3. Details of the Program

(1) Components

a. Organizing Community Associations

Community associations would be organized to implement the social forestry program. The process of organization would focus on strengthening and promoting the Philippine traditional system of collaboration called "Bayanihan". This is a system whereby a group of ten members or less work in rotation at each others' farms. Under this program, it is planned to organize groups of 5 to 8 members each and integrate several groups in one association.

Community associations are important mechanisms for administering and managing the components mentioned in the following paragraphs b, d, e and f, and should be organized at an early stage of implementation. However, with regional variance in socioeconomic factors taken into consideration, some districts may take more time to organize associations. For example, flexible measures may be needed prior to the shift to a formal association. The solidarity of the local people would first be strengthened by improving social infrastructure through the Bayanihan approach.

b. Ensuring the Right of Land Use

Tenure security and the right to use land will be ensured by issuing Certificate of Stewardship Contract (CSC) to grant rights for 25 years. However, issuing procedures including surveys take a considerable period of time because the CSC is applicable to individuals. According to a survey of inhabitants, there are about 2,000 households on the watershed. If all these households or all adults are eligible for this certificate, issuing alone will take several years.

For these reasons, it would be more effective for the program to utilize Certificate of Community Forest Stewardship (CCFS) which were approved by the DENR in 1991. The contents of this certificate are almost the same as the CSC except that the

former is applicable to communities instead of individuals. Therefore, the number of certificates to be issued would be much less than if individual CSCs are used. Under the program, a total of 16 CCFSs would be issued. As a general rule, one certificate would be issued to each sitio. In the districts where issuing CCFSs seems to be impossible, CSCs would be granted as before. On the other hand, boundary disputes need to be resolved by each community association. Towards this end, the program would promote boundary forestation mentioned below. This would help clarify the boundaries between individually managed lands and avoid disputes.

c. Improving Social Infrastructure

(a) Footpaths

Footpaths as well as highways will be indispensable to effective management. A footpath means a path approximately 1m wide that can accommodate an oxcart. If such footpaths are extensively provided, every community would be able to perform its functions.

Footpaths would be constructed at a rate of 30 m per ha (the same as the forest management plan). Depending on the density of villages and other factors, the rate of construction may need to be adjusted on a district basis.

As for structure, the footpaths would consist of carefully laid out alignments one meter wide with gravel surfacing about 15 cm thick in the individual management area, and simple footpaths without gravel in the community forest area like the forest management area.

Footpath maintenance and management would be assumed mainly by the communities.

(b) Potable Water Facilities

In six districts having domestic water problems, wells would be bored or small water tanks would be installed.

Wells would be bored near streams and manually pumped. Small tanks with a capacity of 24 m^3 each would be installed, from which water would be piped to villages.

In Boso Boso, Kaysakat and Calawis, several wells or small tanks have already been installed under the previous ISF program or by barangays or individuals. These facilities can already supply water without any problems in terms of quantity and quality.

However, in Boso Boso, where water supply facilities including a small tank were provided under the previous ISF program, the initial purpose of supplying water to families has not yet been achieved due to the opposition of farmers who want to use the available water for paddy irrigation. To avoid such problems, a consensus should be established in every community association prior to implementation through full study and discussion about the purpose, location, scale, specifications and expected negative effects of the installation.

(c) Drain Construction

In view of topographical conditions, drains would be constructed in the individual management areas where there is a high risk of soil erosion.

The size of a drain would be approximately 60 m long to cover an area of 200 ha. The drains would be simple. They would be made by improving existing ditches created by erosion. They would be stabilized through appropriate measures including installation of cogon bands (bundles of weeds) with wooden posts inside the ditch. Vetiver grass would also be used, depending upon availability.

(d) Small-scale Nursery

i. Policy

A nursery would be developed in every community. The nurseries would be designed to supply necessary seedlings

and test and raise new species under the social forestry program. The nurseries would be managed by the communities but government would provide seeds, plastic bags, tools and technical assistance.

ii. Criteria for Selecting Nursery Sites

Nursery sixes should be established in the proximity to streams and springs able to supply water throughout the year, subject to no submersion under water during the rainy season or on the occurrence of a flood.

iii. Size and Facilities

A small fixed nursery with an area of about 600 m^2 would be an appropriate size for independents management by the community.
A waterway and a warehouse would be constructed as facilities.

iv. Tendering Standards

Seeds would be collected as much as possible from good trees in local plantations or other plantations under similar environmental conditions. Seedlings would be produced through proper germination control and tendering. Bare-rooted seedlings would be raised for Gmelina arborea, Leucaena leucocephala and Pterocarpus indicus. For other species, potted seedlings would be produced.

(e) Multi-purpose Building

One meeting place would be constructed in each community association. The facilities would be used for various purposes and include a general meeting room, a seminar room for extension activities, a storage area to temporarily collect and store agricultural and forest products, and a space for projects (handicraft, etc.) that will provide additional income.

The size and specifications of each hall would be determined depending on the actual conditions of each district, including the population, and the purpose and form of use. Generally, each hall would have an area of 100 m^2 (10 m x 10 m).

The design and construction of a hall would be entrusted to appropriate companies, and necessary materials such as building materials and gravel, machinery and labor would be locally procured as far as possible.

d. Individual Management

(a) Boundary Forestation of Individually Managed Lands

There are still boundary problems, even though boundaries were determined by surveying parcels at the time of issuing CSCs under the previous ISF program.

Therefore, the program would actively promote boundary forestation, which would also contribute to water and soil conservation. This type of forestation would entail planting trees on the boundaries of the lands to be managed by individuals having the right of use.

The species to be planted would include fast-growing species such as Kakawate: (Gliricidia sepium) and Calliandra confusa. Trees would be planted at intervals of about 2 m.

(b) Developing Individual Management Areas

Within each individual management area, agroforestry would be carried out under in land use systems that incorporate, water and soil conservation measures as fundamental components. (For specific models, see Paragraph f. (a). Model Farm Development.) Activities will comprise:

- Developing sites for cultivation (including terraces)
- Cultivating crops

- Constructing drainage ditches inside and outside the land under cultivation
- Planting hedgerows
- Creating farm forests, and
- Planting fruit trees (mango, jackfruit, tamarind, citrus) and species for firewood.

e. Community Forest Development

In the social forestry program, all of the lowlands and areas included in CSCs would be subject to individual management, except for areas covered by existing plantations. Areas not managed by individuals will be subject to community forest development. Community forests will perform the function of conserving water and soil and also play a role as buffer zones to protect plantations and the residual natural forests.

(a) Planted Species

Species for planting would include fast-growing trees such as Acacia auriculiformis, Acacia mangium, Gmelina arborea, Leucaena leucocephala, Melia dubia and Cassia spectabilis as well as medium- and slow-growing species such as Pterocarpus indicus, Swietenia macrophylla, and bamboos. Buri palm, rattan and other non-timber species with commercial value may also be included.

(b) Managing Procedure

In new plantations, Assisted Natural Regeneration (ANR) treatments would be applied to promote natural vegetational succession. As many preceding trees as possible would be conserved and new trees would be planted at varying levels, depending on the existing density of trees nurtured through ANR.

When a community forest is harvested (felled), interplanting would be immediately carried out to gradually create a multistory forest.

Firebreaks would be established at a rate of about 140 m per ha.

(c) Harvesting

To harvest community forests, the cutting age and the number of trees to be cut (per ha) would be determined for each of their applications, such as fuelwood, poles and timber. The standard cutting periods would generally be 5 to 13 years for firewood, 14 to 24 years for poles, and 25 to 40 years for timber. Bamboo would be harvested every year from the eighth year of planting.

Trees would be cut selectively in the whole area.

The use of forest products, the selection of planted species, planting and tendering procedures, and the preparation of a management plan would be determined by agreement within each community association.

f. Technical Extension and Support Activities

For the efficient implementation of the social forestry program, technical extension activities would be carried out as follows:

(a) Establishment of Demonstration Farm

Models for land use systems based on soil conservation would be developed on the slopes. Large-scale development would be avoided in order not to dampen the enthusiasm of farmers. The average size of each model would be about 1,000 m^2 (50 m x 20 m).

1) Methods of Using the Land

· Terrace Construction

Terraces would be constructed in order to prevent soil erosion, and cuttings of fast-growing species (Kakawate) would be planted as terrace hedgegrows.

· Contour Cultivation

Food crops and trees would be alternately planted in lands (20 to 30 m wide) along contours. This method will considerably prevent soil erosion, and also diversify

crops. If the rotation system of several crops, including leguminous plants, is established, soil fertility will improve.

2) Planted Species and Cultivated Crops

The following species would be planted: leguminous and non-leguminous species, leguminous crops, fruit trees (citrus, banana, papaya, mango, guava, avocado, etc.), staples (rice cultivated in the paddy and dry field, maize, cassava), cash crops (coconut, cacao, coffee, cashew nut), and vegetables.

3) Cultivation Methods

Several cultivating methods would be applied such as plowing or manual tillage, depending on what would be most suitable for the formers living nearly.

4) *Countermeasures against Soil Erosion*

- Drainage Ditch Construction
  In areas where terraces are constructed, drainage ditches would be constructed longitudinally and along the contour of terraces.

- Planting Cover Plants
  Leguminous perennials such as Centro (Centrosema pubescens) and Siratro (Macroptilium atropurpureum) would be planted.
  Their nitrogen fixation capability will help restore soil fertility.

(b) Outline and Policy of Extension, Education and Training

The extension, education and training program would be implemented as follows:

1) Selecting, educating and training persons responsible for extension in every community;

2) Extension Activities by responsible persons to cover all the members of the community;
3) Field practice in demonstration farms and information exchange by cross visit to other communities; and
4) Extension activities by selected key farmers.

(c) Sales Promotion of Agricultural and Forest Products

To promote the sales of agricultural and forest products,the communities would take the initiative in:

1) Improvement of road conditions
2) Market research
3) Joint shipment and sale
4) Securing distribution channels, and
5) Cooperation with relevant agencies.

(2) Considerations for Implementation

a. Encouraging People Dependent on Shifting Cultivation to Settle themselves

As one of the purpose of this program is water and soil conservation, it is very important to resettle the occupants in mountain areas dependent on shifting cultivation.

The people dependent on shifting cultivation can be divided into two groups, namely the occupants from other provinces (especially Bicol and Aklan) and the Dumagat aboriginal tribe. The former have their own social backgrounds as resettlers, and some have changed from shifting cultivation to settlement. The latter live in a closed society with their own culture. Accordingly, it is necessary to promote the change to settled agriculture while maintaining respect for their social and cultural backgrounds.

Specifically, efforts would be made to bring about the change from shifting cultivation to settlement through the following activities:

- A survey of their customs, living practices and aspirations through consultation with inhabitants in lowland villages who originate from the tribe, liason people who can understand them, or cultural anthropologists.
- Community organization and exchange with villages in the flat areas.
- Enlightenment through liason people about settled agriculture, including settled cultivation, fruit tree planting and raising domestic animals.
- Participation in any forestation project near the residential district.

b. Extension Activities in Privately-Owned Lands

Privately-owned lands account for about 17% (4,846 ha) of the total area (about 28,410 ha) of the Marikina watershed.

Of these lands, an area of 2,883 ha belongs to farmers who have received Certificate of Land Ownership Agreement (CLOA) from the Department of Agrarian Reform (DAR). These farmers are supported by the Department of Agriculture (DA): e.g., free supply of seedlings, purchase of agricultural equipments by installment payment, and assistance for garment sewing projects and so on. The DAR has also deployed extension agents responsible for promoting village development. As a result, some associations of the local inhabitants have been established.
In view of these realities, the DENR should also support the existing communities (e.g., nursery development, technical assistance, etc.) in cooperation with relevant agencies to achieve its watershed conservation.

4. Procedures for Implementing Social Forestry

To a certain degree, implementation of the previous social forestry program was driven by external rather than internal forces. That is, the program was in response to a national policy based on social needs, but not derived from living customs of the local people. Accordingly, any social forestry program must meet social needs as well as local needs. It is also a matter of course that the program must be positively accepted by the local inhabitants.

Prior to the implementation of the program envisioned in this plan, it is essential to take a sufficient lead time for full communication and discussion with the local inhabitants. In any case, this program must be implemented by mutual agreement. The program must effectively reflect their needs. For this purpose, this program would be phased in as follows:

Phase I Preparation of a Specific Action Plan

- Understand the needs of the local people
- Discussions with them
- Determine the contents of the social forestry program.

Phase II Establishment of an Implementation System

- Improve social infrastructure
- Organize communities
- Delineate boundaries
- Issue tenure documents
- Establish demonstration farms
- Select and train persons in charge of extension
- Consider promotion measures for selling agricultural and forest products.

Phase III Implementation of this Program

- Start individual management
- Establish community forests
- Carry out technical extension activities.

Phase IV Sustainable Management

- Carry out technical extension activities
- Promote community-based sustainable management.

VI. Guidelines on Developing the Private Area

The Marikina watershed is largely divided into the area under the jurisdiction of the government or its agencies (83% of the total) and the private area (17%). Watershed management cannot produce satisfactory results unless both these areas are harmoniously managed. Privately-owned land must be properly managed along with state-managed land in order to conserve the whole of the Marikina watershed. The private lands are located in the uppermost reaches of the Boso Boso, and their orderly management is a key to success in conserving the watershed. Therefore, privately-owned land must be properly administered and managed with respect to forest and agricultural development and water and soil conservation.

1. Forest Management

As already mentioned, the Marikina watershed consists of state-owned land (including that managed by government agencies and MWSS) and privately-owned land. It is assumed that the forests in the former will be properly maintained and managed under the forest management plan described in Chapter IV. On the other hand, the forests in the latter are beyond the government's authority to manage. Nevertheless, they constitute an important part of the Marikina watershed and occupy an area of about 1,800 ha or 11% of the watershed.

Presumably, the owners of private land have an obligati to the rest of society to contribute to watershed conservation. From this point of view, it is necessary to ask them to cooperate with the government for proper forest management. However, the government has not yet established any compensation system for limiting their property rights in order to attain public aims such as watershed conservation. More over, neither can it currently impose legal restrictions on their rights. Therefore, approaches must be found to seek their cooperation based on their social responsibility and enlightenend self-interest.

Thus, it is strongly recommended that the following policies should be considered to give proper guidance to private land owners:

1) The residual natural forests will be conserved as protected forests and their felling will, in principle, be prohibited. If some part must be felled for valid reasons, selective cutting should be adopted.
2) In the case of plantations and shrubs, small-area cutting should be promoted as recommended in the plan for state-owned forests.
3) Logged-over areas should be immediately reforested.
4) In the case of unused grassland, active forestation will be promoted by the government through attractive incentives (e.g., the supply of low-cost seedlings or the free distribution of seedlings)
5) When trees are felled, this should be reported to the CENRO for its guidance.
6) The CENRO would provide technical guidance in cutting and forestation.

2. Agricultural Development

Agricultural development in the government-managed area would be carried out through individual management under the ISF program. On the Marikina watershed, however, such development must comply with the principle of water and soil conservation. Therefore, the expansion of agricultural land should be fixed at the current level in both the government-managed and private areas. Improvements in productivity should rely on an increase in earnings per unit area.

The agricultural production area in the watershed may be classified by crop into three districts, rice-growing land, land where fruit trees are cultivated, and vegetable growing areas.

The management of rice production utilizing appropriate technology is important to sustainable agricultural management in flat areas, and will help bring about self-sufficiency in rice.

To improve rice productivity, the following initiatives should be effective:

1) Selecting Suitable Varieties

Vinernal, which is the prevailing variety of rice cultivated in the fields, is tasty and fetches a high price. For paddy rice, however, mostly old varieties are used except in some cases where R110 is used. It is recommended that suitable varieties be selected to achieve better harvests.

2) Increasing the Use of Fertilizers

Rice harvests are closely linked to the amount of fertilization. The amount required is determined by the conditions of soil and irrigation. However, it is generally effective to increase the use of compost, fowl droppings, pig dung, and chemical fertilizers. Fowl droppings are relatively easy to obtain and suitable for rainwater paddies. The people concerned should increase their use of such organic, natural fertilizers.

3) Improving Irrigation

The National Irrigation Administration (NIA) is reportedly drawing up a plan for improving irrigation within the watershed. Although a large-scale irrigation program is important, an increase in small-scale irrigation facilities such as small reservoirs and dams collaboratively constructed by farmers, is a higher priority.

It is expected that fruit cultivation will continue to increase. The continuous development of fruit orchards will require support from the government and cooperation with agribusinesses entities. For this purpose, there is a strong need to support and strengthen the activities of cooperative associations to promote fruit cultivation, including seedling production, production management, collection of harvests transportation and sales.

The Marikina watershed has favorable geographical conditions to become a vegetable supply area for Manila. Accordingly, vegetable production in the watershed is very promising. It would be advisable to promote the production of highly profitable vegetables, such as beans, including kidney bean and 3R cowpea, bitter gourd and pumpkin. These vegetables can be cultivated as secondary crops in rainfed paddies, as a component of agroforestry on the slopes or as cash crops in orchards. An

important requirement for success in vegetable production is irrigation during the dry season. Efforts should be made to ensure adequate water supplies by tapping rivers, springs and underground water. Since the availability of fertilizers is also an important factor, it is a great advantage of the watershed that fowl droppings can be obtained in the neighborhood. Lessons emerging from application of the Kabsaka technology on Panay Island are instructive and could be applied at Marikina.

3. Water and Soil Conservation

Privately-owned land in the Marikina watershed accounts for 17% (4,846 ha) of the total area. It is located in the uppermost reaches of the Boso Boso. Privately-owned land accounts for 61% of the watershed area that empties into the Boso-boso river. This land is geographically very important to water and soil conservation. It is extensively used, and the existing natural forests account for no more than 6% of the land area (35% in the case of state-owned lands). Whereas cultivated land is extensive, the unattended grassland accounts for 30% of the total area. As noted in the (the Master Plan for Forestry Development (June, 1990), water and soil conservation is a problem which cannot be limited only to forest areas.

When using land, various matters should be considered in respect of water and soil conservation. For example, it is important to avoid making any radical change in the natural features of a slope. When a structure is built on the slope, supportive posts should be erected and cutting or filling the slope should be avoided as far as possible. In the cultivated land areas, ridges should be formed along contours. This is in order to make rainwater flow slowly over the ground and increase the rate of infiltration. Hillside water sources must be carefully protected. If possible, every hillside water source should be covered with trees and agricultural use practice should be avoided.

It is also important to avoid changing the direction of a streams. The streams in the Marikina watershed are characteristically meandering, and therefore have a great water-storing effect. When using an sedimentary area on the stream, it should be done with the assumption that the area may be submerged. The direction of the stream should not be altered. If water is used or discharged through a waterway in the plain, it is preferable to make the waterway as wide and shallow as possible. If

possible, it would be advisable to construct small impoundments to store water in the course. This would prevent water from flowing quickly and facilitate infiltration.

The Marikina watershed is accessible and has many gentle slopes. Consequently, agricultural development is expected to expand. Proper land management is necessary to upgrade land-use together for development as well as land that has already been developed.

However, the management of privately-owned land must depend on voluntary cooperation or administrative guidance with the intention of conserving the soil, water and environment of the watershed. From this point of view, it is necessary to consider the following measures, and begin with those that are feasible:

1) For new land development (other than forest and agricultural development), a pre-report system will be established to give guidance at need.
2) For new land development, the developer should be required to forest a certain area.
3) The land-use system envisioned for the social forestry program could be applied to private land under cultivation and to future agricultural development in close association with relevant departments.
4) Studies should be conducted on the extent to which industrial drainage can be qualitatively regulated looking forward to the future when the water resources of the Marikina watershed will be used to supply drinking water to Metro Manila.

VII. Systematic Implementation of the Watershed Management and Development Plan

As previously stated, the watershed management and development plan comprises the forest management plan, the social forestry program, guidance to privately-land areas, and the general management and promotion of all three. It may be possible to perform these assignments through the CENRO. However, given personnel and resource constraints, and the lack of sufficient flexibility, this approach may suffer from communication gaps and inability to respond to the needs of different sections. Furthermore, because many different agencies are already operating in the watershed, specific responsibilities are not clear.

Therefore, it is recommended that other administrative arrangements should be explored in order to carry out all the assignments in an integrated way, appointing a person responsible for general administration, establishing cooperative relations with other departments, and coordinating relevant matters with concerned sectors. Development and management of the watershed may have to be treated as a semi-autonomous project. To coordinate among all governments and private sector stockholders it may be necessary to establish a multi-sector Steering Committee that would establish overall policy guidelines.

VIII. Problems on the Current Development Plan

Proposed construction of the Kaliwa dam creates a special problem as noted in Part I, Chapter II, Section 3. A proposed 4,424 ha resettlement site for people who will be displaced by the dam is located in the Marikina watershed. However, people have been settled on the site for a long time, and about 1,900 people now live there. The area surrounding the village has been transformed into cultivated land or grassland. The proposed site is located in the upper reaches of the Tayabasan, where an improvement in the ratio of forests cover is desired for watershed conservation. It is intended that social forestry activities would be implemented in collaboration with the present inhabitants to enhance water and soil conservation. Bringing more settlers to this site would not be prudent in view of the need to conserve the entire watershed. If inhabitants increase, virgin forests in the neighborhood will face a higher risk of destruction.

Moreover the proposed site for resettlement has no room to welcome more inhabitants, and an alternative site should be considered.

Another important matter to consider is the Montalban Dam Project which is designed to supply water in the future to the northeastern part of Manila. While it is doubtful that a new dam would be constructed, rehabilitation of the aqueduct of the Wawa dam seems probable given the increasing demand for water and hydro power. Forests capable to provide more water cannot be created overnight. Consequently, development of the forest should be completed even prior to rehabilitation of the Wawa facilities. Without sufficient forest, there would be no assurance of an adequate supply of water or the ability to prevent soil erosion. These factors would reduce the efficiency and financial viability of any new investment in water distribution facilities. It is already apparent that the forests in the Marikina watershed have been significantly degraded. The plan proposed herein is important not only in terms of watershed conservation but also as a step towards possible utilization of the Wawa dam in the future.

Finally, there is the issue of NIPAS and private land. The watershed is subject to the provisions of NIPAS and should be perceived as a ecosystem including privately-owned land cover which NIPAS has no control. The conservation of water resources will be ineffective unless it also covers privately-owned land in the upper reaches of the Boso

Boso. In this sense, administrative guidance may be needed to require proper land management and proper drainage control on privately-owned land. Prior to the enforcement of the NIPAS, it will probably be necessary to consider what can be done through administrative guidance or legal regulation.

PART III FEASIBILITY STUDY

I. Coverage of the Feasibility Study

1. Programs Covered

Numerous activities are envisioned for implementation under the proposed master plan for the Marikina watershed. Depending on where these activities would be carried out, they can be divided into two general categories: a forest management program for higher elevations and steep slopes, and a social forestry program for the middle and lower elevations where the topography is more gentle. Studies were conducted to assess the feasibility of proposed activities in each program.

a. Forest Management Program

The proposed forest management program would cover approximately 18,168 ha comprised of land that already contains forests, plus grasslands and shrublands that would be converted into forests. The program would fall into two sub-categories: production forests to provide both direct financial benefits and environmental benefits, and protection forests for the sole purpose of providing environmental benefits. In the former low-intensity harvests are envisioned whereas in the latter harvesting would be prohibited. Studies were conducted to estimate the cost-benefit ratio of proposed investments and anticipated benefits. The studies examined the entire range of proposed activities including seedling production, planting, maintenance, improvement of forest roads, construction of footpath, water and soil conservation, forest fire prevention and so forth. It is envisioned that government would finance most of the forest management activities proposed in the master plan.

b. Social Forestry Program

The social forestry program proposed newly in the master plan will cover an area of 3,965 ha. These areas will be managed by dividing them into community forests and individually-managed land (managed by individual inhabitants like agroforestry).

This program will be carried out at the cost of both the government and the inhabitants who will participate in this program. The government will bear the minimum cost of the program. Other costs will be borne by inhabitants. Thus, the social forestry program will be collaboratively carried out by the government and the inhabitants.

2. Outline of the Feasibility Study

The feasibility study will involve:

① Financial and economic analyses of the forest management and social forestry programs; and

② Environmental assessment of proposed activities included in each of the aforementioned program.

3. Basic Assumptions

The following assumptions were used in carrying out the study.

(1) Duration of the Programs

The programs would be commenced in January, 1995 and continue for the forty (40) years at which time plantations of medium- and slow-growing species established under the program would mature and initial harvests would be carried out.

(2) Activities

Both the forest management and social forestry programs would include seedling production, planting and replanting, construction of footpaths, road improvement, installation of facilities (e.g. household water supply systems), harvesting, protection and maintenance.

(3) Allocation of Activities

The allocation at the work under the forest management program is based on the following assumptions:

i. Forestation of all grassland and shrub areas would be completed in twenty (20) years. Annual targets are properly adjusted in order to continue forestation activities for forty (40) years.

ii. Nurseries would be established in the first year of implementation. Forest road improvement would be completed during the first three (3) years. Construction of footpaths would proceed at the same rate as forestation. In other words, trail construction would be implemented concurrent with forestation targeted for a given year.

iii. Lookout tower and other facilities would be constructed in the initial year.

The allocation of the work under the social forestry program is based on the following assumptions:

i. Delineation surveys, issuance of the respective tenure security certificates, and identification of areas for individual and communal management (i.e. zoning) would commence in Year 1 and be completed in Year 5.

ii. Agroforestry (i.e. development of individually-managed lands) would commence in Year 2 and gradually be expanded to cover the entire area under individual management in eight (8) years.

iii. Development of community forests would commence in Year 1 and be completed in five (5) years. The first year of implementation would consist primarily of assisted natural regeneration treatments (ANR) and nursery activities. The annual work would be equally allocated every year.

II. Cost Calculation

1. Forest Management Program

(1) Forestation Costs

Forestation costs were calculated by taking into account the species to be planted, the number of hectares and trees planted, maintenance requirements that would be applied based on prevailing site-specific conditions and the treatments required to achieve different objectives (e.g. protection or production). These variables are identified on the following table.

Item	Dipterocarp. Residual Reserve Improvement Area	Selective Harvest Area (excluding Shrub I)	Shifting Harvest Areas I & II (including Shrub I)	Selective & Shifting Harvest Areas I & II Firebreak
Plantation Area	63 ha (enrichment)	1,492 ha	4,271 ha	206 ha
Cutting Age	No cutting	Fast-growing spp. 20 years Medium & slow spp. 40 years		Unspecified
Planted Species	Dipterocarp. Medium & slow growing spp.	Fast-growing species Medium & slow growing spp. Dipterocarp. (underplanting)	Fast-growing species Medium & slow growing spp.	Fast-growing species
Land Preparation	Line weeding	Line weeding	Line weeding	Overall weeding
Planting Density	2 x 2 Under-tree planting in the 20th and following years: 2 x 4	2 x 2	Fast-growing stands (incl. Shrub I) 2x3 Medium & slow 4 x 4 Mixed fast 2 x 4	1 x 1
Ratio	Mixture	50% mixture	Fast: c. 2/3 Mixed medium & slow with fast: c. 1/3	Fast spp. 100 %
Weeding	Spot weeding 2nd year: 1 3rd year: 1	Spot weeding 1st year: 2 2nd year: 2 3rd year: 2	Spot weeding 1st year: 2 2nd year: 2 3rd year: 2	N/A
Supplementary Planting	20 %			
Climber-cutting Liberation	Once every required stand			

Annual expenses for forestation are estimated as Table II-1.

Table II-1 Plantation Costs by Year

(Area: ha, Amount: 1,000 Pesos)

Year	Selective Harvest Area						Shifting Harvest Areas I & II (mixture)						Shifting Harvest Areas I & II (fast-growing sp.)					
	1st Year		2nd Year		3rd Year		1st Year		2nd Year		3rd Year		1st Year		2nd Year		3rd Year	
	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount
		(16,988)		(6,924)		(3,724)		(13,371)		(5,983)		(2,835)		(12,070)		(5,663)		(2,535)
1	91	1,546					61	816					156	1,883				
2	91	1,546	91	630			61	816	61	365			156	1,883	156	883		
3	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
4	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
5	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
6	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
7	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
8	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
9	91	1,546	91	630	91	339	61	816	61	365	61	173	156	1,883	156	883	156	395
10	43	730	91	630	91	339	78	1,043	61	365	61	173	188	2,269	156	883	156	395
11	86	1,461	43	298	91	339	59	789	78	467	61	173	148	1,786	188	1,065	156	395
12	86	1,461	86	595	43	160	59	789	59	353	78	221	148	1,786	148	838	188	477
13	86	1,461	86	595	86	320	55	735	59	353	59	167	142	1,714	148	838	148	375
14	83	1,410	86	595	86	320	57	762	55	329	59	167	144	1,738	142	804	148	375
15	0	0	83	575	86	320	84	1,123	57	341	55	156	180	2,173	144	815	142	360
16	80	1,359	0	0	83	309	50	669	84	503	57	162	135	1,629	180	1,019	144	365
17	67	1,138	80	554	0	0	42	562	50	299	84	238	137	1,654	135	765	180	456
18	60	1,019	67	464	80	298	45	602	42	251	50	142	121	1,460	137	776	135	342
19	82	1,393	60	415	67	250	23	308	45	269	42	119	103	1,243	121	685	137	347
20	0	(10,187)	82	568	60	223	55	735	23	138	45	128	153	1,847	103	583	121	307
21	91	927	0	(5,081)	82	305	0	0	55	329	23	65	119	1,436	153	866	103	261
22	91	927	91	462	0	(1,852)	6	80	0	0	55	156	106	1,279	119	674	153	388
23	91	927	91	462	91	169	5	67	6	36	0	0	112	1,352	106	600	119	302
24	91	927	91	462	91	169			5	30	6	17	129	1,557	112	634	106	269
25	91	927	91	462	91	169					5	14	149	1,798	129	731	112	284
26	91	927	91	462	91	169							167	2,016	149	844	129	327
27	91	927	91	462	91	169							169	2,040	167	946	149	378
28	91	927	91	462	91	169							169	2,040	169	957	167	423
29	91	927	91	462	91	169							171	2,064	169	957	169	428
30	43	438	91	462	91	169							220	2,655	171	968	169	428
31	86	876	43	218	91	169							152	1,835	220	1,246	171	433
32	86	876	86	437	43	80							149	1,798	152	861	220	558
33	86	876	86	437	86	159							149	1,798	149	844	152	385
34	83	846	86	437	86	159							153	1,847	149	844	149	378
35	60	611	83	422	86	159							163	1,967	153	866	149	378
36	67	683	60	305	83	154							150	1,811	163	923	153	388
37	80	815	67	340	60	111							131	1,581	150	849	163	413
38	82	835	80	406	67	124							136	1,642	131	742	150	380
39	0	0	82	417	80	148							237	2,861	136	770	131	332
40	91	927	0	0	82	152	61	816					166	2,004	237	1,342	136	345

(Continued)

Year	Firebreak						Dipterocarp. Residual Forest								Total Cost
	1st Year		2nd Year		3rd Year		1st Year		2nd Year		3rd Year		Liberation & Refining		
	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	Area	Amount	
		(33,468)		(4,050)		(167)		(13,810)		(3,366)		(167)		(510)	4,647
1	12	402													6,574
2	12	402	12	49											7,483
3	12	402	12	49	12	2									7,483
4	12	402	12	49	12	2									7,483
5	12	402	12	49	12	2									7,483
6	12	402	12	49	12	2									7,483
7	12	402	12	49	12	2									7,483
8	12	402	12	49	12	2									7,483
9	12	402	12	49	12	2									7,483
10	11	368	12	49	12	2									7,246
11	10	335	11	45	12	2	7	97					45	23	7,274
12	10	335	10	41	11	2	7	97	7	24			45	23	7,201
13	10	335	10	41	10	2	7	97	7	24	7	1	45	23	7,080
14	10	335	10	41	10	2	6	83	7	24	7	1	45	23	7,009
15	10	335	10	41	10	2	6	83	6	20	7	1	45	23	6,368
16	9	301	10	41	10	2	6	83	6	20	6	1	45	23	6,486
17	8	268	9	36	10	2	6	83	6	20	6	1	45	23	6,099
18	8	268	8	32	9	2	6	83	6	20	6	1	45	23	5,782
19	6	201	8	32	8	1	6	83	6	20	6	1	46	23	5,390
20	6	201	6	24	8	1	6	83	6	20	6	1	46	23	4,882
21			6	24	6	1			6	20	6	1			4,235
22					6	1					6	1			3,968
23															3,915
24															4,065
25															4,385
26															4,745
27															4,922
28															4,978
29															5,007
30															5,120
31															4,777
32															4,610
33															4,499
34															4,510
35															4,403
36															4,264
37															4,109
38															4,129
39															4,528
40															5,585

Note: Figures in parenthesis show unit cost (pesos) per ha derived from Annex II-1 in Part III.
Liberation & Refining would be implemented in 452 ha of forests with crown density of 41% or more.
Plantation schedule is based on Annex IV-2 in Part II. Planting after Year 21 in Selective Harvest Area is underplanting.

(2) Felling and Hauling Costs

Timber from production forest areas would be harvested to produce sawlogs and fuelwood for local use or sale. These products would be hauled from the plantations via footpaths to the forest roads. These operations would be performed manually. Felling and hauling costs by year are estimated as Table II-2.

Table II-2 Felling and Hauling Costs by Year

(1,000 pesos)

Year	Felling & Hauling Costs				
	Sawlog		Fuelwood		Total
	V (m^3)	Cost	V (m^3)	Cost	Cost
5	3,886	3,874	5,830	2,116	5,990
10	7,059	7,038	8,819	3,201	10,239
15	12,169	12,132	15,565	5,650	17,782
20	10,097	10,067	12,145	4,409	14,476
21	8,340	8,315	12,509	4,541	12,856
22	7.490	7,468	11,234	4,078	11,546
23	7,732	7,709	11,602	4,212	11,921
24	8,906	8,879	11,599	4,210	13,089
25	7,490	7,468	13,360	4,850	12,318
26	8,299	8,274	12,449	4,519	12,793
27	10,526	10,494	15,789	5,731	16,225
28	10,526	10,494	15,789	5,731	16,225
29	10,607	10,575	15,910	5,775	16,350
30	10,647	10,615	15,971	5,797	16,412
31	9,635	9,606	14,453	5,246	14,852
32	9,514	9,485	14,270	5,180	14,665
33	9,514	9,485	14,270	5,180	14,665
34	9,554	9,525	14,332	5,203	14,728
35	9,028	9,001	13,541	4,915	13,916
36	8,785	8,759	13,178	4,784	13,543
37	8,542	8,516	12,813	4,651	13,167
38	8,826	8,800	13,283	4,822	13,622
39	9,595	9,566	14,392	5,224	14,790
40	21,670	21,605	15,546	5,643	27,248

Note: Changes in harvest were derived from Annex IV-2 in Part II.
The volumes of sawlog and fuelwood were derived from Annex IV-1 in Part II.
The unit costs of felling and hauling were derived from Annex II-2 in Part III.
(Sawlog: 997 p/m^3, Fuelwood: 363 p/m^3)

(3) Construction/Improvement and Maintenance Costs of Forest Roads and Footpaths

Costs of forest roads and footpaths are estimated as Table II-3.

Table II-3 Construction and Improvement Costs of Forest Roads and Footpaths

(Length in km; Cost in 1,000 Pesos)

Year	Forest Road Improvement	Forest Road Maintenance		Footpaths Construction		Footpaths Maintenance		Total Cost
	Cost	Length	Cost	Length	Cost	Length	Cost	
1	2,214	21.6	15	15.4	86			2,315
2	1,933	21.6	15	15.4	86	15.4	4	2,038
3	1,933	21.6	15	15.4	86	30.8	8	2,042
4		21.6	15	15.4	86	46.2	11	112
5		21.6	15	15.4	86	61.6	15	116
6		21.6	15	15.4	86	77.0	19	120
7		21.6	15	15.4	86	92.4	23	124
8		21.6	15	15.4	86	107.8	26	127
9		21.6	15	15.4	86	123.2	30	131
10		21.6	15	15.4	86	138.6	34	135
11		21.6	15	15.0	84	154.0	38	137
12		21.6	15	15.0	84	169.0	41	140
13		21.6	15	14.5	81	184.0	45	141
14		21.6	15	14.5	81	198.5	49	145
15		21.6	15	13.5	76	213.0	52	143
16		21.6	15	13.5	76	226.5	55	146
17		21.6	15	12.5	70	240.0	59	144
18		21.6	15	11.5	64	252.5	62	141
19		21.6	15	10.7	60	264.0	65	140
20		21.6	15	10.7	60	274.7	67	142
21		21.6	15			285.4	70	85
22		21.6	15			285.4	70	85
23		21.6	15			285.4	70	85
24		21.6	15			285.4	70	85
25		21.6	15			285.4	70	85
26		21.6	15			285.4	70	85
27		21.6	15			285.4	70	85
28		21.6	15			285.4	70	85
29		21.6	15			285.4	70	85
30		21.6	15			285.4	70	85
31		21.6	15			285.4	70	85
32		21.6	15			285.4	70	85
33		21.6	15			285.4	70	85
34		21.6	15			285.4	70	85
35		21.6	15			285.4	70	85
36		21.6	15			285.4	70	85
37		21.6	15			285.4	70	85
38		21.6	15			285.4	70	85
39		21.6	15			285.4	70	85
40		21.6	15			285.4	70	85

Note: The unit costs of construction were derived from Annex II-3 and II-4 in Part III.
(Forest road maintenance: 673 p/km, Footpaths construction: 5,605 p/km, Footpaths maintenance: 245 p/km)

(4) Construction Costs of Small Impoundments

Item	Number	Cost(p)	Remarks
Small Impoundment Construction	14	78,400	in the first year

Note: The unit cost was derived from Annex II-5 in Part III.

(5) Costs for Nursery Facilities and Forest Fire Prevention

a. Costs of Facilities and Equipment

Item	Quantity	Cost(p)	Remarks
Potting House	11	137,500	To be constructed in the first year. (Other costs are included in seedling cost.)
Lookout Tower	6	60,912	To be constructed in the first year.
Fire-fighting Equipment	16 sets	68,000	To be provided in the first year.
Radio System	7	68,200	To be provided in the first year.
Total		334,612	

Note: The unit costs were derived from Annex II-6 in Part III.

b. Costs for Forest Patrol System

Forest watchers would conduct periodic patrols to observe the forests in specified districts every year and report the growth the forests, disease and insect damage, and illegal cutting to the PENRO. The cost for this scheme is as follows:

Item	Number	Cost(p)	Remarks
Watchman	6	30,000	Annual renewal of contract. Required every year.

2. Social Forestry Program

Costs were estimated as follows.

(1) Delineation Boundary and Issuance of Tenure Document

Item	Total	1st Yr.	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.
Work Area (ha)	3,956	800	800	800	800	765
Cost (pesos)	5,798	1,170	1,170	1,170	1,170	1,118
Cost allocation	All the costs will be borne by Government					

Note: Work area is based on Table V-2 in Part II.
Unit cost (1,462 P/ha) was derived from Annex II-8 in Part III.

(2) Infrastructure

Item	Total	1st Yr.	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.
Footpath Construction						
Length (km)	119 ((44,188))	10	30	30	30	19
Cost (1000 pesos)	5,259	442	1,326	1,326	1,326	839
Potable Water Facilities						
· Artesian wells (number)	27 ((28,000))	6	12	9		
Cost (1000 pesos)	756	168	336	252		
· Small water tanks (number)	16 ((55,499))	4	8	4		
Cost (1000 pesos)	888	222	444	222		
Drains						
Length (m)	801 ((113))		150	210	210	231
Cost (1000 pesos)	91		17	24	24	26
Small-scale Nursery						
Number	8 ((15,812))	2	2	2	2	
Cost (1000 pesos)	128	32	32	32	32	
Multi-purpose Hall						
Number	7 ((56,000))			7		
Cost (1000 pesos)	392			392		
Total Cost (1000 pesos)	7,514	864	2,155	2,248	1,382	865
Cost allocation	All: Government					

Note: (( )) are unit costs which were derived from Annex II-9 in Part III.

(3) Technical Extension Activities

Item	Total	1st Year	2nd Year	3rd Year
Demonstration Farm				
Number	8		4	4
Cost (1000 pesos)	38		19	19
Cost allocation	All: Government			

Note: Unit cost (4,776 pesos) was derived from Annex II-9 in Part III.

(4) Agroforestry (individually-managed lands)

Agroforestry activities would be carried out in collaboration with inhabitants who are willing to adopt the improved land use methods promoted by the program. Operations would include seedling production, land preparation, planting, supplementary planting, maintenance and management (including harvesting). On the average one third of each individually-managed agroforestry area would be used to grow annual crops (e.g. grains/vegetables) and the remaining two thirds would be used as tree farms.

Planted species and the number of planted trees per ha in the agroforestry areas would (on the average) be as follows:

Mango	10	Bamboo	20
Jackfruit	20	Fuelwood species	200
Tamarind	10	Hedgerow species	5,000
Citrus	50	Covercrops	400

Cost estimates for development of the entire agroforestry areas are indicated on Table II-4.

Table II-4 Agroforestry Costs by Year

(Thousand Pesos)

Item	Cost per ha	Area Cost	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Seedling Production		ha	150	200	300	350	400	400	400	472									
1st Year	1,828	Cost	274	366	548	640	731	731	731	863									
2nd Year	1,786	ha		150	200	300	350	400	400	400	472								
		Cost		268	357	536	625	714	714	714	843								
3rd year	323	ha			150	200	300	350	400	400	400	472							
		Cost			48	65	97	113	129	129	129	152							
Subtotal			274	634	954	1,240	1,453	1,559	1,575	1,706	972	152							
2. Site Preparation		ha		150	200	300	350	400	400	400	472								
2nd Year	3,920	Cost		588	784	1,176	1,372	1,568	1,568	1,568	1,850								
3. Planting		ha		150	200	300	350	400	400	400	472								
2nd Year	2,044	Cost		307	409	613	715	818	818	818	965								
4. Replanting		ha			150	200	300	350	400	400	400	472							
3rd Year	332	Cost			50	66	100	116	133	133	133	157							
5. Maintenance & Management		ha		150	200	300	350	400	400	400	472								
2nd Year	9,445	Cost		1,417	1,889	2,834	3,306	3,778	3,778	3,778	4,458								
		ha			150	200	300	350	400	400	400	472							
3rd Year	8,486	Cost			1,273	1,697	2,546	2,970	3,394	3,394	3,394	4,005							
4th Year	8,129	ha				150	200	300	350	400	400	400	472						
		Cost				1,219	1,626	2,439	2,845	3,252	3,252	3,252	3,837						
5th Year	7,997	ha					150	200	300	350	400	400	400	472					
		Cost					1,200	1,599	2,399	2,799	3,199	3,199	3,199	3,775					
6th Year	7,966	ha						150	200	300	350	400	400	400	472				
		Cost						1,195	1,593	2,390	2,788	3,186	3,186	3,186	3,760				
7th Year	7,966	ha							150	200	300	350	400	400	400	472			
		Cost							1,195	1,593	2,390	2,788	3,186	3,186	3,186	3,760			
8th Year	7,905	ha								150	200	300	350	400	400	400	472		
		Cost								1,186	1,581	2,372	2,767	3,162	3,162	3,162	3,731		
9th Year	7,905	ha									150	200	300	350	400	400	400	472	
		Cost									1,186	1,581	2,372	2,767	3,162	3,162	3,162	3,731	
10th & Following Years	7,905	ha										150	350	650	1,000	1,400	1,800	2,200	2,672
		Cost										1,186	2,767	5,138	7,905	11,067	14,229	17,391	21,112
Subtotal				1,417	3,162	5,750	8,677	11,981	15,205	18,392	22,247	21,569	21,313	21,214	21,175	21,151	21,122	21,122	21,122
Total			274	2,945	5,359	8,846	12,317	16,042	19,298	22,617	26,167	21,878	21,313	21,214	21,175	21,151	21,122	21,122	21,122
Cost allocation		Government	130	271	398	509	590	626	628	690	328	23							
		Inhabitant	144	2,674	4,960	8,337	11,727	15,417	18,670	21,926	25,839	21,854	21,313	21,214	21,175	21,151	21,122	21,122	21,122

Note: The costs of maintenance, management and harvesting will remain unchanged from the 17th year until the 40th year.
Accordingly, the figure of 21,122 (thousand pesos) in the row under "total" will also be unchanged until the 40th year.
Unit Costs were derived from Annex II-10 in Part III.

(5) Community Forest

a. Plantation establishment

Approximately 348 ha would be in the sub-category of "newly-forested" land. These areas are presently dominated by grass and brush, with a few scattered trees. Assisted Natural Regeneration (ANR) treatments would be applied in the first two (2) years, consisting of grass lodging and ringweeding to liberate suppressed pioneer trees and seedlings, thus expediting their growth. Subsequently, enrichment planting would be implemented to fill vacant spots. At full establishment, these forests would consist of mature natural regeneration and planted seedlings.

(a) Initial ANR work (grass lodging/liberation)

The estimated initial expenses of ANR are summarized in the following tables.

Item	Total	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.
ANR					
1st Year					
Area (km)	348 ((2,404))	100	120	128	
Cost (1000 pesos)	836	240	288	308	
2nd Year					
Area (km)	348 ((2,142))		100	120	128
Cost (1000 pesos)	745		214	257	274
Total Cost	1,581	240	502	565	274
Cost allocation					
Government	56	16	19	21	
Inhabitants	1,525	224	483	544	274

Note: (( )) are unit costs which were derived from Annex II-11 in Part III.

(b) Firebreak Construction

In addition to initial ANR work, firebreaks will be constructed at a rate of 140 m per ha (10 m wide). Firebreaks construction would start in the second year of the program and be completed in four years. Costs are estimated as follows:

Item	Total	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.	6th Yr.	7th & Sub.Yr.
Firebreak Construction							
Length (km)	181 ((10,200))	28	42	56	55		
Cost (1000 pesos)	1,486	286	428	571	561		every year
Maintenance/Management							
Length (km)	- ((4,080))		28	70	126	181	181
Cost (1000 pesos)	-		114	286	514	738	738
Total Cost(1000 pesos)	-	286	542	857	1,075	738	738
Cost allocation	All: Inhabitats						

Note: (( )) are unit costs which were derived from Annex II-11 in Part III.

(c) Seedling Production

Seedling production for the 348 ha of "newly-forested" areas would begin in Year 4 and be completed in 3 years, with costs as follows:

Item	Total	4th Year	5th Year	6th Year
Seedling Production				
Number	146,160	42,000	50,400	58,760
Cost (1000 pesos)	431	124	149	158
Cost allocation	All: Inhabitants			

Note: Unit cost (2.95 P/sdlg) was derived from Annex II-11 in Part III.

(d) Planting

After the initial two-years of ANR treatments, enrichment planting would be implemented (as needed) at an estimated average rate of 340 pieces per ha. In the existing plantations, on the other hand, underplanting would be carried out after harvesting. In these areas, sawlog species would be planted at a rate of 150 pieces per ha.

These operations would cost as follows:

(New Planting)

Item	Total	4th Year	5th Year	6th Year
Planted Area (ha)	348	100	120	128
Cost (1000 pesos)	914	263	315	336
Cost allocation	All: Inhabitants			

Note: Cost (2,452 P/ha) was derived from Annex II-11 in Part III.

(Underplanting)

Item	3rd - 38th Year
Planted Area (ha)	220 every year
Cost (1000 pesos)	273 every year
Cost allocation	All: Inhabitants

Note: Cost (1,239 P/ha) was derived from Annex II-11 in Part III.

(e) Weeding

Weeding would be carried out for planted trees and liberated pioneer trees for three years after planting. Underplanting would also be subject to weeding for three years.

Weeding costs are estimated as follows:

(New Plantation)

Item	Total	4th Yr.	5th Yr.	6th Yr.	7th Yr.	8th Yr.
1st Year: Area (ha)	348	100	120	128		
Cost (1000 pesos)	596	171	206	219		
2nd Year: Area (ha)	348		100	120	128	
Cost (1000 pesos)	596		171	206	219	
3rd Year: Area (ha)	348			100	120	128
Cost (1000 pesos)	596			171	206	219
Total Cost (1000 pesos)	1,788	171	377	596	425	219
Cost allocation	All: Inhabit ants					

Note: Unit cost (1,713 P/ha) was derived from Annex II-11 in Part III.

(Underplanting)

Item	Total	3rd	4th	5th	6th-37th	38th	39th	40th
1st Year:								
Area (ha)	7,920	220	220	220	...	220		
Cost (1000 pesos)	3,060	85	85	85	...	85		
2nd Year:								
Area (ha)	7,920		220	220	...	220	220	
Cost (1000 pesos)	3,060		85	85	...	85	85	
3rd Year:								
Area (ha)	7,920			220	...	220	220	220
Cost (1000 pesos)	3,060			85	...	85	85	85
Total Cost	9,180	85	170	255	...	255	170	85
Cost allocation	All: Inhabitants							

Note: Unit cost (388 P/ha) was derived from Annex II-11 in Part III.

(f) Climber Cutting and Eradication

The cost is as follows:

Item	Total	8th Yr.	9th Yr.	10th Yr.	11th Yr.	12th Yr.	13th Yr.
5th Year:							
Area (ha)	348 ((408))	100	120	128			
Cost (1000 pesos)	142	41	49	52			
8th Year:							
Area (ha)	348 ((306))				100	120	128
Cost (1000 pesos)	106				30	37	39
Total Cost	248	41	49	52	30	37	39
Cost allocation	All: Ihabitants						

Note: Unit costs were derived from Annex II-11 in Part III.

(g) Total Cost

The total cost of the operations described in Subparagraphs (a) to (f) for plantation is summarized in Table II-5.

b. Felling and Hauling Costs

The felling and hauling costs of community forests are estimated as shown in Table II-6.

(6) Summary of Social Forestry Costs

The costs of the operations described in Paragraphs (1) to (5) are summarized in Table II-7.

3. Summary of Costs

The aggregated costs of the forest management and social forestry programs are summarized in Table II-8.

Table II-5 Summary of Community Forest Costs by Year

(Unit: 1,000 Pesos)

Year	Total			ANR		Firebreak	Seedling	Planting	Under-planting	Weeding		Climber Cutting/ Liberation
										Planting	Under-planting	
	Total	Government	Inhabitant	Government	Inhabitant	Inhabitant	Inhabitant	Inhabitant	Inhabitant	Inhabitant	Inhabitant	Inhabitant
1												
2	526	16	510	16	224	286						
3	1,402	19	1,383	19	483	542			273		85	
4	2,423	21	2,402	21	544	857	124	263	273	171	170	
5	2,718		2,718		274	1,075	149	315	273	377	255	
6	2,356		2,356			738	158	336	273	596	255	
7	1,691		1,691			738			273	425	255	
8	1,485		1,526			738			273	219	255	41
9	1,315		1,315			738			273		255	49
10	1,318		1,318			738			273		255	52
11	1,296		1,296			738			273		255	30
12	1,303		1,303			738			273		255	37
13	1,305		1,305			738			273		255	39
14	1,266		1,266			738			273		255	
15	1,266		1,266			738			273		255	
16	1,266		1,266			738			273		255	
17	1,266		1,266			738			273		255	
18	1,266		1,266			738			273		255	
19	1,266		1,266			738			273		255	
20	1,266		1,266			738			273		255	
21	1,266		1,266			738			273		255	
22	1,266		1,266			738			273		255	
23	1,266		1,266			738			273		255	
24	1,266		1,266			738			273		255	
25	1,266		1,266			738			273		255	
26	1,266		1,266			738			273		255	
27	1,266		1,266			738			273		255	
28	1,266		1,266			738			273		255	
29	1,266		1,266			738			273		255	
30	1,266		1,266			738			273		255	
31	1,266		1,266			738			273		255	
32	1,266		1,266			738			273		255	
33	1,266		1,266			738			273		255	
34	1,266		1,266			738			273		255	
35	1,266		1,266			738			273		255	
36	1,266		1,266			738			273		255	
37	1,266		1,266			738			273		255	
38	1,266		1,266			738			273		255	
39	908		908			738					170	
40	823		823			738					85	

Table II-6 Felling and Hauling Costs by Year (Community Forest)

(Unit: 1,000 Pesos)

Year	Total Cost	Fuelwood		Bamboo		Pole		Sawlog	
		Volume(m^3)	Cost	Volume(m^3)	Cost	Volume(m^3)	Cost	Volume(m^3)	Cost
1									
2	1,373	1,681	477			2,240	896		
3	1,340	1,627	462			2,195	878		
4	381	1,340	381						
5	410	1,445	410						
6	2,448	1,240	352			5,240	2,096		
7	2,538	1,545	439			5,247	2,099		
8	465	1,636	465						
9	507	1,785	507						
10	36			4,000	36				
11	3,848	500	142	12,800	115	5,031	2,012	2,240	1,579
12	3,860	600	170	26,720	240	4,757	1,903	2,195	1,547
13	543	749	213	36,640	330				
14	376			41,760	376				
15	470	330	94	41,760	376				
16	3,119	396	112	41,760	376	2,630	1,052	2,240	1,579
17	3,105	422	120	41,760	376	2,457	983	2,307	1,626
18	3,597			41,760	376	180	72	5,000	3,525
19	4,027	420	119	41,760	376	192	77	4,900	3,455
20	519	504	143	41,760	376				
21	864	538	153	41,760	376	325	130	291	205
22	456			41,760	376	200	80		
23	3,997			41,760	376	240	96	5,000	3,525
24	4,109			41,760	376	256	102	5,150	3,631
25	376			41,760	376				
26	4,254			41,760	376			5,500	3,878
27	4,593			41,760	376	250	100	5,840	4,117
28	1,335			41,760	376	300	120	1,190	839
29	910			41,760	376	320	128	576	406
30	376			41,760	376				
31	4,254			41,760	376			5,500	3,878
32	4,370			41,760	376			5,665	3,994
33	376			41,760	376				
34	729			41,760	376			500	353
35	799			41,760	376			600	423
36	1,331			41,760	376			1,355	955
37	376			41,760	376				
38	376			41,760	376				
39	376			41,760	376				
40	376			41,760	376				

Table II-7 Summary of Social Forestry Costs by Year

(Unit: 1,000 Pesos)

Year	Total			Demarcation	Infrastructure	Technical Extension	Agroforestry		Community Forest		
									Establishment		Felling/Hauling
	Total	Government	Inhabitant	Government	Government	Government	Government	Inhabitant	Government	Inhabitant	Inhabitant
1	2,308	2,164	144	1,170	864		130	144			
2	8,188	3,631	4,557	1,170	2,155	19	271	2,674	16	510	1,373
3	11,537	3,854	7,683	1,170	2,248	19	398	4,960	19	1,383	1,340
4	14,202	3,082	11,120	1,170	1,382		509	8,337	21	2,402	381
5	17,428	2,573	14,855	1,118	865		590	11,727		2,718	410
6	20,847	626	20,221				626	15,417		2,356	2,448
7	23,527	628	22,899				628	18,670		1,691	2,538
8	24,607	690	23,917				690	21,926		1,526	465
9	27,989	328	27,661				328	25,839		1,315	507
10	23,231	23	23,208				23	21,854		1,318	36
11	26,457		26,457					21,313		1,296	3,848
12	26,377		26,377					21,214		1,303	3,860
13	23,023		23,023					21,175		1,305	543
14	22,793		22,793					21,151		1,266	376
15	22,858		22,858					21,122		1,266	470
16	25,507		25,507					21,122		1,266	3,119
17	25,493		25,493					21,122		1,266	3,105
18	25,985		25,985					21,122		1,266	3,597
19	26,415		26,415					21,122		1,266	4,027
20	22,907		22,907					21,122		1,266	519
21	23,252		23,252					21,122		1,266	864
22	22,844		22,844					21,122		1,266	456
23	26,385		26,385					21,122		1,266	3,997
24	26,497		26,497					21,122		1,266	4,109
25	22,764		22,764					21,122		1,266	376
26	26,642		26,642					21,122		1,266	4,254
27	26,981		26,981					21,122		1,266	4,593
28	23,723		23,723					21,122		1,266	1,335
29	23,298		23,298					21,122		1,266	910
30	22,764		22,764					21,122		1,266	376
31	26,642		26,642					21,122		1,266	4,254
32	26,758		26,758					21,122		1,266	4,370
33	22,764		22,764					21,122		1,266	376
34	23,117		23,117					21,122		1,266	729
35	23,187		23,187					21,122		1,266	799
36	23,719		23,719					21,122		1,266	1,331
37	22,764		22,764					21,122		1,266	376
38	22,764		22,764					21,122		1,266	376
39	22,406		22,406					21,122		903	376
40	22,321		22,321					21,122		823	376

Table II-8 Summary of Costs by Year

(Thousand Pesos)

Year	Forest Management Plan	Social Forestry (at government cost)	Total	Social Forestry (at inhabitants' cost)	Total
1	7,405	2,164	9,569	144	9,713
2	8,642	3,631	12,273	4,557	16,830
3	9,555	3,854	13,409	7,683	21,092
4	7,625	3,082	10,707	11,120	21,827
5	13,619	2,573	16,192	14,855	31,047
6	7,633	626	8,259	20,221	28,480
7	7,637	628	8,265	22,899	31,164
8	7,640	690	8,330	23,917	32,247
9	7,644	328	7,972	27,661	35,633
10	17,650	23	17,673	23,208	40,881
11	7,441	0	7,441	26,457	33,898
12	7,371	0	7,371	26,377	33,748
13	7,251	0	7,251	23,023	30,274
14	7,184	0	7,184	22,793	29,977
15	24,323	0	24,323	22,858	47,181
16	6,662	0	6,662	25,507	32,169
17	6,273	0	6,273	25,493	31,766
18	5,953	0	5,953	25,985	31,938
19	5,560	0	5,560	26,415	31,975
20	19,530	0	19,530	22,907	42,437
21	17,206	0	17,206	23,252	40,458
22	15,629	0	15,629	22,844	38,473
23	15,951	0	15,951	26,385	42,336
24	17,269	0	17,269	26,497	43,766
25	16,818	0	16,818	22,764	39,582
26	17,653	0	17,653	26,642	44,295
27	21,262	0	21,262	26,981	48,243
28	21,318	0	21,318	23,723	45,041
29	21,472	0	21,472	23,298	44,770
30	21,647	0	21,647	22,764	44,411
31	19,744	0	19,744	26,642	46,386
32	19,390	0	19,390	26,758	46,148
33	19,279	0	19,279	22,764	42,043
34	19,353	0	19,353	23,117	42,470
35	18,434	0	18,434	23,187	41,621
36	17,922	0	17,922	23,719	41,641
37	17,391	0	17,391	22,764	40,155
38	17,866	0	17,866	22,764	40,630
39	19,433	0	19,433	22,406	41,839
40	32,948	0	32,948	22,321	55,269

III. Benefit Calculation

1. Forest Management Program

It is assumed that sawlogs and fuelwood would be sold at farmgate prices (i.e. roadside along the forest roads). The estimated volumes and farmgate selling prices are as follows:

Table III-1 Sales by Year: Forest Management

(thousand pesos)

Year	Sales by Year				
	Sawlog		Fuelwood		Total
	V (m^3)	Amount	V (m^3)	Amount	Amount
5	3,886	9,715	5,830	1,749	11,464
10	7,059	17,648	8,819	2,646	20,294
15	12,169	30,423	15,565	4,670	35,093
20	10,097	25,243	12,145	3,644	30,587
21	8,340	20,850	12,509	3,753	24,603
22	7,490	18,725	11,234	3,370	22,095
23	7,732	19,330	11,602	3,481	22,811
24	8,906	22,265	11,599	3,480	25,745
25	7,490	18,725	13,360	4,008	22,733
26	8,299	20,748	12,449	3,735	33,197
27	10,526	26,315	15,789	4,737	31,052
28	10,526	26,315	15,789	4,737	31,052
29	10,607	26,517	15,910	4,773	42,427
30	10,647	26,618	15,971	4,791	31,409
31	9,635	24,087	14,453	4,336	28,423
32	9,514	23,785	14,270	4,281	28,066
33	9,514	23,785	14,270	4,281	28,066
34	9,554	23,885	14,332	4,300	28,185
35	9,028	22,570	13,541	4,062	26,632
36	8,785	21,962	13,178	3,953	25,915
37	8,542	21,355	12,813	3,844	25,199
38	8,826	22,065	13,283	3,985	26,050
39	9,595	23,998	14,392	4,381	28,306
40	21,670	45,175	15,546	4,664	58,839

Note: Changes in harvest were derived from Annex IV-2 in Part II.
The volumes of sawlog and fuelwood were calculated according to Annex IV-1 in Part II.
The price of sawlog was derived from Annex III-1 in Part III.
[Sawlog: 2,500 p/m^3; Fuelwood: 300 P/m^3 (60 bundles/m^3 x 5p/bundle)]

2. Social Forestry Program

(1) Agroforestry

Agroforestry (i.e. individually-managed lands) income would be derived from the sales of fruits, firewood and various foodcrops (rootcrops, vegetables and grain crops). Estimated harvest volumes and schedules are based on conditions prevailing on the watershed as assessed during preparation of the master plan. This information was supplemented by interviews with local residents regarding their experiences and observations. Using this data, harvests are expected to commence as follows:

Mango, jackfruit, tamarind	7 years after planting
Citrus, firewood	3 years
Bamboo	4 years
Agricultural products	the same year as planting

Products from agroforestry would be sold at farmgate prices which have been determined by market surveys, and interviews with site residents and buyers who transact business at the proper site. Aggregated data of anticipated sales from the entire agroforestry area are indicated on Table III-2.

Table III-2 Sales by Year: Agroforestry

(Unit: 1,000 Pesos)

Year	Mango	Jackfruit	Tamarind	Citrus	Fuelwood	Bamboo	Rootcrops	Vegetables	Grain Crops	Total
1										0
2							450	375	84	909
3							1,050	1,063	225	2,338
4				225	150		2,175	2,250	459	5,259
5				638	350	90	3,525	3,938	778	9,319
6				1,350	725	300	5,400	6,188	1,191	15,154
7				2,363	1,175	690	7,425	8,750	1,678	22,081
8	150	375	240	3,713	1,800	1,200	9,675	11,563	2,213	30,929
9	350	1,250	680	5,363	2,475	1,830	12,000	14,680	2,825	41,453
10	1,100	2,875	1,440	7,313	3,225	2,520	13,200	16,770	3,204	51,647
11	1,900	5,375	2,600	9,671	4,072	3,240	14,400	18,360	3,518	63,136
12	3,750	7,500	4,080	11,675	4,672	4,003	15,000	19,450	3,756	73,886
13	5,450	12,125	5,880	13,566	4,872	4,526	15,600	20,040	3,920	85,979
14	8,650	16,000	8,000	15,308	4,872	4,810	15,600	20,040	4,008	97,288
15	11,422	20,180	10,555	16,824	4,872	4,810	15,600	20,040	4,008	108,311
16	15,622	23,360	12,733	18,078	4,872	4,810	15,600	20,040	4,008	119,123
17	19,138	25,540	14,790	19,032	4,872	4,810	15,600	20,040	4,008	127,830
18	23,466	26,720	16,688	19,686	4,872	4,810	15,600	20,040	4,008	135,890
19	27,126	26,720	18,346	20,040	4,872	4,810	15,600	20,040	4,008	141,562
20	30,150	26,720	19,683	20,040	4,872	4,810	15,600	20,040	4,008	145,923
21	33,964	26,720	20,701	20,040	4,872	4,810	15,600	20,040	4,008	150,755
22	35,804	26,720	21,398	20,040	4,872	4,810	15,600	20,040	4,008	153,292
23	38,652	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	156,518
24	38,748	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	156,614
25	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
26	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
27	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
28	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
29	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
30	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
31	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
32	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
33	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
34	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
35	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
36	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
37	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
38	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086
39	40,940	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	158,806
40	39,220	26,720	21,776	20,040	4,872	4,810	15,600	20,040	4,008	157,086

Note: Details of integration are shown in Annex III-2 and III-3 in Part III.

(2) Community Forest

Income from community forests (i.e. communally-managed lands) would be derived from the sales of fuelwood, bamboo, poles and sawlogs. These products would be harvested from plantations developed and existing plantations by selective cutting. It is assumed that the products just mentioned would be sold at farmgate prices (i.e. roadside). Average selling prices have been estimated on the basis of market surveys under prevailing conditions and interviews with residents of the watershed and adjacent municipalities. Total estimated sales from community forestry are indicated on Table III-3.

3. Summary of Benefits

The combined estimated benefits of the forest management and social forestry programs are aggregated as shown in Table III-4.

Table III-3 Sales by Year: Community Forest

(Unit: 1,000 Pesos)

Year	Fuelwood (m^3)	Amount (Peso)	Bamboo (Pcs.)	Amount (Peso)	Poles (Pcs.)	Amount (Peso)	Sawlog (m^3)	Amount (Peso)	Total (Peso)
1	0	0	0	0	0	0		0	0
2	1,681	504	0	0	2,240	3,360		0	3,864
3	1,627	488	0	0	2,195	3,293	0	0	3,781
4	1,340	402	0	0	0	0	0	0	402
5	1,445	434	0	0	0	0	0	0	434
6	1,240	372	0	0	5,240	7,860	0	0	8,232
7	1,545	464	0	0	5,247	7,871	0	0	8,334
8	1,636	491	0	0	0	0	0	0	491
9	1,785	536	0	0	0	0	0	0	536
10	0	0	4,000	120	0	0	0	0	120
11	500	150	12,800	384	5,031	7,547	2,240	5,600	13,681
12	600	180	26,720	802	4,757	7,136	2,195	5,488	13,605
13	749	225	36,640	1,099	0	0	0	0	1,324
14	0	0	41,760	1,253	0	0	0	0	1,253
15	330	99	41,760	1,253	0	0	0	0	1,352
16	396	119	41,760	1,253	2,630	3,945	2,240	5,600	10,917
17	422	127	41,760	1,253	2,457	3,686	2,307	5,768	10,833
18	0	0	41,760	1,253	180	270	5,000	12,500	14,023
19	420	126	41,760	1,253	192	288	4,900	12,250	13,917
20	504	151	41,760	1,253	0	0	0	0	1,404
21	538	161	41,760	1,253	325	488	291	728	2,630
22	0	0	41,760	1,253	200	300	0	0	1,553
23	0	0	41,760	1,253	240	360	5,000	12,500	14,113
24	0	0	41,760	1,253	256	384	5,150	12,875	14,512
25	0	0	41,760	1,253	0	0	0	0	1,253
26	0	0	41,760	1,253	0	0	5,500	13,750	15,003
27	0	0	41,760	1,253	250	375	5,840	14,600	16,228
28	0	0	41,760	1,253	300	450	1,190	2,975	4,678
29	0	0	41,760	1,253	320	480	576	1,440	3,173
30	0	0	41,760	1,253	0	0	0	0	1,253
31	0	0	41,760	1,253	0	0	5,500	13,750	15,003
32	0	0	41,760	1,253	0	0	5,665	14,163	15,415
33	0	0	41,760	1,253	0	0	0	0	1,253
34	0	0	41,760	1,253	0	0	500	1,250	2,503
35	0	0	41,760	1,253	0	0	600	1,500	2,753
36	0	0	41,760	1,253	0	0	1,355	3,388	4,640
37	0	0	41,760	1,253	0	0	0	0	1,253
38	0	0	41,760	1,253	0	0	0	0	1,253
39	0	0	41,760	1,253	0	0	0	0	1,253
40j	0	0	41,760	1,253	0	0	0	0	1,253

Note: Cutting standard is shown in Annex III-3 in Part III

Selling price: Sawlog 2,500 P/m^3, Fuelwood 300 P/m^3, Bamboo 30 P/pcs, Pole 1,500 P/pcs

Table III-4 Summary of Benefits

(Unit: 1,000 Pesos)

Year	Forest Management Program	Social Forestry Program	Total
1	0	0	0
2	0	4,773	4,773
3	0	6,119	6,119
4	0	5,661	5,661
5	11,464	9,753	21,217
6	0	23,386	23,386
7	0	30,415	30,415
8	0	31,420	31,420
9	0	41,989	41,989
10	20,294	51,767	72,061
11	0	76,817	76,817
12	0	87,491	87,491
13	0	87,303	87,303
14	0	98,541	98,541
15	35,093	109,663	144,756
16	0	130,040	130,040
17	0	138,663	138,663
18	0	149,913	149,913
19	0	155,479	155,479
20	30,587	147,327	177,914
21	24,603	153,385	177,988
22	22,095	154,845	176,940
23	22,811	170,631	193,442
24	25,745	171,126	196,871
25	22,733	160,059	182,792
26	33,197	172,089	205,286
27	31,052	175,034	206,086
28	31,052	161,764	192,816
29	42,427	161,979	204,406
30	31,409	158,339	189,748
31	28,423	173,809	202,232
32	28,066	172,501	200,567
33	28,066	160,059	188,125
34	28,185	159,589	187,774
35	26,632	161,559	188,191
36	25,915	161,726	187,641
37	25,199	160,059	185,258
38	26,050	158,339	184,389
39	28,306	160,059	188,365
40	58,839	158,339	217,178

IV. Financial and Economic Analysis

1. Financial Analysis

1) This project combines a forest management program with a social forestry program. Environment-friendly and sustainable use of land can be promoted by implementing the project cooperatively between the government and the local people.

The proposed master plan for the project anticipates that costs would be shared by the government and the watershed inhabitants. In the forest management program, the costs would be borne by the government. In the social forestry program, most of the costs would be borne by the inhabitants. If costs and benefits are aggregated as if the government and the inhabitants were partners, it is estimated that the internal rate of return (IRR) would be 26.0% as shown in Table IV-1.

2) As shown in Table IV-2, the IRR was calculated from the total cost of the above-mentioned forest management and social forestry programs borne by the government and the benefit derived from the forest management program.
The IRR of this project in financial terms would be 2.5%.

The respective IRRs of the forest management and social forestry programs are shown in Annexes IV-1-1 and IV-1-2.

Table IV-1 Calculation of Internal Rate of Return (IRR)

(1,000 pesos)

Year	Total Cost	Total Benefit	Present Value			Present Value		
			Discount Rate (26%)	Cost	Benefit	Discount Rate (27%)	Cost	Benefit
1	9,713	0	1	9,713	0	1	9,713	0
2	16,830	4,773	0.7937	13,357	3,788	0.7874	13,252	3,758
3	21,092	6,119	0.6299	13,285	3,854	0.6200	13,077	3,794
4	21,827	5,661	0.4999	10,911	2,830	0.4882	10,656	2,764
5	31,047	21,217	0.3968	12,318	8,418	0.3844	11,935	8,156
6	28,480	23,386	0.3149	8,968	7,364	0.3027	8,620	7,078
7	31,164	30,415	0.2499	7,788	7,601	0.2383	7,427	7,249
8	32,247	31,420	0.1983	6,396	6,232	0.1877	6,052	5,896
9	35,633	41,989	0.1574	5,609	6,609	0.1478	5,265	6,204
10	40,881	72,061	0.1249	5,107	9,003	0.1164	4,757	8,384
11	33,898	76,817	0.0992	3,361	7,616	0.0916	3,106	7,038
12	33,748	87,491	0.0787	2,656	6,885	0.0721	2,434	6,311
13	30,274	87,303	0.0625	1,891	5,452	0.0568	1,720	4,959
14	29,977	98,541	0.0496	1,486	4,884	0.0447	1,341	4,407
15	47,181	144,756	0.0393	1,856	5,694	0.0352	1,662	5,098
16	32,169	130,040	0.0312	1,004	4,060	0.0277	892	3,606
17	31,766	138,663	0.0248	787	3,436	0.0218	694	3,028
18	31,938	149,913	0.0197	628	2,948	0.0172	549	2,577
19	31,975	155,479	0.0156	499	2,427	0.0135	433	2,105
20	42,437	177,914	0.0124	526	2,204	0.0107	452	1,896
21	40,458	177,988	0.0098	398	1,750	0.0084	340	1,494
22	38,473	176,940	0.0078	300	1,381	0.0066	254	1,169
23	42,336	193,442	0.0062	262	1,198	0.0052	220	1,007
24	43,766	196,871	0.0049	215	968	0.0041	179	807
25	39,582	182,792	0.0039	154	713	0.0032	128	590
26	44,295	205,286	0.0031	137	635	0.0025	113	522
27	48,243	206,086	0.0025	119	506	0.0020	97	412
28	45,041	192,816	0.0019	88	376	0.0016	71	304
29	44,770	204,406	0.0015	69	316	0.0012	56	254
20	44,411	189,748	0.0012	55	233	0.0010	43	185
31	46,386	202,232	0.0010	45	197	0.0008	36	156
32	46,148	200,567	0.0008	36	155	0.0006	28	121
33	42,043	188,125	0.0006	26	116	0.0005	20	90
34	42,470	187,774	0.0005	21	91	0.0004	16	70
35	41,621	188,191	0.0004	16	73	0.0003	12	56
36	41,641	187,641	0.0003	13	58	0.0002	10	44
37	40,155	185,258	0.0002	10	45	0.0002	7	34
38	40,630	184,389	0.0002	8	36	0.0001	6	27
39	41,839	188,365	0.0002	6	29	0.0001	5	21
40	55,269	217,178	0.0001	7	26	0.0001	5	19
				110,130	110,207		105,680	101,689
					76			-3,990

IRR=26%+(27%-26%)x76/(76+3,990)=26.0%

Table IV-2 Calculation of Financial Internal Rate of Return (FIRR)

(1,000 pesos)

Year	Total Cost	Total Benefit	Present Value			Present Value		
			Discount Rate (2%)	Cost	Benefit	Discount Rate (3%)	Cost	Benefit
1	9,569	0	1	9,569	0	1	9,569	0
2	12,273	0	0.9804	12,032	0	0.9709	11,916	0
3	13,409	0	0.9612	12,888	0	0.9426	12,639	0
4	10,707	0	0.9423	10,089	0	0.9151	9,798	0
5	16,192	11,464	0.9238	14,959	10,591	0.8885	14,386	10,186
6	8,259	0	0.9057	7,480	0	0.8626	7,124	0
7	8,265	0	0.8880	7,339	0	0.8375	6,922	0
8	8,330	0	0.8706	7,252	0	0.8131	6,773	0
9	7,972	0	0.8535	6,804	0	0.7894	6,293	0
10	17,673	20,294	0.8368	14,788	16,981	0.7664	13,545	15,554
11	7,441	0	0.8203	6,104	0	0.7441	5,537	0
12	7,371	0	0.8043	5,928	0	0.7224	5,325	0
13	7,251	0	0.7885	5,717	0	0.7014	5,086	0
14	7,184	0	0.7730	5,553	0	0.6810	4,892	0
15	24,323	35,093	0.7579	18,434	26,596	0.6611	16,080	23,201
16	6,662	0	0.7430	4,950	0	0.6419	4,276	0
17	6,273	0	0.7284	4,570	0	0.6232	3,909	0
18	5,953	0	0.7142	4,251	0	0.6050	3,602	0
19	5,560	0	0.7002	3,893	0	0.5874	3,266	0
20	19,530	30,587	0.6864	13,406	20,996	0.5703	11,138	17,443
21	17,206	24,603	0.6730	11,579	16,557	0.5537	9,527	13,622
22	15,629	22,095	0.6598	10,312	14,578	0.5375	8,401	11,877
23	15,951	22,811	0.6468	10,318	14,755	0.5219	8,325	11,905
24	17,269	25,745	0.6342	10,951	16,326	0.5067	8,750	13,045
25	16,818	22,733	0.6217	10,456	14,134	0.4919	8,273	11,183
26	17,653	33,197	0.6095	10,760	20,235	0.4776	8,431	15,855
27	21,262	31,052	0.5976	12,706	18,556	0.4637	9,859	14,399
28	21,318	31,052	0.5859	12,489	18,192	0.4502	9,597	13,979
29	21,472	42,427	0.5744	12,333	24,369	0.4371	9,385	18,544
30	21,647	31,409	0.5631	12,190	17,687	0.4243	9,186	13,328
31	19,744	28,423	0.5521	10,900	15,692	0.4120	8,134	11,710
32	19,390	28,066	0.5412	10,495	15,191	0.4000	7,756	11,226
33	19,279	28,066	0.5306	10,230	14,893	0.3883	7,487	10,899
34	19,353	28,185	0.5202	10,068	14,663	0.3770	7,297	10,626
35	18,434	26,632	0.5100	9,402	13,583	0.3660	6,748	9,749
36	17,922	25,915	0.5000	8,961	12,958	0.3554	6,369	9,210
37	17,391	25,199	0.4902	8,525	12,353	0.3450	6,000	8,694
38	17,866	26,050	0.4806	8,587	12,520	0.3350	5,985	8,726
39	19,433	28,306	0.4712	9,157	13,337	0.3252	6,320	9,206
40	32,948	58,839	0.4619	15,220	27,181	0.3158	10,403	18,579
				391,647	402,922		324,309	312,745
					11,275			-11,564

FIRR=2%+(3%-2%)x11,275/(11,275+11,564)=2.5%

2. Economic Analysis

(1) Economic Analysis Excluding Off-site Benefits

This project is intended to rehabilitate the water-conserving functions of the watershed by developing and implementing a watershed management plan that focuses principally on forestation. Forests provide direct benefits to people who reside within them or close by, and also a range of indirect benefits to society as a whole (e.g. recharging of acquifers and improving air quality). However, these indirect (off-site) benefits cannot be accurately determined. Consequently, they are not taken into account in calculation of the economic internal rate of return anticipated from the project. Thus, the economic analysis of the project is confined to direct benefits which can be measured with a high degree of confidence.

Based on the data provided in Section 1. Paragraph 1), the IRR was calculated by using the following assumptions.

1) Timber Prices

A border price of 3,752 pesos/m^3 (CIF plus domestic transportation and distribution costs) was applied to sawlogs (logs for sawing) (Annex IV-2).

The market price less indirect taxes, or the price used for calculating benefit in Chapter III multiplied by 0.9 (ADB applies it to non-trade goods), was applied to fuelwood which is not exported or imported.

2) Fruits and Other Agricultural Products

Although border prices (FOB plus domestic transportation and distribution costs) should be applied to exported agricultural products such as mango and tamarind (Annex IV-3), the prices used for calculating benefit in Chapter III multiplied by 0.9 were applied to these products as non-trade goods in the economic analysis. This is because exported products are of high quality and represent a very small part of the total output.

3) Conversion of Foreign Currencies into Pesos

The official rate of 27.8 pesos to the dollar (as of December 1993) was applied because it was not significantly different from free-market exchange rates.

4) Wages

According to interviews, unskilled workers engaged in forestation in this area earn about 100 pesos a day, almost the level of the minimum wage (Annex IV-4).

The shadow wages were determined by multiplying the wages used for cost calculation in Chapter II by the shadow rate of 0.6 used by ADB.

The wages used for skilled workers engaged in surveys applied same rate of cost calculation in Chapter II.

5) Other Material Prices

Other costs except wages were determined by multiplying the prices used for cost calculation in Chapter II by 0.9.

Thus, the IRR of this project would be 36.4% in economic terms (Annex IV-5).

(2) Unquantifiable Effects

Forests are social capital. That is, forests have social utility, including water and soil conservation and environmental protection. However, this utility is not directly measured in terms of market value but is captured concurrently in the process of forests management. Society at large receives benefits from the resource without paying any fee.

The area covered by this study has been a designated watershed reserve since early days, and recently become subject to the NIPAS. The area is expected to have proper utility as social capital. This project would facilitate the following effects of the

watershed:

1) Conservation of Water Resources

The forests in this area have been gradually decreasing due to illegal cutting and land use and losing its water-conserving function.

This project is intended to manage forests in view of their present condition and create new forests. As a result, their water-conserving effect will markedly increase.

2) Prevention of Soil Erosion

The lower reaches of the Marikina River are frequently severely damaged by floods. Such disasters are partially attributable to soil erosion from the watershed owing to the decrease in the extent of forests covering the watershed. If forests are created, soil erosion would be more effectively prevented.

3) Protection of the Natural Environment

If this project is implemented, forests to be conserved will be protected as a forest ecosystem reserve area, and the natural environment and a variety of wild species will be protected and conserved.

4) Benefits of Forest Beauty

Many people from the metropolitan area often visit Marikina and around the Wawa Dam for recreation in the forest and by the streams. If forests are extended and footpaths are improved under this project, the recreational, scenic, educational, and cultural utility of the watershed will be increased.

5) Improvement of Local Livelihood

Forestation and social forestry would increase job opportunities for the local people and improve their income level.

(Reference) Tentative Quantification of Utility for Water Conservation and Prevention of Soil Erosion

In Japan, the Forestry Agency quantifies and assessed the public functions of forests as a whole, and published the results. However, this is just an attempt, and no firm methodology for such quantification and assessment has been established. Data on previous cases of useful assessment are seldom available.

Of the above-mentioned effects of forests, an attempt was made to assess the water-conserving and erosion-preventing effects based on fearless assumptions, and subsequently, calculate the internal rate of return.

a. Conservation of Water Resources

i. According to "Ansätzezur Bewertung der Sozialfunktion des Waldes" by Heiner R. Pabst, the macroscopic circulations of water in forests and grassland are as follows:

	Blockage	Transpiration	Evaporation	Overflow	Infiltration
Grassland	7%	16%	20%	20%	37%
Forest	18	21	7	0	54

The advantage of forests is the large amount of water infiltration. That is:

Water use potential from the water-conserving function (17%) = infiltration of forests (54%) - infiltration of grassland (37%)

Accordingly, If grassland on the watershed is forested, the annual water use potential will be:

3,117 mm (annual average rainfall) x 0.17 = 0.53 m^3/m^2/year

ii. The value of water can be estimated at 9.45 pesos/m^3 according to the water rates adopted by the MWSS (Annex IV-6).

Thus, the potential value of water per ha and year is:

0.53 m^3/m^2/year x 9.45 pesos x 10,000 m^2 ≒ 50,000 pesos/ha

iii. The utility derived from grassland forestation will increase as the afforested area increase. Assuming that such a plantation could exert its effects after the development of crown (in the fourth and following years), the value of forestation could be calculated as shown in the following table.

Effect of Water Conservation

Year	Cumulative Area of Afforestation (ha)	Utility value (thou.peso)	Year	Cumulative Area of Afforestation (ha)	Utility value (thou.peso)
1			21	4,978	248,900
2			22	5,198	259,900
3			23	5,215	260,750
4	320	16,000	24	5,219	260,950
5	640	32,000	25	5,237	261,850
6	960	48,000	26	5,254	262,700
7	1,280	64,000	27	5,254	262,700
8	1,504	75,200	28	5,254	262,700
9	1,824	91,200	29	5,254	262,700
10	2,144	107,200	30	5,254	262,700
11	2,464	123,200	31	5,254	262,700
12	2,784	139,200	32	5,254	262,700
13	2,957	147,850	33	5,254	262,700
14	3,267	163,350	34	5,254	262,700
15	3,577	178,850	35	5,254	262,700
16	3,877	193,850	36	5,254	262,700
17	4,177	208,850	37	5,254	262,700
18	4,178	208,900	38	5,254	262,700
19	4,478	223,900	39	5,254	262,700
20	4,738	236,900	40	5,254	262,700

b. Prevention of Soil Erosion

i. According to the quantification and assessment of the public functions of forests by the Forestry Agency of Japan, the annual average soil loss from the forest area is 0.44 m^3/ha, while that from the non-forest area is 226 m^3/ha.

According to a report of study by Santiago R. Bacongus (ERDB, DENR), the annual average soil loss from the experimental plantation of Leucaena leucoephala (2 to 3 years after

planting) was 49 m^3/ha, while that from the control area was 271 m^3/ha (Annex IV-7).

Although data of this type vary with precipitation, topography, soil and surveying method, they depend substantially on the existence of forests.

In the above-mentioned cases, there is a difference of 222 m^3/ha to 225 m^3/ha depending on whether forests exist or not.

On the assumption that if the grassland on the watershed is not forested, a soil loss of 220 m^3/ha will occur, the annual soil loss can be estimated as follows:

5,254 ha (afforestation areas) x 220 m^3/ha ≒ 1,156,000 m^3

ii. This huge volume of earth and sand will be deposited on the riverbeds and beaches, and consequently do great damage to the Manila Metropolitan area. Such damage has already occurred, but the amount of damage has not been made clear. In this report, the utility of forestation can be equated with the construction cost of a erosion-control dam to prevent soil erosion.

The construction cost will vary significantly depending on geology, gradient, weather and natural conditions, and design. Moreover, there is no precedent case of such construction in the Philippines. Therefore, the construction cost in this study was derived from the above mentioned case of the Forestry Agency in Japan.

To arrive at an estimate of benefits received from afforestation, the cost of a concrete dam (its size can trap 12 m^3 of sediment per 1 m^3 of concrete) per 1 m^3 of sediment was estimated at 50 pesos which is one tenth of the cost in the case of Japan (2,000 yen). At the prevailing exchange rate, 200 yen is equivalent to about 50 pesos.

Thus, the cost of a concrete dam to trap the volume of soil efflux from 1 ha of grassland that is not forested may be computed as follows:

220 m^3/ha x 50 pesos/m^3 = 11,000 pesos/ha

In other words, one hectare of forestation would create utility worth 11,000 pesos per year in preventing soil erosion.

iii. Given the utility of grassland forestation could be exerted as mentioned in Subparagraph a.iii, the value could be calculated as in the following table.

Effect of Prevention of Soil Erosion

Year	Cumulative Area of Afforestation (ha)	Utility value (thou.peso)	Year	Cumulative Area of Afforestation (ha)	Utility value (thou.peso)
1			21	4,978	54,758
2			22	5,198	57,178
3			23	5,215	57,365
4	320	3,520	24	5,219	57,409
5	640	7,040	25	5,237	57,607
6	960	10,560	26	5,254	57,794
7	1,280	14,080	27	5,254	57,794
8	1,504	16,544	28	5,254	57,794
9	1,824	20,064	29	5,254	57,794
10	2,144	23,584	30	5,254	57,794
11	2,464	27,104	31	5,254	57,794
12	2,784	30,624	32	5,254	57,794
13	2,957	32,527	33	5,254	57,794
14	3,267	35,937	34	5,254	57,794
15	3,577	39,347	35	5,254	57,794
16	3,877	42,647	36	5,254	57,794
17	4,177	45,947	37	5,254	57,794
18	4,178	45,958	38	5,254	57,794
19	4,478	49,258	39	5,254	57,794
20	4,738	52,118	40	5,254	57,794

c. Based on the calculations in Paragraphs a. and b. and Subsection (1) above, the internal rate of return would be 84.9% (Annex IV-8).

V. Environmental Impact Assessment

Studies were carried out to predict and assess the probable environmental impacts of the proposed forest management and social forestry programs on natural and socioeconomic environments.

1. Natural Environment

The watershed management plan is designed to create, maintain and manage forests to protect the watershed. Therefore, it is fundamentally a plan for environmental improvement. With the focus on the improvement and conservation of the present environment, the plan would have very few factors which may harm the environment. In particular, foresting grassland that was result of the degradation of forests will lead to improvement in biomass and environment. Conserving forests is an essential requirement for conserving water and soil resources. Accordingly, if forests for eventual timber production are treated in improperly, there would be a risk of degradation. To mitigate this potential problem, the plan proposes adoption of environmentally-sound harvesting systems. Cutting would be on a very small scale and no heavy equipment would be used. Harvesting would be exclusively by labor-based methods with animals (carabaos) used for skidding. Furthermore, undisturbed areas would be retained adjacent to areas that are harvested, in a mosaic-type of arrangement. The area covered by undisturbed forest would always be much larger than the area subjected to harvest. Moreover, timber harvesting would be confined to plantations which would be replanted immediately after they are harvested. No timber harvests would be allowed in natural forests.

The assessment of probable impact of development on the natural environment is summarized in Table V-1-(1) and specifically discussed hereunder.

a. Valuable Wildlife and Ecosystem Area

Fast-, medium- and slow-growing species would be mixed when foresting grassland in order to avoid monoculture and restore diverse vegetation. Improving the residual Dipterocarp forests would lead to a substantial improvement in forests as a whole. The diversification of vegetation and the enrichment of natural forests would also protect the ecosystem including wildlife such as wild

deer and pigs. Although other unique valuable organisms have not been found so far, it is possible that the introduction of fast-growing species may be accompanied by new diseases and damage by insects. To reduce such a risk, the plan prioritizes the indigenous species. Although cutting would temporarily change vegetation, its impact would be substantially mitigated by employing a selective or small-area cutting system rather than the large-scale clear cutting usually practiced or man-made forests.

b. Soil and Land

The project would bring about changes in land-use on land situated at an altitude of 500 m or less and composed of reddish white and impermeable clay. Above 500 m, the only major intervention will be protection.

The A Horizon, which is the humus layer and has a crumb structure, is not expected to develop in a short time, but would in the longer term after planting.

The development of root systems from planted trees would reduce the rate of overland flow, prevent soil erosion and increase the infiltration rate of rainwater.

The shading of direct sunlight by the crown would effectively reduce differences in temperature and humidity between day and night. In tropical areas, the drying of topsoil inhibits the physical properties of soil. Grassland forestation and agroforestry would effectively protect soil, prevent oxidization, and improve fertility.

Table V-1 Environmental Assessment

(1) Natural Environment

Category Group, Subgroup, Item	Assessment Development Action						
	Seedling Production	Natural Regeneration	Forestation	Harvesting	Forest Road Improvement	Water and Soil Conservation	Agroforestry
1. Valuable Wildlife and Ecosystem Area							
1) Change of Vegetation		+					
2) Effects on Valuable Species and Indigenous Animals		+					
3) Degradation of Bio-diversity			+	△			
4) Invasion and Increase of Harmful Organisms			△	△			
5) Deterioration of Natural Forests		+					
2. Soil and Land							
Soil							
1) Erosion		+	+	△		+	+
2) Salification							
3) Oxidization			+				
4) Degradation of Fertility		+	+				
5) Contamination							
Land							
1) Devastation		+	+			+	+
2) Landslide							
3) Degradation of Wind, Sand and Fire Control Functions			+				+
4) Subsidence							

3. Hydrology and Water Quality

Hydrology

1) Change of Overland Flow		+	+			+	+
2) Occurrence of Droughts and Flood		+	+				+
3) Sedimentation of Earth and Sand		+	+	△		+	+
4) Fluctuation of Riverbed		+	+			+	+
5) Change of Underground water		+	+			+	
6) Effects on Board Transportation							

Water Quality and Temperature

1) Contamination		+	+	△			
2) Eutrophication							
3) Change in Temperature		+	+				

Atmosphere

1) Pollution		+	+				
2) CO_2 levels		+	+				
3) Microclimatic Change		+	+				+
4) Noise Levels							

4. Sustainability of Forest Resources and Functions

1) Sustainability as Resources	+	+	+				+
2) Sustainability of Environment-Conserving Function	+	+	+			+	+

◎ Adverse effect ○ Slightly adverse effect △ Probably adverse effect + Good effect

(2) Social Environment

Category Group, Item	Assessment Development Action						
	Seedling Production	Natural Regeneration	Forestation	Harve-sting	Forest Road Improvement	Water and Soil Conservation	Agroforestry
1. Life of Inhabitants							
1) Change of Life Style			+	+	+		+
2) Conflict among Inhabitants			△				△
3) Population Increase			△				△
4) Economy			+	+	+		+
2. Institutions and Customs							
1) Right of Forest Utilization				△			+
2) Organization							+

◎ Adverse effect ○ Slightly adverse effect △ Probably adverse effect + Good effect

Since large-scale irrigation is not planned in the social forestry area, there is no risk of salt sedimentation on the ground. The risk of soil contamination is small because fertilizers and agricultural chemicals are used in small amounts, and the use of organic fertilizers would be promoted. As cutting is expected to trigger some soil erosion, a low-intensity small-area cutting system would be employed. At all times, stands aged five years or more would be carefully retained adjacent to cut stands. Thus, cutting is not expected to raise any serious problems.

Most of the land covered by this project is situated at an altitude of 500 m or less, comprises sedimentary earth and sand from landslides, and has a gradient of 30° or less. Any significant topographical change in such a talus area could cause a secondary landslide. There is no plan to construct a forest road, only footpaths about 1m wide. Land development in this project would not destabilize the slope. There is little risk of subsidence. Although the surface of the existing forest road is found to subside in places, this subsidence resulted from small landslides. Small landslides would not increase due to this project.

c. Hydrology and Water Quality

Forests would reduce the overland flow of rainwater and increase the infiltration rate. When a river floods, forests will reduce the maximum efflux (peak flow rate). This is the flood-control function of forests.

Although this flood-control function is widely recognized, the impact of forests during a drought has long been controversial. This is because forests increase the infiltration rate of rainwater on the one hand, but absorb and transpire water from soil on the other. In regions where the water consumption of forests creates a problem, the dry season is long and the annual rainfall is 1,000 mm or less. In regions where the annual rainfall is 2,000 mm or more, forests are positively evaluated in terms of flood control and erosion prevention, rather than negatively for water consumption.

Climatological data indicates that in this watershed the average annual rainfall is 3,100 mm, and the average annual transpiration is 1,600 mm. World average annual rainfall is 700 mm, and the annual

transpiration is 500 mm. Tropical temperatures are probably the reason that transpiration in the watershed is nearly triple the world average. The figure of 1,600 mm represents the amount of evaporation from the surface of the water and ground, combined with the amount of transpiration from plants in forests.

In this project, a grassland and shrubland of about 5,300 ha would be transformed into forests. It is difficult to predict how much transpiration would subsequently change. Even if the annual amount of transpiration remains unchanged, it is expected that differences in river flow and transpiration would be reduced between the rainy and dry seasons. The constant inflow and outflow of water throughout the year can be highly evaluated as an element of the natural environment.

Harvesting of trees would cause crown shading to disappear, soil to dry, and subsequent changes in the overland flow. In this project, however, only small patches of forests (1-2 ha) would be harvested, and logged-over areas would be immediately reforested. On all sides of harvested patches, mature intact stands would be retained. Forests of different ages would exist side by side. No heavy machine would be used for extraction and hauling of timber. Labor-based/animal supported methods would be applied. With these concerns taken into account, felling forests under this project should not significantly affect overland flow. Cutting would supply branches and leaves to the forest floor thus increasing litter, protecting forest land, reducing the speed of surface flow and facilitating infiltration.

The transformation of grassland into forest land would reduce the amount of microsoil grains supplied from the hillside to the stream, reduce surface flow, and consequently reduce the capability of surface flows to carry earth and sand during flooding. Judging from the present condition of mountain slopes, the possibility of frequent landslides is very minimal unless abnormally heavy rain occurs.

Raindrops hit and break the ground or disperse microsoil grains. Fallen leaves on the forest floor can absorb the impact of raindrops and limit such raindrop erosion. Moreover, rainwater infiltrating slowly from the surface into the ground does not contain microsoil

grains which may fill pores in the ground. These characteristics will facilitate the recharge of underground acquifers.

It is presumed that grassland and dry fields in the watershed are eroded at more or less constant rate. In this case, the efflux of microsoil grains owing to surface flow contaminates water. However, most of the grassland would be forested under this project. In cultivated land, also, a green belt would reduce the drifting capacity of overland flow. As a result, it is expected that rivers would be qualitatively improved.

Even if some forests are eventually felled, breakage of the topsoil should only be temporary and its adverse effect on water quality would be negligible.

Rainwater which has temporarily accumulated on the surface of grassland several days after falling will evaporate. On the other hand, forests continuously transpire even during the dry season. This means that forests replenish the supply of water in the air during the dry season. Although this action cannot increase precipitation during the dry season, it is presumable that transpiration has some effect on the annual distribution of rain along with the supply of water from the ocean to the land.

Forests have a great effect on the ground layer and the atmosphere in contact with the ground. In terms of microclimate, significant fluctuations in atmospheric temperature and humidity near the ground can create problems. Forests can reduce the degree of daily and monthly fluctuations.

This microclimatic stability has a good effect on soil and living organisms. In particular, the soil's resistance to erosion is maintained by preventing dramatic increases in the ground temperature in the daytime in high-temperature tropical areas.

In addition to these functions, forests have a positive effect on the living environment by fixing CO_2 and providing protection against wind and dust.

d. Sustainability of Forest Resources and Functions

If forests remain intact over a long time span, their environment-protecting functions are usually enhanced. In this project, natural forests, including virgin forests would be designated as protected forests (54% of the total). This will help conserve valuable genetic resources in addition to maintaining the protective functions of the forest. Protected forests would be separated from forests that would be harvested. Where harvesting is permitted and low-intensity procedures would be followed. After harvesting, reforestation would be continuous. If the process of harvesting and planting is steadily performed in accordance with the plan, the sustainability of resources would be assured and the environment-conserving functions of the watershed would be maintained.

2. Social Environment

From a social point of view, project impacts would generally be positive. Forestation would increase job opportunities and create community forest. Tenure security would contribute to stability and a sense of well-being. However, the increase of job opportunities and the improvement of living standards could induce more people from other regions to move to the watershed and occupy land illegally. This can be prevented by expediting issuance of tenure documents to the existing inhabitants, thus creating incentive for them to discourage in migration.

The assessment of the probable social impacts of the project is summarized in Table V-1-(2).

a. Life of Inhabitants

The increase in job opportunities under the forest management program and the guarantee of tenure security under the social forestry program would significantly stabilize the local people's livelihood. Job opportunities have been scarce in the Marikina watershed. Forestation and other programs will create significant employment opportunities. Social forestry interventions would put an end to illegal occupation and legitimize settlement. As a result, the area devoted to sustainable farming such as orchards

would be expanded, and incomes from agriculture would increase. Increases in wage-earnings and agricultural incomes would raise the living standard of the local inhabitants. By improving infrastructure, including road networks, the welfare of the local people would also be improved.

As this project is expected to improve the living environment of the local people, the development of the local society may trigger the inward migration of people from outside to the watershed or the invasion of the managed forest area. In this project, it is intended that only those who currently reside in the watershed would be eligible for employment in forestation and participation in social forestry. Newcomers are not included. If forests are illegally occupied again after the start of this project, the watershed could relapse into its pre-project state. Forests and forest land should be properly managed to avoid repeated illegal occupation.

On the other hand, if opportunities for employment are not fairly or equally given to the local inhabitants, this would create opposition and complaints. Conflicts would occur between the unemployed, the employed and government agents. This aspect of employment should be taken into full consideration.

b. Institutions and Customs

Tenure security would provide incentives for the inhabitants to improve their land-use methods and productivity. However, land-use rights would be confined to certain areas. Other unused areas would be managed as forests, and unjustified land use would be prohibited. Hitherto, land has been used illegally and without limits. If an area to be managed by inhabitants is established, these conventional practices must be strictly regulated, and prior living customs must change. Proper land management and thorough education of the local people would be required to overcome resistance to change. If land is haphazardly used as before, the establishment of the managed area would lose its significance.

Community associations would be organized under the social forestry program in order to establish a cooperative system for inhabitants based on the traditional "bayanihan" concept. If they are organized

poorly, associations would not work effectively. Therefore, it is intended that various activities related to social forestry would be collaboratively performed first. Formal organization would not be initiated until such time that the spirit of cooperation has become well engrained. This organizational strategy will strengthen and revitalize the communities.

VI. Evaluation of the Project

The Marikina watershed is a designated reserve where development or exploitation is formally prohibited. In fact, however, forests are felled and exploited, and forest land is illegally occupied. This represents problems in forest management. Such practices will probably continue as long as forests and forest land remain and people live there. In this situation, it is advisable to take a somewhat paradoxical measure. That is, forests will be intensively managed by introducing development plan in a limited way, and hereby the watershed will eventually be properly managed.

Thus, this project comprises the forest management and social forestry programs involving partial cutting. The internal rate of return of this watershed development project comprising these programs would be 26.0%, and the economic internal rate of return would be 36.4%. If off-site benefits are tentatively included in calculation, the rate would rise.

In terms of environmental assessment, this project is fundamentally designed to improve the natural environment and has very few factors which may deteriorate the environment. It is expected that forest management and social forestry with the focus on watershed forestation would substantially improve the natural and social environments of the watershed. What is important for environmental protection is the steady implementation of this project to avoid the adverse effect of cutting. Moreover, to avoid the resettlement of newcomers from other regions and the illegal occupation of land, proper land management should be promoted in the course of this project.

Everyone recognizes the importance of the watershed as a natural environment remaining in the Manila Metropolitan area, a recreational space for citizens and a habitat of valuable virgin forests. In time, if left as is, the watershed would be gradually degraded. To stop this degradation, swift measures are urgently required.

Thus, it is necessary to implement this project as soon as possible in terms of the public interest as well as profitability.

Moreover, two (2) land use alternatives were identified in which the Marikina watershed can take its course. Firstly, it may be proposed as a National Integrated Protected Areas System (NIPAS), and secondly it

may retain its present status as proclaimed watershed reserve. In regard to the first alternative, the watershed needs to follow the procedures embodied in the National Integrated Protected Areas System (NIPAS) Act. In such a case, it would take long so that the demand of urgency could not be addressed immediately. The second alternative provides the opportunity to address the problems and issues sooner than the later.

From the viewpoint to prevent degradation of the watershed, an appropriate measure is expected to be taken based on the comprehensive consideration of Philippines' forest policy and current situation of the Marikina watershed.

ANNEX

ANNEX 1 (1)

MINUTES OF THE MEETING ON THE INCEPTION REPORT OF THE STUDY ON THE MARIKINA WATERSHED DEVELOPMENT PROJECT IN THE REPUBLIC OF THE PHILIPPINES

In pursuance to the objective of the Inplementing Arrangement between the Department of Environment and Natural Resources (hereinafter referred to as "DENR") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") for the Study on the Marikina Watershed Development Project in the Republic of the Philippines (hereinafter referred to as "the Study") signed on March 13, 1992, JICA dispached the Study Team headed by Mr. Tsutomu HANDA and the Advisory Team headed by Mr. Masayoshi SHINAGAWA from October 1, 1992 to November 14, 1992 and from October 1, 1992 to October 7, 1992 respectively.

The JICA Study Team submitted 20 copies of the Inception Report to the Philippine side and held a series of discussions with the Philippine authorities and counterparts headed by Mr. Antonio S. TRIA, Undersecretary of DENR.

The salient results of the discussions are as follows:

1. Philippine side has agreed in principle upon the contents of the Inception Report, and that of the notes of discussions which is hereto attached.
2. Both sides agreed to cooperate with each other for the efficient conduct of the study so that its objectives would be attained as described in the Inception Report.

Metro Manila, October 6, 1992

Mr. Antonio S. TRIA
Undersecretary of DENR

Mr. Tsutomu HANDA
Leader of Study Team, JICA

Witnessed by

Mr. Masayoshi SHINAGAWA
Leader of Advisory team, JICA

ATTACHMENT TO THE MINUTES OF MEETING
ON THE INCEPTION REPORT OF THE STUDY
ON THE MARIKINA WATERSHED DEVELOPMENT PROJECT
IN THE REPUBLIC OF THE PHILIPPINES

1. The Philippine side agreed to allow the Study Team to use the RP-Japan Forestry Development Project office in the Headquarters , of DENR in order to implement the Study smoothly.

2. The Philippine side has agreed to arrange for issuance of a permit for aerial photography in order to put forward the scheduled survey.

3. The Philippine side agreed to arrange for issuance of a permit for carrying aerial photographs in the field survey.

4. The Study Team has requested DENR to provide identification cards for members of the Study Team.

5. The Study Team has requested DENR to make necessary arrangement of visa for members of the Study Team.

6. The Philippine side requested JICA to provide necessary equipments in the implementation of the Study.

ANNEX 1 (2)

MINUTES OF MEETING
FOR INTERIM REPORT
ON
MASTER PLAN STUDY
FOR THE
MARIKINA WATERSHED DEVELOPMENT PROJECT
IN
THE REPUBLIC OF THE PHILIPPINES

September 6, 1993

MR. RICARDO M. UMALI
Undersecretary of DENR

MR. TSUTOMU HANDA
Leader of Study Team, JICA

WITNESSED BY:

MR. HARUYUKI MOCHIDA
Leader of Advisory Team, JICA

MR. ANTONIO PRINCIPE
Regional Executive Director, DENR

MINUTES OF MEETING AMONG REPRESENTATIVES OF THE DENR AND THE JICA STUDY TEAM REGARDING THE MARIKINA WATERSHED DEVELOPMENT PROJECT (MWDP)

1. The meeting convened at 2:15 PM on August 31, 1993 in the conference room of the Foreign-Assisted and Special Projects Office (FASPO) of the Department of Environment and Natural Resources (DENR), Visayas Avenue, Quezon City . It was chaired by Mr. Antonio Principe, Regional Executive Director (RED) of DENR, Region IV. The list of participants is attached hereto.

2. The primary purpose of the meeting was to formally present the Interim Report for the MWDP and discuss its contents.

3. Initially, the JICA Study Team explained the activities that were conducted to prepare the Interim Report. Key members of the Team discussed the processes applied to generate, interprete and analyze important data contained in the report. To facilitate the discussion, the Team presented several maps that have been prepared thus far and explained the features and information contained therein.

4. Following the presentation and discussions, the DENR representatives requested further information regarding tentative recommendations mentioned in the Interim Report and illustrated on the proposed land use map. The salient results of the discussions are as follows:

   (a) Buffer zones - The buffer zones were proposed primarily to provide protection for natural forests. Numerous activities could be considered in buffer zone development and management. Multiple-use management by local communities may be allowed in some buffer zones. Alternatively, a buffer zone could be an area where utilization is prohibited. Specific recommendations for each buffer zone area would be formulated and included in the master plan.

   (b) Agroforestry - Expansion of agroforestry did not imply measures that would encourage in-migration. The objective would be to follow the prevailing DENR policy to help improve the land use methods of present occupants, rather than resort to resettlement. The Team also pointed out that most of the lands identified for agroforestry are already denuded consisting primarily of grass and brush. Agroforestry is proposed as a means to improve hydrological functions of these lands while concurrently enhancing the socio-economic welfare of the existing occupants.

   In preparation of the master plan, the Study Team was advised to consider Presidential Proclamations which have designated portions of the watershed for specific purposes (i.e. social forestry and Lungsod Silangan).

(c) Aerial photos - The existing aerial photos could be used to assess the status of contract reforestation previously carried out on the watershed. However, interpretations from the photos would have to be compared with ground verification data. The ground verification would enhance the capability to conduct assessment through aerial photographs.

(d) IPAS - It was agreed that the MWDP provided an excellent opportunity to collaborate on the development of clearer definitions and criteria in respect of the nine (9) categories of management zones indicated in the IPAS guidelines of DENR. These criteria/ definitions would be needed to finalize the MWDP master plan. At the same time, the criteria/definitions so formulated could possibly be applied elsewhere in the Philippines.

Given the importance of this issue, both panels agreed to initiate a two-step process of consultation on IPAS criteria/definitions. This process would begin with a meeting on September 3 at 9:00AM. DENR participants would include representatives from the Parks and Wildlife Bureau (PAWB), field operations, policy and FASPO. JICA participants would include members of the Advisory Mission and the Study Team. This initial meeting would establish the framework for follow-on discussions between the DENR and the Study Team.

(e) Commercial timber production - Forest plantations could be used for small and medium-scale commercial timber production by local residents depending upon the selection of tree species to be used (e.g. narra and mahogany).

(f) Other matters - DENR pointed out that the procedures followed in data generation and analysis (e.g. flood risk assessment) could be very useful in the design of training programmes for DENR staff.

5. Forthcoming activities in the MWDP were discussed as the final item on the agenda. The Team explained work now underway to complete a master plan for the MWDP and informed DENR that a draft plan is scheduled for presentation by the end of March 1994. Both panels agreed on the need for continuous collaboration and consultation in formulation of the master plan.

6. The meeting adjourned at 3:45 PM.

LIST OF PARTICIPANTS

DENR	
Antonio G. Principe	Regional Executive Director Region IV
Alfredo S. Pascual	Technical Director for Forestry Region IV
Robert Jara	Chief, Project Preparation Division, FASPO
Jesus Cariño	Project Development Officer IV Project Preparation Division, FASPO
JICA	
Motofumi Kohara	Asst., Resident Representative JICA Philippine Office
JICA Advisory Team	
Haruyuki Mochida	Leader
Kunihiko Isizaki	Watershed Management
Akio Kagawa	Coordinator
JICA Study Team	
Tsutomu Handa	Leader
Toshiaki Tsuchiya	Vegetation/ Upland Plantation & Land Development
Jun Kataoka	Watershed Mngt./Environmental Impact Analysis
Patrick C. Dugan	Socio-economic survey

ANNEX 1 (3)

MINUTES OF MEETING

ON

DRAFT FINAL REPORT

FOR

THE STUDY

ON

THE MARIKINA WATERSHED DEVELOPMENT PROJECT

IN THE REPUBLIC OF THE PHILIPPINES

BETWEEN

THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

May 19, 1994

ATTY. LOPE REYES
OIC, Undersecretary
Department of Environment
and Natural Resources

MR. TSUTOMU HANDA
Leader of the Study Team
JICA

WITNESSED BY:

DR. HARUYUKI MOCHIDA
Leader of the Advisory Team
JICA

MR. ANTONIO PRINCIPE
Regional Executive Director
Region IV, DENR

MINUTES OF THE MEETING

1. The meeting convened on May 17 and May 18, 1994 in the conference room of the Foreign-Assisted and Special Projects Office (FASPO) of the Department of Environment and Natural Resources (DENR). It was chaired by Regional Executive Director Antonio Principe, Region IV, DENR. The list of attendants is attached hereto.

2. The purpose of the meeting was to formally present and to discuss the contents of the Draft Final Report (hereinafter referred to as the Report) for the Study on the Marikina Watershed Development Project (MWDP). The report was prepared pursuant to an Implementing Arrangement (S/W) signed on March 13, 1992.

3. The DENR formally received twenty (20) copies of the Report from JICA.

4. The DENR panel accepted the Report in principle. They also commended the Study Team for the high quality of the document and the detailed technical information contained therein. They commented that the Report provided a comprehensive framework for development and rehabilitation of the Marikina Watershed.

5. Mr. Tsutomu Handa presented a verbal summary of the principal features of the Report. Thereafter, detailed discussions were conducted, the salient points of which are summarized hereunder:

   (a) The DENR called attention to a number of important institutional issues that are relevant to accomplishment of the environmental and socio-economic objectives of the project. They also requested the Study Team to prepare proposals for addressing institutional issues. The Study Team acknowledged that the institutional issues raised by the DENR are crucial and should be seriously considered. However, the Study Team emphasized that full elaboration of institutional issues would have exceeded the bounds of the study, as reflected in the Terms of Reference.

   (b) The DENR also presented certain recommendations relevant to technical matters for inclusion in the Final Report. The Study Team agreed with such recommendations and assured DENR that the same would be incorporated in the Final Report.

(c) Details of all matters discussed will be contained in a Record of Meeting which will be attached to the Final Report. A draft copy of said Record will be provided to the DENR.

6. After concluding discussions on technical and institutional topics, the DENR expressed its intention to send a formal communication through the appropriate channels, requesting assistance from the Government of Japan in implementation of the project.

7. Additional comments of the Philippine Side will be submitted to JICA within one (1) month of this meeting.

8. The Final Report will be submitted to the DENR within two (2) months after receiving the comments.

9. The meeting adjourned at 3:15 PM on May 18, 1994.

ANNEX

LIST OF ATTENDANTS

DENR PANEL

Mr. Antonio Principe, Regional Executive Director
Mr. Mariano Valera , Regional Executive Director
Mr. Robert Jara, FASPO
Mr. Jesus Cariño, FASPO
Dr. Antonio Manila, FMB
Mr. Sofio Quintana, FMB
Mr. Danilo Morales, FMB
Mr. Wilbur Dee , PAWB
Mr. Hurley Salig , DENR, Region IV
Mr. Antonio Tullas , DENR, Region IV
Mr. Arnulfo Hernandez, CENRO, Antipolo, Rizal

JICA PANEL

Dr. Haruyuki Mochida, Team Leader
Mr. Akio Kagawa , Coordinator

Survey Team

Mr. Tsutomu Handa , Leader/Development Planning
Mr. Toshiaki Tsuchiya , Vegetation/Upland Plantation and Land Development
Mr. Patrick Dugan , Socio Economic Survey

PART I

ANNEX I-1 Main Species Growing in the Watershed

List of Vegetation

Tree Species in Dipterocarp Old Growth & Dipterocarp Residual Forest

COMMON NAME	SCIENTIFIC NAME
Apitong	*Dipterocarpus grandiflorus*
Antipolo	Artocarpus blanco
Alibangbang	Pileostigma malabaricum
Bagtikan	Parashorea plicata
Bitaog	Calophyllum inophyllum
Bokbok	Xanthophylum excelsum
Bulala	Nephelium philippinensis
Balete	Ficus balete
Balobo	Diplodiscus paniculatus
Balukanag	Chisocheton cumingianus
Bayok	Pterospermum diversifolium
Binayuyu	*Antidesma ghaesembilla*
Binuang	Octomeles smatrana
Binunga	Macaranga tanarius
Bitanghol	Calophyllum blancoi
Dao	Drancontomelon dao
Dungon	Tarrietia sylvatica
Dalingdingan	Hopea foxworthyi
Gatasan	Garcinia venulosa
Guijo	Shorea guiso
Gubas	Endospermum peltatum
Hagimit	Ficus minahassae
Ilang Ilang	Gananga odorata
Igem	Podocarpus imbricatus
Kamagong	Diospyrus Philippinensis
Kamatog	Erythorophloem desiflorum
Kalingag	Cinnamomum mercadoi
Lansones Gubat	Lancium dubium
Lanutan	Miterephora lanotan
Lingo Lingo	Vitex turozaninowii
Magabuyo	Celtis luzonics
Malaikmo	Celtis philippinensis
Malabayabas	Tristania dicorticata
Makaasim	Syzygium nitidum
Mayapis	Shorea squamata
Malasantol	Sandoricum vidalii
Mangasinoro	*Shorea philippinensis*
Malaruhat	Cleistocalyx operculatus
Malugai	Pometia pinnata
Nato	Palaquium luzoniense
Narig	Vatica mangachapoi
Pahutan	Mangifera altissima
Palosapis	Anisoptera thurifela

COMMON NAME	SCIENTIFIC NAME
Puso Puso	Neolitsea Vidalii
Pili	Canalium ovatum
Putian	Alangium meyera
Red lauan	Shorea negrosensis
Talisai Gubat	Terminalia Foetidissima
Tanguile	Shorea polysperma
Tamayuan	Strombosia philippinensis
Tibig	Ficus nota
Tuai	Biscofia javanica
Tikim	Neonauclea vidalii
White lauan	Pantacme contorta

Bamboo in the Study area

COMMON NAME	SCIENTIFIC NAME
Indian bamboo	Bambusa arundinacea
Kauayan	Dendrocalamus merrillanus
Bungbong	Schizostachyum diffusum
Lumanpau Buho	Schizostachyum lumampao

Grasses in the Study area

COMMON NAME	SCIENTIFIC NAME
Salai-salai	Arundinella ciliata
Carabao grass	Axonopus compressus
Marakuayan	Brachiaria reptans
Kogon	Imperata cylindrica
Tarahib	Saccharum spontaneum
Samon	Themeda triandra
Tal-tal	Paspalum longifolium
Elephant grass	Pennisetum purpureum
Others	Cyrtococcum acorescens
	Dimeria ornithopoda
	Pseudoraphis squarrosa
	Chloris barbata

ANNEX I-2 Changes in Planted Areas

(Unit: ha)

Year	Government	Private Sector	Total
1990	153,949	37,714	191,663
1989	89,452	41,952	131,404
1988	31,226	32,957	64,183
1987	28,843	10,968	39,811
1986	24,426	8,572	32,998
1985	12,684	11,547	24,231
1984	16,088	22,847	38,935
1983	42,239	36,229	78,538
1982	35,201	28,061	63,262
1981	33,296	31,245	64,541
1980	39,881	20,635	60,516
1979	51,859	27,589	79,397
1978	44,686	33,739	78,425
1977	33,365	19,898	53,263
1976	23,228	8,505	31,733

Forestry Stastistics 1990

ANNEX I-3 Monthly Rainfall by Thiessen Method

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOT
1911	23.8	20.0	36.8	169.0	205.5	243.6	1111.8	590.0	361.1	78.7	9.1	20.2	2870
1912	25.7	28.4	7.9	20.3	221.5	228.1	736.2	768.3	404.4	283.2	239.4	29.3	2993
1913	60.8	8.5	9.6	84.1	126.2	320.8	883.4	694.1	536.2	235.9	21.4	66.3	3047
1914	16.5	10.0	5.5	84.9	308.6	489.3	751.1	951.6	892.9	105.7	67.1	88.8	3772
1915	16.9	8.0	20.0	22.2	217.6	253.0	527.2	552.7	552.2	262.5	288.0	290.6	3011
1916	36.3	47.5	31.5	69.5	144.2	348.8	394.9	518.6	540.3	299.9	146.3	125.4	2703
1917	26.1	17.3	35.0	75.6	147.5	394.2	829.6	427.8	376.9	466.0	327.6	125.1	3249
1918	2.9	2.6	19.1	12.7	156.8	319.8	971.1	580.2	466.2	312.7	23.5	63.9	2931
1919	21.7	12.5	11.0	42.0	245.2	332.6	625.7	2181.3	174.0	395.4	204.2	48.0	4294
1920	16.4	24.5	.8	19.9	193.7	410.9	1076.4	454.9	336.1	281.7	277.5	161.3	3254
1921	9.8	37.3	30.5	28.3	129.9	336.0	670.5	1136.6	407.3	102.3	450.2	67.5	3406
1922	16.3	2.6	1.5	29.6	410.0	229.0	594.2	388.1	631.0	264.9	112.7	175.4	2855
1923	22.5	47.3	118.5	28.5	406.9	668.3	439.0	1263.4	451.2	175.8	721.0	55.7	4398
1924	53.9	6.5	14.8	16.7	300.5	353.1	771.1	725.4	427.9	494.3	281.3	64.5	3510
1925	20.9	40.8	10.7	29.6	238.1	723.3	586.6	701.0	538.9	235.6	49.3	12.2	3187
1926	4.5	1.4	4.7	21.4	125.0	671.5	591.3	499.1	405.9	232.3	141.4	62.7	2762
1927	18.8	17.4	55.8	171.7	528.9	496.6	578.2	724.7	303.7	404.6	40.2	94.8	3435
1928	22.4	46.4	18.7	66.0	222.8	480.7	634.6	233.1	663.9	117.0	149.7	26.1	2681
1929	50.5	4.7	2.6	76.6	290.9	257.1	849.3	435.0	469.8	372.4	97.4	71.8	2978
1930	12.4	5.3	23.9	12.3	434.0	459.6	777.5	529.9	340.7	165.3	122.8	60.3	2944
1931	27.4	.9	6.5	56.5	290.0	374.6	391.7	1446.3	385.4	537.1	388.2	190.8	4095
1932	3.4	9.0	11.0	1.8	192.9	352.9	830.3	318.9	577.3	288.6	233.5	117.6	2937
1933	50.4	6.5	6.2	35.3	131.5	187.8	588.5	403.1	673.8	395.9	128.1	37.4	2545
1934	42.5	18.2	26.5	94.3	562.3	150.5	758.2	747.4	660.7	503.6	612.3	84.9	4261
1935	13.6	48.3	23.8	62.5	474.0	154.9	1022.6	719.0	475.8	322.0	57.3	118.0	3492
1936	43.9	5.7	2.5	19.4	96.4	433.3	511.2	621.1	585.5	300.2	205.9	214.4	3039
1937	60.1	78.9	51.1	12.7	120.7	365.1	1294.3	921.1	485.0	562.1	829.7	409.2	5190
1938	41.8	2.9	93.5	92.3	237.7	504.2	377.2	399.5	443.8	290.6	279.8	94.9	2858
1939	25.7	10.0	21.4	106.1	297.5	302.0	524.0	607.7	372.7	189.6	209.6	312.1	2978
1940	279.7	44.4	12.4	64.7	323.8	411.0	1028.5	576.1	497.6	237.2	81.9	71.8	3629
1941	30.0	8.1	40.4	83.0	142.7	412.2	458.7	766.0	544.1	273.0	104.2	79.3	2942
1942	40.3	8.1	34.6	74.3	362.3	424.2	584.4	796.8	314.0	439.3	.4	10.5	3089
1943	41.2	14.3	77.9	37.4	178.3	453.3	665.7	555.0	493.6	263.4	190.9	177.4	3148
1944	18.4	16.5	36.5	59.9	385.2	321.3	471.4	661.9	488.3	267.5	117.6	113.9	2958
1945	15.7	10.1	44.2	54.3	319.6	457.0	460.9	514.7	550.7	67.3	404.1	83.2	2982
1946	75.7	4.7	79.7	31.6	213.1	432.3	581.0	567.0	529.3	404.7	52.4	129.4	3101
1947	18.6	7.3	36.3	60.2	291.1	294.0	796.3	724.3	358.8	199.9	288.6	302.6	3378
1948	16.2	48.4	33.5	93.5	298.7	287.2	551.6	975.5	576.1	245.0	128.6	89.4	3344
1949	26.6	8.3	31.1	8.6	38.0	383.7	244.5	399.0	385.9	367.5	183.3	155.2	2232
1950	26.8	14.3	84.3	54.0	222.3	379.9	535.7	468.0	518.1	366.9	83.8	158.7	2913
1951	21.9	23.4	.9	66.9	206.1	405.8	385.4	792.0	420.2	251.2	255.7	149.1	2979
1952	13.4	4.5	12.1	39.8	166.1	607.7	212.0	914.6	540.1	569.6	71.6	182.7	3334
1953	10.1	17.2	15.3	50.2	157.0	495.4	448.9	773.8	510.2	355.1	101.4	222.5	3157
1954	14.8	4.3	58.1	21.9	224.5	306.5	476.4	692.3	377.9	226.6	385.7	40.3	2829
1955	20.3	5.1	3.5	26.0	213.6	221.6	452.6	375.5	383.2	279.5	311.3	20.7	2313
1956	16.5	28.8	38.8	156.7	256.3	186.1	481.0	652.3	782.5	153.3	212.6	250.1	3217
1957	45.3	3.3	11.7	36.1	143.6	413.3	521.0	712.9	403.2	317.1	67.4	36.1	2711
1958	26.0	8.7	23.8	20.6	190.2	685.6	713.3	391.7	720.6	330.2	55.6	16.7	3183
1959	24.0	3.3	74.7	15.1	233.7	124.3	418.1	655.6	329.5	202.9	224.1	170.0	2475
1960	22.0	67.8	86.6	85.3	404.9	427.1	366.6	1015.3	423.5	567.8	55.4	20.1	3542
1961	14.1	3.3	34.6	40.8	254.9	729.5	571.5	664.5	479.5	267.9	134.3	17.4	3212
1962	14.1	3.4	19.2	82.9	218.9	247.1	685.5	908.8	553.0	441.2	148.3	17.9	3340

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOT
1963	10.9	3.7	4.0	19.3	106.1	751.2	405.0	519.0	492.2	164.1	30.0	90.3	2596
1964	17.6	7.6	6.9	39.3	421.8	391.1	132.0	931.6	400.5	246.5	285.0	258.7	3139
1965	14.4	2.5	8.3	40.0	303.4	151.1	478.6	431.0	405.8	157.6	151.6	65.1	2209
1966	11.8	9.6	3.5	13.7	502.3	231.3	530.3	503.4	647.3	159.4	386.4	140.0	3139
1967	32.1	14.0	6.0	23.3	181.8	726.5	503.5	555.3	450.0	226.9	100.7	16.2	2836
1968	14.8	3.3	16.8	30.0	216.2	247.8	641.3	675.8	424.6	226.4	22.8	10.5	2530
1969	19.0	3.3	43.2	25.8	157.8	290.0	492.8	600.2	436.9	293.6	77.6	138.3	2579
1970	20.3	3.4	14.2	50.0	178.2	334.1	553.8	499.9	714.1	273.1	231.0	23.6	2896
1971	13.4	17.2	231.7	18.0	247.7	482.2	586.4	339.6	216.6	456.6	294.7	232.2	3136
1972	35.2	8.8	30.7	16.5	276.9	542.0	1670.6	725.8	261.8	64.2	112.6	209.5	3955
1973	13.6	2.7	.9	5.8	121.5	294.2	738.8	590.2	352.0	428.4	253.6	122.0	2924
1974	11.8	4.8	42.0	40.3	189.9	568.5	380.0	1483.5	132.0	517.4	592.2	167.4	4130
1975	25.8	35.0	95.5	58.2	238.0	266.1	168.8	644.6	314.8	435.6	159.9	191.6	2634
1976	16.2	4.2	18.1	9.2	428.4	285.8	486.0	628.1	465.2	172.2	119.4	110.1	2743
1977	13.8	4.4	35.0	11.2	334.9	217.2	578.6	770.3	562.9	65.6	193.1	18.8	2806
1978	9.3	2.4	1.2	22.2	211.3	206.0	385.4	772.3	554.9	1104.8	191.1	103.1	3564
1979	17.2	2.1	.8	250.6	515.4	398.8	756.8	796.2	309.8	276.4	91.0	83.1	3498
1980	9.4	3.0	320.2	15.0	103.2	216.5	509.9	251.1	454.3	277.5	365.6	74.4	2600
1981	10.2	4.3	.8	49.6	126.8	616.4	609.8	636.5	412.1	295.4	275.1	104.9	3142
1982	10.1	3.5	42.3	120.0	175.4	341.0	808.2	517.1	456.4	65.1	150.8	85.0	2775
1983	26.5	4.0	1.9	12.0	138.4	128.8	372.0	952.4	425.8	247.4	46.0	11.8	2367
1984	16.6	3.7	64.7	108.8	225.6	490.5	335.1	778.2	298.2	469.0	98.2	31.4	2920
1985	9.3	14.5	16.1	99.0	70.3	1042.0	333.3	340.7	491.5	288.3	138.9	58.1	2902
1986	9.4	15.5	11.9	46.2	233.4	215.8	894.2	872.5	575.1	811.6	368.4	91.4	4145
1987	17.0	2.3	1.2	39.7	286.3	377.7	238.8	430.5	456.5	262.9	171.7	159.7	2444
1988	60.9	34.8	3.0	63.4	243.1	502.2	410.2	348.6	293.0	767.4	222.0	13.2	2962
1989	25.8	24.1	141.2	31.0	304.1	267.1	526.4	638.8	432.3	383.9	141.8	12.7	2929
1990	11.1	2.1	3.4	6.8	221.5	566.8	699.0	975.3	730.6	236.8	255.6	108.0	3817
1991	11.2	14.7	4.6	31.9	82.3	324.5	473.9	796.2	501.6	99.1	59.3	13.7	2413
No.	81	81	81	81	81	81	81	81	81	81	81	81	81
AVER.	26.3	14.6	34.1	50.9	243.7	387.9	598.9	680.2	466.5	311.6	197.0	105.5	3117
ST.D.	32.0	16.2	48.9	42.9	112.8	168.8	249.1	293.6	133.0	172.3	156.6	82.7	531
SKEW	6.42	1.89	3.62	2.02	.87	1.09	1.37	2.15	.42	1.71	1.72	1.18	1.22
C.V.	1.22	1.11	1.43	.84	.46	.44	.42	.43	.29	.55	.79	.78	.17
V.80%	11.8	3.3	4.0	18.0	143.6	243.6	405.0	435.0	361.1	175.8	67.4	23.6	2711
V.90%	9.8	2.6	1.5	12.3	121.5	206.0	366.6	388.1	309.8	105.7	46.0	16.2	2530

MWSS

「MANILA NORTH-EAST WATER SUPPLY PROJECT」

ANNEX I-4 Discharge at Observation Spots

River	Location	Area (km2)	Date	Discharge (m3/s)
CONTINUOUS CONTROL SECTIONS:				
Montalban	Inigan (ME Damsite)	255	Nov. 19	12.2
Montalban	" "	"	Dec. 18	4.6
Montalban	" "	"	Jan. 29	2.0
Montalban	" "	"	Feb. 20	1.4
Montalban	" "	"	Mar. 5	1.2
Montalban	" "	"	Mar. 13	.95
Montalban	" "	"	Mar. 23	.81
Montalban	" "	"	Apr. 2	.65
Montalban	" "	"	Apr. 14	.51
Montalban	" "	"		
Montalban	At Wawa Dam (U/S)	280	Jan. 29	2.0
Montalban	" "	"	Feb. 20	1.3
Montalban	" "	"	Mar. 5	1.0
Montalban	" "	"	Mar. 13	.87
Marikina	Spillway Bridge	282	Jan. 29	1.7
Marikina	" "	"	Feb. 20	1.6
Marikina	" "	"	Mar. 5	.88
Marikina	" "	"	Mar. 13	.81
Marikina	" "	"	Mar. 17	.78
Marikina	" "	"	Mar. 23	.75
Marikina	" "	"	Apr. 2	.61
Marikina	" "	"	Apr. 14	.49
Marikina	" "	"	Apr. 28	.43
Marikina	" "	"	May 6	.37
CHECK SECTIONS:				
Montalban	Anipa (MC' Damsite)	140	Nov. 19	8.7
Montalban	" "	"	Dec. 18	3.1
Boso Boso	Upstream of Montalban	105	Mar. 5	.21
Montalban	Upstream of Bosoboso	145	Mar. 5	.80
Marikina	S. Rafael	281	Mar. 17	.83
Marikina	"	"	Mar. 23	.78
Marikina	Tabak	283	Feb. 20	1.5
Marikina	S. Jose	375	Mar. 17	1.1
Puray	S. Jose	92	Apr. 2	.05

ANNEX I-5 Monthly Discharge from the Wawa Dam

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1912	1.9	3.1	.6	1.1	3.2	.8	52.7	91.1	31.7	29.6	16.7	20.4	21.1
1913	8.8	2.7	1.6	1.1	1.1	1.2	40.1	36.1	52.0	29.4	5.9	3.6	15.3
1914	5.5	1.1	.8	.6	.7	24.2	61.1	53.5	114.7	12.1	4.5	3.9	23.6
1915	1.1	.8	.6	.5	1.7	.8	19.8	33.0	44.7	17.6	27.2	38.8	15.6
1916	8.0	3.3	1.7	1.3	1.1	9.5	11.4	38.5	45.0	23.8	10.5	8.0	13.5
1917	11.6	2.8	1.4	1.2	1.6	5.7	39.3	34.2	27.5	40.4	33.2	20.6	18.3
1918	6.3	2.2	1.4	1.0	2.3	2.6	73.0	50.4	49.0	30.8	5.4	2.6	18.9
1919	2.4	1.4	.9	.6	1.0	13.9	39.6	169.3	26.1	20.6	12.1	22.4	25.9
1920	2.9	1.6	1.3	.6	4.4	12.3	79.9	24.3	39.2	17.5	17.6	11.4	17.8
1921	2.8	2.0	2.1	1.2	1.1	5.5	21.9	71.2	31.3	8.0	51.7	12.4	17.6
1922	2.4	1.5	1.1	.6	1.1	8.0	36.5	46.9	65.4	18.4	7.6	19.3	17.8
1923	1.9	2.8	2.3	1.4	9.5	41.4	45.5	113.3	39.8	20.1	69.4	13.6	30.1
1924	6.1	1.9	1.5	.7	1.7	14.1	44.6	77.0	25.1	40.6	30.2	17.3	21.7
1925	5.2	2.5	2.0	1.0	1.8	45.6	65.9	62.6	68.3	24.6	10.7	4.1	24.5
1926	2.0	1.6	.7	.5	.7	39.0	36.9	47.1	36.1	23.9	22.1	8.6	18.3
1927	2.8	1.7	1.2	1.0	13.8	30.6	56.4	67.9	32.8	39.3	10.8	6.8	22.1
1928	3.0	2.1	2.0	1.2	1.4	14.3	39.0	24.8	72.8	21.1	22.3	14.3	18.2
1929	5.3	2.1	1.7	1.2	2.0	4.6	89.8	52.6	83.2	26.7	15.3	12.2	24.7
1930	2.9	2.9	1.2	.8	8.6	20.3	79.9	60.8	27.0	15.7	11.5	5.5	19.8
1931	2.9	1.6	1.2	.8	2.7	23.9	7.4	89.4	39.1	37.6	38.6	22.7	22.3
1932	5.0	2.0	1.3	.7	2.0	13.0	46.6	37.2	49.6	34.3	28.2	18.4	19.9
1933	6.2	2.0	1.4	.9	1.3	.8	24.9	39.0	49.4	30.6	17.7	6.2	15.0
1934	4.9	2.1	.8	.5	12.6	8.5	72.0	47.4	61.6	57.5	57.3	24.5	29.1
1935	4.1	2.6	1.8	1.1	8.4	8.1	75.2	84.0	49.7	33.4	12.9	10.1	24.3
1936	5.8	2.7	1.0	.6	4.4	18.8	36.0	29.8	44.2	34.3	12.8	17.9	17.4
1937	7.1	2.7	1.5	.7	1.4	25.8	86.1	158.6	68.8	39.4	48.2	33.1	39.4
1938	4.9	1.6	1.5	1.0	2.6	17.3	9.7	29.6	53.4	24.1	36.7	15.5	16.5
1939	3.5	1.8	1.3	.3	1.0	6.8	51.0	101.2	19.3	17.3	25.0	35.5	22.0
1940	4.6	1.9	2.3	.6	.7	16.0	102.9	24.2	30.7	29.6	18.6	10.3	20.2
1941	4.4	1.8	1.4	.6	1.7	18.5	9.9	54.0	46.9	30.3	12.4	9.2	15.5
1942	9.7	2.0	.7	1.0	2.5	10.0	15.3	58.0	20.3	22.8	4.4	4.0	12.6
1943	4.1	2.4	1.6	.6	.6	16.3	25.1	88.7	69.6	15.2	7.1	27.4	21.6
1944	5.2	1.9	.9	.8	6.1	10.8	20.5	18.7	52.3	23.9	13.0	6.4	13.4
1945	4.5	1.7	.9	.6	2.0	12.3	26.6	71.6	52.8	6.4	39.3	9.8	19.0
1946	4.0	2.2	1.7	1.1	3.0	3.1	43.3	42.9	26.4	24.8	5.1	10.1	14.0
1947	3.5	1.7	1.3	.6	3.5	9.6	36.4	81.3	22.4	23.9	27.3	21.7	19.4
1948	3.1	1.6	1.9	1.3	.7	5.3	39.1	108.6	37.4	15.9	13.8	12.3	20.1
1949	5.5	1.6	1.6	.6	.7	2.5	7.5	17.9	60.8	18.5	18.2	18.7	12.8
1950	3.8	2.4	1.5	1.0	3.0	23.1	43.2	46.0	54.0	41.9	29.9	10.4	21.7
1951	5.4	2.2	1.5	.6	1.6	14.2	14.3	61.2	44.2	14.9	28.4	19.0	17.3
1952	2.0	1.6	1.2	.8	1.2	24.3	5.8	60.7	13.4	44.0	9.5	20.0	15.4
1953	4.0	2.1	1.4	.6	1.3	30.8	13.4	61.8	64.8	17.7	11.7	23.8	19.5
1954	4.7	1.7	1.4	.8	1.9	4.9	45.0	24.0	58.1	14.3	11.6	11.0	15.0
1955	3.9	1.6	1.2	.7	1.7	1.0	11.7	72.0	26.3	24.1	24.1	8.3	14.7
1956	2.2	1.9	2.1	1.0	2.6	1.6	13.5	54.8	101.8	16.9	13.4	35.0	20.6
1957	8.9	2.9	1.4	.9	.7	4.1	20.8	66.5	47.0	26.0	13.7	3.1	16.3
1958	1.8	1.4	1.1	.7	1.5	13.4	75.7	20.2	72.5	21.4	8.2	5.1	18.6
1959	2.0	1.3	1.0	.6	1.5	2.0	4.5	37.2	27.7	27.2	32.4	10.3	12.3

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOT
1960	7.3	3.8	2.6	1.2	3.6	20.2	6.7	96.2	37.2	59.0	7.8	3.2	20.7
1961	2.8	1.4	1.0	.5	1.3	17.2	30.1	45.5	67.9	34.7	16.5	6.3	18.8
1962	2.3	1.8	1.0	.8	.9	6.5	64.4	40.8	60.8	12.9	12.1	5.1	17.4
1963	1.9	1.4	.8	.7	.8	22.2	31.0	29.0	49.8	10.4	4.8	5.1	13.2
1964	2.4	1.6	1.1	.8	1.9	18.3	27.3	92.7	53.4	21.6	27.2	35.0	23.6
1965	4.9	2.6	1.2	.8	2.3	12.0	20.6	19.2	26.8	10.8	15.6	10.4	10.6
1966	3.3	1.6	1.2	.7	8.5	6.1	13.0	13.1	47.9	7.6	50.2	5.2	13.2
1967	1.8	1.3	.8	.8	1.4	67.5	12.8	11.8	27.2	24.9	39.3	5.5	16.3
1968	3.0	1.5	1.1	.7	1.7	.8	49.6	58.2	42.2	32.3	6.0	4.2	16.8
1969	2.0	1.3	1.0	.6	.9	3.2	13.0	37.6	27.4	29.0	9.9	16.1	11.8
1970	1.9	1.3	.8	.6	.7	2.0	35.6	30.6	70.5	35.9	50.6	24.9	21.3
1971	2.7	1.5	.8	.5	1.5	6.6	40.9	31.3	31.1	4.5	29.3	11.0	13.5
1972	2.8	1.1	.8	.5	.9	23.7	148.5	157.8	34.4	5.8	4.7	5.6	32.2
1973	1.7	1.1	2.2	1.9	1.2	2.0	5.8	44.2	42.8	25.6	10.6	6.9	12.2
1974	3.0	1.5	1.1	1.0	1.7	9.6	17.5	84.4	14.8	29.6	50.4	7.7	18.5
1975	1.5	.8	.6	.5	.4	1.5	6.6	25.0	12.6	22.1	20.8	9.0	8.5
1976	1.7	.7	.4	.3	8.1	27.1	15.3	48.6	13.7	17.9	13.1	2.6	12.5
1977	2.0	.8	.6	.3	.3	2.3	21.6	29.6	12.5	12.8	26.5	2.4	9.3
1978	1.1	.9	.6	.4	.3	1.7	4.4	29.7	39.2	40.0	18.8	6.4	12.0
1979	4.0	1.6	1.1	.8	.5	21.8	59.0	68.9	38.6	23.9	10.9	11.3	20.2
1980	3.2	1.5	2.1	1.2	1.5	.9	17.7	20.6	54.8	24.0	34.2	13.7	14.6
1981	3.6	1.5	1.3	.8	1.4	31.9	50.9	55.5	49.5	25.1	25.9	15.3	21.9
1982	3.6	1.7	1.3	1.0	1.4	8.5	54.8	47.1	55.0	12.8	15.6	12.1	17.9
1983	4.4	1.7	1.2	.7	1.3	.8	3.0	70.9	51.1	22.1	7.6	4.6	14.1
1984	3.0	1.5	1.3	1.0	1.8	21.6	14.3	59.7	37.5	37.7	11.5	6.8	16.5
1985	2.8	1.7	1.3	1.0	1.8	68.5	48.4	32.7	59.8	24.6	14.6	9.6	22.2
1986	3.0	1.7	1.3	.8	1.8	1.7	25.5	74.6	31.5	14.5	15.8	6.5	15.2
1987	3.1	1.9	1.2	.8	3.0	12.8	7.5	32.3	55.0	23.1	17.2	19.0	14.7
1988	7.2	2.8	1.8	1.1	2.1	22.8	23.1	28.9	37.1	65.8	21.7	6.6	18.4
1989	5.2	3.5	8.3	4.1	14.2	13.4	21.5	50.5	52.0	31.1	14.9	5.7	18.7
1990	3.5	1.7	1.1	.6	1.7	7.0	35.1	39.6	56.4	17.5	14.2	12.6	15.9
1991	2.7	1.1	.6	.4	1.7	7.3	18.6	61.8	61.2	14.2	9.7	4.7	15.3
1992	2.0	2.1	.8	.5	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
N.OB.	81	81	81	81	80	80	80	80	80	80	80	80	80
AVER.	3.9	1.87	1.36	.84	2.70	13.9	35.8	55.1	45.3	25.0	20.4	12.6	18.2
ST.D.	2.1	.63	.90	.46	2.97	13.5	26.8	31.7	19.2	11.7	13.9	8.7	5.1
SKEW.	1.36	.75	5.79	4.49	2.41	1.94	1.39	1.52	.78	.99	1.35	1.22	1.22
C.V.	.53	.34	.66	.54	1.10	.97	.75	.57	.42	.47	.68	.69	.28
V.80%	2.0	1.40	.83	.60	.90	2.3	13.0	29.6	27.4	15.2	9.9	5.2	14.0
V.90%	1.9	1.10	.70	.50	.70	1.2	7.4	24.0	22.4	12.1	6.0	4.0	12.5
V.95%	1.7	.84	.60	.38	.50	.8	5.8	18.7	13.7	7.6	4.8	3.1	11.8

MWSS

[MANILA NORTH-EAST WATER SUPPLY PROJECT]

ANNEX I-6 Population and Households in Districts Related to the Marikina Watershed

May 1990

Municipality/Barangay	Population	No. of Households
ANTIPOLO		
Calawis	1,662	353
San Jose	26,121	5,067
San Juan	1,394	298
San Isidro	19,260	3,776
BARAS		
Pinugay	3,492	685
RODRIGUES		
San Rafael	10,548	2,060
SAN MATEO		
Pintong Bocaue	617	131
TANAY		
Santa Ines	1,256	270
Total	64,350	12,640

ANNEX I-7 Forest Occupancy in Rizal Province

1989

Municipality /Barangay	No. of Households	No. of Households Members	No. of Tiller Operators	Total Area of Farm
ANTIPOLO	1,218	5,279	925	2,825.73
Cailawin	173	838	185	698.66
San Jose	998	4,249	692	1,995.40
San Juan	47	192	48	133.67
BARAS	115	537	69	138.92
Pinugay	85	396	39	75.53
San Jose	13	57	13	26.34
San Salvador	17	84	17	37.05
JALA-JALA	71	349	72	169.66
Bayugo	71	349	72	169.66
RODRIGUES	494	2,380	479	1,349.71
Mascap	131	587	138	245.19
Puray	141	647	122	279.94
San Rafael	222	1,146	219	824.58
SAN MATEO	83	362	86	332.18
Pintong Bocaue	83	362	86	332.18
TANAY	526	2,668	389	1,448.22
Cuyambay	65	315	62	247.39
Daraitan	104	607	82	241.84
Kay-buto	52	229	41	128.01
Layban	126	585	82	348.74
Mamuyao	15	77	3	14.94
Santa Ines	34	122	33	177.18
Santo Nino	68	386	52	135.73
Tinucan	62	347	34	154.39
TERESA	82	371	85	200.16
May-Iba	82	371	85	200.16
Total	2,589	11,946	2,105	6,464.58
Total	1,642	7,305	1,302	4,235.20

Source : [Inventory of Forest Occupants-Southern Tagalog, DENR]

Barangays related to Marikina Watershed

ANNEX I-8-1 Source of Livelihood in Municipalities Related to the Marikina Watershed

Unit : Households

Municipality	Farming	Tree Farming	Forest Product	Employ't	Gov't Employ't	Profess'n	Business	Others	No Answer	Total
ANTIPOLO	852	9		60	23	6	28	232	8	1,218
BARAS	65	1		19	7		5	18		115
JALA-JARA	71									71
RODORIGUES	434		13	7	1			38	1	494
SAN MATEO	67	1		1				14		83
TANAY	340	8	70	44	13	1	16	34		526
TERESA	72			3	1		4	2		82
Total	1,901	19	83	134	45	7	53	338	9	2,589

ANNEX I-8-2 Crops in Municipalities Related to the Marikina Watershed

Municipality	No Answer		Palay		Corn		Vegetables		Root Crops		Other Crops		Fruit Trees		Coffee/Cacao		Other		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ANTIPOLO	75	3.56	471	22.38	322	15.30	269	12.78	405	19.24	373	17.72	804	38.19	248	11.78	508	24.13	925	43.94
BARAS	4	0.19	41	1.95	43	2.04	41	1.95	24	1.14			60	2.85	32	1.52	37	1.76	69	3.28
JALA-JALA			56	2.66	54	2.57	42	2.00	50	2.38	11	0.52	58	2.66	21	1.00	19	0.90	72	3.42
RODORIGUES	5	0.24	358	17.01	356	16.91	261	12.40	341	16.20	220	10.45	449	21.33	137	6.51	207	9.83	479	22.76
SAN MATEO			75	3.56	60	2.85	65	3.09	70	3.33	26	1.24	83	3.94	46	2.19	68	3.23	86	4.09
TANAY	9	0.43	256	12.16	288	13.73	323	15.34	302	14.35	130	6.18	341	16.20	222	10.55	161	7.65	389	18.48
TERESA	4	0.19	60	2.85	49	2.33	57	2.71	37	1.76	11	0.52	76	3.61	33	1.57	58	2.76	85	4.04
Total	97	4.61	1,317	62.57	1,173	55.72	1,058	50.26	1,229	58.38	771	36.63	1,869	88.79	739	35.11	1,058	50.26	2,105	100.00

Remark:multiple choice by the householders