

Table VII-2 Subject Land Size of Planned Reforestation Work by Working Area

(Unit: ha)

Land Category	Planned Work	Working Area				
		Oesao East	Oesao West	Olio	Oebelo	Total
State Forest Land	F1	8	260	32	92	392
	F2	440	764	116	412	1,732
	F3	16	104	4	0	124
	Sub-Total	464	1,128	152	504	2,248
Enclaves	F1	0	0	28	8	36
	F2	0	0	132	12	144
	F3	0	0	0	0	0
	Sub-Total	0	0	160	20	180
Private Land	F1	52	120	124	64	360
	F2	256	620	184	748	1,808
	F3	48	16	4	8	76
	Sub-Total	356	756	312	820	2,244
Total	F1	60	380	184	164	788
	F2	696	1,384	432	1,172	3,684
	F3	64	120	8	8	200
	Sub-Total	820	1,884	624	1,344	4,672

VII-2 Farmland Improvement Plan

Trees will be planted for existing dry crop fields, mixed gardens with a crown density of less than 70% and shrub land to increase the ground coverage by trees so that the farming use of these land types can be conducted with care taken in regard to soil conservation.

(1) Farmland Improvement Type 1: Crop Cultivation with Fruit and Other Trees

Existing dry crop fields and shrub land which are classified as Farmland Improvement Type 1 in Table VII-3 will be subject to the planting of fruit and other trees so that crop cultivation can be accompanied by fodder production.

1) Selection of Tree Species and Crops

While the preferences of local farmers will be respected in the selection of the tree species to be planted and crops to be cultivated, the likely species are as follows.

- Forest Trees : jati, kemiri, jambu mente, gamal, *Acacia auriculiformis*, johar, turi, cendana, nitas, mahoni and lamtoro
- Fruit Trees : jeruk manis, papaya, mangga, nangka, apokat and kelapa, etc.
- Crops : jagung (maize), kacang tanah (peanuts), kacang hijau, kacang turis, dry field rice, *Allium ascalonicum* (bawang merah), garlic, tomatoes, cucumbers, red peppers, ubi kayu (cassava), coffee, king grass and bananas, etc.

The introduction of nitrogen fixing trees is highly desirable. Proper care should be taken in regard to the spatial distribution of the trees and crops to avoid congestion and to ensure efficient harvesting. Fodder production will be aimed at in areas where beef cattle are raised in the vicinity of the home and priority will be given to those species which produce fodder during the dry season.

2) Planting Method

In principle, the trees will be planted at a distance of 5 m by 5 m and such crops as maize and beans will be cultivated between the trees and between the lines of the trees. Turi, gamal, lamtoro and king grass will be planted along the contour lines.

3) Tending Method

Thinning of the forest trees will be conducted where deemed appropriate. Depending on the condition of soil, etc., the crops will receive mixed chemical fertilisers and barnyard manure and/or compost with emphasis placed on the increased use of organic fertilisers. The application of agrochemicals and weeding will be conducted if necessary.

(2) Farmland Improvement Type 2: Mixed Gardens of Fruit and Other Trees

Trees, mainly fruit trees, will be planted at existing dry crop fields, mixed gardens with a crown density of less than 70% and shrub land which are classified as FI2 in Table VII-3 in order to create mixed gardens with a tree crown density of 70% or more.

1) Selection of Tree Species and Crops

While the selection principles for the sites earmarked for Farmland Improvement Type 1 are also applicable to those sites earmarked for Farmland Improvement Type 2, the trees to be planted will mainly consist of fruit trees. In the case of crops, priority will be given to king grass and bananas, etc. Fodder trees and fodder plants

will be important planting candidates for areas where beef cattle raising in the vicinity of the home is popular.

2) Planting Method

In principle, the trees will be planted at a distance of 5 m by 5 m and such crops as king grass and bananas, etc. will be cultivated between the trees and between the lines of the trees.

Table VII-3 Selection of Subject Sites for Farmland Improvement Plan (Part 1)

Zoning Existing Land Use	Protection Zone						Buffer Zone						Cultivation Zone					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Shrub Land							FI2						FI1		FI2			
Dry Crop Field	FI1									FI1							FI1	
Mixed Garden (Crown Density < 70%)	FI2									FI2							FI2	

Note

FI1 : Farmland Improvement Type 1

FI2 : Farmland Improvement Type 2

Table VII-4 Selection of Subject Sites for Farmland Improvement Plan (Part 2)

Existing Land Use		Planned Work
Shrub Land	Gradient 0 - 8%	Mulching and contour cropping
	Gradient 8 - 25%	Vegetative barrier
	Gradient 25 - 45%	Improved terrace; teras gulud
Dry Crop Field	Gradient 0 - 8%	Mulching and contour cropping
	Gradient 8 - 25%	Vegetative barrier
	Gradient 25 - 45%	Improved terrace; teras gulud
Mixed Garden (with Traditional Terraces)		Improved terraces
Mixed Garden (without Terraces)		Mulching and contour cropping

Notes

1) Work is conducted for that shrub land which is subject to FI1 or FI2 improvement work.

2) A teras gulud is only planned when the stones required for an improved terrace are unavailable.

(3) Construction of Terraces

The preconditions for the construction of a bench terrace include deep soil, positive prospects for large investment and viability of growing cash crops to justify such investment. As these preconditions do not exist in most parts of the Study Area, no bench terrace is planned under the Land Rehabilitation Plan. Instead, improvement of the existing traditional terraces is planned (for information on traditional terraces refer to V-5 (3)). If the introduction of new terraces is found necessary, either improved terraces or teras gulud will be constructed (see Table VII-4).

1) Creation of Improved Terraces

Improved terraces will be created at existing mixed gardens equipped with traditional terraces (some 80% of the total mixed garden area), at existing shrub land with a gradient of 25 - 45% where FI1 or FI2 work will be implemented and at existing dry crop fields with a gradient of 25 - 45% (some 50% of the total area of existing dry crop fields and shrub land). The actual improvement work will involve the placing of stones in double lines along the contour lines at a height of 40 - 50 cm above the ground while minimising the gaps between the stones. The distance between the two lines will be approximately 10 - 15 cm which will be filled with soil and compacted by the feet to prevent the discharge of soil and water from the terraces. Fascines made of the branches and plants of such local species as lamtoro and turi, etc. (cut into a handy length and made into some 15 cm diameter fascines) will be buried along the upper side of the terraced lines of stones. These fascines will fill the gaps between the stones and, once decayed, will improve the soil fertility. Lamtoro, turi and other soil improving trees and such plants as king grass and gamba grass will be planted at intervals of 1 - 2 m and 0.5 - 1.0 m respectively at the lower side of the terraced lines of stones to reinforce the terrace and to improve the site environment (Fig. VII-2). The terracing works will be accompanied by waterway works to drain the overland flow.

Traditional terraces have been constructed at some 80% of the mixed gardens located around the homes of farmers in the Study Area. These mixed gardens have been created on land of which the gradient falls between 5% and 40% (in rare cases, the gradient is more than 40%). For the Land Rehabilitation Plan, all traditional terraces will be subject to improvement and new terraces will only be planned for those sites with a gradient of 25 - 45%. In the case of sites where the gradient is less than 25%, a vegetative barrier will be created.

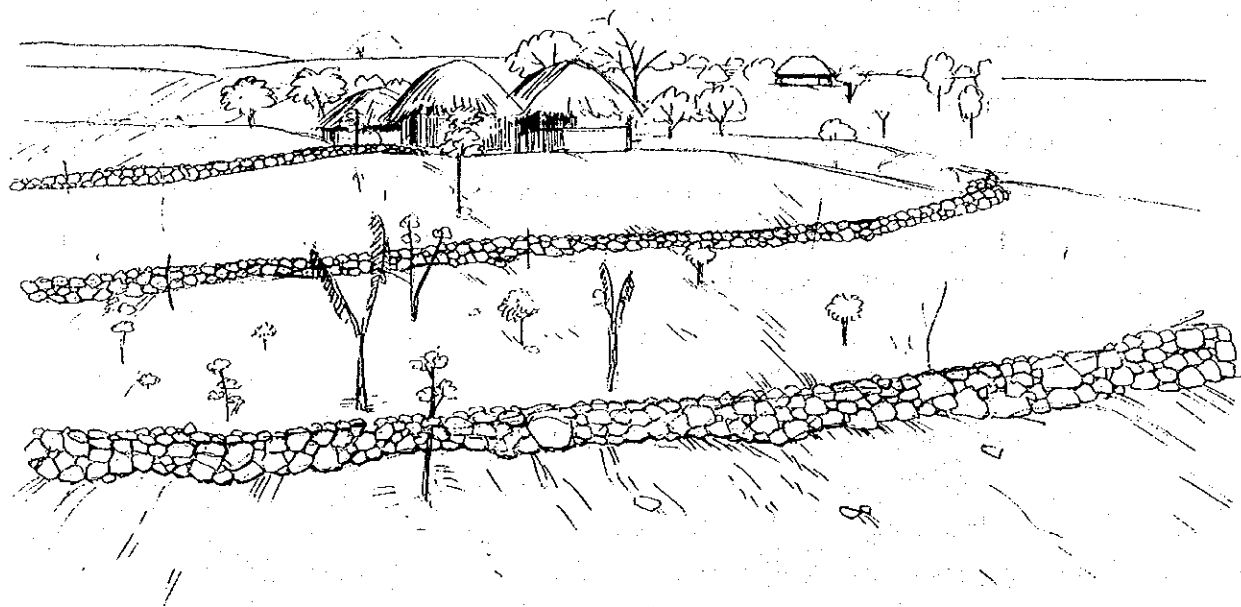


Fig. VII-1 Existing Traditional Terrace

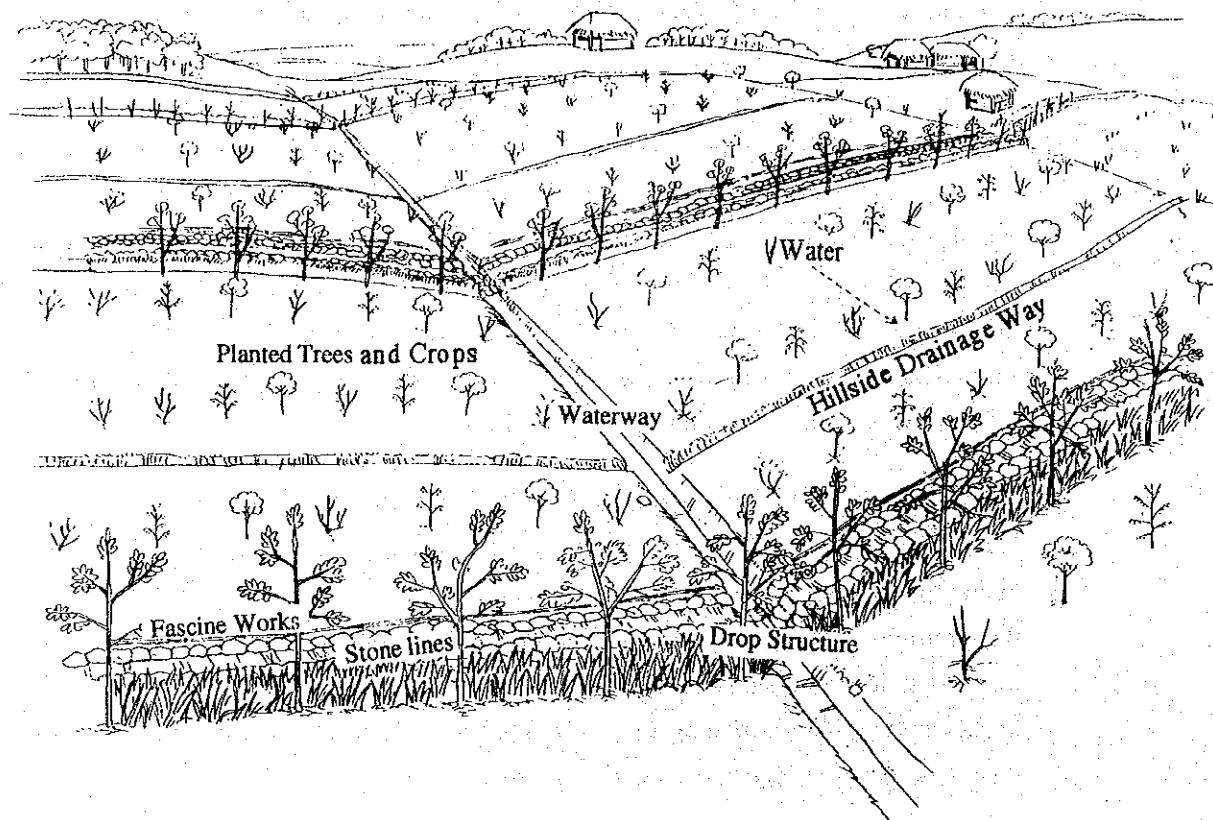


Fig. VII-2 Improved Terrace

2) Creation of Teras Gulud

Teras gulud will be created at existing shrub land (gradient: 25 - 45%) subject to FI1 or FI2 work and at existing dry crop fields (gradient: 25 - 45%) where the stones required to create improved terraces are not sufficiently available. The total subject area accounts for some 50% of the existing dry crop fields and shrub land. These terracing works will be accompanied by waterway works to drain the overland flow (Fig. VII-4).

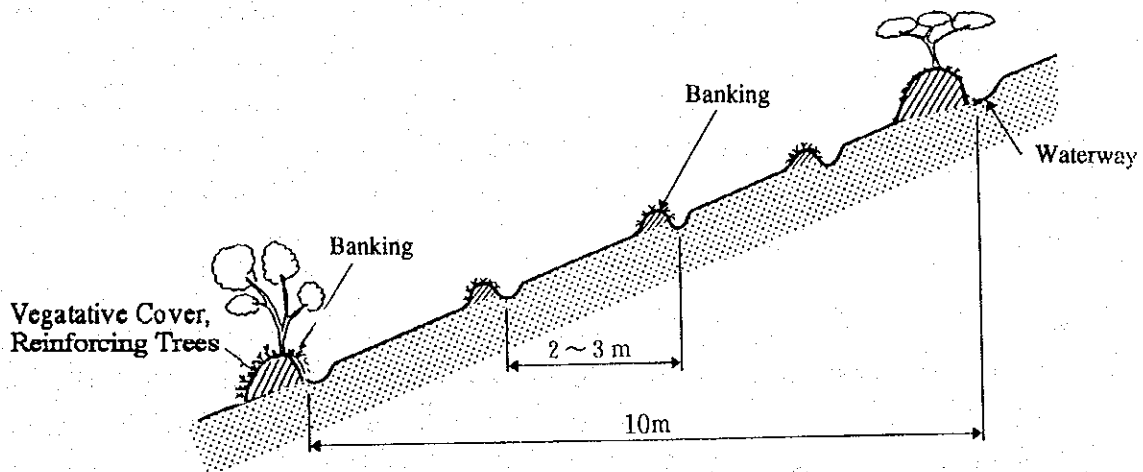


Fig. VII-3 Teras Gulud

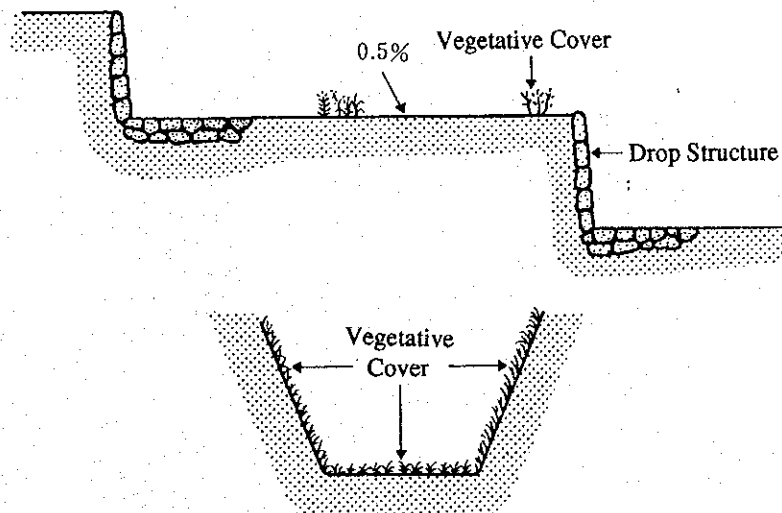


Fig. VII-4 Waterway Works

(4) Mulching and Contour Cropping

Mulching and contour cropping will be conducted at existing shrub land (gradient: 0 - 8%) designated for FI1 or FI2 improvement work, at existing dry crop fields with a gradient of 0 - 8% and at existing mixed gardens without terraces, some 20% of the total mixed garden area (Table VII-4).

(5) Vegetative Barriers

Vegetative barriers will be created at existing dry crop fields and shrub land with a gradient of 8 - 25%. The vegetative barrier will consist of such plants as elephant grass, king grass and/or gamba grass and such trees as lamtoro, turi and/or gamal, etc. Each barrier will be 0.5 - 1.0 m wide and the distance between barriers will be approximately 10 m. On slopes, a series of vegetative barriers will act as natural terraces by slowing down the descending speed of surface runoff and blocking and depositing the eroded soil. Leaves and branches falling from the barriers will act as a mulch, improvement the soil fertility.

Table VII-5 shows the planned farmland improvement work by working area. The total land size of the subject sites is 1,120 ha for Farmland Improvement Type 1 and 5,184 ha for Farmland Improvement Type 2. In the case of terracing, the total size of the subject sites is 1,072 ha for improved terraces, 394 ha for teras gulud and 2,948 ha for vegetative barriers.

Table VII-5 Planned Work Volume of Farmland Improvement by Working Area

(Unit: ha)

Land Type	Planned Work	Working Area				
		Oesao East	Oesao West	Olio	Oebelo	Total
State Forest Land	FI1	16	124	8	64	212
	FI2	1,636	428	92	228	2,384
	Sub-Total	1,652	552	100	292	2,596
	Improved Terraces	72.4	113.2	20.4	42.4	248.4
	Teras Gulud	18.0	78.0	14.0	20.0	130.0
	Vegetative Barriers	584	264	60	212	1,120
Enclaves	FI1	24	0	0	0	24
	FI2	292	0	0	0	292
	Sub-Total	316	0	0	0	316
	Improved Terraces	28.4	0.0	0.0	0.0	28.4
	Teras Gulud	6.0	0.0	0.0	0.0	6.0
	Vegetative Barriers	224	0	0	0	224
Private Land	FI1	116	272	180	316	884
	FI2	1,020	472	536	480	2,508
	Sub-Total	1,136	744	716	796	3,392
	Improved Terraces	191.6	254.4	180.4	169.2	795.6
	Teras Gulud	134.0	8.0	110.0	6.0	258.0
	Vegetative Barriers	676	336	380	212	1,604
Total	FI1	156	396	188	380	1,120
	FI2	2,948	900	628	708	5,184
	Sub-Total	3,104	1,296	816	1,088	6,304
	Improved Terraces	292.4	367.6	200.8	211.6	1,072.4
	Teras Gulud	158.0	86.0	124.0	26.0	394.0
	Vegetative Barriers	1,484	600	440	424	2,948

Note

FI1 : Farmland Improvement Type 1

FI2 : Farmland Improvement Type 2

VII-3 Grassland Improvement Plan

The total area of existing grassland is approximately 17,700 ha which will be reduced to some 13,200 ha following the implementation of grassland improvement work under the Land Rehabilitation Plan, making the fodder shortage in the dry season even more serious. This prospect of a serious fodder shortage may prove an obstacle to the successful implementation of the Land Rehabilitation Plan. Therefore, the following types of improvement works are designed to achieve increased fodder production in the dry season and to facilitate soil conservation. Grassland Improvement Type 1 which combines the introduction of grazing grass and the creation of fodder forests is planned for all Type I and Type II sites in cultivation zones on private lands and enclaves while Grassland Improvement Type 2 which aims at creating fodder forests is planned for that grassland without trees in Type III of cultivation zones. Moreover, to support the production of fodder in the area, Grassland Improvement Type 2 is planned for that state forest land which is designated as Type I and Type II cultivation zones and grassland and grassland with trees other than palm for Type III cultivation zones (Table VII-6).

Moreover, sites could not be found for grassland improvement in categories I and II of Buffer zone. As shown in Table VII-7, the total subject area for grassland improvement by working area is 1,700 ha for Type I and 1,960 ha (of which 1,960 ha is state forest land) for Type II.

Table VII-6 Selection of Subject Sites for Grassland Improvement Plan

Land Ownership Type	Zone Existing Land Use	Site Category	Buffer Zone						Cultivation Zone						
			I	II	III	IV	V	VI	I	II	III	IV	V	VI	
Enclave/ Private Land	Open grassland														
	Grassland with Palm Trees	GI1 GI2		NG					GI1		GI2				
	Grassland with Trees other than Palm Trees										NG				
State Forest Land	Open grassland														
	Grassland with Palm Trees	GI1 GI2		NG					GI2		NG				
	Grassland with Trees other than Palm Trees														

Note

NG : Natural Grassland

GI1 : Grassland Improvement Type I

GI2 : Grassland Improvement Type II

Table VII-7 Planned Work Volume of Grassland Improvement by Working Area

(Unit ha)

Land Type	Planned Work	Working Area				
		Oesao East	Oesao West	Olio	Oebelo	Total
Private Land	GI1	40	880	520	180	1,620
	GI2	250	170	20	40	470
	Natural Grassland	1,060	1,130	630	1,210	4,010
	Sub-Total	1,350	2,180	1,140	1,030	6,100
Enclaves	GI1	60	-	20	-	80
	GI2	30	-	20	-	50
	Natural Grassland	360	-	350	80	790
	Sub-Total	450	-	390	80	920
State Forest	GI2	730	220	160	330	1,440
	Natural Grassland	1,820	580	530	1,770	4,708
	Sub-Total	2,550	800	690	2,100	6,140
Total	GI1	100	880	540	180	1,700
	GI2	1,010	390	190	370	1,960
	Natural Grassland	3,240	1,710	1,490	3,060	9,500
	Total	4,350	2,980	2,220	3,610	13,160

Note

GI1 : Grassland Improvement Type 1

GI2 : Grassland Improvement Type 2

(1) Grassland Improvement Type 1: Introduction of Grazing Grass and Fodder Trees

As the sites classified as Type I or Type II cultivation zones are relatively flat with a gradient of less than 15% where cultivation is permitted from the viewpoint of the soil and water conservation requirements, Grassland Improvement Type 1 is planned to create pasture together with the introduction of fodder trees. Because this type of improvement is important to assist the future development of stock raising in these areas, individual farmers, groups and inter-village organizations, etc. will be encouraged to conduct the work.

1) Creation of Pasture

Such fast growing fodder trees as turi, lamtoro and gamal, etc. will be planted at intervals of 75 cm along the contour lines (1,600 trees/ha) and such leguminous grasses as centro, siratro and stylo and such grasses as king grass (when irrigation is possible) and gamba grass, etc. will be cultivated in the 8 m areas between the lines

of the planted trees. As the fencing off of cattle from the planted area until the planted grasses have sufficiently grown for grazing is preferable, gamal and other species with a strong sprouting performance will be planted to create a perimeter fence.

2) Planting and Tending Methods

Apart from gamba grass where stumps are laid in the ground, all other grasses will be seeded with a density of 2 - 4 kg/ha (seeding distance of 20 cm × 20 cm). In the case of fodder trees, seeds or stumps will be used for lamtoro and gamal while potted seedlings will be used for turi. Supplementary planting will be conducted during the subsequent rainy season if the survival rate of these grasses and trees does not reach approximately 80%. As a good water supply is essential for the creation of superior fodder field, the selection of an irrigable site location is important. In regard to tending, weeding will be conducted where deemed appropriate and fertilisers (phosphate and molybdenum, etc.) will be applied to the grasses for the first two years after seeding (Refer to Appnedix F-2).

In those places where dry field rice can be cultivated, the seeding of herbaceous legumes for co-existence with rice before the rice harvesting season is possible. Therefore, the planting of rice along with the fodder trees at the beginning, followed by the planting of herbaceous legumes before the rice harvest will produce rice while reducing competition from weeds. Herbaceous leguminous are relatively rich in coarse protein compared to true herbs and their quality as fodder when dead is said to be fairly good.

(2) Grassland Improvement Type 2: Creation of Fodder Forests

Grassland Improvement Type 2 is planned because fodder trees will be planted on grassland designated for cultivation at all types of land due to good soil fertility on the grounds that they will maintain green forage in the dry season in addition to contributing to soil and water conservation. This type of improvement work should prove particularly effective in mountainous areas (Refer to Table VII-6 and Appndix F-3).

1) Selection of Species

Fast growing fodder, as well as soil improving, species such as turi, lamtoro and gamal will be selected. Mixed planting of the 3 species is preferable to mitigate the possible devastating damage by diseases or insects.

2) Planting Method

Lamtoro and gamal will be seeded or stumps will be used. In the case of turi, potted seedlings will be used. The planting distance will be 1 m along the contour lines and the distance between the lines will be approximately 6 m to allow the grazing of cattle. (The resulting planting density is approximately 1,600 trees/ha). The best planting method (group planting) will be employed to facilitate the formation of a micro-climate to ensure regeneration. Supplementary planting will be conducted if the survival rate does not reach approximately 80%. Gamal and other trees with a strong sprouting performance will be planted to create perimeter fencing to fence off cattle for the first three years after planting in order to prevent the cattle from eating the leaves of the young trees.

3) Tending Method

Weeding will be conducted annually for the first three years after planting and the cut weeds will be used as a mulch for the planted trees.

4) Provision of Fodder

The grazing of cattle on Grassland Improvement Type 2 sites will be permitted in the dry season after three years provided that the fodder forests are not seriously damaged by such grazing. Lateral branches can be cut to provide fodder in addition to the naturally grown grass.

(3) Other Improvement Work

Apart from grassland to be improved by Grassland Improvement Type 1 or Type 2 work, there are many areas of natural grassland in the Study Area. Paddy fields and dry crop fields also contain grasses. All this grassland provides much scope for utilisation. The possible improvement work for this grassland from the viewpoint of soil and water conservation and fodder production is described below.

1) Improvement of Natural Grassland

While natural grassland which is not designated for improvement work will be used for grazing, problems lie with securing drinking water sources for the cattle and causing erosion around water supply sources. To avoid the concentration of cattle during watering, new watering places will be created at a rate of one/200 ha by drilling for groundwater or channelling water from river or check dams and a shelter wood will be created around each watering place using fodder trees for shade and extra fodder.

2) Fodder Production at Paddy Fields and Dry Crop Fields

The cultivation of king grass in and around paddy fields and dry crop fields is becoming popular. However, the cultivation of gamba grass, a true grass species, and leguminous species which provide high quality fodder even when dead is hardly seen. Leguminous grasses will, therefore, be introduced at paddy fields and dry crop fields where their growth can be easily controlled during the off season.

3) Fodder Field Demonstration Plots

The introduction of measures in the Study Area to secure a fodder supply during the dry season has begun to prompt a shift from the traditional laissez faire grazing to a raising method which requires more money and manpower. The creation of five irrigated and fertilised fodder fields is planned to act as demonstration plots which will produce a large amount of fodder throughout the year and which will demonstrate desirable raising methods for calves and extensive raising to shorten the raising period for improved cattle raising and its management in the future. A standard demonstration plot size of 10 ha is assumed, consisting of 2.5 ha of man-made grassland, 3.0 ha of shelter woods and 4.5 ha of miscellaneous sites (altogether capable of raising approximately 100 heads) (see VII-9 - Extension Plan and Appndix F-4).

(4) Use of Grassland After Improvement Work

The grassland area and raising capacity after completion of the improvement work are estimated in Table VII-8. As described earlier, some 23,000 heads of cattle are now raised in the Study Area, 25% of which is raised in an intensive or semi-intensive manner in barns and on tethers. The number of cattle raised on natural grassland is, therefore, believed to be around 17,000. Based on the productivity of natural grassland during the dry season, however, a reasonable raising level appears to be around 9,000, indicating fairly excessive grazing at present.

With the implementation of the Land Rehabilitation Plan, while the total area of grassland will be reduced, the grassland improvement work will increase the productivity to allow the grazing of some 16,000 heads as shown in Table VII-8, solving the current problem of excessive grazing. The increased fodder production with the use of paddy fields, dry crop fields and farmland, etc. will likely increase the number of cattle raised in barns and on tethers. Fodder forests will also be created under the forest establishment Plan, comprising important sources of fodder. Although the grassland improvement of state forest land will create new fodder forests, this should be treated as a transitional measure in the process of overall land rehabilitation.

Table VII-8 Grassland Types and Grazing Capacity

Planning Item	Planned Area (ha)	Grazing Capacity (heads)	Remarks
Grassland Improvement Type 1	1,700	6,800	4 heads/ha
Grassland Improvement Type 2	1,960	3,300	1.7 heads/ha
Natural Grassland	9,500	5,700	0.6 heads/ha
Total	13,160	15,800	-

VII-4 Changes of Land Use Under Land Rehabilitation Plan

The general picture of the land use changes under the Land Rehabilitation Plan (the Plan) is shown in Fig. VII-5. Major changes will be from grassland to forest and from shrub/bushland to mixed gardens. Details of the land use changes after the Plan's implementation are given in Table VII-9.

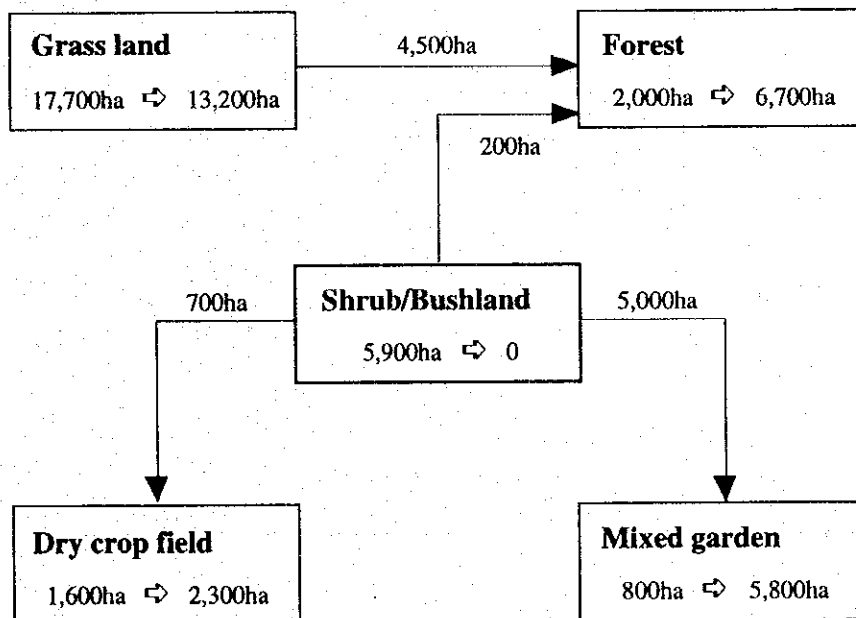


Fig. VII-5 Changes of Land Use Under Land Rehabilitation Plan

Table VII-9 Major Changes of Land Use Before and After Plan Implementation

Land Use Type	Improvement Measure	Land Area (ha) (%)	
		Before	After
Open Grassland	1. Natural Grassland	17,700	9,500
	2. GI1 (Pasture and Fodder Trees)		1,740
	3. GI2 (Fodder Forests)		1,960
	Sub-Total	17,700 (53.3%)	13,200 (39.8%)
Shrub/Bushland		5,900 (17.8%)	0
Forests		2,000 (6.0%)	6,700 (20.2%)
Dry Crop Fields	1. Without Terraces	500	0
	2. Traditional Terraces	1,100	200
	3. Improved Terraces; Teras Gulud		2,100
	Sub-Total	1,600 (4.8%)	2,300 (6.9%)
Mixed Gardens	1. Improved Terraces; Teras Gulud	100	5,800
	2. Traditional Terraces	700	0
	Sub-Total	800 (2.4%)	5,800 (17.5%)
Total		28,000 (84.3%)	28,000 (84.3%)
Others		5,200 (15.7%)	5,200 (15.7%)
Total		33,200 (100.0%)	33,200 (100.0%)

VII-5 Control of Soil Loss Caused by Surface Erosion

Most soil loss in the Study Area can be attributed to surface erosion while the actual soil loss volume is largely determined by the topographical, soil and rainfall conditions as well as changes of the land use conditions.

As Fig. VII-5 and Table VII-9 show, the Plan intends to change the types of land use to increase forests, terraced dry crop fields and mixed gardens, all of which are less prone to erosion, while substantially decreasing areas of pasture, frequently burned natural grassland and bushland used for slash-and-burn agriculture, all of which are believed to be highly responsible for surface erosion. On the whole, the volume of surface erosion is expected to dramatically decline.

There is a shortage of actual data on soil loss by land use type which are applicable to the Study Area and the only data of the Kupang BPK are those given in Table VII-10. As these data are the annual records for a specific experimental site, they cannot constitute standard data which are applicable to the entire Study Area. Nevertheless, these data were used to estimate possible changes of the land use and soil loss due to implementation of the Plan to a certain extent. The estimation results are given in Appendix F-5. In short, all the major surface erosion control measures are expected to achieve a reduction of 65 - 85%, suggesting their effectiveness. Based on this estimate, it is believed that the soil loss control target described earlier in VI-3 will be almost fully achieved.

Table VII-10 Soil Loss by Land Use Type

Land Use Type	Soil Loss (tons/ha/year)
- Young Reforestation Site of Mahoni and Turi (on True Grass Ground Cover)	7.59 ①
- Grass Crop Field	23.1 ①
- Dry Crop Field under Amarasi System	
o Opening rows of Lamtoro	7.30 ②
o Total opening of Lamtoro	9.83 ②

Note: The soil loss data for ① are estimated based on the soil loss at three experimental plots in Soe from January to March. A 10% is added to compensate for soil loss of other months.

Sources: ① Laporan Tahunan Kajian Teknik Konservasi Tanah Wilayah NTT/NTB Di Das.Benain Noelmina Tahun IV (1991/1992)

② Savana No. 8/1993: 15 - 23

VII-6 Watershed Conservation Plan

Plans on stream protection, landslide rehabilitation, gully erosion control, riverbank protection and finally improvement of settlement environment will be discussed in this section.

(1) Stream Conservation

It is practically impossible to completely prevent the soil loss caused by surface erosion and the flow of some of the eroded soil into streams is equally unavoidable. The amount of soil inflow into streams is related to the characteristics of a watershed and the maximum volume is the same as that determined by the SDR of soil loss targeted for control in each working area as mentioned in Table VI-2. As the SDR for the Oesao East, Oesao West, Olio and Oebelo Working Areas is 14.15%, 14.44%, 16.80% and 14.85% respectively, the likely soil inflow into streams in a ten year period is as follows.

- Oesao East Working Area	:	47,000 tons
- Oesao West Working Area	:	390,000 tons
- Olio Working Area	:	234,000 tons
- Oebelo Working Area	:	147,000 tons
<hr/>		
Total	:	818,000 tons

This amount of soil inflow into streams will be deposited at existing and planned dam pengendali (earth check dams) and dam penahan in the Study Area to prevent its sedimentation at intake weirs, embungs, reservoirs, riverbeds and coastal areas in the Study Area.

Although the year of completion, size and sedimentation volume of existing dam pengedali varies from one to another in the Study Area, the remaining sedimentation capacity by working area is estimated to be 25,000 tons for the Oesao East Working Area, 52,000 tons for the Oesao West Working Area, 15,000 tons for the Olio Working Area and 18,000 tons for the Oebelo Working Area. The new dam pengendali and dam penahan to be constructed under the Plan will deposit the remaining amount of soil after deducting the sedimentation capacity of the existing dams from the expected soil inflow in the ten year period. As the implementation criteria require a large catchment area for earth check dams, making the selection of suitable construction sites difficult, the Plan will emphasise the construction of dam penahan requiring a small catchment area which can be proportionally distributed in all the working areas.

The planned specifications for the earth check dams are a height of 6 - 8 m, a sedimentation capacity of 19,000 tons and a standard catchment area of 150 - 250 ha. A total of 23 earth check dams are planned for the Study Area.

The planned specifications for a dam penahan are a height of 4 m, a sedimentation capacity of 900 tons and a standard catchment area of 25 - 50 ha. A total of 303 such dams are planned for the Study Area. Table VII-12 shows the number of planned dams by working area.

Table VII-11 Stream Conservation Plan (Construction of Check Dams)

Type of Check Dam	Working Area				Total
	Oesao East	Oesao West	Olio	Oebelo	
Dam Penahan (Small Check Dam)	4	186	96	17	303
Dam Pengendali (Earth Check Dam)	1	9	7	6	23
Total	5	195	103	23	326

(2) Landslide Rehabilitation

Four landslide sites located along the Oelelo tributary in the Oebelo Working Area (Desa Oelpuah and Desa Bokong) have been partially covered by vegetation as several years have passed since the occurrence of these landslides. There are no houses or roads, etc. in the vicinity of each landslides which would require immediate protection measures. No serious sediment inflow from landslides has so far been observed at the Noelbaki intake weir located downstream. The required conservation measure is the prohibition of such activities as burning and grazing which prevent the invasion of vegetation at landslide sites and in their vicinity to facilitate the permanent spread of vegetation.

In the case of the landslide site located in Desa Kotabes in the upper reaches of the Olio Working Area, there are mixed gardens, etc. which require immediate protection from landslides and little vegetation cover is observed at this site. Consequently, civil engineering and vegetative measures will be required. Gabions will be used to form soil retaining structures as a civil engineering measure. One retaining wall block will have a width and height of 1.2 m and 0.5 m respectively and a line of gabions will consist of 4 blocks placed like a staircase (2.1 m wide and 2.0 m high in total) (Fig. VII-6). Assuming that the gabion lines are placed at intervals of 20 m, 8 lines will be required to cover the landslide length of 180 m. The work width will be 26 m, i.e. a landslide width

of 25 m with an allowance of 0.5 m at both ends. The new growth of vegetation will be encouraged in the same manner planned for the 4 sites in the Oebelo Working Area for the area of some 4,000 m² between the retaining wall lines (excluding the area of some 500 m² covered by the walls).

The landslide rehabilitation plan for each working area is shown in Table VII-12.

Table VII-12 Landslide Rehabilitation Plan

Rehabilitation Measure	Working Area				
	Oesao East	Oesao West	Olio	Oebelo	Total
Gabion as Rataining Wall (m)	-	-	208	-	208
Regeneration of Natural Vegetation (m ²)	-	-	4,000	26,400	30,400

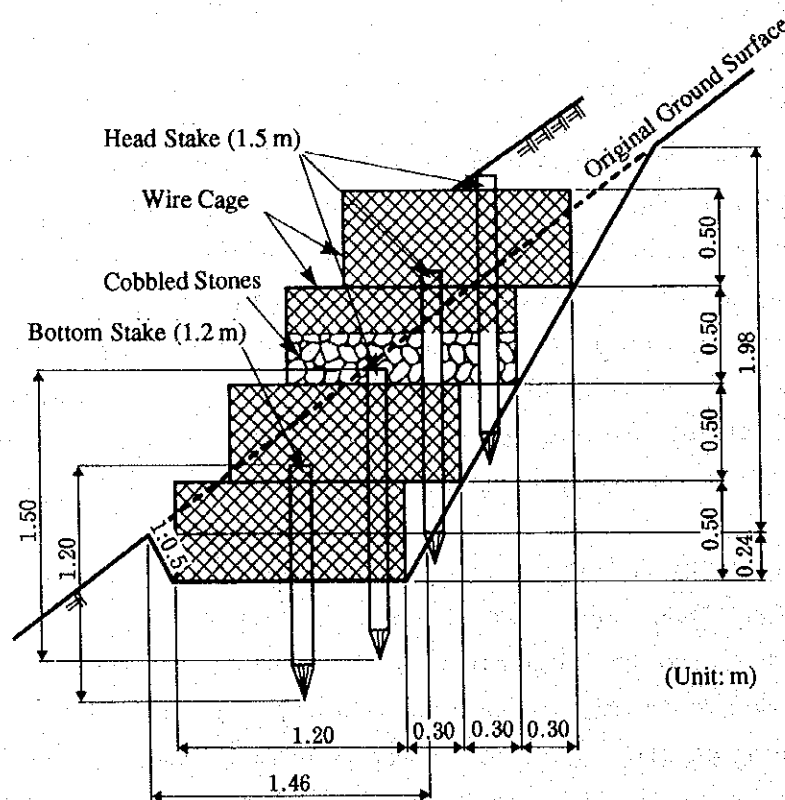


Fig. VII-6 Cross-Section of Soil Retaining Walls

(3) Gully Erosion Control

Large-scale gully erosion is taking place at Nabem in Desa Oelpuah in the Oebelo Working Area as described earlier. The erosion control measures to be introduced are the construction of infiltration ditches (the standard dimensions of which are 50 cm to 60cm wide and 80 - 100 cm deep) for a total length of some 8,000 m with feeder torrents to the gully in question in order to prevent the inflow of rainwater to the gully from surrounding areas. In addition, *Pennisetum perpolophoydas* (kinggrass), *Andropogon gayanus* (gamba grass) and *Setaria splendia* (setaria grass) will be planted in 2 lines at intervals of 50 - 100 cm and a planting density of approximately 20,000 plants/ha at the lower side of the infiltration ditch to reinforce the ditch.

In addition to the above measures, the construction of gully plugs will be necessary to prevent sediment discharge to the downstream area and to prevent gully expansion. Simple gully plugs using bamboo, etc. will be constructed with feeder torrents. The height of these gully plugs will be 1.0 - 1.5 m from the gully bed and some 250 will be constructed at 20 m intervals. The minimum end diameter of the bamboo to be used should be 10 - 12 cm (Figs. VII-7 and VII-8). For the main gully channel, the gully plug height will be 3 - 5 m and approximately 10 plugs will be required. The construction of gabion gully plugs is desirable and the standard gabion dimensions will be 85 cm × 85 cm × 200 cm to ensure work efficiency. Planting is planned to rehabilitate the upstream area of the gully (approximately 67 ha, excluding the area actually subject to gully erosion) where farming is impossible due to the gully erosion. Some 1,700 trees/ha of lamtoro, turi and johar will be planted employing a planting distance of 2 m × 3 m.

The gully erosion control plan is summarised in Table VII-13.

Table VII-13 Gully Erosion Control Plan

Working Area	Bamboo Gully Plug	Gabion Gully Plug	Infiltration Ditch (m)	Planting (Trees)		Planting (Grass and Plants)	
				Area (ha)	Quantity	Area (ha)	Quantity
Oebelo	250	10	8,000	67	113,900	0.8	16,000

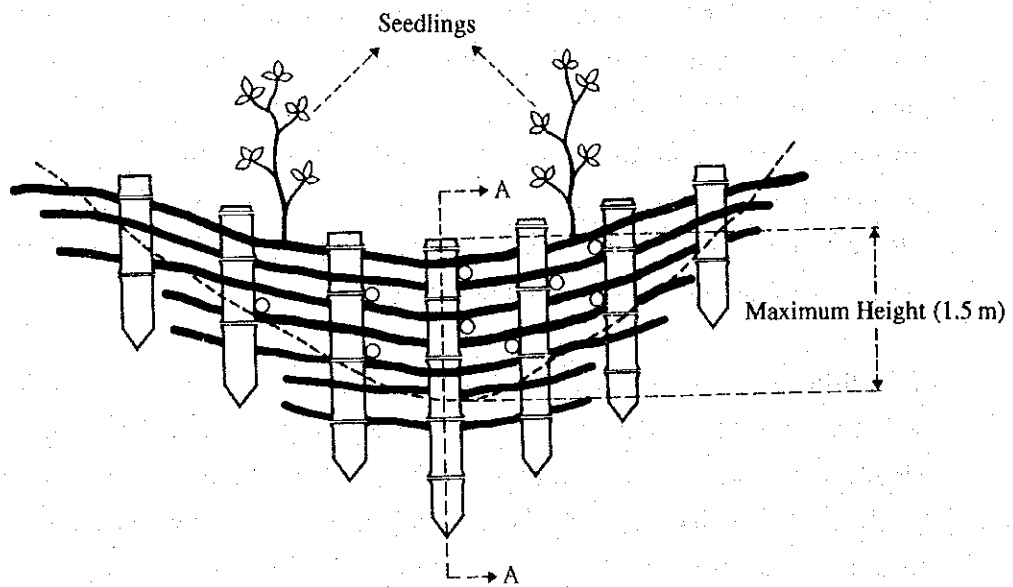


Fig. VII-7 Front View of Bamboo Gully Plug

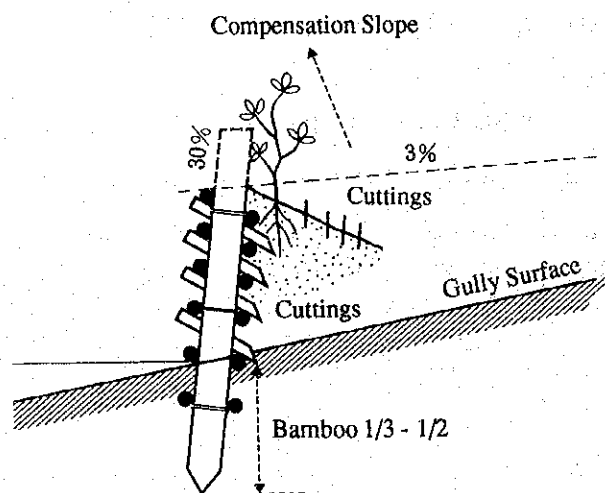


Fig. VII-8 Cross-Section of Bamboo Gully Plug

(4) Bank Erosion Control

1) Revetment Work

As some of the bank erosion sites along both banks of Oebelo, Olio and Oesao Rivers and their tributaries do not require immediate protection works as described earlier, a revetment will be constructed at those banks where lateral erosion due to flowing river water is particularly severe. The field survey identified the subject proportion of banks erosion to be 37% for Oebelo River and its tributaries. The corresponding figures are 28% for Olio River and its tributaries and 22% for Oesao River and its tributaries. Revetment work will be planned in 10% of these sites that require direct protection. The revetment work will use gabions with standard dimensions of 85 cm × 85 cm × 200 cm. The planned bank erosion control for each working area is shown in Table VII-14.

Table VII-14 Bank Erosion Control

(Unit: m)

Length of Revetment	Working Area				
	Oesao East	Oesao West	Olio	Oebelo	Total
Sites with Objects Requiring Protection	-	650	350	380	1,380
Sites Other than Above	300	1,100	700	1,300	3,400
Total	300	1,750	1,050	1,680	4,780

2) River Bank Planting

Planting at river banks is planned to stabilise the banks and to prevent soil discharge from nearby areas to river channels. A planting area of approximately 50 m will be secured on both banks. The tree species such as Jati, johar, lamtoro, turi, sukun, tamarind, nangka, citrus spp., etc. are deemed appropriate for these purposes. The planting density will be some 1,700 trees/ha (2 m × 3 m) in the case of forest trees, 400 trees/ha (5 m × 5 m) in the case of the mixed planting of forest trees and fruit trees and 100 trees/ha (10 m × 10 m) in the case of fruit trees. The subject land area by working area is shown in Table VII-15.

Table VII-15 Bank Planting Plan

(Unit: ha)

Length of Revetment	Working Area				
	Oesao East	Oesao West	Olio	Oebelo	Total
Sites with Object Requiring Protection	-	65	35	38	138
Sites Other than Above	30	110	70	130	340
Total	30	175	105	168	478

(5) Settlement Site Conservation

The total land area of settlement sites, including house premises and domestic gardens, in the Study Area amounts to 1,432 ha (approximately 4.3% of the entire area). Some of these sites are located on steep slopes which are mainly bare and lack the application of adequate soil and water conservation measures, constituting a source of soil discharge. In view of the importance of reducing soil loss from settlement areas and conserving the environment around settlements, the following measures will be implemented with the cooperation of local inhabitants.

1) Infiltration Wells

An infiltration well is designed to reduce the amount of surface runoff and to increase the supply of groundwater. The wells to be constructed under the Plan will have a cylinder shape and will be 1 m in diameter and 3 m in depth. These wells will be introduced (distributed) at a rate of 2 wells/ha in selected highly dense settlement sites (covering some 28% of the total settlement area identified by the Local Inhabitants Survey). The total number of planned infiltration wells is 802 as shown in Table VII-16.

2) Drinking Water Wells (Shallow Wells)

In addition to infiltration wells, the construction of shallow wells is planned at a rate of one well/15 households for some 60% of the total households in the Study Area in order to boost the supply of drinking water and irrigation water for small plots. The total number of planned shallow wells is 261 as shown in Table VII-16.

Table VII-16 Planned Number of Wells by Working Area

(Unit: well)

Working Area	Oesao East	Oesao West	Olio	Oebelo	Total
Infiltration Wells	206	287	87	222	802
Drinking Water Wells	61	103	18	79	261

3) Planting of Fruit Trees

Jack fruit and other fruit trees will be planted in domestic gardens and the planned planting volume is shown in Table VII-17.

Table VII-17 Planned Planting Volume of Fruit Trees

(Unit: tree)

Working Area	Oesao East	Oesao West	Olio	Oebelo	Total
Number of Trees	7,360	10,240	3,120	7,920	28,640

Note: The number of trees is calculated based on a planting density of 100 trees/ha for 20% of the total settlement area.

4) Hedges

Hedges will be created around the premises of houses using kaliandra and other shrubs. The planned work volume is shown in Table VII-18.

Table VII-18 Planned Planting Volume for Hedges

(Unit: tree)

Working Area	Oesao East	Oesao West	Olio	Oebelo	Total
Number of Trees	36,800	51,200	15,600	40,000	143,600

Note: The shrubs will be planted in lines at 1 m intervals for approximately 1% of the total settlement area.

VII-7 Seedling Production Plan

The seedlings required for the Land Rehabilitation Plan will be supplied by the nursery under construction at Nevonaek in Kab. Kupang as part of the Central Nursery Development Programme and by the village nurseries to be newly created in the Study Area. As the poor performance of most of the reforestation sites in the Study Area can be partly attributed to the use of inferior seedlings, hardening treatment should be employed in order to produce highly resistant seedlings vis-a-vis the dry weather and strong sunlight in the Study Area.

(1) Seedling Production

1) Species

The species of the seedlings to be produced will be those required by the reforestation plan and farmland improvement plan, etc.

2) Seeds

The production of high quality seedlings which are capable of surviving the harsh dry season and low productivity soil in the Study Area is essential. Every effort must be made to obtain superior seeds which must then be stored in a proper seed storage.

3) Types of Seedlings

The seedlings to be supplied will be either potted seedlings or stump seedlings.

4) Watering

Watering will be conducted twice a day, i.e. in the morning and in the evening, until midway through the nursing period. For hardening purposes, watering will be reduced to once a day or every two days with a reduced amount for one month before shipment for planting purposes.

5) Shading

In the case of the use of artificial shading, the light conditions will be reduced to a relative light intensity of 60 - 70% of the normal level. Such shading should be removed as soon as possible to expose the seedlings to direct sunlight for hardening purposes.

6) Weeding

Weeding should be conducted sooner rather than later while the weeds are still small.

7) Standard Size

The standard seedling size will be a stem height of 30 - 45 cm for potted seedlings and a minimum basal diameter of 2 cm for stump seedlings and there will be balance between the above ground parts and root system of the seedling.

8) Production Volume

The planned production volume by working area under the Plan is shown in Table VII-19.

Table VII-19 Planned Seedling Production Volume by Working Area

Plan Type	Working Area				Total
	Oesao East	Oesao West	Olio	Oebelo	
1. Reforestation Plan	1,193,288	2,874,641	794,014	1,836,370	6,698,313
F1	81,000	762,360	257,296	304,943	1,405,599
F2	1,074,216	2,040,896	531,960	1,526,668	5,173,740
F3	38,072	71,385	4,758	4,759	118,974
2. Farmland Improvement Plan	1,775,488	741,312	466,752	622,336	3,605,888
FI1	89,232	226,512	107,536	217,360	640,640
FI2	1,686,256	514,800	359,216	404,976	2,965,248
3. Grassland Improvement Plan	2,933,920	3,354,780	1,928,740	1,455,300	9,672,740
GI1	264,000	2,323,200	1,425,600	475,200	4,488,000
GI2	2,666,400	1,029,600	501,600	976,800	5,174,400
Natural Grassland	3,520	1,980	1,540	3,300	10,340
4. Watershed Conservation Plan	104,676	394,284	213,642	492,162	1,204,764
Settlement Conservation					
- Fruit Trees	8,096	11,264	3,432	8,712	31,504
- Hedges	40,480	56,320	17,160	44,000	157,960
Stream Conservation					
- Gully-Related				125,290	125,290
- Bank-Related	56,100	326,700	193,050	314,160	890,010
Total	6,007,372	7,365,017	3,403,148	4,406,168	21,181,705

Notes

1. The number of seedlings produced is 10% more than the planned number of trees for planting, taking the rate of successful shipment for planting trees into consideration.
2. The number of seedlings produced for the reforestation plan and farmland improvement plan is calculated based on the following. (Supplementary planting will be conducted twice at a rate of 20% for the first time and 10% for the second time.)
 - o Reforestation Type 1 (F1)
 - State forest land: planned area × planting density of 1,666 trees/ha × 1.3 × 1.1
 - Private forests and enclaves: planned area × planting density of 833 trees/ha × 1.3 × 1.1
 - o Reforestation Type 2 (F2)
 - State forest land: planned area × planting density of 1,300 trees/ha × 1.3 × 1.1
 - Private forests and enclaves: planned area × planting density of 700 trees/ha × 1.3 × 1.1
 - o Reforestation Type 3 (F3): planned area × planting density of 416 trees/ha × 1.3 × 1.1
 - o Farmland Improvement: planned area × planting density of 400 trees/ha × 1.3 × 1.1
3. The number of seedlings to be produced for settlement conservation is calculated based on a planting density of 100 trees/ha for fruit trees and line planting at 1 m intervals for hedges.
4. The number of seedlings to be produced for stream conservation is calculated based on a planting density of 1,700 trees/ha for both gully-related and bank-related measures.

(2) Village Nurseries

While the nursery currently under construction at Nevonaek in Kab. Kupang under the Central Nursery Development Programme will play a central role in the production of seedlings for the Study Area, village nurseries will also be created in the Study Area to supplement the production activities of the central nursery. The nursery sites will be selected in view of the convenience of transporting the seedlings to the planting sites, convenient access from a public road and the opinions of local inhabitants. The planned nursery facilities and their sizes are outlined below.

1) Nursery Size

The standard nursery size is 0.25 ha with the nursing field occupying 0.15 ha.

2) Number of Nurseries

In general, two village nurseries per working area will be created, totalling 8 nurseries.

3) Nursery Office

A nursery office building will be constructed on each site to control the nursery operation and to act as a warehouse, as well as a seed storage.

4) Potting Shed

A potting shed will be constructed to conduct potting and to store the potting soil.

5) Water Tank

A water tank will be provided to store water for watering purposes.

6) Nursing Beds

Each nursing bed will have dimensions of 1 m × 20 m and 50 beds will be created for each nursery.

7) Shading System

A movable shading system using cheesecloth will be installed.

8) Road

A spur road will be constructed to provide access to the site and to assist nursing work.

9) Information Board

An information board will be erected at each site, describing the purpose of the nursery, the names of the species grown, the production volume and the name of the farmers' group, etc.

VII-8 Road and Forest Protection Plan

(1) Road Plan

1) Road Improvement Plan

Most of the existing road sections requiring improvement from the viewpoint of soil and water conservation in the Study Area are in the desa and kabupaten road categories. These sections are very steep with no surface treatment in terms of asphalt paving or gravel. Due to the lack of drainage facilities along the route, scouring and other types of damage occur at these sections, resulting in a problem of soil loss. Improvement of the road surface of these sections by means of asphalt paving or the laying of gravel is essential. Moreover, it may be necessary to review the alignment. At sites with insufficient drainage facilities, the introduction of side ditches and/or drop structure should be considered. The construction of cross-drains may be necessary depending on the actual road conditions. Table VII-20 shows the planned desa and kabupaten road improvement for each working area necessitated from the viewpoint of soil and water conservation.

Table VII-20 Road Improvement Plan

Road Type	Improvement Measure		Working Area				
			Oesao East	Oesao West	Olio	Oebelo	Total
Desa Road	Surface Improvement (m) (Earth → Gravel)		18,900	9,300	2,400	10,200	40,800
	Drainage	Side Ditches (m)	11,340	5,580	1,440	6,120	24,480
		Drop Structure (no.)	113	56	15	61	245
Kabupaten Road	Surface Improvement (m) (Gravel → Asphalt)		-	-	11,000	21,000	32,000
	Drainage	Side Ditches (m)	-	-	6,600	12,600	19,200
		Drop Structure (no.)	-	-	66	126	192

Notes

1. The total length of side ditches is equivalent to 60% of the total length of all roads subject to improvement.
2. One drop structure will be constructed for every 100 m of the side ditch.

2) New Road Construction

Most of the existing access roads to the check dams are impassable by vehicles. The construction of new roads, together with the construction of new check dams, is preferable to facilitate the proper maintenance of such dams and to serve local inhabitants.

The planned forest roads will serve for reforestation, greening and forest management purposes and an average total length of 300 m per 100 ha of the subject area has been decided. The total length of new forest roads is calculated by multiplying the planned land area for the reforestation plan by the above unit length. The planned work volume by working area is shown in Table VII-21. It must be noted that spur roads (with of 2.5 m) are not included in this calculation.

The Local Inhabitants Survey results clearly indicate the strong hope of the public for improvement of the ordinary roads used for the transportation of goods and other purposes. For the smooth implementation of the Land Rehabilitation Plan and promotion of the local economy, an increase of the public road density from 4.9 m/ha in the Oesao West Working Area, 6.0 m/ha in the Olio Working Area and 7.8 m/ha in the Oebelo Working Area to approximately 10 m/ha to match the public road density of 10.3 m/ha in the Oesao East Working Area is desirable (Table VII-21). Particular attention must be paid to the gradient and earth work volume in the selection of new routes in the upper reaches of the Oebelo and Olio Working Areas (dominated by shale or marl) where landslides frequently occur in order to minimise the outflow of soil to the lower reaches during and after the road construction work. The new spur roads will be 2.5 m wide and will be paved with gravel to ensure soil conservation and smooth travelling. In contrast, the new forest roads and ordinary roads will be 4 m wide (effective width: 3 m) and will be paved with gravel or asphalt.

A side ditch of 0.4 - 0.6 m in width will be dug on one side of the road and drop structures will be introduced where deemed necessary (Fig. VII-9). Areas above a slope height of 0.5 m will be seeded with grass to cover the entire slope in view of slope protection and providing fodder for livestock.

Table VII-21 New Road Construction Plan for Study Area

(Unit: m)

Category	Objective	Land Type	Working Area				Total
			Oesao East	Oesao West	Olio	Oebelo	
Forest Road	Reforestation, Regreening and/or Forest Management	State Forest Land	1,392	3,384	456	1,512	6,744
		Enclave	0	0	480	60	540
		Private Land	1,068	2,268	936	2,460	6,732
		Total	2,460	5,652	1,872	4,032	14,016
Ordinary Road	Transportation of Goods, etc.	-	-	51,000	19,000	19,000	89,000

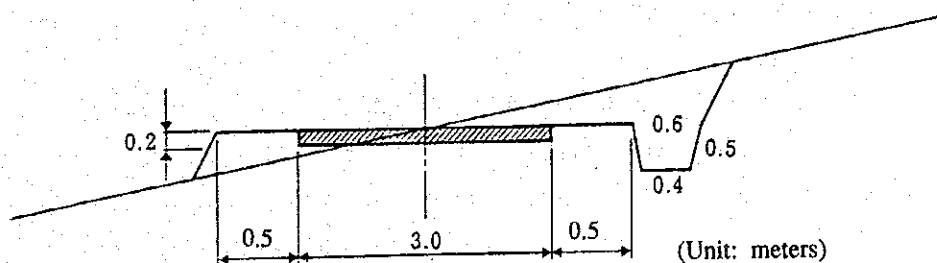


Fig. VII-9 Standard Cross Section for New Roads

(2) Forest Protection Plan

The introduction of the following measures is planned to deal with the largest task of forest protection, i.e. the prevention of and mitigation of damage due to forest fires.

1) Creation of Firebreaks

At the reforestation sites to be identified under the Plan, a 10 m wide clear cut strip will be created on both sides of the new forest roads along the entire planned length of 14,016 m to make a total firebreak width, including the road shoulders, of 25 m. Clearing will be conducted at these firebreaks during the dry season. Due to the poor

recovery of the vegetation in the dry season, the cleared firebreaks are expected to sufficiently perform their function of preventing fires. In the case of the planned reforestation sites in the Study Area, a 10 m wide firebreak will be created along those boundaries facing grassland or farmland.

2) Fire Monitoring and Reporting System

Fire look-out towers will be introduced at reforestation sites to monitor and report forest fires. Prerequisites in the selection of fire look-out tower sites are proximity to a road (public road or forest road), convenience vis-a-vis construction work and maintenance and a clear all-round view. The number of fire look-out towers to be introduced will be one each for the Oebelo Working Area, Olio Working Area and Oesao East Working Area and two for the Oesao West Working Area based on the planned distribution and land area of the reforestation sites in each working area. In consideration of the view from the fire look-out tower, the fire look-out height is set at approximately 14 m and communication equipment will be provided for each fire look-out tower for the prompt reporting of the sighting of a forest fire to the Project Implementation Centre. A full-time watchman will be assigned to each look-out tower during the dry season of 270 days a year in order to report the occurrence of forest fires to the Centre. A team of two members will patrol 100 ha of reforestation sites of upto 5 years of age with particular emphasis on those districts where forest fires frequently occur. When the team members detect a forest fire, they will report to the Centre via the look-out tower. The patrol team members will also conduct public relations activities on the prevention of forest fires. As forest fire prevention requires the active cooperation of local inhabitants, measures to facilitate the understanding of local inhabitants of the importance of reforestation and forest fire prevention should be introduced.

3) Fire-Fighting Activities

Some 20 shoulder-type jet shooters (18 litre capacity) will be loaned to 10 desas out of the 23 desas in the Study Area in view of their proximity to reforestation sites in order to ensure effective fire-fighting which will be jointly conducted by the competent authority and the villagers using these jet shooters and other tools. Table VII-22 summarises the planned forest fire prevention facilities in the Study Area.

Table VII-22 Forest Fire Prevention Facilities by Working Area

Item	Unit	Working Area				Total
		Oesao East	Oesao West	Olio	Oebelo	
Fire Look-Out Tower	no.	1	2	1	1	5
Communication Equipment	unit	1	2	1	1	5
Shoulder-Type Jet Shooter	unit	40	60	40	60	200
Watchman	2 men/look-out tower	2	4	2	2	10
Patrol Team	2 men/100 ha	16	40	14	30	100

4) Local Inhabitants Enlightenment Activities

The main causes of forest fires in the Study Area are believed to be shifting cultivation and burning for stock raising. Shifting cultivation involves the burning of follow shrub land, etc. around October when the rainy season has not yet started, followed by planting when the rainy season actually commences. Burning between September and November for stock raising has often caused extensive fires in the past, necessitating extremely careful attention.

Under the Land Rehabilitation Plan, it will be necessary to introduce forest fire prevention measures while incorporating the wishes of local inhabitants. It will be important to repeatedly explain to the local inhabitants that the Plan will create new employment under the reforestation and other programmes, will provide firewood and wood for agricultural use and will promote the local economy through social forestry, etc. Measures to enlighten local inhabitants of the benefits of the Plan should include briefing of the Plan objectives and contents at church and other meetings using audio-visual materials. Similar efforts vis-a-vis school children in the Study Area as part of the regular teaching should also prove useful.

Also, "school forestation" as used in the mangrove forestation example may also be an effective forestry education activity.

VII-9 Extension Plan

(1) Extension, Guidance and Cooperation Systems

1) Extension and Guidance System

The main components of the extension activities under the Land Rehabilitation Plan are (i) extension work designed to facilitate the understanding of local inhabitants of such methods and techniques as reforestation, social forestry, agroforestry and silvopastoral to develop local communities and to improve soil and water conservation in the Study Area and (ii) technical guidance. The actual activities will, therefore, be diverse, ranging from pure technical guidance to meetings and the exchange of opinions with various groups of local inhabitants and the sponsoring of various seminars. These activities will be conducted by forestry extension workers and 11 workers are currently responsible for conducting extension activities in 63 desas in the 3 kecamatans located in the Study Area. Given the need to organize new community groups to assist the implementation of the various programmes and the expected increase of the guidance and supervisory work volume under the Plan, it is essential to increase the number of extension workers which are mainly responsible for the Study Area. In addition, new training courses should be provided to improve the technical expertise of these extension workers in order to consolidate their extension and guidance abilities. Furthermore, the cooperation of agricultural and stock raising extension workers will prove essential as the successful implementation of the Plan will demand the active use of agricultural and stock raising techniques.

2) Consolidation of Extension Facilities and Equipment

As the extension activities related to the Plan will basically be conducted on-site, extension workers will naturally be required to stay close to their assigned areas, making it highly desirable to establish local offices for the current extension workers in the respective working areas for their full-time posting. Efficient extension activities will require consolidation of the transport and communication facilities to suit the local conditions, such as motorbikes and radio equipment, etc. Further equipment for extension work vis-a-vis the local inhabitants should include audio-visual equipment, such as a slide projector, camera and VCR and such office equipment as a word-processor.

3) Cooperation System

It is essential to secure the understanding and cooperation of the leaders of local communities and groups for the smooth implementation of the Plan. Moreover, while maintaining a good relationship with NGOs and the Church, both of which have strong influence in the Study Area, active efforts should be made to incorporate women's groups and school teachers, etc. in the cooperation system for the Plan in order to establish community-wide participation.

① Local Leaders

In order to maintain and strengthen the cooperation of such local leaders as desa heads and the members of various desa committees, there should be active contact to facilitate their understanding of the Plan. A seminar/training course for some 90 people, consisting of desa heads and the members of desa committees will be organized under the Plan.

② Community Group Leaders

As there are a few active community groups in the Study Area at present, efforts will be made to organize as many groups as possible to consolidate the basis for the implementation of the Plan. Assuming that the immediate target for grouping is to secure the participation of some 50% of the local households with a group size of 10 - 20 members for easy management and quick action, some 180 groups will be required in the Study Area, i.e. 2 - 3 groups per settlement. A training course/seminar for the leaders of these newly formed groups will be planned as early as possible.

(2) Training of Extension Workers and Local Inhabitants

1) Training Facilities

A national forestry training centre is located in Kupang as described earlier which is responsible for the training of forestry staff in 3 provinces, i.e. West Nusa Tenggara, East Nusa Tenggara and East Timor. Apart from official staff, only 6-7 ordinary people per kabupaten are provided training at the centre. Consequently, this centre is unsuitable as a training facility for local inhabitants to closely serve the objectives of the Plan. It is, therefore, necessary to establish a training facility which is specifically related to the Plan to provide a place for the exchange of opinions between those responsible for the Plan's implementation and members of existing NGOs and community groups. It appears preferable that this training facility be attached to the Project Implementation Centre to be established in the Study Area

rather than being independently run (see the next two sections on the Training Programme and Subjects for details of the training facility) in view of its efficient operation and maintenance. Due to the urgency to construct a training facility to facilitate understanding of the Plan among the local inhabitants in order to ensure the Plan's smooth progress, this facility will be constructed in the first year of the Plan.

2) Training Plan

The training plans under the Plan are outlined in Table VII-23 with emphasis on improvement of the technical expertise of the staff and extension workers. Training will be conducted until the Plan's completion, using a different curriculum each year to reflect the improvements following the previous courses. The timing of the training should be carefully planned to reflect the local circumstances. While avoiding the busy farming periods during the rainy season, the training of leaders should preferably be conducted for a full five days without a break. The participation of women will be encouraged in view of the need to foster female leaders.

Table VII-23 Immediate Training Programme

	Office Staff	Extension Workers	Local Leaders	Group Leaders	Total
Target Number of Subject People	15	20	90	180	310
Number of Training Courses/Year	6	2	1	1	10
Training Period (days/course)	10	15	5	5	-
Training Period (weeks/course)	2	3	1	1	-
Number of Trainees (No./course)	15	10	15	15	-
Aggregate Number of Courses	6	4	6	12	34
Aggregate Number of Training Weeks	12	12	6	12	42
Maximum Accommodation Capacity					15

3) Training Subjects

The training is designed to enable the trainees to obtain the necessary ability to think and perform their field work on their own initiative. The training emphasis will be placed on practical training with the extensive use of demonstration plots, etc. to facilitate the learning of practical skills. Efforts will also be made to teach a systematic understanding of the methods to solve the various problems faced by

local inhabitants. While lectures will mainly be provided by senior extension workers with first-hand knowledge and experience of the Study Area, the assistance of agricultural and stock raising extension workers as well as other knowledgeable persons should be sought to provide comprehensive education and training courses. Based on the above principles, training courses will be provided on the following subjects, taking the level of the trainees into consideration.

- Soil and water conservation techniques
- Reforestation and nursery techniques
- Social forestry techniques and management
- Agroforestry techniques and management
- Silvopastoral techniques and management
- Organization and management of farmers' groups
- Marketing of agricultural, stock raising and forestry products
- Guidance on improvement of rural life
- Methods to solve problems faced by local inhabitants

(3) Creation of Demonstration Plots

In order to show local inhabitants diverse, concrete measures to improve their understanding of the significance and details of the technology, technique and application method of each measure as well as the relationship between measures, a demonstration plot which incorporates all types of farmland and grassland improvement and various soil and water conservation measures will be created for each small sub-watershed.

1) Planning of Details

The basic idea is the creation of a comprehensive demonstration plot for each small sub-watershed of some 200 ha in size to demonstrate various measures in line with the land use judgement criteria and soil and water conservation measures. While the details of the plot should reflect the local characteristics as well as the opinions expressed by local inhabitants at group meetings at the planning stage, the main components should be as shown in Table VII-24.

2) Selection of Sub-Watersheds

In principle, one small sub-watershed will be selected for each Working Area based on (i) the strong desire for a demonstration plot and willingness to cooperation on

the part of local inhabitants, (ii) local conditions suitable for the implementation of the planned measures and (iii) the prospect of the medium or higher success of each measure.

These demonstration plots will be completed in the first half of the plan implementation period to maximise their demonstration effects vis-a-vis local inhabitants.

Table VII-24 Details of Demonstration Plot

Main Activity	Combined Activities
Reforestation	<ul style="list-style-type: none"> - Farmland improvement (mixed gardens; improved terraces) - Grassland improvement (Creation of grazing/fodder forests; natural grassland improvement) - Soil loss prevention work; construction of earth check dam; drilling of infiltration well and drinking water well)
Farmland Improvement	<ul style="list-style-type: none"> - Reforestation (forage tree, fuel tree; planting of trees with a long cutting period) - Grassland improvement (creation of fodder field; introduction of grazing grasses) - Bank and gully protection measures
Grassland Improvement	<ul style="list-style-type: none"> - Reforestation (forage tree, fuel tree ; planting of trees with a long cutting period) - Farmland improvement (improved terraces) - Bank and gully protection measures; landslide site rehabilitation work
Soil and Water Conservation Measures	<ul style="list-style-type: none"> - Reforestation - Improved terraces; terrace gulud; vegetative interception works - Grassland improvement (creation of grazing/fodder forests; natural grassland improvement)

3) Monitoring

During the demonstration plot creation process, local inhabitant groups will be approached to recruit construction workers. With the provision of technical guidance by extension workers, these workers will be encouraged to learn the necessary skills while earning a cash income (also refer to monitoring in VII-11). At the operational stage, monitoring of the effects of the experimental improvement measures (changes of the soil and water conservation conditions and income of participating households) and the diffusion effects vis-a-vis other areas will be required. It is desirable that this monitoring be conducted by the participating farmers with the guidance of extension workers in order to enhance the understanding of land rehabilitation issues on the part of the former.

(4) Activities to Assist Local Inhabitants

Given the facts that most land in the Study Area is private land and that the majority of local inhabitants rely on agriculture and/or stock raising as the main income source, the implementation of the Plan with the active understanding and cooperation of the local inhabitants is essential. As local inhabitants will be expected to play an increasingly important role at the maintenance stage following the completion of the work envisaged by the Plan, it will be difficult for the Plan to successfully move to this stage without economic incentives as well as better farming prospects for the participants right from the initial stage. In this context, a reduction of the immediate financial burden on local inhabitants as much as possible with the assistance of all related administrative organizations should prove critical. The responsibilities and rights, limit of financial burden and possibility of loan arrangements and conditions, etc. must be fully explained to all prospective participants, i.e. local inhabitants, prior to the commencement of the Plan.

1) Possible Incentives

The income level of most local inhabitants is extremely low and it is practically impossible for them to make any advance investment for the future. Funding through government loans or subsidies, etc. may be one way of solving the fund shortage of local agriculture. As financing by ordinary financial institutions is not expected to be readily available, it may be necessary to arrange special measures, such as the provision of a KUD loan with specific conditions. Local inhabitants have also expressed the hope for assistance in kind, including fertilisers, agrochemicals, agricultural tools, seeds of new varieties, seedlings and breeding cattle. In the case of fertilisers and agrochemicals, it may be necessary to provide these over several years instead of just the first year of the plan period depending on assessment of the local situation by extension workers. Moreover, after implementation of the project, giving rights to use of wood for fodder and pasture land or giving fruit, charcoal, and agricultural tools to participating groups and villages may also be effective initiatives. Also, the increased employment opportunities under the Plan will certainly lead to improved cash income for local inhabitants and, therefore, it may be useful for Plan-related work to be spread as evenly as possible over a long period of time.

2) Assistance for Local Inhabitants

As described earlier, the establishment of community groups in the Study Area has been quite slow although there are new movements aimed at establishing groups. As

the implementation of the Plan requires the commitment of local inhabitants to extra work in addition to the traditional farming and/or stock raising during the busy rainy season, the active participation of those households with limited manpower cannot be anticipated. This prospect underlines the importance of grouping to secure a strong commitment and higher labour productivity for the successful outcome of the Plan. In addition to establishing active groups, the new type of farming envisaged by the Plan must be seen to be attractive by local farmers if the positive effects of the Plan are to be maintained for a long time. In view of this and also in view of promoting the local economy, extended assistance such as that described below should also be provided for farming techniques and management.

① Assistance Relating to Farming Techniques

i) Soil and water conservation and land rehabilitation

- Reforestation/social forestry
- Soil and water conservation techniques

ii) Farming techniques

- Soil conservation and farming practices
- Planting patterns
- Production techniques
- Procurement of seeds (including those of new varieties)
- Stock raising techniques
- Obtaining of farming information

iii) Livestock technology

- Fodder production technology
- Livestock management
- Livestock breeding techniques

② Assistance Relating to Management

i) Management of community groups

- Organization and rules
- Management of meetings
- Financial management (book-keeping and fund control, etc.)

ii) Fund raising

iii) Marketing

- Market information of agricultural, livestock and forestry products
- Central information on local products to be marketed elsewhere in Indonesia
- Information on new varieties
- Transportation and storage of harvest
- Linkage with farming products processing companies and cattle traders

iv) Joint purchase of farming materials and equipment (fertilisers, agrochemicals and farming machinery, etc.)

- Linkage with KUD and other suppliers
- Financing for purchases

Because of the wide variety of assistance issues, it is essential to secure as many assistance providers as possible, including administrative organizations, research institutes, agricultural cooperatives and NGOs, etc. to maximise the effects of the available subsidies and information to assist local inhabitants.

① Assistance Activities for Local inhabitants

In reality, the assistance for local inhabitants will take the following forms.

i) Extension Activities

- Confirmation of the willingness of prospective participants (group members) through meetings to commit to the Plan prior to the commencement of individual projects under the Plan.
- Provision of technical and managerial advice and assistance at meetings during the implementation stage of the Plan.
- Demonstration plots
- Provision of advice at the project sites.
- Introduction of excellent activity results and new varieties, etc. by means of audio-visual equipment and pamphlets.

ii) Training Activities

- Improvement of the leadership abilities of group leaders through field practice and study trips, etc.
- Distribution of pamphlets and reference materials to all group members

iii) Commendation

- Commendation of groups or project sites with excellent results.

iv) Assessment and reporting

- Regular assessment and reporting (by groups).
- Evaluation of project performance by the Steering Committee and feeding-back of the findings to project sites.

Fig. VII-10 shows the project implementation procedure, from project planning to evaluation, under the Plan.

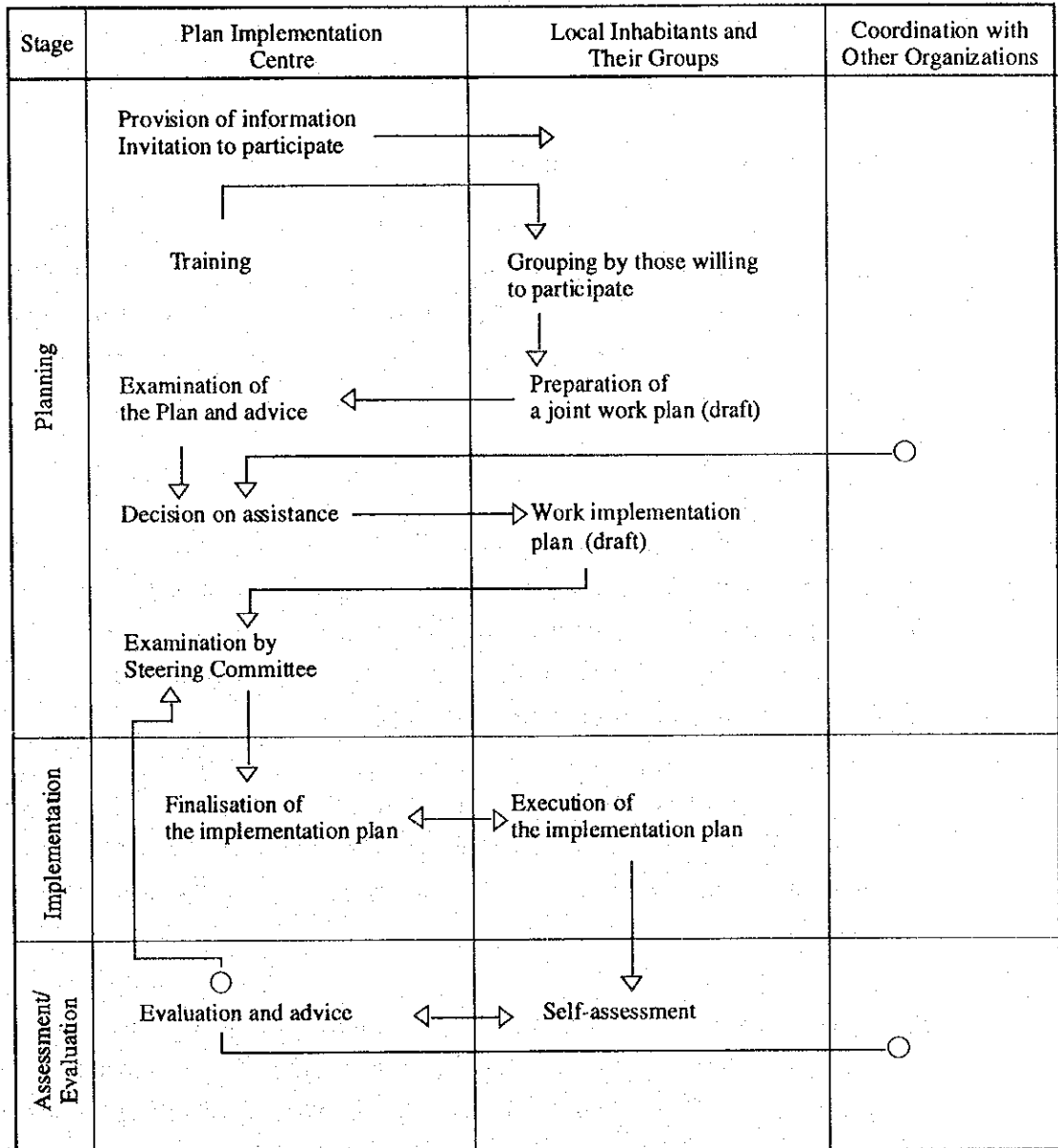


Fig. VII-10 Project Implementation Procedure Under the Plan

VII-10 Management Plan

(1) Operation and Management Structure

In implementing the Plan, while no special administrative organization will be established, the following operation and management structure will be adopted.

1) Coordination With Local Administrative Organizations

Due to the involvement of many local administrative organizations in the implementation of the Plan, their coordination will be essential for the successful outcome of the Plan. The Steering Committee will be established with the participation of representatives of the related organizations to ensure smooth coordination.

2) Implementation System

The implementation system is shown in Fig. VII-11 with special attention paid to the provision of assistance for local inhabitants and coordination with and between local administrative organizations. This system will require further examination at the time of seeking coordination with related organizations. The envisaged implementation system has the following characteristics.

- ① Appointment of village advisory group members who are leaders of various groups in the Study Area: this group is expected to provide useful advice and feed-back to the Project Officer and others in charge of the implementation of the Plan.
- ② Establishment of the Planning and Evaluation Unit and coordination between the extension activities and civil engineering work under the supervision of the project officer for the long-term success of the Plan (and its projects): it may be an idea for staff of the sub-Balai RLKT of the Ministry of Forestry to be dispatched to the Project Implementation Centre. As part of the evaluation activities of this unit, the extension activities and soil and water conservation projects will be monitored and evaluated. Feed-back of the evaluation results at regular intervals and the provision of advice based on the evaluation results should prove useful for not only those directly involved in the implementation of the Plan but also for many others.

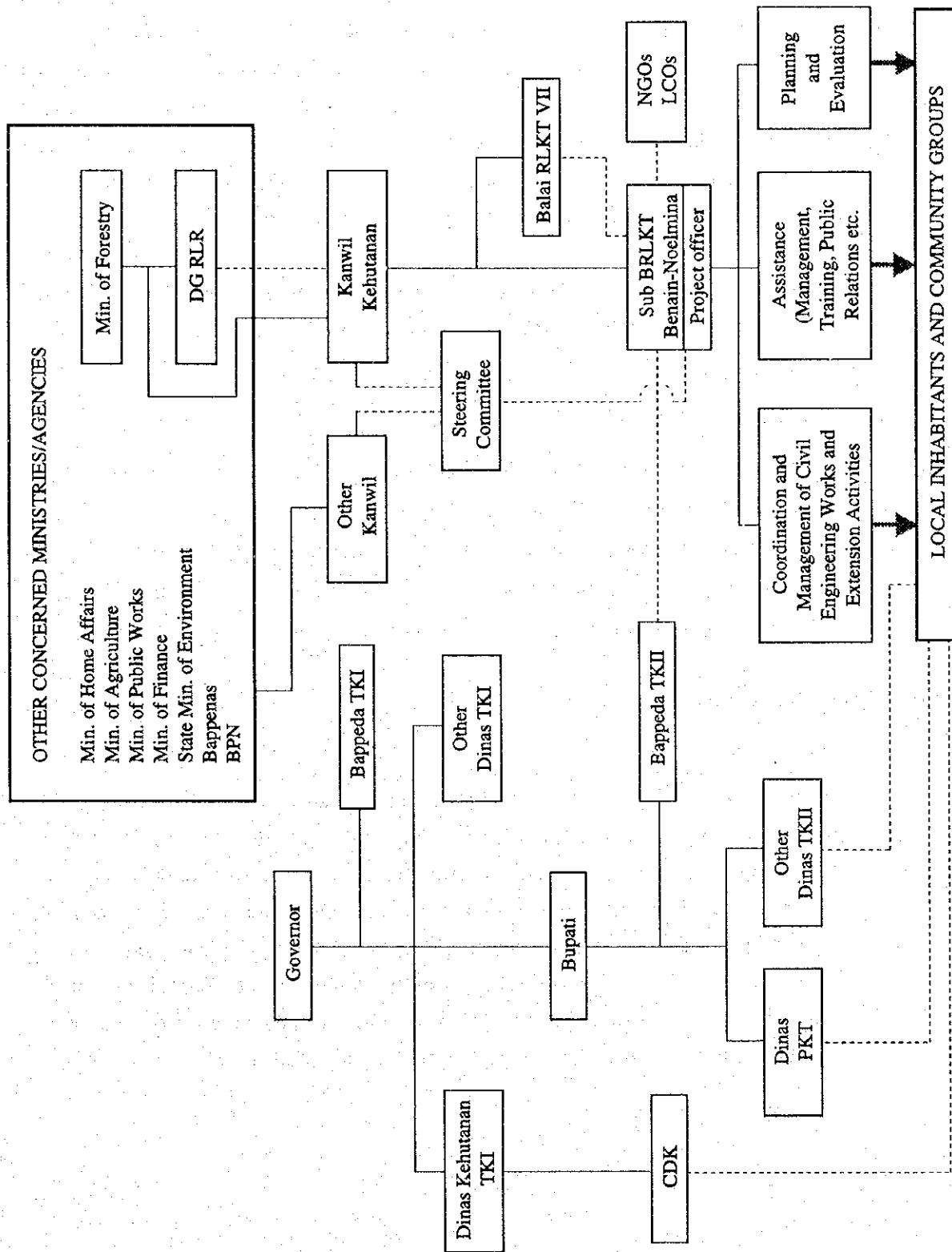


Fig. VII-11 Implementation System

(2) Project Implementation Centre

It will certainly prove efficient for the Project Centre responsible for the implementation of Plan-related projects to be located in the Study Area. As described earlier, it is also desirable that a training centre to facilitate the extension programme be established together with the Project Implementation Centre. Assuming that the Project Implementation Centre will have some 20 staff members led by the Project Officer and that some 20 people will undergo training at one time, the planned size of the Project Implementation Centre and the range of equipment are as follows.

- o Building : 800 m² (administration office, meeting room, training room, laboratory, seed storage, library and dormitory, etc.)
- o Demonstration Area 3,000 m² (arboretum and demonstration nursery)
- o Equipment
 - Vehicles (jeep, microbus and motorbike, etc.)
 - Communication equipment (radio equipment and telephone, etc.)
 - Audio-visual equipment (slide projector, OHP, camera and VCR, etc.)
 - Office equipment (personal computer, word-processor, copier and stationary, etc.)
 - Dormitory equipment (shower unit, washing machine and canteen fixtures, etc.)

(3) Implementation Plan

1) Annual Plan

As described earlier, the Plan should be commenced and completed as soon as possible due to its urgency. Based on the total work volume involved, the strength of the implementation system and the availability of farmers' and other groups and the nature of their activities in the Study Area, the completion of all components of the Plan in 10 years is planned. Nevertheless, due to the need to complete many of the components as soon as possible, the early completion of the projects will be designed where possible based on the work volume involved and other considerations. Table VII-25 shows the work volume for each year.

Table VII-25 Annual Plan

Plan Component	Unit	Plan Year										Total			
		1	2	3	4	5	6	7	8	9	10				
Reforestation	F1	30	62	87	87	87	87	87	87	87	87	87	87	87	788
	F2	143	293	406	406	406	406	406	406	406	406	406	406	406	3,684
	F3	8	16	22	22	22	22	22	22	22	22	22	22	22	200
	Sub-Total	181	371	515	515	515	515	515	515	515	515	515	515	515	4,672
Farmland Improvement	FI1	46	90	123	123	123	123	123	123	123	123	123	123	123	1,120
	FI2	208	416	570	570	570	570	570	570	570	570	570	570	570	5,184
	Sub-Total	254	506	693	693	693	693	693	693	693	693	693	693	693	6,304
	Improved Terraces	106	161	161	161	161	161	161	161	161	161	161	161	161	1,072
Grassland Improvement	Texas Gulud	40	59	59	59	59	59	59	59	59	59	59	59	59	394
	Vegetative Barriers	290	443	443	443	443	443	443	443	443	443	443	443	443	2,948
	GI1	50	200	200	200	200	200	200	200	200	200	200	200	200	1,700
	GI2	160	300	300	300	300	300	300	300	300	300	300	300	300	1,960
Settlement Environment Improvement	Sub-Total	210	500	500	500	500	500	500	500	500	500	500	500	500	3,660
	Wells (Infiltration and Drinking Water)	102	106	106	107	107	107	107	107	107	107	107	107	107	1,063
	Tree Planting	2,293	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	2,923	28,600
	Hedge Creation	11,489	14,679	14,679	14,679	14,679	14,679	14,679	14,679	14,679	14,679	14,679	14,679	14,679	143,600
Stream and Bank Conservation	Earth Check Dams	2	2	2	2	2	2	2	2	2	2	2	2	2	23
	Small Check Dams	25	30	31	31	31	31	31	31	31	31	31	31	31	303
	Bamboo Gully Plugs	28	37	37	37	37	37	37	37	37	37	37	37	37	250
	Gabion Gully Plugs	1	1	1	1	2	2	2	2	2	2	2	2	2	10
	Infiltration Ditches	800	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	8,000
	Planting	9	9	10	10	10	10	10	10	10	10	10	10	10	68
	Revetment Work	451	481	481	481	481	481	481	481	481	481	481	481	481	4,780
	Bank Planting	46	48	48	48	48	48	48	48	48	48	48	48	48	478
	Retaining Wall	104	104	104	104	104	104	104	104	104	104	104	104	104	208
	New Forest Roads	558	1,122	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	14,016
Roads	New Ordinary Roads	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	89,000
	Road Improvement	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	7,280	72,800
	Sub-Total	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Nurseries	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Forest Protection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5
Management	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10

2) Preparatory Work and Annual Schedule

The implementation schedule for the Plan must be establishment prior to the commencement of the projects through careful preparation. Basic background materials to determine the schedule must be prepared to allow accurate assessment and examination of such issues as coordination between related organizations, arrangement of the back-up system and required period to complete each project, etc. Establishment of full coordination and agreement vis-a-vis the work between the Plan implementation body and the farmers or owners of the subject land is essential prior to the commencement of any work.

Following the successful completion of these preliminary arrangements, the Plan will proceed to the implementation stage. As the Study Area has a clear dry season and rainy season, agricultural activities are concentrated in the rainy season. In order to efficiently utilise the local workforce, it is important to listen to the opinions of farmers on the annual work schedule.

In general, the dry season is an appropriate time to conduct such civil engineering work as terracing etc. while the rainy season (or early rainy season) is suited to farmland improvement and reforestation work. The concrete schedule should be determined taking the local farming practices into consideration. Table VII-26 shows the likely standard annual schedule for the implementation of the Plan.

Table VII-26 Standard Annual Schedule

Work Type	April - June	July - September	October - December	January - March
Civil Engineering Work	Preparatory Work, Survey, Coordination and Detailed Design, etc.	Field Work	Field Work	Preparatory Work, Survey, Coordination and Detailed Design, etc.
Vegetation Work	Preparatory Work, Survey, Coordination and Detailed Design, etc.	Field Work	Field Work	Field Work

Legend

■ Field Work

▨ Preparatory Work, Survey, Coordination and Detailed Design, etc.

VII-11 Monitoring

As part of the Plan implementation process, it is desirable to conduct monitoring to assess the suitability of the components of the Plan and work progress and to identify problems and remedial measures so that the Plan components can be revised even at the implementation stage and so that the findings can be used for other plans and projects. The proposed monitoring contents are described below.

(1) Reforestation

Monitoring will be conducted once a year on such issues as the height of the planted trees, DBH, stand density, ground vegetation, soil depth, supplementary planting rate, failed planting area, causes of failure and possible remedial measures, types and amounts of fertilisers used and fruit production volume, etc. while clearly indicating the project site location, project commencement year, project area size, soil type, gradient, planting method and species planted.

(2) Farmland Improvement

Monitoring will be conducted once a year on such issues as the height of the planted trees, DBH, stand density, ground vegetation, soil depth, supplementary planting rate, failed planting area, causes of failure and possible remedial measures, types and amounts of fertilisers used and production volumes of fruit and agricultural products, etc. while clearly indicating the project site location, project commencement year, project area size, soil type, gradient, planting method, species planted and crops cultivated, etc.

(3) Grassland Improvement

Monitoring will be conducted once a year on such issues as the height of the planted trees, DBH, stand density, grass growth conditions (weight per m² and maximum height), supplementary planting rate and amount of additional seeding, types and amounts of fertilisers used, area of failed operation and causes of failure, etc. while clearly indicating the project site location, project commencement year, project area size, soil type, gradient, species planted, types of grass and amount of seeding, etc.

(4) Seedling Production

Monitoring will be conducted once a year on such issues as the procurement of seeds, nursery hardening process, seedling production volume, nursing period, types of seedlings, shipping times, successful shipping rate and types of and standards for

seedlings ready for shipping (planting) while clearly indicating the nursery location, operation commencement year, nursery land size, available facilities and manpower, etc.

(5) Watershed Conservation

- 1) Monitoring will be conducted continuously after the completion of construction work for check dams maintenance and management.
- 2) Annual monitoring of damage to the dam body and spillway will be conducted at the end of the dry season.
- 3) The area within a 200 m radius of a fountain will be monitored to check compliance with the prohibition of burning, grazing and felling.
- 4) With the implementation of soil and water conservation measures under the Plan, soil loss due to erosion is expected to decrease. To ascertain the degree of effectiveness of the said measures, soil erosion test plots for monitoring purposes will be established at those sites which are believed to be representative of the land use with or without the said measures and of the main soil types, etc. to measure the surface runoff rate and eroded soil volume.
- 5) An annual cross-section survey on deposited sediment will be conducted at the existing check dams, reservoirs and other dams for the same purpose described in 4) above to obtain data on the deposited sediment volume and its proportion vis-a-vis the catchment area.
- 6) With the progress of the reforestation, farm land and grassland improvement projects under the Plan, the growth of the planted trees will presumably affect the river discharge, flooding prospect and conditions of the headwater areas, etc. No monitoring on the impacts of vegetation recovery on the environment is currently conducted. An observation station will, therefore, be established along each Oebelo River and Olio River to observe the river discharge level.

(6) Environment

When the plan proceeds to the actual implementation stage, it will be necessary to monitor changes of the environmental elements which will be affected by the Plan and also the implementation progress of the environmental conservation measures.

1) Environmental Elements Subject to Monitoring

The main environmental conservation subjects considered by the Plan are the soil and water conservation function of forests following their rehabilitation, water quality, rare fauna and flora and the living environment of local communities. Of these, river water quality and the ecology of rare wild animals are often considered to be important indices for the state of the environment. In particular, any change of the water quality in the upper reaches can be quickly detected by a water contamination survey and it is also possible to identify both the source and cause of environmental pollution through a tracking survey. These features make water quality testing an important element of environmental pollution monitoring and water quality is generally considered the leading indicator of environmental pollution.

2) Monitoring Method

① River Water Contamination Survey

Flowing river water will be sampled from the lowest point or from confluence points with tributaries of Oesao River and Oebelo River in the respective catchment areas in order to measure the transparency using a transparency meter. Appropriate timing for sampling is, for example, on a day following rain when the occurrence of muddy water in the upper reaches can be easily detected. Measurement should preferably continue for a few days to compare the length of muddy flow with that of other times so that the exact places and causes of muddy water in the upper reaches can be tracked down.

② Wild Fauna Habitat Survey

The rare wild fauna protected by law in Indonesia and believed to inhabit the Study Area are listed in Table VIII-2. The proposed survey here involves the establishment of fixed survey sites in each working area to check the appearance and living density of Mammalia and Aves in every quarter for continuous observation.

③ Environmental Monitoring Implementation System

At the time when actual environmental monitoring is planned as part of the Plan's implementation stage, many environmental elements requiring monitoring are certain to be identified, necessitating the cooperation of experts, engineers and local inhabitants. This necessity suggests that it may be useful to

commission an independent environmental survey organization to conduct the monitoring rather than the Plan's implementation body.

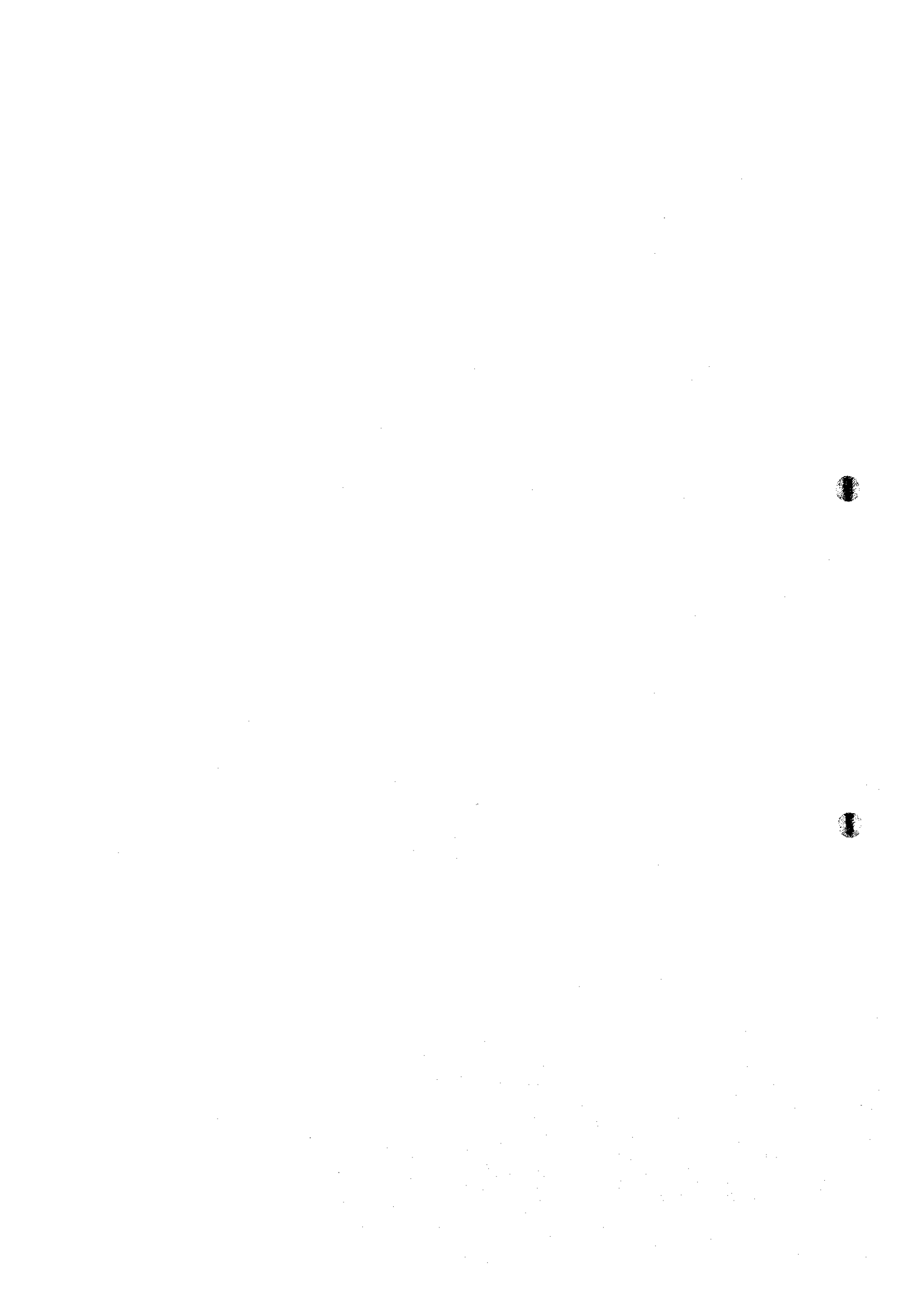
VII-12 Estimate of Plan Cost

The cost of the Plan to be implemented under the Land Rehabilitation Plan is estimated to be Rp. 35,000 million as shown in Table VII-27. The preconditions for estimation are a plan period of 10 years, a commencement year of 1996, a domestic annual inflation rate in Indonesia of 8% and a physical contingency rate of 8% of the cost of each project. The details of the data used for the estimation can be found in Appendix F-6.

Table VII-27 Project Cost by Plan Year

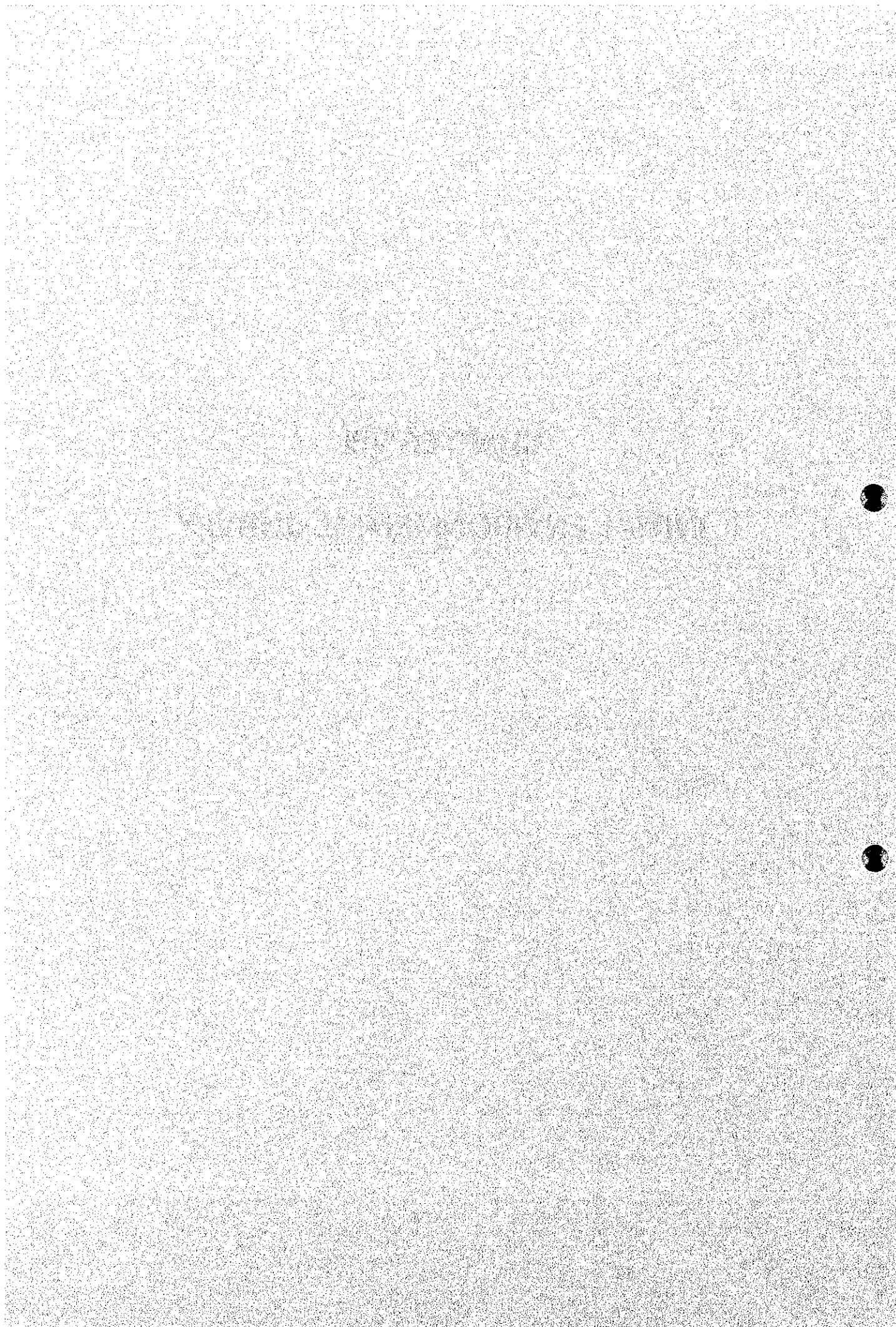
(Unit: 1,000 Rp)

Plan Component	Plan Year										Total
	1	2	3	4	5	6	7	8	9	10	
Reforestation	113,558	251,064	376,133	406,223	438,723	473,821	511,728	552,664	596,877	644,630	4,365,421
F1	22,743	50,317	75,392	81,423	87,938	94,973	102,572	110,776	119,638	129,211	874,983
F2	88,311	195,335	292,705	316,121	341,412	368,725	398,222	430,080	464,487	501,646	3,397,044
F3	2,504	5,412	8,036	8,679	9,373	10,123	10,934	11,808	12,752	13,773	93,394
Farmland Improvement	121,528	233,148	309,382	334,349	361,098	389,985	421,183	315,120	340,329	367,556	3,193,878
F1	27,324	57,736	85,219	92,037	99,400	107,352	115,940	125,215	135,232	146,051	991,506
F2	40,435	87,340	129,246	139,586	150,753	162,813	175,838	189,905	205,097	221,505	1,502,518
Improved Terraces	18,545	30,422	32,855	35,484	38,323	41,388	44,699	0	0	0	241,716
Texas Gulud	8,164	13,006	14,047	15,170	16,384	17,695	19,110	0	0	0	103,576
Vegetation Barriers	27,060	44,644	48,215	52,072	56,238	60,737	65,596	0	0	0	354,562
Grassland Improvement	204,789	518,369	561,098	607,345	632,837	685,051	741,569	375,182	407,196	137,522	4,870,958
G1	50,760	219,283	236,825	255,771	276,233	298,332	322,198	347,974	375,812	101,469	2,484,657
G2	133,056	269,438	290,993	314,272	339,414	366,567	395,893	0	0	0	2,109,633
Dry Crop Field and Paddy Field Use	1,836	1,982	2,141	2,312	2,497	2,697	2,913	3,146	3,398	3,670	26,592
Water Drinking Places(Natural Grassland Improvement)	2,160	9,331	11,337	13,604	14,693	17,455	20,565	24,062	27,986	32,383	173,576
Fodder Field	16,977	18,335	19,802	21,386	0	0	0	0	0	0	76,500
Settlement Environment Improvement	151,690	171,621	185,350	201,985	218,144	235,596	254,443	274,799	296,784	320,527	2,310,939
Wells (Infiltration and Drinking Water)	146,336	164,241	177,380	193,378	208,848	225,556	243,600	263,088	284,136	306,867	2,213,430
Trees Planting	2,674	3,682	3,976	4,294	4,638	5,009	5,410	5,843	6,310	6,815	48,651
Hedge Creation	2,680	3,698	3,994	4,313	4,658	5,031	5,433	5,868	6,338	6,845	48,858
Stream and Bank Conservation	294,245	351,799	386,985	417,945	452,411	488,606	527,694	615,910	665,184	718,398	4,919,177
Earth Check Dams	85,310	92,135	99,506	107,466	116,063	125,349	135,377	149,310	163,855	178,804	1,473,175
Small Check Dams	131,220	170,061	189,788	204,971	221,368	239,078	258,204	278,861	301,170	325,263	2,319,984
Bamboo Gully Plug	3,265	4,660	5,033	5,436	5,871	6,341	6,848	0	0	0	37,454
Gabion Gully Plug	758	818	884	955	2,062	2,227	2,406	0	0	0	10,110
Infiltration Ditches	1,399	2,267	2,448	2,644	2,856	3,084	3,331	0	0	0	18,029
Planting	7,095	7,663	9,195	9,931	10,726	11,584	12,510	0	0	0	68,704
Revetment Work	28,932	33,325	35,991	38,871	41,980	45,339	48,966	52,883	57,114	61,683	445,084
Bank Planting	36,266	40,870	44,140	47,671	51,485	55,604	60,052	64,856	70,045	75,648	546,637
Landslide Site Rehabilitation	10,310	11,135	0	0	0	0	0	0	0	0	21,445
Roads	676,217	738,838	804,805	869,202	938,738	1,013,840	1,094,946	1,182,542	1,277,144	1,379,317	9,975,589
New Forest Roads	7,810	16,960	25,174	27,188	29,363	31,712	34,249	36,989	39,948	43,144	292,537
New Ordinary Roads	332,190	358,765	387,467	418,464	451,941	488,097	527,144	569,316	614,861	664,050	4,812,295
Road Improvement	336,217	363,113	392,164	423,550	457,434	494,031	533,553	576,237	622,335	672,123	4,870,757
Nurseries	14,688	1,110	1,199	1,295	1,398	1,510	1,631	1,762	1,903	2,055	28,551
Forest Protection	36,579	21,559	57,046	35,248	69,324	41,114	80,861	7,016	50,101	8,184	407,032
Fire Look-Out Towers	20,169	0	23,525	0	27,440	0	32,006	0	37,332	0	140,472
Materials, Personnel Cost	16,410	21,559	33,521	35,248	41,884	41,114	48,855	7,016	12,769	8,184	266,560
Management	636,539	129,696	140,071	151,277	163,379	176,450	190,566	205,812	222,277	240,059	2,256,126
Personnel Cost	109,404	118,156	127,608	137,817	148,842	160,750	173,610	187,499	202,499	218,699	1,584,884
Building Construction Cost	516,450	0	0	0	0	0	0	0	0	0	516,450
Office Running Cost	10,685	11,540	12,463	13,460	14,537	15,700	16,956	18,313	19,778	21,360	154,792
Sub-Total	2,260,143	2,428,339	2,822,269	3,024,869	3,276,052	3,505,973	3,824,621	3,530,807	3,857,795	3,818,248	32,349,116
Physical Contingency (8%)	180,811	194,267	225,781	241,989	262,084	280,477	305,969	282,464	308,623	305,459	2,587,924
Total	2,440,954	2,622,606	3,048,050	3,266,858	3,538,136	3,786,450	4,130,590	3,813,271	4,166,418	4,123,707	34,937,040



CHAPTER VIII

INITIAL ENVIRONMENTAL SURVEY



CHAPTER VIII INITIAL ENVIRONMENTAL SURVEY

The initial environmental survey was conducted to check the environmental conditions of the Study Area to determine the natural, as well as socioeconomic, environmental issues to be examined as part of the Land Rehabilitation Plan and the possible environmental impacts of the Plan's implementation have been predicted and evaluated.

VIII-1 Environmental Conditions of Study Area

The identified characteristics of the environmental conditions of the Study Area are summarised in Table VIII-1.

VIII-2 Environmental Issues to be Considered in Project Formulation Process

Based on the identified environmental conditions in the Study Area, the environmental issues to be considered in the project formulation process were examined and the findings are described below.

Table VIII-1 Environmental Conditions of Study Area

(1) Socioeconomic Environment	
Land Ownership	State forests, enclave, private land and desa land
Land Use	Paddy field, dry crop field, mixed garden, open grassland, shrub and bush, natural/secondary forest, man-made forest, settlement, etc.
Economic Activities	Agriculture and stock raising
Customary Practices	Exclusive right of use is associated with the land, exception state land, and land may be inherited by blood kin
Local Inhabitants	There are some long-standing illegal settlers in the state forests
Public Health	Nothing special
Population	Total population of 23 desas, the administrative areas of which cover the Study Area: approximately 31,000
(2) Natural Environment	
Climate	Mean annual rainfall: 1,174 - 1,518 mm, more than 90% of which is concentrated between November and April. The severe dry season lasts from May to October. The mean monthly temperature is 25.5 - 28.9°C with minimum and maximum temperatures of 19.0°C and 34.6°C respectively. The monthly evapotranspiration is 108 - 235 mm. The prevailing wind is from the east between April and July and from the west between August and March.
Vegetation	The original vegetation was tropical monsoon forest with palm forests in the lowlands. The current vegetation consists of farmland, degraded land due to forest fires and burning, grassland, palm tree forests, savannah and remaining tropical monsoon forests. Mangrove forests are observed at the rivermouths.
Topography	The Study Area is closed by gentle ridges with an elevation of 500 - 600 m and shows an almost regular distribution of alluvial lowland, raised coral terraces, hills and mountains.
Geology/Soil	The geological components of the Study Area are fluvial deposits, coralline rock, marl and shale. The dominant soil type in the mountainous areas is chromic luvisols. This soil, which has a slightly low pH value, is derived from calcareous materials and its productivity is slightly low. While it does not necessarily determine the type of land use, it is advisable to use sloping land with this type of soil as forest land from the viewpoint of soil conservation because of its vulnerability to erosion. If it is used for cultivation or if forest regeneration work is conducted at such land, measures to prevent soil erosion should be employed.
Hydrology	Three major rivers, i.e. Oesao, Oebelo and Olio, are located in the eastern part and western part of the Study Area and in-between respectively. All these rivers originate from the headwater mountain range in the south and empty into Kupang Bay in the north. Oesao River has the largest watershed and the highest discharge.
Ecosystem	While the remaining tropical monsoon forests are scattered in the mountainous areas in the southwestern part of the Study Area, palm tree forests, grassland and natural eucalyptus forests are observed in the lowlands. Mangrove forests are observed in areas adjacent to the Kupang Bay Marine Recreation Area where the mouths of the main rivers are located.
Rare Fauna	The species of wild fauna protected by law in Indonesia and believed to inhabit the Study Area are listed in Table VIII-2.

(1) Protected Wild Fauna

Of those wild fauna protected by government laws and notifications of the East Nusa Tenggara provincial government, those which are believed to live or which do live in the Study Area are shown in Table VIII-2. The information accuracy was confirmed by wildlife experts at the Nature Protection Centre (BKSDA) and Nusa Cendana University and by local inhabitants using the list of designated species compiled by the BKSDA which is a local agency of the MOF.

Undan Kacamata *Pelecanus conspicillatus* is a species of pelican which is protected by the Bilateral Migrating Birds Protection Treaty and some 40 - 50 of these are said to arrive from Australia in the paddy fields of Desa Oesae, located in the northeastern part of the Study Area, in January - March every year. Although the paddy fields will not be affected by the Plan, attention should be paid to avoiding any indirect adverse impacts by the Plan on these birds.

Kupang Bay Marine Recreation Area is located beyond the 5 m wide belt of the beach line along the coast of the Study Area and covers a total sea area of 50,000 ha. It is believed that this area has many coral and shellfish species to be protected. Any Plan-related work in coastal mangrove forests and watershed conservation works in the area must carefully take these species into consideration in order to ensure their survival.

(2) Soil and Water Conservation in Southwestern Mountain Ranges

The geology of the headwater areas in the southwestern mountain ranges in the Study Area, which are believed to be the main areas for Plan-related work, shows a predominance of shale and marl in the upper reaches of Oebelo River and Olio River and of coralline rock in the upper reaches of Oesao River. This difference in geology has led to significant topographical and soil type differences between the two areas. In the mountain ranges of the Olio Watershed and the watershed of Oelelo River, a tributary of Oebelo River, many landslide sites which are assumed to be attributed to the local geological features are observed at the upper parts of slopes and along ridges. In these southwestern mountain ranges, attention must be paid to the special geological and topographical features of the subject areas when implementing Plan-related work, particularly planting.

There is a fairly high density of natural *Casuarina* spp. in the mountain ridge areas of the southwestern part of the Study Area. As this species is a soil improving species with the help of the root nodule bacteria, it can be considered a strong candidate as a pioneer tree species for reforestation work at the shale and marl sites vulnerable to landslides.

(3) Forest Conservation Around Falls and Lakes

A valley with a waterfall lies upstream of Dusun Koat in Desa Tesbatan in the southeastern part of the Study Area. Although the discharge in the valley significantly declines at the end of the dry season, there is a flow of clean water throughout the year. This water is supplied to the water storage tanks owned by inhabitants in the lowerstream via a pipeline for both domestic and irrigation use. There are also separate irrigation channels to assist the development of local farming.

Lake Nafko is located in Desa Apren in the southeastern part of the Study Area which is reported to be used by villagers as a fish culture pond. In general, this lake begins to store water in December at the beginning of the rainy season and keeps some water until the end of August in the second half of the dry season. It is dried up from September to November.

The above fall and lake are surrounded by state-owned, naturally regenerated, secondary forests which are believed to be the remains of the original tropical monsoon forests, forming forest land consolidations which are rare in the Study Area. Protection of the existing forests should not be the only consideration for forest development under the Plan and strengthening of the soil and water conservation functions of the existing forests should also be particularly emphasised. While neither the kecamatan nor kabupaten authorities currently plan to utilise the forests around the above-mentioned fall and lake, the possibility of introducing measures to use them from a broader perspective should not be discounted.

Table VIII-2 Wild Fauna Protected by Law in Indonesia and Believed to Inhabit the Study Area

Indonesian Name	Scientific Name
[Mammalia]	
Rusa Timor	<i>Cervus timorensis</i>
[Reptiles]	
Biawak Timor	<i>Varanus timorensis</i>
Sanca Timor	<i>Python timorensis</i>
[Aves]	
Burung Elang	<i>Aviceda subberista</i>
Raja Udang	<i>Alcedo atthis</i>
Burung Madu	<i>Anthreptes malacensis</i>
Rangkonk Sumba	<i>Rhyticeros everetti</i>
Elang Laut	<i>Haliaetus leucogaster</i>
Gangsa Batu Coklat	<i>Sula leucogaster</i>
Bangau Putih Susu, Bluwok	<i>Mycteria cinerea</i>
Kuntul Karang	<i>Egretta sacra</i>
Undan Kacamata	<i>Pelecanus conspicillatus</i>
[Insects]	
Kupu Raja Plato	<i>Troides plato</i>
[Coral]	
Ketam Kelapa	<i>Birgus latro</i>

Sources 1) Mengenai Khasanah Satwa Di Propinsi NTT, Sub-Balai Konservasi Sumber Daya Alam NTT, 1994

2) "Indonesia: A Glimpse of Nature Conservation" published by the Ministry of Forestry, Republic of Indonesia, 1991/1992

(4) Forest Conservation Around Water Sources

Fountains or wells are often observed around or at the centre of settlements. As these are important to secure water for domestic use or animals from the underground water veins, local inhabitants are said to be careful in regard to conserving the trees around them. However, the reality is that the ground cover by trees around the fountains and wells is inadequate. Those trees surrounding water sources should be protected to conserve the area as it is essential to secure such water sources to maintain and improve the lives of local inhabitants in terms of a stable supply of domestic water and water for animals, etc.

(5) Environmental Conservation of Communal Graveyards

Apart from small family-based graveyards, a large communal graveyard covering 1 - 2 ha has recently been planned or constructed in each village under the guidance of the provincial government. The implementation of the Plan must take the existing plans for these communal graveyards into careful consideration.

(6) Development of Sandalwood and Mangrove Forests

Sandalwood has long been strongly protected as East Nusa Tenggara Province's only important commercial commodity. When a tree reaches a specific size, it is registered for the purpose of prohibiting its felling until such time when it becomes usable with the accumulation of scented oil. Sandalwood originally grows in limestone areas and is said to have strong resistance to drought. While it is suited to the climate of Timor Island, the resources are dwindling due to cutting over many years. The stage has now been reached where special attention is required in regard to the conservation of genes. The East Nusa Tenggara provincial government has been making heavy investment in order to consolidate the sandalwood resources. One example is a 25 ha sandalwood plot at an industrial reforestation site run by the Perum Perhutani in the Study Area. The practice of agroforestry has been introduced, combining the planting of sandalwood with the cultivation of crops by the local inhabitants. This and other examples suggest that the planting of sandalwood has now reached the practical project stage. Some issues still require clarification, however, including the best combination of sandalwood trees and preliminary, as well as secondary, host plants. These uncertainties stress the need for continuous efforts to achieve the ideal development of sandalwood forests.

In the case of mangrove forests lying next to the area designated as the Kupang Bay Marine Recreation Area, their cutting is prohibited in view of their protection. However, already cutting is taking place at some sites, causing a likelihood of coastal erosion. Further efforts are, therefore, required to strengthen the protection measures.

VIII-3 Prediction of Environmental Impacts and Preliminary Assessment

The prediction and preliminary assessment of the environmental impacts of various components of the Plan have been conducted taking the environmental characteristics of the Study Area into consideration.

(1) Environmental Impacts Preliminary Assessment Method

As the Plan stipulates the basic principles for land rehabilitation work instead of the details of such work, assessment of its environmental impacts is of a preliminary, abstract and qualitative nature. The assessment procedure is illustrated in Fig. VIII-1.

(2) Factors Affecting Environment and Environmental Elements

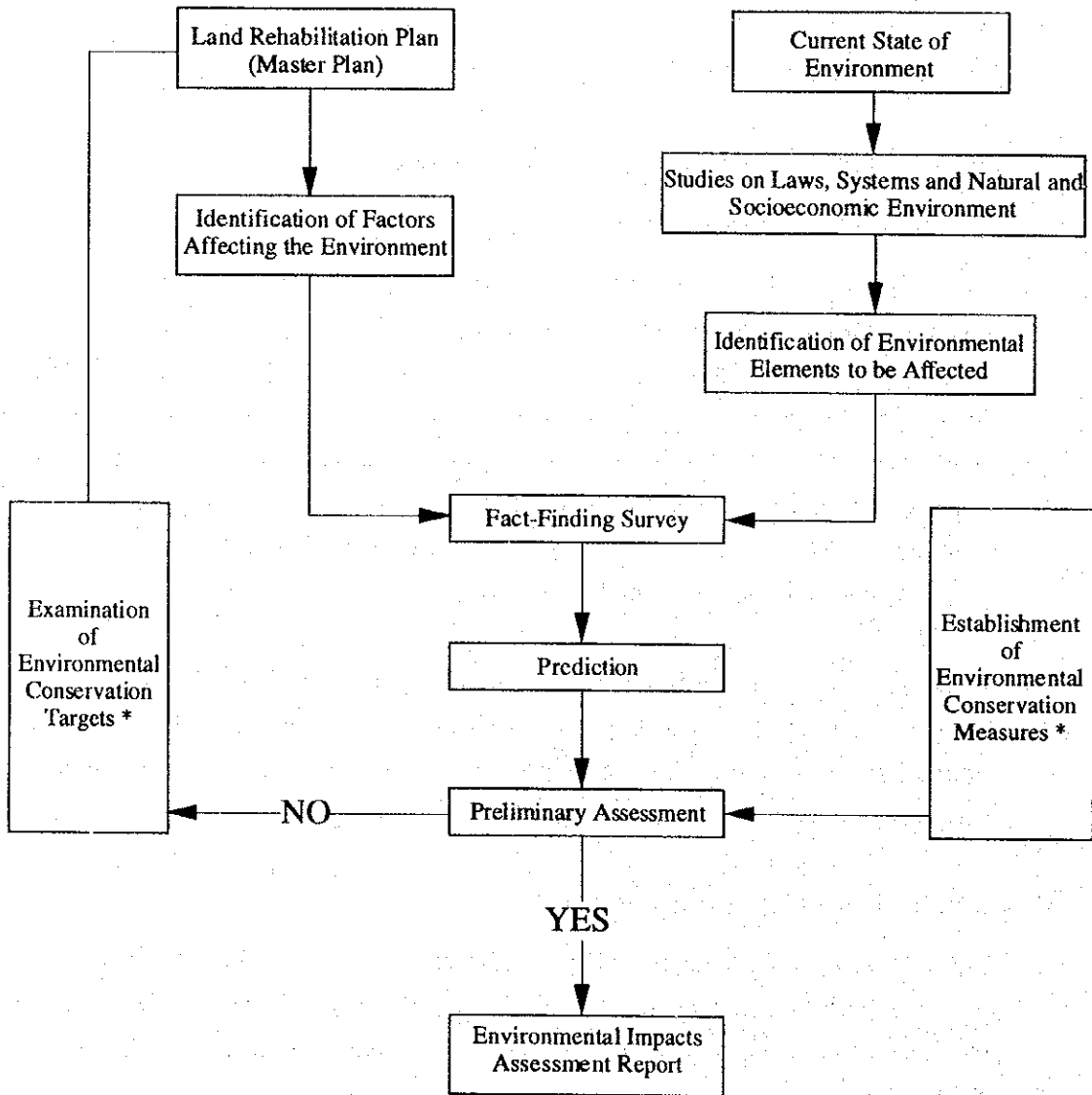
1) Identification of Factors Affecting Environment

The major development activities under the Plan as shown in Table VIII-3 are the construction of new roads, reforestation, as shown in Table VIII-3 nursery practice, erosion control, farmland improvement and silvopastoral (grassland improvement). Given these activities, the likely factors affecting the environment are construction work, permanent sites for specific use and/or facilities following the completion of individual projects, activities to be conducted at these sites or facilities and human activities. Table VIII-4 lists the factors which are likely to affect the environment at different stages of the Plan's implementation.

Although the encouragement of natural regeneration is planned for natural/secondary forests with a crown density of less than 70%, its description is omitted from the present report due to the fact that the Plan does not anticipate active development efforts in this regard.

2) Identification of Environmental Elements

The environmental elements which are believed to be affected by the factors listed in Table VIII-4 have been identified and the causal relationship between the said factors and elements have been examined. The examination results are given in Table VIII-5.



Note: * Generally of an abstract of qualitative nature.
 Source: Based on Practical Environmental Assessment
 (Environmental Development Division, Kajima Corporation, 1987)

Fig. VIII-1 Environmental Impacts Assessment Procedure

Table VIII-3 Development Activities Under the Plan

Development Activity	Work Involved	Operation Size (ha; m)	Major Structures (Machinery)
Road Construction	Cutting, banking, side ditch construction and gravel paving	103,000	None
Reforestation	Planting of forest trees, soil improving and fodder trees (tumpangsari system)	4,672 ha	None
Nursery Practice	Production of seedlings	2 ha	
Erosion Control	Hillside work, stream work, and bank planting	23 and 303 check dams	Check dams and revetment work
Farmland Improvement (Agroforestry)	Distribution of seedlings for intercropping and agroforestry involving fruit trees	6,300 ha	Terracing
Grassland Improvement (Silvopastoral)	Planting of fodder trees, creation of grassland and improvement of natural grassland	3,700 ha	

Table VIII-4 Factors Affecting the Environment

Development Activity	Implementation of Construction Work	Existence of Facility	Common Activity
Forest Road Construction	New construction or improvement of roads	Road	Vehicle traffic
Reforestation	Planting	Reforestation site	Land preparation, planting and tending
Nursery Practice	Creation of nursery	Nursery	Nursery activities
Erosion Control	Erosion control work and improvement of erosion control facilities	Erosion control facilities	Sedimentation and water storage
Farmland Improvement	Planting and terracing	Farmland	Farming
Grassland Improvement	Creation of grassland and planting	Grassland	Grazing

Table VIII-5 Relationship Between Factors Affecting the Environment and Environmental Elements Affected

Environmental Elements Affected		Factors Affecting Environment					
		Forest Road Construction	Reforestation	Nursery Practices	Erosion Control	Farmland Improvement	Grassland Improvement
Geosphere	Topography	○	-	-	○	-	-
	Soil	○	Δ	-	Δ	○	○
Hydrosphere	Hydrology	○	○	-	-	-	-
	Water Quality	○	Δ	-	Δ	Δ	Δ
Atmosphere	Weather	-	○	-	-	-	-
	Air Quality	Δ	○	-	-	-	-
	Noise	○	-	-	-	-	-
Biosphere	Flora	Δ	○	-	-	○	Δ
	Fauna	Δ	○	-	-	-	-
Landscape	Landscape	○	○	-	○	-	-
Socioeconomy	Land Use	-	○	-	-	○	Δ
	Transport	○	-	-	-	-	-
	Employment	○	○	○	○	○	○
	Health and Hygiene	Δ	-	Δ	-	Δ	-
	Firewood Supply	○	○	-	-	○	○

Note

○: Affected, Δ: Slightly Affected, -: Hardly Affected

(3) Environmental Conservation Targets

An environmental conservation target has been determined for each environmental element listed in Table VIII-5 as shown in Table VIII-6. The basic principle adopted is "maintenance of the present state of the environment and minimisation of any undesirable effect".

(4) Prediction of Degree of Impact of Development Activity

Based on various materials on the environment and the findings of the field survey, the likely degree of impact of each development activity (factor affecting the environment) on the environmental elements is predicted. Table VIII-7 gives the prediction results in connection with the causal relationship between the said factors and elements. The forecast impacts of different development activities under the Plan are described below.

Table VIII-6 Environmental Conservation Targets Under Land Rehabilitation Plan

Environmental Elements		Conservation Target
Geosphere	Topography	Maintenance of present state with no noticeable change
	Soil	Minimum surface soil loss
Hydrosphere	Hydrology	Maintenance of approximately present runoff
	Water Quality	Maintenance of approximately present water quality
Biosphere	Flora	Protection of rare species
	Fauna	Protection of rare species
Landscape	Landscape	No major change of landscape (long view)
Socioeconomy	Land Use	Conversion to forest in Protection Zone. In other zones in principle, maintenance of present land use
	Transport	Transport safety
	Employment	Maintenance of approximately present level of employment
	Firewood and Charcoal Supply	Maintenance of approximately present level of firewood supply

Table VIII-7 Degree of Impact by Development Activity on Environmental Elements

Environmental Elements Affected		Factors Affecting Environment					
		Forest Road Construction	Reforestation	Nursery Practices	Erosion Control	Farmland Improvement	Grassland Improvement
Geosphere	Topography	2	-	-	-	-	-
	Soil	2	+	-	+	+	+
Hydrosphere	Hydrology	1	+	-	+	-	-
	Water Quality	1	+	-	+	-	1
Atmosphere	Weather	-	+	-	-	-	-
	Air Quality	-	+	-	-	-	-
	Noise	-	+	-	-	-	-
Biosphere	Flora	1	+	-	-	+	-
	Fauna	1	-	-	-	-	-
Landscape	Landscape	-	-	-	-	-	-
Socioeconomy	Land Use	-	2	-	-	-	-
	Transport	+	-	-	-	-	-
	Employment	+	+	+	+	-	-
	Health and Hygiene	+	-	1	-	1	-
	Firewood Supply	-	-	-	-	-	-

Note

Degree of Impact - 3: Major Deterioration, 2: Medium Deterioration, 1: Minor Deterioration, +: Positive Impact, -: No Impact

1) Construction of Forest Roads

The health and hygiene environment may suffer a temporary decline depending on how the soil excavated or cut for the construction of roads is handled. The natural environment may also suffer in the form of altered vegetation, fauna, soil erosion, change of the flow regime of surface water and/or increased turbidity of river water depending on how the work is conducted. The degree of possible adverse impact may be considered to be in the range of minor to medium deterioration.

2) Planting

Many people have actually lived in the same place in state forest sites for more than 20 years. The forced relocation of these people to pave the way for planting under the Plan may well face strong resistance. In fact, reforestation is not planned at any site which may require the relocation of the present inhabitants and, therefore, adverse impacts vis-a-vis the present inhabitants should be minimal, if any. Depending on the designated sites for reforestation, significant restrictions on the historically accepted use of forests, particularly for grazing purposes, may be required. The resulting adverse impact should be considered to be of a minor to medium degree for those who strongly rely on grazing in national forests for their livelihood. In terms of the overall natural environment, it should be little affected by the Plan as replacement of the existing forests by man-made forests is not planned.

3) Nursery Practices

The possible adverse impact of nursery practices is associated with the increased use of agrochemicals to repel or combat diseases and harmful insects. Given the planned scale of use, the degree of adverse impact will be minor.

4) Erosion Control

No plan is envisaged to construct large dams which will significantly change the discharge level. Most of the erosion control work will be on a minor scale and, excluding the construction period, no significant impact on the social or natural environment is expected to result from such work.

5) Farm Land and Grassland Improvement

The expected expansion of agroforestry in the form of the tumpangsari system or the farmland improvement scheme under the Plan in the Study Area will lead to the increased production of farming crops. As most of the crops are common to the local farming scene and as a substantial increase of the use of agrochemicals is unlikely, the impact of agroforestry will be minor. No adverse impact on the natural environment is anticipated.

6) Positive Impacts of Forest Establishment, etc.

The implementation of the Plan is expected to result in an overall improvement of the living environment in the Study Area. In regard to the social environment, forest development activities may increase employment opportunities and improve the lives of local inhabitants. In regard to the natural environment, forest rehabilitation

can have many positive impacts. For example, the construction of various roads will improve the road network with a wider effect on the basis for local life and economic activities. Forest roads will also function as fire-breaks to contain the spread of forest fires. Planting will strengthen the local firewood resources as well as intensify the soil and water conservation functions and environmental conservation function of forests while erosion control work will have a direct bearing on the prevention of landslides and land collapse. Agroforestry and silvo-pasture are expected to contribute to the improvement of local life and ensure the growth of trees through joint work by the authorities concerned and local inhabitants while keeping damage due to grazing and/or forest fires, etc. to a minimum.

(5) Preliminary Assessment

The preliminary assessment of the possible impacts of the implementation of various projects under the Plan on the local environment has been conducted taking the prediction of such impacts and the environmental conservation targets shown in Table VIII-5 and Table VIII-7 respectively into consideration. The assessment results are given below.

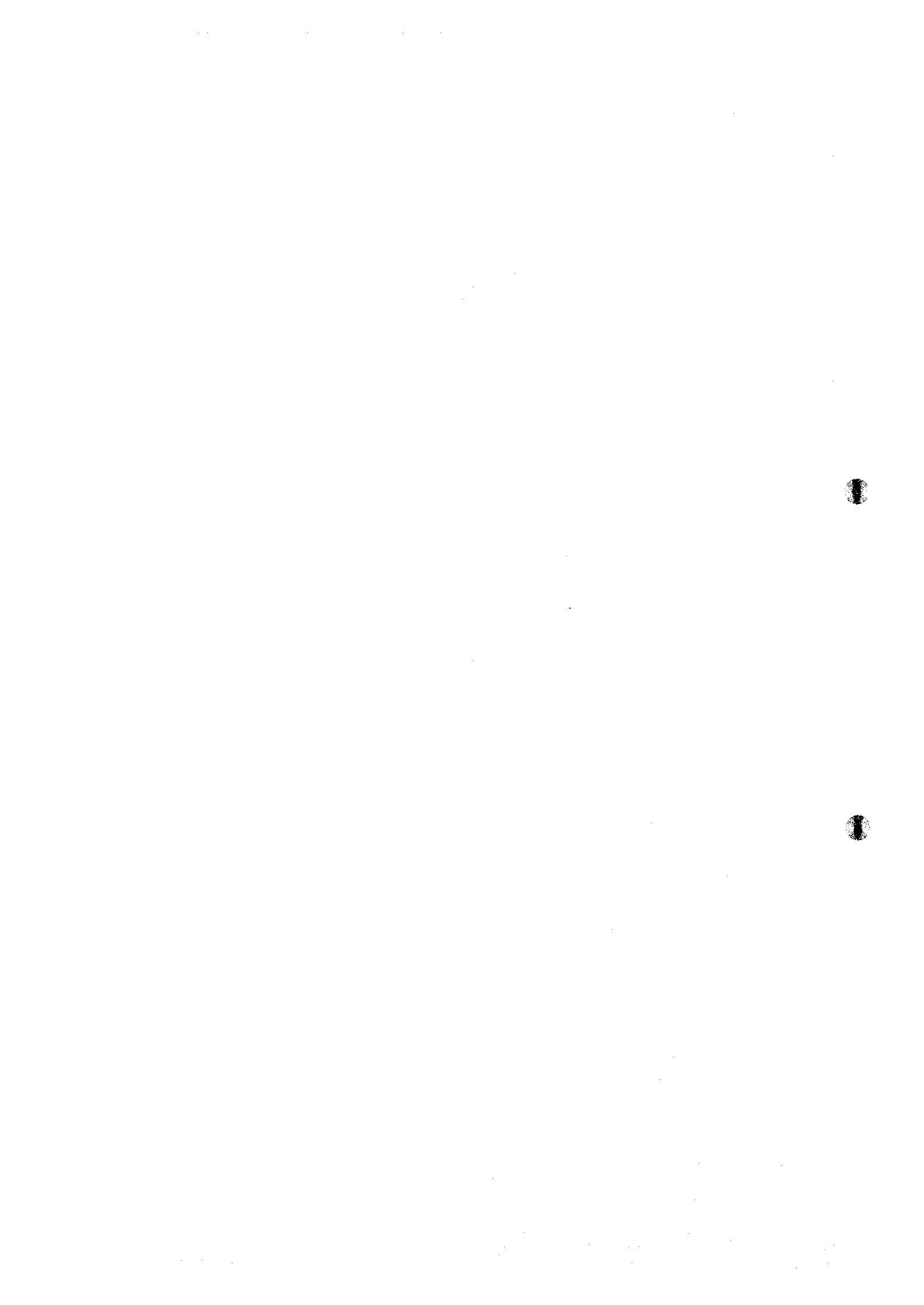
1) Natural Environment

Of the 6 planned development activities under the Plan, only road construction is predicted to cause any adverse impact on the environmental elements. All other activities are expected to have a favourable impact through the creation of forests and other soil and water conservation measures. The policies of avoiding steep road gradients and greening slope areas above 0.5 m of the road surface have been adopted for the road construction programme in line with the conservation target of not causing any topographical change or surface soil loss at those sites where medium deterioration is predicted due to the topographical and soil conditions. Because of these precautions, the conservation targets under the Plan for all natural environmental elements are assessed as achievable.

2) Socioeconomic Environment

Of the 6 planned development activities under the Plan, it is believed that reforestation and natural regeneration will result in possible restrictions on local life and grazing rights at the subject sites. These negative possibilities should be solved at the stage of preparing the concrete implementation programme for the Plan. In regard to nursery practices and agroforestry (farmland improvement), the excessive use of agrochemicals could have an adverse impact on health and hygiene. Other

activities should prove beneficial in terms of increased employment and a better transport network. The Plan has already acknowledged the possibility of negative development and calls for thorough dialogue with local inhabitants on issues affecting their lives and also for the appropriate use of agrochemicals. Consequently, the environmental conservation targets for all the socioeconomic elements are assessed as achievable.



CHAPTER IX

TRANSFER OF TECHNOLOGY



CHAPTER IX TRANSFER OF TECHNOLOGY

The transfer of technology was conducted by means of OJT during the field survey period and training in Japan for those counterparts selected from among staff members of Sub-Balai RLKT Benain Noelmina.

IX-1 Transfer of Technology in Indonesia

For the smooth progress of the Study and effective transfer of technology, a regular Monday meeting was held between the above counterparts and other technical staff members of the Sub-Centre and the Japanese Study Team members at the Sub-Centre to explain and discuss the subject issues of the Study for the coming weeks and ways to conduct the Study. The subject fields for the transfer of technology were land rehabilitation planning, social forestry and extension, reforestation and agroforestry, watershed conservation and forestry infrastructure, socioeconomic and local inhabitants, land use and vegetation, soil, environmental impacts, surveying and mapping.

In the field of land rehabilitation planning, discussions were held on a suitable method to formulate a land rehabilitation plan suitable for a specific locality, taking the natural conditions, socioeconomic conditions and all other relevant conditions into consideration.

In the field of social forestry and extension, discussions focused on the principles of social forestry and its extension, the current conditions of social forestry and problems associated with social forestry. In addition, OJT was provided on methods of conducting an interview survey and social forestry survey.

In the field of reforestation and agroforestry, OJT was provided on methods to check the achievements of existing planting sites and to conduct a forest survey using aerial photographs.

In the field of watershed conservation and forestry infrastructure, OJT was provided on the landslide site survey method, erosion pin method, check dam sedimentation volume survey method and stream devastation survey method, etc.

In the field of socioeconomic and local inhabitants survey, OJT was provided on various aspects of a questionnaire survey aimed at local inhabitants. The aspects included the sampling method, questionnaire preparation techniques, actual interview techniques and compilation techniques, etc.