financial year 1994, the remaining service life of the dam will be extended to more than 48.8 years. The dam will still have a sedimentation capacity of 16,241,000m^3 or more with the implementation of the Project when the present remaining capacity supposedly runs out in 43.4 years after June, 1994.

In short, the Project will prolong the service life of Saguling dam by at least 5.4 years with a remaining capacity of at least 16,241,000m^3 at the time when no remaining capacity will remain if the present rate of sedimentation continues (see Supporting Report C2).

5.4 Infrastrucutre Plan

5.4.1 Road Construction and Improvement

In addition to the construction of new work roads to serve the demonstration plots and check dams, community roads will be newly constructed or improved to provide the good transportation prospect of project-related items for the smooth implementation of the Project and subsequent local development.

(1) Construction of New Roads

Many of the access roads to the existing demonstration plots and check dams are impassable by vehicles. The construction of appropriate access roads along with the construction of new demonstration plots and check dams is, therefore, highly desirable to enhance the prospect of their proper maintenance and demonstration effects vis-a-vis farmers. The average length of a work road to a demonstration plot or check dam/small check dam is assumed to be 200m or 100m respectively and the total length of new work roads to be constructed is calculated based on the planned number of new plots and dams.

In the case of community roads used for the transportation of goods, it is apparent from the interview survey that local inhabitants strongly hope for their upgrading or repair. Consequently, the construction of new community roads is planned as part of the Project, particularly in mountainous areas with a low road density, in view of the smooth implementation of the Project as well as local development.

Careful attention should be paid to the slope gradient and required earth volume in the selection of routes in order to minimise soil discharge towards the downstream during and after construction work.

The total length of work roads will be 26,600m for check dams and 6,000m for demonstration plots, totalling 32,600m. With the construction of 41,800m of community roads, the total length of new roads to be constructed under the Project will be 74,400m. The planned scale of new road construction by sub-watershed is shown in Table 5-17.

As shown in Fig. 5-9, the new roads will have a width of 4m (effective width: 3m) and will be paved with either gravel or asphalt to ensure both soil conservation and smooth traffic. A dug gutter will be provided on one side of the road for drainage and falling works will also be introduced as required.

Slopes with a height of 0.5m or more will be covered by grass for slope protection as well as to supply animal feed.

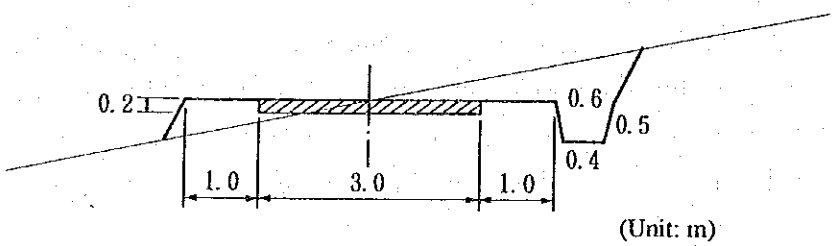


Fig. 5-9 Standard Cross-Section of New Roads

Construction machinery, notably road rollers, will be used for compacting and asphalt paving while all other type of work will be conducted manually.

(2) Road Improvement

1) Road Surface Repair

The total lengths of different types of roads, established by the field survey, are given in Table 5-16. The ratio of scoured or damaged sections totals 30% in the case of gravel common roads, 60% in the case of gravel tracks and 30% in the case of earth tracks, causing problems in terms of soil conservation and use.

Table 5-16 Road Conditions (Private Land)

Road Category	Surface Type	Length (m)	Remarks
Common Road	Asphalt	153,384 (70)	Total Length: 219,120m
	Gravel	65,736 (30)	
Track	Asphalt	27,009 (10)	Total Length: 270,090m
	Gravel	162,054 (60)	
	Earth	81,027 (30)	

Note: Figures in brackets are the ratio in the total road length.

In regard to roads with poor surface conditions, earth roads will be upgraded to gravel roads while gravel roads will be repaired. The planned road surface improvement work covers 19,721m of gravel common roads, 64,822m of gravel tracks and 40,516m of each tracks.

In the case of steep sloping sections of gravel or earth roads, the present gravel surface and earth surface will be upgraded to an asphalt surface and gravel surface respectively to ensure smooth vehicle traffic during rain. The total length of such upgrading work will be 2,192m for gravel common roads and 2,702m for earth tracks. The planned volume of repair and upgrading work by sub-watershed is given in Table 5-18.

2) Slope Protection and Other Work

The findings of the field survey clearly indicate the need to introduce measures to improve road drainage and slope protection in the Planning Area. Revegetation with grass will be conducted at those slopes which have become bare and have a potential risk of soil erosion. Revegetation work will be conducted over 54,781m^2 of slope areas along common roads and 67,525m^2 of slope areas along tracks

Simple dug gutters will be introduced at the sides of roads where there is serious scouring to facilitate drainage. Falling works will be constructed at changing points in the topography to reduce the flowing speed of drained water in order to prevent undesirable soil erosion.

A total of 109,560m of gutters will be constructed along common roads with falling works introduced at 1,096 sites. In the case of tracks, 135,045m of gutters will be provided together with falling works at 1,351 sites. The standard structures of the slope protection works and gutters will be the same as those employed for new roads. The planned volume of slope revegetation work and drainage work (gutters) by sub-watershed is given in Table 5-19.

(3) Roadside Planting

Most village roads in the Planning Area have hardly any roadside trees except in some parts of settlements and farmland as the shoulders are squeezed to the minimum width by neighbouring farmland. In addition to revegetation work, the prevention of soil loss from shoulders will be an important task in the coming years. Moreover, the improved local standard of living may well stimulate the desire of local inhabitants to create better landscaping along roads.

Table 5-17 New Road Construction Plan

Type of Road	Objective	Unit	Sub-Watershed Code Number												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
Work Road	Check Dam	m	1,800	2,800	1,900	4,900	2,300	3,300	2,200	2,100	1,800	2,000	1,100	400	26,600
	Demonstration Plot	m	500	500	500	500	500	500	500	500	500	500	500	500	6,000
Community Road	-	m	-	-	-	-	-	6,200	16,700	10,400	2,100	6,400	-	-	41,800
Total		m	2,300	3,300	2,400	5,400	2,800	10,000	19,400	13,000	4,400	8,900	1,600	900	74,400

Table 5-18 Road Improvement Plan (Surface Improvement)

Type of Road	Type of Work	Unit	Sub-Watershed Code Number												Total
			1	2	3	4	5	6	7	8	9	10	11	12	
Common Road	Repair (Gravel Road)	m	2,178	2,336	2,714	3,793	1,273	225	619	1,681	2,503	1,193	1,109	97	19,721
	Upgrading (Gravel to Asphalt)	m	242	260	302	421	141	25	69	187	278	133	123	11	2,192
Track	Repair (Gravel Road)	m	5,664	10,718	5,957	8,390	8,570	7,870	4,589	3,250	3,036	3,149	3,516	113	64,822
	Upgrading (Earth to Gravel)	m	3,540	6,699	3,723	5,244	5,357	4,919	2,868	2,031	1,898	1,968	2,198	71	40,516
	Upgrading (Earth to Gravel)	m	236	447	248	350	357	328	191	135	127	131	147	5	2,702

Table 5-19 Road Improvement Plan (Slope Protection/Drainage)

Type of Road	Type of Work		Unit	Sub-Watershed Code Number												Total
				1	2	3	4	5	6	7	8	9	10	11	12	
Common Road	Slope Revegetation		m^2	6,050	6,490	7,540	10,535	3,535	625	1,720	4,670	6,953	3,313	3,080	270	54,781
	Drainage	Dug Gutter	m	12,100	12,980	15,080	21,070	7,070	1,250	3,440	9,340	13,905	6,625	6,160	540	109,560
		Falling Works	-	121	130	151	211	71	13	34	93	139	66	62	5	1,096
Track	Slope Revegetation		m^2	5,900	11,165	6,205	8,740	8,928	8,198	4,780	3,385	3,163	3,280	3,663	118	67,525
	Drainage	Dug Gutter	m	11,800	22,330	12,410	17,480	17,855	16,395	9,560	6,770	6,325	6,560	7,325	235	135,045
		Falling Works	-	118	223	124	175	179	164	96	68	63	66	73	2	1,351

Note: Slope Regeneration : 50% of total road length x slope length of 0.5m
Dug Gutter : along 50% of total road length
Falling Works : at 100m intervals of dug gutters

Surian will be planted under the Project on both sides of the existing roads to protect the shoulders and to create pleasant road scenery. The selection of surian is based on its root system's strong soil holding ability, the prospect of multi-purpose use and appearance. The surians are to be planted at 10m intervals to cover 30% of the total road length. The distribution of settlements and land use along the roads have also been taken into consideration in the decision on the planting scale.

5.4.2 Nursery Development

Nurseries will be established under the Project to produce seedlings to ensure a stable and increased supply of selected seedlings for afforestation, agroforestry and roadside planting purposes, which in turn should contribute to soil conservation, increased employment opportunities for local inhabitants and reinforcement of the activities of farmers' groups.

(1) Seedling Production

In addition to providing a sufficient quantity of seedlings, the production of excellent seedlings with a high survival rate will also be aimed at.

1) Tree Species

The seedlings to be produced will be of species which are appropriate for the intended afforestation, agroforestry and/or roadside planting purposes.

2) Seeds

Given the extensive area for development, a large quantity of seeds will be required. Efforts will be made to secure high quality seeds in cooperation with the Perum Perhutani which enjoys a high nursery performance level.

3) Nursing

Pot nursing will be the main nursing method. In addition to the use of fertilizers and pesticides, irrigation should also be considered during the dry season to establish a strict control regime for the seedlings.

4) Planting

The standard planting timing will be approximately 10 months after seeding when the seedlings reach a height of 50 - 100cm although the actual timing will differ from species to species. The standard nursing schedule is given in Table 5-20.

5) Production Quantity

The seedling production quantity is given in Table 5-21 based on the requirements for forest development, agroforestry and roadside planting. The planned production quantity by sub-watershed is given in Table 5-22.

Table 5-20 Nursing Schedule (Albizia)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Nursery Bed Preparation												
Seeding												
Weeding												
Fertilizer Application												
Pesticide Application												
Watering												
Planting												

Table 5-21 Production Quantity of Seedlings Envisaged by Project

	Number of Seedlings	Remarks
1. Forest Development	3,474,680	
Type 1	3,414,400	1,000 trees/ha x 3,104 ha x 1.1
Type 2	5,280	200 trees/ha x 24 ha x 1.1
Type 3	55,000	500 trees/ha x 100 ha x 1.1
2. Agroforestry	1,315,380	
Type 1	1,293,600	400 trees/ha x 2,940 ha x 1.1
Type 2	21,780	150 trees/ha x 132 ha x 1.1
3. Settlement Environment Conservation	308,880	
Tree Planting	51,480	46,800 trees x 1.1
Hedges	257,400	234,000 trees x 1.1
4. Torrent and Bank Conservation	708,400	
Line Planting	202,400	1 tree/m x 2 lines x 92,000m x 1.1
Green Belts	506,000	1,000 trees/ha x 460 ha x 1.1
5. Demonstration Plots	66,000	2,000 trees/plot x 30 plots x 1.1
6. Roadside Planting	32,288	146,763 ÷ 10m/tree x 2 x 1.1
Total	5,905,628	

Note: The number of required trees for planting is multiplied by 110% to obtain the required seedling production quantity in order to allow for a growth failure rate of 10% of the planted stock.

Table 5-22 Planned Production Quantity of Seedlings by Sub-Watershed

(Unit: trees)

Sub-Watershed Code Number		1	2	3	4	5	6	7	8	9	10	11	12	Total
Forest Development	Type 1	224,400	114,400	39,600	466,400	330,000	369,600	290,400	365,200	347,600	563,200	171,600	132,000	3,414,400
	Type 2	0	1,760	0	1,760	0	0	0	0	0	0	1,760	0	5,280
	Type 3	8,800	0	11,000	8,800	6,600	6,600	4,400	2,200	0	6,600	0	0	55,000
	Sub-total	233,200	116,160	50,600	476,960	336,600	376,200	294,800	367,400	347,600	569,800	173,360	132,000	3,474,680
Agroforestry	Type 1	105,600	96,800	132,000	124,960	124,960	158,400	121,440	107,360	147,840	72,160	47,520	54,560	1,293,600
	Type 2	3,300	2,640	2,640	3,300	1,320	1,980	1,320	0	1,320	0	3,960	0	21,780
	Sub-total	108,900	99,440	134,640	128,260	126,280	160,380	122,760	107,360	149,160	72,160	51,480	54,560	1,315,380
Settlement Environment Conservation	Tree Planting	2,728	10,120	7,744	10,032	3,168	2,024	4,048	3,432	2,904	2,728	2,376	176	51,480
	Hedges	13,640	50,600	38,720	50,160	15,840	10,120	20,240	17,160	14,520	13,640	11,880	880	257,400
	Sub-total	16,368	60,720	46,464	60,192	19,008	12,144	24,288	20,592	17,424	16,368	14,256	1,056	308,880
Torrent and Bank Conservation	Line Planting	17,600	26,400	13,200	39,600	8,800	26,400	13,200	13,200	13,200	17,600	8,800	4,400	202,400
	Green Belts	44,000	66,000	33,000	99,000	22,000	66,000	33,000	33,000	33,000	44,000	22,000	11,000	506,000
	Sub total	61,600	92,400	46,200	138,600	30,800	92,400	46,200	46,200	46,200	61,600	30,800	15,400	708,400
Demonstration Plots		4,400	4,400	6,600	6,600	8,800	6,600	4,400	6,600	8,800	2,200	4,400	2,200	66,000
Roadside Planting		3,155	4,661	3,629	5,089	3,290	2,329	1,716	2,127	2,670	1,740	1,780	102	32,288
Total Production Quantity		427,623	377,781	288,133	815,701	524,778	650,053	494,164	550,279	571,854	723,868	276,076	205,318	5,905,628

(2) Nursery Construction

The nurseries to be established under the Project will be of a moderate size to allow their construction and maintenance by local inhabitants. The sites will be fixed for easy management, convenience of use and function as focal points for soil conservation efforts.

The location of the nursery site in each sub-watershed will be decided based on a sufficient water supply, convenient access and other conditions and also taking the opinions/wishes of local inhabitants, improvement of the survival rate and use of local inhabitants into consideration.

The planned scope and scale of the nursery facilities are described below.

- Nursery Beds

  The introduction of 50 nursery beds of 1m x 20m each is planned to ensure operational efficiency. This size has been decided in view of the scale of land ownership, the need for efficient management and the findings of the survey on similar cases.

- Water Tanks

  Water tanks will be provided in preparation for possible water shortages in the dry season.

- Soil Storage

  Potting soil will be stored in this storage.

- Roads

  An access road to the nursery and work roads on the premises will be constructed.

- Information Board

  An information board indicating the establishment purpose, names of species grown at the nursery, production quantity and name of farmers' group responsible for nursery operation, etc. will be erected on the premises in the hope of stimulating the interest of visiting farmers from other areas to implement similar activities.

- Land Area

  The standard land areas of the nursery and nursery field will be 0.25 ha and 0.15 ha respectively.

- Number of Nurseries

  A total of 12 nurseries will be established based on the required number of seedlings under the Project, anticipated production quantity of 100,000 seedlings/year/nursery and planting period of 5 years.

(3) Seedling Supply System

When the production of a large quantity of seedlings is required as in the case of the Project, management of the operation collectively by a farmers' group is desirable rather than by individual farmers in order to achieve higher production efficiency and to provide employment opportunities for local inhabitants.

The functions of such farmers' groups include seed procurement and the adoption of new techniques, etc. in addition to the production of seedlings with the actual operation usually conducted under the guidance of the Project Office and/or extension workers. In the present case, the field survey found that some farmers' groups have a high nursery technique level although the provision of managerial and technical training in regard to the nurseries to be newly established under the Project is suggested.

5.5 Extension Plan

5.5.1 Extension, Guidance and Cooperation

(1) Extension and Guidance

At present, 32 regreening extension workers of the SBRLKT Citarum are conducting extension activities for 122 forests in the Study Area. The main subjects of these extension activities are (i) soil conservation work, (ii) agroforestry and the production of seedlings, (iii) improvement of agricultural production and (iv) village development. The extension workers are engaged in diverse activities, ranging from visits to villages for direct talks with farmers and on-site technical guidance to lectures at seminars for farmers at the BPP.

The shortage of facilities, equipment and manpower vis-a-vis the number of subject villages has been pointed out in regard to the activities of extension

workers. As the Project necessitates the further grouping of farmers, as well as extensive guidance and supervision, in addition to the numerical increase of manpower, the scope of the education and training of extension workers must be expanded and upgraded together with the extension and guidance systems.

(2) Consolidation of Facilities and Equipment

As the activities of extension workers will focus on providing assistance for demonstration plots, nurseries and village development, the provision of the following equipment is planned to improve the means of transportation and communication and to enable the self-production of promotion brochures.

Vehicles	:	motorcycles	... 15
Communication	:	radio equipment	... 6 sets
		telephones	... 3
Audio Visual	:	slide projectors	... 3
		cameras	... 6
Office	:	electric typewriters	... 6

The BPP will remain the base for activities in view of the necessary liaison with agricultural extension workers. Consequently, no new forestry promotion centre will be established. Concrete activities to expand and consolidate extension activities are discussed in 5.5.3 — Supporting Services for Farmers.

(3) Cooperation System

An accurate understanding of and cooperation for the Project on the part of local leaders and the leaders of farmers' groups is essential for the smooth implementation of the Project. From the long-term perspective, the integration of women's groups and school representatives into the cooperation system is also necessary in view of participation in the Project becoming a community-wide activity.

1) Local Leaders

For the successful outcome of the Project, it will be necessary to regularly communicate with village chiefs and members of the Village Institution for Community Development (LKMD), both of which have strong influence on farmers and farmers' groups, in order to maintain and even strengthen their cooperation for the Project. These local leaders should be

actively approached to enhance their understanding of soil and water conservation projects.

A training course will be provided as part of the Project for a total of 250 village chiefs and members of the LKMDs.

2) Leaders of Farmers' Groups

The inadequate number of farmers' groups has been as much a stumbling block in the promotion of soil and water conservation projects as the shortage of extension workers. The organization of farmers' groups throughout the Planning Area is, therefore, important. The performance of existing soil and water conservation projects suggests that a project is implemented for each farmers' group with a total land area of some 20 ha. Based on this figure, some 600 farmers' groups will be required to cover the entire farmland of some 12,000 ha in the Planning Area. This extent of the required organizational work forms part of the planning for the Project.

At present, 320 farmers' groups are established in the Planning Area. Therefore, a training course for 600 leaders (320 farmers' groups + 280 new groups to be established under the Project) will be planned. Concrete measures to strengthen farmers' groups and to establish new groups are discussed in 5.5.3 - Supporting Services for Farmers.

5.5.2 Education and Training of Extension Workers and Farmers

(1) Construction of Training Centre

In the Planning Area, the education and training of local inhabitants by the SBRLKT Citarum are mainly conducted at schools and community halls while the education and training of extension workers are conducted at the Kadipaten and Cimanuk Training Centres.

The smooth progress of the Project will require the education and training of both the Planning Area's local inhabitants and extension workers, necessitating the establishment of a new training centre in the Planning Area given the achievements so far made by the 2 existing centres mentioned above. In view of the necessary maintenance and administration work of such a training centre following the completion of the Project, the size of the facilities will be modest

and field training will be emphasised. The centre will incorporate broad features so that its activities are not confined to soil and water conservation training. Proper consideration will be given to such conditions as good access, stable electricity and water supply and flat, single premises, etc. in the selection of the construction site.

1) Trainees and Staff

a) Trainees

The number of trainees to be accepted by the centre will be as follows.

Extension workers	:	50
Local leaders	:	250
Farmers' Group Leaders	:	600

The number of training courses and their duration are given below. These courses will be repeated every year with a different curriculum under the completion of the Project. The training of extension workers will be conducted throughout the year while the training of local leaders and farmers' group leaders will be conducted in the dry season to avoid the busy farming season.

Extension workers	:	5 times for 15 days each (10 workers/time)
Local leaders	:	10 times for 5 days each (25 persons/time)
Farmers' Group leaders	:	12 times for 5 days each (50 persons/time)

The maximum number of participants per time will be 85 and these will, in principle, stay at the centre throughout the course.

b) Staff

The following staff will be required to operate the centre and to provide the necessary education and training. All staff members except instructors will commute to the centre.

Director (management and coordination)	1
General affairs (personnel, accounting and welfare)	3
Education and training (extension, education and marketing)	3
Technical management (soil and water conservation, agriculture and forestry)	3
Instructors (full-time) (afforestation, soil and water conservation and agriculture)	5
Security guards	2
Total	17

2) Facilities and Equipment

a) Facilities

The following facilities will be constructed based on the envisaged number of trainees and staff.

Office	330m^2 (22 persons x 15 m^2/person)
Conference room	160m^2 (80 persons x 2 m^2/person)
Library	120m^2 (20 persons x 6 m^2/person)
Lecture building	200m^2 (50 persons x 4 m^2/person)
Trainee accommodation	250m^2 (50 persons x 5 m^2/person)
Instructor accommodation	150m^2 (10 persons x 15 m^2/person)
Laboratory building	100m^2 (25 persons x 4 m^2/person)
Dining hall	400m^2 (100 persons x 4 m^2/person)
Garage	200m^2
Water supply facility	45m^2
Power facility	45m^2
Arboretum	10,000m^2
Agroforestry Field	10,000m^2
Erosion control facilities	10,000m^2
Nursery	5,000m^2
Roads	5,000m^2
Others	8,000m^2
Total	50,000m^2

Note: Others include a fire-fighting reservoir, sports facilities and a car-park.

b) Equipment

The following equipment will be provided to ensure the smooth running of the centre.

Vehicles	4-wheel drive cars (5 seater for staff use)	4
	bus (50 seater for trainee transportation)	1
	motorcycles	10
Communication	radio equipment	2 sets
	telephones	10 sets
Audio/visual	slide projectors	2
	overhead projectors	2
	8mm projectors	2
	VCRs	2
Office	personal computers	2 sets
	wordprocessors	2 sets
	blackboards	5
	desks	150
	chairs	150
	bookshelves	40
Canteen equipment		1 set
Accommodation fixtures and fittings		1 set
Nursery equipment		1 set
Exhibition equipment		1 set

3) Education and Training Subjects

The experience of the Kadipaten Training Centre suggests that there is room for improvement in terms of field training intensity, course contents, trainee selection, course availability timing and course frequency. In fact, efforts are being made to improve the course curriculum at the Kadipaten Training Centre. Under the Project, the training course will emphasise field training using demonstration plots, the provision of capable teaching staff and appropriate course availability timing. Given the above, education and training will be provided at the new centre on the following subjects. The level of education and training will depend on the level of the trainees.

- Soil conservation work
- Soil conservation techniques
- Silviculture techniques and nursery development
- Organization of farmers' groups
- Marketing of agricultural products and finance
- Solving of problems associated with farming life

4) Construction of Training Centre

In view of the necessity to urgently proceed with the construction of the new training centre for the smooth implementation of the Project, the construction of the centre is scheduled in the first year of the Project.

(2) Development of Demonstration Plots

Demonstration plots will be established under the Project to facilitate participation in the Project by local inhabitants and also in view of the teaching and display of soil conservation works and techniques.

1) Demonstration Plot Development Plan

Farmer participation at the planning stage will be encouraged in the establishment of the demonstration plots in order that their opinions are reflected on the plan contents. In addition to features to ensure soil conservation, the demonstration plot development plan will adopt the principle of the right species on the right sight. For example, the efficient production of firewood will be stressed in the case of Sub-Watersheds No. 1 and No. 4 where there is an acute firewood shortage while the mixed planting of trees and grass will be conducted in Sub-Watersheds No. 2, No. 3 and No. 4 which are stock raising areas. In the case of Sub-Watersheds No. 3, No. 5 and No. 6, citrus and other honey plants will be planted to assist apiculture which is popular in these sub-watersheds. All the demonstration plots will, therefore, provide an appropriate mixture of social forestry components to suit the local conditions and expectations of the local inhabitants.

The following standard size and contents of the demonstration plots to be established under the Project have been decided based on a demonstration plot currently being established by the SBRLKT Citarum.

Scale	:	10 ha (20 families)	
Vegetative measures	:	timber trees	- albizia (100 trees/ha)
		fruit trees	- avocado (100 trees/ha)
		crops	- upland rice (40 kg/ha)
			- maize (30 kg/ha)
			- groundnuts (40 kg/ha)
		fertilizer and pesticide application	
Civil engineering measures	:	bench terraces	- 10m (slope height: 1m)
		waterway works	- 70m (1m x 0.5m x 0.5m)
		falling works	- 30 (fall of 0.5m each)

Note: One head of sheep will be given to each family as an added incentive for participating farmers.

The construction of a simple meeting place is also important so that the exchange of opinions and technical guidance between participating farmers and extension workers can take place as part of the exercises at the demonstration plots. An access road and information board will prove crucial to enhance the demonstration effects of these plots.

2) Site Selection

Site selection will take the following conditions into consideration.

- The site should have easy access and maintenance and should be relatively near a settlement(s).

- No soil conservation measures, such as terraces, should currently be implemented at the site and farmers should be willing to participate in the development of a demonstration plot.

3) Number

Some 30 new demonstration plots will be established to add to the existing 30 plots. This decision based on the following considerations.

- In principle, several plots will be required in each sub-watershed to ensure the demonstration effects.

- The number of plots should be sufficient to make the travelling supervision by extension workers and daily maintenance by farmers easy.

- The number of plots should be sufficient to reflect the different land use conditions in each sub-watershed.

The planned number of demonstration plots in each sub-watershed is shown in Table 5-23.

Table 5-23 Number of Demonstration Plots in Each Sub-Watershed

Sub-Watershed Code Number	1	2	3	4	5	6	7	8	9	10	11	12	Total
Number of Demonstration Plots	2	2	3	3	4	3	2	3	4	1	2	1	30

A total of 10 demonstration plots a year will be established following the commencement of the Project to achieve the demonstration effects vis-a-vis farmers as soon as possible.

4) Monitoring

Farmers organized into groups will be employed as construction workers at the demonstration plot construction stage to boost their cash income and will be provided with active technical guidance by the extension workers.

Once a demonstration plot has been established, monitoring will be required to examine the results of the vegetative and civil engineering measures employed at the demonstration plot. Possible monitoring items include the results of the application of the right species on the right site principle, the effects of tree shade on crop growth, crop yields, soil discharge changes, the effects of newly introduced techniques, the diffusion effects to neighbouring areas and the income change of participating families, etc. It is desirable for monitoring to be conducted by the participating farmers with the assistance of extension workers to stimulate the understanding of farming management on the part of farmers.

5.5.3 Supporting Services for Farmers

As most of the Planning Area is privately owned and as most farmers in the Planning Area earn most of their income from farming, the understanding and cooperation of local farmers are essential to achieve the objectives of the Project. The role of local farmers will progressively increase at the maintenance stage of the Project. In this respect, agriculture should continue to be financially attractive for farmers when soil conservation measures are implemented.

Bearing the above in mind, the project management plan has been designed so as to promote the active participation of farmers in the Project. The reinforcement of extension activities and good coordination at a local government level will be important to provide farmers with supporting services.

(1) Provision of Incentives

A large number of the respondents of the questionnaire survey on farmers complained of a shortage of available capital. The provision of capital in the form of credit and/or subsidy is deemed one way of solving the cash shortage for farming to increase the income level. The provision on assistance in kind is also favoured by farmers, the components of which include fertilizers, pesticides, high yield seeds, certified seeds and agricultural equipment. Such assistance should prove a strong incentive for farmers to participate in the Project.

(2) Supporting Services for Farmers

In regard to the social conditions in the Planning Area which are partly represented by "Gotong Royong" (mutual help), the establishment of farmers' groups may prove efficient for the implementation of the Project and may have long-lasting effects in terms of the group members helping to conduct soil conservation through the increased cohesiveness of members.

Not all farmers in the Planning Area are members of farmers' groups and not many groups are actively functioning. One of the farmers' groups visited by the JICA Study Team appears to have been established to receive government assistance at the time of the government implementation of a subsidized project. This farmers' group appears not to have been very active since the completion of the project.

In addition to the establishment of farmers' groups, agriculture itself needs to become more attractive for farmers to achieve long-lasting effects of the Project. For this purpose, the provision of supporting services which cover both technical and managerial aspects is appropriate.

Possible technical and managerial supporting services consist of the following components.

Technical Supporting Services

1) Land Rehabilitation and Soil Conservation
   - ① Civil works (terracing, check dam, gully plug, etc.)
   - ② Vegetative development (regreening activities, reforestation, social forestry, community forestry, etc.)

2) Agricultural production
   - ① Soil management
   - ② Production method
   - ③ Cropping pattern
   - ④ New species
   - ⑤ Fishery at check dams
   - ⑥ Storage of products (from technical aspect)
   - ⑦ Procurement of input materials

Managerial Supporting Services

1) Management of farmers' group
   - ① Organizational set-up
   - ② Financial aspect
   - ③ Regular meetings
   - ④ Written statue

2) Marketing
   - ① Market information on new species

② Linkage with private agricultural product processing companies, wholesalers, retailers, etc.

③ Linkage with markets (local and central markets)

④ Cooperation with local radio stations to provide market information

⑤ Storage of products (from marketing aspect)

⑥ Transportation of products

⑦ Introduction of credit facilities

⑧ Market information on products of cottage industries

⑨ Contact with research institutes for new species and method of cultivation

3) Establishment of Revolving Funds

① Simple bookkeeping

② Management of farmer credit

③ Group saving & credits from financial institutions

4) Collective Purchasing of Inputs

① Linkage with KUD and other wholesalers

② Storage of input materials

③ Credit facilities from KUD, BRI, etc.

5) Land Ownership

① Agreement with land owners

② Land titling at BPN

Assistance for farmers' groups will be provided through the following activities.

1) Extension Activities

① Technical and managerial assistance to farmers' groups through regular visits and meetings with farmers and/or their leaders

② Demonstration farms

③ Regular meeting among extension offices and coordination of extension activities

④ Distribution of brochures, usage of visual aids

2) Training

① In-class and on-site training courses

② Study tours

③ Textbook

3) Awarding system

① Awarding to excellent farmers

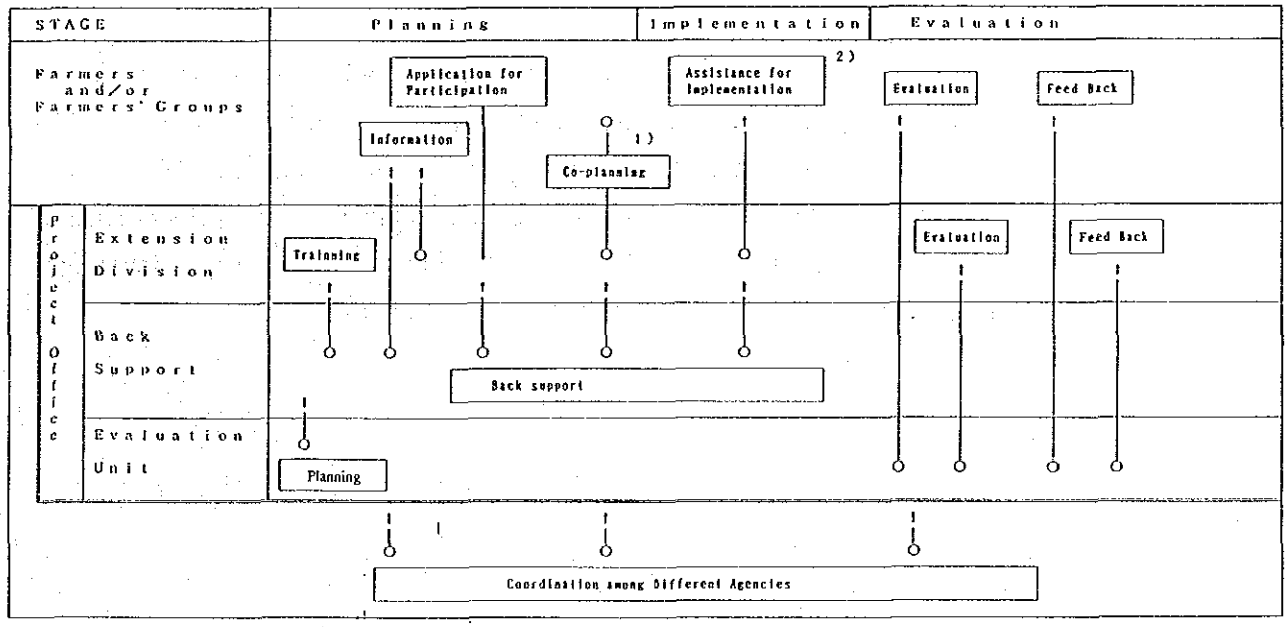
4) Evaluation and reporting

① Periodical evaluation, reporting and filing

② Periodical meeting with advisory groups 1 and 2

③ Feed back system of evaluation results

The planned implementing proceudre to encourage farmers' participation in the Project is as follows.



(Note) 1) Completion of EDFF
2) Technical and Managerial Assistance

(3) Reflection of Farmer Preferences on Agricultural Practices

As the Project will be implemented on farming land which is currently under cultivation by farmers and as long-term effects of the Project are sought, the respecting of farmers' preferences and their reflection on cropping patterns, etc. will be important.

(4) Reinforcement of Extension Activities

The reinforcement of extension activities will be necessary to provide supporting services for farmers and/or farmers' groups and such reinforcement will be conducted in the following ways.

- Intensive training of extension workers
- Coordination of extension activities between different government agencies
- Long-term employment of extension workers
- Recruitment of capable extension workers

Intensive training courses should be provided for extension workers prior to commencing extension activities and brush-up courses should be held during the implementation period. Such training can be provided through the utilisation of the existing forestry training centres. According to a member of staff of one of these centres, these centres conduct various types of training based on a training need analysis.

The assignment of extension workers should be properly considered in terms of their career development plan. The assignment of staff with a good relationship with farmers in the Planning Area and with good understanding of the local conditions is desirable to play a supporting role to the assistant project officers. Senior extension workers are a possible choice for this role when such assignment is clearly linked to their career development.

5.6 Management Plan

5.6.1 Management Organizations

(1) Coordination of Local Organizations

As various local agencies will be involved in the implementation of the Project, the coordination of these agencies at the local government level will be of crucial importance for the successful implementation of the Project.

(2) Proposed Implementation System

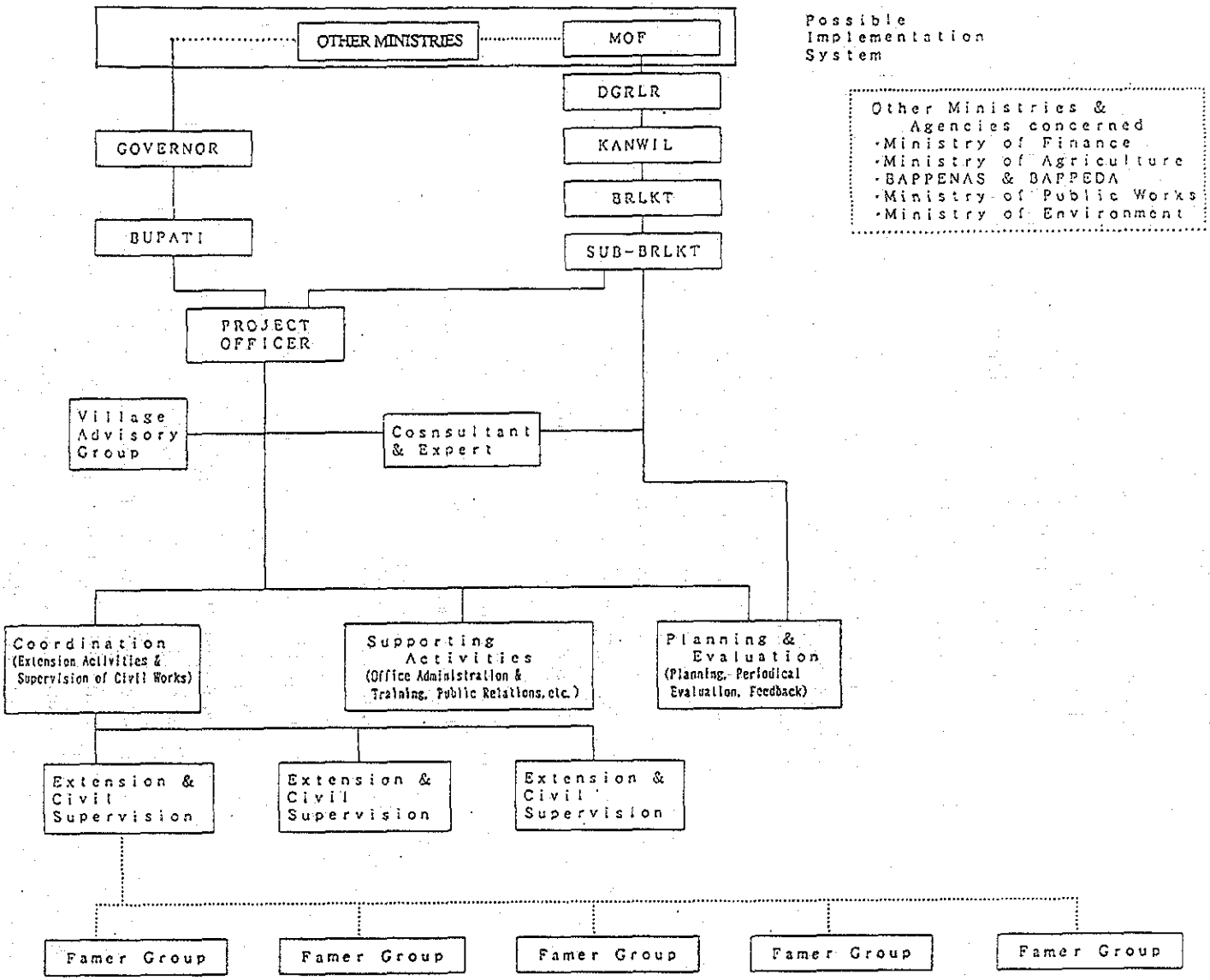
In view of the above possible activities, the proposed implementation system is shown in Fig. 5-8 based on the assumption that the details will be discussed in the course of establishing the local arrangements for project implementation. The implementation system features the following.

1) Establishment of a coordinating unit for extension activities and civil works and assignment of assistant project managers for coordination work. These assistant project managers will maintain close contact with the farmers' groups in their areas of supervision either directly or through the mobilization of extension workers.

2) Establishment of a village advisory group consisting of a number of leaders of farmers' groups in the Planning Area. This group is expected to provide useful suggestions and feedback to project officers for implementation.

3) Establishment of a planning and evaluation unit as part of the Project Office. While the establishment of such a unit under the existing local administrative arrangements may prove difficult, its establishment as part of the Project Office is worthy of consideration. The SBRLKTs of the DEPHUT may second its staff to the planning unit in this case. The evaluation and monitoring of both promotion activities and soil conservation and land rehabilitation will be conducted and the periodic feedback of the evaluation results and suggestions will be made available to the public.

Fig. 5-10 Proposed Implementation System



5.6.2 Project Implementation Schedule

(1) Advance Preparation and Annual Schedule

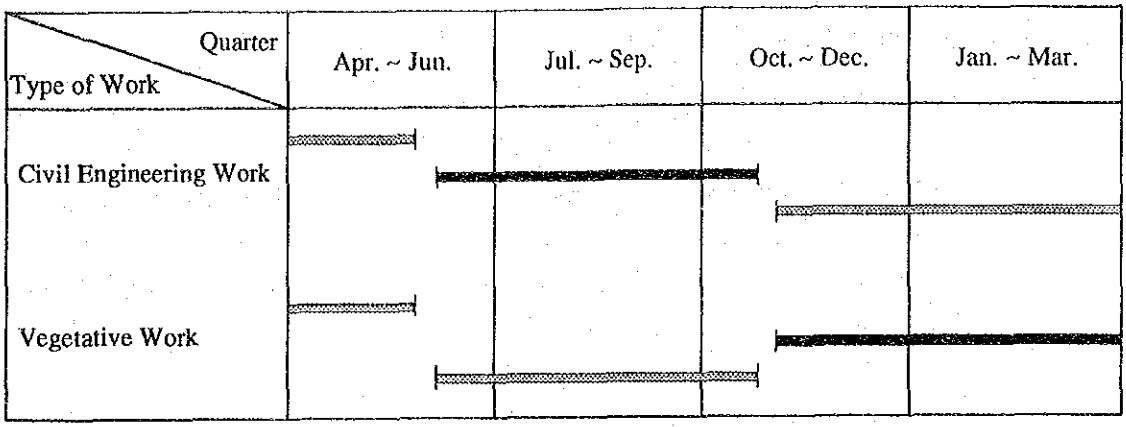
The implementation schedule for the Project must be carefully prepared with proper discussions on and examination of all the relevant issues in advance, including coordination between the government offices involved, the firm arrangement of a back-up system and an appropriate construction work period. All relevant basic data and information must be collected and sorted to make these advance preparations both efficient and effective.

The solving of any differences of opinions and the reaching of agreement between the project implementation body and the farmers or landowners of the subject sites prior to the commencement of construction work are also necessary. The implementation of the Project will only commence after these preparatory stages have been fully completed. As explained earlier, the Planning Area has relatively distinctive dry and rainy seasons and farming is mainly conducted in the rainy season. Many farmers move to urban areas in the dry season in order to earn extra cash income. Therefore, it is important to incorporate the opinions of farmers in the work schedule in order to effectively use the local labour.

Needless to say, it is preferable to conduct such civil engineering work as the construction of terraces during the dry season. Conversely, the improvement of dry crop fields and forest development should be conducted during the rainy season (or early rainy season). The actual work schedule and duration, however, should be determined based on the local farming conditions and other relevant factors.

Table 5-24 gives the standard annual work schedule for the Project, clearly indicating the need for a long preparatory period prior to the actual commencement of the work. One year has been adopted for this preparatory period for the Project.

Table 5-24 Standard Annual Work Schedule



Notes

On-site work

Preparatory procedure, Surveying, adjustment and detailed design, etc.

(2) Annual Schedule

As often pointed out so far, the Project has a high degree of urgency and should be implemented and completed as soon as possible. Given the envisaged work volume, implementation system conditions and the availability and activities of farmers' groups, etc., it has been decided to complete the entire Project in 7 years. Wherever possible, there is a weighted distribution of the work volume in the early years in view of the Project's early completion. The planned work volume for each project year is shown in Table 5-25.

All the major components of the Project will, in fact, be completed in the first 5 years and an additional 2 years is provided for essential tending and maintenance work to make up a total project period of 7 years. The construction of check dams and gully plugs, etc. will be spread over the entire 7 year period as tending or maintenance work after their completion is not required so that the work load is levelled over the entire period to ensure completion on time.

Table 5-26 shows the annual plan for the assignment and training of staff members at the training centre.

Table 5-25 Annual Project Implementation Plan

Project Component Item	Unit	0	1	2	3	4	5	6	7	Total
[Advance Preparation before Project Implementation]	Unit	1								1
[Farmland and Forest Land Conservation]										
Bench Terraces	ha		544	1,090	1,362	1,362	1,090			5,448
Small Dike Terraces	ha		232	464	580	580	464			2,320
Forest Development	ha		322	646	807	807	646			3,228
Type 1	ha		310	621	776	776	621			3,104
Type 2	ha		2	5	6	6	5			24
Type 3	ha		10	20	25	25	20			100
Agroforestry	ha		308	614	768	768	614			3,072
Type 1	ha		294	588	735	735	588			2,940
Type 2	ha		14	26	33	33	26			132
Improved Dry Fields	ha		782	1,566	1,957	1,957	1,566			7,828
Type 1	ha		612	1,225	1,531	1,531	1,225			6,124
Type 2	ha		170	341	426	426	341			1,704
Settlement Environment Conservation										
Absorption Wells	unit		176	352	440	440	352			1,760
Tree Planting	trees		4,680	9,360	11,700	11,700	9,360			46,800
Hedges	trees		23,400	46,800	58,500	58,500	46,800			234,000
[Torrent and Bank Conservation)										
Check Dams	unit		7	8	11	11	11	11	11	70
Small Check Dams	unit		15	19	21	21	21	21	21	139
Gully Plugs	unit		200	280	320	320	320	320	320	2,080
Revetment Works	m		1,600	3,200	4,000	4,000	3,200			16,000
Line Planting	km		10	18	23	23	18			92
Green Belts	ha		46	92	115	115	92			460
[Extension]										
Demonstration Plots	unit		10	10	10					30
Training Centre	unit		1							1
Education and Training	unit		1	1	1	1	1	1	1	7
New Extension Facility	unit		1							1
[Infrastructure]										
New Roads	m		14,160	14,160	14,160	12,160	12,160	3,800	3,800	74,400
Road Upgrading (to asphalt road)	m		438	438	438	438	438			2,192
(to gravel road)	m		25,552	25,552	25,552	25,552	25,552			127,761
Slope Protection (revegetation)	m^2		24,461	24,461	24,461	24,461	24,461			122,306
(gutters)	m		48,921	48,921	48,921	48,921	48,921			244,605
(falling works)	unit		489	489	489	489	489			2,447
Roadside Planting	m		5,870	5,870	5,870	5,870	5,870			29,350
Nurseries	unit		12							12
[Management]										
Management Services	unit		1	1	1	1	1	1	1	7
External Consultant Services	unit		1	1	1	1	1	1	1	7
[Environment]										
Monitoring	unit		1	1	1	1	1	1	1	7

Notes - Advance preparation includes coordination, detailed design and procurement preparation.
- Education and training consists of the training of extension workers and farmers and teaching by instructors at the training centre.
- The first year of the nurseries involves its construction and seedling production, followed by seedling production until the end of the fifth year.

Table 5-26 Annual Plan for Staff Assignment and Training at Training Centre

(Unit: persons)

Year		1	2	3	4	5	6	7	Total
Staff	Unit	10	10	10	10	10	10	10	-
Instructors									
Full-Time	persons	5	5	5	5	5	5	5	-
External [1]	manday	70	70	70	70	70	70	70	-
Trainees [2]									
Field Regreening Extension Workers	persons	25	25	25	25	25	25	25	175
Senior Regreening Extension Workers	persons	25	25	25	25	25	25	25	175
Village Chiefs	persons	125	125	125	125	125	125	125	875
LKMD Members	persons	125	125	125	125	125	125	125	875
Farmers' Group Leaders	persons	600	600	600	600	600	600	600	4,200

Notes
1) The number of external instructors is the annual aggregate manday.
2) The number of trainees is the annual aggregate.

5.6.3 External Consultants

(1) Foreign Consultants

The contents of the Project have been decided in view of maximising the use of techniques and methods which are firmly established or established locally. Consequently, all the technical requirements should be successfully met by local staff, particularly those of the DEPHUT. However, external assistance appears necessary to efficiently conduct the comprehensive procurement of the required equipment and materials and to provide proper guidance and training on financial matters. Moreover, there appears to be a shortage of sufficiently experienced local personnel who are capable of evaluating changes/improvement in the soil loss conditions, land productivity and water quality, etc. The appointment of foreign consultants is, therefore, planned to ensure smooth progress in all these fields.

(2) Domestic Consultants

While local engineers and technicians, particularly those of the DEPHUT, meet the technical requirements of the Project as described in (1) above, their expertise may not be sufficient to ensure a project design which is totally suitable for the local conditions and high quality construction results. In addition, with the progress of project implementation, the work emphasis for

extension workers will shift from on-site guidance and supervision to more non-technical issues, such as the establishment of farmers' groups through consultations with farmers and arrangements for work sites for the subsequent year, etc. The inclusion of domestic consultants with specialist expertise in project design and implementation in the project team to assist technical staff at the Project Office has been decided. Table 5-27 shows the assignment fields for external consultants.

Table 5-27 Assignment Fields for External Consultants

Work Category	Assignment Field	Remarks
Project Preparation		
1. General Administration	General Administration	F
2. Finance/Procurement	Tender, Procurement, Finance	F
3. Facilities	Design of Training Centre, Nursery and Buildings	D
4. Extension	Contents of Training, Promotion of Local Participation	D
Construction		
1. General Administration	General Administration, Project Planning, Advice on Project Implementation	F
2. Financial Management	Procurement, Finance	F
3. Nursery/Revegetation	Afforestation, Protection, Improvement	D
4. Dry Farming Improvement	Planting, Fertilizer Application, Pesticide Application	D
5. Civil Engineering	Design and Construction of Roads and Terraces, etc.	D
6. Education and Training	Advice on Education and Training Contents and Methods	F
Monitoring and Evaluation		
1. Watershed Management	Sediment Runoff Control, Soil Fertility Conservation	F
2. Agricultural Economy	Improvement of Productivity and Domestic Income	D
3. Environment	Water Quality, Hydrology	D
4. Education and Training	Evaluation of Education/Training Effects	F

Notes
F : Foreign Consultant
D : Domestic Consultant

5.7 Project Cost

5.7.1 Preconditions for Cost Estimate

(1) The project implementation period is 7 years.

(2) The year of project commencement is 1994.

(3) Annual inflation rates: inside Indonesia - 8.0%
outside Indonesia - 5.0%

(4) The base year for costing is 1992.

(5) Foreign exchange rates: 1 US$ = 2,050 Rp
1 US$ = 125 yen

(6) The contingency is set at 8% of each project cost item.

5.7.2 Cost Estimate

The project cost was estimated based on the work plan. As Table 5-28 shows, the base cost for the project period of 7 years is 59,842 million Rp. With the physical contingency (8.0%) and price contingency (based on an annual inflation rate of 8.0%) added, the total project cost is 90,718 million Rp. The amount to be borne by the Indonesian government, given as the sum after deducting the farmers' direct labour cost from the base cost, is 45,722 million Rp.

The details of the project cost estimate are shown in Supporting Report C3.

Table 5-28 Project Cost Estimate

(Unit: million Rp)

Project Item	Base Cost (A)	Total Cost (B)	Farmer's Contribution (C)	Government Contribution (A-C)
1. Farmland and Forest Land Conservation				
(1) Terraces	3,599	5,046	0	3,599
(2) Forest Development	8,189	11,411	3,571	4,618
(3) Agroforestry	8,188	11,409	3,209	4,979
(4) Improved Dry Fields	15,064	21,069	7,340	7,724
(5) Settlement Environment Conservation	755	1,052	0	755
2. Torrent and Bank Conservation	5,292	7,860	0	5,292
3. Extension	4,709	6,312	0	4,709
4. Infrastructure	4,441	6,182	0	4,441
5. Environmental Care	950	1,173	0	950
6. Management	8,656	12,329	0	8,656
Sub-Total	59,842	83,998	14,120	45,722
Physical Contingency	0	6,720	0	0
Total	59,842	90,718	14,120	45,722

Note: The values are rounded.

Table 5-29 Annual Project Cost

Financial Year	1	2	3	4	5	6	7	Total
1. Farm/Forest Land Conservation Plan								49,986,635,257
1) Terracing								5,046,401,786
Bench Terrace	329,951,232	714,004,762	771,125,143	1,040,636,917	1,123,887,870	0	0	3,979,605,924
Dike Terrace	89,299,584	192,887,101	260,397,587	281,229,394	242,982,196	0	0	1,066,795,863
2) Forest Development								11,410,617,476
Forest 1	931,621,176	2,015,547,388	2,720,112,649	2,937,721,661	2,539,009,231	0	0	11,144,012,105
Forest 2	3,569,184	9,836,797	12,489,289	13,488,432	12,139,589	0	0	51,323,290
Forest 3	18,020,880	38,925,101	52,548,886	56,752,797	49,034,417	0	0	215,282,080
3) Introduction of Agroforestry								11,408,585,703
Agroforestry 1	929,831,918	2,008,436,944	2,711,389,874	2,928,301,064	2,530,052,119	0	0	11,108,011,919
Agroforestry 2	26,715,226	53,583,110	73,450,078	79,325,084	67,499,286	0	0	300,573,784
4) Improvement of Dry Farming								21,068,870,824
Dry Farming 1	1,194,990,797	2,835,769,176	3,895,666,263	4,501,332,112	3,889,786,012	0	0	16,317,544,361
Dry Farming 2	396,774,288	859,553,146	1,159,716,162	1,252,493,455	1,082,789,412	0	0	4,751,326,464
5) Conservation of Settlement Environment								1,052,159,468
Absorbing Well	75,955,968	164,064,891	221,487,603	239,206,611	206,674,512	0	0	907,389,584
Trees (Jack Fruit)	6,113,802	13,205,813	17,827,847	19,254,075	16,635,521	0	0	73,037,058
Trees (Gliricidia)	6,004,627	12,969,995	17,509,493	18,910,252	16,338,458	0	0	71,732,825
2. Torrent Conservation Plan								7,859,806,190
1) Check Dam	274,337,280	338,610,586	502,836,720	543,063,657	586,508,750	633,429,450	684,103,806	3,562,890,248
2) Small Check Dam	85,205,520	116,561,151	139,137,206	150,268,182	162,289,637	175,272,808	189,294,633	1,018,029,137
3) Gully Plug	121,305,600	183,414,067	226,385,363	244,496,192	264,055,887	285,180,358	307,994,787	1,632,832,255
4) Revetment Work	87,713,280	189,460,685	255,771,924	276,233,678	238,665,898	0	0	1,047,845,466
5) Riverside Line Planting	25,894,080	50,338,092	69,466,566	75,023,892	63,411,498	0	0	284,134,127
6) Riverside Revegetation	26,290,656	56,787,817	76,663,553	82,796,637	71,536,294	0	0	314,074,957
3. Extension Plan								6,467,941,451
1) Demonstration Plot								
(1st year)	14,509,433	18,513,231	19,581,109	21,156,414	23,136,152	25,497,763	27,483,907	149,878,010
(2nd year)		15,670,187	19,994,290	21,147,598	22,848,927	24,987,044	27,537,584	132,185,631
(3rd year)			16,923,802	21,593,833	22,839,406	24,676,841	26,986,007	113,019,890
2) Training Center	1,030,701,024	0	0	0	0	0	0	1,030,701,024
3) Education and Training	471,221,809	513,068,526	558,618,942	608,859,852	663,618,978	723,569,580	789,235,614	4,328,393,301
4) Extension/Guidance								
(Imported Equipment&Materials)	618,303,086							618,303,086
(Local Materials)	95,460,509							95,460,509
4. Infrastructure Plan								6,181,822,406
1) Access Road								6,154,491,413
New Road Construction	453,664,841	497,886,152	576,247,724	576,110,726	622,199,584	221,115,551	238,804,795	3,186,029,374
Improvement of Road								
Gravel-Gravel	29,691,610	32,066,939	34,632,294	37,402,878	40,395,108	0	0	174,188,828
Earth-Gravel	418,521,578	452,003,304	488,163,569	527,216,654	569,393,986	0	0	2,455,299,092
Slope Protection								
Regreening of Slope	11,897,556	12,849,361	13,877,310	14,987,495	16,186,494	0	0	69,798,216
Drain	36,818,151	39,763,603	42,944,691	46,380,266	50,090,688	0	0	215,997,399
Drop Structure	4,819,823	5,205,193	5,621,608	6,071,337	6,557,044	0	0	28,274,806
Roadside Planting	4,244,996	4,584,596	4,951,364	5,347,473	5,775,270	0	0	24,903,699
2) Nursery	20,519,309	1,511,654	1,632,587	1,763,194	1,904,249	0	0	27,330,993
5. Environmental Assessment	904,893,704	35,536,853	38,379,802	44,941,309	44,766,201	48,347,497	56,613,107	1,173,478,473
6. Management Plan								12,328,677,065
1) Project Office Personnel	128,992,500	135,442,125	142,214,231	149,324,943	156,791,190	164,630,749	172,862,287	1,050,258,025
2) Consultant								
Foreigen Consultant	1,238,933,682	1,172,880,151	794,260,648	827,868,818	863,310,422	900,707,700	940,191,973	6,738,153,392
Local Consultant	576,201,600	524,040,192	565,963,407	534,835,420	536,363,521	534,713,172	577,490,226	3,849,607,538
3) Office Construction	577,647,936	0	0	0	0	0	0	577,647,936
4) Office Running Cost	22,546,345	12,370,737	13,344,272	14,394,883	15,528,697	16,752,327	18,072,914	113,010,174
Sub-Total	11,269,184,390	13,327,149,425	16,521,533,855	18,199,938,186	16,825,092,507	3,778,680,839	4,056,671,639	83,998,360,843
Physical Contingency(8%)	903,134,751	1,066,171,954	1,321,722,708	1,455,995,055	1,346,000,201	302,310,467	324,533,731	6,719,868,867
Grand Total	12,192,319,142	14,393,321,379	17,843,256,564	19,655,933,241	18,171,002,707	4,081,191,307	4,381,205,371	90,718,229,710

5.8 Upland Plantation and Land Development Planning Maps

The Upland Plantation and Land Development Planning Maps (scale: 1/10,000) were prepared in accordance with the conservation measure matrix described in 4.2 using the topographical maps (scale: 1/10,000) as the base maps together with land use and vegetation maps, soil erosion maps and zoning maps, etc. The preparation process for the planning maps is shown in Fig. 5-11. The main mesh map used for the preparation process is shown in the frontispiece of this report. Seventeen sheets of the maps are attached in this report.

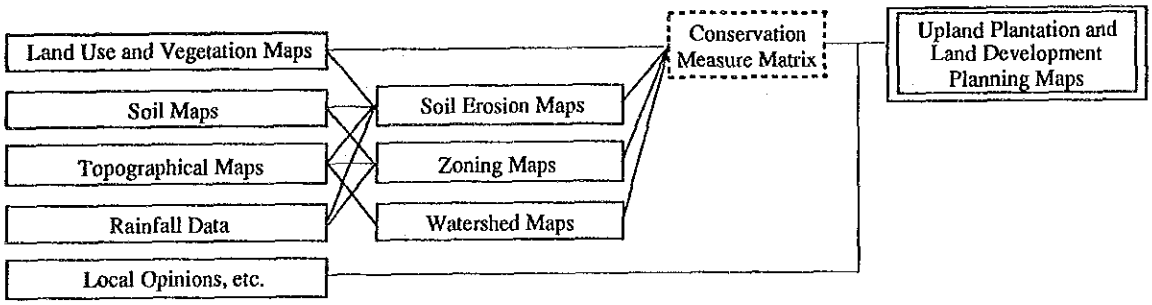


Fig. 5-11 Preparation Process for Upland Plantation and Land Development Planning Maps

CHAPTER 6 FINANCIAL AND ECONOMIC EVALUATION

CHAPTER 6 FINANCIAL AND ECONOMIC EVALUATION

6.1 Financial Analysis

The purpose of the financial analysis is to study financial feasibility of the project. The analysis looks at the expected cash flow when the project is implemented (With Project Case) and when the project is not implemented (Without Project Case) and then finds the net present value(NPV). The incremental difference, obtained by subtracting the latter from the former, is a measure used to judge whether or not the project is feasible. The steps of the financial analysis is illustrated in Fig. 6-1.

6.1.1 Preconditions for Financial Analysis

(1) Implementation Period and Project Life

The project is planned to commence in 1994. The implementation period of the Project is set at 7 years, commencing in 1994. The financial analysis calculations is made over the 25 years of the project life(in the cash flow table, Year 26 is used for the year of liquidation for the project).

(2) Base Year Prices

The financial analysis calculations are based on market prices prevailed at the end of 1992. In the case of agricultural inputs and products, farm gate prices are used for the analysis.

(3) Inflation Rate

The domestic inflation rate is estimated at 8 %/year and the foreign inflation rate is set at 5 %/year throughout the project life.

The domestic inflation rates in the last 7 years are shown below.

Year	CPI	WPI
1985	100.0	100.0
1986	105.9	102.2
1987	115.6	121.9
1988	124.9	127.9
1989	133.0	138.8
1990	142.9	152.8
1991	156.1	160.7
Yearly Average	7.7 %	8.2%

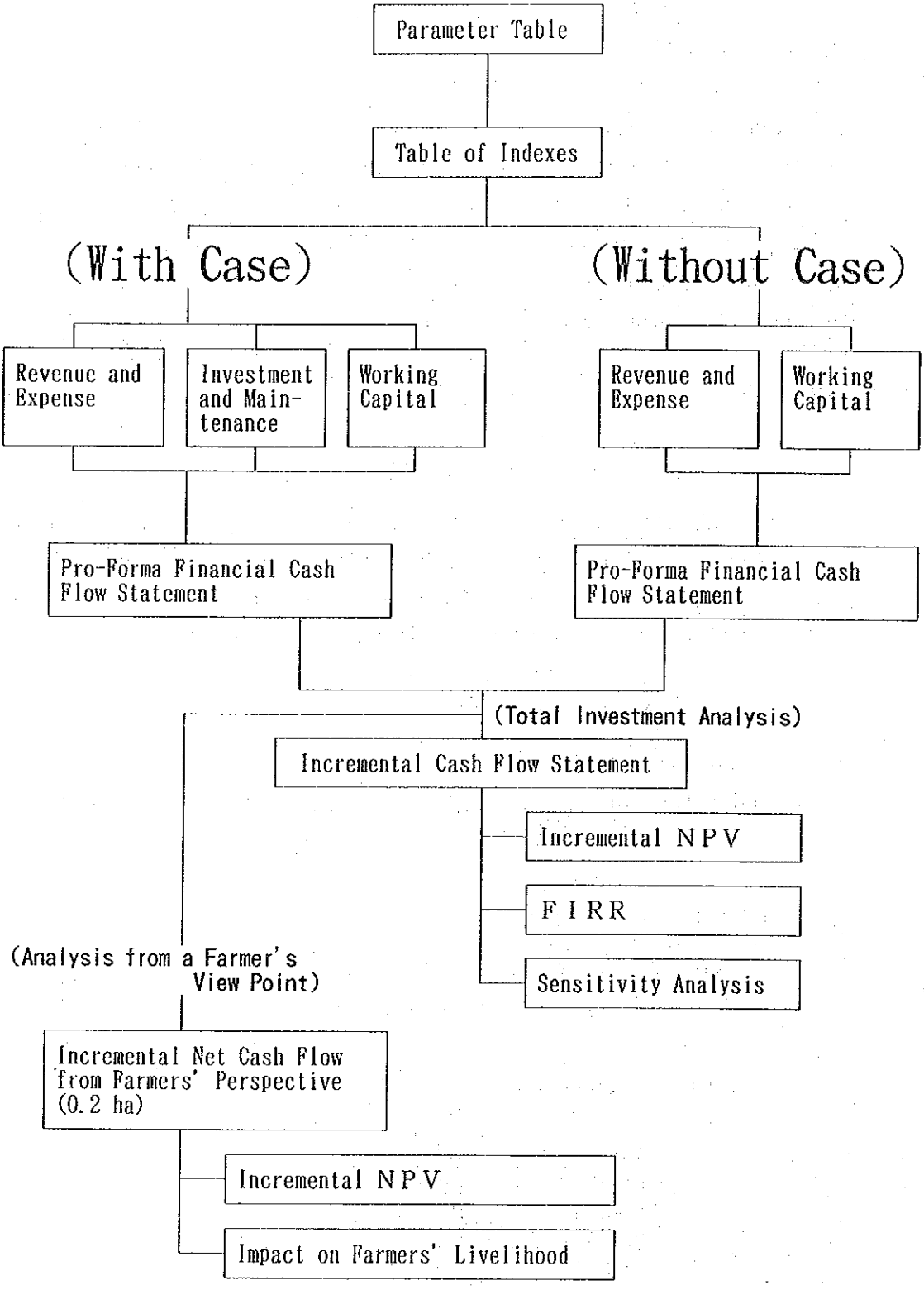


Fig. 6-1 Financial Analysis Flow Chart

(4) Foreign Exchange Rate

The foreign exchange rate of 2,050 Rp/US$, 125 Yen/US$ as of the end of 1992 is used for the analysis. The real exchange rate is assumed to remain at the same level although the nominal exchange rate will be affected by differences between the foreign and domestic inflation rates.

(5) Productivity Increase

The productivity increase will be caused by two factors, i.e. agricultural inputs and soil conservation measures. In the case of productivity increase caused by agricultural inputs, effects of productivity increase are expected to instantly appear. The rate of increase is estimated at 5 %. In the case of productivity increase caused by soil conservation measures, the productivity is expected to gradually increase up to a maximum of 10 %. The increase by soil conservation is taken into account only when the terraces are constructed. The details of productivity increase is illustrated in D1 of the Supporting Report.

(6) In-Use Value of Land

The in-use value of land is the land price which a farmer could get when selling his/her farming land. The continuation of farming on this land means that a farmer gives up the opportunity to earn the amount he/she could receive through selling his/her land. When farmers are expected to continue farming whether the project is implemented or not, the in-use value is mutually offset in the comparison between the with and without cases. Therefore, in-use value of land is not taken into account under the analysis. If land is a tenant land, farm rent is considered to be offset in the same way as in-use value of land.

(7) Working Capital Account

In a practical sense, a farmer must carry over a certain amount of cash or farming materials for the subsequent planting season. Some amount of cash, seeds or input materials are stored for this purpose and are not used. A working capital schedule is added to reflect the impact of the carry-over on the cash flow. If a farmer is engaged in single cropping, the amount of the working capital is set at 70 % of the annual current expenses, excluding labor costs. In the case of double cropping, the amount of the working capital is set at 35 % of the annual current expenses, excluding labor costs.

(8) Current Benefits of Farming

Following farm gate prices and production volume (per ha) are used for calculation. Production volumes differ depending on types of cropping patterns and ages of forest and fruit trees after planting. Following quantities show an example of basic production volumes when the cropping pattern is changed from dry farming without terrace (without project case) to Agroforestry 1 (with project case).

(Without Project Case)
Dry Farming without Terrace

	Farm Gate Price (Rp/Kg,M^3)	Production (note 1)	Volume
Upland Paddy	300	2,210 Kg	
Red Beans	–	–	
Cassava	50	6,350 Kg	
Maize	300	1,450 Kg	
Ground Nuts	–	–	
Albizia			
tree	–	–	
fire wood	–	–	
Jack Fruit	–	–	
Avocado	–	–	

(With Project Case)
Agroforestry 1

	Farm Gate Price (Rp/Kg,M^3)	Production (note 1)	Volume
Upland Paddy	300	1,495 Kg	
Red Beans	300	1,093 Kg	
Cassava	–	–	
Maize	300	3,335 Kg	
Ground Nuts	800	748 Kg	
Albizia			
tree	25,000	3.2 M^3	
fire wood	5,000	6.4 M^3	
Jack Fruit	500	1,500 Kg	
Avocado	500	2,500 Kg	

Note 1) Production volumes indicate those when production reaches its maximum volume. Under "With Project Case", the productivity increase of 15 % is taken into account.
Note 2) In the without project case, double cropping is practiced.

(9) Current Costs of Farming

Following unit costs and input volume (per ha) are applied for the calculation. The volume of the inputs differs, depending on which cropping pattern to choose. The following show the same examples as seen in the above (8).

(Without Project Case)
Dry Farming without Terrace

	Unit Price (Rp/Kg,M^3,lit,MD)	Input Volume (Kg,M^3,lit,MD)
(Seeds)		
Upland Paddy	650	40 Kg
Red Beans	–	–
Cassava	3	3,500 Kg
Maize	3,500	20 Kg
Ground Nuts	–	–
Albizia	–	–
Jack Fruit	–	–
Avocado	–	–
(Fertilizer)		
Manure	50	5,000 Kg
Chemical	300	500 Kg
Lime	–	–
(Pesticide)		
Cairan	20,000	2 L
Butiran	3,000	10 Kg
(Labor Cost)		
Crop and Vegetable	3,000	200 Manday
Tree	–	–

(With Project Case)
Agroforestry 1

	Unit Price (Rp/Kg,M^3,lit,MD)	Input Volume (Kg,M^3,lit,MD)
(Seeds)		
Upland Paddy	650	40 Kg
Red Beans	1,750	30 Kg
Cassava	–	–
Maize	3,500	30 Kg
Ground Nuts	1,500	30 Kg
Albizia	100	200 seedling
Jack Fruit	1,000	100 seedling
Avocado	1,750	100 seedling
(Fertilizer)		
Manure	50	10,000 Kg
Chemical	300	600 Kg
Lime	250	1,000 Kg
(Pesticide)		
Cairan	20,000	4 L
Butiran	3,000	20 Kg
(Labor Cost)		
Crop and Vegetable	3,000	341 Manday
Tree	3,000	15 Manday

(10) Investment Costs

In the case of total investment analysis, the following investment costs are used for the analysis (total of investment costs from 1994 to 2000). Costs for change in cropping patterns in the farm/forest land conservation component of the project have been taken into account in current expenses required for farming and are not included in the investment costs. The all calculation is made by using real prices (prices in 1992, and inflation is adjusted) and physical contingencies are not taken into account.

Investment Items	Investment Costs(1994-2000) (Million Rp in 1992 prices)
1. Farm/Forest Land Conservation Plan	
Terracing	3,599
Settlement Environment	755
2. Torrent Conservation Plan	5,292
3. Extension Plan	4,709
4. Infrastructure Plan	4,441
5. Environmental Assessment	950
6. Management Plan	8,656
Total Investment	28,402

Under the financial analysis from a farmer's view point, terrace construction costs are counted as investment. Construction costs for terraces are estimated at 520,000 Rp/ha for bench terrace and 330,000 Rp/ha for dike terrace. Maintenance costs of terraces are estimated at 20 % of the investment costs for the second year after construction and 10 % of the costs for the subsequent years. If there already exists a terrace, the in-use value of the terrace is assumed to be 425,000 Rp/ha, which is an average of construction costs for bench and dike terraces, and the maintenance costs are estimated at 10 % of the in-use value throughout the project life.

(11) Discount Rate applied for the calculation in the case of Total Investment Analysis

In general, cost of funds will be the discount rate applied for the analysis.

In the case of total investment analysis for the public investment, it will be appropriate to apply the rate of long-term government bond as a cost of funds.

However, to the best of knowledge of the study team, there has been no such long term government bond in Indonesia. Therefore, the cost of funds for the government is assumed by considering nominal interest rates on time deposit and bank certificates of Bank Indonesia.

The nominal interest rate on time deposit(24 months) by groups of banks in Indonesia, excluding rural credit banks, averaged around 19.6 % p.a. from 1987 to 1991. The discount rate of Bank Indonesia 90 days' Certificate(SBI) averaged at 18.2 % p.a.from 1987 to 1991. Taking into account the above figures, the expected cost of funds in the domestic market for the government is assumed to be around 19 % p.a.in the nominal terms. With the annual inflation rate being assumed to be 8 %, the real cost of fund is calculated at 10 %. For the calculation of NPV for total investment analysis, ten(10) % of the real discount rate is applied.

(12) Discount Rate applied for the analysis from a Farmer's View Point

In general, the discount rate for a participating farmer in the project will be the weighted average of farmer's expected rate of return on agricultural investment and the cost of borrowing. If present deposit interest rate (15 % p.a. in nominal terms) is considered as an opportunity cost of farm investment, the expected rate of return on farming by farmers are considered to exceed the deposit interest rate. Hence, the expected rate of return on agricultural investment is assumed to be 18 % p.a. in nominal terms which means 9 % p.a. in real terms after taking away inflation factors. On the other hand, when farmers receive credits at concessional rate, the interest rate of 12 % p.a. has been applied to them. However, as the amount of credits received by farmers, if any, is assumed to be marginal against the total assets held by the farmers over the 25 years of the project life, the weighted average of the farmer's expected rate of return on investment and the cost of borrowing will be nearly equal to the farmers' expected rate of return on investment (The exception will be the case when farmers receive high interest rate bearing credits from usuries). For the analysis from a view point of a farmer, the real discount rate of 9 % is applied. Considering the case of farmers' utilizing informal credits, sensitivity analysis will be done by changing the discount rate.

6.1.2 Results of Financial Analysis (Total Investment Analysis)

(1) Result of Calculation

In the total investment analysis, firstly, per ha incremental net present values are calculated for each of planned changes (A ~ M) in cropping patterns. The results are shown in Table 6-1.

As seen in the results, those which show negative net present values are not feasible as far as per ha base analysis is concerned. But the effects of the project are not expected to be maximized if those areas with negative net present values are excluded from the project area. In short, it is assumed that expected project impacts appear when all planned project components are implemented.

Through multiplying per ha incremental net present values with respective planned sizes of areas, the incremental net present value from changes in cropping patterns from the total project is obtained. After adding the net present value of other project components (such as construction of roads) to this results, following total results have been obtained.

Project Component	Incremental Net Present Value (Million Rp)	Contribution to Total NPV (%)
1. Farm/Forest Conservation	33,135	152.4
Forest	-2,853	-13.2
Agroforestry	15,189	69.9
Dry Farming	21,306	98.0
Settlement Environment	-507	-2.3
2. Torrent Conservation	-2,549	-11.7
3. Extension	522	2.4
4. Infrastructure	-2,846	-13.1
5. Environment	-745	-3.4
6. Management	-5,780	-26.6
Total Incremental NPV	21,737	100.0

(note) Real Financial Discount Rate = 10 %

As incremental net present value is positive as shown in the above table, the project will be feasible from a total investment view point.

The financial internal rate of return is 20.1 % in this case.

Table 6-1 Estimated Incremental NPV for Each Cropping Pattern

Financial Analysis Without Project ⇨ With Project		Change Pattern	Area (ha)	Incremental NPV (1,000Rp/ha)
Mixed Garden 1 (524ha)	→ Forest 2 (No Terrace)	(A)	24	− 1,111
	→ Mixed Garden 1 (No Terrace)		500	0
Mixed Garden 2 (760ha)	→ Forest 3 (No Terrace)	(B)	100	− 745
	→ Agroforestry 2 (No Terrace)	(C)	132	− 34
	→ Mixed Garden 2 (No Terrace)		528	0
Dry Farming with Terrace (1,120ha)	→ Forest 1 (Existing Terrace)	(D)	88	− 1,381
	→ Agroforestry 1 (Existing Terrace)	(E)	116	6,721
	→ Dry Farming 1 (Existing Terrace)	(F)	916	4,028
Dry Farming without Terrace (11,108ha)	→ Forest 1 (No Terrace)	(G)	1,636	− 1,387
	→ Agroforestry 1 (New Dike Terrace)	(H)	2,320	6,538
	→ Agroforestry 1 (New Bench Terrace)	(I)	240	6,225
	→ Dry Farming 1 (New Bench Terrace)	(J)	5,208	3,408
	→ Dry Farming 2 (No Terrace)	(K)	1,704	3,208
Shrub (1,260ha)	→ Forest 1 (No Terrace)	(L)	1,260	− 427
Grassland (320ha)	→ Forest 1 (No Terrace)	(L)	56	− 427
	→ Agroforestry 1 (No Terrace)	(M)	264	7,158
Quarry (64ha)	→ Forest 1 (No Terrace)	(L)	64	− 427

(2) Sensitivity Analysis

Sensitivity analysis examines changes in the incremental net present value by changing following conditions.

1) Discount rate from 5 % to 15 %

2) Project life from 25 years to 10 years

1) Change in Discount Rate

Discount Rate	Incremental Net Present Value (million Rp)
5 %	57,028
10 %	21,737
15 %	6,749

The base case analysis is done by using discount rate of 10 %. As seen in the above table, change in discount rate in this range does not affect feasibility of the project.

2) Change in Project Life

Project life is set at 25 years, considering the time and period of project effects to appear, harvesting time of fruit trees, length of government long-term development plan and so on. Sensitivity analysis is done to study how the length of the project life influences the feasibility of the project.

Project Life	Incremental Net Present Value (million Rp)
25 years	21,737
20 years	18,273
15 years	11,250
10 years	-332

As seen in the above table, the project needs to sustain at least 11 years to be feasible.

6.1.3 Financial Analysis from a Farmer's View Point

The analysis from a farmer's view point looks at the impact of the project when the farming size is taken into account, especially how the project contributes to the increase in their living standard. However, it is difficult to generalize the farming practice in the project area because the farming pattern and farming size vary in the area. Furthermore, since prices used for the analysis are fixed as described under preconditions set for the analysis and the receipt of the cash flow is calculated on production value basis, it cannot be denied that the analytical framework is rather narrowly defined. Therefore, the results of this analysis should be interpreted by taking into consideration these limitation of the analysis.

The following farming pattern is assumed in this analysis as a general pattern of farming practice in the project area. Firstly, per ha incremental net present value is calculated for each of planned changes in cropping patterns. Then, weighted average of per ha incremental net cash flows are obtained in accordance with the planned areas for cropping pattern changes in 1994. The results of the calculation is 3,504 thousand Rp/ha in incremental net present value (real discount rate = 9 %). This incremental net present value alters with changes in discount rate as follows. As seen in the table, the project is still feasible at the discount rate of 20 %.

Discount Rate	Incremental Net Present Value (1000 Rp/ha)
5 %	5,936
9 %	3,504
10 %	3,100
15 %	1,759
20 %	1,061

As the weighted average of incremental net cash flow is per ha base net cash flow, the farming size is scaled down to 0.2 ha and so is the net cash flow. The incremental net present value becomes 701 thousand Rp/0.2 ha (real discount rate = 9 %).

The following show incremental net present values in the case of farming practice with 0.2 ha. The cases are examined by looking at incremental net present values when equal amounts are subtracted from each year's incremental net cash flows (from 0.2 ha farming) for living costs over the 25 years of the project life.

Subtraction for living costs (Real Rp/Year)	Incremental NPV (1000 Rp)
50,000	245
60,000	154
70,000	63
80,000	-28
90,000	-119
100,000	-210
110,000	-301
120,000	-392

The above trial calculation demonstrates that the project is still feasible(positive net present value) even when a model farmer with 0.2 ha of farming land who adopts the weighted average of planned cropping pattern spares additional 70,000 Rp/year in real terms for living costs every year.

6.2 Economic Analysis

The purpose of the economic analysis is to study whether or not a project is feasible for the country. As with financial analysis, a comparison is made of analyses when the project is conducted(With Project Case) and when the project is not conducted(Without Project Case), and the soundness of the project is assessed by analyzing the difference in net present values.

6.2.1 Preconditions for Analysis

(1) Basic Conditions

Basic conditions for the analysis such as implementation period and project life, base year prices, inflation rate, productivity increase, in-use value of land, working capital schedule are the same as in the financial analysis. Prices used for calculation of current benefits and costs from farming practice, and investment costs are adjusted to economic prices from financial (market) prices but quantities used are the same under the both analyses.

(2) Conversion Factor for Price Adjustment

Conversion factors used for price adjustment are shown in Table 6-2. Conversion factor 1 (CF 1) is used to adjust excess profits, subsidies and taxes. Adjustment of tradable goods are made by considering exchange rate premium which is explained in the following section (3). Conversion Factor 2 (CF 2) is

derived from calculating ratios of economic prices to financial prices after adding the foreign exchange premium for tradable portion of goods.

Table 6-2 Conversion Factor 1 and 2

List of Conversion Factor 1 used for calculation of CF 2	
(Item)	(CF 1)
FOB & CIF Price	1.00
Freight & Insurance	1.00
Distribution Cost	0.70
Handling Charge	0.70
Inland Transport.	0.70
Trade Margin	0.70
Registration Fee	0.20
Subsidy	0.00
Tax	0.00

List of Conversion factor 2 used for Economic Analysis	
(Item)	(CF 2)
Urea	1.97
TSP	2.08
ZA	1.36
KCL	1.41
Com'd (Urea, TSP, KCL)	1.89
Lime	1.67
Pesticide (Liquid)	0.81
Pesticide (Granule)	0.89
Computer	0.80
Paddy	1.14
Maize	0.91
Soybeans	0.78
Cement	0.96
Asphalt	0.97
Fuel Oil	0.97
Vehicle	0.64
Motorcycle	0.76
Telephone	0.48
Office Equipment	0.91
Construct. Materials	0.94

(3) Exchange Rate Premium

The foreign exchange rate is 2,050 Rp in the end of 1992. Economic cost of foreign exchange is calculated, assuming that the project creates additional foreign exchange demand and therefore tends to depreciate rupiah against foreign currencies. The estimation of the economic cost of foreign exchange is made by combining the resource cost of additional supply of exports with the reduction in consumer benefits from the cut back in import consumption. Through adjusting distortion caused by export taxes and import duties, the foreign exchange premium is calculated at 0.15.

(4) Economic Opportunity Cost of Labor (EOCL)

1) Unskilled Labor Cost

Through interview with farmers in the project areas, daily labors in Bandung and workers from textile companies, the opportunity cost of

unskilled labor is assumed to be around 3,000 Rp per day. This amount is the same as the one used for financial analysis. Under the economic analysis, daily labor costs of 3,000 Rp is used as the economic opportunity cost of unskilled labors.

2) Skilled Labor Cost

Skilled labors are classified into two groups. One includes those who have high skills, such as consultants and surveyors. The other group consists of semi-skilled labors who are neither skilled nor unskilled labors. For skilled labors, the same remunerations or wage rates with financial analysis are used because the availability of skilled labors are assumed to be limited. In terms of remuneration of foreign consultants, the amounts are adjusted by the foreign exchange premium.

As for semi-skilled labors, it is assumed to be relatively easier to employ this type of labors in the case of long term projects. Therefore, labor costs of 7,500 Rp per day at a construction site in Bandung (dry season in 1993) are used as a reference to the economic opportunity costs of semi-skilled labors. As financial wage rate used for semi-skilled labor ranges from 4,000 Rp to 5,000 Rp per day in 1992 prices, wages for semi-skilled workers are adjusted by multiplying 1.4 as an average multiplier.

In terms of salaries for staff at the project office, the same rates as financial prices are used for the economic analysis.

(5) Economic Opportunity Cost of Capital

The economic opportunity cost of capital (EOCK) is basically obtained by taking weighted average of the rate of time preference for consumption and weighted average of the rate of return on private investment : economic cost of postponing consumption and net return foregone by the private owners of the investment. By adjusting tax factors, the economic opportunity cost of capital is calculated at 13%.

6.2.2 Results of Economic Analysis

(1) Results of calculation

The following show the results of economic analysis. The figures are incremental net present values which are calculated from difference of net cash

flows between with project case and without project. The percentages in the table indicate how much each of the project components contribute to the increase in the total incremental net present value.

Project Component	Incremental Net Present Value (Million Rp)	Contribution to Total NPV (%)
1. Farm/Forest Conservation	22,959	179.9
Forest	-2,380	-18.7
Agroforestry	5,904	46.3
Dry Farming	19,891	155.9
Settlement Environment	-456	-3.6
2. Torrent Conservation	-2,372	-18.6
3. Extension	538	4.2
4. Infrastructure	-2,349	-18.3
5. Environment	-479	-3.8
6. Management	-5,537	-43.4
Total Incremental NPV	12,760	100.0

(note) Real Economic Discount Rate = 13 %

With the incremental net present value being positive, the project is considered to be feasible from an economic view point. It is learned that the contribution of the component "Dry Farming" to the increase in total net present value is rather big among the project components. This analysis is a rather static analysis and the results of the analysis does not tell the whole story of the project: however, based on the above results, the feasibility of the project will be largely dependent upon the successful implementation of "Dry Farming" component. In order to realize expected benefits as planned, it will be important to encourage participation of farmers in the project, to promote farmers' education and co-planning process with farmers, and to strengthen extension activities which support these activities (support in both managerial and technical aspects).

The economic internal rate of return is calculated at 21.1 %.

(2) Sensitivity Analysis

The following sensitivity analysis shows how incremental net present values alter as the economic discount rate changes. As seen in the table, a few percent changes in discount rate does not affect feasibility of the project.

Discount Rate	Incremental Net Present Value (1000 Rp/ha)
5 %	60,017
10 %	23,571
13 %	12,760
15 %	7,988
20 %	956

(3) Other Benefits

Future dredging operation at Saguling Dam will be deferred by at least 5.4 years if this project is implemented. Such benefits can be treated as positive external benefits from this project. The dredging volume of soil to be deferred is estimated at 16,241,000 m3. If silt removal cost of 1,500 Rp/m3 which is budgeted at Directorate of Irrigation, East Java, is used for the calculation, benefits from deferred expense is calculated at 99.6 million rp in NPV (in 1992 prices).

Other qualitative benefits include reduction in flood damage in the downstream areas, improvement of water quality, security of potable and irrigation water, promotion of rural development, and creation of employment opportunities.

The detailed data related to the economic and financial analysis are shown in the Supporting Report D2 and D3.

CHAPTER 7 ENVIRONMENTAL CARE PLAN

CHAPTER 7 ENVIRONMENTAL CARE PLAN

The Project can be described as an environmental conservation project designed to introduce measures to control soil erosion for types of land use causing soil loss. Types of economic activities causing soil loss, such as dry crop farming, exist in the Study Area. Therefore, the Project aims at not only the employment of erosion control measures but also at the promotion of local development by means of assisting such activities.

A series of projects similar to the envisaged Project have been successfully implemented in Indonesia and the active implementation of soil conservation projects is encouraged. In fact, a pilot project (covering an area of some 10 ha) is in progress in the Study Area and the Project can be regarded as being part of the nationwide effort to promote soil and water conservation.

The environmental care plan has been formulated in accordance with the general steps of environmental care shown in Fig. 7-1. Prediction and assessment constitute part of the planning process.

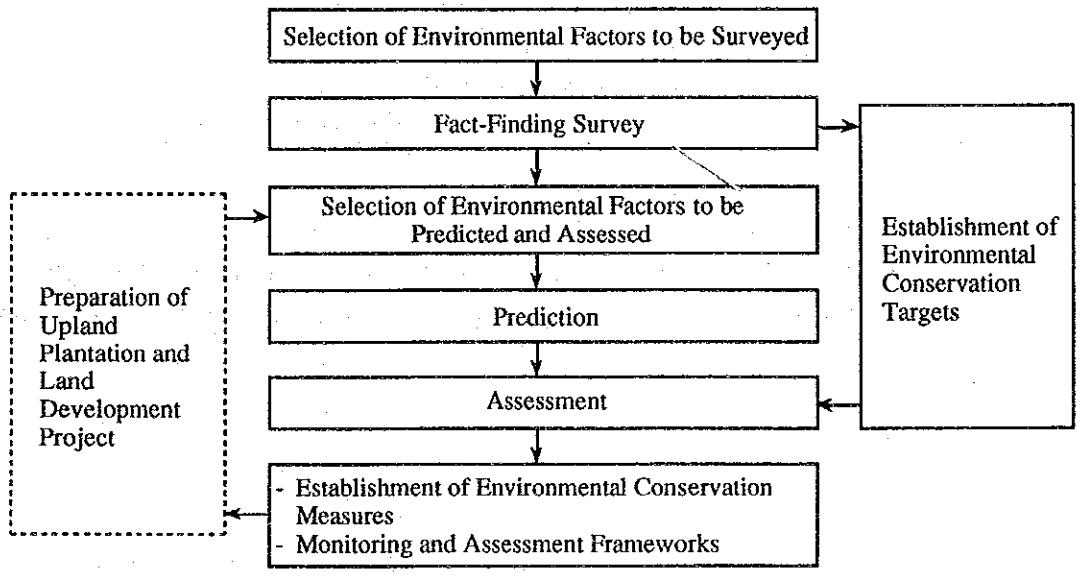


Fig. 7-1 Flow of Environmental Care

7.1 Identification of Environmental Impacts and Conservation Targets

The present general state of the environment in terms of the natural or social environment has already been described in Chapter 3. The Project components affecting the environment are listed in Table 7-1.

Table 7-1 Plans and Their Contents Under the Project

Plan	Contents
Farmland and Forest Land Conservation Plan	- Construction of terraces - Forest development - Introduction of agroforestry - Improvement of dry crop fields - Stimulation of surface water permeation in and around settlements
Torrent and Bank Conservation Plan	- Construction of check dams - Construction of small check dams - Construction of gully plugs - Construction of revetment works - Riverside planting
Extension Plan	- Establishment of demonstration plots - Construction of a training centre
Infrastructure Plan	- Construction and improvement of roads - Construction of nurseries
Management Plan	- Establishment of project implementation system - Implementation of extension activities and guidance

All of the above components of the Project underwent a scoping process to establish the environmental conservation targets for important factors. The results of this scoping process are given in Table 7-2.

Table 7-2 (1) Check List for Scoping (Natural environment)

Planning category			Farm/forest lands conservation plan					Torrent conservation plan					Extension plan		Infrastructure plan		Management plan	
Environmental impact factor			Terra	Forst devlp	Intro agrof	Imprv dry-farm	Absrb well	Check dam	Small check dam	Gully plug	Revet work	River s. pln	Demo. plot	Train centr	Acces road	Nurs.	Ovral Manag	Extns activ
Component	Sub-component	Type of activities	Est.	Imp.	Imp.	Imp.	Est	Est.	Est.	Est.	Est.	Est.	Est.	Est.	Est. Imp.	Est.	Imp.	Imp.
1. Areas with precious living organisms and ecosystems	a. Vegetation change														+			
	b. Precious species/endemic flora and fauna																	
	c. Biological diversification																	
	d. Invasion and propagation of pests																	
2. Soil and land resources (1) Soil	a. Soil erosion		+										+		+			
	b. Degradation of soil fertility		+										+					
	c. Soil pollution																	
(2) Land resources	a. Land denudation																	
	b. Back land denudation																	
	c. Land subsidence																	
3. Hydrology and water quality (1) Hydrology	a. Variation of flow regime surface water		++	+	++	++	++					++	++		++			
	b. Variation of ground water condition and water table						+											
	c. Occurrence of inudation/flood																	
	d. Sedimentation																	
	e. Lowering of stream bed																	
(2) Water quality and temperature	a. Water pollution and quality degradation		+		+			+	+	+	+		++					
	b. Eutrophication				+								++					
	c. Variation of water temperature																	
4. Air	a. Air pollution																	

(LEGEND) Type of activities : Est. = Establishing activities,
Imp. = Improving activities

Impact categories : +++ = Heavy,
++ = Moderate
+ = Slight

Environmental impact factor: Terra = Terracing, Forst Devlp = Forest development, Intro agrof = Introduction of agroforestry,
Imprv dry-farm = Improvement of dry farming, Absrb well = Absorbing well, Revet work = Revetment work,
River s.pln = Riverside planting, Demo. plot = Demonstration plot, Train centr = Training center,
Acces road = Access road, Nurs. = Nursery, Ovral manag = Overall management,
Extns activ = Extension activities,

Table 7-2 (2) Check List for Scoping (Social environment)

Planning category		Farm/forest lands conservation plan					Torrent conservation plan					Extension plan		Infrastructure plan		Management plan	
Environmental impact factor		Terra	Forst devlp	Intro agrof	Imprv dry-farm	Absrb well	Check dam	Small check dam	Gully plug	Revet work	River s. pln	Demo. plot	Train centr	Acces road	Nurs.	Ovral Manag	Extns activ
Component / Type of activities	Sub-component	Est.	Imp.	Imp.	Imp.	Est	Est.	Est.	Est.	Est.	Est.	Est.	Est.	Est, Imp.	Est.	Imp.	Imp.
1. Social life (1) Life of inhabitants	a. Reluctance to shift dwelling													++			
	b. Change of life style																
	c. Friction between inhabitants													++			
(2) Population problems	a. Population increase																
	b. Sudden change in population structure																
(3) Economic activities of inhabitants	a. Shift in base of economic activities																
	b. Conversion or loss of economic activities	++		++	++					++							
	c. Expanded income differential																
(4) Systems & common practices	a. Readjustment of water rights and fishing rights																
	b. Change of social structure												+				+
	c. Modification of existing systems and customs			++	++								+				+
2. Health and hygiene	a. Increased use of agricultural chemicals																
	b. Occurrence of endemic diseases																
	c. Propagation of contagious diseases																
	d. Residual poisons (agricultural chemicals, etc.)																
	e. Increased waste materials and excrement																
3. Historic relics, cultural heritage and scenery	a. Loss or damage to historic relics, cultural heritage																
	b. Loss of valuable scenery																
	c. Buried resources																

(LEGEND) Type of activities : Est. = Establishing activities,
Imp. = Improving activities

Impact categories : +++ = Heavy,
++ = Moderate
+ = Slight

Envirnmental impact factor: Terra = Terracing, Forst Devlp = Forest development, Intro agrof = Introduction of agroforestry,
Imprv dry-farm = Improvement of dry farming, Absrb well = Absorbing well, Revet work = Revetment work,
River s.pln = Riverside planting, Demo. plot = Demonstration plot, Train centr = Training center,
Acces road = Access road, Nurs. = Nursery, Ovral manag = Overall management,
Extns activ = Extension activities.

(1) Natural Environment

1) Rare Species and Their Ecosystems

As the Project intends the employment of various soil conservation measures vis-a-vis the types of land use causing soil loss, such land as forest land where the prevailing land use is desirable from the soil conservation viewpoint are placed outside the scope of the Project. Most measures are vegetative measures designed to increase the vegetation cover, mainly by trees, and are unlikely to have any adverse effect on rare species and their ecosystems.

The Masigit Hunting Park is practically the only area in the Planning Area where animals subject to government protection are found. However, the planned activities mainly comprising "vegetative measures" of land rehabilitation, which do not include the disturbance of the animals' habitat by significant level and it is believed that the Project will not result in any tangible damage to the Park.

2) Soil and Land

As the Project involves the introduction of measures to control the ongoing soil erosion caused by farming and other activities, the scale of soil erosion will generally decline in accordance with the progress of the Project. Nevertheless, there is concern in regard to the temporary deterioration of soil fertility and increased soil loss at the early stage of the Project during which the construction of terraces will disturb the soil forming layer. The Planning Area has no geologically unstable formations, such as faults.

3) Hydrology and Water Quality

Those hydrological factors which may have a serious environmental impact are as follows.

① Changes in surface water flow regime

② Changes in groundwater flow regime and groundwater level

③ Water pollution, deterioration of water quality and eutrophication

As the Project will stimulate the permeation of surface water to mitigate the forces causing soil erosion, it will have favourable effects in terms of the flow regime, groundwater level and sedimentation. Temporary turbid water

may occur at the early construction stage of check dams and other structures. A deterioration of the water quality could eventually occur due to the increased use of pesticides and fertilizers following agricultural development in the Planning Area.

(2) Social Environment

Social environment factors which may have a serious environmental impact are as follows.

① Transformation of economic activities and unemployment

② Changes in social structure due to grouping and other causes

③ Reform of existing systems and/or customs

The introduction of agroforestry and the construction of new terraces are expected to change the economic activities of local inhabitants in terms of the crops to be cultivated and other aspects. Agroforestry will reduce the consumption of pesticides in the long term.

These new features of local farming will affect the local use of water, in turn affecting the conditions of present economic activities. The planned construction or improvement of roads may cause friction with local inhabitants, particularly when such work involves the undesired relocation of farmland or homes.

The activities of the new training centre and extension workers could lead to the successful establishment of farmers' groups. All promotion activities will inevitably affect existing farming practices in one way or another.

There are no historical sites or cultural remains which could be adversely affected by the Project in the Planning Area.

The environmental conservation targets given in Table 7-3 have been established based on the above considerations.

Table 7-3 Environmental Conservation Targets

Factor	Target
Deterioration of soil fertility	To maintain soil fertility at the early construction stage of terraces and other structures
Changes in surface water flow regime	To avoid a substantial change of the flow regime of rivers
Deterioration of Water Quality	To alleviate the occurrence of turbid water following the construction of terraces and check dams, etc.
Eutrophication	To alleviate eutrophication due to fertilizer inflow
Transformation of economic activities and friction with local inhabitants	To harmonise the transformation of farming practices and construction of new roads, etc. with the conventional economic activities of local inhabitants in the Planning Area
Changes in social structure due to grouping, etc.	To pay proper attention to existing communal organizations and traditional organizations as well as social system so that the promotion system incorporates local opinions in the establishment of farmers' groups
Reform of customs	To harmonise the changed farming practices with local conventional customs

7.2 Environmental Prediction and Assessment

Environmental prediction and assessment in connection with the Project were conducted for the entire Planning Area on the subject issues of environmental conservation targets.

7.2.1 Natural Environment

(1) Deterioration of Soil Fertility

No scientific report has yet been fully compiled on the deterioration of soil fertility due to the ongoing dry crop farming with no consideration given to soil conservation. Nevertheless, according to the questionnaire survey, such deterioration is recognised by local inhabitants.

The pilot project has also made it clear that the construction of terraces leads to not only a deterioration of soil fertility but also to an increase of the soil's pH value, necessitating the use of lime prior to the commencement of farming at newly established terraces. One of the countermeasures included in the vegetative measures to be employed by the Project is the use of lime and the increased use of NPK fertilizer by 20% above the ordinary level (500 kg/ha). In the case of similar projects, no serious crop damage has been reported due to deteriorated soil fertility following the construction of terraces. Therefore, it is assumed that the

use of a sufficient amount of lime and fertilizer as envisaged by the Project will prevent a critical deterioration of soil fertility.

(2) Changes in Surface Water Flow Regime

The sub-watersheds in the Study Area are characterised by radial streams in mountain areas around the bottom (paddy field area) of Bandung basin, forming Citarik river's well-developed tributary system. The flow regime characteristics of various rivers observed by the DPMA show that the river regime coefficient and specific discharge are extremely large in the mountain areas compared to the bottom area. These high values indicate an unstable flow regime, in turn suggesting a high contribution rate to the discharge of Citarik river. Consequently, mountain areas should be given higher priority in the watershed conservation efforts in the Study Area (see Supporting Report E1).

The prediction and assessment subjects relating to changes of the surface water flow regime are such important indices as the evapotranspiration volume, infiltration capacity and retained water quantity, roughness of sub-watershed and travelling time for surface water to reach downstream, runoff coefficient and runoff volume, etc. The subject area of prediction and assessment is the entire Planning Area. One component of the Project which can significantly affect the surface water regime is the measure to control soil erosion. In this context, the types of land use where the ground cover conditions include forest cover, such as forests, mixed gardens and estates, are grouped under the land use with arboreous cover category and changes of the land ratio in this category (land use with arboreous cover) were studied to facilitate prediction of the possible impacts of such changes. The land ratio and other data of this category are given in Table 7-5 E1. With the implementation of the Project, the land use with arboreous cover ratio in the Planning Area will increase by some 14% as shown in Table 7-4.

Table 7-4 Changes in Land Use with Arboreous Cover Ratio After the Project

Subject Area	Area (ha)	Before Project		After Project		Change
		Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	of Ratio
Planning Area	33,348	12,544	38	17,328	52	+14
Study Area	50,204	12,832	26	17,616	35	+9

Note: Mesh data were used for calculation purposes.

1) Evapotranspiration Volume

The possible changes of the evapotranspiration volume with the implementation of the Project were estimated using the Blaney-Criddle formula and the mesh analysis results (see Table 7-5). The mean evapotranspiration volume at present was found to be 1,487.35 mm/year and is expected to slightly increase to 1,490.72 mm/year following the completion of the Project. This value will be used as the index value for evapotranspiration volume before and after the Project. A report jointly published by the DEPHUT and University of Gadjamada put the evapotranspiration volume in the Citarik watershed at between 1,238mm and 1,513mm (1980 - 1985) using Thornthwaite's method. As the above value of 1,490.72mm is within this range, it is not an unrealistic estimate. From the viewpoint of long-term water management, increased interception evaporation by forests generally leads to a quantitative decline of the runoff. Since the Project mainly anticipates the sparce planting of trees with a low leaf density to allow the use of the ground surface for agroforestry and other purposes, no serious increase of the evapotranspiration volume is expected to occur.

2) Infiltration Capacity and Retained Water Quantity

It is known that the infiltration capacity and retained water quantity increase in proportion to an increase of organic matter and/or the porosity of the soil caused by development of the root system. Therefore, ground cover by forests appears to have a positive effect on flood control.

The rate of land use with arboreous cover in the Planned Area is expected to increase from 38% before the Project to 52% after the Project, suggesting a qualitative improvement of the flood control function in the Planning Area.

3) Roughness of Watershed and Travelling Time for Surface Water to Reach Downstream

In general, the roughness coefficient is said to be largely determined by the state of land use in the subject watershed and increases in proportion to an increase of the forest or paddy field area. According to a 1974 report issued by the Ministry of Construction, the roughness coefficient for a watershed characterised by terraced dry crop fields is 0.2 - 0.4 while a roughness coefficient of 0.4 - 0.8 is suggested for a mountainous

watershed with fairly good forest physiognomy. The increase of land use with arboreous cover and mitigation of the slope gradient through the construction of terraces under the Project should increase the roughness coefficient and resistance to surface water flow of the watershed. As a result, the travelling time for surface water to reach the downstream will be prolonged.

4) Runoff Coefficient and Runoff Volume

As the Study Team was unable to obtain or establish the runoff coefficient which would correspond to the improved land use resulting from the Project, the theoretical value suggested by a Japanese scholar (Takami) in 1980 was modified to check changes of runoff coefficient of ordinary rain.

The land use and vegetation types and basic runoff coefficient for the present study purposes are given in Table 7-5. The weighted average method using the size of the Planning Area found that the general runoff coefficient in the Planning Area would drop by 3% from 0.58 to 0.56 as a result of the Project (see Table 7-5).

One report (jointly published by the DEPHUT and University of Gadjah Mada in 1991) established the runoff coefficient for the Citarik watershed using a runoff model which assumed that 50% of one month's effective rainfall would be added to the effective rainfall of the following month. This model relying on the temperature and rainfall data of a representative site put the runoff coefficient for the Citarik watershed at 0.60 as of 1985 which was not dissimilar to the calculated value for the present study. On the grounds that the calculated value is used as the index value, the Project will not dramatically change the runoff volume in the Planning Area.

In short, the following forecast of possible changes of the surface water flow regime by the Project can be made.

- The evapotranspiration volume will hardly change
- The infiltration capacity and retained water volume will increase
- The travelling time for surface water to reach the downstream will be prolonged
- The general runoff coefficient will slightly decrease

Table 7-5 Changes of Evapotranspiration and Runoff Coefficient before/after Project

RUNC001

TABLE CHANGE OF EVAPOTRANSPIRATION AND RUNOFF COEFFICIENT BEFORE/AFTER PROJECT

	CLASS		LAND USE WITH ARBOREOUS COVER*1	AREAL WEIGHT BEFORE PROJECT	AREAL WEIGHT AFTER PROJECT	C	ET	CHANGE OF EVAPOTRANSPIRATION BEFORE PROJECT WEIGHED VALUE(mm)	CHANGE OF EVAPOTRANSPIRATION AFTER PROJECT WEIGHED VALUE(mm)	CHANGE OF RUNOFF COEFFICIENT RUNOFF COEFFICIENT	CHANGE OF RUNOFF COEFFICIENT BEFORE PROJECT WEIGHED VALUE	CHANGE OF RUNOFF COEFFICIENT AFTER PROJECT WEIGHED VALUE
LAND USE/ VEGETATION	Irrigated paddy field			0.1391	0.1391	1.20	2,237	311.14	311.14	0.73	0.10	0.10
	Rainfed paddy field			0.0297	0.0297	1.20	2,237	66.43	66.43	0.73	0.02	0.02
	Dry crop field with terraces			0.0336	0.0275	0.75	1,398	46.97	38.45	0.60	0.02	0.02
	Dry crop field without terraces			0.3331	0.0511	0.75	1,398	465.67	71.44	0.60	0.20	0.03
	Mixed garden closed with CD >70 %		O	0.0157	0.0150	0.70	1,305	20.49	19.57	0.50	0.01	0.01
	Mixed garden closed with CD 21-70 %		O	0.0228	0.0158	0.70	1,305	29.75	20.62	0.50	0.01	0.01
	Coconut estate		O	0.0006	0.0006	0.60	1,118	0.67	0.67	0.50		
	Mulberry estate		O	0.0038	0.0038	0.60	1,118	4.25	4.25	0.50		
	Quinine estate			0.0036	0.0036	0.60	1,118	4.03	4.03	0.50		
	Clove estate		O	0.0070	0.0070	0.60	1,118	7.83	7.83	0.50		
	Shrub (Belukar)		O	0.0378		0.60	1,118	42.28		0.50	0.02	
	Bamboo		O	0.0543	0.0543	0.75	1,398	75.91	75.91	0.50	0.03	0.03
	Grass land			0.0096		0.75	1,398	13.42		0.55	0.01	
	Quarry			0.0019		0.60	1,118	2.12		0.70		
	Landslide					0.60	1,118			0.70		
	Settlement			0.0702	0.0702	0.50	932	65.43	65.43	0.70	0.05	0.05
	Fish pond			0.0005	0.0005	1.00	1,864	0.93	0.93	1.00		
	Industrial facilities			0.0014	0.0014	0.50	932	1.3	1.3	0.70		
	Road											
	Cemetry			0.0011	0.0011	0.50	932	1.03	1.03	0.70		
	Railway											
	Swamp											
	River											
	Natural/Secondary forest	H:1 CD:1	O	0.0004	0.0004	0.75	1,398	0.56	0.56	0.50		
	ditto	H:1 CD:2	O			0.75	1,398			0.50		
	ditto	H:1 CD:3	O	0.0004	0.0004	0.75	1,398	0.56	0.56	0.50		
	ditto	H:2 CD:1	O	0.0006	0.0006	0.75	1,398	0.84	0.84	0.50		
	ditto	H:2 CD:2	O	0.0196	0.0196	0.75	1,398	27.4	27.4	0.50	0.01	0.01
	ditto	H:2 CD:3	O	0.0065	0.0065	0.75	1,398	9.09	9.09	0.50		
	ditto	H:3 CD:1	O			0.75	1,398			0.50		
	ditto	H:3 CD:2	O	0.0100	0.0100	0.75	1,398	13.98	13.98	0.50	0.01	0.01
	ditto	H:3 CD:3	O	0.0251	0.0251	0.75	1,398	35.09	35.09	0.50	0.01	0.01
	Man-made forest	H:1 CD:1	O	0.0120	0.0120	0.75	1,398	16.78	16.78	0.50	0.01	0.01
	ditto	H:1 CD:2	O	0.0058	0.0058	0.75	1,398	8.11	8.11	0.50		
	ditto	H:1 CD:3	O	0.0061	0.0061	0.75	1,398	8.53	8.53	0.50		
	ditto	H:2 CD:1	O	0.0031	0.0031	0.75	1,398	4.33	4.33	0.50		
	ditto	H:2 CD:2	O	0.0190	0.0190	0.75	1,398	26.56	26.56	0.50	0.01	0.01
	ditto	H:2 CD:3	O	0.0307	0.0307	0.75	1,398	42.92	42.92	0.50	0.02	0.02
	ditto	H:3 CD:1	O	0.0008	0.0008	0.75	1,398	1.12	1.12	0.50		
	ditto	H:3 CD:2	O	0.0091	0.0091	0.75	1,398	12.72	12.72	0.50		
	ditto	H:3 CD:3	O	0.0852	0.0852	0.75	1,398	119.11	119.11	0.50	0.04	0.04
COUNTER-MEASURES	VP=0 : CP=1				0.1562	0.75	1,398		218.37	0.55		0.09
	VP=0 : CP=2					0.75	1,398			0.55		
	VP=1 : CP=0		O		0.0154	0.70	1,305		20.09	0.50		0.01
	VP=1 : CP=1		O		0.0072	0.70	1,305		9.39	0.50		
	VP=1 : CP=2		O		0.0696	0.70	1,305		90.81	0.50		0.03
	VP=2 : CP=0		O		0.0968	0.75	1,398		135.33	0.50		0.05
	VP=2 : CP=1		O			0.75	1,398			0.50		
	VP=2 : CP=2		O			0.75	1,398			0.50		
		TOTAL		1.0000	1.0000							
		WEIGHED AVERAGE						1487.35	1490.72		0.58	0.56

NOTE : *1 : The subject classes for land use with arboreous cover are indicated by "O".

VP=0 : IMPROVEMENT TYPE 1 & 2
VP=1 : AGROFORESTRY TYPE 1 & 2
VP=2 : FOREST DEVELOPMENT TYPE 1, 2 AND 3

CP=0 : NO ACTION
CP=1 : BENCH TERRACE
CP=2 : SMALL DIKE TERRACE

EVAPOTRANSPIRATION CALCULATION BASED ON BLANEY/CRIDDLE FORMULA

MONTH	MONTHLY TEMP. t(°C)	t(°F)	% OF POSSIBLE SUNSHINE (%)	DAY	DURATION OF SUNSHINE (hr)	K VALUE (%)	ET/c (25.4*t*K)
1	22.6	72.7	43	31	160	0.06	111
2	22.7	72.9	52	28	175	0.07	130
3	22.9	73.2	53	31	197	0.08	149
4	23.2	73.8	59	30	212	0.08	150
5	23.3	73.9	60	31	223	0.09	169
6	23.0	73.4	66	30	238	0.09	168
7	22.5	72.5	76	31	283	0.11	203
8	22.7	72.9	74	31	275	0.11	204
9	23.2	73.8	64	30	230	0.09	169
10	23.3	73.9	58	31	216	0.08	150
11	23.0	73.4	51	30	184	0.07	131
12	22.9	73.2	51	31	190	0.07	130
			TOTAL		2,583		1,864

Note: This table is modified from the data of Fig. 3-1.

Because of the expected increase of both the infiltration capacity and retained water volume and also because of the prolonged travelling time for the surface water to reach the downstream, the Project should have positive effects for flood control. The negligible change of both the evapotranspiration volume and general runoff coefficient means that the Project will not have any serious impact on the water supply volume. Given these observations, it is highly likely that the environmental conservation targets of the Project will be fully achieved.

(3) Water Pollution, Deterioration of Water Quality and Eutrophication

The BAPEDAL is conducting the monitoring and improvement of water quality through the inspection of specific sources of contamination such as factories. In contrast, the control of non-point sources, including farmer, is much less rigourous except the control of soil erosion. Neither systematic nor continuous observation data are available for river water which has a strong bearing on the Project. The DPMA, however, conducts annual water quality checks of the Citarik, Cikeruh and Cipamokolan rivers. The main analysis items and analysis results are given in Supporting Report E2. The BOD value of the Citarik and Cikeruh rivers is below 10 mg/l while the relevant value for Cipamokolan river exceeds 10 mg/l, indicating an advanced state of contamination. The coliform count is more than 10^4MPN/100ml for all the rivers while the total nitrogen, excluding organic nitrogen, exceeds the 1 mg/l level except at the middle reaches of the Citarik and Cikeruh rivers. Taken together, these water quality indices appear to suggest a fairly advanced stage of river water contamination which is already causing concern in regard to the appearance of eutrophication in the lower reaches. In particular, the ammonia value far exceeds Indonesia's suggested maximum concentration of 0.016 mg/l for water quality standard category C (for fisheries and stock raising) at all the rivers.

The most popular agrochemicals used in the Planning Area are Dursban, Furadan and Diazinon (based on the questionnaire survey). Other pesticides are also supplied to farmers by the P.T. Perhutani via the KUD as shown in Supporting Report E3. These pesticides are mainly used to protect vegetables (tomatoes and ginger, etc.) and tobacco, particularly in Sub-Watersheds Nos. 2, 3 and 4 in the Cilengkrang, Cileunyi, Tanjungsari and Cikeruh Districts. Presidential Decree Inpres No. 3 (November, 1986) prohibits the use of 57

different types of pesticides on paddy fields but there is no restriction in the case of dry crop fields.

Two components of the Project which may adversely affect water quality are described below.

- Occurrence of turbid water at the time of constructing terraces and check dams, etc.

- Increased consumption of agrochemicals (pesticides) and fertilizers following the development of local agriculture

Measures envisaged by the Project to prevent turbid water include the construction of check dams and small check dams prior to the construction of terraces. Appropriate decisions on the timing of check dam construction and on check dam sites and the introduction of diversion channels are important to achieve the environmental conservation targets.

The increased consumption of fertilizers and pesticides under the Project can be assumed to be caused by the following.

- Temporary deterioration of soil fertility due to disturbance of the existing soil making layer at the construction stage due to terracing and other work

- Introduction of high yield varieties

In addition to soil erosion control measures, the Project also envisages the introduction of water quality improvement measures, including the idea of a aeration or gravel contact oxidation system as an integral feature of waterway works. With regard to pesticides, the use of pesticides with a low toxicity or residual toxicity is planned.

Indirect measures include (i) reduced dependence on external input in terms of the physical cycle system as in the case of reduced fertilizer use due to the introduction of agroforestry, (ii) reduced consumption of pesticides due to the avoidance of monoculture and diversification of the ecosystem and (iii) reduced migration quantities of nitrogen and phosphorous due to the decrease of soil discharge.

A quantitative prediction of the compound impacts of the above-mentioned measures is difficult because of the shortage of relevant data. While it is safe to predict that the Project will result in a qualitative improvement in general compared to the possible outcome of the unchecked development of dry crop fields, regular monitoring of the situation will still be necessary.

7.2.2 Social Environment

(1) Transformation of Economic Activities and Friction With Local Inhabitants

The population of the Study Area shows a generally increasing trend with the working population of the industrial sector growing at the expense of the agricultural population. This trend is caused by the following characteristics of the Study Area.

- Proximity to Bandung city which is an expanding economic zone
- Inclusion of paddy field areas in the Bandung basin where industrial parks and housing estates are being developed
- Inclusion of the Jatinagor area in the Bandung District where the large development of educational facilities is in progress.

The population pressure, defined by Otto Soemarwoto, is reportedly 1.66 as of 1991 in the Study Area, far exceeding the general tolerance limit of 1.00. The farming of dry crop fields in the Planning Area is mainly conducted manually.

It is assumed that the local work force will be used as much as possible for construction work under the Project. Most construction work for civil engineering structures, including terraces, and buildings is planned to be conducted during the dry season for soil conservation. As the dry season is an off-farming season, there will be few clashes of interest between the Project-related work and farming. Consequently, the Project is expected to increase employment opportunities for local inhabitants and the structures and buildings to be constructed will form the base for the future economic activities of local inhabitants.

The contents of the farmland and forest land conservation plan under the Project have been determined through 2 approaches, i.e. improved performance of the present land use and conversion of land use types. The economic analysis results of these 2 approaches are given in Chapter 6. These approaches

are considered rational from the viewpoint of soil and water conservation and supportive measures are also provided in terms of promotion activities and subsidies, etc. Special measures may be required, however, if little cooperation is forthcoming from local inhabitants due to reasons relating to income, etc.

The Project does not envisage the mechanisation of farming after its completion and, therefore, will not drastically alter the local farming structure or system.

In addition to the construction of access roads to check dam and demonstration plot sites, the construction of community roads is also planned. Only a number of such community roads is planned in order to allow local inhabitants to express their route preferences. These roads are basically intended to promote development in mountain areas which are defined as dry farming areas. The main purpose is to increase the road density in the Planning Area and not to develop new farming fields. Proper care should be taken in the construction of new roads to avoid friction with local inhabitants. Given the above argument, it is believed that the environmental conservation targets in these fields will be achieved by the implementation of the relevant conservation measures.

(2) Changes of Social Structure Due to Grouping, etc. and Reform of Existing Systems and Customs

Several farmers' groups have already been established in the Planning Area following the participation of farmers in government projects or guidance provided by the BPPs. The objective of the existing farmers' groups is to provide mutual assistance for farming. Concrete activities include the joint purchase of chemical fertilizers using joint funds. These groups are also recognised as being useful for the extension of agricultural techniques to ensure soil conservation and revegetation work as part of the overall soil and water conservation efforts.

In general, however, most farming households in the Study Area own only a small area of land and farmers are inclined to give their highest priority to making as much profit as possible. Consequently, the general interest in the types of land use which are preferred from the viewpoint of soil and water conservation is weak.

There is a traditional custom of mutual help (Goton Royon) which is organized on a village basis in terms of farming, public civil engineering work and disaster prevention/rehabilitation work.

With regard to existing farming customs related to soil conservation, there is a tendency for traditional farming, such as home gardens and mixed gardens on sloping land, using the ecosystem's material cycle to be replaced by farming using energy supplied from outside the cycle (dry crop farming).

As already discussed in Chapter 3, the BRLKT IV is implementing extension activities through the 3 BPPs and farmers' groups. According to the results of the questionnaire survey, farmers participating in such activities have not experienced any harmful effects on farming due to the establishment of farmers' groups. Consequently, it can be argued that the establishment of farmers' groups will not result in any damage to the local communities.

Agroforestry is somewhat similar to the traditional farming methods, such as home garden. Given the fact that agroforestry has already been introduced through projects similar to the present Project, there is sufficient potential for its techniques to be readily accepted. The Project also envisages the introduction of the following incentive measures to stimulate the participation of local inhabitants.

- Economic incentives : material assistance and provision of conveniences for soil and water conservation activities

  encouragement of and subsidy for soil and water conservation efforts

- Management incentives : assistance for information exchange through strengthening and improvement of the extension system

7.3 Environmental Conservation Measures

Environmental conservation measures will be introduced in the case of those environmental factors for which prediction and assessment are conducted in 7.2 and of which the forecasting of negative impacts necessitates a concrete response under the Project.

(1) Deterioration of Soil Fertility

The temporary deterioration of soil fertility during the terrace construction period can be directly prevented through the use of fertilizers. Increased fertilizer use as well as the use of lime is planned as part of the farmland and forest land conservation plan. It is desirable in the future for a method to allow the maximum restoration of the plow layer to be employed for terrace construction.

(2) Changes of Surface Water Flow Regime

It is necessary to check the actual changes by monitoring in order to quantify the impacts of such changes so that appropriate countermeasures can be prepared. A detailed discussion of this issue is given in 7.4.

(3) Changes in Water Quality

Viable measures to prevent turbid water are listed below.

- Erosion control fencing and the piling of sand bags along waterway works (strict implementation of appropriate measures on end treatment)
- Employment of fascine works
- Suspension of construction work during heavy rain

In addition, the following measures can be employed in view of the specific conditions in the Study Area.

- Commencement of construction work from the lower reaches upwards in each sub-watershed
- Preferential implementation of large-scale civil engineering work during the dry season where possible
- Particularly careful treatment of the lower ends of slopes on the work sites during the terrace or check dam construction period

The volume of fertilizer use at the Project implementation stage can be reduced by the either the employment of an improved fertilizer application method or the use of improved fertilizers. The use of fertilizers along ridges will improve the efficiency of fertilizer use and the use of fertilizers with a low diffusion feature is desirable.

(4) Social Environment

Factors relating to the social environment were taken into consideration at the project planning stage and the measures discussed in Chapter 5 constitute environmental conservation measures. Should no cooperation on the part of local inhabitants be forthcoming at the implementation stage of the farmland and forest land conservation plan, the most appropriate conservation measures to improve the functions of the present land use will be introduced within the scope of the planned budget for conservation measures.

In the case of road construction, priority will be given to an increased road density, particularly that of communal roads, within village boundaries and the actual road construction volume will be distributed to each village in proportion to the total area of village farmland. Routes will be decided with the consent of the villagers.

7.4 Principles of Monitoring and Assessment

Monitoring will be conducted for those environmental factors for which quantification is deemed necessary because of their grave implications vis-a-vis the objectives of the Project of for which long-term, homogeneous data is required to identify the likely environmental impacts.

(1) Monitoring of Natural Environment

The natural environment monitoring items are listed below.

- State of sediment discharge
- River flow regime
- River water quality

With regard to sediment production (erosion), transportation and deposit, all of which are closely related to the main objective of the Project, the focus of monitoring is sediment discharge which is the result of sediment production and transportation.

The monitoring unit is a watershed and the emphasis of monitoring is placed on the quantitative relationship between the functional changes of land use due to the implementation of the farmland and forest land conservation plan and the above monitoring items.

While each watershed is considered an independent water system, the monitoring unit is, in reality, mini-watersheds in mountain areas which are classified in the secondary category of the stream order or lower. The selected mini-watersheds are those where the effects of each project component can be clearly established. A hydrological observation station will be established at the lower end of each mini-watershed to conduct observations of the above items. It has been decided that the following hydrological observation stations will be established.

- The sub-watersheds in which the mini-watersheds are located are Sub-Watersheds No. 2 (Cipanjaru river), No. 4 (Cikeruh river) and No. 8 (Cijalupang river). The DPMA observes the discharges of these rivers.

- Four mini-watersheds of between several tens of ha and several hundreds of ha will be selected in each sub-watershed so that 4 types of land use, i.e. forests, mixed gardens, dry crop fields and paddy fields, respectively excels in one of these 4 mini-watersheds.

The observation results of the above Cijalupang river and for Rancakemit along Citarik river will be compared with each other in order to determine the combined impacts of the Project on each sub-watershed, taking the need to refer to observation data of the DPMA into consideration.

(2) Monitoring of Social Environment

Monitoring of the following items will be conducted to determine changes due to the implementation of the farmland and forest land conservation plan and the impacts of the relevant promotion activities.

- Crop yield
- Conditions of activities of farmers' groups

With regard to crop yield, monitoring will be conducted at the demonstration plots to make both a general and individual evaluation of the effects of the civil engineering (non-vegetative) and vegetative measures employed under the farmland and forest land conservation plan.

In regard to the activities of farmers' groups, the evaluation will focus on the effects of grouping.

The joint evaluation of the results of the monitoring of both the natural and social environment is desirable in view of comprehensively evaluating the effects of the Project.

(3) Monitoring System

The Wonogiri Project, a project which is similar to the present Project, is mainly managed by the SBRLKTs. The section of the DEPHUT responsible for providing comprehensive technical consulting services for the Wonogiri Project states that no standard principles or methods have yet been established in Indonesia in relation to the monitoring and evaluation of soil and water conservation projects.

Given the planned implementation system for the Project and the example set by the Wonogiri Project, one of the SBRLKT together with the BPPs can be assigned the monitoring role for the Project. The SBRLKT Citarum has experience of running a pilot project (involving some 10 ha) for soil conservation purposes but it cannot be said to have sufficient experience to run a project covering a vast area of tens of thousands of ha. Strengthening of the monitoring system and monitoring ability, including the functions of the SBRLKT Citarum is, therefore, necessary.

The monitoring and evaluation activities can be classified into 2 categories depending on the subject items, i.e. on-site type activities and research type activities.

Table 7-6 Characteristics of Monitoring and Evaluation Activities

On-Site Type Activities	Research Type Activities
- simple method	- complicated method
- quick processing of findings	- time-consuming processing of findings
- quick response to findings required	- long-term monitoring required

In the case of the on-site type activities, it is desirable for on-site supervisors and those responsible for on-site work to have the ability to evaluate and respond to crop damage caused by pests and diseases or damage to structures which demand immediate attention and remedial measures. In this regard, extension workers should comprise suitable on-site supervisors and their assignment should lead to

improved communication with farmers, stronger pride on the part of extension workers and a qualitative improvement of extension activities.

In contrast, research type activities will be conducted by the SBRLKTs, BTP-DAS and other related research institutions. As these institutions already have a work environment capable of using computers, the introduction of personal computers for data processing purposes is highly feasible.

(4) Monitoring and Evaluation Frameworks

The planned monitoring items, methods and frequencies are given in Table 7-7.

Table 7-7 Monitoring Details

Item	Method	Frequency
[Natural Environment]		
- sediment discharge	- establishment of soil erosion volume at fixed plots	monthly
- river flow regime	- measurement of runoff and sediment transportation volume by hydrological stations	daily
- river water quality	- Testing of water quality items near hydrological stations	monthly in principle
[Social Environment]		
- crop yield	- survey on yield of standard crops at fixed plots	every harvest
- farmers' group activities	- detailed study of farmers' groups participating in Project	monthly

Although most of the analysis relating to river water quality will be commissioned to the DPMA, easy items to check (such as pH, electric conductivity and turbidity, etc.) will also be monitored as part of the BPP's promotion activities to stimulate interest in the environment on the part of local inhabitants.

The evaluation will be conducted by the project implementation body referred to in Fig. 5-10 in Chapter 5. The collected data will be subject to continuous analysis, keeping pace with the monitoring. The evaluation results will be regularly reported every 3 - 6 months. At the end of each project year, the monitoring and evaluation results upto that time from the initial commencement of the Project will be thoroughly reviewed in order to make an up-to-date evaluation of the Project.

CHAPTER 8 RECOMMENDATIONS

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(1) The Project is judged to be suitable from the technical, economic and social viewpoints and the Project's early implementation is highly desirable.

(2) Given the fact that implementation of the Project involves many government departments and offices as well as one municipality and 2 districts, coordination between all related organizations from the preparatory stage and the establishment of an appropriate implementation system are essential. In particular, prior coordination at the provincial level is highly desirable for the smooth implementation of the Project.

(3) The national forests located in the upper reaches of the subject sub-watersheds perform an excellent function in terms of soil and water conservation. While the Project is mainly concerned with private land in the middle and lower reaches, work in these national forests should be conducted with full understanding of the objectives of the Project.

(4) The active participation of local inhabitants should be sought right from the preparatory stage, i.e. detailed design stage, to facilitate their understanding of and cooperation for the Project taking the local conditions into proper consideration.

(5) The Project is a type of environmental conservation project and includes an environmental care plan to emphasise its environmental features. This environmental care plan should be fully implemented to ensure a high degree of perfection of the Project.

(6) The implementation of active monitoring of soil loss, changes in crop yields and impacts on local inhabitants, etc. is recommended in view of establishing a smooth implementation method for similar projects in other areas in the future.

(7) The Upland Plantation and Land Development Project is still at the feasibility study stage where the suitability of the Project is under examination. More concrete implementation programmes should be prepared to reflect the actual conditions of the subject areas, including the historical changes of various conditions in such areas.