% (the average annual growth rate during the period from 1993 to 1998), Legazpi City and Daraga Municipality would be able to burden enough the operating and maintenance cost by the flood control budget in the target year of 2020 for a long-term. In the target year of 2005 for a short-term, Legazpi City would be possible to burden enough the operating and maintenance cost (13 million pesos) by its flood control budget (20 million pesos). On the contrary, Daraga Municipality would be impossible to burden enough the operating and maintenance cost (12 million pesos) by its flood control budget (4 million pesos). But judging from the financial situation of Daraga Municipality that the development budget (15 million pesos) as a source of flood control budget exceed the operating and maintenance cost, is can afford to pay the operating and maintenance cost by revising the allotment rate of the development budget to flood control budget or by the subsides by the national Government and/or loan from financial institution.

Judging from the discussion above, is became clear that the targeted per capita GRDP is achievable and as a result of it, the economic surplus of local residents and the financial surplus of LGUs by the increase of development budget and flood control budget will make LGUs possible to burden the operating and maintenance cost of the projects.

4.3 Basic Concepts and Strategies for Formulating a Comprehensive Disaster Prevention Plan

In relation to the basic policy of the Philippine Government on disaster mitigation, the "Updated Medium-term Philippine Development Plan 1996-1998" states that "In many areas, natural calamities aggravated the situation by destroying facilities already in place or worsening living and working condition. In this light, the Government may have to formulate a more rational and extensive approach to disaster mitigation". However, the Government has not always put higher priority on disaster management in terms of budget allocation, because of insufficient budget to fulfil this requirement.

The objective of the Master Plan Study on Comprehensive Disaster Prevention is to formulate a framework plan to impede/prevent the occurrence of disasters and mitigate their effects with a view to avoiding loss of life and reducing damages to properties in the areas around Mayon Volcano.

The proposed Master Plan comprises disaster prevention projects and programs, which aim to challenge and overcome the problems/constraints clarified in Master Plan Study. These projects and programs are to be formulated in line with the government development policy and strategies for sustainable socio-economic development. To realize the above objective of this Master Plan Study, it is prerequisite to formulate and propose a complete set of countermeasures or disaster-related projects/programs consisting of both the structural and non-structural ones.

4.3.1 Direct Disaster Prevention Measures

To formulate a long-term sustainable disaster prevention plan in the Study Area, the following three broad coping measures or "direct countermeasures" are conceived:

- Countermeasure I : Prevention and mitigation
- Countermeasure II : Evacuation
- Countermeasure III : Relocation and/or resettlement

The basic direction and typical activities of the respective three development strategy alternatives are compared as summarized below.

Comparison of Three Countermeasures

Characteristics	**Coping Measure I (C-I)** Prevention & Mitigation-based Countermeasure	**Coping Measure II (C-II)** Evacuation-oriented Countermeasure	**Coping Measure III (C-III)** Relocation and/or Resettlement-driven Countermeasure
Basic Strategy	To impede/prevent the occurrence of a disaster event and/or reduce its harmful effects on key installations or communities	To remove persons from a disaster-stricken area into safer, better surroundings and conditions, and/or protect disaster-threatened persons from the full effects of the disaster	To relocate and/or resettle the communities, groups or individuals living in the highly dangerous areas, where disasters occur repeatedly
Advantages (+) and Disadvantages (-)	+ Effective to cope with a specific localized disaster - Relatively higher cost needed for construction and O&M - Difficulty to secure a special fund for preventive purposes - Depend on hazard	+ Possible and flexible to take measures and actions suited to the occasions + Low cost compared to C-I - Difficulty to make timely and accurate decision - No protection to property - Reliability of system	+ Remarkable reduction of disaster threat - Need to secure a huge amount of funds for promoting community development - Right of way and land acquisition
Typical Activities	- Construction of disaster prevention infrastructure like sabo dams, dikes, etc., and installation of forecasting and warning facilities - Enforcement of land use regulations and implementation of agricultural programs to cope with disasters, etc.	- Information management (forecasted & warning information) - Public cooperation & movement assistance - Preparation of evacuation centers (adequate accommodation) - Logistic support - Arrangements for return	- Construction of basic social infrastructure such as houses, roads, water & electric supply system, etc. - Community development
Key Issue or Requirement	- Sustainability of the programs and projects - Promotion of the community-based disaster management	- Establishment of reliable forecasting and warning system - Awareness raising and public enlightenment	- Promotion of the community-based disaster management - Sustainability of the programs and projects
	Implementation of the Socio-economic Development Programs and projects		
	Institutional and Financial Arrangements		

The most desirable yet realistic option for "comprehensive disaster prevention" in the Study Area may be defined by combining the above three strategic countermeasures. In formulating the Master Plan projects and programs, a combination of three coping strategies or countermeasures are proposed in each area, river system or river, and put in order of priority considering the disaster experiences in the past as well as respective local circumstances.

4.3.2 Supporting Programs (Indirect Countermeasures)

To achieve the goal and purpose of this Master Plan Study (see Section 1.6), it is prerequisite to formulate and propose a complete set of countermeasures or disaster-related projects/programs consisting of both the direct and indirect ones. The former includes the minimum requirements in "hardware" (or infrastructure), while the latter concerns "software" to cope with the disaster through institutional and financial arrangements.

In formulating the "comprehensive" disaster prevention plan, it is essential to study every aspect from the balanced standpoints of the both: "hard and soft" or not only "structural measures" but also "non-structural ones". These viewpoints apply to the four factors: person (personnel or organization), goods (facilities & equipment), money (funding), and information.

To ensure sustainable operations and management of the Master Plan projects and programs, "supporting" measures or programs should be taken up and provided as indirect measures, primarily centering on institutional strengthening, appropriation of necessary funds, transmission of accurate and timely information, awareness raising, and so on.

As for the "relocation/resettlement" projects, the supporting programs including livelihood and area development projects need to be implemented as a package together with institutional, technical and financial programs. As emphasized on the importance of "integration of disaster management into area development" in Subsection 2.2(5), it is vital to incorporate all disaster-related activities into specific area development projects and programs, so as to ensure their "effectiveness" and "sustainability".

4.3.3 Basic Disaster Prevention Strategies

(1) Sabo Planning

Basic concept for Sabo planning around Mayon Volcano is itemized as follows:

- Phenomenon to be treated by a Sabo facility is assumed to be debris flow and mud flow:
- Eruptive magnitude to be treated by a Sabo facility is assumed to be equal that produced in the 1984 eruption:
- Existing structure and alignment of Sabo facility (limited to hard and strong structure only) will be considered and utilized positively in this planning:
- Natural undulation on slope landform will be considered. For example, lava flow mound can be utilized as natural barrier to perform in part of large dike:

- Sabo planning will adapt to changeable river course, landform changes and increase of runoff volume by the future eruption:
  - Changeable channel course will develop on fan surface
  - New channel will form by deposition of pyroclastic flow or lave flow

The selection criteria and protection area for Sabo planning for each river are summarized as follows:

Criteria and Protected Area for Sabo Planning

River	Area and Object to be Protected	Criteria for Sabo Planning
Yawa river system	Legazpi City area, Yawa main river, rail way, Cagasawa ruins, National road	All debris material must be trapped by structure measure in upstream area to main river to protect efficient property in/around City area.
Arimbay river	No action plan since the drainage area disappeared by lava flow occurred the 1993 eruption	
Padang river & Basud river	National road, Barangay	There are some parallel tributaries next to target rivers. Debris material should be converged into one channel and flowed out the ocean or deposit field safely and directly.
Bulawan river	National road, Malilipot	Countermeasure concept for the downstream area is the same to Padang river and Basud river. On the upstream area, it is possible that one tributary of Bulawan river will capture Tabigyan river. Facility planning should protect this piracy phenomenon.
San vicente river & Buang river	National road, Barangay, River improvement in plain area	All debris material shall be trapped by structure measure in upstream area from the national road. Or only property of Barangay shall be protected by another structure.
Nasisi river & Ogsong river	No action plan is contemplated since protection area located far away for downstream area. Fan area shall be utilized as natural retarding basin.	
Quinali (A) river system	National road, Barangay, Paddy field, Rail way	Debris material should be gathered into main channel and flowed down between barangays and the paddy field safely.

(2) River Improvement Planning

Planning for river improvement in the Study Area is carried out on the basis of the following conditions and criteria.

1) Heavy rainfall

The Study Area has unique climate characteristics such as indistinct dry season and very pronounced maximum rainfall from September to January. The heavy rainfall is often caused by Southwest and Northeast Monsoons, frequent passing of Tropical Cyclones and strong convective air ascends. Mean annual rainfall is estimated to be 3,000mm at lower elevation such as Legazpi and Tabaco, and 4,000-5,000mm at higher elevation over slopes of the Mt. Mayon. Daily

maximum rainfall ranges 200-300mm at lower elevation and 400-700mm at higher elevation.

2) Year-round soil moisture

Total number of rainy days is 221 days or 60% of the year on average in Legazpi. The relative humidity is almost constant through the year and annual mean is 83% at Legazpi.

3) Steep sloped channel

The channel slope of the rivers around the Mayon Volcano is very steep. Average river bed slopes of mudflow channel and flood flow channel (such as Yawa, Quinali (A) and Quinali (B)) are 0.06-0.26 and 0.003-0.004, respectively.

4) Steep sloped drainage area

The river basins are draining from the mountaintop of the Mayon Volcano (EL 2,400m). Therefore, river piracy caused by mudflow events had frequently occurred, especially in the rivers of the southeast slope. River courses such as the Bulawan River are unstable in the alluvial fan. Flash floods with very short concentration time (25 - 130 min) occurs in each river basin. Excepting for the Ogsong River, retarding effects are not expected.

5) Sediment transport

The river bed materials survey revealed that average particle sizes (D50) of the river bed materials are 13.0mm in the sediment flow portion and 0.4mm in the flood flow portion.

6) Intensive existing land use

Paddy fields are dominant land use in the flood flow portion of the rivers. In particular, the lower reaches of the Nasisi, Ogsong, Quinali (B), and San Vicente rivers are fully utilized for rice production.

National road network is installed around the Mayon Volcano. The road system is passing the rivers to be considered with bridges

7) River related facilities

River improvement plan will be carefully studied to take into consideration the above river related facilities such as irrigation and drainage system and bridges in the river basins.

8) Alignment for planning

Riverbed of the flood flow portion is rather stable, and the extreme riverbed aggradation or degradation is not observed in the flood flow portion. Therefore, general alignment of the improved river sections shall follow the original river courses.

(3) Urban Drainage Planning

The conditions and criteria for urban drainage planning are the following.

1) Heavy rainfall

The same conditions as those for river improvement.

2) Topography

Legazpi City is situated in the low-lying area and some areas in the central district are below sea level.

3) Insufficient drainage capacity

Main river channels functioning as an outlet (estero) for urban drainage in the Legazpi City are :

a) Macabalo River in the south and
b) Tibu River in the north.

Flow capacity of the main river channels is suitable up to 5-year flood peak. But, drainage capacity of secondary and tertiary channels is presently insufficient.

4) Insufficient maintenance

Insufficient maintenance causes flood inundation in the city as described below.

a) Absence or inadequacy of drainage structures to properly train or guide the flow of rainwater to natural receptacles or water bodies
b) Siltation or clogging in some drainage pipes because of inadequate maintenance
c) Dumping of solid and liquid waste in natural and man-made channels which lessen their conveyance capacity
d) Construction of subdivisions or housing developments in nearby areas without adequate drainage outflow connection

5) High tide

The extreme high tide was measured as 1.8m in the past. The coincidence of high tide and flood events has occasionally caused inundation in the City proper. Therefore, needs for installation of floodgates and pumping facilities are raised by Legazpi City.

6) Design flood

Design flood for urban drainage projects is recommended to be 10-year in the Philippines and this is also adopted to the Study.

(4) Forecasting, Warning and Evacuation Planning

1) Forecasting and Warning System

A reliable warning based on an accurate forecasting is fundamental to an effective evacuation of people at risk to reduce vulnerability. It is indispensable for emergency response activities of governments to cope with disaster through mitigating hazard. The enhancement of a forecasting and warning system might be, therefore, one of the key strategy for the comprehensive disaster prevention. A forecasting and warning system comprises several activities as observation of hazard, forecasting of hazard, judgement of risk, preparation and issuance of warning and transmission of the warning. Some activities such as monitoring are specific to a hazard but others such as warning transmission are common to all hazards.

The study on present conditions evaluated the degree of equipage of forecasting and warning systems in the Study Area as summarized below:

For volcanic eruption:

There are still certain possibilities to strengthen the methods to observe, forecast and to judge risk. The existing system to issue warning is satisfactory but that of warning transmission or dissemination should be strengthened to afford promptness and a higher reliability.

For typhoon:

The improvement or strengthening of the existing systems to observe, forecast, judge and to issue warning are not conceivable for the time being because these activities depend on global monitoring information.

The system for warning transmission or dissemination should be strengthened as mentioned above.

For flood and inundation:

An intensive improvement in observation, forecasting, judgement of risk and issuance of warning are necessary to furnish information to reduce vulnerability and to mitigate hazard. The system for warning transmission or dissemination should be strengthened as mentioned above.

For mud and debris flow:

An intensive strengthening in observation, forecasting, judgement of risk and issuance of warning are necessary to furnish information to reduce vulnerability and to mitigate hazard. The system for warning transmission or dissemination should be strengthened as mentioned above.

The proposed basic strategies for disaster prevention with regard to forecasting and warning system are capacity strengthening of the existing system in terms of quantity and improvement of the system by means of the enhancements in terms of quality and quantity.

2) Evacuation System

The residents of the Study Area are usually threatened by the following hazards: pyroclastic flow, lava flow and ash fall (due to eruption of the Mayon Volcano), flood, inundation and mud and debris flow (caused by heavy rainfall) and strong wind (due to typhoon). Hence, the Study Team has identified evacuation-oriented coping strategy as one of the possible countermeasures, which will enable the affected residents to better cope with the effects of such hazards. The strategy will involve the designing of evacuation centers that will consider the type of hazard that will affect the community and will ensure the safety and comfort of the evacuees during their stay there. It will also entail strengthening of the present evacuation system that will be carried out based on a clear and detailed understanding of the disaster threat particularly on the part of the residents. In this case, public awareness campaign will also be given prime importance in this coping strategy.

(5) Resettlement Plan

There are two types of relocation/resettlement to be considered in this Study. One is related to the resettlement of the people living within a 6km radius from the crater of Mayon Volcano. The other concerns the “relocation” to be caused by implementation of the disaster prevention projects or due to acquisition of the right-of-the way and construction of the disaster prevention facilities.

The basic policy or principles for resettlement planning in the Study Area are as follows:

1) The resettlement site must be located in a safer place in terms of the land use and environmental regulations and restrictions.
2) Enforced relocation should be avoided, even though its program turned out to be feasible.
3) In case that relocation of people is unavoidable, it should be minimized by exploring all viable options.
4) The eligible people to be displaced should be compensated and assisted in restoring and improving their living standard.
5) The existing social and cultural institutions and communities of resettlers should be supported and used to the greatest extent possible.
6) Detailed inventory of the affected people should be prepared during the social preparation period prior to the project implementation.
7) In principle, resettlement of the people is to be done within the respective administrative divisions (municipality and city).
8) The resettlement site should be equipped with the following facilities to form and integrated community: housing area, electricity, drainage, water supply system, access roads, sewerage system, elementary school, day care center, etc.
9) Design standards proposed in the Master Plan Study
    a. Lot allocation: 120m^2 (10 x 12m) - 210m^2 (12 x 17.5m)
    b. House lot: 33.7m^2 - 42.7m^2 (core house: 21.7m^2)
    c. Strength of the house: withstanding 200kmph wind velocity, earthquake of moderate intensity (6 Richter scale) and other similar natural hazards
    d. Materials/components and maintenance of the house and site: The core house will be awarded, but its maintenance will be done by residents themselves. The gradual improvement is allowed according to the needs, preferences, and capacity of the families.
    e. Implementation of social infrastructure and livelihood development programs as an integral part of the resettlement project
10) The resettlement projects should be implemented as a package with the livelihood and area development projects as well as institutional & financial supporting programs.
11) The following factors have been considered in preparation of livelihood projects and socio-economic development programs: (a) labour-intensive or employment generation program, (b) utilization of local resources (material

and expertise), (c) prospects of marketability and (d) availability of the utilities (e.g. water, energy and others).

4.4 Land Use Plan

4.4.1 Basic Concept

To improve the coping capacity, two major concepts are conceived for land use plan, the improvement of productivity and the prevention of area decrease for agriculture. For each concept, the plans stated below are proposed, respectively.

1) Prevention of Area Decrease for Agriculture

- Sabo Project (Refer to the Sabo Planning as a detail) with Resettlement Plan

2) Improvement of the Productivity

- Agricultural Development Plan
- Livelihood Development Plan

(1) Hazard Zone

The Study Team defined the new hazard zone by mud flow and is proposing the sabo facility for this zone, which are the eight areas, Yawa (Pawa-Burabod, Budiao-Anoling), Basud, Padang, Bulawan, Buang, San Vicente, Quirangai and Masarawag. The protected areas by the sabo facility, which is the hazard zone without the sabo facility, are mostly situated between 6km and 10km horizontally extending from the summit of Mayon Volcano, which is the active agricultural zone.

(2) Environmental and Agricultural Category and Other Issue

The present zoning of environmental and agricultural category must be respected as well as the development plan of each municipality.

4.4.2 Zoning

(1) Zoning Element

1) Sabo Buffer Zone

A 150-300m-belt zone along the sabo facility with agroforestry and intercropping.

2) Vacant Land and Bush & Grass Area

a) Agriculture

For the high productivity and low cost for the agricultural land development,

- the slope < 4% : to be irrigated rice paddy
- the slope > 4% : to be intercropping area of coconut, banana or abaca

b) Residential

New residential area is primarily for the people to be resettled due to the sabo project.

c) Industry & Research Area

Industry in the protected area serves for enhancement and growth of the existing small family manufacture. Also its products will be the first processed goods for the final process in the Banquerohan. Research Area includes the research forestry, nursery and some tourism function.

d) Service and Commercial

The function is to connect other functions in the community and serve for people's activity, including tourism.

(2) Zoning Concept

Three alternatives had been proposed as the possible plan. These alternatives can be evaluated economically to chose the final plan.

1) Alternative I : Without Sabo Project + Resettlement of All Residents.

This is the alternative without the sabo facility. In this option all residents in the hazard area of the mudflow must be resettled and the hazard area will not be utilized for any purpose. The number of residents who should be resettled is the largest among the three alternatives and the new resettlement site must be provided.

2) Alternative II : Sabo Project + Intensive Agricultural Plan + Resettlement Plan

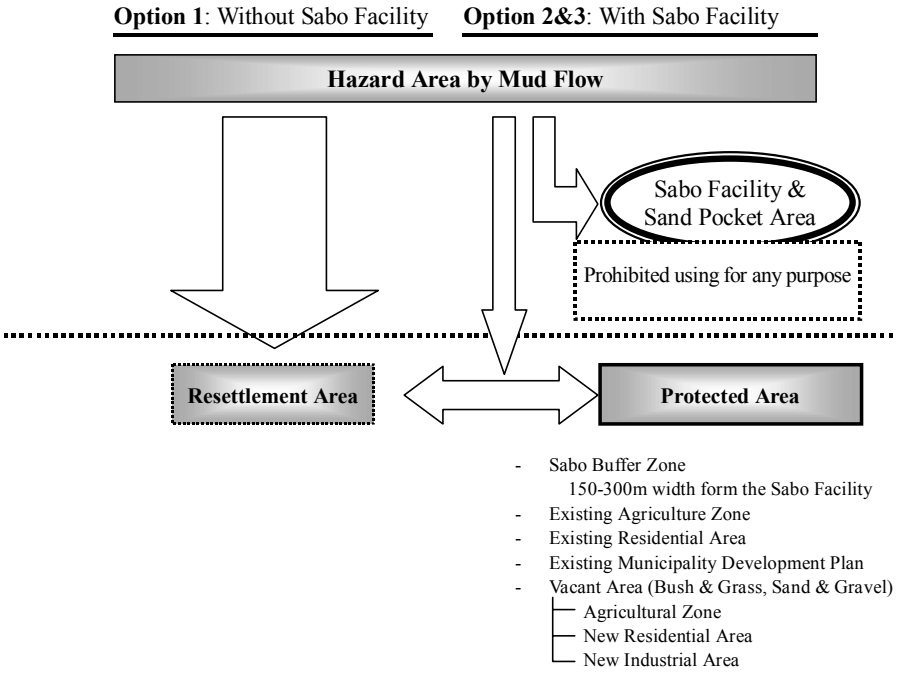
; Enhancement of the productivity keeping the present land use.

In the protected area by the sabo project, the agricultural productivity will be enhanced but the present land use should be maintained. The residents under the sabo facility and the sedimentation area must be resettled in the resettlement area.

3) Alternative III : Sabo Project + Agricultural Plan + Agro-industrial Plan + Resettlement Plan

; Enhancement of the productivity the intensification of the land use.

In this alternative the land use of the protected area will be enhanced by agro-industrial usage as well as agricultural. The residents under the sabo facility and the sedimentation area must be resettled in the resettlement area.



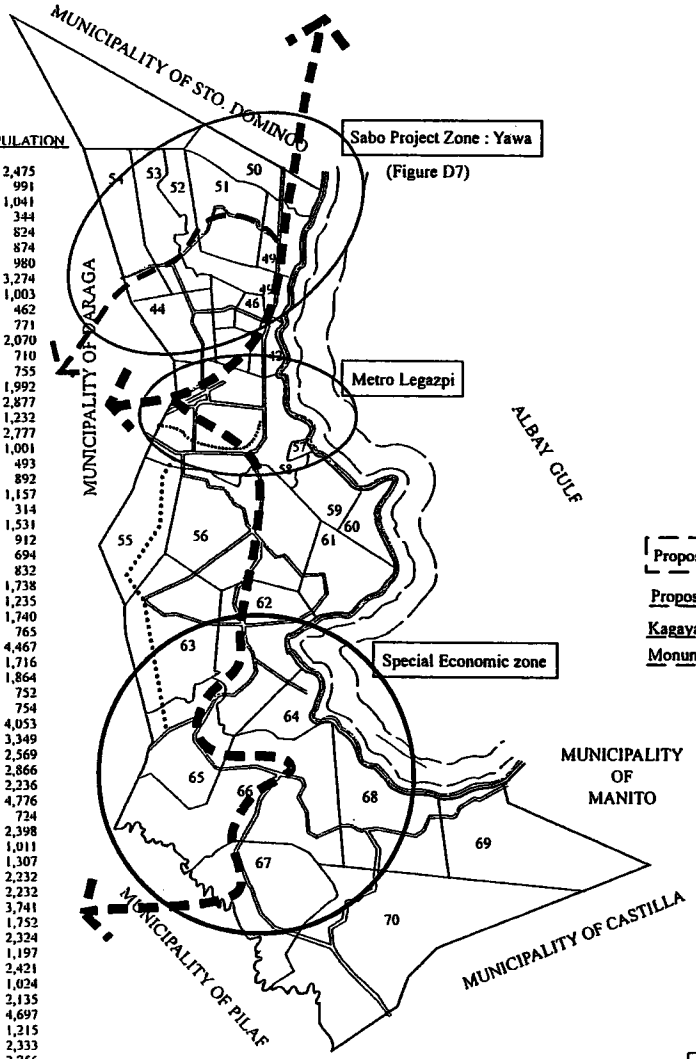
Basic Concept of Land Use Plan

4.4.3 Land Use Plan

Based on the existing land management issues and the zoning criteria, the Land Use Plan is provided as follows (see Table 4.3.1).

Area : 15,370km²
Population : 155,786
Pop. Dencity : 1,014p/km²
Revenue : P249,262,861.94('97)
No. of Evacuation Center : 49
Resettlement Site : Banquerohan
(Phase I + II : 1,040houses
460,045m²)
No. of Residents in PDZ : 330
55households

BARANGAY (70)			POPULATION
01	Bgy. 1	Em's Barrio	2,475
02	Bgy. 2	Em's Barrio (S)	991
03	Bgy. 3	Sagpon (Leg.)	1,041
04	Bgy. 4	Sagpon (Leg.)	344
05	Bgy. 5	Sagmin	824
06	Bgy. 6	Bañadero	874
07	Bgy. 7	Baño	980
08	Bgy. 8	Bagumbayan	3,274
09	Bgy. 9	Pinaric	1,003
10	Bgy. 10	Cabugao	462
11	Bgy. 11	Mauyod	771
12	Bgy. 12	Tula-tula	2,070
13	Bgy. 13	Ilawod West	710
14	Bgy. 14	Ilawod	755
15	Bgy. 15	Ilawod East	1,992
16	Bgy. 16	Kawit, East Wash, Drive	2,877
17	Bgy. 17	Rizal St., Ilawod	1,232
18	Bgy. 18	Cabangan West	2,777
19	Bgy. 19	Cabangan	1,001
20	Bgy. 20	Cabangan East	493
21	Bgy. 21	Binanuahan West	892
22	Bgy. 22	Binanuahan East	1,157
23	Bgy. 23	Imperial Court Subd. I	314
24	Bgy. 24	Rizal Street	1,531
25	Bgy. 25	Lapu-lapu	912
26	Bgy. 26	Dinagaan	694
27	Bgy. 27	Victory Village South	832
28	Bgy. 28	Victory Village North	1,738
29	Bgy. 29	Sabang	1,235
30	Bgy. 30	Pigcale	1,740
31	Bgy. 31	Centro Baybay	765
32	Bgy. 32	San Roque	4,467
33	Bgy. 33	PNR Peñaranda St., Iraya	1,716
34	Bgy. 34	Qrosite & Magallanes St.	1,864
35	Bgy. 35	Tinago	752
36	Bgy. 36	Capantawan	754
37	Bgy. 37	Bitano	4,053
38	Bgy. 38	Gogon	3,349
39	Bgy. 39	Bonot	2,569
40	Bgy. 40	Cruzada	2,866
41	Bgy. 41	Bogtong	2,236
42	Bgy. 42	Rawis	4,776
43	Bgy. 43	Tamaoyan	724
44	Bgy. 44	Pawa	2,398
45	Bgy. 45	Dita	1,011
46	Bgy. 46	San Joaquin	1,307
47	Bgy. 47	Arimbay	2,232
48	Bgy. 48	Bagong Abre	2,232
49	Bgy. 49	Bigaa	3,741
50	Bgy. 50	Padang	1,752
51	Bgy. 51	Buyuan	2,324
52	Bgy. 52	Matanag I	1,197
53	Bgy. 53	Bonga	2,421
54	Bgy. 54	Mabinit	1,024
55	Bgy. 55	Estanza	2,135
56	Bgy. 56	Taysan	4,697
57	Bgy. 57	Dap-dap	1,215
58	Bgy. 58	Buragwis	2,333
59	Bgy. 59	Puro	2,756
60	Bgy. 60	Lamba	657
61	Bgy. 61	Maslog	2,764
62	Bgy. 62	Homapon	2,780
63	Bgy. 63	Mariawa	1,175
64	Bgy. 64	Bagacay	1,097
65	Bgy. 65	Imalnod	1,271
66	Bgy. 66	Banquerohan	3,503
67	Bgy. 67	Bariis	1,533
68	Bgy. 68	San Francisco	1,477
69	Bgy. 69	Buenavista	740
70	Bgy. 70	Cagbacong	1,739



Source : City of Legazpi
National Housing Authority
JICA Study Team

COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBLIC OF THE PHILIPPINES

JAPANINTERNATIONAL COOPERATION AGENCY

Figure : Municipality Profile of CITY OF LEGAZPI

Not to scale

Special Economic Zone

Banquerohan : 1,838ha
Hamapon : 1,500ha

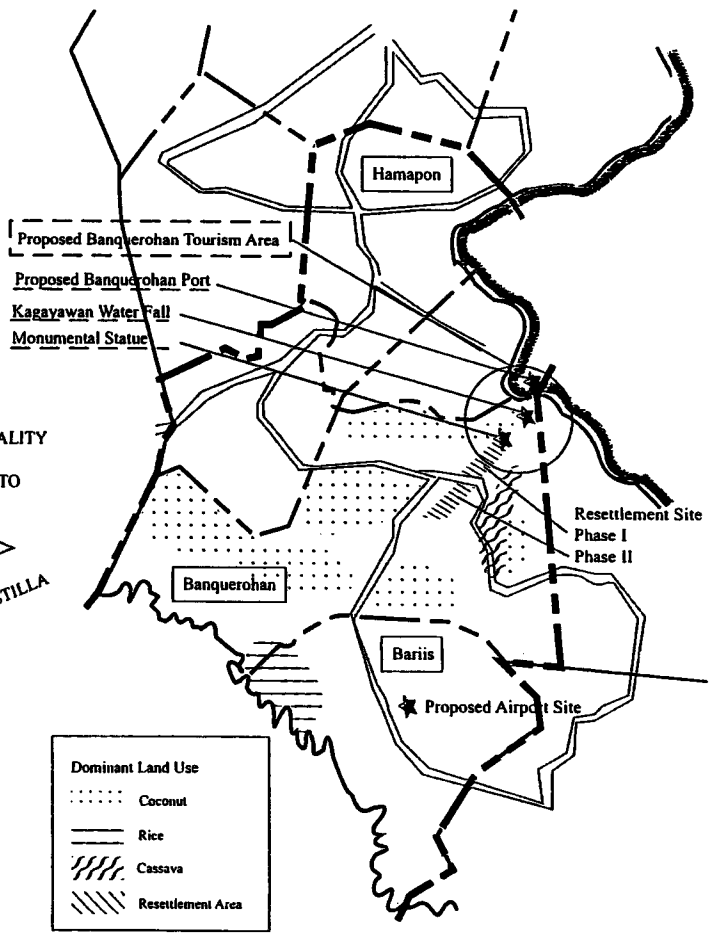
1. **Resettlement Area : 46.9ha**
2. **Agrarian Reform Community : 300ha**
3. **Industrial Area : 90ha**
   - **Banquerohan : 33ha**
   - **Hamapon : 57ha**
4. **Proposed International Airport : Bariis**

Existing Land Use (Banquerohan)

Agriculture	**1,092.14ha**	**59.42%**
Cropland	920.89ha	84.32%
Fishing	171.25ha	15.68%
Residential	**20.77ha**	**1.13%**
Institutional	**1.29ha**	**0.07%**
Open Spaces	**700.46ha**	**38.11%**
Others	**23.34ha**	**1.27%**
(Road, Road lots, etc)		

		(/Year)
Coconut	747.89ha	112.19MT
Rice	100.00ha	250.00MT
Banana	30.00ha	180.00MT
Cassava	18.00ha	21.60MT
Intercrop		
Corn	18.00ha	54.00MT

* 742 Farmers
with an avarage farm size of 1.76ha



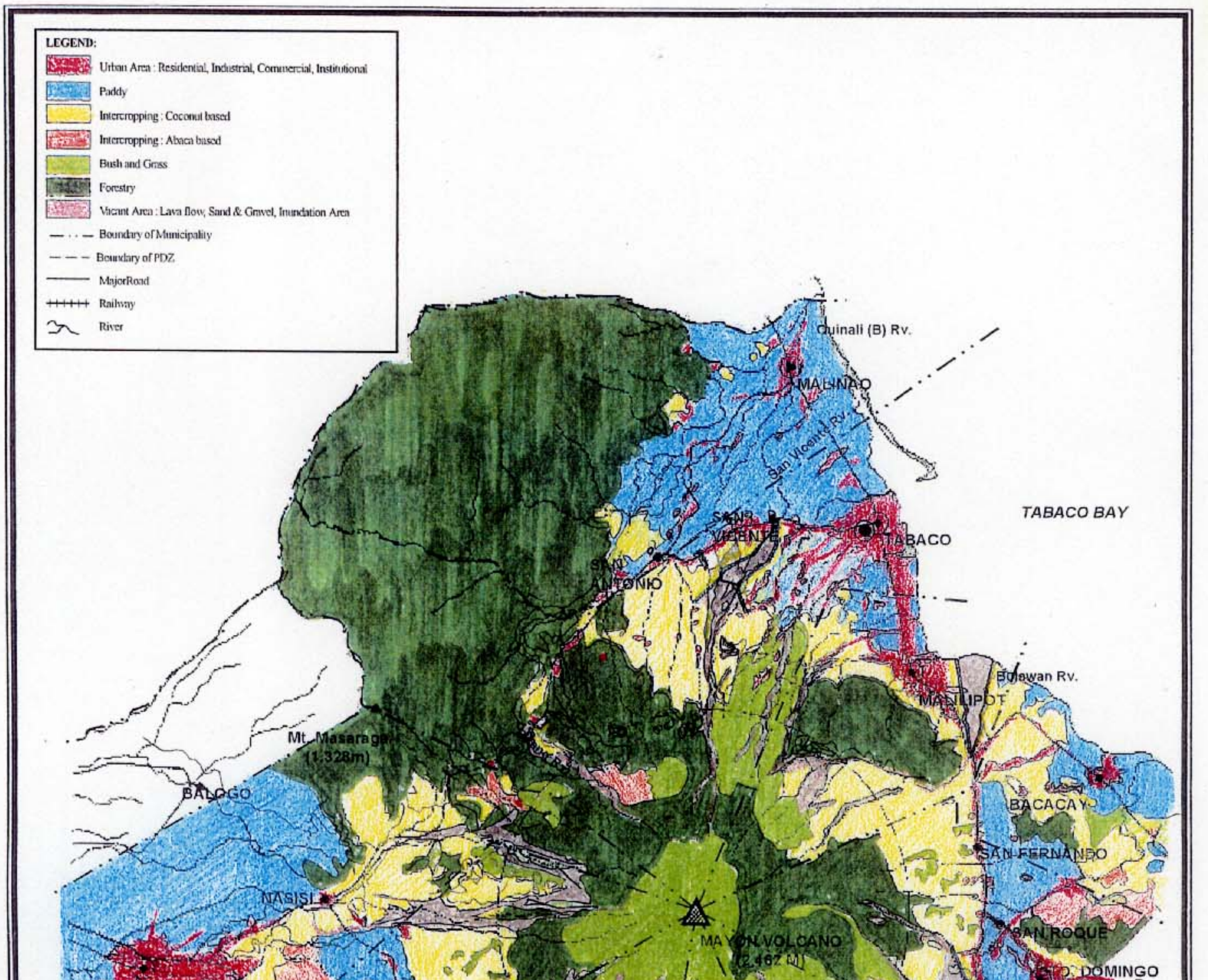
Banquerohan Resettlement Site

Phase I

Land Area	: 18.9ha	
Residential Lots	: 78,934(m2)	41.70%
Commercial Lots	: 6,468	3.42
Open Space	: 6,477	3.42
Foot Path	: 13,132	6.94
Road Lots	: 12,097	6.39
C.D.S.	: 1,312	0.69
Unbuildable	: 4,806	2.54
Waterway	: 654	0.35
Creek Lot	: 10,051	5.31
Remaining Lot	: 55,345	29.24
Units	: 629 Lots 504 Units	
Residencial	: 604 Lots	
Comercial	: 25 Lots	
Lot Size	: 100-120sq.m	
Drainage System	: Opened Lined Canal	
Sewer System	: Indivisual Septic Tank	
Water System	: Shallow Well	
Power System	: Alleco II	
Total Cost	: P38.93M	
Land	: 0.658M	
Land Development	: 9.672M	
House Construction	: 28.600M	

Phase II

Land Area	: 27ha
Units	: 460 Lots
Lot Size	: 120-200sq.m
Drainage System	: CHB Lined Canal
Sewer System	: Septic Tank
Water System	: Shallow Well
Power System	: Alleco II
Cost for Land Development & House Construction.	: P8,038M



Source : GIS Survey-Land Cover Map
Aerial Photo 1982
Aerial Photo 1999
Development Plan of Municipality
Provincial Development Plan
JICA StudyTeam

COMPREHENSIVE DISASTER PREVENTION AROUND MAYON VOLCANO IN THE REPUBRIC OF THEPHILIPINES

Land Use in 2020

JAPAN INTERNATIONAL COOPERATION AGENCY

4.5 Regional Socio-economic Development Plan

4.5.1 Core Problems of Infrastructure

The Province of Albay, considered as one of the potential agricultural and industrial giants in the region, abounds with resources that can considerably make it into the economic giant it dreams to be. But these resources are not utilized to the maximum due to lack of infrastructure support facilities such as farm-to-market roads and bridges, public markets, school buildings, ports and the improvement of communication facilities, specifically the telephone system should be undertaken to ensure that economic activities will run into a high gear. Provision of these infrastructure facilities would mean progress and development through province.

In Albay Province, there are many regional development plans and programs from various aspects in the level of province, city, municipality, official development assistance (ODA). The LGUs in Albay Province are preparing or have prepared a medium-term public investment program (MTPIP) during the period from 2000 to 2004. Recently, the Master Plan for the Legazpi-Iriga-Naga-Daet Growth Corridor (LINDGC) Projects was reported by Coordinating Council of the Philippine Assistance Program, Regional Development Council (RDC-V) in July 1998. This project is the central strategy for the acceleration of growth through agro-industrialization of the Bicol region.

4.5.2 Development Plan

The following are the major plans or projects programmed in the regional socio-economic development plans or programs mentioned above which can be expected to solve the problems of infrastructure and to accelerate the economic growth of the Study Area.

(1) Agriculture

- Technology generation and dissemination for crops
- Farm inputs/Farm implements assistance program
- Market linkage program
- Integrated animal health and production service
- Food terminal/ice plant and cold storage facilities
- Seedling production projects
- Promotion of food basket approach
- Abaca industry recovery and promotion project
- Multi-purpose drying pavement

(2) Agro-industry

- Seedling production project
- Provincial industrial cluster promotion center
- Bicol regional agro-industrial center
- Legazpi PEZA(Philippine Economic Zone Authority)
- Malilipot Ecozone
- Product development and promotion of export commodities
- Enterprise development program
- Investment promotion program
- Public employment service

(3) Tourism Industry

- Sea-based eco-tourism development : Rapu-Rapu, Tabaco, Bacacay and Tiwi
- Land-based development : Mayon Skyline Hotel Development : Mayon Volcano National Park and Waterfalls (Bubusuran, Vera, Pale, Busay falls)
- Ecological based development : Mayon View Park, Penaranda Park, Hoyop.

(4) Service Industry

- Development Pio Duran Port as municipal port serve as a gateway to the Visayas and the island of Mosbate
- Improvement of Tabaco and Legazpi Ports to upgrade their services/facilities that could accommodate bigger ships ad sea vessels as international port
- Agricultural support facilities like irrigation system to provide adequate supply of water to farm and agricultural land for increased production
- School buildings in accordance with DECS and LGU to accommodate increasing enrolment and improve delivery of educational services to rural area
- Installation of modern technology of communication system so as to make more the province updated and equipped with the service of high-tech telephone system
- Rehabilitation of the railroad network so as to make the province accessible to the railroad system for low cost transportation of goods to the trade center of Metro Manila.
- Establishment of an international airport (Bariis in Legazpi City) and open/construction of domestic airport in a particular municipality, to accommodate other passengers and cargoes for easy accessibility and delivery. Likewise, to modernize air navigation and communication facilities/ equipment.

The detailed development plans are shown in Tables XII 5.7.1 to XII 5.7.5 in Supporting Report (1) XII.

4.6 Institutional Improvement Plan

The Philippine Government repeatedly stated its policy of self-reliance in disaster management since the enactment of PD1566 in 1978. In this Decree, each administrative division is requested to utilize all available resources in its area before asking for assistance from higher authority. In 1989, the NDCC issued the Memorandum Order (No.1/1989) and reiterated that it was the inherent responsibility of every local official through the Disaster Coordinating Council (DCC) to implement immediately appropriate measures to minimize disaster impacts. The Memorandum Order also instructed the DCC Chairmen to encourage people's participation in the government efforts thereby fostering the spirit of "bayanihan" during disasters or emergencies.

In the Philippines, there has been a long tradition of communal irrigation system (CIS) managed by farmers. Such traditional irrigation facilities were mostly constructed utilizing local materials as wood, bamboo, grass, sand, and gravel. Barangay chairperson and wealthy farmers mostly plan the CIS facilities, farmers engage in construction work.

The government idea of community-based disaster prevention seems to have its base on the CIS. In other words, the background for promotion of community-based approach in disaster management can be summarized as follows. Many top-down approaches may lead to inequitable and unsustainable results, and fail to address the local needs. Such approach may ignore the potential of local needs of vulnerable communities and also that of local resources and capacities.

Though the community-based approach in disaster management has been advocated in the Philippines, there are some institutional constraints to disaster management in Mayon Volcano areas. The institutional constrains in community-based disaster management is summarized below, by categorizing them into the following three viewpoints: regulatory, operational and financial ones.

4.6.1 Regulatory Constraints and Improvement Plan

(1) Revision of National Calamities and Disaster Preparedness Plan

The National Calamities and Disaster Preparedness Plan was last prepared in 1988. The current Plan focuses on the structure and responsibilities of the member organizations involved in disaster prevention. The Plan should be revised so as to

be a more comprehensive disaster prevention plan. The following issues should be included in the Plan.

National Calamities and Disaster Preparedness Plan Improvement

Main issues and topics to be included in the National Calamities and Disaster Management Plan
Introduction Vision, task, and purpose of the Plan Analysis on the disaster occurrence in the Philippines National policy on disaster prevention Organization, structure and operation (national and local levels) of disaster prevention Roles and responsibilities of the organizations and agencies related to disaster prevention
Standard Disaster Preparedness Plan Public relations plan for disaster prevention (national and local level) Awareness raising plan for disaster prevention
Standard Disaster Operation Plan Disaster operation plan before, during and after the disaster Disaster operation plan by responsible organizations Disaster operation plan by disaster type (flood, typhoon, volcanic eruption)
Guideline for formulation of local comprehensive disaster operation plan Guideline for regional, provincial, city, municipality and barangay plan
5. Monitoring and Review Mechanism for the Plan
6. Appendices Organization chart of the National Disaster Coordinating Council Members list of the National Disaster Coordinating Council Roles and Responsibilities of the member organizations Law, Presidential Decree, Executive Orders pertinent to disaster prevention

Local Government Code (RA7160) was issued in 1991. It provided for greater responsibility of LGUs in disaster management. A new Plan stipulating the roles of LGUs should be prepared and regularly updated.

(2) Monitoring responsibility for mud and debris flow

Responsibility for mud and debris flow is not defined in the Mayon Volcano area though currently OCD is in charge for monitoring. Though there is a Committee on Warning at PDCC, there is no specific mandate to appoint an agency responsible for mud and debris flow.

4.6.2 Operational Constraints and Improvement Plan

(1) Review of the government policy on budget allocation

There are many Sabo and river facilities around Mayon Volcano installed by DPWH. Little attention has, however, been paid to maintenance of these facilities. Review of the current maintenance activities by DPWH is required. It is recommended that more budgets for maintenance works should be appropriated.

It is therefore necessary to prioritize budget allocation for maintenance of existing facilities over newly proposed facilities.

(2) Inter-LGU Cooperation Agreement on Disaster Management

There is no cooperation agreement on disaster operations among LGUs.

Promotion of cooperation among LGUs, NGOs and private sector including Rotary Club and Lions Club in disaster management activities is to be promoted.

(3) Non-Structural Mitigation Measures are not stressed at Provincial and Municipal Levels

Enforcement of National Building Code is not done. There are many houses made of light materials and vulnerable to disasters. Similarly, comprehensive land use plans at provincial and municipal levels need to be prepared.

(4) Disaster Preparedness Plan and Contingency Plan (Operation Manual) prepared at Municipal and Barangay levels are mostly on paper only

Most LGUs in the Study Area have Disaster Preparedness Plan. Some LGUs have Disaster Contingency Plan or Operation Manual. However, the residents are not well aware of the contents of these plans. These plans should be explained to the residents as the Study Area is situated in a disaster-prone area. Unless the residents understand what assistance can be expected from the public sector and what they are supposed to do cope with disaster, the community-based disaster management can not be realized.

(5) Public Education Campaign on disaster and its precautionary measures are not integrated in school curricula.

Though the National Calamities and Disaster Preparedness Plan mandates DECS as the agency responsible for public education campaign, such campaign is not integrated in school curricula.

4.6.3 Financial Constraint and Improvement Plan

(1) Beneficiary to pay principle

Community-based approach in disaster management stipulated by PD1566 encouraged the active involvement of LGUs and the people in disaster management.

Both national and local governments are not able to appropriate their budget sufficient for disaster management operations. Further study shall be made to enable LGUs to generate more funds for disaster management operations. One such idea may include the introduction of "calamity contribution" from the residents. The Calamity Contribution may be collected from each citizen as a source for disaster management operation. Such contribution will be charged for those who reside in danger zone.

4.7 Sabo Planning

(1) Selected Project

Candidate sabo projects in this Study Area are selected by the conditions and criteria for this Study as follows.

- Yawa River System Sabo Project (SF-1)
- Quinali (A) River System Sabo Project (SF-2)
- Buang River Sabo Project (SF-3)
- San Vicente Sabo Project (SF-4)
- Padang River Sabo Project (SF-5)
- Basud River Sabo Project (SF-6)
- Bulawan River Sabo Project (SF-7)

(2) Proposed Alternative Plan

Phenomenon to be treated by the Sabo facility is assumed to be debris flow and mud flow, which is including the sediment run off by the eruption.

1) Probable runoff and design runoff of mud and debris flow

The probable runoff volume formula as the estimation model (Technical Standard for the Measures against Debris Flow (Draft), 1988, Ministry of Construction)

The quantitative relationship between rainfall and the magnitude of mud and debris flow is not available in the Study Area since no measurement of mud and debris flow had been conducted.

The empirical probable runoff volume formula is applicable to estimate the magnitude of mud and debris flow on the basis of a rainfall depth.

The formula reflects the topographic and geologic conditions of the site and has yielded satisfactory results in Japan.

2) Facility Alignment

The basic components of each alternative plan for sabo planning are as the below:

a) Sand Pocket (Sabo dam + Long spur dike)

The proposed sand pocket alignment is composes of the long spur dikes and the Sabo dam. This alignment is designed to trap sediment material, and to protect houses and cultivate area widely.

b) Spur Dike and Training Dike

The proposed spur dike and the training dike converge debris flows into the one channel, and flows the debris out to the downstream safely and directly.

c) Protection Dike

The proposed protection dike is designed to protect only houses as protect objects. This alignment permit the debris flowing down for cultivate area except protect area.

The table of alternative plans on each river is shown in Data book.

(3) Facility design for Sabo Planning

The proposed facilities in the Study Area will be designed with the following structural conditions:

- Strong and large-scale facilities constructed in the past exist along Pawa-Burabod river, Budiao river, Quirangay river, Masarawag river, and Nasisi river.
- A part of facility around Mayon volcano shall be needed rehabilitation.
- In facility design for structural planning, CSG (concrete, sand and gravel) method was widely adopted to minimise the cost.
- CSG method was a kind of aggregate as the filling material for created embankment of spur dikes and consolidation. Sabo works in Pinatubo have already used it in Philippines and have shown its advantage.
- Advantage of CSG method is easy construction work, low cost and high local supplement.

Typical cross sections of the facilities are as follows (in case of the probable one day rainfall 20 year).

1) Sabo dam (All CSG method):

Dam height=6.0m (Effective height=4m), Cut off height=2m, Crown width=5.0m

2) Spur Dike:

- Type A (All CSG method): Height=6.5m, Crown width=4.0m
- Type B (CSG method + Embankment): Height=6.5m, Crown width=6.0m
- Type C (Embankment): Height=6.5m, Crown width=6.0m
- Type D (Raising)

3) Training Dike (CSG method):

In case of water depth 1.5m, Height=4.5m, Crown width=3.0m

4.8 Flood Control Facility Strengthening

4.8.1 River Improvement Plan

(1) Candidate scheme

Several candidate schemes for river improvement in the Study Area are selected by the conditions and criteria for the study as follows.

- Yawa river improvement project
- San Vicente river flood way project
- Quinali (B) river improvement project
- Nasisi river improvement project
- Ogsong river improvement project

Rivers other than the above selected rivers will be treated by Sabo works and no river improvement works are recommended by the study.

Backwater effects occasionally occur in the lowest reaches of the Quirangay, Tumpa, Maninila and Masarawag rives near the confluence to the Quinali (A) river. The river improvement for the Quinali (A) river is a premise for solving the inundation in the lowest reaches of those rivers affected by the backwater from the Quinali (B) river. The lowest parts of those rivers are situated south of National Highway passing between Legazpi and Ligao.

(2) Basic Concept and Alternative Plan

1) Basic concept

Basic concepts for river improvement plan are:

a. to mitigate flood damage in the flood prone area
b. to upgrade the function of river as a flood way for Sabo works
c. to enhance the productivity of land use

2) Alternative plan

Based on the basic concepts, several alternative plans are considered as follows.

a. Dredging the river channel
b. Raising the existing dike
c. Widening the river channel with embankment
d. New flood way

Alternative c. is selected for all schemes to secure in advance the right of way for future river improvement works suitable for 100-yr probable flood.

Alternative d. is selected for the San Vicente river to mitigate the flood inundation in Malinao by diverting the river course into the sea instead of presently draining into the Quinali (B) river.

(3) Facility Design

1) General

Master Plan level designs are prepared for the proposed structures of the alternative plan described in Section 3.5. The design of river structures is based on the results of hydraulic calculation, incorporating relevant design criteria as described in Chapter I, Supporting Report (1).

2) Alignment

The alignment of the dike for each alternative plan for the Yawa, San Vicente, Quinali (B), Nasisi and Ogsong rivers is shown in Figure 4.7.1 to 4.7.3. The channel alignment is chosen to minimize the social and environmental impact by following the existing river channel wherever possible. For new flood way channel in the San Vicente river, the flood way alignment is chosen by following the past water course of the river.

The length of the dike for each alternative plan is summarized below.

Length of Dike for Alternative Plan

River Name	Length of Dike (m)	Location
Yawa	2,000	From the river mouth
San Vicente	4,000	New flood way from San Vicente Bridge to the sea following the past water course
Quinali (B)	2,650	First section (from the river mouth)
	1,400	Second section
	7,050	Third section
	150	Fourth section
	11,250	Total section
Nasisi	600	First section (from Quinali (A) to Ogsong)
	7,033	Second section
	7,633	Total section
Ogsong	5,700	From the confluence to the Nasisi river

3) Hydraulic design

Typical cross section of the dike is shown in Figure 4.7.4. The crest width is set at 4.0m for all alternatives. The riverside slope is set at 1v:1.2h and the revetment works of wet masonry in provided. Gabion is installed to provide protection from scour.

The landside slope is 1v:2h and protected by mountain soil and sodding to protect it from rainfall run-off.

The common hydraulic design of the dike for each alternative is summarized below.

Hydraulic Design Standard for River Improvement Plan

Free board	1.2m
Roughness coefficient	0.035

Design discharge, channel gradient, design depth and river width for each alternative are summarized below.

List of Hydraulic Design Parameters (Q20)

River Name	River Section	Design Discharge (20-year)	Channel Gradient	Design Depth (m)	Design River Width (m)
Yawa	Total section	1,350	0.0015	4.4	90
San Vicente	Total section	180	0.0063	1.6	30
Quinali (B)	First	1360	0.0008	4.0	140
	Second	1250	0.0015	4.0	120
	Third	1210	0.0021	3.5	100
	Forth	1080	0.01	2.4	80
Nasisi	First	1220	0.0025	3.8	80
	Second	680	0.0050	2.8	50
Ogsong	Total section	570	0.0035	3.5	35

List of Hydraulic Design Parameters (Q10)

River Name	River Section	Design Discharge (10-year)	Channel Gradient	Design Depth (m)	Design River Width (m)
Yawa	Total section	-	-	-	-
San Vicente	Total section	150	0.0063	1.5	30
Quinali (B)	First	1130	0.0008	3.6	140
	Second	1040	0.0015	3.6	120
	Third	1010	0.0021	3.2	100
	Forth	900	0.01	2.2	80
Nasisi	First	1070	0.0025	3.5	80
	Second	590	0.0050	2.6	50
Ogsong	Total section	500	0.0035	3.3	35

4.8.2 Urban Drainage Plan

(1) Alternative Plan

1) Enlargement of flow capacity

The main river channels such as the Macabalo and Tibu rivers are to be enlarged if design discharge is larger than flow capacity of the existing channels. But, to minimize the social impact of land acquisition along the main river channels, it is fully recommended to maintain the existing river width as same as possible. The flow capacity of two rivers is estimated to be around 5-year probable flood peak discharge. Riprapping of the channels is properly installed along the water course.

2) Pump drainage

a. Pumping stations

Pump drainage system is fully recommended to minimize the flood damage in the city. Suitable size of pumping station is to be determined to minimize the project cost.

b. Flood gates

Suitable size of flood gate is to be installed in the Macabalo and Tibu rivers to protect the low-lying areas from the intrusion of tidal flood in the city.

c. Retention pond

Installation of retention pond is considered as an effective measure to regulate flood peak and to minimize the size of pumping station if installed with a pumping station.

(2) Proposed Drainage Plan

The proposed drainage plan is selected as an integration of all alternative plans considered as follows.

a. Riprapping along main river channels (Macabalo and Tibu rivers)
b. Flood gates to protect tidal flood into the rivers
c. Pumping stations to compulsorily drain interior flood inundation with flood gate operation
d. Retention pond to regulate flood peak

(3) Facility design

1) General

Master Plan level designs are prepared for the proposed structures of the alternative plan described in Section 3.5. The design of urban drainage structures is based on the results of hydraulic calculation, incorporating relevant design criteria as described in Chapter I, Supporting Report (1).

2) Alignment

The alignment of the dike for each alternative plan for the Macabalo and Tibu rivers is shown in Figure 4.7.5. The channel alignment is chosen to minimize the social and environmental impact by following the existing river channel wherever possible.

The length of the dike for each alternative plan is summarized below.

Length of Dike for Alternative Plan

River Name	Length of Dike (m)	Location
Macabalo	1,700	From the river mouth
Tibu	834	From the river mouth

3) Hydraulic design

a. Main river channel

Typical cross section of the dike is shown in Figure 4.7.4. The riverside slope is set at 1v:1.2h and is protected by grouted riprap. Gabion is installed to provide protection from scour.

The common hydraulic design of the dike for each alternative is summarized below.

Hydraulic Design Standard for Urban Drainage Plan

Free board	1.0m
Roughness coefficient	0.035

Design discharge, channel gradient, design depth and river width are summarized below.

List of Hydraulic Design Parameters (Q10)

River Name	River Section	Design Discharge (10-year)	Channel Gradient	Design Depth (m)	Design River Width (m)	River Width to be Widen (m)
Macabalo	Total section	105	0.001	2.0-2.5	26-32	0.0-28
Tibu	Total section	17	0.001	1.1-4.0	4.8-39	-

b. Flood gate

Flood gate is planned to be installed in the Macabalo and Tibu rivers at the river mouth as shown in Figure 4.7.5.

Hydraulic design adopted to the rivers is briefed below.

Hydraulic Design for Flood Gate

River Name	Probable Flood (year)	Flood Peak (m^3/s)	Gate Height (m)	Gate Width (m)	No. of Flood Gates
Macabalo	10	105	3.5	3.0	5
Tibu	10	17	3.5	3.0	3

c. Pumping station

Pumping station is designed in the Macabalo and Tibu rivers as follows.

Hydraulic Design for Pumping Station

River Name	Probable Flood (year)	Flood Peak (m^3/s)	Design Pumping Capacity (m^3/s)
Macabalo	10	105	10.0
Tibu	10	17	1.0

d. Retention pond

The design of retention pond are roughly carried out with limited information from the Legazpi City.

Hydraulic Design for Retention Pond

River to be Drained	Pond Capacity (m^3)	Pond Area (ha)	Design Water Depth (m)
Macabalo	444,600	12.0	3.7
Tibu	13,536	0.5	2.7

4.9 Forecasting and Warning System Improvement

The forecasting and warning system improvement plan contemplated are for volcanic eruption, flood and inundation, mud and debris flow and system for transmission and dissemination of warning for all hazards in accordance with the proposed strategy discussed in 4.2.3(4).

The systems and equipment described below are the candidate to be selected to strengthen and to improve the existing forecasting and warning systems. The proposed Master Plan is formulated through the construction of systems with the selected candidates.

a) For eruption

(For monitoring of the activity of magma)

Seismic sensor of 3 elements good for the period of 20 second with telemeter.
Analyzing and data storing processor with A/D converter.
Graphic terminal with DAT or MO control function.

(For monitoring of de-formation of the mountain)

GPS with a simulation model to assess the pressure of magma on the basis of the deformation.

(For monitoring of SO_2)

Automatic gas sampler with simple analyzer and telemeter system.

Automatic wind velocity and direction recorder with telemeter system.

b) For mud and debris flow

- Optical sensor
- Seismic sensor
- Supersonic water level gauge
- Acoustic sensor
- Event reporting type rainfall gauge
- Telemetering system with data processing unit is fundamental to all

c) For flood and inundation

- Telemetered rainfall gauging system
- Telemetered water level gauging system (Float type)
- Supersonic type water level gauge and velocity meter
- Supervisory control and data processing unit for telemeter.

d) For warning system

The relayed warning is the most important information for the evacuation. The warning is fundamental for other disaster coping activities as well such as rescue, flood fighting and other emergency response.

- Inter agency disaster information network with client server
- Inter agency disaster information network with web server
- VHF radio communication system
- Radio paging system and equipment for barangay

4.10 Evacuation System Improvement

4.10.1 Selection of Candidates

The enlargement and betterment of existing evacuation centers are the most practical measure in view of economy and operation. Emergency shelter and livestock sanctuaries are indispensable to make evacuation effective.

1) Enlargement and betterment of existing evacuation center
2) Emergency shelter
3) Livestock sanctuary

4.10.2 Selected Project

(1) Concept of planning

The basic concepts adopted to plan evacuation are as follows:

- Existing evacuation center is enlarged to accommodate all the evacuee
- Existing evacuation center should be enhanced to provide more comfortable circumstance
- Emergency shelter should be provided for those who have lost the chance to go to evacuation center
- Evacuation plan should provide livestock sanctuary to protect livestock of evacuee

(2) Criteria for planning

- Standard area of evacuation center is 3.52m^2 per person
- Standard number of toilets in evacuation center is 1/100 persons
- Standard number of emergency shelter is one per major river basin
- Standard number of livestock sanctuary is one per municipality

(3) Adopted evacuation facility

Evacuation center (extension of existing center)

Bacacay	m^2	4,567
Camalig	m^2	27,511
Daraga	m^2	10,409
Guinobatan	m^2	30,186
Ligao	m^2	7,452
Malilipo	m^2	30,028
Malinao	m^2	1,175
Santo Domingo	m^2	18,309
Tabaco	m^2	32,854
Legaspi	m^2	42,268

Installation of water supply facility to evacuation center (faucet)

Bacacay	m^2	19
Camalig	m^2	92
Daraga	m^2	41
Guinobatan	m^2	114
Ligao	m^2	29
Malilipo	m^2	4
Malinao	m^2	103
Santo Domingo	m^2	57
Tabaco	m^2	77
Legaspi	m^2	154

Installation of toilet facility to evacuation center

Bacacay	nos	10
Camalig	nos	50
Daraga	nos	23
Guinobatan	nos	44
Ligao	nos	1
Malilipo	nos	93
Malinao	nos	3
Santo Domingo	nos	53
Tabaco	nos	53
Legaspi	nos	129

Emergency shelter

Bacacay	nos	-
Camalig	nos	2
Daraga	nos	1
Guinobatan	nos	2
Ligao	nos	1
Malilipo	nos	2
Malinao	nos	-
Santo Domingo	nos	3
Tabaco	nos	3
Legaspi	nos	2

Livestock sanctuary

Bacacay	nos	1
Camalig	nos	1
Daraga	nos	-
Guinobatan	nos	1
Ligao	nos	1
Malilipo	nos	1
Malinao	nos	1
Santo Domingo	nos	1
Tabaco	nos	1
Legaspi	nos	1

4.11 Resettlement Site Development

4.11.1 Existing Resettlement Sites

Improvement and expansion works of the existing resettlement site were studied, referring to the "design standards" described in Section 4.1.3(5) (Main Report). In addition to the above site improvement and/or expansion, some of the following projects/programs are proposed to be implemented as a package for sustainable development of the respective resettlement communities:

(1) Legazpi city

Banquerohan Resettlement Site

(Resettlement Site Development)

a) Overall Community Development

b) Area Infrastructure Improvement

- Roads and bridges
- Communal irrigation project (CIP)

- Potable water supply
- Flood control structures
- Multi-purpose center
- Fishing support facilities
- Mini-hydro power plant
- Social services facilities (hospital)

(Livelihood development)

c) On-farm and Marine Production Improvements

- Coco-based intercropping (with banana, corn, etc.)
- Vegetable production
- Poultry
- Fishing development

d) Industrial and Manufacturing Development

- Legazpi City Special Economic Zone (LCSEZ)
- Bicol Regional Agro-Industrial Center (BRAIC)
- City Light Industrial Park (CLIP)
- Pilinut processing
- Handicraft development
- Coco coir production
- Peanut butter making
- Coco-nectar and coco-distilled water processing

e) Tourism Promotion

- Improvement of the Karangahan falls site
- Coastal eco-tourism

f) Institutional and System Strengthening

- Farm land trust management
- Cooperative development with micro-credit
- Communal education center (vocational training programs to make master the required skills of the applicant resettlers)

(2) Camalig Municipality

<u>Tagaytay Resettlement Site</u>

(Resettlement Site Development)

a) Improvement and Expansion of the Existing Resettlement Community

(Livelihood Development)

b) On-farm Development

- Coconut production
- Fresh vegetable production
- Cutflower production
- Pili nuts processing
- Poultry development

c) Industrial and Manufacturing Development

- Integrated coco processing plant project
- Food processing
- Cement industry development

d) Institutional and System Strengthening

- Farm land trust management
- Cooperative development with micro-credit lending

3) Daraga Municipality

Mi-isi (Salvacion) Resettlement Site

(Resettlement Site Development)

a) Upgrading of the Resettlement Community Facilities

(Livelihood Development)

b) On-farm Development

- Cutflower production
- Vegetable and root crops production

c) Industrial and Manufacturing Development

- Coconut by-products development (coco coir products)
- Handicraft center (souvenirs for tourists)
- Abaca pulp industry

d) Institutional and System Development

- Farm land trust management

Anislag Resettlement Scheme

(Resettlement Site Development)

a) Resettlement Area Development

(Livelihood Development)

b) On-farm Development

- Coconut by-products development (coco coir products)
- Dairy development

c) Industrial and Manufacturing Development

- Pilinut processing
- Handicraft and furniture center (including furniture, decoration and novelty)

d) Tourism Development

- Cagsawa ruins park expansion

e) Institutional and System Strengthening

- Farm land trust management
- Cooperative lending

4) Guinobatan Municipality

Quitago Resettlement Site

(Resettlement Site Development)

a) Improvement of the Resettlement Area (i.e. access to farm lots)

(Livelihood Development)

b) On-farm Development

- Cutflower production
- Coconut industry
- Cacao and coffee production
- Vegetable (cabbage & pole sitao) production
- Quality fruit production (papaya & pineapple)

c) Industrial and Manufacturing Development

- Agricultural product processing

d) Institutional and System Strengthening

- Cooperative development with micro-credit lending
- Farm land trust management

5) Ligao Municipality

Baligang resettlement site

(Resettlement Site Development)

a) Upgrading of the Resettlement Site (i.e. road improvement for immediate evacuation and easy access to main road)

b) Rural Infrastructure Improvement

- Betterment of access road
- Improvement of water supply system

(Livelihood Development)

c) On-farm Development

- Vegetable production
- Pili production and its product processing
- Livestock development
- Quality seedling propagation with extension service

d) Industrial and Manufacturing Development

- Post-harvest and processing technology development of pili products

e) Institutional and System Strengthening

- Cooperative development for agricultural products and their marketing
- Farm land trust management
- Agribusiness and trading center development with warehouse and cooling storage facilities

6) Tabaco Municipality

San Vicente Resettlement Scheme

(Resettlement Site Development)

a) Construction of the Resettlement Site

(Livelihood Development)

b) On-farm Development

- Abaca production
- Pilinut production and processing
- Livestock and poultry development

c) Industry and Manufacturing Development

- Cutlery development
- Handicraft and processing industry

d) Institutional and System Strengthening

- Farm land trust management
- Cooperative development for abaca and pili production and marketing

(2) Resettlement Schemes (including those under construction)

1) Bacacay Municipality

(Resettlement Site Development)

a) Construction of a Resettlement Site

(Livelihood Development)

b) On-farm Development

- Nipa and caragumoy production
- Seaweed production and processing

c) Industry and Manufacturing Development

- Marble industry
- Handicraft development of nipa and karagumoy

d) Institutional and System Strengthening

- Cooperative development with micro-credit scheme
- Farm land trust management

2) Malilipot Municipality

<u>Sta. Teresa & San Isidro Resettlement Scheme</u>

(Resettlement Site Development)

a) Construction of a resettlement site

(Livelihood Development)

b) On-farm and Agro-based Industry Development

- Caragumoy production and its handicraft
- Abaca production and its processing

c) Institutional and System Strengthening

- Farm land trust management

3) Malinao Municipality

(Resettlement Site Development)

a) Construction of a Resettlement Site

(Livelihood Development)

b) On-farm and Agro-based Industry Development

- Rice production and its processing
- Abaca industry
- Coconut production and processing
- Pineapple production and processing
- Abaca pulp industry

c) Institutional and System Strengthening

- Farm land trust management

4) Sto. Domingo Municipality

San Andres Resettlement Scheme

(Resettlement Site Development)

a) Construction of a resettlement site

(Livelihood Development)

b) On-farm and Agro-based Industry Development

- Banana production
- Rootcrops production
- Coffee and cacao production
- Seaweed production and industry

c) Tourism Development

- Tourism promotion as access gate to Mayon Volcano and in coastal areas

d) Institutional and System Strengthening

- Farm land trust management

4.12 Initial Environmental Examination

(1) Rationale for the Conduct of IEE for Disaster Mitigation Projects/Programs

Disaster mitigation projects/programs are intended to improve living conditions in areas prone to natural hazards. As such, it is expected that the benefits derived

from these projects should far outweigh whatever negative impacts that may result from the activities associated with their implementation. However, in some cases, due to lack of careful planning and study of potential environmental impacts, disaster mitigation projects cause more serious problems than the ones they are trying to solve. Therefore, even if it already seems apparent that positive impacts outweigh the negative ones, it is necessary to prepare at least an IEE to ensure that negative impacts are identified and mitigated and positive impacts are enhanced. In addition, the conduct of an IEE will help promote social acceptability. Some disaster mitigation projects in the Philippines have been suspended because of strong opposition from stakeholders and due to lack of IEE or EIA study.

In the study on Comprehensive Disaster Prevention (CDP) around Mayon Volcano, the conduct of an IEE is necessary to address the potential impacts of possible structural and non-structural measures especially to the socioeconomic environment. The most critical social issue seems to be the relocation of residents within 6-km radius from the crater of Mayon Volcano which has been declared a Permanent Danger Zone (PDZ).

At the present stage, the following are identified as conceivable projects and programs:

a. Spur Dikes – these are dikes with V-shaped alignment designed to protect barangay centers around Mayon volcano which are vulnerable to debris flow. Around 18 of these structures will be built.
b. Sand Pockets – these are channels, with or without consolidation dams, between two converging dikes designed to direct and concentrate the debris flow to a specific area or drainage way. The dike will have 1 to 2 m width at the top and 7 to 10 m width at the base. The height is about 2 meters.
c. Diversion Channel – this is a new floodway proposed to be constructed to direct the main debris flow channel towards Legazpi Bay. It has a width of about 60 meters and a total length of about 3 km.
d. Consolidation Dams – these are series of spillway structures across debris flow channel that will trap debris in a terrace-like manner.
e. Levees – these are dikes along portions of rivers with gentle slopes to prevent overflowing of banks during flood events. These are proposed to be constructed along the downstream reaches of Yawa and Quinali B rivers.
f. Sabo Dams – these are discontinuous dikes which protect populated areas and farms from debris flow. Many of these structures are already existing although some need repair, desilting and extension. New sabo dams may be proposed.

g. Reclamation – this involves dumping of volcanic debris into shallow coastal waters for commercial, industrial and other land uses. A proposed reclamation is located at Legazpi Bay near the mouth of the proposed diversion channel.
h. River Improvement Works – this involves river dredging, widening or raising of existing dikes along river channels to increase their carrying capacities.
i. New Pawa-Burabod Floodway – this involves construction of a new drainage channel parallel to Yawa river to provide additional drainage capacity during flood events.
j. Urban Drainage Rehabilitation and Upgrading – this involves repair and improvement of drainage systems of flood prone urban centers such as Legazpi City and Tabaco.
k. Bridge construction and armouring – this involves construction of new bridges designed to remain passable during debris flow events (e.g., elevated bridges rather than spillways) and to provide protective armor to abutments of existing bridges in order to withstand impact of debris flows.
l. Relocation of residents within PDZ – this involves planning and implementation of transfer of residents within the 6-km PDZ to resettlement areas. This also involves provision of opportunities for livelihood and monitoring of living conditions of relocated residents. The PDZ will also be monitored to ensure that relocated residents or new settlers will not occupy the evacuated areas again.
m. Resettlement area development – this involves acquisition of resettlement areas, development of infrastructures, construction of houses and provision of facilities.
n. Establishment of Multipurpose Evacuation Centers – these are intended for households residing outside PDZ but are affected by debris flows. These will avoid disruption of classes after disaster events due to continued occupation of evacuees of school buildings, which usually serve as temporary evacuation centers. These centers will also serve other purposes after disaster events.
o. Establishment of Industrial Zones near Resettlement Areas – These are intended to provide employment and livelihood opportunities to relocated households. These will involve development of industrial zones by providing infrastructures, facilities and incentives to prospective locator industries.
p. Mineral Water Development – this involves tapping of springs within the Study Area for mineral water bottling industry. This will provide employment and contribute to the economic development of municipalities. This will involve construction of spring reservoir, pipeline system and bottling plant.

q. Pili Nut Plantation and Reforestation within PDZ – This will replace the short-term crops (e.g., vegetables) planted within PDZ in order to discourage return of relocated residents. This involves establishment of nurseries, tree planting and monitoring to ensure high survival rate.
r. Construction/Improvement of Evacuation Roads – This involves construction of short roads, which are free from hazard of flooding or debris flow. In some barangays (e.g., Sua, Tumpa, Masarawag and Muladbucad), where roads are frequently cut off during flood events, safe evacuation routes were already identified but were not constructed yet due to lack of funds.

These projects need to be assessed with regards to their potential impacts to the environment. The environmental elements that may be considered are:

a. Natural and Biological Environment – surface water, groundwater, soil, geology, climate, wildlife habitat, ecology of fisheries and natural vegetation
b. Environmental Hazards – solid wastes and hazardous substances
c. Resource Conservation and Use – water resources, agricultural production, timber production, mining and energy resources
d. Air Quality and Noise Environment – air quality and noise
e. Community facilities/Services and Structures – community facilities and services, infrastructure, transportation, community population, resettlement, income, ethnic distribution and lifestyle
f. Open Space and Recreation – accessibility and activities
g. Historic Resources – historical sites and structures, and archaeological sites
h. Visual Resources – natural landscape and cultural landscape
i. Economic environment – dislocation of industries, employment and local economy

(2) Initial Environmental Assessment of the Conceivable Projects

The environmental assessment was tentatively carried out using the "Environmental Impact Matrix for IEE". Their preliminary results are shown in Tables 4.11.1, 4.11.2, and 4.11.3.

CHAPTER 5 MASTER PLAN

5.1 Basic Conditions for Master Planning

5.1.1 Constitution of Master Plan

The havoc of the volcano when it erupts is overwhelming, while the human power is too small to cope with it. Besides, the countermeasure against the disaster requires a considerable economic investment. Accordingly, the disaster prevention should be incorporated into the regional land use and area economic development plans.

Along this line, the Master Plan was formulated in referring to the following plans and programs:

(1) Land Use Plan

(2) Disaster Prevention Plans and Programs:

- Prevention plans for mud and debris flow
- Prevention plans for flood and inundation
- Forecasting, warning and evacuation plan
- Resettlement plans

(3) Supporting Programs

The proposed disaster prevention plans are discussed and assessed on the basis of the assumed land use. In addition, the supporting programs are proposed to complement and assist the sound implementation of the proposed prevention plans.

5.1.2 Assessment of Plans

(1) Land Use Plan

a) Study Area

Based on the constraints and zoning criteria described in the previous chapters, the land use plan of the Study Area was proposed to solve the problems and issues over the land and promote the agricultural activity (refer to Section 4.2).

As to the industrialization of the Area, the southern part of the Legazpi City including Banquerohan is deemed as a promising industrial zone in Albay Province. Several industrial development plans are proposed to be a future economic center including the resettlement site for Mayon Volcano evacuees.

b) Hazard Area by Mud Flow

The land use plan for eight hazard areas: Yawa (Pawa-Burabod, Budiao-Anoling), Basud, Padang, Bulawan, Buang, San Vicente, Quirangai and Masarawag will be proposed based on the criteria and options.

- Option 1: Without Sabo Project
  - + Resettlement of all residents in the hazard area of the mudflow
- Option 2: Sabo Project + Intensive Agricultural Plan
  - Enhancement of the productivity with maintaining present land use
- Option 3: Sabo Project + Agricultural Plan + Industrial Plan + Residential Plan
  - Enhancement of the productivity with the intensification of land use

5.1.3 Basic Conditions for Assessing the Plan

(1) Basis for Economic Evaluation

The basic conditions of economic evaluation are as follows:

a. Economic evaluation is carried out by comparison between "With-the-Project" and "Without-the-Project" with regard to benefit and cost.
b. Economic evaluation is conducted for the projects for mudflow protection, flood control and urban drainage.
c. The period for evaluation is assumed to include two to three years as the implementation period for construction and 50 years including 30 years of project life.
d. The social opportunity cost of capital in the Philippines is considered to be 15%.
e. The indicators of economic evaluation are "Economic Internal Rate of Return" (EIRR), "Benefit Cost Ratio"(B/C) and "Net Present Value"(NPV).
f. The discount rate of social opportunity cost of capital of 15% is adopted to figure out B/C and NPV.

(2) Economic Benefit

a) Resettlement Plan

Three options are set up for land use plan in this Study. In resettlement plan, Option 1 is taken into consideration for land use plan and two kinds of benefits are calculated by return period of mudflow (2-, 5-, 10- and 50-year) as follows.

Livelihood in Resettlement Area

Benefit generated from livelihood in resettled area is estimated on the basis of assumption with regard to cost (resettlement, land acquisition, land development, annual labor and materials) and production by sector (agriculture, industry and service)

Loss of Assets in Residing Area

It is assumed that residents in hazard area will completely loose their properties and agricultural crops when the hazard occurs. Thus, the negative benefit by land use category as mentioned in the following "(2) Sabo Plan" is calculated for agricultural products and assets in the hazard area on the basis of probabilistic theory. The rate of damage is shown in Tables XII 6.1 and 6.2 (Supporting Report (1), Chapter XII).

b) Sabo Plan

Methodology and Calculation Conditions

In Sabo plan, Option 2 and 3 are taken into consideration for land use data.

Direct Damage

Damageable value is the maximum amount of asset value that will suffer the mud and debris flow. Generally, direct damage in the area can be calculated as follows:

[Direct Damage in the Area (Peso)] = [Area Size (ha)] x [Unit Damageable Value (Peso/ha)]

Damageable value is calculated for each asset classification such as (a) agricultural products for main crops such as palay, coconut (copra), corn, banana, and vegetables, (b) buildings for residence, industry and commerce), including indoor movables, (c) public facilities including indoor movables and (d) other agricultural products including livestock, poultry and fishery (15% of other assets), are presented below. The unit values of agricultural products and other assets are shown in Tables XII 6.3 and 6.4 (Supporting Report (1), Chapter XII).

Indirect Damage

Damages caused by business suspension due to the mudflow are estimated using the rate (6%) to the damage to general assets (houses/building and their indoor movables). This rate is applied in accordance with other reports on flood control projects similar to this Study, as well as the "Main Principles on Investigation of River Economy, Ministry of Construction, Japan".

The costs for evacuation, clean up, detour transportation and drainage of mud and debris are inherent for mud and debris flow. In this Study, 20% of direct damage including business suspension is tentatively assumed as indirect damage.

Development Benefit

In this Study, socioeconomic development will be accelerated in the protected area by sabo works. In Option 1, it is assumed that the agricultural productivity will be enhanced. The productivity of the major crops such as rice, coconut and vegetables will be enhanced in future. In Option 2 case, it is assumed that the development of industrial and service sector will be promoted in the protected areas as well as the enhancement of agricultural productivity.

To implement these developments, the cost and benefit are assumed as follows:

- The investment cost including land acquisition, land reclamation and construction of buildings for industrial and service sector is calculated.
- The operation and maintenance cost including cost for labor and materials by sector are calculated.
- The production in money terms is counted as the benefit generated from the development. With regard to agricultural sector, the increase of production derived from the enhancement of productivity is estimated as the benefit.
- These conditions mentioned above are shown in Table XII 6.5 (Supporting Report (1), Chapter XII).

c) Estimation of Annual Average Benefit

Sabo Works

Benefit generated by the prevention of mud and debris flow is defined as the expected amount of average annual reduction of damages by the provision of the sabo works, and it can be estimated on the basis of the following assumptions.

- It is almost impossible that the damaged assets will be recovered to their existing conditions (loss of property)
- Annual output from the land is damaged (loss of production)
- The occurrence of damages caused by mud and debris flow of each return period is non-simultaneous during the project life of 30 years.
- Probability of “no” occurrence of damages caused by mud and debris flow after the project life is assumed after the project life.
- The damage rate and damaged value of assets are estimated on the basis of these assumptions (refer to DT V1 and V2 in Data Book).

Development Benefit

Development benefit per annum for respective return period of 10-, 20 and 50-year is estimated in terms of production amounts by sector for each land use plan (Option 2 & 3).

d) Flood Control Plan and Urban Drainage

Methodology and Calculation Conditions

From the economic viewpoint, inundation and assets were examined for flood prone area by land use category. Land use pattern for "Option 1" is adopted to the flood control plan.

Direct Damage

Damageable value is the maximum amount of asset value that will suffer from the inundation. Generally, direct damage in the area can be calculated as follows:

[Direct Damage in the Area (Peso.)] = [Area Size (ha)] x [Unit Damageable Value (Peso/ha) x [Damage Rate]

Damageable value for each asset classification is calculated on the basis of unit value as the same as the one of mud and debris flow already mentioned above.

Indirect Damage

Damages caused by business suspension due to the flood are estimated using the rate (6%) to the damage to general assets (houses/building and their indoor movable). This rate is applied in accordance with other reports on flood control projects similar to this Study, as well as the "Main Principles on Investigation of River Economy, Ministry of Construction, Japan".

In this Study, 10% of direct damage including business suspension and evacuation from flood is tentatively assumed as indirect damage.

Damage Rate by Inundation Depth and Duration

The damage rates for each item vulnerable to flood damage are determined in accordance with the inundation depth and duration. The field survey and other reports on flood control projects similar to this Study, as well as the "Main Principles on Investigation of River Economy, Ministry of Construction, Japan" are also referred to.

e) Estimation of Annual Average Benefit

Flood control benefit is defined as the expected amount of average annual reduction of damages by the designed works, and it can be calculated in the following procedure:

- Assume several levels of flood discharge: 2-, 5-, 10-, 20-, and 50-year return periods in this study (for urban drainage: 2-, 5-, and 10-year)
- Obtain the average annual probability of the discharges between one discharge level and the next (this can be derived from calculation of the excess probability for each discharge level and then, attaining the difference between these probabilities);
- Obtain the average annual amount of damage due to floods at this discharge level, multiplying the average annual probability by the amount of estimated damage at this discharge level; and
- Obtain a cumulative total of these amounts from the minimum discharge to the maximum discharge.

The estimates of annual average flood damages by return period according to the procedure mentioned above are shown in DT V3 to V8 (Data Book).

3) Economic Cost

The project cost is converted from financial price to economic price. The basic conditions for conversions are as follows:

a. The price level is fixed at constant 1999. Then inflation is excluded from financial cost.
b. In the Master Plan study, the project cost is assumed to be the local currency portion. The local currency portion in financial price includes the transfer items such as custom duties for imported materials, sales tax, value added tax, and subsidies, and so on for locally procured materials. These transfer items are eliminated from them.
c. The tradable goods in the locally procured materials do not reflect the international market price. Then the standard conversion factor (SCF) is applied to it. In this Study, 0.909 is assumed to be SCF which is based on the international trade statistics of the Philippines during the latest 5 years.
d. The cost for unskilled labor does not reflect economic price by being overestimated generally. Then the shadow wage rate (SWR) is applied to the cost for unskilled labor. According to project evaluation procedure and guidelines prepared by ICC (Investment Coordinating Committee) of the Philippines government, the SWR of 60% is recommended. In this Study, the labor cost is not yet figured. So the SWR is not applied implicitly.

e. In this Study, the conversion factor for construction cost is tentatively assumed to be 0.82 by taking account of the factors mentioned above such as SCF, SWR and many kinds of taxes and duties.
f. The land acquisition cost includes usually speculative factor. In this Study, 10% of land acquisition cost is tentatively assumed to include speculative factor. Then the conversion factor of 0.9 is applied to the land acquisition cost.

5.2 Master Plan Projects and Programs

5.2.1 Direct Coping Projects

In formulating the master plan, various relevant projects and programs were firstly identified taking into due consideration the development strategies formulated so far (refer to "Conceivable Projects and Programs" in Chapter 4). Secondly, these projects and programs were scrutinized in terms of objectives, components and outputs in order to choose the fundamental items of the Master Plan for comprehensive disaster prevention around Mayon Volcano.

Based on the basic concepts, strategies and scenario for disaster prevention as described in Section 4.1, there exists a wide range of requirements for establishment of a comprehensive disaster prevention system around Mayon Volcano. Among others, the following 19 projects and programs were identified at national, provincial and community (city/municipality) levels through the Study. These are deemed instrumental to establish a comprehensive disaster prevention system and ultimately lead to boost the socioeconomic development of the area.

(1) Core Countermeasure Projects

(Sabo Facility Construction)

SF-1 Yawa River System Sabo Project
SF-2 Quinali (A) System Sabo Project
SF-3 Buang River Sabo Project
SF-4 San Vicente Sabo Project
SF-5 Padang River Sabo Project
SF-6 Basud River Sabo Project
SF-7 Bulawan River Sabo Project

(River Improvement)

RI-1 Yawa River Improvement Project

(Urban Drainage)

UD-1 Legazpi City Urban Drainage Project

(Forecasting, Warning and Evacuation)

FW-1 Forecasting, Warning and Evacuation System for eruption, mud and debris flow, flood and inundation and typhoon

(Relocation/Resettlement)

RR-1 Relocation and Resettlement Projects

(2) Institutional and Supporting Services Strengthening Programs

The following are the institutional and supporting programs identified at the respective administrative levels, together with the structural countermeasure projects.

At the Central and Regional Level

NP-1 National and Regional Disaster Management System Strengthening

At the Provincial Level

PP-1 Provincial Disaster Management System Strengthening

PP-2 Province-wide Socioeconomic Development and Monitoring

At the Community (City/Municipality) Level

CP-1 Community-based Disaster Management Strengthening

CP-2 Livelihood Development Projects & Programs

- CP-2 (1) On-farm and Marine Production Enhancement
- CP-2 (2) Agro-industry and Manufacturing Development
- CP-2 (3) Tourism Promotion
- CP-2 (4) Institutional and Supporting System Strengthening
- CP-2 (5) Farm Land Trust Management

5.2.2 Scope and Features of the Proposed Projects and Programs

(1) Sabo Facility Construction

SF-1: Yawa River System Sabo Project

a) Objective

All debris material must be trapped by structural measures in the upstream area of the main river. This project aims to protect the land from the eventual disasters and still enhance its land use.

b) Components

- Site : Anoling River and Pawa-Burabod River
- Sabo Facility : Sand pocket alignment to be used for depositing the debris flow material
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 808,000m^3
- Sand pocket capacity : 28,400,000m^3
- Protection Area : Legazpi city area, Yawa main river, Rail way, Cagsawa ruins, National road
- O&M work : 23,600m^3/year

c) Work Volume

- Consolidation dam(CSG) : Length 1,100m, Height 4.0m (Anoling River 600m, Pawa-Burabod River 500m)
- Spur dike
- CSG (Type-A) : Length 1,900m, Height 5.0m (Anoling River 1,900m)
- Combined (Type-B) : Length 5,100m, Height 5.0m (Anoling River 1,730m, Pawa-Burabod River 3,370m)
- Embankment (Type-C) : Length 600m, Height 5.0m (Pawa-Burabod River 600m)
- Training Dike : Length 5,100m, Height 2.3m (Anoling River 4,750m, Pawa-Burabod River 350m)

d) Project Cost : PHP 2,344.5 million

SF-2: Quinali (A) River System Sabo Project

a) Objective

Debris flow material should be gathered into a main channel and flowed down between barangays and the paddy field safely. This project is designed to for enhance the land use by reducing the recurrent disasters.

b) Components

- Site : Masarawag River and Quirangay River
- Sabo Facility : Sand pocket alignment with ground sill to be used for dispersing and depositing the debris flow material. Guiding dike to confluence the Maninila river channel with the Masarawag river channel artificially.
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 510,000m^3
- Sand pocket capacity : 6,262,000m^3
- Protection Area : Barabgay, Railway, National road, Paddy field
- O&M work : 79,600m^3/year

c) Work Volume

- Consolidation dam(CSG) : Length 450m, Height 4.0m (Masarawag River 100m, Quirangay River 350m)
- Spur dike
  - CSG(Type-A) : Length 2,200m, Height 5.0m (Masarawag River 1,250m, Quirangay River 950m)
  - Combined (Type-B) : Length 2,750m, Height 5.0m (Masarawag River 2,050m, Quirangay River 700m)
  - Embankment (Type-C) : Length 1,050m, Height 5.0m (Masarawag River 1,050m)
  - Ground Sill (Type-D) : Length 900m, Height 1.5m (Masarawag River 900m)
  - Raising Dike (Type-E) : Length 1,700m, Height 2.0m (Quirangay River 1,700m)
- Training Dike : Length 3,050m, Height 2.3m (Masarawag River 2,100m, Quirangay River 950m)

d) Project Cost : PHP 1,912.8 million

SF-3: Buang River Sabo Project

a) Objective

Only property of barangay along the Buang River shall be protected by the protection dike. The Quinali (B) River section where located downstream of

the Buang River has the function of natural sediment control with the continuous alternation of narrow valley and wide river floor.

b) Components

- Site : Buang River
- Sabo Facility : Protection Dike to protect the spot area
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 539,000m^3
- Protection Area : Barangay, National road
- O&M work : Not required

c) Work Volume

- Spur dike
  Combined (Type-B) : Length 1,150m, Height 5.0m

d) Project Cost : PHP 249.1 million

SF-4: San Vicente Sabo Project

a) Objective

Debris flow material should be gathered into a main channel and flowed down between barangayes and the paddy field safely. This project aims to confine an avulsion of debris flow.

b) Components

- Site : Vicente River
- Sabo Facility : Sand pocket alignment with huge sub-pocket to be used for converging and depositing the debris flow material.
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 306,000m^3
- Sand pocket capacity : 12,015,200m^3
- Protection Area : Barangay(San Vicente), National road, Paddy field, River improvement in the plain area
- O&M work : 16,200m^3/year

c) Work Volume

- Consolidation dam(CSG) : Length 600m, Height 4.0m
- Spur dike
  CSG(Type-A) : Length 2,400m, Height 5.0m
  Combined (Type-B) : Length 2,700m, Height 5.0m

d) Project Cost : PHP 1,459.4 million

SF-5: Padang River Sabo Project

a) Objective

There are some tributaries next to the target rivers. Debris material should be converged into one channel and trapped by structural measures. This project is designed to trap the sediment materials on the upstream area to protect the National road.

b) Components

- Site : Padang River and Golf course channel
- Sabo Facility : Sand pocket alignment to be used for depositing the debris flow material.
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 211,000m^3
- Sand pocket capacity : 13,500,000m^3
- Protection Area : Barangay, National road
- O&M work : 5,300m^3/year

c) Work Volume

- Consolidation dam(CSG) : Length 350m, Height 4.0m
- Spur dike
  CSG (Type-A) : Length 3,950m, Height 5.0m
  Combined (Type-B) : Length 600m, Height 5.0m

d) Project Cost : PHP 960.4 million

SF-6: Basud River Sabo Project

a) Objective

There are some tributaries next to the target rivers. Debris materials should be converged into one channel and trapped by structural measures. This project aims to trap the sediment materials on the upstream area to protect the National road.

b) Components

- Site : Basud River and one parallel channel
- Sabo Facility : Sand pocket alignment to be used for depositing the debris flow material.
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 198,000m^3
- Sand pocket capacity : 17,100,000m^3
- Protection Area : Barangay, National road
- O&M work : 4,300m^3/year

c) Work Volume

- Consolidation dam(CSG) : Length 350m, Height 4.0m
- Spur dike
  CSG (Type-A) : Length 2,500m, Height 5.0m
  Combined (Type-B) : Length 500m, Height 5.0m

d) Project Cost : PHP 584.9 million

SF-7: Bulawan River Sabo Project

a) Objective

Countermeasure concept for the downstream area is same to the Padang River and the Basud River. On the upstream area, it is possible that one tributary of the Bulawan River will capture the Tabigyan River. Facility planning should protect this piracy phenomenon. This project is designed to protect such a channel movement.

b) Components

- Site : Bulawan River
- Sabo Facility : Continuous spur dike alignment to be used for confirming the debris flow material in the downstream. Deflection dike to protect the piracy.
- Probable 1 day rainfall : 20 year
- Proposed Runoff Volume : 445,000m^3
- Protection Area : Malilipot town proper, National road and Bridge
- O&M work : not required

c) Work Volume

- Spur dike
  Combined (Type-B) : Length 1,350m, Height 5.0m
  Combined (Type-C) : Length 3,050m, Height 5.0m

d) Project Cost : PHP 769.2 million

The Sabo Master Plan projects for each river are summarized below:

The Master Plan Projects for Sabo Facility Construction

River System	River	Type	Work Volume (Length)			Run Off Volume ($1,000 m^3$)	Pocket Capacity ($1,000 m^3$)	Direct Cost (PHP Million)	EIRR (%)
			Sabo Dam (m)	Spur Dike (m)	Training Dike (m)				
Yawa River System	Yawa	River Improvement	-	-	-	-	-	-	-
	Pawa-Burabod	Sand Pocket	500	3,970	350	209	5,280	2,344.5	24.67
	Budiao	Sand Pocket	-	-	-	107	23,120		
	Anoling	Sand Pocket	600	3,630	4,750	492			
Quinali (A) River System	Quirangay	Sand Pocket	350	4,300	950	156	1,830	1,912.8	16.32
	Tumpa	No Action	-	-	-	-	-		
	Maninila	Spur Dike		450	-	168	4,432		
	Masarawag	Sand Pocket	100	6,500	2,100	186			
	Ogsong	No Action	-	-	-	-	-	-	-
	Nasisi	No Action	-	-	-	-	-	-	-
Quinali (B) River System	Buang	Protection Dike	0	1,150		539	2,430	249.1	21.67
	Quinali(B)	River Improvement	-	-	-	-	-	-	-
	San Vicente	Sand Pocket	600	5,100		306	12,015	1,459.4	18.49
Arimbay River System	Arimbay	No Action	-	-	-	-	-	-	-
Padang River System	Padang	Sand Pocket	350	4,550	-	211	13,500	960.4	19.14
Basud River System	Basud	Sand Pocket	350	3,000	-	198	17,100	584.9	14.00
Bulawan River System	Bulawan	Spur Dikes and Deflection Dike	0	4,900	-	445	6,840	769.2	17.16
Total		-	2,850	37,550	8,150	3,017	86,547	8,280.3	-

(2) River Improvement

RI-1: Yawa River Improvement Project

Alternative C (widening the river channel with embankment) is selected for the Yawa River Improvement Project.

a) Objective

The project aims to mitigate flood damage in the flood prone area, to upgrade the function of the river as a suitable flood way for Sabo works in

the upper tributaries and to enhance the productivity of land use along the river improvement portion.

b) Components

- Length of dike : 2,000m from the river mouth
- Design discharge : 1,350m^3/s (20 year)
- Design depth : 4.4m
- Design river width : 90m
- Design river cross section : Double trapezoid

c) Work Volume

- Embankment : 203,000m^3
- Excavation : 85,000m^3
- Rip-rapping : 20,000m^2

d) Project Cost : PHP 509.2 million

(3) Urban Drainage

UD-1: Legazpi City Urban Drainage Project

The proposed drainage plan in Legazpi City is selected as an integration of all alternative plans considered for Macabalo and Tibu rivers as follows.

- Rip-rapping along main river channels
- Flood gates to protect tidal flood into the rivers
- Pump drainage to drain flood water to the sea
- Retention pond to regulate flood peak

a) Objective

The project aims to mitigate flood inundation in the Legazpi City that situates in low-lying area frequently caused by interior flood and tidal flood.

b) Components

- River improvement : 1,700m for Macabalo
  : 34m for Tibu
- Pumping facility (2 stations) : 10m^3/s for Macabalo
  : 1m^3/s for Tibu
- Flood gate facility (2 rivers) : 5 gates for Macabalo
  : 3 gates for Tibu
- Retention pond (2 rivers) : 12 ha for Macabalo
  : 0.5 ha for Tibu

c) Work Volume

• Channel excavation	:	36,400m^3 (Macabalo)
	:	1,500m^3 (Tibu)
• Embankment	:	4,840m^3 (Macabalo)
	:	437m^3 (Tibu)
• Riprapping	:	23,750m^3 (Macabalo)
	:	9,180m^3 (Tibu)
• Pumping facility	:	10 and 1m^3/s
• Flood gates	:	5 units (3 x 3) for Macabalo
	:	3 units (3 x 3) for Tibu

d) Project Cost : PHP 643.7 million

(4) Forecasting, Warning and Evacuation System Improvement

FW-1: Forecasting, Warning and Evacuation System Strengthening

Forecasting, warning and evacuation system is one of the measures which constitute the proposed disaster prevention Master Plan to prevent loss of life and properties of people in the Study Area.

The proposed system complements other proposed measures to secure the safety against such hazards as the mitigation thereof are not conceivable, hazards the magnitudes thereof exceed the designed mitigation levels and emergency response thereto is effective. The objective, components and the requisite work volumes of the proposed system are as follows:

a) Objective

The objective of the introduction or enforcement of forecasting, warning and evacuation system is to protect life and property from the disaster to be caused by volcanic eruption, flood, inundation, mud and debris flow and typhoon through evacuation to safer place prior to the occurrence of the hazard or emergency response thereto.

b) Components

The component of the systems proposed in the Master Plan are selected from those proposed candidate to improve forecasting, warning and evacuation systems as discussed in the Chapter 4. In this respect, following criteria were adopted:

Technical reliability	(accuracy in forecasting and reliability in warning) Accuracy and reliability should be sufficient for evacuation and disaster fighting activity.
Compliance to needs	(lead time and quick response) Since the system is to furnish a reliable information for evacuation and disaster fighting activity, the system should afford sufficient lead time with quick judgement for those activities.
Availability	(existing infra-structure and system) The proposed system should adapt to the existing local conditions, the existing infra-structure and system should avail the existing resources as much as possible.
OMR	(OMR cost and manpower) In order to secure sustainability, OMR cost and manpower input should be minimized.
Durability	(natural circumstance) The proposed system should be available in a critical circumstance and be durable against site conditions.
Economic aspect	(cost and space) Disaster prevention reduce damage value but does not produce any positive economic value and lesser cost and space are preferable.

The proposed system for forecasting, warning and evacuation as the components of the Master Plan are as follows:

Forecasting

- Seismographic telemeter system with 7 gauging stations (4 existing)
- Slope deformation monitoring system with GPS
- Slope deformation monitoring system with EDM (Existing)
- SO_2 gas sampling and analyzing equipment (Existing)
- Event reporting type rainfall gauging telemeter system with 41 gauging stations (5 existing)
- Water level gauging telemeter system with 7 gauging stations (one tidal gauge)
- Typhoon monitoring system (Existing)

Warning

- VHF radio system among agencies (Existing)
- Inter agency disaster information network with WEB servers.
- Radio paging system between MDCC/CDCC and BDCC

Extension of evacuation center

- 114 evacuation centers for 9 municipalities and one city with the area of 328,500m^2 (existing area 123,600m^2)
- Water supply system with 855 faucet (existing 165 faucet)
- Toilet of 1,080 set (existing 621 set)

Emergency shelter

- 16 sites of emergency shelter in 9 municipalities and one city
- 16 set of telecontroled siren systems in 9 municipalities and one city

Livestock sanctuary

- 10 sites of livestock sanctuaries in 9 municipalities and one city (existing site one)

c) Work Volume

The estimated work volumes for the extension or improvement of the existing facility or new installation are as follows:

Item	Unit	Nos.	Volume
Forecasting			
• Seismograph	set	3	3
Repeater station	unit	2	2
Monitor/processor	set	1	1
Software	set	1	1
• GPS	set	8	8
Monitor/processor	set	1	1
Software	set	1	1
• Gas sampler	set	2	2
• Rainfall telemeter	set	36	36
Repeater	unit	2	2
Monitor/processor	set	1	1
Software	set	1	1
• Water level telemeter	set	7	7
Monitor/processor	set	1	1
Repeater	unit	2	2
Software	set	1	1
• Radio paging system	set	500	500
Siren	set	16	16
• Web server	Unit	7	7
Software	set	1	1
• Evacuation center	m^2	114	204,900
Water supply (faucet)	unit	690	690
Toilet	unit	459	459
• Emergency shelter	m^2	16	1,600
• Livestock sanctuary	m^2	9	9,000

d) Project Cost PHP 3,740.2 million

(5) Relocation/Resettlement

RR-1: Relocation and Resettlement Projects

a) Objective

This project aims to improve the existing resettlement sites for the people already settled and develop the new resettlement sites for the people still residing within the permanent danger zone (6km-radius from the crater), and likewise for those to be relocated due to implementation of the physical projects around Mayon Volcano.

b) Components

- The numbers of households and population to be resettled both from 6km-radius zone and due to implementation of the project works are estimated as follows:

- No. of residents within 6km-radius zone : 440 households (2,332 persons)
- No. of the people to be relocated due to Implementation of the project works : 137 households (724 persons)

- The areas of the respective resettlement development sites are to be determined with the numbers of the households to be relocated/resettled. The lot area occupies 70% of the total resettlement site and the remaining area (30% of the gross area) will be reserved/used for communal facilities like main and access roads, town hall, plaza, school building, health center and others.
- The resettlement site is to be equipped with the following facilities to form an integrated community: housing area, electricity, drainage, water supply system, access and circulation roads, sewerage system, elementary school, day care center, church, production area including "productivity center" or "mini-industrial estate" adjacent to or near the resettlement site.
- The standard house area starts with a core house of 21.7m^2, with provisions for expansion. The core house (Type I) will consist of multipurpose living room, kitchen, toilet and bath. As for the detailed specifications for resettlement site development, refer to Chapter X "Relocation and Resettlement" of Supporting Report (1).
- In the existing resettlement sites and among the people to be relocated as well, a social inventory survey has to be carried out to grasp the needs and preferences of the people and requirements of the community, especially focusing on the basic infrastructure, basic human needs (BHNs), living environment including livelihood.
- For sound operations of the resettlement projects, especially for their sustainability, the livelihood programs and projects must be carried out in parallel as a package (as to the livelihood development and supporting programs, refer to CP-2). At the planning and design stage of the resettlement projects, it is therefore indispensable to incorporate this concept or strategy into the site development plan.

c) Work Volume

- Residential development : 272 houses
- Industrial development : 16.1ha

d) Project Cost PHP 186.6 million

(6) Institutional and Supporting Services Strengthening Programs

1) Central and Regional Level

NP-1 : National and Regional Disaster Management System Strengthening

a) Objective

This program aims to continue and extend the ongoing strengthening efforts of the disaster management system at national and regional levels to upgrade/support coordination activities among the disaster-related government agencies with respect to administrative and operational aspects that are essential for smooth implementation of comprehensive disaster prevention projects and programs.

b) Components

- For smooth implementation of the comprehensive disaster prevention plan, this program is designated to establish and strengthen the overall coordination framework among the government agencies such as LGUs, DPWH, PHIVOLCS, OCD, and DSWD, as well as private sector and NGOs.
- Under this program, a "Inter-Agency Task Force (IATF)" is to be established under NDCC/RDCC and composed with its respective member-representatives at technical working level. The PMTF is to advise the NDCC/RDCC on final decisions concerning coordination and arrangement with other departments, agencies and intra-departmental offices, and also on technical and administrative matters relating to the programs' implementation, and so on.
- This program will consist of the following typical components as itemized below :
  - Review of institutional set-up,
  - Consolidation of financial system (focusing on budget allocation & appropriation),
  - Capability building of the NDCC secretariat staff,

- Promotion of the Flood Control and Sabo Engineering Center Project,
- Operational guidance for international assistance and inter-area disaster coping agreement,
- Establishment of a task force to study on incorporation of mitigation into specific development projects, and
- Others.

c) Project Cost PHP 53.9 million

2) Provincial Level

PP-1: Provincial Disaster Management System Strengthening

a) Objective

This program is designed with a view to upgrading managerial and operational capability of the Provincial Government staff in charge of disaster management (especially PDMO and PDCC), so that they can properly cope with disasters and take quick response actions in accordance with the Disaster Management Operation Manual.

b) Components

- Capability building will be made to the Provincial officers in charge of disaster management, especially those in the Provincial Disaster Management Office (PDMO) and other agencies concerned, through execution of periodical staff training. These training programs will be implemented by holding seminars and workshops.
- The disaster management training will cover a wide range of functions and skills. These include planning, organization, day-to-day management activities, counter-disaster operations, crisis management activities, logistic functions, recovery management, participation in major programs such as regional development prevention and mitigation, special skills applicable to rescue, first aid, assessment, emergency relief and welfare, communications, information management and so on.
- These training courses will be prepared by professional third parties (ex. Asian Disaster Preparedness Center in AIT) taking into account the existing basis of competence of the target personnel. The annual training program is to be made up in October before entering into the negotiation about budget allocation.

- To assure communications with the subordinate LGUs concerned (city/municipalities and barangays), an information network system will be established or improved by installing a set of the facilities and equipment.
- The disaster management needs to upgrade accuracy and reliability of the data and information on vulnerabilities to hazards, hazard areas and number of population residing in danger areas, etc., which are essential to the disaster-related activities and project planning.
- Policy and legal arrangements to cope with the current disaster-related issues such as optimum land use, enforcement of laws & regulations, ownership, natural conservation and so on.
- In this program, the following will be taken up as the program components:
  - Institutional arrangement for mud and debris flow observation and monitoring,
  - Capacity building of PDCC/PDMO,
  - Establishment of the early & accurate forecasting, timely warning and prompt & reliable evacuation system,
  - Consolidation of coordination framework and networking for disaster management (LGUs-DCCs-PDMO-NGAs-Private Sector/ NGOs),
  - Restructuring of the provincial system for integrating disaster mitigation into area development,
  - Reorientation of cooperation in disaster coping and conclusion of an agreement on response & recovery operations among the neighboring LGUs at every level, and
  - Others.

c) Project Cost PHP 2.2 million

PP-2: Province-wide Socioeconomic Development and Monitoring

a) Objective

This Program is based on an idea that through implementation and promotion of the socioeconomic development projects and programs, the economic and financial status of Albay Province may be improved/consolidated owing to rapid GRDP growth and increased tax

revenues as well. A part of generated "economic surplus" is to be invested in disaster prevention works and activities.

To assure smooth implementation of the inter-city/municipal projects/ programs and monitor the balanced socioeconomic development of the Province as a whole, this Program also aims to strengthen a monitoring system by establishing a much closer linkage connecting the Provincial Government with its relevant city and municipalities.

b) Components

- For smooth implementation of the individual development programs, this program is designed to establish and strengthen the overall coordination framework among the government agencies concerned such as the LGUs at every level, national government offices (both central and regional) as well as the private sector including NGOs.
- This program will include the following typical projects and programs as indicated below :
  - Resettlement and livelihood development and monitoring,
  - Introduction and establishment of the "Social Investment Fund" as social safety net scheme to support/assure the livelihood of disaster victims and social weak in the Province,
  - Establishment of Technology and Livelihood Development Center (TLRC) in Albay Province (TLRC data center & information technology support services for livelihood and entrepreneur development),
  - Eco-tourism development around Mayon Volcano (with one-stop eco-tourism guidance center and "Mayon eco-panorama promenade" under or in tie-up with disaster mitigation scheme),
  - Implementation of the socioeconomic development projects and programs, centering on the increase in agricultural production, industrialization (agro-industry development in particular) and tourism, and
  - Others.

c) Project Cost PHP 5.6 million

3) Community (City/Municipality) Level

CP-1: Community-based Disaster Management Strengthening

a) Objective

This program is to extend the ongoing efforts to upgrade/strengthen the disaster management system of the city/municipalities and barangays concerned in the Study Area.

b) Components

- Capacity building will be made to the city/municipality and barangay staffs in charge of disaster management, through execution of periodical staff training. These training programs will be implemented by holding seminars, workshops and drills.
- The training program will be prepared by PDMO and/or professional third party considering the competence level of the target personnel.
- The disaster management training will include a wide range of functions and skills relating to planning, organization, day-to-day management activities, counter-disaster operations, crisis management activities, logistic functions, recovery management, special skills applicable to rescue, first aid, assessment, emergency relief and welfare, communications, information management and so on.
- An information network system will be established to assure communications among PDMO/PDCC, CDCC/MDCCs and BDCCs.
- This program will incorporate the following disaster-related component programs:
  - Institutional consolidation of CDCC/MDCCs including BDCCs with capability building of their disaster management staff,
  - Enhancement of disaster coping capacity through upgrading of the forecasting & warning and evacuation system,
  - Resettlement community development program in association with livelihood programs and projects,
  - Strengthening of volunteer disaster operation groups,
  - Awareness promotion campaign and enlightenment on disaster management through seminars, workshops and drills for general public and including the disaster-related education at primary and junior schools.

- Preparation of the comprehensive city/municipal land use plan including hazard mapping & resource assessment, key commodity development strategy, etc.,
- Development of the integrated community disaster planning program, and
- Others.

c) Project Cost PHP 11.3 million

CP-2: Livelihood Development and Supporting Projects and Programs

For sound operations of the resettlement projects, especially for their sustainability, the livelihood programs and projects must be carried out in parallel and as a package with institutional and financial supporting programs and even coupled with area socioeconomic development projects. The livelihood development and supporting programs could be categorized into the following five components:

CP-2(1): On-farm and Marine Production Enhancement

a) Objective

This program aims to enhance the farming and marine production, and improve the living standard of the people, specially those relocated in the resettlement sites, through provision of a package of supporting programs in the managerial, technical and financial aspects.

b) Components

- For implementation of this program in on-farm production aspect, a new scheme named "Farm Land Trust Management"(refer to CP-2 (5)) will be introduced and practiced under the auspices of LGU and other authorities concerned like DAR, DA, CDA, etc.
- In this on-farm production enhancement program, inter-cropping farming (mostly coco-based one with banana, pili, abaca, corn, etc.) is recommended with a view to assuring a stable livelihood of tenant farmers.
- This program is intended to produce indigenous and still quality raw materials to provide stably the agro-based industries to be set up within or nearby the resettlement sites.

- This program will comprise the following development components:
  - Coco-based intercropping (with banana, pili, abaca, corn, peanuts, etc.),
  - Industrial crops development (ex. pili, abaca, coffee, cacao, etc.)
  - Vegetable production (e.g. tomato, cucumber, squash, pechay, cabbage, mongo, ampalaya, rootcrops, etc.),
  - Cutflower production,
  - Quality fruit production (mango, payapa, pineapple, melon & water melon, etc.),
  - Communal irrigation project (CIP),
  - Livestock and poultry development (cattle, swine, broiler, duck, quail and eggs),
  - Fishing development (mud crab, lapu-lapu, milkfish, seaweeds, etc.), and
  - Others.

CP-2(2): Agro-industry and Manufacturing Development

a) Objective

This program aims to generate/provide employment opportunities for the resettled people by developing the labor intensive industries in or around the resettlement sites.

b) Components

- This program is designed to create job opportunities for the resettlers and enable them to continue to make a living without returning to the former farming places at risk (for those who had lived within the permanent danger zone) and losing their means of livelihood for those affected by implementation of the structural projects.
- The main activity is to construct a "productivity center" or mini-industrial estate by installing the post-harvest, processing and/or manufacturing facilities and equipment, together with the basic infrastructure development such as access road, utilities (water and power) and so on.
- To produce highly value-added commercial products and increase resettlers' income, the professional training program for agribusiness will be provided to the applicant workers as described in CP-2 (4).

- The following are likely to be the most promising program candidates for the resettlement sites:
  - Handicraft development using local materials like abaca, bamboo, anahaw, karagumoy, gogon, etc. (including decorations, daily necessaries and novelties),
  - Pilinut processing
  - Coco-nectar and coco-distilled water processing,
  - Coco coir production (twine, coco dust or peat, etc.),
  - Peanut butter making,
  - Food processing (ex. bottling and canning for preservation)
  - Cement industry development,
  - Gravel and sand exploitation,
  - Dairy factory and butchery, and
  - Others.

c) Project Cost PHP 54.6 million

CP-2(3): Tourism Promotion

a) Objective

This program is designed to promote the tourism industry in the area by improving/upgrading the transport system, utilities & accommodations, communications and as the result tourist amenities, and likewise through tapping new tourist spots as eco-tourism or resort development sites.

b) Components

- The main activity is to develop new tourist spots or resorts endowed with majestic scenery of the Mayon Volcano, and adopting an eco-tourism concept.
- The eco-tourism development around Mayon Volcano will be tied up with disaster mitigation schemes or making the most of the constructed disaster preventive structures like access roads, dikes, groundsills, sand pockets and others (ex. Mayon eco-panorama promenade).
- To promote tourist development in the area, several one-stop tourism guidance centers will be established at major tourist spots, together with handicraft souvenir shops and stalls.
- This program will include the following typical projects and programs as indicated below :

- Development of the sightseeing resources such as ruins, falls, caves and various festivities as well,
- Establishment of one-stop tourism guidance centers (for leisure & recreation, including hiking, trekking, marine sports, hang-riding, etc.)
- Coastal eco-tourism,
- Improvement of Mayon skyline hotel,
- Spring and beach resorts, and
- Development of cultural assets including local festivities, traditions and customs.

CP-2(4): Institutional and Supporting System Strengthening

a) Objective

This program aims to upgrade the institutional and operational capabilities of the staffs in charge of disaster management in the government agencies and private organizations concerned, and also enable the resettled people to improve their living standards through implementation of the integrated and comprehensive supporting programs and projects for livelihood development.

b) Components

- This program focuses on institutional strengthening to insure the sustainability of the projects and programs proposed in the Master Plan. The main focus of this component is the human resources development in both of disaster-related organizations and resettlement communities.
- The institutional development component will provide the various levels of training programs for capability building in the following areas of concerns :

(For the staff in charge of disaster management)

- Planning,
- Crisis management activities,
- Counter-disaster operations,
- Logistic functions,
- Recovery management,
- Special skills on rescue, first aid, assessment, emergency relief and welfare, communications, information management, and
- Others.

(For the resettled people)

- Building cooperative partnership,
- Micro-lending scheme,
- Productivity enhancement,
- Organizational skills management and leadership,
- Entrepreneurial and information systems management, and
- Others.

- To ensure the sustainability of the projects and programs proposed in the Master Plan, some of the following component programs are to be implemented in parallel or as a package with the respective structural and sectoral area development projects and programs :

(For Institutional Strengthening)

- Capability building through training programs,
- Policy and legal arrangements (including preparation of operational guidance),
- Consolidation of coordination framework and networking for information management,
- Reorientation of cooperation in disaster coping and conclusion of an agreement on response & recovery operations among the neighboring LGUs at every level,

(For Livelihood Development)

- Farm land trust management (refer to CP-2 (5)),
- Cooperative development,
- Expansion of micro-lending scheme
- Business resource center (vocational training programs for applicant resettlers to make them master the required skills, consulting guidance on business opportunities, etc.),
- Agribusiness and trading system development (quality control of the products, business and marketing information, etc.)

CP-2(5): Farm Land Trust Management

a) Objective

This program aims to provide the resettled farming candidates with an occasion to assure their living standards by introducing a new scheme for arrangement and/or coordination of the "land lease agreement" between absentee landlords and resettled farmers.

b) Components

- The LGU will act as guarantor to assure its smooth implementation in close cooperation with the authorities concerned such as CDA, DAR, DA and PCA.
- In each LGU concerned, a special task force unit will be established to prepare an inventory of candidate trust farmlands and a list of potential participant farmers.
- To ensure the sustainability of this trust management system, participant farmers will be grouped as cooperatives (coops) considering the respective farming activities and their crops.
- The established coops will be entrusted by member farmers to manage and operate this trust management system, and even mandated to negotiate the terms of lease with the landlords. Moreover, the coops will deal with transactions for financing, post-harvest & processing and marketing on behalf of member farmers.

5.3 Cost Estimate

(1) Basic Conditions and Assumptions

Project cost comprises (a) Construction cost, (b) Government administration cost, (c) Engineering services cost, (d) Land acquisition cost, (e) Physical contingency, and (f) Price contingency. The conditions and assumptions for the project cost estimate in the Master Plan are as follows:

1) Project cost is estimated at the price level as of July 1999.
2) Exchange rates used in the cost estimate are as follows:
   US$ 1.0 = PHP 38.2 = ￥122.4
3) Construction cost is composed of two parts, 1) the direct cost consisting of the labor cost, material cost, and equipment expenses, 2) the indirect cost consisting of overhead expenses, unforeseen contingencies, miscellaneous expenses, and contractor's profit, pursuant to the Department Order (DPWH) No.30.
4) The unit price estimating method is applied to the estimate of construction cost.
5) Government administration cost for detailed design and supervision is estimated at a percentage of the total construction cost.
6) The engineering services cost for detailed design and supervision is estimated at a percentage of the total construction cost.

7) Physical contingency is estimated at 10% of the total of construction cost, government administration cost, engineering services cost, and land acquisition cost.
8) Price contingency is calculated based on the escalation rate of 7.85% per annum and the Implementation Schedule of the Master Plan Projects and Programs.
9) Value Added Tax (VAT) is not included in the cost estimate.

(2) Structural Countermeasure Projects

The total project cost for all structural countermeasures is estimated at PHP 13,360 million as summarized below.

Project Cost for Structural Countermeasure Projects

(Unit: Million PHP)

Code No.	Description	Amount
Sabo Facility Construction		
SF-1	Yawa River System Sabo Project	2,344.5
SF-2	Quinali (A) River System Sabo Project	1,912.8
SF-3	Buang River System Sabo Project	249.1
SF-4	San Vicente River System Sabo Project	1,459.4
SF-5	Padang River System Sabo Project	960.4
SF-6	Basud River System Sabo Project	584.9
SF-7	Bulawan River System Sabo Project	769.2
River Improvement		
RI-1	Yawa River Improvement Project	509.2
Urban Drainage		
UD-1	Legazpi City Urban Drainage Project	643.7
Forecasting, Warning and Evacuation		
FW-1	Forecasting, Warning and Evacuation System Strengthening Project	3,740.2
Relocation/Resettlement		
RR-1	Relocation and Resettlement Projects	186.6
Total		**13,360.0**

The annual operation and maintenance cost of each is summarized below.

Operation and Maintenance Cost

(Unit: Million PHP)

Code No.	Description	Amount
Sabo Facility Construction		
SF-1	Yawa River System Sabo Project	7.1
SF-2	Quinali (A) River System Sabo Project	11.0
SF-3	Buang River System Sabo Project	0.3
SF-4	San Vicente River System Sabo Project	3.7
SF-5	Padang River System Sabo Project	2.4
SF-6	Basud River System Sabo Project	1.7
SF-7	Bulawan River System Sabo Project	1.2
River Improvement		
RI-1	Yawa River Improvement Project	1.1
Urban Drainage		
UD-1	Legazpi City Urban Drainage Project	1.7
Forecasting, Warning and Evacuation		
FW-1	Forecasting, Warning and Evacuation System Strengthening Project	82.2
Relocation/Resettlement		
RR-1	Relocation and Resettlement Projects	5.4
Total		117.8

(3) Institutional and Supporting Services Strengthening Programs

The total amount of each program cost for institutional and supporting services strengthening is estimated at PHP 127.6 million as summarized below.

Project Cost for Institutional and Supporting Services Strengthening Programs

(Unit: Million PHP)

Code No.	Description	Amount
NP-1	National and Regional Disaster Management System Strengthening	53.9
PP-1	Provincial Disaster Management System Strengthening	2.2
PP-2	Province-wide Socioeconomic Development and Monitoring	5.6
CP-1	Community-based Disaster Management Strengthening	11.3
CP-2	Livelihood Development and Supporting Projects and Programs	54.6
Total		**127.6**

(4) Project Cost for the Master Plan

As a conclusion of the project cost estimate, the total amount of investments necessary to attain the development objectives of this Master Plan is estimated at PHP 13,487.6 million.

Meanwhile, the total amount of annual operation and maintenance cost is estimated at PHP 117.8 million.

5.4 Project Evaluation and Priority Ranking

(1) Economic Evaluation

1) Economic and Social Evaluation

Sabo Plan

Confirmation of Return Period

The economic evaluation is conducted for Yawa River System to decide the optimum construction design with regard to the magnitude of disaster (return periods for 2-, 5-, 10-, 20-, and 50-year) by option of land use plan (Option 2 and 3).

To calculate the indicators of EIRR, B/C, and NPV of alternative projects, the annual cost-benefit flow is calculated by accumulation of the annual costs and benefits of alternative projects in the Master Plan Study. The annual cost-benefit flows for return period of 20-year are shown in DT V10 and V11 (Data Book) for Option 2 & 3. The indicators are summarized as follow.

Comparison of Indicators for Economic Evaluation for Alternatives of Yawa River System

Option No.	Return Period	EIRR (%)	B/C	NPV (Million Peso)
1	10	16.96	1.07	60
	20	17.85	1.12	111
	50	16.73	1.07	91
2	10	17.79	1.16	190
	20	20.99	1.00	480
	50	18.00	1.18	280
3	10	24.10	1.54	2,848
	20	24.67	1.58	3,248
	50	23.33	1.50	2,904

Judging from the result, all indicators are evaluated to have high economic viability. Particularly, the alternative for the return period of 20-year for land use plan of Option 3 indicates a highest viability. So the project of 20-year return period for Option 3 are selected to be optimum design.

Evaluation of Other Alternative Projects

The alternative projects of other river system are evaluated. The results are summarized as follows.

Comparison of Indicators of Economic Evaluation for the Alternatives of Sabo Plans of Other River Systems

River system	Option No.	Return Period (Year)	EIRR (%)	B/C	NPV (Million Peso)
Quinali(A) River System	1	20	12.17	0.84	-52.3
	2	20	13.25	0.43	-79.4
	3	20	16.32	1.07	88.3
Buang River	1	20	9.24	0.64	-8.7
	2	20	13.12	0.53	-6.0
	3	20	21.67	1.43	40.8
San Vicente River	1	20	11.03	0.83	-26.4
	2	20	14.34	0.45	-18.8
	3	20	18.49	1.21	103.1
Padang River	1	20	12.52	0.88	-85.5
	2	20	13.46	0.62	-54.3
	3	20	19.14	1.28	168.7
Basud River	1	20	11.72	0.83	-25.5
	2	20	12.71	0.31	-42.3
	3	20	14.00	0.95	-21.8
Bulawan River	1	20	-2.20	-2.27	-85.5
	2	20	15.90	1.06	13.1
	3	20	17.16	1.16	700.4

The indicators of Option 3 give the highest values for all alternatives of river systems. Judging from the values of EIRR, the highest economic viability is estimated for Buang River of Option 3 as 21.67% followed by Padang River as 19.14%, and Bulawan River as 17.16%, respectively.

The annual cost-benefit flows for other projects by river system are shown in DT V12 to V17 (Data Book).

Flood Control Plan

The alternative projects of river improvement projects are evaluated. The obtained indicators of all projects are positive, but less than 15%. Yawa River Sabo Project shows the highest indicators as shown in the annual cost-benefit flow in DT18 (Data Book).

Results of Economic Evaluations for the Alternative Projects for Flood Control Plan

Name of River	Return Period (Year)	EIRR (%)	B/C	NPV (Milli. Poso)
Yawa	20	10.08	0.65	-65.9
Quinali (B)	20	5.66	0.38	-555.4
San Vicente	20	6.47	0.43	-112.4
Nasisi	20	5.23	0.36	-364.7
Ogsong	20	6.10	0.41	-271.6

Urban Drainage Plan

The economic evaluation for the urban drainage plan for Legazpi City is conducted for return period of 10-year. The indicators of economic evaluation are figured out as follows:

- EIRR : 23.96%
- B/C : 1.73
- NPV : PHP197.4 million

Judging from the indicators acquired, the Urban Drainage Plan for Legazpi City has a high economic viability. The annual cost-benefit flow is shown in DT V19 (Data Book).

2) Social Evaluation

Sabo Works

The following table presents the numbers of beneficiaries for households and the people to be affected to demonstrate the social impact of each Project.

River Systems or Rivers	No. of Beneficiaries	No. of Relocated
1. Yawa	758	65
2. Quinali (A)	1,619	21
3. Buang	16	5
4. San Vicente	129	8
5. Padang	574	38
6. Basud	134	0
7. Bulawan	467	0

Flood Control and Urban Drainage

Social assessment was done by estimating the number of beneficiaries for households. Legazpi drainage is estimated to bring about 1,663 beneficiaries, as shown below:

River Systems or Rivers	No. of Beneficiaries
1. Yawa	391
2. Quinali (B)	488
3. San Vicente	331
4. Nasisi	50
5. Ogsong	402
6. Legazpi Drainage	1,663

Urban Drainage Plan

The protected area from flood corresponding to 10-year return period is 1,070 ha and the number of beneficiaries for households is estimated as 13,334.

(2) Prioritization of the Projects

In this Section, evaluation of the proposed projects was made on the basis of the criteria determined by the JICA Study Team. Main objective of the evaluation is to classify the projects into different ranks corresponding to the priority of the implementation.

1) Criteria for Prioritization of the Projects

In formulating the sabo and river improvement plans for each of river basins and rivers, it is prerequisite to assess the respective project sites, based on the results of overall investigations on the respective physical and socioeconomic conditions. The most optimum project (or construction) sites were selected for mitigation of the possible hazards like mud & debris flow and flood through alternative study in each river basin and river.

In order to screen out the priority project, the following criteria were established and used, referring to the formulated basic concepts and strategies and through discussion with the authorities concerned. The evaluation criteria are composed of the following four key indicators:

a. Urgency of implementation
   Urgency might be assessed by the degree of imminence of the impeding disaster.
b. Economic advantage
   The economic advantage can be represented by EIRR of the project.
c. Number of beneficiaries and affected people
d. Degree of representation as a model project
   As a representing model, the project should be comprehensive and include substantial components.

2) Priority Ranking of the Sabo and Flood Control Projects

For each of the key indicators set out for priority ranking, evaluation was carried out based on the three grades of scored points ranging “High or Large”(5 points), “Medium”(3 points) to “Low or Small”(1 point).

The prioritization results of the structural projects are given in the following table.

Master Plan Projects/Programs and Their Prioritization.

Code No.	Projects/programs	(1) Urgency of Implemen-tation	(2) Economic Advantage (EIRR)	(3) Social Impact (No. of Beneficiaries)	(4) Degree of Represen-tation as Model	Total Scores (Accumulated Points)
Sabo Facility Construction						
SF-1	Yawa River System Sabo Project	A	A	A	A	20
SF-2	Quinali (A) River Sabo Project	B	B	A	B	14
SF-3	Buang River Sabo Project	C	A	C	B	10
SF-4	San Vicente River Sabo Project	C	B	C	B	8
SF-5	Padang River Sabo Project	B	B	A	A	16
SF-6	Basud River Sabo Project	B	C	C	B	8
SF-7	Bulawan River Sabo Project	C	B	B	B	10
River Improvement						
RI-1	Yawa River Improvement Project	B	C	B	C	8
Urban Drainage						
UD-1	Legazpi City Urban Drainage Project	A	A	A	B	18

Notes: (1) Urgency of Implementation A: High, B: Medium, C: Low
(2) Economic Advantage (EIRR) A: >20%, B: 15 - 20%, C: <15%
(3) Social Impact (No. of Beneficiaries) A: >500, B: 200 - 500, C: <200
(4) Degree of Representation as a Model Project A: Large, B: Medium, C: Small
Accumulated Scores: A=5 points, B=3 points, C=1 point

Among the Sabo projects, Yawa River System Sabo Project could be the highest priority project in reference of the selection criteria. Next to Yawa, Padang and Quinali (A) should be prioritized in respect of their accumulated points.

As for the flood control project, only Legazpi City Urban Drainage is the urgent project. The estimated EIRR is by far the highest. It has no negative social impact. In the light of this, the urban drainage of Legazpi City is to be selected as the priority project.

3) Selected Resettlement Project and Possible Supporting Programs

As mentioned in Section 5.2.2(5), the resettlement project should be implemented as a package with the structural projects and also supported with livelihood projects/programs. In view of the fact that the Yawa River System Sabo Project was selected as the highest priority project, the related resettlement projects at

Banquerohan (Legazpi City) and Anislag (Daraga Municipality) are accordingly to be given the priority.

Based on the key factors for selection of the livelihood projects such as (a) labour-intensive or employment creation, (b) utilization of local resources (materials and expertise), (c) prospects of marketability, and (d) availability of the utilities (water and energy), the following enterprises or projects are promising and their developments may be investigated in the feasibility study.

a. Increase in agricultural productivity and production
   - Coco-based Intercropping with banana, abaca, corn, pilinuts, rootcrops, vegetables and others
   - Increase in paddy production

b. Promotion of agro-industry and agribusiness
   - Handicraft (abaca, nipa, caragumoy, etc.) and furniture making (pili tree, bamboo, etc.)
   - Coco coir production (coco fibre, twine, dust or peat, etc.)
   - Food processing (pilinuts, fruits, vegetables, etc.)

The following programs for stretching institutional and supporting services will be focused and scrutinized in the feasibility study.

a. Clarification of the duties and responsibilities about forecasting and monitoring of mud and debris flows
b. Establishment and strengthening of the operations and maintenance (O&M) of the constructed structures and installed facilities
c. Upgrading of the forecasting, warning and evacuation system
d. Awareness promotion of the people

5.5 Organization for Implementation of the Proposed Projects and Programs

DPWH will be the executing agency at the central and regional level responsible for implementation of the physical projects relating to the sabo and flood control works and their operations and maintenance. For overall supervision of the project implementation, it is recommended to establish "Project Management Office (PMO)" under the control of DPWH Region V. The substantial management activities for the both organizations are to be entrusted to the Assistant Director of the DPWH Regional Office, who will act as the superior supervisor on behalf of the Director General of DPWH Region V.

PMO will be composed of representatives from the following government agencies and private organizations: DPWH, OCD/RDCC, PHIVOLCS, PAGASA, DSWD, NEDA, DTI , TLRC, CDA, LGUs concerned (ex. PDCC & PDMO and C/MDCCs), and the private sector including NGOs & POs. The Planning and Design Division of DPWH Region V will function as the "Secretariat" of the Committee. The major duties and responsibilities of each member agencies are as follows:

- DPWH : Overall planning and budgeting for implementation of the Master Plan projects/programs, specially specialized in construction and O/M of physical structures (in this Report, newly proposed to assume the monitoring functions of mud and debris flows)
- OCD : Disaster information management
- PHIVOLCS : Monitoring of the volcanic & seismic activities and hazards, and warning issuance
- PAGASA : Observation and forecasting of the weather (ex. typhoon,rainfalls, etc.) and its information dissemination
- DSWD : Social welfare activities including promotion of the Resettlement and livelihood development for poverty Alleviation (e.g. expansion of the self-employment assistance program)
- NEDA : Socioeconomic planning and coordination for regional development
- DTI : Industrial development and capability building
- TLRC : Industrial development and capability building, especially for agro-based industry and agribusiness development
- CDA : Cooperative development through capability building and micro-lending
- LGUs Concerned : Co-implementing agencies together with DPWH and other areas and sectors
- Private Sector : Voluntary contributions and supports in all aspects of (incl. NGOs&POs) disaster coping activities and socioeconomic development

PMO to be established in DPWH Region-V will be responsible for coordination of all matters relating to the overall implementation of the Master Plan projects and

programs. The members of "Coordination Committee" will give advice for smooth and efficient implementation of the projects/programs in each of their proper concerns.

The Coordination Committee will also advise the Assistant Director of DPWH Region V on technical and managerial issues in the implementation of the projects/programs and keep contact with the similar committees to be established at the provincial and city/municipal levels.

The main activities of PMO are coordination among the agencies and authorities concerned in charge of projects/programs implementation, control of their performance, application and allocation of annual budgets, holding of the disaster-related conferences & seminars, execution of training programs at every administrative level.

At the provincial level, the Provincial Disaster Coordinating Council (PDCC) will take charge of coordination and management of the inter-city/municipality projects and programs. The Provincial Disaster Management Office (PDMO) acts as PDCC's Secretariat. The main agenda to be discussed in this Council will be the technical and managerial matters such as program components specified in the "Consolidation of the Provincial Disaster Management System (PP-1)". On the other hand, as to the projects and programs categorized into the "Province-wide Socioeconomic Development and Monitoring (PP-2)", they will be under the control or monitoring of the Provincial Planning and Development Coordinating Office.

At the city/municipality level, a "City or Municipality Coordinating Council (C/MDCC)" under the control of Mayor will be consolidated so that the council can coordinate and monitor the component projects/programs proposed in the "Community-based Disaster Management Strengthening (CP-1)". The coordination and monitoring tasks of the "Livelihood Development and Supporting Projects and Programs (CP-2)" will be entrusted to the Planning and Development Coordinating Office in each city or municipality concerned.

In parallel with the restructuring and strengthening arrangements at both the provincial and city/municipality levels, the participation of the people and establishment of people's organizations are a "must" for successful implementation of the Master Plan projects and programs as well as their sustainability. At the preparatory stage prior to the commencement of implementation, social design or social preparation study will be carried out, together with resources inventory survey, so as to assess the people's participation and make preparations for establishing "cooperatives" by grouping the workers by

sector. Activities of the established workers' groups will be institutionally and financially consolidated by regrouping them into "Associations" and through their engagement in agro-processing industry, agribusiness, and marketing.

It is, however, true that in view of the existing constraints relating to the formation and activities of the cooperatives in Bicol Region, there exist several institutional, financial, technical issues and points to be clarified as to the establishment and strengthening of the workers' groups associations. Consequently, such issues need to be scrutinized in implementing the "Institutional and Supporting System Strengthening (CP-2[4])" and referring to the successful cases in the TLRC programs.

5.6 Implementation Schedule

The planning period up to the target year 2020 is divided into three phases : Phase I up to 2005, Phase II for 2006 – 2010, and Phase III for 2011 – 2020.

The programs and projects relating to the upstream enterprises like institutional strengthening and relocation/resettlement should be commenced from the very early stage of Phase I, because these projects/programs contain the institutional arrangements and resettlement site development with livelihood provisions which are indispensable to ensure sound implementation of the programs/projects proposed in the Master Plan. In addition, such projects/programs as strengthening of forecasting, warning and evacuation system has to be also commenced in Phase I, in view of the imminent disaster threat of Mayon Volcano.

As to the implementation of 20 projects and programs proposed in Master Plan, they will be executed in three phases as per the prioritized order, and following the implementation schedule (or staged procedures) as indicated in the following figure: Implementation Schedule of the Master Plan Projects and Programs.

In the first year of Phase I, subsequent to the approval of the implementation program and establishment of the implementation organization, the programs relating to institutional strengthening through human resource development will be firstly set about, concentrating on the training of staff in charge and through awareness raising among the general public. And then the construction works and installation of the facilities are to follow successively in the further stages. As shown in the following figure, the construction work schedule for Sabo facility extends over one year and half to three years depending on its scale, while flood control and urban drainage works take one year and half to two years.

Substantial forecasting and warning system and evacuation facilities are to be implemented in the first phase starting from 1999. However the development of some rainfall gauging stations and evacuation centers are to be commenced in 2011.

Lastly, it is prerequisite that the resettlement site development projects packaged with livelihood programs be completed before implementation of the physical projects, or the eligible resettlers should be properly compensated and/or assisted so that their economic and social conditions would be as favorable as before.

Implementation Schedule of the Master Plan Projects and Programs

Code No.	Description	Phase I (1999 - 2005)							Phase II (2006 - 2010)					Phase III (2011 - 2020)									
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sabo Facility Construction																							
SF-1	Yawa River System Sabo Project																						
SF-2	Quinali (A) River System Sabo Project																						
SF-3	Buang River Sabo Project																						
SF-4	San Vicente River Sabo Project																						
SF-5	Padang River Sabo Project																						
SF-6	Basud River Sabo Project																						
SF-7	Bulawan River Sabo Project																						
River Improvement																							
RI-1	Yawa River Improvement																						
Urban Drainage																							
UD-1	Legazpi City Urban Drainage Project																						
Forecasting, Warning and Evacuation																							
FW-1(1)	Forecasting, Warning and Evacuation System Strengthening																						
FW-1(2)	Strengthening & Development of Remnant Rainfall Gauging Stations and Evacuation Centers																						
Relocation/ Resettlement																							
RR-1	Relocation and Resettlement Projects																						
Institutional and Supporting Services Strengthening																							
NP-1	National and Regional Disaster Management System Strengthening																						
PP-1	Provincial Disaster Management System Strengthening																						
PP-2	Province-wide Socioeconomic Development and Monitoring																						
CP-1	Community-based Disaster Management Strengthening																						
CP-2	Livelihood Development Projects and Programs																						

Notes : Feasibility Study or Preparatory Study
Detailed Design or Preparation of Works
Construction Works and/or Installation of Equipment
Project Activity or O&M including Monitoring and Review

5.7 Project Sustainability Assessment

(1) Economic Viability

1) Potentiality of Resources

To judge the potentiality of the area, the availability of resources is one of the most important factors. This potentiality is composed of natural resources and human resources. In agriculture, palay, coconut, banana and abaca are major and conventional crops and their production have been steadily increased. Mineral resources are assumed to be high potentiality. In future, agro-industrial development will be accelerated. Furthermore, tourism industry is expected to be grown by implementation of disaster prevention against eruption of Mayon Volcano. And Mayon Volcano itself might be a more attractive tourism resource.

Human resources should be substantially the most important key factor for any kind of development. The quality of human resources depends basically on the level of education. But according to the result of the survey on disaster awareness by the JICA Study Team, the level of education is not so high comparing with the area outside the hazardous area.

2) Contribution of Socioeconomic Sustainability

As a result of economic evaluation, Yawa River system and also other river systems for Sabo Plan, Yawa River for river improvement plan and Legazpi City urban drainage plan are figured out to have a high economic viability. The degree of contribution of these plans to socioeconomic sustainability depends heavily on whether the development in protected area which is planned as Option 3 for land use plan could extract the potentiality inherent in the hazardous area to be protected from volcanic or flood disaster.

According to land use plan of Option 3, the following impacts are expected:

- The enhancement of agricultural productivity is expected for major agricultural crops such as palay, coconut (copra), and vegetables.
- New areas for industrial and service sector are planted and from these lands, agri-industrial products with high value added is expected to increase and trade industry including distributing these products in the form of transportation, wholesale and retail service will be accelerated.
- Tourism will be more activated by implementation of disaster prevention. Especially Mayon Volcano is expected to be the most important trigger of regional economic prosperity by expansion of disaster free zones in the Study Area.

- The feeling of freedom from disaster of residents could be a fundamental factor of their daily lives. At the same time, this fact will accelerate to promote the socioeconomic development of the protected area.

From these impacts, the projects in the Master Plan are expected to extract the potentiality of the Study Area and contribute considerably to socioeconomic sustainability of the area.

(2) Operation and Maintenance of the Disaster Preventive Structures

As described in Secton 5.5 Organization for Implementation of the Proposed Projects and Programs, the Project Management Office (PMO) will be established for implementation of the proposed projects and programs. PMO will be led by DPWH Region V together with various National Government Agencies, provincial, municipal and city governments (LGUs). Though investment cost will not be covered by Active involvement of LGUs.

A little attention has been paid to maintenance of sabo facilities in the past. Lack of coordination between DPWH and LGUs concerned is sometimes reported. Participation of LGUs in project implementation will enhance the project ownership of LGUs and residents. PMO should prepare operation and maintenance plan. The estimated labor required for O&M is shown in Table 8.8.1, Expected Job creation for Implementation of the Master Plan Projects and programs.

(3) Environmental Impacts

In addition to the above-mentioned positive effects from incremental net profits in agricultural and industrial productions and business activities as well, the following indirect effects and socioeconomic and cultural impacts would be produced by the implementation of the projects and programs proposed in the Master Plan.

1) Physical Impacts

The disaster prevention/mitigation projects proposed in this Master Plan will generally have a positive impact on the environment. The construction and rehabilitation works of the disaster preventive facilities are mostly designed to improve environmental conditions in the disaster prone areas. The improvement of such basic infrastructure will prevent the occurrence of disasters and mitigate their effects.

2) Socioeconomic and Cultural Impacts

Subsequent to the implementation of the Master Plan projects and programs, the following socioeconomic and cultural impacts will be brought about:

- Increase in agricultural productions and development of their processing industries
- Generation of employment opportunities
- Improvement of the people's living standards (especially those living in disaster-prone areas
- Expansion of business chances
- Promotion of WID (women in development)
- Other socioeconomic (multiplier) effects
    - Contribution to social welfare development
    - Promotion of area development by reducing the vulnerability to disasters
    - Acceleration of intensified land use and development investment
    - Alleviation of poverty and regional disparities

As to the increase in employment opportunities, which is the most imminent socioeconomic issue to be addressed and conductive to the improvement of resettlers' living standards, it is expected to generate about 3,500,000 man-days of job opportunities, if all the Master Plan projects and programs are implemented up to the target year of 2020, as summarized below.

Expected Job Creation for Implementation of the Master Plan Projects and Programs

(Unit : man-days)

Physical Projects			Labor Requirements	
			Construction Stage	O&M Stage
1.	Sabo Facility Construction			
	SF-1	Yawa River System Sabo Project	599,220	77,760
	SF-2	Quinali (A) River System Sabo Project	452,100	52,650
	SF-3	Buang River System Sabo Project	40,980	0
	SF-4	San Vicente River System Sabo Project	259,800	6,150
	SF-5	Padang River System Sabo Project	222,840	20,250
	SF-6	Basud River System Sabo Project	158,100	15,000
	SF-7	Bulawan River System Sabo Project	146,460	4,050
	Total		*1,879,500*	*175,860*
2.	River Improvement			
	RI-1	Yawa River Improvement	88,320	9,750
	Total		*88,320*	*9,750*
3.	Urban Drainage			
	UD-1	Legazpi City Urban Drainage Project	160,440	34,680
	Total		*160,440*	*34,680*
4.	Forecasting, Warning and Evacuation			
	FW-1	Forecasting, Warning and Evacuation System Strengthening	469,960	591,840
	Total		*469,960*	*591,840*
5.	Relocation/Resettlement			
	RR-1	Relocation and Resettlement Projects	34,400	58,320
	Total		*34,400*	*58,320*
Grand Total			*2,632,620*	*870,450*

CHAPTER 6 PRIORITY PACKAGE AND RECOMMENDATIONS

6.1 Priority Projects and Supporting Programs

In consideration of the administrative procedures and formalities to be followed in GOP and DPWH for formulation and adoption of the new projects/programs, allocation of the budget, establishment of the project organization, and set-up of the project monitoring and management system, the Master Plan is formulated so as to implement 16 projects/programs abreast for comprehensive disaster prevention. The projects/programs recommended to be immediately executed in this Master Plan are combined as "Short-term Plan" or "Priority Package" which is subjected to a feasibility study in next phase.

The Priority Package consists of:

(1) Yawa River System Sabo Project

(2) Legazpi City Urban Drainage

(3) Forecasting, Warning and Evacuation

(4) Resettlement Sites Development Project

(at two sites: Banquerohan in Legazpi City and Anislag in Daraga Municipality)

(5) Institutional and Supporting Services Strengthening Programs and Projects

With regard to the sites development, the livelihood and supporting projects/programs have to be implemented in the following sector as a package, considering the respective local resources and preferences of the resettlers :

- On-farm and marine production improvements
- Industrial and manufacturing development
- Tourism development
- Institutional strengthening

The Priority Package is to be implemented during Phase I (up to 2005), but before its implementation, at least one year is needed for administrative preparations such as formulation and approval of the projects/programs as well as budgetary arrangement. As to the physical projects, which aim to construct or rehabilitate Sabo and flood & drainage control facilities, DPWH will be responsible for preparatory works as well as technical administrative arrangements as an executing agency. For the projects related to strengthening of the forecasting, warning and evacuation system, an inter-agency organization will be established

by mobilizing staffs from the respective authorities concerned like LGUs, DPWH, PHIVOLCS, OCD, DSWD, AFP, PNP.

6.2 Conclusions and Recommendations

(1) Conclusions

As identified in Section 2.2, there are evident connections between the risks people face and the reasons for their vulnerability to hazards. The risk faced by people must be considered as a complex combination of vulnerability and hazard. The crucial point about understanding why disasters occur is that it is not only natural events that cause them, but the product of the political and socioeconomic environment. It is important to realize such aspects of the social environment that make the people live in adverse economic situations and why they are obliged to inhabit the disaster-prone areas. There are also trade-offs between "poverty and vulnerability" where poverty can be reduced by borrowing and investment, and then the impact of these interventions may increase vulnerability.

It goes almost without saying that disasters have caused very serious effects on the contemporary development of the area. In reality, disasters brought about damages to not only life and property of the people but also their livelihood. When disaster strikes, it deprives an area of many of its current vital resources. Besides, we needs to pay attention to the fact that as a general rule, the poor suffer more from hazards than the rich.

In view of this disaster mechanism or cause and effect relationship, and new conceptualization on disaster and development, it is pertinent to take the tripartite "countermeasures" proposed in Master Plan for sound and sustainable area development. The countermeasures or projects for "prevention/mitigation" and "evacuation" following the forecasting and warning will be useful to impede or reduce the effects of disaster and save or protect the life and property of the people in the area. The "relocation/resettlement" countermeasure or project with various livelihood programs is expected to contribute to the area socioeconomic development and will be conducive to the creation of job opportunities, increase of resettlers' income, and social betterment.

Likewise, it is essential to recognize the cause and effect relationship between disasters and social and economic development, and incorporate mitigation into specific development projects and programs. In other word, a successful strategy will incorporate preventive risk-reduction measures into normal practices.

The Master Plan projects and programs were formulated to support the provincial and city/municipal socioeconomic development plans. The Provincial Medium-term Plan calls for a program of policies and investments, specifically focusing on rural development, human resources, and the improvement of governance and infrastructure development. The projects and programs proposed in Master Plan will be instrumental in helping achieve this Plan.

(2) Recommendations

For a more successful implementation of the Master Plan projects and programs, the following are particularly recommended:

<u>For the Master Plan Projects and Programs in General</u>

1) As the disaster prevention/mitigation measure or project is an integral part of the area socioeconomic development, the government is advised to allocate the required fund to the former in proportion to that of the latter;
2) The accomplishment of the Mayon Sabo and flood control projects is far below the target due to the limited funds from the national government. It is then recommended for the government to tap a funding source and have recourse to the cooperation of the local government units (LGUs) to raise the necessary fund to implement the projects;
3) To ensure the soundness and sustainability of the Sabo and flood control projects, maintenance of their structures has to be given priority, especially for the existing facilities damaged by calamities;
4) In view of the incessant or unforeseen change of the volcano and river conditions, the sabo and flood planning and design should be regularly reviewed;
5) To complement or upgrade the "disaster management capacity" of the communities (decision maker in particular), the information management system needs to be strengthen through provision of the forecasting and warning facilities, and transmission and dissemination of accurate, timely and clear information;
6) As the public awareness plays an important role in coping with crisis situations, the programs of disaster education in schools and assistance in educating the public should be provided for the benefits of long-term mitigation, especially in relation to area development and preservation of the environment;
7) The government and the community must act together to overcome the crises which arise from disaster and to ensure a rapid return to normal conditions. To keep good understanding and cooperation between governments and

communities, it is important to have for both parties a common understanding of the scope and limitations of the respective responsibilities and duties;

8) Any engineering schemes should be supported by social development programs to encourage the participation of the community in the projects/programs;
9) To assure the sustainability of the proposed projects and programs, social preparation should be carried out beforehand by sparing enough time to encourage the participation of the community or local people;
10) In view of the potential risk of the volcano's eruption, the people still residing within 6km-radius from the crates are strongly advised to be resettlers in the safer places where livelihood programs are well provided;
11) To support and promote the livelihood development, it is suggested to implement employment generation programs as a safety net measure, coupled with micro-finance programs that are designed to have the greatest outreach and reach the poorest segments of the population; and
12) As the priority package projects and programs include both the structural and non-structural countermeasure components, it is suggested for their operations and management to establish a "Project Management Office (PMO)" composed of the representatives from the government agencies such as LGUs, DPWH, OCD, PHIVOLCS, DSWD, etc. and the private sector including NGOs.

<u>For the Priority Package Projects and Programs</u>

1) In view of the imminence of needs, socioeconomic effects and representing model of the priority package projects and programs, it is strongly recommended to set about their works and activities as quickly as possible;
2) Implementation of the institutional and supporting services strengthening programs is indispensable to the successful performance of the physical projects and their sustainability. Therefore, the latter should be implemented as a package and still abreast together with the former;
3) In the Philippines, no legislation stipulates for the monitoring of the mud and debris flow. To cope with such imminent disaster threat, it is advised to establish immediately an "Inter-agency Committee", which takes charge of the mud and debris flow monitoring and warning.
4) In parallel with the above steps and procedures, the Master Plan proposals should be disseminated widely to facilitate implementation and to cultivate public acceptance through implementation of the orientation seminars and workshops, information displays, preparation of publicity materials such as posters and videos together with the newly prepared "hazard maps".