Appendix-L

PROJECT EVALUATION

THE STUDY
ON
CRITICAL LAND
AND
PROTECTION FOREST REHABILITATION
AT TONDANO WATERSHED
IN
THE REPUBLIC OF INDONESIA

Volume-III

APPENDIX-L

PROJECT EVALUATION

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PROJECT EVALUATION

CHAPTER 1 INTRODUCTION

Appendix-L describes, in detail, methodological procedure and results of the project evaluation on the Watershed Conservation Plan (WCP) for the proposed intensive area in the Tondano watershed. The 6 main components of WCP under the evaluation are as follows :

- Forestry measures and actions,
- Agroforestry measures and actions,
- Physical construction works,
- Community empowerment measures and actions,
- Institutional capacity development measures, and
- Monitoring system development

Chapter 2 presents the scope and methodological outline of the project evaluation, discussing general approaches for economic and financial analyses. A framework of the cost-benefit analysis applied for the economic evaluation is conceptually described at the first part of Chapter 3, with important points specially considered to proceed the evaluation. Then, the chapter presents how to evaluate in monetary terms the following economic benefits, estimation of which is essential to complete the economic evaluation with the cost-benefit analysis :

- Increased water resources,
- Conserved or improved water quality,
- Strengthened erosion and flood control capacity,
- Improved or conserved air quality,

- Conserved or improved aesthetic and recreational amenity,
- Improved forestry resources,
- Conserved or improved fishery resources, and
- Improved or conserved agricultural resources

At last in Chapter 3, results of the benefit calculation and the cost-benefit analysis are presented, in addition to some findings from the sensitivity analysis on the estimated economic benefits and costs.

Chapter 4 is for establishment of a financial plan for the WCP implementation, which is a subject of the financial evaluation. Basic principles and potential financial sources for cost recovery are examined first, and then financial plans for each WCP measures are proposed depending on possible sources as well as kinds of costs.

A financial evaluation described in Chapter 5 consists of calculation of the Financial Internal Rate of Return (FIRR), cost recovery schedule for WCP, and a financial analysis on the farm household concerned. Finally in Chapter 6, some recommendations are mentioned towards the actual implementation of WCP from financial standpoints. Major topics are fund establishment and appropriate financial system. Chapter 7 discusses project feasibility and soundness from institutional points of view.

CHAPTER 2 APPROACH AND METHODOLOGY OF PROJECT EVALUATION

2.1 Scope of Project Evaluation

Technical evaluations of the proposed WCP were carried out through formulating necessary actions and countermeasures in the previous Appendixes concerned, while an environmental evaluation on WCP was implemented by means of the environmental impact assessment as described in Appendix K. Therefore, WCP is evaluated in Appendix-L, only from economic, financial and institutional points of view. For the results of technical and environmental evaluations, refer to their respective sections in the Appendixes concerned.

2.2 Analytical Approaches and Methods

The main goal of WCP is watershed conservation of the Intensive Area through sustainable land use, so that key components for the economic evaluation are environmental goods or services which have been conventionally ignored in the usual economic evaluation in monetary terms. At the same time, such watershed conservation measures as agroforestry and afforestation generate direct marketable products which are important factors to evaluate the financial validity of projects. Under these innate characteristics of WCP, the following analytical approaches and methods are applied in the project evaluation while the conventional cost-benefit analysis with the economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) are utilized:

1) To evaluate environmental benefits in monetary terms as much as possible, by reviewing the evaluation methods already developed or proposed by environmental economists,
2) To collect and make use of any related data from the existing case studies in economic analysis on the other environmental projects/programs, in order to set out scientific and reasonable assumptions for evaluation in any inevitable cases,
3) To utilize the results of the RRA survey and the environmental impact assessment implemented in the study, to collect reliable baseline information and data useful in applying evaluation methods especially for intangible environmental functions, and
4) To focus on how to recover the implementation cost of the proposed watershed conservation measures with limited marketable products, examining any possibility of financial instruments such as natural resource taxation and environmental funding system in association with foreign financial assistance.

Objective of the financial evaluation is to analyze viability of a proposed financial plan for WCP, examining whether the central and local executing agencies can procure money to recover the estimated costs for the WCP implementation. Money necessary for the WCP implementation can be largely classified into:

- Money to be input for initial investment (buildings, physical measures, facilities and equipment), and
- Money for running costs (O & M of the measures and staff salary).

Main components of the financial evaluation, under this objective, are consisting of:

- Calculation of FIRR, comparing the incremental costs with potential revenues from WCP,
- Formulation of a cost recovery schedule for loan including interests and repayment in accordance with the financial plan, and
- Examination on financial viability and feasibility of the proposed financial plan, by calculating balance based on the cash flow.

CHAPTER 3 ECONOMIC EVALUATION

3.1 Conceptual Framework of Cost-Benefit Analysis

The economic analysis is integrated into the evaluation of WCP by including not only direct costs of physical works, equipment, operation and maintenance (O & M), but also benefits and "damage costs" avoided in use of forestry resources and environmental functions of the Tondano watershed. This analysis builds on the environmental/resource economic expertise developed so far, aiming at evaluating feasibility of the WCP's implementation from the socioeconomic point of view.

For evaluation of socioeconomic feasibility, "Cost-Benefit Analysis" approach which is internationally common and accepted is applied with its general conceptual framework of evaluation equation as below:

$$NB = Bd + Be - Cd - Cp - Ce$$

where NB : Net benefit generated by implementation of a plan/measures
Bd : Tangible productive benefit directly generated
Be : Intangible benefit including environmental value
Cd : Direct cost necessary for the implementation
Cp : Cost for preventive measures for environmental conservation
Ce : Cost as environmental damage due to the implementation

In many cases of productive development or infrastructual sector projects, "Be" and "Ce" have been conventionally ignored as "external economic item" and "external diseconomic item" respectively. The both are usually regarded as unmeasurable in monetary terms.

A major part of the WCP's "Bd" is equivalent to "Be", while "Cd" equals "Cp". This is because its main target is to conserve a good quality of environmental functions of the watershed or to further improve them through sustainable land use. On the other hand, "Ce" hardly accrues from WCP for the same reason. Therefore, the most proper cost-benefit equation for WCP is as below:

$$NB = Be - Cp$$

If "Be" of WCP is still left unmeasured as conventional, any cost-benefit analysis calculating "NB" could be hardly carried out. In this context and nature of the WCP's benefits, the JICA Study Team considered the "Be"-calculation as essential.

3.2 Points of Economic Evaluation

Understanding both the economic and environmental values of the Tondano watershed's ecosystem, the cost-benefit analysis can serve as a useful tool in analyzing

conservation alternatives for the existing natural resources. The evaluation was carried out on various important functions of the watershed, including forestry and agricultural resources, soil erosion control, and purification of the surrounding environment. The followings are key points duly considered for accurate evaluation of these functions in the cost-benefit analysis.

3.2.1 Use of Social Cost and Benefit

Economic data, namely "social cost/benefit", reflecting real scarcity and consumption of local resources was utilized, not nominal market prices used in the financial evaluation. Shadow prices based on opportunity costs, standard conversion factors (SCF) and labor conversion factor (LCF) were calculated, when the related market prices were severely distorted.

3.2.2 Application of EIRR

Among the three typical evaluation criteria, i.e. EIRR, net present value (NPV), and benefit-cost ratio (B/C), EIRR was applied to finally examine the economic viability. It is because EIRR could reduce difficulty in selecting a specific discount rate from the very beginning of the analysis, which should be solved at first in cases of NPV and B/C.

3.2.3 Determination of Proper Discount Rate

Opportunity cost of capital, government borrowing rate, and social rate of time preference were examined in finally defining a discount rate and determining the trade offs between present and future values of the evaluated goods or services. But in case it is difficult to calculate the rate due to lack of necessary data, the discount rates applied by donor countries or international development banks are to be referred to.

3.2.4 Appropriate Time Horizon for Analysis

The economic analysis has to cover all the period when any cost or benefit accrues from the WCP's implementation consisting of both construction and operation stages. The WCP's benefits would last long beyond the period requiring direct costs of the conservation measures. However, 60-year is used as the time horizon subject to the economic analysis, since any costs and benefits accruing beyond such a period are discounted into present value of extremely small amount. One possibility to assess the economic soundness of WCP covering the further future is to discount the long-term benefits by setting basis years for discounting at the beginning of every generation

(every 30 ~ 40 years). This approach would be tried if the calculated EIRR becomes considerably low with the usual discounting due to major benefits in a longer term.

3.2.5 With-Project/Without-Project Framework

The analysis was carried out based on the net costs and benefits, identifying incremental costs/benefits generated purely due to the WCP's implementation. Natural degradation of environment, measured in the without-project situation, was distinguished from that under the with-project one. In the same way, any costs and benefits attributed to the other local plans and projects for rural improvement, infrastructural works, industrial development, tourism promotion and so on were discriminated from those of WCP. This is because the economic evaluation within the current study framework is defined for the watershed conservation, not for such existing or expected development projects which are the given conditions in formulating WCP.

3.3 Monetary Evaluation Methods for Environmental Benefits

Environmental functions of the Tondano watershed are major targets for conservation under the current study. The main purpose to apply the monetary evaluation methods is to qualitatively measure the benefits from the WCP's implementation, not to measure these environmental values of the watershed as a whole. Envisaged benefits from the WCP implementation could be largely classified into 8 categories as follows:

1) Increased water resources,
2) Conserved water quality,
3) Strengthened erosion and flood control capacity,
4) Conserved air quality,
5) Conserved aesthetic and recreational amenity,
6) Improved forestry resources,
7) Conserved fishery resources, and
8) Improved agricultural resources

Potential methods for estimating the monetary value of natural resources and environmental benefits, which might result from the WCP's implementation, were examined. The next table presents a menu of valuation techniques which have been developed so far in environmental/resource economics, as well as typical examples of the evaluated effects. These are largely divided into two categories (OVA and SVA), based on their extent of objectivity or subjectivity.

Menu of Valuation Methods for Environmental Effects

Valuation Method	Typical Effects Valued
(1). Objective Valuation Approaches (OVA)	
1) Change in Productivity	Productivity
2) Cost of Illness	Health (morbidity)
3) Human Capital	Health (mortality)
4) Replacement (Restoration) Cost	Capital assets, and natural resource assets
(2) Subjective Valuation Approaches (SVA)	
1) Preventive (mitigative) Expenditure	Health, productivity, capital assets, and natural resource assets
2) Hedonic Approaches	
- Property (Land) Value	Environmental quality, and productivity
- Wage Differential	Health
3) Travel Cost (TCM)	Natural resource assets, and touristic assets
4) Contingent Valuation (CVM)	Any effects including biological and aesthetic values

Source: Economic Analysis of Environmental Impacts, ADB/WB, 1994

Objective Valuation Approaches

The first set of methods in the table are the Objective Valuation Approaches (OVA) that are based on physical relationships that formally describe cause and effect relationships and provide objective measures of effects resulting from various causes. OVA use "damage functions" which relate the level of offending activity to the degree of physical damage to a natural or man-made asset, or to the degree of health impact. OVA in general provide measures of the gross benefits, in the sense of losses avoided, of preventive or remedial actions. The important assumptions for OVA are:

- The net value of averting damage is at least equal to the cost which would be incurred if the damage actually occurred; and
- Rational individuals, in order to prevent some damage from occurring, would be willing to pay an amount less than or equal to the costs arising from the predicted level of environmental effects.

Subjective Valuation Approaches

In contrast to OVA, the second set of approaches in the table, the Subjective Valuation Approaches (SVA), are based on more subjective assessments of possible damage expressed in real or hypothetical market behavior. Using revealed behavior involves examination of real markets for goods or services which are affected by environmental impacts, such as air or water pollution, in which people actually make trade offs between the environmental impact and other goods or income. In other cases environmental impacts cannot be valued, even indirectly, through market behavior. The alternative is to construct hypothetical markets for various options to reduce environmental damages, and

to ask directly a sample of people to express how much they would be willing to pay for various reductions in environmental impacts. These are the so-called "Contingent Valuation Methods" (CVM).

3.4 Applicable Evaluation Framework for WCP's Benefits

The choice of a particular method of measurement obviously depended on what was being measured. Figure L.3.1 presents a valuation flowchart that suggests where an analysis might begin. The figure starts with any environmental impact and determines whether or not there is a measurable change in production, or if the primary effect of the impact is change in environmental quality. According to this flowchart and availability of necessary data for monetary calculation, the more applicable evaluation methods for the above-mentioned 8 kinds of benefits brought from watershed conservation could be selected as below.

3.4.1 Increased Water Resources

It was assumed that development water discharge (incremental water discharge usable during the dry season) was equal to an average outflow of groundwater fostered by incremental vegetation attributed to the WCP measures. Therefore, benefit of the water fostering function of the incremental vegetation was evaluated with costs necessary to obtain the same development discharge from irrigation dams (construction and O & M costs of irrigation dams).

Natural vegetation in the watershed fosters groundwater for use in the watershed area and the downstream. And the fostered water flows into rivers and lakes, contributing to stabilization of discharged water amount there. So, loss of the vegetation affects the groundwater utilization and river discharge, decreasing products of agricultural and fishery sectors using water as key input. These industrial production losses can be taken as value of the water fostering function of the vegetation.

Increased water resources → Change in environmental quality → Human habitat
→ **Replacement Cost Method**

[Benefit] = [Incremental vegetation area] × [Average unit groundwater outflow of vegetation] x [(Annual construction cost of irrigation dam per unit development discharge) + (Annual O&M cost of irrigation dam per unit development discharge)]

Increased water resources → Measurable change in production → Non-distorted market prices
→ **Change in Productivity Method**
[Benefit] = [Incremental vegetation area] × [Fostered groundwater per unit vegetation] ×
[Contribution rate of unit groundwater to each sectoral production]

3.4.2 Conserved or Improved Water Quality

The value of water quality was assumed to be equivalent to the incremental cost of treating the water so that it is suitable for downstream uses. The level of treatment depends on the downstream use. For example, irrigation water does not require the same level of purity as drinking water, so the cost of treating water for use in agriculture would be less than drinking water supply.

Removal of suspended solids is the largest incremental cost for restoring water quality in Lake Tondano to suitable quality for downstream users. The incremental cost could be calculated as the extra alum or lime, filter capacity, treatment plant operation costs, etc. needed to treat the excess suspended solids, as compared with the quantities needed to treat the suspended solids that are naturally present in the water.

Conserved or improved water quality → Change in environmental quality → Water quality
→ **Replacement Cost Method** or **Preventive Expenditure Method**
[Benefit by preventive expenditure method]
= [Reduced water pollutants]
× [Unit cost for construction & operation of water filter plant to remove the pollutants]

3.4.3 Strengthened Erosion and Flood Control Capacity

In case there is stripped area without vegetation in the watershed, severe erosion would occur under heavy rainfall and its downstream water quality is degraded. So value of the vegetation's erosion control function was evaluated using construction cost of check dams to control and mitigate the washed-away soil.

Strengthened erosion control capacity → Change in environmental quality → Water quality
→ **Replacement Cost Method** or **Preventive Expenditure Method**
[Benefit by preventive expenditure method]
= [Amount of soil erosion without vegetation]
× [Unit cost for check dam construction to control or mitigate the washed-away soil]

Watershed degradation contributes to increased flooding in two ways. First, tree cutting and other land disturbance reduce the water holding capacity of the soil, causing larger peak flows of drainage after rain storms. Second, the sediment that erodes from the stripped or disturbed land fills the beds of rivers and lakes, allowing

flood water to rise above the river and lake banks. The value of flood damage resulting from watershed degradation could be estimated as the value of the incremental amount of increased flooding or decreased flood control capacity.

When land and buildings are damaged, the measure of damage should be calculated as the cost to restore them to their original condition. The restoration activities might include removal of mud and dust, repairing of buildings and paddy dikes, and finding temporary accommodation while the buildings are being repaired. Roads, bridges, pipelines, electrical power lines and other public infrastructure could be damaged by mud slides and flooding associated with land disturbance activities in the watershed. The value of the damage in these cases could be calculated as cost to rebuild or relocate the damaged infrastructure.

Strengthened flood control capacity →Change in environmental quality
→ Human habitat → **Replacement Cost Method**
[Benefit] = [Reduced cost to rehabilitate damages due to mud-slide and flooding]
= [Cost to restore damaged land & building] + [Cost to remove mud & water]
+ [Repair cost of paddy dikes]+ [Cost to rebuild or relocate damaged infrastructure]
+ [Other expenditure in rehabilitation]

The next equation reflects that the loss of revenue from lost farm production is a value of the strengthened erosion- and flood-control capacity when agricultural land is covered by mud slides.

Strengthened erosion and flood control capacity → Measurable change in agricultural production
→ Non-distorted market prices → **Change-in-Productivity Method**
[Benefit] = [Agricultural area protected from erosion] × [Incremental products]
× [Unit market price of product]

3.4.4 Improved or Conserved Air Quality

Oxygen supply function of the incremental vegetation under WCP was evaluated by calculating the oxygen weight discharged from the vegetation based on the existing research data, which is multiplied by unit market price of the industrial oxygen. And amount of CO_2 absorbed by the incremental vegetation was estimated for calculation of a total cost to remove them alternatively. This total cost is regarded as an economic value of the air purification function of the incremental vegetation.

Improved air quality → Change in environmental quality → Air quality
→ **Replacement Cost Method**

[Benefit] = [Amount of incremental vegetation] x {[(Annual net O_2 discharge per vegitation) x (Unit market price of O_2)] + [(Annual net CO_2 absorption per vegitation) x (Unit removal cost of CO_2)]}

3.4.5 Conserved or Improved Aesthetic and Recreational Amenity

The value of the aesthetic quality of the natural environment is difficult to calculate in monetary terms, because it depends on the subjective preference of each individual person. One approach to assigning a monetary value to aesthetic qualities is to estimate how much the people living in an area would pay to preserve them (willingness to pay, WTP). The cumulative regional WTP could be interpreted to be equal to the overall value of restoring the aesthetic quality of the environment.

In addition, it is likely that Indonesian and international tourists who visit the Tondano watershed area would also be willing to pay some small amount of money such as a surcharge on hotel room rates for preserving the aesthetic quantities of the watershed.

Conserved or improved aesthetic quality → Change in environmental quality
→ Aesthetics → **Contingent Valuation Method**

[Non-use benefit including existence value]
= [Average WTP of non-use value of local households] × [Number of local households]
+ [Average WTP of non-use value of tourists] × [Number of tourists]

Conserved or improved aesthetic quality → Change in environmental quality
→ Recreation → **Travel-Cost Method** or **Contingent-Valuation Method**

[Use-benefit by travel cost method]
= [Average travel cost of tourists] × [Incremental number of tourists]
+ [Average travel cost of local visitors] × [Incremental number of local visitors]

[Average travel cost] = [Transportation fee] + [Time cost] + [Opportunity cost]

[Use-benefit by contingent- valuation method]
= [Average WTP of use value of local households] × [Number of local households]
+ [Average WTP of use-value of tourists] × [Number of tourists]

Tourism accounts for a part of the trade of goods and services in the Tondano watershed. A majority of tourists visiting the watershed could be classified as 'Adventure and Ecotourists', enjoying the natural landscape of the area.

Conserved or improved aesthetic quality → Measurable change in tourism production
→ Non-distorted market prices → **Change in Productivity Method**
[Benefit] = [Incremental tourists due to environmental improvement or conservation]
× [Incremental net profit of tourism sector per tourist]

3.4.6 Improved Forestry Resources

Forests provide several valuable goods and services, including wood products, flood control by stabilizing soil, aesthetic quality and habitat for wildlife. Potential methods for calculating the value of the loss of flood control and aesthetic quality are mentioned in the above Sections 3.4.3 and 3.4.5 respectively. The value of wildlife habitat could be considered to be included in the aesthetic evaluation, similar to the value of a scenic view or a clear lake.

The value of loss of timber and other wood products could be estimated as the overall income that would be derived from harvesting, processing, and selling the products on a sustainable basis. This income could be estimated by comparing the income from sustainable logging on land of similar area, tree types, proximity to roads and factories, etc. where watershed management has been well done.

Improved forestry resources → Measurable change in forestry production
→ Non-distorted market prices → **Change in Productivity Method**
[Benefit] = [Incremental forest land] × [Amount of incremental forest goods]
× [Unit market price of forest goods]

3.4.7 Conserved or Improved Fishery Resources

Siltation of river/lake beds and other fish habitat is the main source of environmental damage that poor waterhsed management causes to fishery resources. Top soil is eroded during heavy rain, and the sediment drains into these sensitive aquatic areas decreasing their ability to support fish life. The value of the damage to fishery resources might be estimated as the loss of fishing income caused by the siltation of fish habitat.

The loss of fishing income might be estimated directly or indirectly. If historical records were available, it might be possible to directly estimate the reduction in fishing income. But these results might be unreliable because such factors as improved fishing techniques and boats, increase in the sale price of fish, and increases in the number of people who work in the fishing industry must all be considered. In addition, this direct estimate might unfairly bias against the watershed management, because the other factors such as over-harvesting and pollution from the inland fishery itself might have contributed to the decline in fishing. Consequently, an indirect method of

comparison would probably give better results.

Conserved or improved fishery resources → Measurable change in fishery production
→ Non-distorted market prices → **Change in Productivity Method**
[Benefit] = [Improved or conserved water area]
× [Amount of incrementally caught fish and other fishery products]
× [Unit market price of such fishery products]

3.4.8 Improved or Conserved Agricultural Resources

Under the proposed land use of WCP, there would be hardly incremental agricultural land. However, the extension program of agroforestry technology would increase productivity of the existing agricultural land. This could be a major benefit of WCP, so that the incremental agricultural products between with-project and without-project were evaluated with non-distorted market prices.

Improved agricultural resources → Measurable change in agricultural production
→ Non-distorted market prices → **Change in Productivity Method**
[Benefit] = [Amount of incremental agricultural products]
x [Unit market price of the agricultural products]

3.5 Results of Benefit Calculation and Cost-Benefit Analysis

In accordance with these theoretical and measurement frameworks, values of the benefits (mostly Be) from the WCP's implementation were calculated in monetary terms. At last, qualitative description, calculation assumption, calculation procedure, and estimated value for each benefit were detailed in Tables L.3.1 ~ L.3.8 and summarized in the next table.

Annual Economic Benefit of WCP Implementation

Benefit Items	Evaluation Method	Benefit in 14th Year (Rp. million in 2000 price)	Ratio (%)
(1) Increased water resources	Replacement cost	1.0	0.0
(2) Conserved water quality	Preventive expenditure	negligible	---
(3) Strengthened erosion and flood control capacity	A. Replacement cost	1.3	---
	B. Change in productivity	1.9	---
	C. Preventive expenditure	* 426.2	9.5
(4) Conserved air quality	Replacement cost	10.4	0.2
(5) Conserved aesthetic and recreational amanity	Contingent valuation, Travel cost, or Change in productivity	negligible	---
(6) Improved forestry resources	Change in productivity	23.5	0.5
(7) Improved fishery resources	Change in productivity	unmeasurable	---
(8) Improved agricultural resources	Change in productivity	4,025.2	89.7
	Total	4,486.3	100.0

*Note : * For Item (3), the benefit estimated with the Method C is only counted ignoring double counting with the Methods A and B.*

Inputting these economic benefits in addition to economic costs for the proposed measures under WCP (Tables L.3.9 ~ L.3.14), the cost-benefit analysis was carried out. The following conditions or assumptions were applied to the analysis.

1) Project life under analysis is 60 years after commencement of WCP. The economic benefits are supposed to occur even after the target year (the 14th year) in a long term, while effects of discounting are almost nothing without any present values beyond two generations.
2) Most of the O & M costs occurring in the target year should be also expended every additional year through the project life, in order to keep the same conservation level as in the target year.
3) Intangible environmental benefits commence to occur in the second year of the WCP's implementation, in a proportional way toward the target year, and then is constant from the target year to the end of the project life.
4) All prices are expressed in 2000 constant prices with an average exchange rate of 2000 (Rp. 9,100 / US$).
5) The estimated financial costs are re-calculated as economic costs by multiplying them with the standard conversion factor (SCF) of 0.995 (Table L.3.15).
6) The financial unskilled-labor costs are re-calculated as economic cost by multiplying them with the labor conversion factor (LCF).

   LCF = SCF x (1 - Unemployment rate) = 0.995 x (1 – 0.2) = 0.796

Annual break-down of the costs by measure is presented in Table L.3.16, showing an overall spread sheet to compare costs and benefits. EIRR and B/C (with 12% discount rate) were calculated as 4.5 % and 0.39, respectively, based on this spread sheet. To assess socioeconomic feasibility of WCP, this EIRR figure has to be compared with "social rate of time preference" which is usually difficult to calculate. Therefore, many donor agencies are using "opportunity cost of capital" as its approximation to evaluate economic feasibility of their aid projects, such as 12% of World Bank, 10% of ADB, 8% of USAID, and 7% of JBIC.

Referring to these rates, it can be justified that the WCP implementation is economically acceptable from social viewpoint of the Study Area, taking account of the following factors.

1) The social rate of time preference is theoretically lower than the opportunity cost of capital.
2) Intangible benefits of WCP such as fishery, scientific, ecological and educational values as well as non-use value were not fully counted in the cost-benefit analysis.

3.6 Sensitivity Analysis

A sensitivity analysis was carried out to evaluate socioeconomic soundness of the WCP implementation against unexpected adverse changes of the economic costs and benefits in the future, by examining potential effects on EIRR of the following three situations:

a) In case that the WCP costs run over the estimated prices and physical contingencies by 10%,
b) In case that the expected benefits decrease by 10%, and
c) In case of combination of the above two situations

The effects of these changes on EIRR are summarized as in the next table. Elasticity on the project feasibility in all these three cases is large, since EIRR ranging from 3 to 4% is below even the JBIC's evaluation standard rate.

Results of Sensitivity Analysis

Cases	Estimated	a) Cost + 10%	b) Benefit – 10%	c) = a) + b)
EIRR (%)	4.5	3.9	3.9	3.3

CHAPTER 4 FINANCIAL PLAN

4.1 Consideration of Cost Recovery of WCP

4.1.1 Basic Principles of Cost Recovery for WCP

Under the national and local socioeconomic and financial background, the following three principles were basically set out for considering on how to recover the costs necessary for the WCP implementation.

(1) Extra Financial Source for WCP

An obligation of GOI is to contribute financially to watershed conservation, using possible financing sources for watershed management activities, such as the state budget allocated for it. However, because the existing financial sources of the central and provincial governments are quite limited, some other financial sources have to be found ignoring too much rely on the existing national and local municipalities' budgets.

(2) Polluter Pays Principle (PPP)

Private or public degraders of the Tondano watershed area should pay to recover their damages to the important watershed functions. There are the obligations of those who exploit natural/environmental resources to contribute financially to their protection. In general, a degrader should not receive public subsidies to control the damage he generates (e.g. grants or tax allowances for damage control equipment, below-cost charges for public services, etc.).

(3) User Pays Principle (UPP)

Another guiding principle of sustainable development, UPP, concerns the allocation of and charges for resource use. Users of or beneficiaries from the natural resources in the Tondano watershed should contribute based on their payable capacity. Its premise is that all resource users should pay the full long-run marginal social cost of using a resource and related services.

4.1.2 Potential Financial Sources for Cost Recovery for WCP

Applying these three basic principles, the following four types of sources were considered as major and more possible ones to jointly finance the WCP implementation.

(1) Special Forestry Program in Indonesia

There would domestically be some possibility for additional financial support to WCP, especially for training and technical co-operation related to monitoring and institutional activities in the local communities. For example, the following rehabilitation programs for the forestry sector have been established with financial support under the new forestry law (Law No. 41/999) (For more detail, refer to Appendix-F) :

- Reforestation program (Reboisasi),
- Regreening program (Penghijauan) with Regreening Assistance Fund,
- Tending program (Pemeliharaan),
- Enrichment planting program (Pengayaan tanaman), and
- Soil conservation program through vegetative and mechanical means on critical and non-productive lands.

(2) Grant or Loan from Bilateral or Multilateral Donors

A certain portion of the costs for WCP could be financed from foreign grant or borrowing, taking account of the OECD/DAC policy putting emphasis on assistance for environmental sector as well as the past donors' technical and financial cooperation to Indonesia. For example, the Partnership Program of Japan would be a potential technical assistance tool on a grant basis.

(3) Private or Public Industrial Enterprises as Degraders

In accordance with the PPP principle, these enterprises should control and manage damages to the watershed functions from their economic activities. Although potential industries as degraders include forestry, agriculture, inland fishery and tourism around Lake Tondano, there would be no clearly identified sector or people considerably degrading the watershed at present.

(4) Users and Beneficiaries of WCP

Under the UPP principle, the three kinds of users or consumers of natural resources in the Study Area could be considered, such as local farmers, tourists and fishermen. There would be potential space for local people to contribute some labor force or money for WCP. A part of beneficiaries might be local fishermen using aquatic resources in Lake Tondano, though their benefits from the WCP implementation are unclear. On the other hand, local farmers involved in the proposed agroforestry program are a large number and could obtain incremental benefits definitely (Refer to Section 5.3). Some portion of their extra profits could reasonably be sources to fund

the Agroforestry program as well as their community development.

4.2 Establishment of Financial Plan to Implement WCP

Considering the potential financial sources and procurement methods to collect and manage money necessary for the measures included in WCP, their combination could be proposed. A financial plan is also based on the three basic principles for cost recovery above-mentioned.

A large size of the initial investment is to rely on the international donors' soft loan, while the O & M costs are covered by domestic financial programs and by charging to local farmers as users of natural resources in the Tondano watershed. And costs for the proposed institutional measures and software works, such as planning, surveys, training and equipment, are suitable to local governmental budgets or grant assistance from possible donors. Financial planning for each WCP measure was considered in detail as below. The next table shows a summary of the financial plan by WCP measure and type of financial arrangement.

(1) Forestry Measures and Actions (Table L.4.1)

The proposed forestry activities consist of 1) forestry boundary setting, 2) reforestation, 3) forest patrol, 4) research on non-wood forest products, 5) community forestry, 6) timber plantation, and 7) delivery stations for firewood plantation. For the first 14 years, these activities necessitate about Rp.10 billion in 2000 market price. Out of them, costs for skilled labor (experts, extension workers, etc.) and new equipment are to be procured through foreign donors' grant services including technical assistance projects and partnership programs. And the remaining costs necessary for the unskilled labor as well as materials should be financed domestically. Besides, all the expenditures from 15th year on are also suitable to domestic arrangement because they can be regarded as O & M or replacement costs.

Summary of Financial Plan for First 14 Years

Measures under WCP	Project Cost by Financial Arrangement for First 14 Years (Rp.million in 2000 price) Grant (%)	Soft-loan (%)	Domestic-financing (%)	Total (%)	Major Financial Sources of Cost Recovery for Soft-loan and Domestic Financing
(1)Forestry measures and actions	7,123 (73)	0 (0)	2,652 (27)	9,775 (100)	- Reforestation program - Regreening program - Tending program - Enrichment planting program
(2)Agroforestry measures and actions	5,639 (82)	0 (0)	1,268 (18)	6,907 (100)	- Local farmers - Soil conservation program
(3)Physical construction works	0 (0)	6,379 (70)	2,780 (30)	9,159 (100)	- Reforestation program - Regreening program
(4)Community empowerment measures and actions	9,754 (41)	0 (0)	14,256 (59)	24,010 (100)	-----
(5)Institutional capacity development measures	10,124 (73)	0 (0)	3,657 (27)	13,781 (100)	- Governmental routine budget (APBN/APBD)
(6)Monitoring System Development	1,189 (25)	0 (0)	3,578 (75)	4,767 (100)	- River clean-up program (PROKASIH) - Governmental routine budget (APBN/APBD)
Total	33,829 (49)	6,379 (9)	28,191 (42)	68,399 (100)	-----

Note: Total cost differs from that in Table J.4.30. It is that the above total includes domestic costs spent routinely which is excluded in Table J.4.30, while the price contingency is not taken into account.

(2) Agroforestry Measures and Actions (Table L.4.2)

Major activities are extension training for agroforestry, costing approximately Rp. 7 billion in the first 14 years. Remuneration for trainers and salary for other skilled labor in addition to extension equipment costs should be donated with the donors' grant program, while the other expenses (remuneration for trainees, training materials, equipment maintenance, etc.) are to be financially procured by the Indonesian side. Then, all the costs accruing after the 15th year to sustain the introduced agroforestry activities could be funded within Indonesia, as well.

(3) Physical Construction Works (Table L.4.3)

The physical construction includes 1) check dam, 2) groundsill, 3) river revetment works, 4) hillside works, and 5) road cut slop protection. Major initial costs for labor, equipment, material and engineering services could be funded through foreign grant program. On the other hand, indirect construction cost such as O & M, land acquisition, physical contingency as well as equipment replacement is to be procured domestically. The total cost necessary within the first 14 years was estimated as Rp. 9

billion.

(4) Community Empowerment Measures and Actions (Table L.4.4)

This is for local community development activities, which would play a key role for the future watershed management in Tondano. All costs for the pilot projects of Rp. 10 billion will accrue during the first four years. The pilot project activity for community empowerment could be financed with the international grant system such as the partnership program of Japan.

(5) Institutional Capacity Development Measures (Table L.4.5)

The measures are totally for institutional building and training without any physical works, costing about Rp. 14 billion for the first 14 years. Expenditures for equipment and international personnel should be financed through foreign donors' grant assistance, while training material, Indonesian personnel and equipment maintenance cost would be arranged domestically in Indonesia.

(6) Monitoring System Development (Table L.4.6)

This is to establish and enforce the monitoring system for the future management of the Tondano watershed, providing monitoring facilities and equipment. The total cost for the initial 14 years amounts to about Rp. 5 billion, direct costs for facility construction and equipment purchase of which are proposed to be arranged through donors' grant program. The remaining part such as indirect cost, equipment O & M and engineering services is to be arranged domestically by the Indonesian side.

CHAPTER 5 FINANCIAL EVALUATION

5.1 FIRR Calculation

The breakdown of financial costs and revenues accrued from EMP are tabulated year by year as shown in Table L.5.1. FIRR and B/C were calculated as 5.4 % and 0.27 respectively, simply comparing the incremental costs with potential revenues, based on the evaluation conditions that the project life for financial evaluation is 60 years and that the future annual inflation rate will be 1.66 % (an average rate between 2 % in 1999 and 1.32 % in 2000). This is because of the long repayment period and necessity of continuous O & M and equipment replacement cost even after the target year to maintain the WCP goals. The sensitivity analysis under the same conditions for EIRR (Section 3.6) implies that FIRR decreases to 4.2 ~ 4.8 %. And another sensitivity analysis for inflation (price escalation) was carried out, since the inflation in Indonesia had drastically increased up to 10 % in 2001. Assumption of 10 % inflation rate up to the 10th or 20th years resulted in FIRR of 7.4 % or 10.8 %, respectively.

These FIRR figures are lower than the market interest rates in Indonesia, as tabulated below. Such low FIRR figures are not feasible for usual commercial or productive projects carried out by profit-oriented enterprises so that money should be invested to more profitable projects. However, most of the measures proposed under WCP are for watershed conservation hardly generating internal monetary profits, and implemented mostly by non-profit public agencies. Therefore, from viewpoint of the public implementing agencies, WCP might be regarded as financially acceptable, when its FIRR is over 0% at least.

Market Interest Rates in Indonesia for 1999/2000

Bank	State banks	Regional government	Private national	Foreign	Commercial	Average
Rp. Time Deposit Interest Rate (%/year)	15.4	14.9	20.3	13.1	15.6	15.9

5.2 Cost Recovery Schedule for WCP

In accordance with the financial plan proposed in Chapter 4 and the following financial arrangement, the cost recovery schedules for the measures of WCP were formulated as in Table L.5 2:

- Interest rate of donor's soft loan : flat rate of 1%
- Maximum repayment period of the donor's soft loan : 40 years (including 10-year grace period)
- Payment during the grace period : only interest payment

- Tax duty : all the costs for WCP free from any taxation obligation
- Duration for cost recovery : 60 years

The schedules include interest, repayment, and domestic expenditure such as O & M costs, all of which amount to the total cash outflow to be recovered. Grant portion is excluded from the cash outflow.

Annual average is about Rp. 0.9 billion ranging from Rp. 4.2 billion in the fifth year to about Rp. 280 million for the final period. These cash outflows in the cost recovery schedules are compared with the potential revenues. As the total annual budget for forestry services of the North Sulawesi province in 1998/1999 was more than Rp. 7 billion of which over 80% was for project implementation (refer to Appendix-I), the expected provincial budget for 60 years would be able to adequately cover the cash outflow as a whole. The proposed financial plan is appropriate to realize a sound financial management for WCP.

5.3 Financial Analysis on Farm Household and Capacity to Pay

The farmers, who would participate in agroforestry activities under the WCP measures, are a major beneficiary group of the Tondano watershed conservation because their agricultural incomes are expected to increase. With such income improvement, there would be a strong incentive for them to participate in agroforestry. While the technical extension costs for agroforestry would be expended by the local executing agencies, these farmers are required to pay for some basic inputs such as saplings and fertilizers and to provide labor force for cultivation.

Aiming at assessment on the future financial situation of the farmer's households as well as on extent of the financial incentive to them, a farm budget analysis was carried out based on the incremental net revenue from the agroforestry activities under WCP. According to the results of the farmers' interview survey for 5 villages as mentioned in Section 3.1.1 of Appendix-G, the average farm size is about 1.4 ha per farm household ranging 1.2 to 1.6 ha. Since the agricultural area owned by the local farmers is too similar to examine the financial impact on the farmers' communities of the agroforestry promotion under WCP, the analysis was done by intensive area, not by farm size. The next table summarizes its result. (For more detail, refer to Section 4.2.7 in Appendix-G.)

Average Incremental Financial Balance by Intensive area

(Unit : Rp. 000/Household/year)

Intensive Area	East Area		South Area		West Area		Total Average	
Financial Item	Without	With	Without	With	Without	With	Without	With
Income	11,404	12,221	9,382	10,205	9,779	10,534	10,188	10,986
Expenditure	10,957	11,254	8,958	9,245	9,409	9,617	9,775	10,039
Balance	447	967	424	960	370	917	413	947
Incremental Balance	520		536		547		534	
Increase Rate (%)	116		126		148		129	

They could generate a considerable increase of balance by nearly 130% on average, so that they would have a strong incentive enough to be involved in the agroforestry program and be even a financial source for some costs needed for the WCP measures.

CHAPTER 6 RECOMMENDATIONS ON FINANCIAL ASPECTS

6.1 Establishment of Funds for Community Development

For instance of dam construction projects in Japan, establishment of "funds", financed by downstream administrations for the sake of upstream regions, has been practiced in several major river basins since the early 1970s. It stemmed from the recognition prevailing in upstream areas during the 1950s and 1960s that only those in downstream regions enjoyed the benefits created by dams. Laws and regulations for establishing funds were enacted in the early 1970s.

Funds might be usually regarded as a mechanism to share benefits of a project, which are enjoyed only by a certain people in limited areas, among people in the whole project on- and off-sites. The aims of such funds are firstly to meet the operation and maintenance cost of the project as well as in promoting rural development of the project site, and secondly to pay interest on the money provided to the local people who have to purchase additional inputs for the project.

The latter is in cases, where the project requires the local people to expend a lot of money in participating into the project. It might not be appropriate for WCP in Tondano. However, the former seems quite relevant for the current project, for enhancing local community of the area where the existing farmers start improved agroforestry to conserve the watershed, which is indispensable to empower the community functions for the purpose of economic stabilization on the newly directed cultivation activities. Funds might also be used to meet unexpected expenditures incurred after introduction of the agroforestry techniques, which are generally not covered by the initial budget for the project, such as taking additional and corrective measures for the local farmers who failed to re-establish their livelihood with agroforestry practices.

In addition, funds could be utilized to give project executing agencies monetary incentives to employ local people who are not skilled enough to be employed for physical construction works without such support. The creation of funds might be instrumental in the Tondano watershed for the sake of safeguarding job security of the local farmers, particularly when they are obliged to change cultivation patterns under agroforestry measures.

The most potential financial source of the fund could be the incremental profits of the farmers expected through agroforestry activities under WCP. Since their profits with the project will increase by about 30% on average compared with the without-project case, 5 ~ 10% out of the 30% could be contributed by each farmer to establish the fund.

The fund would be utilized mainly for enhancement and development of their own communities and for financially safeguarding their agroforestry practices on the sustainable basis in the future. Besides, this financial back-up would meet a system "Social Safety Network" proposed in Appendix-E.

6.2 Appropriate Financial System for Funding WCP

In the Indonesian budget system, a large part of money collected on a local level has generally gone to the central governmental reserves. And then each provincial budget is usually controlled and re-allocated based on the central governmental financial policies. It means that all the collected money as provincial revenue does not necessarily come back for the local expenditures including watershed conservation. Under such the central government's budget control, many public service offices have a lack of budget even for their routine works.

Therefore, unless the central government could arrange special additional budget for the WCP implementation from the central reserves, some special financial system for funding WCP should be proposed in cooperation with foreign financial assistance.

CHAPTER 7 INSTITUTIONAL EAVALUATION

7.1 Key Institutional Outcomes

How far will the implementation of the development plan address the institutional problems as identified?

The current conditions which are driven mainly by the present disarray surrounding the recent constant atmosphere of instability within central government structures, and the decentralization process requires a broad based approach to institutional development. A strategy is required, not only to build capacities, but also to create linkages between several key regional institutions and between these institutions and the community. The coordination of, and cooperation between these institutions is an imperative ingredient in the recipe for sustainable development in the Tondano Watershed. Successful project implementation will produce the following key outcomes that will contribute to the achievement of this condition by ensuring that each stakeholder institution has a distinct role, and each role is undertaken in a reliable, professional and positive manner:

1) A consolidated Legal and Regulatory Framework for coordination of all forestry stakeholders in the Tondano watershed including regulations and decrees about forestry management in the North Sulawesi/Minahasa regions specifically.
2) A consolidated organizational structure for all Province and District Forestry Offices and units with written terms of reference including authorities, duties and responsibilities of all key positions.
3) A consolidated capacity for local agroforestry research and development and a system for routine dissemination of findings, and an action plan to ensure application in the environment.
4) A consolidated village cadre training center and a band of village cadres who will always be available as village forestry development facilitators.
5) A consolidated accurate village boundary mapping and update process, complete with an up to date set of geographically referenced village boundary maps (digital and hardcopy), for planning, to support facilitation of micro village level project implementation, geographical coordination and monitoring and evaluation.
6) A consolidated watershed management capacity at local universities which will serve to maintain momentum and interest in conservation committee meetings, and strengthen the idea of holistic watershed management. This capacity will be developed from the perspective of both social and pure sciences.
7) A consolidated watershed conservation committee, which, although being initially

focussed on conservation will create a strong foundation for gradual sustained development, toward a broader based watershed management capacity.

8) A more integrated and coordinated approach to government activity and project planning.
9) Strengthened capacity of local NGOs to act as community representatives and village facilitators, as well as project implementors, and an alternative source of monitoring and evaluation.
10) A consolidated and sustainable recruiting and management process for maintaining the band of village cadres.
11) A consolidated village proposal submission process open to the broadest range of community institutions and groups. This process will provide the framework to guarantee maximum involvement of the community in identification, planning, implementation and management of village development (forestry).
12) A coordinated information system that will channel data through the district to the provincial office and run on a sustained regular update of watershed data, and ad hoc updates as required. A regular reporting and dissemination strategy will also be in place to ensure that the community are kept up to date with forest conditions in the watershed.
13) A reallocation of duties and responsibilities which will see the province office take a leading role in regional coordination, planning, monitoring and evaluation, while the district office will concentrate on supervision and implementation of watershed rehabilitation projects (forestry).
14) Consolidated and improved leadership and management structures within forestry offices that will be combined with improved human and material resources, and work practices to support efficiency and effectiveness of government forestry offices, particularly the Minahasa forestry services office.

Analysis of Problems and Outcomes

Problems as stated in Field Report	Effect of Outcomes/ Comments
(1) Salary	Out of project scope: Recommendation only to central and regional Government
(2) Routine operational budget	Out of project scope: Recommendation only to central and regional Government, however, establishing a village proposal process, and re-aligning the role of Government extension services workers to village project supervision will re-direct energy and ensure that workers are focussed on conservation activities. The provision of project funds in this area will encourage the forestry department to at least institutionalize funding in this area in the post project stages. The installation of computers and provision of hardware such as office facilities and vehicles will increase efficiency so that more can be done on the existing budget. On the job training will also increase efficiency through managerial, leadership and work practices improvements.

Problems as stated in Field Report	Effect of Outcomes/ Comments
(3) Routine/project budget balance	Out of project scope: Recommendation only to central and regional Government
(4) Staff mobility	New vehicles supplied to increase staff mobility
(5) Government-community communications	Cadre group will increase government-community communications significantly. The cadres and government supervisors will attend the same training program together which will increase coherence. Monitoring and evaluation activities undertaken by cadres will provide a direct data and information linkage to district office. The village proposal process will also bring the government and community much closer together. The government will become a partner with the community in sustainable development. The Watershed Conservation Committee will also improve Government – Community communications
(6) Underdeveloped information systems	The underdeveloped information systems problem will be addressed directly through the development of an integrated Watershed Conservation Information System (WCIS) The development plan includes installation of hardware, software, standardization of formats, training and general information systems development activities that will return a well developed system to gather, enter, process, analyze, report, and disseminate watershed information.
(7) Separating technical government services from general administration	The current forestry services has no capacity for the technical role. Its focus will be re-aligned with administration and supervision of implementation. The technical role will be taken over for the most part by the cadres and the community.
(8) The form and quality of extension services	The form and quality of extension services will be improved significantly above and beyond the former capacity (as above)
(9) Sustainable Funding for Conservation Programs	The further research and development of water regulations and methods (through the institutional development plan) to raise funds through taxes or levies would increase the adoption of new conservative farming techniques and decrease encroachment through the provision of incentives to upstream resource users.
The General Non Government Institutional Problems	
(1) No institutionalized method to increase community awareness	The information systems development which will include the dissemination of information to the community. The University of Manado will produce simplified versions of its reports, and distribute them broadly among the community. Involving the community in conservation projects will increase awareness along with ownership. Involve schools in activities such as seedling propagation, as a community institution that may take part in the proposal submission process. Watershed management committee.
(2) No institutionalized method to decrease apathy	Providing the opportunity for community members to participate in development will have a significant effect on apathy.
(3) Watershed management coordination	Watershed conservation committee will integrate all stakeholders. The general project design is such that maximum integration is encouraged. Research projects at the university of Manado will emphasize the need for holistic and strategic management by researching and clarifying major management issues, proposing solutions, and encouraging an action plan through discussion, development of regulations, and elimination of obstacles. The integration forum will also increase coordination for watershed management.

7.2 Conclusion

The institutional development plan will bring significant change to the present method of operation of forestry services offices. Under the former structure the capacity for administration and management of forestry was severely restricted by the number and quality of human resources, inadequate budget allocations, lack of staff mobility and poor information systems. It is therefore important to take the pressure off the government offices (Dinas and UPT) by re-allocating a major part of the technical and implementation role to the community, and have the government offices (Dinas Province and District) assume a primarily adminstrative and supervisory role. The plan will narrow the scope of duties in these offices and thereby boost efficiency while strengthening supporting organizations in watershed conservation. The resulting institutional development will increase inter-institutional coordination, promote community involvement in partnership with forestry offices, improve the quality and quantity of extension services, encourage development of the watershed *management* perspective, increase awareness, and decrease apathy in the community.

Tables

Table L.3.1 Benefit from Increased Water Resources

Beneficial Function	Increased water resources
Qualitative Description	* It may be assumed that development water discharge (incremental water discharge usable during the dry season) is equal to an average outflow of groundwater fostered by incremental vegetation attributed to the WCP measures. Therefore, benefit of the water fostering function of the incremental vegetation is evaluated with costs necessary to obtain the same development discharge from irrigation dams (construction and O & M costs of irrigation dams). * Natural vegetation in the watershed fosters groundwater for use in the watershed area and the downstream. And the fostered water flows into rivers and lakes, contributing to stabilization of discharged water amount there. So, loss of the vegetation affects the groundwater utilization and river discharge, decreasing products of agricultural and fishery sectors using water as key input. These industrial production losses can be taken as value of the water fostering function of the vegetation.
Selected Evaluation Method and Typical Equation	Increased water resources => Change in environmental quality => Human habitat => **Replacement-Cost Method** [Benefit attributed to increased water resources] = [Incremental vegetation area] x [Average unit groundwater outflow of vegetation] x x [(Annual construction cost of irrigation dam per unit development discharge) + (Annual O&M cost of irrigation dam per unit development discharge)] Increased water resources => Measurable change in production => Non-distorted market prices => **Change-in-Productivity Method** [Benefit attributed to increased water resources] = [Incremental vegetation area] x [Fostered groundwater per unit vegetation] x [Contribution rate of unit groundwater to each sectoral production]
Data and Assumption	<Fostered Groundwater and Development Water Discharge> (a) Average net penetration rate of the incremental vegetation between the with-WCP afforested condition and the without-WCP natural one in the target year (??) = 1.0 % 0.01 (Source : Soil test implemented by the JICA Study Team, November 2000) * It was identified that there was no difference of infiltration rate among the the East, West and South Areas. * It is assumed that all the incremental vegetation land has a similar penetration rate. (b) Estimated incremental vegetation area = 200 ha = 2,000,000 m^2

Site	Purpose (tree species)	Area (ha)
Upper part of the encroached area	Protection forest (pine & multi-purpose trees)	10
Inside of the protection forest *	Enrichment planting (multi-purpose trees & cempaka)	40
Private lands	Fuel wood plantation (gamal & kaliandra)	150
Total incremental vegetation area (ha)		200

* The area is estimated assuming that trees are planted with 3-m interval, since they are planted intermittently at the logged-over spots in the protection forest.

(c) Average annual precipitation in the Tondano watershed = 1,869 mm/year = 1.9 m/year
(Sources : Meteorogical & Geophysical Agency, and National Electric Power Corporation)
(d) Average annual fostered groundwater = a x b x c = 37,380 m^3/year
(e) Discharging rate from the groundwater to the rivers = 27 % 0.27
(Source : Phase-I Study of the JICA Study Team)
(f) Water discharge contributing to stable water flow in rivers and lakes = d x e = 10,093 m^3/year
(g) Development water discharge of the incremental vegetation
= f / (365 days x 24 hours x 60 minutes x 60 seconds) 0.00032 m^3/s

<Construction and O & M Costs of Irrigation Dams per Unit Development Water Discharge>
(h) Construction costs of irrigation dams per unit development water discharge = 18,460,000,000 Rp./m^3/s (in 2000 price)
(Sources : SSIMP-III Project in the South Sulawesi Province)
(i) Depreciation period for the irrigation dam = 20 years
(Source : Pelaparado Dam, Small Scale Irrigation Management Project, Indonesia)
(j) Market interest rate = 15.9 % 0.16

Bank	State banks	Regional government	Private natio.	Foreign	Commercial	Average
Rp. time deposit interest rate (%/year) in 1999/2000	15.4	14.9	20.3	13.1	15.6	15.9

(Source : Indonesian Financial Statistics Vol.II No.8, Bank Indonesia, August 2000)
(k) Annual depreciation costs of irrigation dams per unit development water discharge
= h x j x $(1 + J)^i$ / $[(1 + j)^i - 1]$ = 3,089,120,333 Rp./m^3/s/year
(l) Annual O & M costs of irrigation dams per unit development water discharge = k x 0.01 30,891,203 Rp./m^3/s/year
* The annual O & M costs of a irrigation dam is assumed to be 1 % of its annual depreciation cost.
(m) As for the benefit evaluation by the **change-in-productivity method**, a supplimentary survey would be needed to collect necessary data and information.

Applied Equation and Estimated Benefit	[Benefit attributed to increased water resources in the target year by the **replacement-cost method**] = [Development water discharge of the incremental vegetation] x [(Annual depreciation costs of irrigation dams per unit development water discharge) + (Annual O & M costs of irrigation dams per unit development water discharge)] = g x (k + l) = 998,511 Rp./year (in 2000 price)

Table L.3.2 Benefit from Conserved Water Quality

<table>
<tr><td>Beneficial Function</td><td>Conserved water quality</td></tr>
<tr><td>Qualitative Description</td><td>* The value of water quality can be assessed to be the incremental cost of treating the water so that it is suitable for downstream uses. The level of treatment depends on the downstream use. For example, irrigation water does not require the same level of purity as drinking water, so the cost of treating water for use in agriculture would be less than drinking water supply.
* Removal of suspended solids is the largest incremental cost for restoring water quality in the Tondano lake to suitable quality for downstream users. The incremental cost can be calculated as the extra alum or lime, filter capacity, treatment plant operation costs, etc. needed to treat the excess suspended solids, as compared with the quantities needed to treat the suspended solids that are naturally present in the water.</td></tr>
<tr><td>Selected Evaluation Method and Typical Equation</td><td>Conserved water quality => Change in environmental quality => Water quality => Replacement-Cost Method or Preventive-Expenditure Method
[Benefit from pollutant abatement]
= [Reduced water pollutants] x [Unit cost for construction and operation of water filter plant to remove the pollutants]</td></tr>
<tr><td>Data and Assumption</td><td>(a) Run-off water-pollution loads into the Tondano Lake due to soil erosion in the target year without WCP
<table>
<tr><td>Pollutant</td><td>Suspended Solids (SS)</td><td>Total Nitrogen (T-N)</td><td>Total Phosphorus (T-P)</td></tr>
<tr><td>Loads (kg/day)</td><td>27</td><td>not available</td><td>not available</td></tr>
</table>
(b) Run-off water-pollution loads into the Tondano Lake due to soil erosion in the target year with WCP
<table>
<tr><td>Pollutant</td><td>Suspended Solids (SS)</td><td>Total Nitrogen (T-N)</td><td>Total Phosphorus (T-P)</td></tr>
<tr><td>Loads (kg/day)</td><td>24</td><td>not available</td><td>not available</td></tr>
</table>
(Source of a and b : Phase-I Study of the JICA Study Team, 2000)
(c) Net WCP's contribution to the pollutant abatement in the Tondano Lake with soil erosion control in the target year = a - b
<table>
<tr><td>Pollutant</td><td>Suspended Solids (SS)</td><td>Total Nitrogen (T-N)</td><td>Total Phosphorus (T-P)</td></tr>
<tr><td>Loads (kg/day)</td><td>3</td><td>not available</td><td>not available</td></tr>
</table>
(d) Average unit cost to abate water pollution load through simple treatment facilities (in 2000 price)
<table>
<tr><td>Pollutant</td><td>Suspended Solids (SS)</td><td>Total Nitrogen (T-N)</td><td>Total Phosphorus (T-P)</td></tr>
<tr><td>Cost (US$/kg)</td><td>0.004</td><td>6</td><td>49</td></tr>
</table>
(Sources : Adjusted for the Indonesian economic situation taking account of different foreign exchange rates, commodity price levels and domestic product levels, based on data from the studies on treatment costs for rural area (1995), the Biwa Lake (1992) in Japan and the Min River in China (1997) as well as "Coastal and Marine Environmental Management for Ha Long Bay : Final Report", ADB, August 1996)
(e) The other potential evaluation techniques such as replacement-cost method, loss-of-earnings method, and human-capital method are not applied due to lack of data for these methods and assuming that there will be little incremental damage to the future human health associated with water pollution in the lake even without WCP.</td></tr>
<tr><td>Applied Equation and Estimated Benefit</td><td>[Benefit attributed to water pollutant abatement in the target year by the preventive-expenditure method]
= [Pollutant abatement in the Tondano Lake with soil erosion control]
x [Average unit cost to abate water pollution load through simple treatment facilities]
= c x d x 365 days = 4 US$/year (in 2000 price)</td></tr>
</table>

Table L.3.3 Benefit from Strengthened Erosion and Flood Control Capacity

Beneficial Function: Strengthened erosion and flood control capacity

Qualitative Description

* In case there is stripped area without vegetation in the watershed, severe erosion will occur under heavy rainfall and its downstream water quality is degraded. So value of the vegetation's erosion control function is evaluated using constriction cost of check dams to control and mitigate the washed-away soil.
* Watershed degradation contributes to increased flooding in two ways. First, tree cutting and other land disturbance reduce the water holding capacity of the soil, causing larger peak flows of drainage after rain storms. Second, the sediment that erodes from the stripped or disturbed land fills the beds of rivers and lakes, allowing flood water to rise above the river and lake banks. The value of flood damage resulting from watershed degradation can be estimated as the value of the incremental amount of increased flooding or decreased flood control capacity. The incremental amount may be determined by comparison with conditions in undisturbed catchment areas that have similar topography, soil types, and rainfall patterns
* When land and buildings are damaged, the measure of damage should be calculated as the cost to restore them to their original condition. The restoration activities may include removal of mud and dust, repairing of buildings and paddy dikes, and finding temporary accommodation while the buildings are being repaired. Roads, bridges, pipelines, electrical power lines and other public infrastructure can be damaged by mud slides and flooding associated with land disturbance activities in the watershed. The value of the damage in these cases can be calculated as cost to rebuild or relocate the damaged infrastructure
* The loss of revenue from lost farm production is a value of the strengthened erosion- and flood-control capacity when agricultural land is covered by mud slides.

Selected Evaluation Method and Typical Equation

Strengthened flood control capacity => Change in environmental quality => Human habitat => **Replacement-Cost Method**

[Benefit due to reduced damage]
= [Reduced cost to rehabilitate damages due to mud-slide and flooding]
= [Cost to restore damaged land and building] + [Cost to remove mud and water] + [Repair cost of paddy dikes + [Cost to rebuild or relocate damaged infrastructure] + [Other expenditure in rehabilitation

Strengthened erosion and flood control capacity => Measurable change in agricultural production => Non-distorted market prices => **Change-in-Productivity Method**

[Benefit related to agriculture] = [Agricultural area protected from erosion and flood] x [Incremental products] x [Unit market price of product]

Strengthened erosion control capacity => Change in environmental quality => Water quality => **Preventive-Expenditure Method**

[Benefit attributed to reduced erosion] = [Amount of soil erosion without vegetation under WCP] x [Unit cost for check dam construction to control or mitigate the washed-away soil]

Data and Assumption

<Benefit due to Reduced Damage by the **Replacement-Cost Method** and the **Change-in-Productivity Method**>

(a) It is assumed that, during the heavy rain storm, erosion of soil from deforested areas resulted in heavy siltation of the river, clogging o water-supply intakes, and damages on local houses and roads. Deforested catchment area has raised the small stream, river and lake beds resulting in greater quantities of runoff during heavy rain storms. Then, it contributes to flooding on some agricultural land as well

(b) Average annual occurrence rate of the heavy rain storms like (a) in the past 20 years = 0.21 events/year
(Source : Meteorogical & Geophysical Agency, and National Electric Power Corporation)

(c) Average number of water-supply intakes damaged by flood associated with storms like (a) in the Study Area in the past 20 years = 0.028 intakes/event
* 15 as average operation years for water-supply intakes and 2 as damaged intakes in the past are assumed.

(d) Estimated average repair-work cost for the intakes = 80,000,000 Rp./intake (in 2000 price)

(e) Average number of houses totally damaged by flood associated with storms like (a) in the Study Area during the 20 years = 20 houses/event
* It is assumed that the damage only in Remboken will be mitigated with the WCP implementation.

(f) Assumed average area of the damaged houses = 250 m^2/house

(g) Average unit price for housing construction (in 2000 price) = 1,000,000 Rp./m^2 (in 2000 price)
(Source : BRLKT in Manado, February 2000)

(h) Average length of roads totally damaged by flood associated with storms like (a) in the Study Area in the past 20 years = 0.1 km/event

(i) Average total cost of road relocation = 540,000,000 Rp./km (in 2000 price)
(Source : Feasibility Study Report of Highland Agriculture Development Project in West Java

(j) Predicted suspended solids into the Tondano Lake in the target year without WCP = 27 kg/day

(k) Predicted suspended solids into the Tondano Lake in the target year with WCP = 24 kg/day

(l) The present suspended solids into the Tondano Lake = 27 kg/day
(Sources of j, k and l : Phase-I survey of the JICA Study Team)

(m) Suspended solids reduction in the target year with the WCP implementation = j - k = 3 kg/day

(n) Incremental extent of erosion and flood in the target year without the WCP implementation = j / l = 1 times

(o) Assumed reduction rate of soil erosion and flood like (a) in the target year attributed to WCP = m / j 0.11

(p) Average agricultural area totally damaged by storms like (a) during the past 20 years = 7.5 ha/event
* It is assumed that the damage on paddy only in the northern side of Lake Tondano will be mitigated with the WCP implementation

(q) Average local agricultural productivity (lowland paddy) = 8,960 kg/ha/year
(Source : Laporan Tahunan, Dinas Pertanian Tanaman Pangan Kab. Minahasa, 1998)

(r) Average price of the agricultural product (lowland paddy) around the Study Area = 1,210 Rp./kg (in 2000 price)
(Source : Farm household survey of the JICA Study Team, 2000)

<Benefit Attributed to Reduced Erosion by the **Preventive-Expenditure Method**>

(s) Incremental area of vegetation and agroforestry with erosion control measures = 9,380 m^2

Incremental vegetation	ha
Upper part of the encroached area	10
Inside of the protection forest	40
Private lands	150
Total	200

(Source : Field Report of the JICA Study Team, p.4-18)

Agroforestry development	ha
AGF-I (Type I-2)	1,900
AGF-I (Type I-4)	1,200
AGF-I (Type I-5)	100
AGF-I (Type I-6)	10
AGF-II (Type II-2)	2,020
AGF-III (Type III-2)	2,270
Upland farming	1,680
Total	9,180

(t) Reduced erosion depth on average of (s) in the target year, attributed to the WCP implementation = 0.001 m/year

(u) Annual reduction of the eroded soil in the target year = s x t = 9 m^3/year

(v) Amount of earth and sand stopped per unit concrete volume of the check dam = 40 m^3
(Source : Forestry Agency of Japan, 1972)

(w) Construction cost of the check dam per unit concrete volume = 1,136,000 Rp./m^3
* The cost is estimated for wet-masonry check dam including its appurtenant work.

(y) Construction cost of the check dam per unit amount of the eroded earth and sand = v x w = 45,440,000 Rp./m^3

Applied Equation and Estimated Benefit

A. [Benefit due to reduced damage in the target year by the **replacement-cost method**]
= [Reduced cost to rehabilitate damages due to mud-slide, flooding, etc.]
= [Cost to restore damaged land & building] + [Cost to remove mud & water] + [Repair cost of paddy dikes + [Cost to rebuild or relocate damaged infrastructure] + [Other expenditure in rehabilitation]
= [b x (c x d + e x f x g + h x i)] x n x o = 1,260,000 Rp./year (in 2000 price)

B. [Benefit related to agriculture in the target year by the **change-in-productivity method**]
= [Agricultural area protected from erosion and flood] x [Incremental products] x [Unit market price of product
= (b x p x q x r) x n x o = 1,897,280 Rp./year (in 2000 price)

C. [Benefit attributed to reduced erosion in the target year by the **preventive-expenditure method**]
= [Annual reduction of the eroded soil in the target year]
x [Construction cost of the check dam per unit amount of the eroded earth and sand] = u x y = 426,227,200 Rp./year (in 2000 price)

* Benefit A should be added to Benefit B for the total benefit, although Benefit C cannot be added to ignore double counting
* Either Benefit A plus Benefit B or only Benefit C can be the total benefit exclusively

Table L.3.4 Benefit from Conserved Air Quality

Beneficial Function	Conserved air quality
Qualitative Description	* Oxygen supply function of the incremental vegetation under WCP is evaluated by calculating the oxygen weight discharged from the vegetation based on the existing research data, which is multiplied by unit market price of the industrial oxygen. * Amount of CO2 absorbed by the incremental vegetation will be estimated for calculation of a total cost to remove them alternatively. This total cost is regarded as an economic value of the air purification function of the incremental vegetation.
Selected Evaluation Method and Typical Equation	Improved air quality => Change in environmental quality => air quality => **Replacement-Cost Method** [Benefit from air purification] = [Amount of incremental vegetation] x {[(Annual net O_2 discharge per vegetation) x (Unit market price of O_2)] + [(Annual net CO_2 absorption per vegetation) x (Unit removal cost of CO_2)]}
Data and Assumption	<O_2 Discharge of Vegetation> (a) Market unit price of O_2 per kg in Japanese Yen = 55 Yen/kg (Source : Forestry Agency of Japan, September 2000) (b) Exchange rate of Rp. = 79 Rp./yen (in 2000) (c) Market unit price of O_2 per ton in Rp. = a x b x 1,000 kg = 4,345,000 Rp./t (in 2000 price) (d) Photo-synthesis formula : $6CO_2 + 6H_2O \Rightarrow C_6H_{12}O_6 + 6O_2$ (e) Molecular weight of cellulose ($C_6H_{12}O_6$) = 12 x 6 + 1 x 12 + 16 x 6 = 180 (f) Molecular weight of oxygen ($6O_2$) = 6 x 16 x 2 = 192 (g) Annual amount of produced dry cellulose (net plant products) per unit incremental vegetation under WCP (Unit : t/ha/year)

Species	Net Plant Products (m^3/ha/year)	Average	Weight Factor	Net Plant Products (t/ha/year)
Pine	12 ~ 27	20	0.7	0.0137
Mahogany	7 ~ 11	9	0.7	0.0063
Kaliandra	5 ~ 20	13	0.7	0.0088

(h) Area of the incremental vegetation attributed to the WCP implementation (Unit : ha)

Typical Planted Species	Incremantal Area (ha)	Site
Pine	10	Upper part of the encroached area
Cempaka *	40	Inside of the protection forest
Gamal and Kaliandra	150	Private lands

* It is assumed that Cempaka has almost the same annual production amount as Mahogany.

(i) Annual O_2 discharge from the incremental vegetation = (f / e) x g x h = 1.8 t /year

<CO_2 Absorption and Fixation of Vegetation>
(j) Unit cost of CO_2 removal per ton in Japanese Yen = 12,704 yen/t
(Source : Forestry Agency of Japan, September 2000)
(k) Unit cost of CO_2 removal per ton in Rp. = j x b = 1,003,616 Rp./t (in 2000 price)
(l) Molecular weight of carbon dioxide ($6CO_2$) = 6 x (12 + 16 x 2) = 264
(m) Annual CO_2 absorption and fixation by the incremental vegetation = (l / e) x g x h = 2.5 t /year

(n) It is assumed that both the oxygen sold in market and that discharged from vegetation provide people with the similar services. But the benefit calculated in this way may be over-evaluated, since the sold oxygen in the container has some extra value added with a high-pressure spraying function the natural oxygen does not have, or because the incremental oxygen will be little needed due to too much oxygen on the earth.
(o) The amount of oxygen discharge and carbon-dioxide absorption of the incremental vegetation is assumed not to fluctuate in accordance with its plant succession.
(p) The other potential evaluation techniques such as **loss-of-earnings method**, and **human-capital method** are not applied due to lack of data for these methods and assuming that there will not be any incremental contribution to the future human health associated with the afforestation and agrofoestry under WCP. |
| Applied Equation and Estimated Benefit | [Benefit from air purification in the target year by the **replacement-cost method**]
= [Market unit price of O_2 per ton] x [Annual O_2 discharge from the incremental vegetation]
+ [Unit cost of CO_2 removal per ton] x [Annual CO2 absorption and fixation by the incremental vegetation]
= c x i + k x m = 10,387,389 Rp./year (in 2000 price) |

Table L.3.5 Benefit from Conserved Aesthetic and Recreational Amenity

Beneficial Function	Conserved aesthetic and recreational amenity
Qualitative Description	* The value of the aesthetic quality of the natural environment is difficult to calculate in monetary terms, because it depends on the subjective preference of each individual person. One approach to assigning a monetary value to aesthetic qualities is to estimate how much the people living in an area would pay to preserve them (willingness to pay, WTP). The cumulative regional WTP can be interpreted to be equal to the overall value of restoring the aesthetic quality of the environment. * In addition, it is likely that Indonesian and international tourists who visit the Tondano watershed area would also be willing to pay some small amount of money such as a surcharge on hotel room rates for preserving the aesthetic quantities of the watershed. * Tourism accounts for a part of the trade of goods and services in the Tondano watershed. A majority of tourists visiting the watershed can be classified as 'Adventure and Ecotourists', enjoying the natural landscape of the area.
Selected Evaluation Method and Typical Equation	Conserved or improved aesthetic quality => Change in environmental quality => Aesthetics => **Contingent-Valuation Method** [Non-use benefit including existence value] = [Average WTP of non-use value of local households] x [Number of local households] + [Average WTP of non-use value of tourists] x [Number of tourists] Conserved or improved aesthetic quality => Change in environmental quality => Recreation => **Contingent-Valuation Method** or **Travel-Cost Method** [Use-benefit by **contingent-valuation method**] = [Average WTP of use-value of local households] x [Number of local households] + [Average WTP of use-value of tourists] x [Number of tourists] [Use-benefit by **travel-cost method**] = [Average travel cost of tourists] × [Incremental number of tourists] + [Average travel cost of local visitors] × [Incremental number of local visitors] [Average travel cost] = [Transportation fee] + [Time cost] + [Opportunity cost] Conserved or improved aesthetic quality => Measurable change in tourism production => Non-distorted market prices => **Change-in-Productivity Method** [Benefit related to the tourism sector by **change-in-productivity method**] = [Incremental tourists due to environmental improvement or conservation] x [Incremental net profit of tourism sector per tourist]
Data and Assumption	(a) There is no tourist prediction analysis around the Tondano Lake in the future, and most of the other reliable data and information related to tourism around the lake are not statistically available for the **travel-cost method** and the **change-in-productivity method**. (b) A time- and money-consuming questionnaire survey has to be carried out to collect and analyze statistically reliable WTPs of the local residents and tourists, which are essential to apply the **contingent-valuation method**. (c) In the with- and without-project framework, it is strongly assumed that the net effect of WCP on the aesthetic and recreational amenity in the Intensive Area would be quite limited, taking into account the present scenery situation as well as the relatively small-sized tourism activities in and around the Tondano Lake.
Applied Equation and Estimated Benefit	[Benefit attributed to conserved or improved aesthetic and recreational amenity in the target year] = 0 Rp./year (in 2000 price) * It is due to the methodological reasons and realistic assumption as mentioned above.

Table L.3.6 Benefit from Improved Forestry Resources

Beneficial Function	Improved forestry resources
Qualitative Description	* Forests provide several valuable goods and services, including wood products, flood control by stabilizing soil, aesthetic quality and habitat for wildlif Potential methods for calculating the value of the loss of flood control and aesthetic quality are described in the tables for the strengthened erosion & flood control capacity as well as the conserved aesthetic & recreational amenity respectively. The value of wildlife habitat could be considered to be included in the aesthetic evaluation, similar to the value of a scenic view or a clear lake * The value of loss of timber and other wood products can be estimated as the overall income that would be derived from harvesting, processing, anc selling the products on a sustainable basis. This income can be estimated by comparing the income from sustainable logging on land of similar area, tree types, proximity to roads and factories, etc. where watershed management has been well done
Selected Evaluation Method and Typical Equation	Improved forestry resources => Measurable change in forestry production => Non-distorted market prices => **Change in Productivity Method** [Benefit of forest resources] = [Incremental forest land] x [Amount of incremental forest goods] x [Unit market price of forest goods
Data and Assumption	(a) Incremental reforested area under the land rehabilitation within the Intensive Area of WCP as of the target year of these measures = 200 ha

Related Measures under WCP	Purpose	Tree Species	Area (ha)
- Upper part of the encroached area	Protection forest	Pine and multi-purpose trees	10
- Inside of the protection forest	Enrichment planting	Multi-purpose trees & Cempaka	40
- Private lands	Fuel wood plantation	Gamal and Kaliandra	150
Total incremental reforested area (= with WCP - without WCP)			200

(b) Assumed growth duration of the planted trees to have commercial valu

Planted Tree Species	Products	Range of Growth Duration (years)	Average Duration (years)
Pine	Timber	20 ~ 30	25
Cempaka	Timber	20 ~ 50	35
Drian	Fruits	5 ~ 10	7.5
	Timber	30 ~ 50	40
Gamar	Fuel wood	2 ~ 3	2.5
Kaliandra	Fuel wood	2 ~ 3	2.5

(c) Assumed rate of commercial selling of the incremental forests = 1 / b

Planted Tree Species	Products	1 / b	%/year
Pine	Timber	0.040	4.0
Cempaka	Timber	0.029	2.9
Drian	Fruits	0.133	13.3
	Timber	0.025	2.5
Gamar	Fuel wood	0.400	40.0
Kaliandra	Fuel wood	0.400	40.0

(d) Assumed commercial value of the forest goods around the Tondano watershed

Planted Tree Species	Products	Average Retail Price in 2000 (Rp./m^3)
Pine *	Timber	1,736,000
Cempaka	Timber	900,000
Drian	Fruits	600,000
	Timber	not available
Gamar	Fuel wood	1,000
Kaliandra	Fuel wood	1,000

* As pine timber is not sold in the local market, log price in the international Malaysian market is applied as calculated below
US$ 190.8 /m^3 in 2000 x Rp.9,100 /$ = Rp.1,736,280 /m^3
(Source : World Bank Development Prospects, Commodity Price Data Pinksheet, December 2000)

(e) Average volume of the forest goods in the incremental reforested area as of the target yea

Planted Tree Species	Products	Range of Annual Amount of Production (m^3/ha/year)	Average Amount (m^3/ha/year)
Pine	Timber	12 ~27	20
Cempaka (Mahogany)	Timber	7 ~ 11	9
Drian	Fruits	not available	---
	Timber	not available	---
Gamar	Fuel wood	not available	---
Kaliandra	Fuel wood	5 ~ 20	13

Applied Equation and Estimated Benefit	[Benefit of forest resources in the target year by the **change-in-productivity method**] = [Incremental reforest area] x [Amount of incremental forest products] x [Unit market price of forest products = [Incremental reforest area] x [(Rate of commercial selling) x (Average tree volume) x [Average unit value of wood production] = a x c x d x e = 23,547,943 Rp./year (in 2000 price)

Table L.3.7 Benefit from Conserved or Improved Fishery Resources

Beneficial Function: Conserved or improved fishery resources

Qualitative Description

* Siltation of river/lake beds and other fish habitat is the main source of environmental damage that poor watershed management causes to fishery resources. Top soil is eroded during heavy rain, and the sediment drains into these sensitive aquatic areas decreasing their ability to support fish life. The value of the damage to fishery resources may be estimated as the loss of fishing income caused by the siltation of fish habitat.
* The loss of fishing income may be estimated directly or indirectly. If historical records are available, it may be possible to directly estimate the reduction in fishing income. But these results may be unreliable because such factors as improved fishing techniques and boats, increase in the sale price of fish, and increases in the number of people who work in the fishing industry must all be considered. In addition, this direct estimate may unfairly bias against the watershed management, because the other factors such as over-harvesting and pollution from the inland fishery itself may have contributed to the decline in fishing. Consequently, an indirect method of comparison would probably give better results.

Selected Evaluation Method and Typical Equation

Conserved or improved fishery resources => Measurable change in fishery production => Non-distorted market prices
=> **Change-in-Productivity Method**

[Benefit of fishery resources] = [Conserved or improved water area]
x [Amount of incrementally caught fish and other fishery products]
x [Unit market price of the fish and other fishery products]

Data and Assumption

(a) Average market price of fish and other fishery products caught in the Tondano Lake (Rp./kg in 2000 price)

Main Fishery Product / Market Site	Langowan	Tondano	Average
a1. Tilapia (Nila)	10,000	10,000	10,000
a2. Carp (Ikan Mas)	10,000	12,500	11,250

(Source : Interview data by the Study Team in Langowan and Tondano Sub-districts, 2000)

(b) Average annual productivity of fishery products from the Tondano Lake (kg/year)

Fish Production/year	1995	1996	1999	2000	Average
b1. Tilapia (Nila)	2,534,000	2,146,200	1,895,600	1,493,100	2,017,225
b2. Carp (Ikan Mas)	1,086,000	919,800	812,400	639,900	864,525
Total	3,620,000	3,066,000	2,708,000	2,133,000	2,881,750

(Source : Dinas Perikanan Tondano)

* It is assumed that a production ratio for the net cage culture (30 % for carp and 70 % for Tilapia) is applicable to the above.

(c) Estimated ratio of negatively affected fish habitat in the Tondano Lake in the target year without WCP = not available (?? %)
(Source : Estimation based on a simple model in "Ecological Study for Chubu International Airport", Japan, 1998)

(d) Predicted suspended-solids load into the Tondano Lake in the target year with the WCP implementation = 24 kg/day

(e) Predicted suspended-solids load into the Tondano Lake in the target year without the WCP implementation = 27 kg/day
(Source of d and e : Phase-I Study of the JICA Study Team, 2000)

(g) Assumed decrease rate of fishery catch from the Tondano Lake in the target year without the WCP implementation
= d x (f - e) / f = #VALUE! (?? %)

Applied Equation and Estimated Benefit

[Benefit of fishery resources in the target year by the **change-in-productivity method**]
= [Total of (Average market price of fish and other fishery products) x (Average annual productivity of fishery products)]
x [Area of the Tondano Lake] x [Assumed decrease rate of fishery catch from the Tondano Lake]
= (a1 x b1 + a2 x b2) x g = #VALUE! Rp./year (in 2000 price)

Table L.3.8 Benefit from Conserved or Improved Agricultural Resources

Beneficial Function	Improved or conserved agricultural resources
Qualitative Description	* Under the proposed land use of WCP, there will be no incremental agricultural land in the Intensive Area. However, the extension program of agroforestry technology will increase productivity of the existing agricultural land. This can be a major benefit of WCP, so that the incremental agricultural products between with-project and without-project are evaluated with non-distorted market prices.
Selected Evaluation Method and Typical Equation	Improved agricultural resources => Measurable change in agricultural production => Non-distorted market prices => **Change in Productivity Method** [Benefit of agricultural resources] = [Agroforestry area] x [Amount of incremental agricultural goods] x [Unit market price of agricultural goods]

Data and Assumption

(a) Area, yield, international price, and production cost of main tradable products without- and with-agroforestry within the Intensive Area as of the target year

	Area (ha)		Yield (kg/ha/year)		International Market Price in 2000		Production Cost (Rp./ha/year)	
Products	a1.Without	a2.With	a3.Without	a4. With	(US$ /kg)	a5. (Rp./kg, Rp.9,100/$)	a6.Without	a7.With
Paddy	1,021	1,021	4,800	5,040	0.17	1,547	3,304,000	3,372,000
Maize	5,343	4,955	2,900	3,050	0.09	819	2,547,000	2,578,000
Coffee	141	270	950	1,000	0.09	819	3,060,000	3,398,000

(Source : World Bank Development Prospects, Commodity Price Data Pinksheet, December 2000)

(b) Incremental net benefits of the main tradable agricultural products between without-agroforestry and with-agroforestry in the target year

= Σ [a2 x (a4 x a5 -a7) - a1 x (a3 x a5 - a6)] = 456,887,780 Rp./year

Tradable Agricultural Product	Paddy	Maize	Coffee	Total
Incremental net benefits (Rp./year)	309,648,880	521,813,950	-374,575,050	456,887,780

(c) Incremental net benefits of the other products between without- and with-agroforestry in the target year = 3,568,309,000 Rp./year

	Area (ha)		Return (Rp.000/ha/year)		Total Return (Rp.000/year)		Incremental Benefit
Products	c1.Without	c2.With	c3.Without	c4.With	c4.Without (c1 x c3)	c5.With (c2 x c4)	(Rp.000/year) c5 - c4
Ground nut	323	600	1,180	1,248	381,140	748,800	367,660
Cowpea	129	360	1,230	1,355	158,670	487,800	329,130
Cassava	32	0	350	350	11,200	0	-11,200
Vegetables	341	485	3,916	4,305	1,335,356	2,087,925	752,569
Clove	1,466	2,571	1,685	1,775	2,470,210	4,563,525	2,093,315
Coconut	185	82	70	120	12,950	9,840	-3,110
Other estate crops	110	165	1,580	1,633	173,800	269,445	95,645
Fruits	228	250	500	500	114,000	125,000	11,000
Trees	1,749	922	100	100	174,900	92,200	-82,700
Hedgerow crop	198	358	100	100	19,800	35,800	16,000
Total	4,761	5,793	10,711	11,486	4,852,026	8,420,335	3,568,309

(d) Occurrence rates of the incremental net benefits for each year

Year	Paddy	Maize	Coffee	Ground nut	Cowpea	Cassava	Vegetables	Clove
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.0
3	0.6	0.6	0.0	0.6	0.6	0.6	0.6	0.0
4	0.8	0.8	0.0	0.8	0.8	0.8	0.8	0.0
5	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0
6	1.0	1.0	0.1	1.0	1.0	1.0	1.0	0.1
7	1.0	1.0	0.3	1.0	1.0	1.0	1.0	0.3
8	1.0	1.0	0.7	1.0	1.0	1.0	1.0	0.7
9	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9
10	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11 ~	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Year	Coconut	Other estate crops	Fruits	Trees	Hedgerow crop
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.1	0.1	0.1	0.1	0.1
7	0.3	0.3	0.3	0.3	0.3
8	0.7	0.7	0.7	0.7	0.7
9	0.9	0.9	0.9	0.9	0.9
10	1.0	1.0	1.0	1.0	1.0
11 ~	1.0	1.0	1.0	1.0	1.0

Applied Equation and Estimated Benefit

[Benefit of agricultural resources in the target year by the **change-in-productivity method**]

= [Incremental agroforestry area] x [Total of (Amount of incremental agricultural products) x (Unit market price of agricultural products)]

= [Incremental agroforestry area] x [(Rate of commercial selling) x (Average net agricultural productivity under agroforestry)] x [Average unit value of agricultural production]

= b + c = 4,025,196,780 Rp./year (in 2000 price)

[Benefit of agricultural resources in each year by the **change-in-productivity method**]

= b x d + c x d = (Unit : Rp./year in 2000 price)

Year	Paddy	Maize	Coffee	Ground nut	Cowpea	Cassava	Vegetables	Clove
1	0	0	0	0	0	0	0	0
2	92,894,664	156,544,185	0	110,298,000	98,739,000	-3,360,000	225,770,700	0
3	185,789,328	313,088,370	0	220,596,000	197,478,000	-6,720,000	451,541,400	0
4	247,719,104	417,451,160	0	294,128,000	263,304,000	-8,960,000	602,055,200	0
5	309,648,880	521,813,950	0	367,660,000	329,130,000	-11,200,000	752,569,000	0
6	309,648,880	521,813,950	-37,457,505	367,660,000	329,130,000	-11,200,000	752,569,000	209,331,500
7	309,648,880	521,813,950	-112,372,515	367,660,000	329,130,000	-11,200,000	752,569,000	627,994,500
8	309,648,880	521,813,950	-262,202,535	367,660,000	329,130,000	-11,200,000	752,569,000	1,465,320,500
9	309,648,880	521,813,950	-337,117,545	367,660,000	329,130,000	-11,200,000	752,569,000	1,883,983,500
10	309,648,880	521,813,950	-374,575,050	367,660,000	329,130,000	-11,200,000	752,569,000	2,093,315,000
11 ~	309,648,880	521,813,950	-374,575,050	367,660,000	329,130,000	-11,200,000	752,569,000	2,093,315,000

Year	Coconut	Other estate crops	Fruits	Trees	Hedgerow crop	Total
1	0	0	0	0	0	0
2	0	0	0	0	0	680,886,549
3	0	0	0	0	0	1,361,773,098
4	0	0	0	0	0	1,815,697,464
5	0	0	0	0	0	2,269,621,830
6	-311,000	9,564,500	1,100,000	-8,270,000	1,600,000	2,445,179,325
7	-933,000	28,693,500	3,300,000	-24,810,000	4,800,000	2,796,294,315
8	-2,177,000	66,951,500	7,700,000	-57,890,000	11,200,000	3,498,524,295
9	-2,799,000	86,080,500	9,900,000	-74,430,000	14,400,000	3,849,639,285
10	-3,110,000	95,645,000	11,000,000	-82,700,000	16,000,000	4,025,196,780
11 ~	-3,110,000	95,645,000	11,000,000	-82,700,000	16,000,000	4,025,196,780

Table L.3.9 Economic Cost Spread Sheet of Forestry Measures and Actions

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)																							Labor Conversion Factor *** (LCF)	Standard Conversion Factor (SCF)	Economic Cost (UL x LCF + O x SCF)
	Forestry Boundary				Reforestation			Forest Patrol				Rese.*	Community Forestry				Timber Plantation			Delivery St.**		Annual Total				
	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Mat-erials	Unskill-ed labor	Mat-erials	Unskilled labor (UL)	Others (O)			
1	42	14	14	30																		14	86	0.796	0.995	96
2	1	6		30									107	2								8	138	0.796	0.995	144
3													98	1	1	7						1	106	0.796	0.995	106
4													98		1	2						0	101	0.796	0.995	100
5					116	4		108	60	120	66	74	98		1	2	376	6	16	2	2	72	979	0.796	0.995	1,031
6					98	115	36	108			6	74	98		1	2	376	168	34	1	1	284	834	0.796	0.995	1,056
7					98	120	11	108			6		98		1	2	376	168	34	1	1	289	735	0.796	0.995	961
8					98	120	11	108			6		98		1	2	376	162	19			282	719	0.796	0.995	940
9					98	120	11	108			6		98		1	2	376	162	19			282	719	0.796	0.995	940
10					98	10		108			6		98		1	2	368	162	18			172	699	0.796	0.995	832
11	1	6		30	98	10		108			6		98		1	2	368	162	18			178	730	0.796	0.995	868
12	1	6		30	98	10		108			6						368	162	18			178	629	0.796	0.995	768
13					98	10		108			6						368	162	18			172	598	0.796	0.995	732
14					98	10		108			6						368	162	18			172	598	0.796	0.995	732
15						10		54	2	120	5						135	54				66	314	0.796	0.995	365
16						10		54	2		5						135	54				66	194	0.796	0.995	246
17						10		54	2		5						135	54				66	194	0.796	0.995	246
18						10		54	2		5						135	54				66	194	0.796	0.995	246
19						10		54	2		5						135	54				66	194	0.796	0.995	246
20						10		54	2		5						135	54				66	194	0.796	0.995	246
21	1	6		30		10		54	2		5						135	54				72	225	0.796	0.995	281
22	1	6		30		10		54	2		5						135	54				72	225	0.796	0.995	281
23						10		54	2		5						135	54				66	194	0.796	0.995	246
24						10		54	2		5						135	54				66	194	0.796	0.995	246
25						10		54	2	120	5						135	54				66	314	0.796	0.995	365
26						10		54	2		5						135	54				66	194	0.796	0.995	246
27						10		54	2		5						135	54				66	194	0.796	0.995	246
28						10		54	2		5						135	54				66	194	0.796	0.995	246
29						10		54	2		5						135	54				66	194	0.796	0.995	246
30						10		54	2		5						135	54				66	194	0.796	0.995	246
31	1	6		30		10		54	2		5						135	54				72	225	0.796	0.995	281
32	1	6		30		10		54	2		5						135	54				72	225	0.796	0.995	281
33						10		54	2		5						135	54				66	194	0.796	0.995	246
34						10		54	2		5						135	54				66	194	0.796	0.995	246
35								54	2	120	5						135	54				56	314	0.796	0.995	357
36								54	2		5						135	54				56	194	0.796	0.995	238
37								54	2		5						135	54				56	194	0.796	0.995	238
38								54	2		5						135	54				56	194	0.796	0.995	238
39								54	2		5						135	54				56	194	0.796	0.995	238
40								54	2		5						135	54				56	194	0.796	0.995	238
41	1	6		30				54	2		5						135	54				62	225	0.796	0.995	273
42	1	6		30				54	2		5						135	54				62	225	0.796	0.995	273
43								54	2		5						135	54				56	194	0.796	0.995	238
44								54	2		5						135	54				56	194	0.796	0.995	238
45								54	2	120	5						135	54				56	314	0.796	0.995	357
46								54	2		5						135	54				56	194	0.796	0.995	238
47								54	2		5						135	54				56	194	0.796	0.995	238
48								54	2		5						135	54				56	194	0.796	0.995	238
49								54	2		5						135	54				56	194	0.796	0.995	238
50								54	2		5						135	54				56	194	0.796	0.995	238
51	1	6		30				54	2		5						135	54				62	225	0.796	0.995	273
52	1	6		30				54	2		5						135	54				62	225	0.796	0.995	273
53								54	2		5						135	54				56	194	0.796	0.995	238
54								54	2		5						135	54				56	194	0.796	0.995	238
55								54	2	120	5						135	54				56	314	0.796	0.995	357
56								54	2		5						135	54				56	194	0.796	0.995	238
57								54	2		5						135	54				56	194	0.796	0.995	238
58								54	2		5						135	54				56	194	0.796	0.995	238
59								54	2		5						135	54				56	194	0.796	0.995	238
60								54	2		5						135	54				56	194	0.796	0.995	238
Total	53	80	14	360	998	729	69	3,564	152	720	350	148	989	3	9	23	9,930	3,960	212	4	4	4,928	17,443	---	---	21,278

Notes : * This research is for the non-wood forest products.
** This delivery stations are for the firewood plantation .
*** Labor Conversion Factor (LCF) for unskilled labor cost = Standard Conversion Factor (SCF) x [1 - (unemployment rate : 0.2)]

Table L.3.10 Economic Cost Spread Sheet of Agroforestry Measures and Actions

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)						Standard Conversion Factor (SCF)	Economic Cost (AT x SCF)
	Administration	Lecture Fee	Meeting Cost	Extension Services		Annual Total (AT)		
	Skilled labor	Skilled labor	Materials	Extension equipment	Equipment maintenance			
1				1,592	80	1,672	0.995	1,664
2					80	80	0.995	80
3					80	80	0.995	80
4					80	80	0.995	80
5	483	10	30		80	603	0.995	600
6	483	5	29		80	597	0.995	594
7	483	10	30		80	603	0.995	600
8	483	5	29		80	597	0.995	594
9	483	10	30		80	603	0.995	600
10					80	80	0.995	80
11				1,592	80	1,672	0.995	1,664
12					80	80	0.995	80
13					80	80	0.995	80
14					80	80	0.995	80
15					80	80	0.995	80
16					80	80	0.995	80
17					80	80	0.995	80
18					80	80	0.995	80
19					80	80	0.995	80
20					80	80	0.995	80
21				1,592	80	1,672	0.995	1,664
22					80	80	0.995	80
23					80	80	0.995	80
24					80	80	0.995	80
25					80	80	0.995	80
26					80	80	0.995	80
27					80	80	0.995	80
28					80	80	0.995	80
29					80	80	0.995	80
30					80	80	0.995	80
31				1,592	80	1,672	0.995	1,664
32					80	80	0.995	80
33					80	80	0.995	80
34					80	80	0.995	80
35					80	80	0.995	80
36					80	80	0.995	80
37					80	80	0.995	80
38					80	80	0.995	80
39					80	80	0.995	80
40					80	80	0.995	80
41				1,592	80	1,672	0.995	1,664
42					80	80	0.995	80
43					80	80	0.995	80
44					80	80	0.995	80
45					80	80	0.995	80
46					80	80	0.995	80
47					80	80	0.995	80
48					80	80	0.995	80
49					80	80	0.995	80
50					80	80	0.995	80
51				1,592	80	1,672	0.995	1,664
52					80	80	0.995	80
53					80	80	0.995	80
54					80	80	0.995	80
55					80	80	0.995	80
56					80	80	0.995	80
57					80	80	0.995	80
58					80	80	0.995	80
59					80	80	0.995	80
60					80	80	0.995	80
Total	2,415	40	148	9,552	4,800	16,955	---	16,870

Table L.3.11 Economic Cost Spread Sheet of Physical Construction Works

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)																																Labor Conversion Factor ** (LCF)	Standard Conversion Factor (SCF)	Economic Cost (UL x LCF + O x SCF)
	Check Dam				River Bed Protection				River Bank Protection				Hillside Works				Slope Protection *				Indirect Construction Cost				O & M Cost			Admini.	En. Ser.	Physical Contingency				Replacement	Annual Total				
	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Unskilled labor	Equip-ment	Mat-erials	Land Acquisition	Skilled labor	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Equip-ment	Unskilled labor (UL)	Others (O)			
1																																			0	0	0.796	0.995	0
2																																			0	0	0.796	0.995	0
3																																			0	0	0.796	0.995	0
4	19	300	112	624	9	136	79	496					1	9	2	31	1	7	7	19	6	90	40	234		360		9	285	3	45	20	117		587	2,474	0.796	0.995	2,929
5	39	600	225	1248					27	438	283	1,254									13	208	102	500					128	7	104	51	250		1350	4,127	0.796	0.995	5,181
6																									7	4	18								7	22	0.796	0.995	27
7																									7	4	18								7	22	0.796	0.995	27
8																									7	4	18								7	22	0.796	0.995	27
9																									7	4	18								7	22	0.796	0.995	27
10																									7	4	18								7	22	0.796	0.995	27
11																									7	4	18								7	22	0.796	0.995	27
12																									7	4	18								7	22	0.796	0.995	27
13																									7	4	18								7	22	0.796	0.995	27
14																									7	4	18							360	7	382	0.796	0.995	386
15																									7	4	18								7	22	0.796	0.995	27
16																									7	4	18								7	22	0.796	0.995	27
17																									7	4	18								7	22	0.796	0.995	27
18																									7	4	18								7	22	0.796	0.995	27
19																									7	4	18								7	22	0.796	0.995	27
20																									7	4	18								7	22	0.796	0.995	27
21																									7	4	18								7	22	0.796	0.995	27
22																									7	4	18								7	22	0.796	0.995	27
23																									7	4	18								7	22	0.796	0.995	27
24																									7	4	18							360	7	382	0.796	0.995	386
25																									7	4	18								7	22	0.796	0.995	27
26																									7	4	18								7	22	0.796	0.995	27
27																									7	4	18								7	22	0.796	0.995	27
28																									7	4	18								7	22	0.796	0.995	27
29																									7	4	18								7	22	0.796	0.995	27
30																									7	4	18								7	22	0.796	0.995	27
31																									7	4	18								7	22	0.796	0.995	27
32																									7	4	18								7	22	0.796	0.995	27
33																									7	4	18								7	22	0.796	0.995	27
34																									7	4	18							360	7	382	0.796	0.995	386
35																									7	4	18								7	22	0.796	0.995	27
36																									7	4	18								7	22	0.796	0.995	27
37																									7	4	18								7	22	0.796	0.995	27
38																									7	4	18								7	22	0.796	0.995	27
39																									7	4	18								7	22	0.796	0.995	27
40																									7	4	18								7	22	0.796	0.995	27
41																									7	4	18								7	22	0.796	0.995	27
42																									7	4	18								7	22	0.796	0.995	27
43																									7	4	18								7	22	0.796	0.995	27
44																									7	4	18							360	7	382	0.796	0.995	386
45																									7	4	18								7	22	0.796	0.995	27
46																									7	4	18								7	22	0.796	0.995	27
47																									7	4	18								7	22	0.796	0.995	27
48																									7	4	18								7	22	0.796	0.995	27
49																									7	4	18								7	22	0.796	0.995	27
50																									7	4	18								7	22	0.796	0.995	27
51																									7	4	18								7	22	0.796	0.995	27
52																									7	4	18								7	22	0.796	0.995	27
53																									7	4	18								7	22	0.796	0.995	27
54																									7	4	18							360	7	382	0.796	0.995	386
55																									7	4	18								7	22	0.796	0.995	27
56																									7	4	18								7	22	0.796	0.995	27
57																									7	4	18								7	22	0.796	0.995	27
58																									7	4	18								7	22	0.796	0.995	27
59																									7	4	18								7	22	0.796	0.995	27
60																									7	4	18								7	22	0.796	0.995	27
Total	58	900	337	1,872	9	136	79	496	27	438	283	1,254	1	9	2	31	1	7	7	19	19	298	142	734	385	580	990	9	413	10	149	71	367	1,800	2,322	9,611	---	---	11,411

Notes : * These protection works are for the road cut slopes.
** Labor Conversion Factor (LCF) for unskilled labor cost = Standard Conversion Factor (SCF) x [1 - (unemployment rate : 0.2)]

Table L.3.12 Economic Cost Spread Sheet of Community Empowerment Measures and Actions

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)						Standard Conversion Factor (SCF)	Economic Cost (AT x SCF)
	Foreign Specialist	Domestic Specialist/Expert	Training Materials		Basic Fund	Annual Total (AT)		
	Skilled labor	Skilled labor	Operation cost	Micro realization cost	Seed money			
1	1,741	143	550		100	2,534	0.995	2,521
2	1,741	91	550	36		2,418	0.995	2,406
3	1,741	80	550	36		2,407	0.995	2,395
4	1,741	80	550	24		2,395	0.995	2,383
5		182	1,600			1,782	0.995	1,773
6		182	1,600			1,782	0.995	1,773
7		182	1,600			1,782	0.995	1,773
8		182	1,600			1,782	0.995	1,773
9		182	1,600			1,782	0.995	1,773
10		182	1,600			1,782	0.995	1,773
11		182	1,600			1,782	0.995	1,773
12		182	1,600			1,782	0.995	1,773
13						0	0.995	0
14						0	0.995	0
15						0	0.995	0
16						0	0.995	0
17						0	0.995	0
18						0	0.995	0
19						0	0.995	0
20						0	0.995	0
21						0	0.995	0
22						0	0.995	0
23						0	0.995	0
24						0	0.995	0
25						0	0.995	0
26						0	0.995	0
27						0	0.995	0
28						0	0.995	0
29						0	0.995	0
30						0	0.995	0
31						0	0.995	0
32						0	0.995	0
33						0	0.995	0
34						0	0.995	0
35						0	0.995	0
36						0	0.995	0
37						0	0.995	0
38						0	0.995	0
39						0	0.995	0
40						0	0.995	0
41						0	0.995	0
42						0	0.995	0
43						0	0.995	0
44						0	0.995	0
45						0	0.995	0
46						0	0.995	0
47						0	0.995	0
48						0	0.995	0
49						0	0.995	0
50						0	0.995	0
51						0	0.995	0
52						0	0.995	0
53						0	0.995	0
54						0	0.995	0
55						0	0.995	0
56						0	0.995	0
57						0	0.995	0
58						0	0.995	0
59						0	0.995	0
60						0	0.995	0
Total	6,964	1,850	15,000	96	100	24,010	---	23,890

Table L.3.13 Economic Cost Spread Sheet of Institutional Capacity Development Measures

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)														Standard Conversion Factor (SCF)	Economic Cost (AT x SCF)
	Training Materials					Equipment (including replacement)					Personnel		Equipment	Annual Total (AT)		
	Village cadre	Information technology	Boarder patrol	Publi-cations	Meet-ing	Province FO *	District FO	Branch FO	University of Manado	NGO	International skilled labor	Indonesian skilled labor	Maintenance cost			
1	455	150	0		6	743	383	133	305	222	2,058	684	39	5,178	0.995	5,152
2	189	150	0	25	6					6	1,173	234	39	1,822	0.995	1,813
3	189		0	25	6					6	1,173	204	39	1,642	0.995	1,634
4	189		0	25	6					6	1,173	174	39	1,612	0.995	1,604
5	189		0	25	6					6	1,173	174	39	1,612	0.995	1,604
6													39	39	0.995	39
7													39	39	0.995	39
8													39	39	0.995	39
9													39	39	0.995	39
10													39	39	0.995	39
11						743	383	133	305				39	1,603	0.995	1,595
12													39	39	0.995	39
13													39	39	0.995	39
14													39	39	0.995	39
15													39	39	0.995	39
16													39	39	0.995	39
17													39	39	0.995	39
18													39	39	0.995	39
19													39	39	0.995	39
20													39	39	0.995	39
21						743	383	133	305				39	1,603	0.995	1,595
22													39	39	0.995	39
23													39	39	0.995	39
24													39	39	0.995	39
25													39	39	0.995	39
26													39	39	0.995	39
27													39	39	0.995	39
28													39	39	0.995	39
29													39	39	0.995	39
30													39	39	0.995	39
31						743	383	133	305				39	1,603	0.995	1,595
32													39	39	0.995	39
33													39	39	0.995	39
34													39	39	0.995	39
35													39	39	0.995	39
36													39	39	0.995	39
37													39	39	0.995	39
38													39	39	0.995	39
39													39	39	0.995	39
40													39	39	0.995	39
41						743	383	133	305				39	1,603	0.995	1,595
42													39	39	0.995	39
43													39	39	0.995	39
44													39	39	0.995	39
45													39	39	0.995	39
46													39	39	0.995	39
47													39	39	0.995	39
48													39	39	0.995	39
49													39	39	0.995	39
50													39	39	0.995	39
51						743	383	133	305				39	1,603	0.995	1,595
52													39	39	0.995	39
53													39	39	0.995	39
54													39	39	0.995	39
55													39	39	0.995	39
56													39	39	0.995	39
57													39	39	0.995	39
58													39	39	0.995	39
59													39	39	0.995	39
60													39	39	0.995	39
Total	1,211	300	0	100	30	4,458	2,298	798	1,830	246	6,750	1,470	2,340	21,831	---	21,722

Notes : * FO means forestry offices.

Table L.3.14 Economic Cost Spread Sheet of Monitoring System Development

(Unit : Rp. million)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant market price)														Labor Conversion Factor * (LCF)	Standard Conversion Factor (SCF)	Economic Cost (UL x LCF + O x SCF)
	Direct Cost for Construction				Indirect Cost				Monitoring Equipment			Engineering Services	Annual Total				
	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Skilled labor	Unskilled labor	Equip-ment	Mat-erials	Initial purchase	Equipment replacement	O & M materials	Skilled labor	Unskilled labor (UL)	Others (O)			
1	9	130	14	254	2	26	3	51	516		38	286	156	1,173	0.796	0.995	1,291
2											112	286	0	398	0.796	0.995	396
3											112	286	0	398	0.796	0.995	396
4											112	286	0	398	0.796	0.995	396
5											62	292	0	354	0.796	0.995	352
6									133	42	62	168	0	405	0.796	0.995	403
7											62	117	0	179	0.796	0.995	178
8											62	117	0	179	0.796	0.995	178
9											62	117	0	179	0.796	0.995	178
10											62	117	0	179	0.796	0.995	178
11									133	304	62	60	0	559	0.796	0.995	556
12											62	8	0	70	0.796	0.995	70
13											62	8	0	70	0.796	0.995	70
14											62	8	0	70	0.796	0.995	70
15											62	8	0	70	0.796	0.995	70
16									133	65	62	60	0	320	0.796	0.995	318
17											62	8	0	70	0.796	0.995	70
18											62	8	0	70	0.796	0.995	70
19											62	8	0	70	0.796	0.995	70
20											62	8	0	70	0.796	0.995	70
21									133	437	62	60	0	692	0.796	0.995	689
22											62	8	0	70	0.796	0.995	70
23											62	8	0	70	0.796	0.995	70
24											62	8	0	70	0.796	0.995	70
25											62	8	0	70	0.796	0.995	70
26									133	26	62	60	0	281	0.796	0.995	280
27											62	8	0	70	0.796	0.995	70
28											62	8	0	70	0.796	0.995	70
29											62	8	0	70	0.796	0.995	70
30											62	8	0	70	0.796	0.995	70
31									133	343	62	60	0	598	0.796	0.995	595
32											62	8	0	70	0.796	0.995	70
33											62	8	0	70	0.796	0.995	70
34											62	8	0	70	0.796	0.995	70
35											62	8	0	70	0.796	0.995	70
36									133	26	62	60	0	281	0.796	0.995	280
37											62	8	0	70	0.796	0.995	70
38											62	8	0	70	0.796	0.995	70
39											62	8	0	70	0.796	0.995	70
40											62	8	0	70	0.796	0.995	70
41									133	437	62	60	0	692	0.796	0.995	689
42											62	8	0	70	0.796	0.995	70
43											62	8	0	70	0.796	0.995	70
44											62	8	0	70	0.796	0.995	70
45											62	8	0	70	0.796	0.995	70
46									133	26	62	60	0	281	0.796	0.995	280
47											62	8	0	70	0.796	0.995	70
48											62	8	0	70	0.796	0.995	70
49											62	8	0	70	0.796	0.995	70
50											62	8	0	70	0.796	0.995	70
51									133	304	62	60	0	559	0.796	0.995	556
52											62	8	0	70	0.796	0.995	70
53											62	8	0	70	0.796	0.995	70
54											62	8	0	70	0.796	0.995	70
55											62	8	0	70	0.796	0.995	70
56									133	26	62	60	0	281	0.796	0.995	280
57											62	8	0	70	0.796	0.995	70
58											62	8	0	70	0.796	0.995	70
59											62	8	0	70	0.796	0.995	70
60											62	8	0	70	0.796	0.995	70
Total	9	130	14	254	2	26	3	51	1,979	2,036	3,846	2,992	156	11,186	---	---	11,254

Note : * Labor Conversion Factor (LCF) for unskilled labor cost = Standard Conversion Factor (SCF) x [1 - (unemployment rate : 0.2)]

Table L.3.15 Standard Conversion Factor for Economic Evaluation

Year	I Total Import Value to Indonesia (CIF) (US$ million)	E Total Export Value from Indonesia (FOB) (US$ million)	It Average Import Tax Rate (%)	Et Average Export Tax Rate (%)	SCF Standard Conversion Factor
1980	10,834	n.a.	5.1	0.9	--
1990	21,837	26,807	0.6	0.9	0.992
1991	25,869	29,635	0.4	0.3	0.996
1992	27,280	33,796	0.5	0.1	0.997
1993	28,328	36,607	0.5	0.2	0.997
1994	31,983	40,223	0.6	0.2	0.997
1995	40,630	47,454	0.3	0.2	0.998
1996	42,929	50,188	0.3	0.6	0.996
1997	41,694	56,298	0.2	0.8	0.995
1998	27,337	50,371	0.7	0.9	0.992
1999	24,004	51,242	n.a.	n.a.	--
2000	n.a.	n.a.	n.a.	n.a.	--
Average Standard Conversion Factor (SCF)					0.995

Note : *SCF = (I+E) / [I (1 + It / 100) + E (1 + Et / 100)]*

Sources : *1) 2000 International Financial Statistics Yearbook, IMF*
2) International Financial Statistics, February 2001, IMF
3) 2000 World Development Indicators, World Bank

Table L.3.16 Economic Cost and Benefit Spread Sheet of Watershed Conservation Plan

(Unit : Rp. million)

Serial	Economic Incremental Costs for Measures and Actions							Economic Incremental Benefits from Measures and Actions *					Net
	Forestry	Agroforestry	Physical	Community	Institutional	Monitoring	Admini-	Increased Water	Strengthened Erosion	Conserved	Improved Forestry	Improved Agricultural	Economic
Year	Measures	Measures	Construction	Empowerment	Development	System Dev.	stration	Resources	& Flood Control	Air Quality	Resources	Resources	Benefit
1	96	1,664	0	2,521	5,152	1,291	85	0	0	0	0	0	-10,810
2	144	80	0	2,406	1,813	396	85	0	33	1	2	0	-4,888
3	106	80	0	2,395	1,634	396	85	0	66	2	4	0	-4,625
4	100	80	2,929	2,383	1,604	396	85	0	98	2	5	0	-7,471
5	1,031	600	5,181	1,773	1,604	352	85	0	131	3	7	0	-10,485
6	1,056	594	27	1,773	39	403	85	0	164	4	9	681	-3,119
7	961	600	27	1,773	39	178	85	0	197	5	11	1,362	-2,089
8	940	594	27	1,773	39	178	85	1	229	5	13	1,816	-1,572
9	940	600	27	1,773	39	178	85	1	262	6	14	2,270	-1,089
10	832	80	27	1,773	39	178	85	1	295	7	16	2,445	-251
11	868	1,664	27	1,773	1,595	556	85	1	328	8	18	2,796	-3,418
12	768	80	27	1,773	39	70	85	1	361	8	20	3,499	1,048
13	732	80	27	0	39	70	85	1	393	9	22	3,850	3,243
14	732	80	386	0	39	70	85	1	426	10	24	4,025	3,095
15	365	80	27	0	39	70		1	426	10	24	4,025	3,905
16	246	80	27	0	39	318		1	426	10	24	4,025	3,776
17	246	80	27	0	39	70		1	426	10	24	4,025	4,025
18	246	80	27	0	39	70		1	426	10	24	4,025	4,025
19	246	80	27	0	39	70		1	426	10	24	4,025	4,025
20	246	80	27	0	39	70		1	426	10	24	4,025	4,025
21	281	1,664	27	0	1,595	689		1	426	10	24	4,025	230
22	281	80	27	0	39	70		1	426	10	24	4,025	3,989
23	246	80	27	0	39	70		1	426	10	24	4,025	4,025
24	246	80	386	0	39	70		1	426	10	24	4,025	3,666
25	365	80	27	0	39	70		1	426	10	24	4,025	3,905
26	246	80	27	0	39	280		1	426	10	24	4,025	3,815
27	246	80	27	0	39	70		1	426	10	24	4,025	4,025
28	246	80	27	0	39	70		1	426	10	24	4,025	4,025
29	246	80	27	0	39	70		1	426	10	24	4,025	4,025
30	246	80	27	0	39	70		1	426	10	24	4,025	4,025
31	281	1,664	27	0	1,595	595		1	426	10	24	4,025	323
32	281	80	27	0	39	70		1	426	10	24	4,025	3,989
33	246	80	27	0	39	70		1	426	10	24	4,025	4,025
34	246	80	386	0	39	70		1	426	10	24	4,025	3,666
35	357	80	27	0	39	70		1	426	10	24	4,025	3,913
36	238	80	27	0	39	280		1	426	10	24	4,025	3,823
37	238	80	27	0	39	70		1	426	10	24	4,025	4,032
38	238	80	27	0	39	70		1	426	10	24	4,025	4,032
39	238	80	27	0	39	70		1	426	10	24	4,025	4,032
40	238	80	27	0	39	70		1	426	10	24	4,025	4,032
41	273	1,664	27	0	1,595	689		1	426	10	24	4,025	238
42	273	80	27	0	39	70		1	426	10	24	4,025	3,997
43	238	80	27	0	39	70		1	426	10	24	4,025	4,032
44	238	80	386	0	39	70		1	426	10	24	4,025	3,674
45	357	80	27	0	39	70		1	426	10	24	4,025	3,913
46	238	80	27	0	39	280		1	426	10	24	4,025	3,823
47	238	80	27	0	39	70		1	426	10	24	4,025	4,032
48	238	80	27	0	39	70		1	426	10	24	4,025	4,032
49	238	80	27	0	39	70		1	426	10	24	4,025	4,032
50	238	80	27	0	39	70		1	426	10	24	4,025	4,032
51	273	1,664	27	0	1,595	556		1	426	10	24	4,025	370
52	273	80	27	0	39	70		1	426	10	24	4,025	3,997
53	238	80	27	0	39	70		1	426	10	24	4,025	4,032
54	238	80	386	0	39	70		1	426	10	24	4,025	3,674
55	357	80	27	0	39	70		1	426	10	24	4,025	3,913
56	238	80	27	0	39	280		1	426	10	24	4,025	3,823
57	238	80	27	0	39	70		1	426	10	24	4,025	4,032
58	238	80	27	0	39	70		1	426	10	24	4,025	4,032
59	238	80	27	0	39	70		1	426	10	24	4,025	4,032
60	238	80	27	0	39	70		1	426	10	24	4,025	4,032
Total	21,278	16,870	11,411	23,890	21,722	11,254	1,190	53	22,589	523	1,248	207,894	124,690

Economic Net Present Value (ENPV) with 12-% discount rate = Mil. Rp. -24,318

Economic Benefit/Cost Ratio (E-B/C) wirh 12-% discount rate = 0.39

Economic Internal Rate of Return (EIRR) = 4.5%

Note: * All the incremental benefits are assumed to be fully occurred in the 14th year of the project.

Sensitivity Analysis on EIRR

Cost + 10 %		Benefit - 10 %		Cost+10% & Benefit-10%
Total Cost	Net Benefit	Total Benefit	Net Benefit	Net Benefit
11,891	-11,891	0	-10,810	-11,891
5,416	-5,380	32	-4,891	-5,384
5,165	-5,094	64	-4,632	-5,101
8,335	-8,228	96	-7,481	-8,239
11,689	-11,548	128	-10,499	-11,562
4,375	-3,517	772	-3,205	-3,603
4,030	-2,456	1,417	-2,247	-2,613
4,000	-1,936	1,858	-1,779	-2,142
4,007	-1,453	2,298	-1,344	-1,708
3,316	-552	2,487	-527	-828
7,225	-4,075	2,835	-3,733	-4,390
3,125	763	3,500	659	375
1,136	3,139	3,848	2,815	2,712
1,530	2,956	4,037	2,646	2,507
639	3,847	4,037	3,457	3,399
781	3,705	4,037	3,327	3,256
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
4,681	-196	4,037	-219	-644
546	3,939	4,037	3,540	3,491
507	3,978	4,037	3,576	3,530
901	3,584	4,037	3,218	3,136
639	3,847	4,037	3,457	3,399
738	3,747	4,037	3,366	3,299
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
507	3,978	4,037	3,576	3,530
4,579	-93	4,037	-125	-541
546	3,939	4,037	3,540	3,491
507	3,978	4,037	3,576	3,530
901	3,584	4,037	3,218	3,136
630	3,856	4,037	3,465	3,407
729	3,756	4,037	3,374	3,308
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
4,673	-187	4,037	-211	-636
538	3,948	4,037	3,548	3,499
498	3,987	4,037	3,584	3,539
892	3,593	4,037	3,226	3,145
630	3,856	4,037	3,465	3,407
729	3,756	4,037	3,374	3,308
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
4,527	-41	4,037	-78	-490
538	3,948	4,037	3,548	3,499
498	3,987	4,037	3,584	3,539
892	3,593	4,037	3,226	3,145
630	3,856	4,037	3,465	3,407
729	3,756	4,037	3,374	3,308
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
498	3,987	4,037	3,584	3,539
	3.9%		3.9%	3.3%

Table L.4.1 Financial Cost Spread Sheet of Forestry Measures and Actions

(Unit : Rp. million in 2000 market price)

	Cost-Items for Measures and Actions (in 2000 constant price)																					Annual	Annual
	Forestry Boundary				Reforestation			Forest Patrol				Rese.*	Community Forestry				Timber Plantation			Delivery St.**		Annual	Total in
Serial	Skilled	Unskill-	Equip-	Mat-	Skilled	Unskill-	Materials &	Skilled	Unskill-	Equip-	Mat-	Skilled	Skilled	Unskill-	Equip-	Mat-	Skilled	Unskill-	Mat-	Unskill-	Mat-	Total	Current
Year	labor	ed labor	ment	erials	labor	ed labor	equipment	labor	ed labor	ment	erials	labor	labor	ed labor	ment	erials	labor	ed labor	erials	ed labor	erials		Price***
1	42	14	14	30																		100	101
2	1	6		30									107	2								146	151
3													98	1	1	7						107	112
4													98		1	2						101	108
5					116	4		108	60	120	66	74	98		1	2	376	6	16	2	2	1,051	1,141
6					98	115	36	108			6	74	98		1	2	376	168	34	1	1	1,118	1,234
7					98	120	11	108			6		98		1	2	376	168	34	1	1	1,024	1,149
8					98	120	11	108			6		98		1	2	376	162	19			1,001	1,142
9					98	120	11	108			6		98		1	2	376	162	19			1,001	1,161
10					98	10		108			6		98		1	2	368	162	18			871	1,027
11	1	6		30	98	10		108			6		98		1	2	368	162	18			908	1,088
12	1	6		30	98	10		108			6						368	162	18			807	983
13					98	10		108			6						368	162	18			770	954
14					98	10		108			6						368	162	18			770	970
15						10		54	2	120	5						135	54				380	486
16						10		54	2		5						135	54				260	338
17						10		54	2		5						135	54				260	344
18						10		54	2		5						135	54				260	350
19						10		54	2		5						135	54				260	355
20						10		54	2		5						135	54				260	361
21	1	6		30		10		54	2		5						135	54				297	420
22	1	6		30		10		54	2		5						135	54				297	427
23						10		54	2		5						135	54				260	380
24						10		54	2		5						135	54				260	386
25						10		54	2	120	5						135	54				380	574
26						10		54	2		5						135	54				260	399
27						10		54	2		5						135	54				260	406
28						10		54	2		5						135	54				260	412
29						10		54	2		5						135	54				260	419
30						10		54	2		5						135	54				260	426
31	1	6		30		10		54	2		5						135	54				297	495
32	1	6		30		10		54	2		5						135	54				297	503
33						10		54	2		5						135	54				260	448
34						10		54	2		5						135	54				260	455
35								54	2	120	5						135	54				370	658
36								54	2		5						135	54				250	452
37								54	2		5						135	54				250	460
38								54	2		5						135	54				250	467
39								54	2		5						135	54				250	475
40								54	2		5						135	54				250	483
41	1	6		30				54	2		5						135	54				287	564
42	1	6		30				54	2		5						135	54				287	573
43								54	2		5						135	54				250	507
44								54	2		5						135	54				250	516
45								54	2	120	5						135	54				370	776
46								54	2		5						135	54				250	533
47								54	2		5						135	54				250	542
48								54	2		5						135	54				250	551
49								54	2		5						135	54				250	560
50								54	2		5						135	54				250	569
51	1	6		30				54	2		5						135	54				287	665
52	1	6		30				54	2		5						135	54				287	676
53								54	2		5						135	54				250	598
54								54	2		5						135	54				250	608
55								54	2	120	5						135	54				370	915
56								54	2		5						135	54				250	629
57								54	2		5						135	54				250	639
58								54	2		5						135	54				250	650
59								54	2		5						135	54				250	660
60								54	2		5						135	54				250	671
Total	53	80	14	360	998	729	69	3,564	152	720	350	148	989	3	9	23	9,930	3,960	212	4	4	22,371	35,103

Notes : * This research is for the non-wood forest products.

** This delivery stations are for the firewood plantation .

*** These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000.

Table L.4.2 Financial Cost Spread Sheet of Agroforestry Measures and Actions

(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)						Annual Total in Current Price *
	Administration	Lecture Fee	Meeting Cost	Extension Services		Annual Total	
	Skilled labor	Skilled labor	Materials	Extension equipment	Equipment maintenance		
1				1,592	80	1,672	1,700
2					80	80	83
3					80	80	84
4					80	80	85
5	483	10	30		80	603	655
6	483	5	29		80	597	659
7	483	10	30		80	603	677
8	483	5	29		80	597	681
9	483	10	30		80	603	699
10					80	80	94
11				1,592	80	1,672	2,004
12					80	80	97
13					80	80	99
14					80	80	101
15					80	80	102
16					80	80	104
17					80	80	106
18					80	80	108
19					80	80	109
20					80	80	111
21				1,592	80	1,672	2,363
22					80	80	115
23					80	80	117
24					80	80	119
25					80	80	121
26					80	80	123
27					80	80	125
28					80	80	127
29					80	80	129
30					80	80	131
31				1,592	80	1,672	2,785
32					80	80	135
33					80	80	138
34					80	80	140
35					80	80	142
36					80	80	145
37					80	80	147
38					80	80	150
39					80	80	152
40					80	80	155
41				1,592	80	1,672	3,284
42					80	80	160
43					80	80	162
44					80	80	165
45					80	80	168
46					80	80	171
47					80	80	173
48					80	80	176
49					80	80	179
50					80	80	182
51				1,592	80	1,672	3,872
52					80	80	188
53					80	80	191
54					80	80	195
55					80	80	198
56					80	80	201
57					80	80	204
58					80	80	208
59					80	80	211
60					80	80	215
Total	2,415	40	148	9,552	4,480	16,955	26,420

Notes : * These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000.

Table L.4.3 Financial Cost Spread Sheet of Physical Construction Works

(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)																																Annual Total	Annual Total in Current Price**
	Check Dam				River Bed Protection				River Bank Protection				Hillside Works				Slope Protection *				Indirect Construction Cost				O & M Cost			Admini.	En. Ser.	Physical Contingency				Replacement		
	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Unskill-ed labor	Equip-ment	Mat-erials	Land Acquisition	Skilled labor	Skilled labor	Unskill-ed labor	Equip-ment	Mat-erials	Equip-ment		
1																																	0	0
2																																	0	0
3																																	0	0
4	19	300	112	624	9	136	79	496					1	9	2	31	1	7	7	19	6	90	40	234		360		9	285	3	45	20	117		3,061	3,269
5	39	600	225	1248					27	438	283	1,254									13	208	102	500					128	7	104	51	250		5,477	5,947
6																									7	4	18							29	32
7																									7	4	18							29	33
8																									7	4	18							29	33
9																									7	4	18							29	34
10																									7	4	18							29	34
11																									7	4	18							29	35
12																									7	4	18							29	35
13																									7	4	18							29	36
14																									7	4	18						360	389	490
15																									7	4	18							29	37
16																									7	4	18							29	38
17																									7	4	18							29	38
18																									7	4	18							29	39
19																									7	4	18							29	40
20																									7	4	18							29	40
21																									7	4	18							29	41
22																									7	4	18							29	42
23																									7	4	18							29	42
24																									7	4	18						360	389	578
25																									7	4	18							29	44
26																									7	4	18							29	44
27																									7	4	18							29	45
28																									7	4	18							29	46
29																									7	4	18							29	47
30																									7	4	18							29	48
31																									7	4	18							29	48
32																									7	4	18							29	49
33																									7	4	18							29	50
34																									7	4	18						360	389	681
35																									7	4	18							29	52
36																									7	4	18							29	52
37																									7	4	18							29	53
38																									7	4	18							29	54
39																									7	4	18							29	55
40																									7	4	18							29	56
41																									7	4	18							29	57
42																									7	4	18							29	58
43																									7	4	18							29	59
44																									7	4	18						360	389	803
45																									7	4	18							29	61
46																									7	4	18							29	62
47																									7	4	18							29	63
48																									7	4	18							29	64
49																									7	4	18							29	65
50																									7	4	18							29	66
51																									7	4	18							29	67
52																									7	4	18							29	68
53																									7	4	18							29	69
54																									7	4	18						360	389	946
55																									7	4	18							29	72
56																									7	4	18							29	73
57																									7	4	18							29	74
58																									7	4	18							29	75
59																									7	4	18							29	77
60																									7	4	18							29	78
Total	58	900	337	1,872	9	136	79	496	27	438	283	1,254	1	9	2	31	1	7	7	19	19	298	142	734	385	580	990	9	413	10	149	71	367	1,800	11,933	15,294

Notes : * These protection works are for the road cut slopes.

** These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000.

Table L.4.4 Financial Cost Spread Sheet of Community Empowerment Measures and Actions

(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)						Annual Total in Current Price *
	Foreign Specialist	Domestic Specialist/Expert	Training Materials		Basic Fund	Annual Total	
	Skilled labor	Skilled labor	Operation cost	Micro realization cost	Seed money		
1	1,741	143	550		100	2,534	2,576
2	1,741	91	550	36		2,418	2,499
3	1,741	80	550	36		2,407	2,529
4	1,741	80	550	24		2,395	2,558
5		182	1,600			1,782	1,935
6		182	1,600			1,782	1,967
7		182	1,600			1,782	2,000
8		182	1,600			1,782	2,033
9		182	1,600			1,782	2,067
10		182	1,600			1,782	2,101
11		182	1,600			1,782	2,136
12		182	1,600			1,782	2,171
13						0	0
14						0	0
15						0	0
16						0	0
17						0	0
18						0	0
19						0	0
20						0	0
21						0	0
22						0	0
23						0	0
24						0	0
25						0	0
26						0	0
27						0	0
28						0	0
29						0	0
30						0	0
31						0	0
32						0	0
33						0	0
34						0	0
35						0	0
36						0	0
37						0	0
38						0	0
39						0	0
40						0	0
41						0	0
42						0	0
43						0	0
44						0	0
45						0	0
46						0	0
47						0	0
48						0	0
49						0	0
50						0	0
51						0	0
52						0	0
53						0	0
54						0	0
55						0	0
56						0	0
57						0	0
58						0	0
59						0	0
60						0	0
Total	6,964	1,850	15,000	96	100	24,010	26,571

Notes : * These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000.

Table L.4.5 Financial Cost Spread Sheet of Institutional Capacity Development Measures

(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)														Annual Total in Current Price**
	Training Materials					Equipment (including replacement)					Personnel		Equipment	Annual	
	Village cadre	Information technology	Boarder patrol	Publi-cations	Meet-ing	Province FO *	District FO	Branch FO	University of Manado	NGO	International skilled labor	Indonesian skilled labor	Maintenance cost	Total	
1	455	150	0		6	743	383	133	305	222	2,058	684	39	5,178	5,264
2	189	150	0	25	6					6	1,173	234	39	1,822	1,883
3	189		0	25	6					6	1,173	204	39	1,642	1,725
4	189		0	25	6					6	1,173	174	39	1,612	1,722
5	189		0	25	6					6	1,173	174	39	1,612	1,750
6													39	39	43
7													39	39	44
8													39	39	44
9													39	39	45
10													39	39	46
11						743	383	133	305				39	1,603	1,921
12													39	39	48
13													39	39	48
14													39	39	49
15													39	39	50
16													39	39	51
17													39	39	52
18													39	39	52
19													39	39	53
20													39	39	54
21						743	383	133	305				39	1,603	2,265
22													39	39	56
23													39	39	57
24													39	39	58
25													39	39	59
26													39	39	60
27													39	39	61
28													39	39	62
29													39	39	63
30													39	39	64
31						743	383	133	305				39	1,603	2,670
32													39	39	66
33													39	39	67
34													39	39	68
35													39	39	69
36													39	39	71
37													39	39	72
38													39	39	73
39													39	39	74
40													39	39	75
41						743	383	133	305				39	1,603	3,148
42													39	39	78
43													39	39	79
44													39	39	80
45													39	39	82
46													39	39	83
47													39	39	85
48													39	39	86
49													39	39	87
50													39	39	89
51						743	383	133	305				39	1,603	3,712
52													39	39	92
53													39	39	93
54													39	39	95
55													39	39	96
56													39	39	98
57													39	39	100
58													39	39	101
59													39	39	103
60													39	39	105
Total	1,211	300	0	100	30	4,458	2,298	798	1,830	246	6,750	1,470	2,340	21,831	29,548

Notes : * FO means forestry offices.

** These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000.

Table L.4.6 Financial Cost Spread Sheet of Monitoring System Development

(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)												Annual Total	Annual Total in Current Price *
	Direct Cost for Construction				Indirect Cost				Monitoring Equipment			Engineering Services		
	Skilled labor	Unskilled labor	Equipment	Materials	Skilled labor	Unskilled labor	Equipment	Materials	Initial purchase	Equipment replacement	O & M materials	Skilled labor		
1	9	130	14	254	2	26	3	51	516		38	286	1,329	1,351
2											112	286	398	411
3											112	286	398	418
4											112	286	398	425
5											62	292	354	384
6									133	42	62	168	405	447
7											62	117	179	201
8											62	117	179	204
9											62	117	179	208
10											62	117	179	211
11									133	304	62	60	559	670
12											62	8	70	85
13											62	8	70	87
14											62	8	70	88
15											62	8	70	90
16									133	65	62	60	320	416
17											62	8	70	93
18											62	8	70	94
19											62	8	70	96
20											62	8	70	97
21									133	437	62	60	692	978
22											62	8	70	101
23											62	8	70	102
24											62	8	70	104
25											62	8	70	106
26									133	26	62	60	281	431
27											62	8	70	109
28											62	8	70	111
29											62	8	70	113
30											62	8	70	115
31									133	343	62	60	598	996
32											62	8	70	119
33											62	8	70	121
34											62	8	70	123
35											62	8	70	125
36									133	26	62	60	281	508
37											62	8	70	129
38											62	8	70	131
39											62	8	70	133
40											62	8	70	135
41									133	437	62	60	692	1,359
42											62	8	70	140
43											62	8	70	142
44											62	8	70	144
45											62	8	70	147
46									133	26	62	60	281	599
47											62	8	70	152
48											62	8	70	154
49											62	8	70	157
50											62	8	70	159
51									133	304	62	60	559	1,294
52											62	8	70	165
53											62	8	70	168
54											62	8	70	170
55											62	8	70	173
56									133	26	62	60	281	707
57											62	8	70	179
58											62	8	70	182
59											62	8	70	185
60											62	8	70	188
Total	9	130	14	254	2	26	3	51	1,979	2,036	3,846	2,992	11,342	17,428

Note : * These total costs in current price are calcuated with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000

Table L.5.1 Financial Cost and Revenue Spread Sheet of Watershed Conservation Plan

(Unit : Rp. million in current market price, with an average inflation rate of 1.66 % between 2 % in 1999 and 1.32 % in 2000)

Serial	Financial Incremental Costs for Measures and Actions							Financial Revenues from Incremental Agroforestry Production		Net
Year	Forestry Measures	Agroforestry Measures	Physical Construction	Community Empowerment	Institutional Development	Monitoring System Development	Administration	Field Crop	Tree Crop	Revenue
1	101	1,700	0	2,576	5,264	1,351	86	0	0	-11,079
2	151	83	0	2,499	1,883	411	88	0	0	-5,115
3	112	84	0	2,529	1,725	418	89	0	0	-4,958
4	108	85	3,269	2,558	1,722	425	91	0	0	-8,258
5	1,141	655	5,947	1,935	1,750	384	92	0	0	-11,905
6	1,234	659	32	1,967	43	447	94	752	0	-3,724
7	1,149	677	33	2,000	44	201	95	1,528	0	-2,670
8	1,142	681	33	2,033	44	204	97	2,072	0	-2,163
9	1,161	699	34	2,067	45	208	99	2,633	0	-1,679
10	1,027	94	34	2,101	46	211	100	2,631	251	-731
11	1,088	2,004	35	2,136	1,921	670	102	2,585	766	-4,605
12	983	97	35	2,171	48	85	104	2,445	1,817	738
13	954	99	36	0	48	87	105	2,394	2,375	3,440
14	970	101	490	0	49	88	107	2,386	2,682	3,264
15	486	102	37	0	50	90		2,426	2,727	4,387
16	338	104	38	0	51	416		2,466	2,772	4,291
17	344	106	38	0	52	93		2,507	2,818	4,693
18	350	108	39	0	52	94		2,549	2,865	4,770
19	355	109	40	0	53	96		2,591	2,912	4,850
20	361	111	40	0	54	97		2,634	2,961	4,930
21	420	2,363	41	0	2,265	978		2,678	3,010	-379
22	427	115	42	0	56	101		2,722	3,060	5,042
23	380	117	42	0	57	102		2,767	3,111	5,180
24	386	119	578	0	58	104		2,813	3,162	4,731
25	574	121	44	0	59	106		2,860	3,215	5,172
26	399	123	44	0	60	431		2,907	3,268	5,118
27	406	125	45	0	61	109		2,956	3,322	5,532
28	412	127	46	0	62	111		3,005	3,377	5,624
29	419	129	47	0	63	113		3,055	3,433	5,718
30	426	131	48	0	64	115		3,105	3,490	5,813
31	495	2,785	48	0	2,670	996		3,157	3,548	-290
32	503	135	49	0	66	119		3,209	3,607	5,944
33	448	138	50	0	67	121		3,263	3,667	6,107
34	455	140	681	0	68	123		3,317	3,728	5,578
35	658	142	52	0	69	125		3,372	3,790	6,116
36	452	145	52	0	71	508		3,428	3,853	6,052
37	460	147	53	0	72	129		3,485	3,917	6,541
38	467	150	54	0	73	131		3,543	3,982	6,649
39	475	152	55	0	74	133		3,601	4,048	6,760
40	483	155	56	0	75	135		3,661	4,115	6,872
41	564	3,284	57	0	3,148	1,359		3,722	4,183	-507
42	573	160	58	0	78	140		3,784	4,253	7,028
43	507	162	59	0	79	142		3,846	4,323	7,220
44	516	165	803	0	80	144		3,910	4,395	6,597
45	776	168	61	0	82	147		3,975	4,468	7,210
46	533	171	62	0	83	599		4,041	4,542	7,136
47	542	173	63	0	85	152		4,108	4,618	7,711
48	551	176	64	0	86	154		4,177	4,694	7,840
49	560	179	65	0	87	157		4,246	4,772	7,970
50	569	182	66	0	89	159		4,316	4,852	8,102
51	665	3,872	67	0	3,712	1,294		4,388	4,932	-289
52	676	188	68	0	92	165		4,461	5,014	8,286
53	598	191	69	0	93	168		4,535	5,097	8,512
54	608	195	946	0	95	170		4,610	5,182	7,778
55	915	198	72	0	96	173		4,687	5,268	8,500
56	629	201	73	0	98	707		4,764	5,355	8,413
57	639	204	74	0	100	179		4,844	5,444	9,092
58	650	208	75	0	101	182		4,924	5,535	9,243
59	660	211	77	0	103	185		5,006	5,626	9,396
60	671	215	78	0	105	188		5,089	5,720	9,552
Total	35,103	26,420	15,294	26,571	29,548	17,428	1,349	184,936	193,924	227,146

Sensitivity Analysis on FIRR

Cost + 10 %		Benefit - 10 %		Cost+10% & Benefit-10%
Total Cost	Net Rev.	Total Benefit	Net Rev.	Net Rev.
12,186	-12,186	0	-11,079	-12,186
5,626	-5,626	0	-5,115	-5,626
5,454	-5,454	0	-4,958	-5,454
9,084	-9,084	0	-8,258	-9,084
13,095	-13,095	0	-11,905	-13,095
4,924	-4,172	677	-3,799	-4,247
4,618	-3,089	1,376	-2,822	-3,242
4,658	-2,586	1,864	-2,370	-2,794
4,743	-2,110	2,369	-1,943	-2,374
3,975	-1,092	2,594	-1,019	-1,381
8,751	-5,400	3,016	-4,940	-5,735
3,876	386	3,836	312	-40
1,462	3,307	4,292	2,963	2,830
1,985	3,083	4,562	2,757	2,577
842	4,310	4,637	3,872	3,795
1,042	4,196	4,714	3,767	3,672
696	4,629	4,792	4,160	4,097
707	4,706	4,872	4,229	4,165
719	4,784	4,953	4,299	4,234
731	4,864	5,035	4,371	4,304
6,673	-985	5,119	-947	-1,554
814	4,968	5,204	4,464	4,390
768	5,110	5,290	4,592	4,522
1,368	4,607	5,378	4,134	4,009
993	5,082	5,467	4,565	4,474
1,163	5,013	5,558	4,501	4,395
820	5,458	5,650	4,905	4,830
834	5,548	5,744	4,986	4,910
848	5,641	5,839	5,069	4,992
862	5,734	5,936	5,153	5,075
7,695	-989	6,035	-960	-1,660
959	5,857	6,135	5,263	5,176
905	6,025	6,237	5,414	5,332
1,613	5,431	6,340	4,874	4,727
1,151	6,011	6,446	5,399	5,295
1,351	5,930	6,553	5,324	5,202
947	6,455	6,661	5,801	5,715
962	6,562	6,772	5,897	5,810
978	6,671	6,884	5,995	5,906
995	6,782	6,999	6,094	6,004
9,253	-1,348	7,115	-1,297	-2,138
1,109	6,927	7,233	6,225	6,124
1,045	7,125	7,353	6,403	6,308
1,879	6,426	7,475	5,766	5,596
1,357	7,087	7,599	6,366	6,242
1,593	6,991	7,725	6,277	6,132
1,116	7,610	7,854	6,839	6,737
1,135	7,736	7,984	6,952	6,849
1,153	7,865	8,116	7,068	6,963
1,173	7,995	8,251	7,185	7,079
10,571	-1,250	8,388	-1,221	-2,182
1,308	8,167	8,527	7,339	7,220
1,232	8,400	8,669	7,549	7,437
2,216	7,576	8,813	6,798	6,597
1,600	8,355	8,959	7,505	7,359
1,878	8,242	9,108	7,401	7,230
1,316	8,972	9,259	8,063	7,943
1,338	9,121	9,413	8,197	8,075
1,360	9,272	9,569	8,333	8,209
1,382	9,426	9,728	8,471	8,345

Financial Net Present Value (FNPV) with 16-% discount rate = Mil. Rp -26,817

Financial Benefit/Cost Ratio (F-B/C) with 16-% discount rate = 0.27

Financial Internal Rate of Return (FIRR) = 5.4% 4.8% 4.8% 4.2%

(FIRR assuming inflation rates of 10 % up to the 10th year and 1.66 % from the 11th year on) 7.4%

(FIRR assuming inflation rates of 10 % up to the 20th year and 1.66 % from the 21th year on) 10.8%

Table L.5.2 Cost Recovery Schedule for WCP Implementation

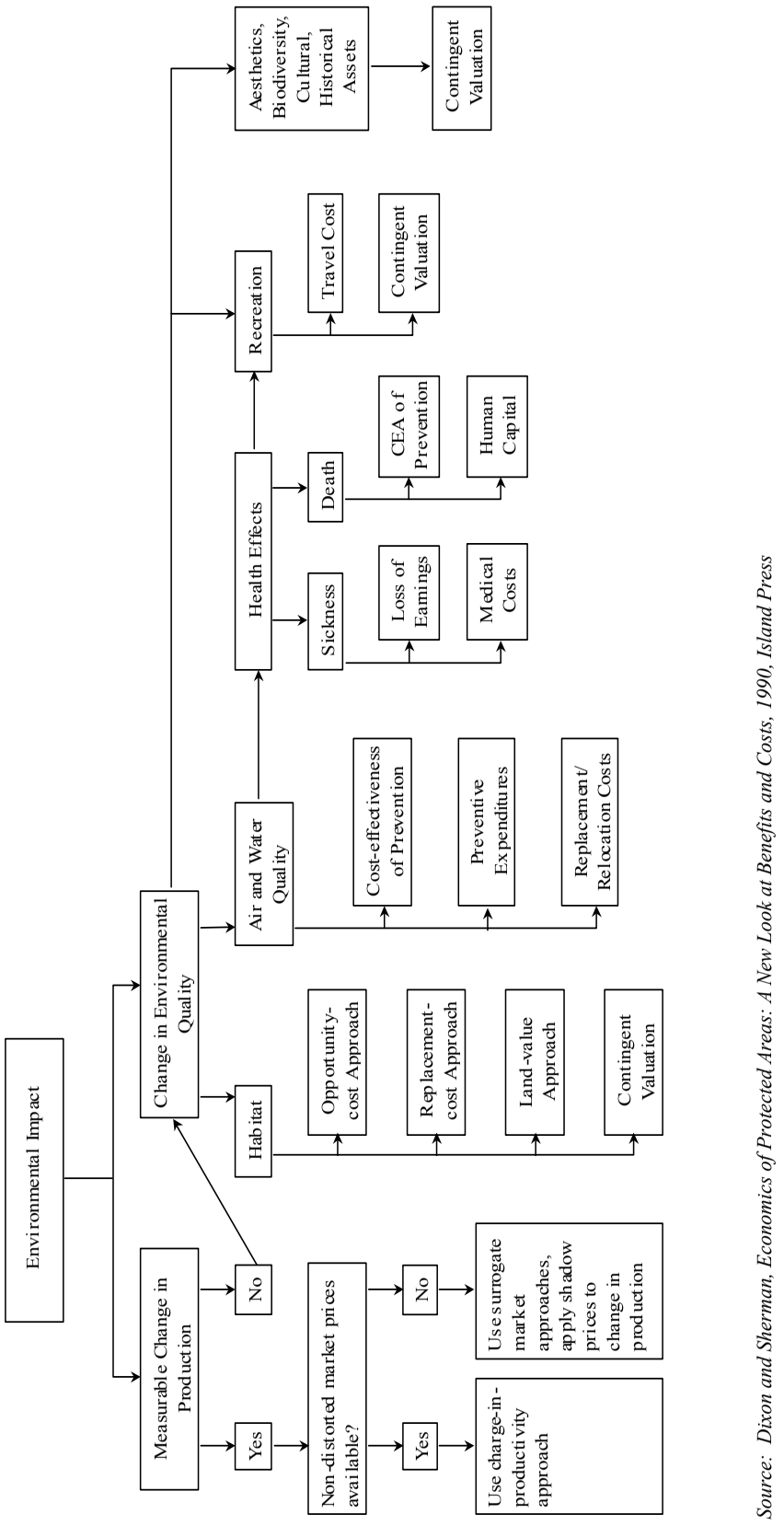
(Unit : Rp. million in 2000 market price)

Serial Year	Cost-Items for Measures and Actions (in 2000 constant price)												Total Cash Outflow (1+2+3)
	Domestic Financing Portion								Loan Portion				
	Forestry Measures	Agroforestry Measures	Physical Construction	Community Empowerment	Institutional Development	Monitoring System	Admini-stration	Total (1)	Physical Construction	Cummulated Loan	Interest * Payment (2)	Repayment ** (3)	
1	44	80	0	0	1,334	406	85	1,949	0	0			1,949
2	38	80	0	0	643	398	85	1,244	0	0	0		1,244
3	8	80	0	0	463	398	85	1,034	0	0	0		1,034
4	2	80	924	0	433	398	85	1,922	2,137	2,137	0		1,922
5	158	110	1,235	1,782	433	354	85	4,157	4,242	6,379	21		4,178
6	363	109	29	1,782	39	272	85	2,679	0	6,379	64		2,743
7	343	110	29	1,782	39	179	85	2,567	0	6,379	64		2,631
8	320	109	29	1,782	39	179	85	2,543	0	6,379	64		2,607
9	320	110	29	1,782	39	179	85	2,544	0	6,379	64		2,608
10	198	80	29	1,782	39	179	85	2,392	0	6,379	64		2,456
11	234	80	29	1,782	39	426	85	2,675	0	6,379	64		2,739
12	232	80	29	1,782	39	70	85	2,317	0	6,379	64		2,381
13	196	80	29	0	39	70	85	499	0	6,379	64		563
14	196	80	389	0	39	70	85	859	0	6,379	64		923
15	71	80	29	0	39	70	0	289	0	6,379	64		353
16	71	80	29	0	39	187	0	406	0	6,166	64	213	682
17	71	80	29	0	39	70	0	289	0	5,954	62	213	563
18	71	80	29	0	39	70	0	289	0	5,741	60	213	561
19	71	80	29	0	39	70	0	289	0	5,528	57	213	559
20	71	80	29	0	39	70	0	289	0	5,316	55	213	557
21	107	80	29	0	39	559	0	814	0	5,103	53	213	1,080
22	107	80	29	0	39	70	0	325	0	4,891	51	213	589
23	71	80	29	0	39	70	0	289	0	4,678	49	213	551
24	71	80	389	0	39	70	0	649	0	4,465	47	213	908
25	71	80	29	0	39	70	0	289	0	4,253	45	213	546
26	71	80	29	0	39	148	0	367	0	4,040	43	213	622
27	71	80	29	0	39	70	0	289	0	3,827	40	213	542
28	71	80	29	0	39	70	0	289	0	3,615	38	213	540
29	71	80	29	0	39	70	0	289	0	3,402	36	213	538
30	71	80	29	0	39	70	0	289	0	3,190	34	213	536
31	107	80	29	0	39	465	0	720	0	2,977	32	213	965
32	107	80	29	0	39	70	0	325	0	2,764	30	213	567
33	71	80	29	0	39	70	0	289	0	2,552	28	213	529
34	71	80	389	0	39	70	0	649	0	2,339	26	213	887
35	61	80	29	0	39	70	0	279	0	2,126	23	213	515
36	61	80	29	0	39	148	0	357	0	1,914	21	213	591
37	61	80	29	0	39	70	0	279	0	1,701	19	213	511
38	61	80	29	0	39	70	0	279	0	1,488	17	213	509
39	61	80	29	0	39	70	0	279	0	1,276	15	213	507
40	61	80	29	0	39	70	0	279	0	1,063	13	213	504
41	97	80	29	0	39	559	0	804	0	851	11	213	1,027
42	97	80	29	0	39	70	0	315	0	638	9	213	536
43	61	80	29	0	39	70	0	279	0	425	6	213	498
44	61	80	389	0	39	70	0	639	0	213	4	213	856
45	61	80	29	0	39	70	0	279	0	0	2	213	494
46	61	80	29	0	39	148	0	357	0				357
47	61	80	29	0	39	70	0	279	0				279
48	61	80	29	0	39	70	0	279	0				279
49	61	80	29	0	39	70	0	279	0				279
50	61	80	29	0	39	70	0	279	0				279
51	97	80	29	0	39	426	0	671	0				671
52	97	80	29	0	39	70	0	315	0				315
53	61	80	29	0	39	70	0	279	0				279
54	61	80	389	0	39	70	0	639	0				639
55	61	80	29	0	39	70	0	279	0				279
56	61	80	29	0	39	148	0	357	0				357
57	61	80	29	0	39	70	0	279	0				279
58	61	80	29	0	39	70	0	279	0				279
59	61	80	29	0	39	70	0	279	0				279
60	61	80	29	0	39	70	0	279	0				279
Total	5,946	4,948	5,554	14,256	5,451	8,956	1,190	46,301	6,379	---	1,648	6,379	54,328

Notes : * Assumed interest rate for donors' soft loan is a flat arate of 1 %.

** Maximum repayment (depreciation) period for the donors' soft loan is 40 years including 10-year grace period.

Figures



Source: Dixon and Sherman, Economics of Protected Areas: A New Look at Benefits and Costs, 1990, Island Press

The Study on Critical Land and Protection Forest Rehabilitation at Tondano Watershed in the Republic of Indonesia

Japan International Cooperation Agency

Figure L.3.1

Valuation Flowchart to Select Applicable Methods