4-3 Work Plans (Project Component)

4-3-1 Nursery Stock Production Plan

(1) Nursery Establishment

1) Nursery Sites

It has been decided that one nursery will be built in each working unit as shown below.

Working unit	Area (m^2)	Compartment	Subcompartment	Location
I	30,000	10	F	Flat land near the public road to the south of Jirak
II	35,000	19	A	Flat land to the south of the public road and to the east Benakat
III	30,000	4	D	Flat land on the right bank of S. Kembahan and to the south of Rambutan

The locations of the nurseries are shown in Fig. 4-4 and Attached Fig. 2-1, 2-2, 2-3, 2-4. The construction of the nursery facilities, roads and reservoirs, etc. will be conducted by machinery which will also be used for the construction of the forest roads.

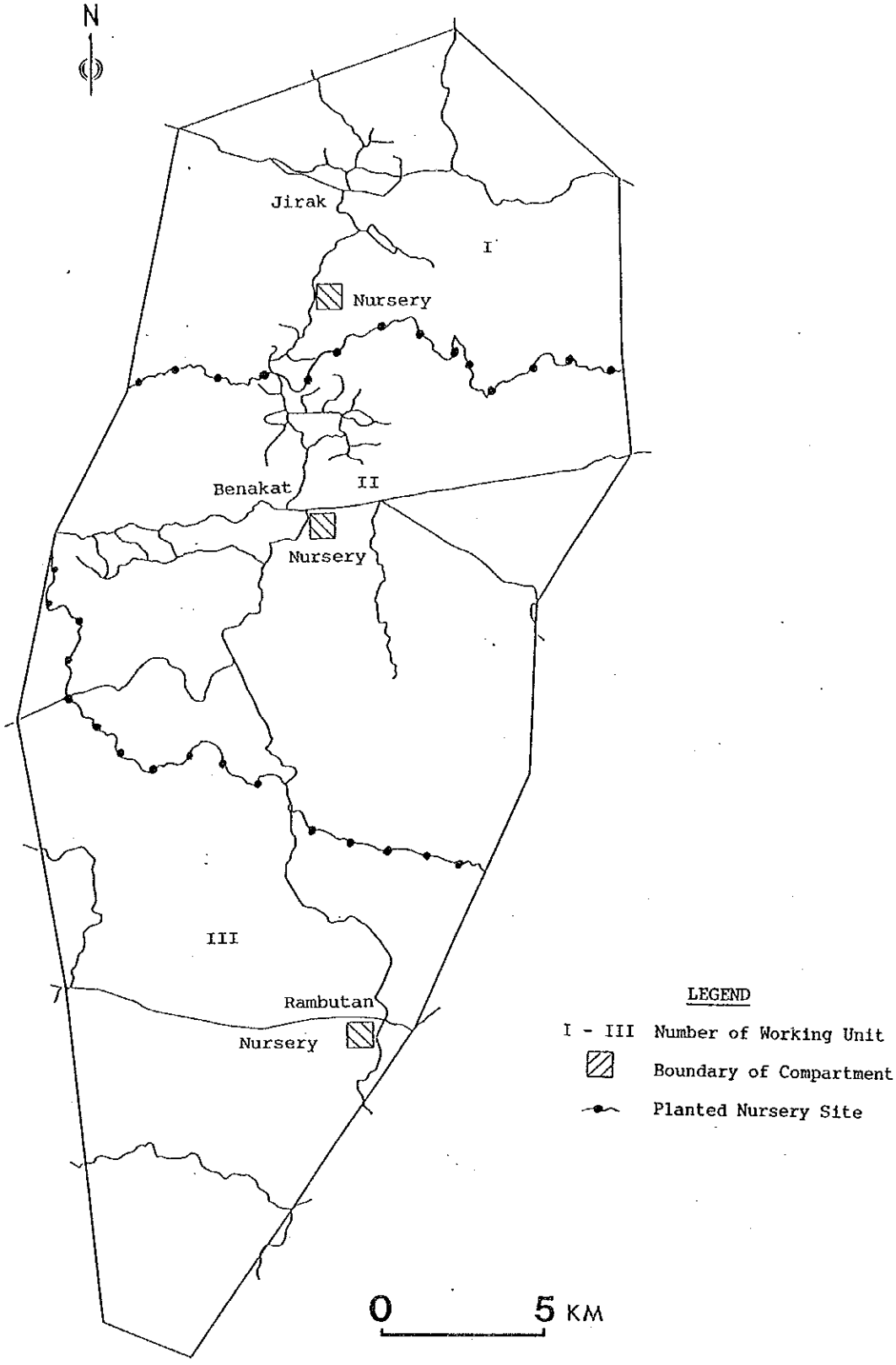


Fig. 4-4 Planned Area for Nursery Establishment

2) Nursery Size

The nursery size for each working unit has been decided as follows in view of the planned nursery stock production volume and the size of the auxiliary facility site.

Working unit	I	II	III
Maximum Stock production capacity (in thousand stocks)	1,817	2,233	1,698
Number of nursery beds* (in thousand places)	341	419	319
Total area of (germination bed and nursery beds) (m^2)	6,500	8,000	6,200
Area of the incidental facilities to the nursery beds (m^2)	4,500	6,000	4,500
Protection tree belts and arboretums (m^2)	19,000	21,000	19,300
Total area (m^2)	30,000	35,000	30,000

* 1 nursery period

3) Nursery Facilities

The following facilities will be provided for each nursery.

a) Work Facilities

i. Field

The field will be divided into several blocks by nursery roads and drains will be provided at the roadsides.

ii. Workshops

The soil heating workshop and soil yard will be separated from the outdoor workshop. Pot storage, pot soil storage, workspace for filling heated soil into pots and transplanting and temporary storage for the transplanted pots will be provided in the outdoor workshop.

iii. Irrigation Facilities

Water tanks will be provided for irrigation of the field. Water will be pumped from the reservoir to these water tanks.

iv. Warehouse

The materials required for nursery operation, including vinyl pots, fertilizers and materials for nursery repair, will be stored in the warehouse.

v. Fuel Storage

Fuel and lubricating oil for the vehicle and machinery will be stored in the fuel storage which will also serve for plantation work.

vi. Work House

This will be used for such indoor work as the preparation of cuttings and will serve as a shelter for other work during rain. It will also be used as the workers' station.

b) Other Facilities

i. Office Building, Repair Shop and Garage, etc.

These will be shared for the plantation work.

ii. Nursery Roads

The access and perimeter roads and roads dividing the blocks will be 6m in width while work roads in the field will be 3m in width.

iii. Protection Tree Belts

Shelter belts (Protection tree belts) will be introduced to prevent dust from external roads and damage due to wind.

Table 4-9 shows the sizes of the above facilities for each working unit while Fig. 4-5 shows the distribution of these facilities.

Table 4-9 Main nursery facility by working unit

Item \ Working unit		I	II	III
Work	Place for bed	6,500 m2	8,000 m2	6,200 m2
	Labour room	85 m2	110 m2	80 m2
	Irrigation system			
	(Pipeline)	200 m	400 m	200 m
	(Water storage tank)	3 tanks	4 tanks	3 tanks
	(Water Pump)	1 pump	1 pump	1 pump
	Warehouse	220 m2	250 m2	210 m2
	Soil heating shed	50 "	50 "	50 "
	Fuel storage room	* 20 "	20 "	20 "
	Work house	1,000 "	1,200 "	1.000 "
Non-work facility	Nursery office, Repair shop, Garage	* 280 "	300 "	280 "
	Road	500 m	500 m	500 m
	Protection treebelt	19,000 m2	21.000 m2	19,300 m2

*: Using for plantation or project management.

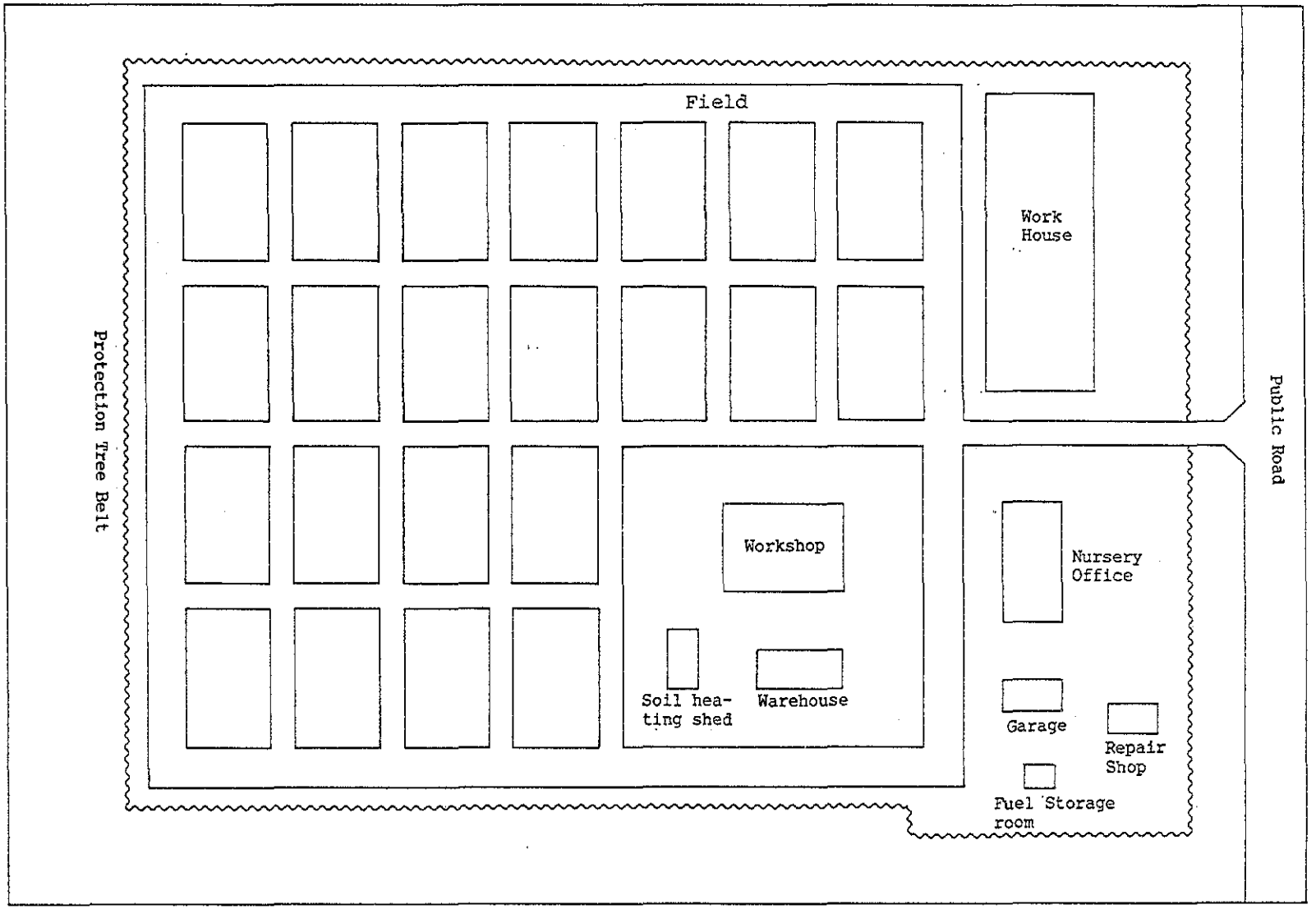


Fig 4-5 Schematic Layout of Nursery Facilities

Scale 1: 1,000 (Total area: 3ha)

(2) Nursery Methods

1) Nursery Work Procedure

The seedling method will be used for the preparation of stocks for 5 species (A. mangium, A. auriculiformis, A. falcataria, S. macrophylla and S. bancana) while cuttings will be used for P. canescens. All the species will be grown in pots in view of a stable stock supply and a higher survival rate. The standard nursery work procedure is shown in Fig. 4-6.

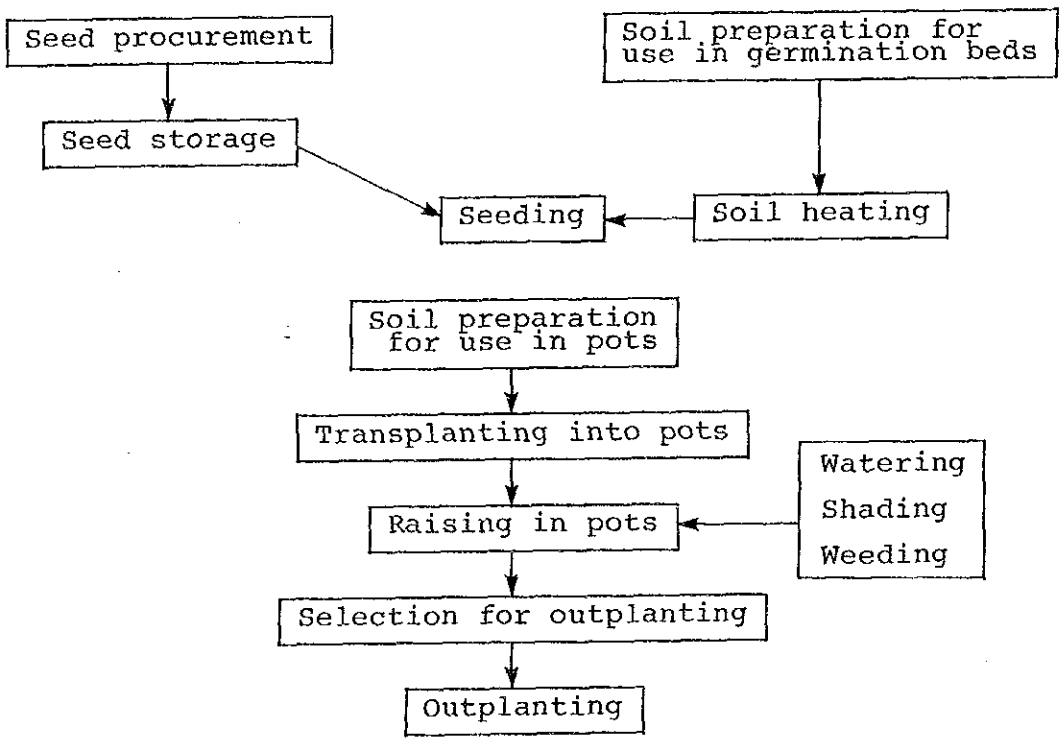


Fig. 4-6 Procedure for Nursery Work

In the case of P. canescens, cuttings will be directly placed in pots and the work processes for the other species using seeds which are described below will then be followed.

2) Required Seed Volumes

The required seed volumes of the selected species for the Plan are given in Table 4-10. Although seeds of A. mangium and S. bancana can be obtained in and around the Study Area, most seeds of A. auriculiformis, S. macrophylla and A. falcataria must be purchased from the Java area or elsewhere.

The seeds will be stored under controlled temperature and humidity in the seed storage room until the seeding season to prevent a decline in germination rate. A sufficient number of P. canescens cuttings will be secured from plantations in and around the Study Area and the survival rate of these cuttings is expected to exceed 90%.

While the supply of bred seeds and cuttings will be required for future afforestation work under the Plan, the present conditions of seed breeding in Indonesia do not allow the immediate provision of the necessary amounts of seeds and cuttings. In the course of the plantation work implementation, therefore, the establishment of both a seed orchard and a cuttings orchard should be considered with the assistance of organizations involved in seed breeding.

Table 4-10 Seed volume required for plantation

(Unit: kg)

Year	Acacia mangium	Acacia auriculiformis	Albizzia falcataria	Swietenia macrophylla	Schima wallichii var. bancana	Total
1	18	21	27	167	2	235
2	27	32	41	251	3	354
3	28	32	42	259	3	364
4	28	33	43	263	3	370
5	30	35	46	283	3	397
6	31	36	47	287	3	404
7	28	33	43	264	3	371
8	27	31	40	249	3	350
9	18	21	27	0	0	66
10	27	32	41	0	0	100
11	28	32	42	0	0	102
12	28	33	43	0	0	104
13	30	35	46	0	0	111
14	31	36	47	0	0	114
15	28	33	43	0	0	104
16	36	42	54	0	0	132
17	36	42	54	0	0	132
18	28	32	42	0	0	102
19	28	33	43	0	0	104
20	30	35	46	0	0	111
21	31	36	47	0	0	114
22	28	33	43	0	0	104
23	36	42	54	0	0	132
24	36	42	54	0	0	132
25	28	32	42	0	0	102
26	28	33	43	0	0	104
27	30	35	46	0	0	111
28	31	36	47	0	0	114
29	28	33	53	0	0	104
30	36	42	54	0	0	132
Total	877	1,023	1,330	2,023	23	5,276

3) Seeding

The soil used for the germination beds will be sterilized by burning (heating) and prepared by the addition of sand. In the case of germination boxes being used, these will be made of wood (each box will be 37cm long, 47cm wide and 10cm high). Approximately 2 weeks will be required from the initial seeding to transplanting to pots. During this period, special attention should be paid to the proper watering of the beds and the prevention of disease and insect damage.

4) Nursing in Pots

The soil used for the pots will be surface soil collected from forest land. Fertilizer and sand, etc. will be added to the soil and the whole mixture will be stirred by a mixer to prepare the required pot media.

The pots will be made of vinyl and each pot will be 6cm in diameter and 12cm in depth. The germinated seeds will be replanted in the pots while the cuttings will be placed directly in the pots in the case of P. canescens.

3 - 4 months will be required to obtain adequate stocks, Watering, sunshading and weeding must be conducted during this period. Watering should be conducted once or twice a day in fair weather and oversaturation must be avoided by carefully examining the growth conditions of the seedlings. The standard stock height for outplanting will be 30 - 40cm.

5) Selection of Stocks and Outplanting Trees

Those stocks damaged by disease or insects will be removed prior to outplanting. The stock survival rate

prior to outplanting is expected to be 80%. The stocks for outplanting will be transported by truck to the planting sites in the boxes to prevent drying and damage during transportation.

6) Standard Nursing Work Process

The standard nursing work process is shown in Table 4-11.

(3) Planned Seedling Nursery Stocks Volume by Year

The number of stocks to be produced annually has been calculated based on the planned planting area per year and the planting density and the calculation results are given in Table 4-12. The number of stocks produced annually will reach a peak in the fifth or sixth year of 1,724,000 pots for Working Unit I, 2,233,000 pots for Working Unit II and 1,698,000 pots for Working Unit III. As mentioned earlier, the survival rate used for the calculation is 80%.

(4) Labour and Equipment

Table 4-13 shows the labour and equipment required for the Nursery Plan.

Table 4-11 Nursery work standard

(per one thousand seedlings)

No.	Work component	Amount of work (man-days/thousand stocks)	Remarks
1	Seed collection	0.037	
2	Seed sellection	0.040	
3	Soil heating	0.076	Including transporting of bed media from the sand yard to soil heater.
4	Germination bed preparation	0.107	Material for beds will be procured in Benakat.
5	Filling with media	0.043	Into germination beds.
6	Seeding	0.034	
7	Watering	0.028	2 times/day, 30 days
8	Seedling disinfection	0.003	
9	Top soil collection	0.131	
10	Pot media mixing	0.457	
11	Hole making (pots)	0.047	
12	Transportation of pot media	0.148	
13	Potting with media	1.275	
14	Cleaning seedling bed	0.025	
15	Transplanting	1.325	
16	Shading	0.015	
17	Watering	1.369	2 times/day, 60 days
18	Disinfection	0.021	
19	Supplementary prick	0.297	Pricking percentage is 13%
20	Cleaning of weeds	0.824	1 time/10 days
21	Seeding sellection & out-planting	0.299	
22	Cleaning of beds	0.147	
Total		6.748	

Table 4-12 Nursery Stock Production Plan by Year - Total -

(1,000 pots)

Year	First Group A	First Group B	First Group C	First Group Sub Total	Second Group D	Third Group E	Third Group F	Third Group Sub Total	Total
1	856.9	856.9	825.3	2,539.1	222.1	222.1	190.4	412.5	3,173.7
2	1,287.3	1,287.3	1,239.7	3,814.3	333.8	333.8	286.0	619.8	4,767.9
3	1,324.6	1,324.6	1,275.6	3,924.8	343.4	343.4	294.4	637.8	4,906.0
4	1,345.4	1,345.4	1,295.5	3,986.3	348.8	348.8	298.9	647.7	4,982.8
5	1,448.7	1,448.7	1,395.0	4,292.4	375.7	375.7	321.9	697.6	5,365.7
6	1,477.9	1,477.9	1,423.3	4,379.1	383.2	383.2	328.4	711.6	5,473.9
7	1,350.5	1,350.5	1,300.5	4,001.5	350.1	350.1	300.2	650.3	5,001.9
8	1,277.0	1,277.0	1,229.7	3,783.7	331.1	331.1	283.8	614.9	4,729.7
9	856.9	856.9	825.3	2,539.1	0.0	0.0	0.0	0.0	2,539.1
10	1,287.3	1,287.3	1,239.7	3,814.3	0.0	0.0	0.0	0.0	3,814.3
11	1,324.6	1,324.6	1,275.6	3,924.8	0.0	0.0	0.0	0.0	3,924.8
12	1,345.4	1,345.4	1,295.5	3,986.3	0.0	0.0	0.0	0.0	3,986.3
13	1,448.7	1,448.7	1,395.0	4,292.4	0.0	0.0	0.0	0.0	4,292.4
14	1,477.9	1,477.9	1,423.3	4,379.1	0.0	0.0	0.0	0.0	4,379.1
15	1,350.5	1,350.5	1,300.5	4,001.5	0.0	0.0	0.0	0.0	4,001.5
16	1,705.5	1,705.5	1,642.3	5,053.3	0.0	0.0	0.0	0.0	5,053.3
17	1,715.8	1,715.8	1,652.3	5,083.9	0.0	0.0	0.0	0.0	5,083.9
18	1,324.6	1,324.6	1,275.6	3,924.8	0.0	0.0	0.0	0.0	3,924.8
19	1,345.4	1,345.4	1,295.5	3,986.3	0.0	0.0	0.0	0.0	3,986.3
20	1,448.7	1,448.7	1,395.0	4,292.4	0.0	0.0	0.0	0.0	4,292.4
21	1,477.9	1,477.9	1,423.3	4,379.1	222.1	0.0	0.0	0.0	4,601.2
22	1,350.5	1,350.5	1,300.5	4,001.5	333.8	0.0	0.0	0.0	4,335.3
23	1,705.5	1,705.5	1,642.3	5,053.3	343.4	0.0	0.0	0.0	5,396.7
24	1,715.8	1,715.8	1,652.3	5,083.9	348.8	0.0	0.0	0.0	5,432.7
25	1,324.6	1,324.6	1,275.6	3,924.8	375.7	0.0	0.0	0.0	4,300.5
26	1,345.4	1,345.4	1,295.5	3,986.3	383.2	0.0	0.0	0.0	4,369.5
27	1,448.7	1,448.7	1,395.0	4,292.4	350.1	0.0	0.0	0.0	4,642.5
28	1,477.9	1,477.9	1,423.3	4,379.1	331.1	0.0	0.0	0.0	4,710.2
29	1,350.5	1,350.5	1,300.5	4,001.5	0.0	0.0	0.0	0.0	4,001.5
30	1,705.5	1,705.5	1,642.3	5,053.3	0.0	0.0	0.0	0.0	5,053.3
Total	41,901.9	41,901.9	40,350.8	124,154.6	5,376.4	2,688.2	2,304.0	4,992.2	134,523.2

A: Acacia mangium B: Acacia auriculiformis C: Albizzia falcataria

D: Peronema canescens E: Swietenia macrophylla F: Schima wallichii var. bancana

Table 4-13 Summary of Materials and Inputs for the Nursery Works

Year	Amount of work (man-days)	Seeds (kg)			Machinery		Construction			
		A. falcataria	A. auriculiformis	S. macrophylla	Soil burner (burners)	Belt conveyor (conveyors)	Stores room (m^2)	Fertilizer storage room (m^2)	Workers' shed (m^2)	Water storage tank (tanks)
1	23,496	20.7	27.1	170.0	3	3	680	90	275	10
2	35,292	31.1	40.8	251.0	0	0	0	0	0	0
3	36,317	32.0	42.0	258.2	0	0	0	0	0	0
4	36,885	32.5	42.6	262.3	0	0	0	0	0	0
5	39,719	35.0	45.9	282.5	0	0	0	0	0	0
6	40,521	35.7	46.8	288.1	3	3	0	0	0	0
7	37,026	32.7	42.8	263.2	0	0	0	0	0	0
8	35,012	30.9	40.5	248.9	0	0	0	0	0	0
9	18,795	20.7	27.1	0.0	0	0	0	0	0	0
10	28,236	31.1	40.8	0.0	0	0	0	0	0	0
11	29,054	30.9	42.6	0.0	0	0	0	0	0	10
12	29,511	32.5	45.9	0.0	0	0	0	0	0	0
13	31,774	35.0	46.8	0.0	3	3	0	0	0	0
14	32,419	35.7	42.8	0.0	0	0	0	0	0	0
15	29,622	32.7	40.5	0.0	0	0	0	0	0	0
16	37,407	41.3	54.0	0.0	3	3	0	0	0	0
17	37,636	41.5	54.4	0.0	0	0	0	0	0	0
18	29,054	30.9	42.0	0.0	0	0	0	0	0	0
19	29,511	32.5	42.6	0.0	0	0	0	0	0	0
20	31,774	35.0	45.9	0.0	0	0	0	0	0	0
21	34,064	35.7	46.8	0.0	3	3	0	0	0	0
22	32,092	32.7	42.8	0.0	0	0	0	0	0	0
23	39,949	41.3	54.0	0.0	0	0	0	0	0	0
24	40,217	41.5	54.4	0.0	0	0	0	0	0	0
25	31,835	32.0	42.0	0.0	0	0	0	0	0	0
26	32,346	32.5	42.6	0.0	3	3	680	90	275	0
27	34,365	35.0	45.9	0.0	0	0	0	0	0	0
28	34,970	35.7	46.8	0.0	0	0	0	0	0	0
29	29,622	32.7	42.8	0.0	0	0	0	0	0	0
30	37,407	41.3	54.0	0.0	0	0	0	0	0	0

4-3-2 Plantation Plan

(1) Species Composition

1) Selection of Suitable Planting Sites

The existence of 5 soil units (based on the FAO/UNESCO classification method) was confirmed in the Study Area during the soil survey as described earlier. All these soil units are considered suitable for afforestation except Plinthic Gleysols found near swamps.

In general, it can be said that tree growth is more favourable at the middle and lower sections of slopes rather than areas of relatively high altitude, including hill tops, ridgelines and the top sections of gentle hills. This tendency is confirmed by the height and density of alang-alang. The species composition in the plantation areas has, therefore, been determined taking this tendency into consideration.

2) Avoidance of Damage Due to Disease or Harmful Insects

The extensive plantation of the same species runs a high risk of damage due to disease or harmful insects and, therefore, those species with medium or long rotation periods will be combined with species with short rotation periods to alleviate this risk.

Species with medium or long rotation periods will be distributed with a view to their acting as firebreaks on full growth. This arrangement should assist the planned firebreaks along forest roads, a description of which is given later. Therefore, these species will be planted in the form of belts or groups in view of harvesting convenience in the future.

The species composition based on the above is shown on the Annex Industrial Plantation Forest Implementation Map.

(2) Plantation Work

As much mechanized work as possible has been introduced in the planning of the plantation work due to the following reasons.

- The maximum planting area per year in the present Plan is as large as some 4,000ha.

- The general inclination of the planting sites is almost gentle, permitting efficient mechanized work.

- Mechanized plantation work is already familiar in the Study Area due to past work by the South Sumatera Provincial Forestry Service and the South Sumatera Reforestation Technical Centre, etc.

Each process of plantation under the Plan is described below with special emphasis on mechanized work.

1) Land Preparation

Most of the subject areas for pure plantation under the Plan are grassland, predominantly alang-alang grassland, with strong clayey soil. Ploughing will, therefore, be conducted twice prior to the first planting (the second ploughing is expected to give a harrowing effect). In the case of bush land, ploughing only once may be sufficient for the survival and growth of the planted trees given the relatively good soil conditions. However, the work plan for bush land must be carefully made taking the various conditions into consideration.

2) Planting

Planting will be conducted by hand and it may be necessary to hire a large number of inexperienced workers. The rate of occurrence of dead trees may vary from stand to stand. However, an average replanting rate of 10% is estimated here.

As for the ferilizing, it was planned to apply the solid fertilizer (3-6-4 type), characterized by its sustained effects with minimum discharge of ingredient even at high temperature and heavy rain, by 50kg per one hectre.

Since all the various types of work from digging the planting holes to the transportation of the seedlings are part of one continuous work, the best combination must be established to minimize wasted manpower and time.

3) Weeding

Weeding must be conducted while paying strict attention to the tree growth. Consequently, weeding will be conducted for the first 2 years for species with a short rotation period and for the first 3 years for species with a medium or long rotation period.

Planting will be conducted after ploughing which will hopefully prevent the growth of weeds to a certain extent. However, the weed growth will greatly vary from stand to stand and the actual growth of the planted trees may also vary. In view of this, weeding should be flexible to suit the situation of each stand.

4) Climber Cutting

The experience of the JICA trial plantation shows that the growth of some stands is hampered, especially in the early years of plantation, by the rapid growth of climbers. Therefore, the cutting of climbers will be necessary even after the planted tree height exceeds the alang-alang height. As a result, climber cutting is planned in the year following the completion of weeding.

5) Pruning

Pruning is planned for both the Group 2 species (P. canescens) and the Group 3 species (S. macrophylla and S. bancana) as these species aim at construction timber production.

6) Salvage Cutting and Thinning

Salvage cutting is planned for all the species to maintain healthy stands by preventing overcrowding while thinning is planned for those species with a medium or long rotation period.

7) Plantation Work Standards

The plantation work standards under the Plan are shown in Tables 4-14, 4-15 and 4-16. Although it is not specified in the plantation work standards, constant observation of the planted trees will be required to prevent damage due to disease or harmful insects by finding damaged trees at an early stage and taking the necessary measures, including the removal of insects.

(3) Annual Planting Plan

As stated in Paragraph 4-2-8, Annual Planting Plan is formulated.

(4) Labour and Equipment Plan

Table 4-17 shows the required labour and equipment, decided on the basis of the above work standards and the planting area by year and by working unit.

Table 4-14 Plantation work standard (1)

Group 1: Acacia mangium
A. auriculiformis
Albizzia falcataria

(ha)

Year	Work component		Amount of work	Remarks
	Kind of work	Work detail		
1	Demarcation survey		1 man-day.	
	Land preparation	Land-clearing	2.20 hours	Using the farm tractor (Operator 0.37 man-day, Assistant 0.37 man-day)
		Plowing-I	1.59 "	-ditto- (Operator 0.27 man-day, Assistant 0.27 man-day)
		Plowing-II	1.59 "	-ditto- (ditto)
				Using the farm tractor only in first rotation
	Preparation for planting	Planting	16 man-days	Including digging pits, fertilization etc.
		Replanting	2 "	
		Transportation of nursery stocks	3 "	
	Tending	Weeding	24 man-days	Using the bush cutter (4 man-day)
2	Tending	Weeding	24 "	-ditto- (ditto)
3	Tending	Climber cutting	4 "	
4	Tending	Slavage cutting	12 "	Using the chainsaw (2 man-day)

Table 4-15 Plantation work standard (2)

Group 2: Peronema canescens

(ha)

Year	Work component		Amound of work	Remarks
	Kind of work	Work detail		
1	Demarcation survey		1 man-day	
	Land preparation	Land-clearing	2.20 hours	Using the farm tractor (Operator 0.37 man-day, Assistant 0.37 man-day)
		Plowing-I	1.59 "	-ditto- (Operator 0.27 man-day, Assistant 0.27 man-day)
		Plowing-II	1.59 "	-ditto- (ditto) Using the farm tractor only in first rotation
	Preparation for planting	Planting	16 man-days	Including digging pits, fertilization etc.
		Replanting	2 "	
		Transportation of nursery stock	3 "	
	Tending	Weeding	24 "	Using the bush cutter (4 man-day)
2	Tending	Weeding	24 "	-ditto- (ditto)
3	Tending	Weeding	24 "	-ditto- (ditto)
4	Tending	Climber cutting	4 "	
5	Tending	Pruning	4 "	
10	Tending	Salvage cutting	12 "	Using the chainsaw (2 man-day)

Table 4-16 Plantation work standard (3)

Group 3: Swietenia macrophylla
Schima wallichi var.
bancana

(ha)

Year	Work component		Amount of work	Remarks
	Kind of work	Work detail		
1	Demarcation survey		1 man-day	
	Land preparation	Land-clearing	2.20 hours	Using the farm tractor (Operator 0.37 man-day, Assistant 0.37 man-day)
		Plowing-I	1.59 "	-ditto- (Operator 0.27 man-day, Assistant 0.27 man-day)
		Plowing-II	1.59 "	-ditto- (ditto) Using the farm tractor only in first rotation
	Preparation for planting	Planting	16 man-days	Including digging pits, fertilization etc.
		Replanting	2 "	
		Transportation of nursery stock	3 "	
	Tending	Weeding	24 hours	Using the bush cutter (4 man-day)
2	Tending		24 "	-ditto- (ditto)
3	Tending		24 "	-ditto- (ditto)
4	Tending	Climber cutting	4 man-days	
5	Tending	Pruning	4 "	
15	Tending	Salvage cutting	6 "	Using the chainsaw (1 man-day)
25	Tending	Thinning	6 "	-ditto- (ditto)

Table 4-17 Summary of Materials and Inputs for the Plantation Works

Amount of work			Materials and machinery		
	Amount of working force*	Fertilizer	Land preparation farm tractor		Weeding
Year	(No. of labors/ day x duration)	(kg)	Purchase (tractor)	Lease (tractor)	Bushcutter (unit)
1	50,322	114,389	9	0	42
2	75,600	171,820	4	0	63
3	85,109	176,792	0	0	74
4	91,832	179,557	0	0	69
5	100,967	193,351	1	0	80
6	103,861	197,256	0	1	76
7	97,383	180,246	0	0	77
8	93,581	170,436	0	0	66
9	58,042	91,496	0	0	43
10	77,428	137,456	5	0	54
11	75,161	141,434	1	0	48
12	76,926	143,646	1	0	56
13	79,374	154,681	1	0	53
14	80,926	157,805	0	0	62
15	75,820	144,196	0	0	50
16	92,747	182,097	2	0	70
17	92,146	183,204	0	0	64
18	76,798	141,434	2	0	55
19	77,859	143,646	1	0	50
20	79,374	154,681	3	0	59
21	84,447	165,811	0	1	58
22	81,112	156,223	0	0	59
23	98,192	194,472	2	0	73
24	98,318	195,773	0	2	75
25	84,357	154,969	0	0	58
26	85,886	157,454	2	0	61
27	86,921	167,298	2	0	64
28	88,262	169,736	2	1	65
29	78,008	144,196	0	0	55
30	94,862	182,097	0	2	69

* The number of labor (man-day) is of normal workers and operators of tractor are not included.

4-3-3 Forest Protection Plan

(1) Forest Fire Control

1) Standard and Distribution of Fire breaks

10m wide zones constantly cleared of vegetation will be introduced on both sides of the existing roads (public roads constructed by the Pertamina and others) and the main forest roads to be newly constructed under the Plan (Table 4-18). As a result, the firebreak width (including road width) will be some 30m, giving a sufficient firebreak effect.

The aggregate length of firebreaks in the operation sites will be approximately 220km and these firebreaks will divide the areas into blocks of some 1,000ha each.

Table 4-18 Firebreak Establishment Plan

Unit: ha

Working unit / Classification	I	II	III	Total
Public road	25.0	55.9	53.8	134.7
Main forest road	126.8	119.9	60.2	306.9
Total	151.8	175.8	114.0	441.6

In addition, the riparian reserved forest zones are also expected to act as firebreaks to prevent the spread of forest fires. If necessary, species with a medium or long rotation period will be planted between these zones and the ridgeline forest roads to act as additional firebreaks.

2) Establishment and Maintenance of Firebreaks

The subject sites for the firebreaks will be completely ploughed as in the case of land preparation to contain the regeneration of alang-alang.

The surface soils are excavated and transformed to bare land by the bulldozer twice a year during the dry season in which there is a high risk of forest fires.

The basic units to plan the manpower and working hour requirement for the establishment and maintenance of the firebreaks are 10 persons/ha for vegetation clearing 2.2 hrs/ha for land clearance, 1.59 hrs/ha for ploughing and 1.59 hrs/ha for weeding (twice).

3) Fire Detection and Reporting System

The locations of look-out towers have been decided based on such conditions as (i) elevated site with a wide area view, (ii) preferable equal distance between any two look-out towers to facilitate mutual viewing and communication and (iii) proximity to a road (public road or forest road) for construction and maintenance convenience. 8 sites have been selected for both Working Units I and III and 10 for Working Unit II, totalling 26. The height of the look-out towers will be 18m in view of the maximum height of the planted trees.

With regard to patrols, patrol teams will be organized around staff of the patrol section and these teams will mainly patrol those areas in the forests frequented by local inhabitants and will also conduct public relations activities vis-a-vis these inhabitants.

The reporting of forest fires requires active cooperation on the part of local inhabitants, necessitating the establishment an Association for Protection of Forest and the introduction of measures to facilitate the further understanding of the significance of afforestation by local inhabitants.

Based on the above considerations, the fire prevention and look-out system will be as shown in Fig. 4-7.

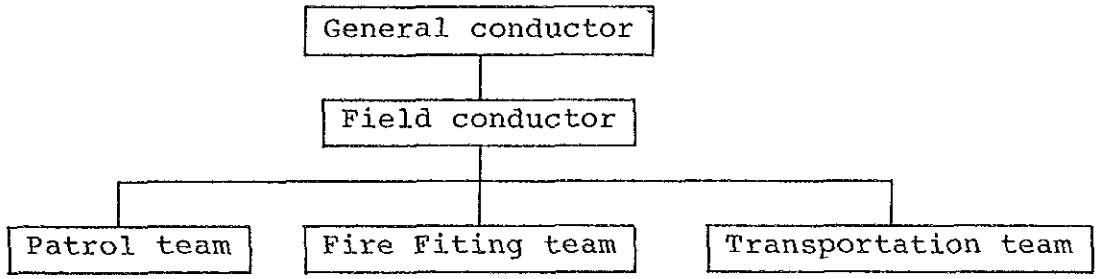


Fig. 4-7 Fire Prevention and Look-out System

o General conductor : Director of the Industrial Plantation Centre (see Fig. 4-9)

o Field conductor : Working Unit Managers (see Fig. 4-9)

o Patrol Teams : Led by the chief of the patrol and extention section of the working unit management office with members appointed from already employed workers.

o Fire-Fighting Teams : Led by the chief of the mechanical service section of the working unit management offices with members appointed from already employed workers.

o Transportation Teams: Led by the chief of the forest roading section officers of the working unit offices and with members appointed from already employed workers.

4) Educational Activities Vis-a-Vis Local Inhabitants

The main cause of forest fires in the Benakat area is said to be burning for shifting cultivation and stock raising purposes. In the case of shifting cultivation, burning takes place around October just prior to the beginning of the rainy season at fertile land along streams and on bush land. Seeding is then carried out once the rainy season begins. Under the present plan, the prevention of forest fires breaking out from shifting cultivation sites is intended by promoting the resettlement of those farmers engaged in shifting cultivation.

On the other hand, the burning for grazing purpose is likely to cause a large scaled forest fire, therefore careful attention should be paid. It is observed that the distance from the village to the grazing land is about 5km or less and the specific places for grazing are located in each village while the grazing are performed moving around the numbers of the places in turn. Further, many of farmers having comparatively large scale stock raising are hoping for some arrangements as supply of grass and the designation of grazing land.

In the execution of the Project, the efforts should be made to prevent the forest fires taking some measures to satisfy the farmers demands.

The direct benefits to be provided in exchange for stopping burning will include employment opportunities in plantation work, the supply of fuelwood and useful timber for agricultural or grazing purposes and the provision of grazing land. The indirect benefits will include the conservation of farmland and the development of timber related industries.

These benefits should be repeatedly explained to the local inhabitants to encourage them to stop burning. For these benefits to be completely understood by the local inhabitants, not only public relations activities to increase the awareness of the importance of afforestation work as well as forest functions through the extensive use of audio-visual materials but also the teaching of these benefits as part of the school curricula (at elementary schools and other educational establishments) will be of great importance.

(2) Disease and Insect Damage Prevention Measures

The following points must be noted to prevent damage due to disease or harmful insects.

- selection of highly resistant varieties
- avoidance of the establishment of pure plantation over an extensive area
- effort of preliminary observation to occurence of disease or insect damage

Testing and research on the resistance of the selected species against disease and harmful insects is currently in progress in Indonesia although the technologies to strengthen the resistance have not yet been fully developed. In the present Plan, therefore, uniform plantation has been avoided as much as possible by combining different species to lessen

the weakness of the planned extensive plantation under the Plan.

Since the occurrence of disease or insect damage is often associated with abnormal weather or environmental changes, the following points must be observed.

- Regular patrols will be necessary in view of the early detection and prevention of disease and insect damage in addition to swift investigation into the causes of abnormal tree states.

- Thorough insect control will be necessary to contain any damage to a minimum and to prevent diseased planted trees or those with insects from entering plantations.

Diseases and insect damage in the Benakat area which were observed in the case of the selected species and their prevention methods are as follows.

1) Damping-Off

This disease tends to spread among young seedlings just after germination and is especially conspicuous in the case of A. mangium. Its prevention is the use of disinfected soil or fresh forest soil for seed beds and fungicides should be immediately used when the symptons are observed in young seedlings to prevent the spread of the disease.

2) Damage by Shoot Borer

The shoot borer (Hypsipyla robuster) lays its eggs on the buds of young S. macrophylla, killing them and arresting tree growth. According to a report by the Technical Cooperation for the Trial Plantation Project in Benakat, South Sumatera, the occurrence of Hypsipyla

robuster is conspicuous when S. macrophylla grows level with alang-alang but the number of damaged trees is limited. The report recommends that the damaged trees be left unattended until the healthy trees are sufficiently grown and then be felled to remove the insects.

The use of pesticides must be based on very careful consideration of the environmental effects.

(3) Annual Firebreak Construction Plan

Table 4-19 shows the Annual Firebreak Construction Plan which is based on the Annual Planting Plan and the Annual Forest Road Construction Plan.

(4) Equipment Plan

Table 4-20 shows the annually required equipment based on the Forest Protection Plan.

4-3-4 Forest Road Plan

(1) Alingment Design by Forest Road Class

The effective width of each class of forest road described in 4-2-7 is given below. The construction of bridges is planned in those places where the crossing of a river or valley is necessary.

1) Main Forest Roads : effective width - 6m
   construction width - 15m
2) Working Forest Roads : effective width - 4m
   construction width - 10m
3) Spur Roads

These are required for such forestry work as planting and harvesting and will be constructed prior to the

implementation of this work. The effective width will be 3m.

Table 4-19 Firebreak establishment plan by year

(Unit: ha)

Working unit	Classification	Year 1	2	3	4	5	6	7	Total*
I	Public road	8.5	2.2	5.3	5.1	-	3.9	-	25.0
	Main forest road	26.4	9.6	6.1	17.8	17.8	26.5	22.6	126.8
	Sub-total	34.9	11.8	11.4	22.9	17.8	30.4	22.6	151.8
II	Public road	13.7	6.5	4.7	4.4	12.4	9.1	5.1	55.9
	Main forest road	17.4	15.0	25.2	37.7	12.7	7.1	7.2	119.9
	Sub-total	31.1	21.5	29.9	42.1	25.1	16.2	12.3	175.8
III	Public road	16.6	8.4	11.5	2.1	3.5	8.1	3.6	53.8
	Main forest road	5.2	3.9	14.7	5.7	13.1	13.3	4.3	60.2
	Sub-total	21.8	12.3	26.2	7.8	16.6	21.4	7.9	114.0
Total	Public road	38.8	17.1	21.5	11.6	15.9	21.1	8.7	134.7
	Main forest road	49.0	28.5	46.0	61.2	43.6	44.9	34.1	306.9
	Total	87.8	45.6	67.5	72.8	59.5	68.0	42.8	441.6

*: As we round off the establishment area by each year, these area was not agreement with the total area.

Table 4-20 Summary of materials and inputs for forest protection

Year	Vehicle (units)			Look-out tower		
	For patrol	For fire fighting		Facility		
	Base machine	Base machine	tank	Material	Hand pump (Jet shooter) (Pumps)	Walkie-talkie (units)
1	3	3	3	3	30	6
2	0	0	0	4	0	0
3	0	0	0	3	0	0
4	0	0	0	4	0	0
5	0	0	0	4	0	0
6	0	3	3	2	30	0
7	0	0	0	4	0	0
8	3	0	0	2	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	3	3	0	30	6
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	3	0	0	0	0	0
16	0	3	3	0	30	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	3	3	0	30	6
22	3	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
26	0	3	3	0	30	0
27	0	0	0	0	0	0
28	0	0	0	0	0	0
29	3	0	0	0	0	0
30	0	0	0	0	0	0

The planned bridge types are as follows.

- Type A : girder length - 10m or more
- Type B : girder length - 5m or more
- Type C : girder length - less than 5m (corrugated pipe)

Table 4-21 shows the total length of the forest roads and the number of bridges by working unit.

Table 4-21 Total Length of Forest Roads and Number of Bridges by Working Unit

Working unit	Main forest road (km)	Working forest road (km)	Bridge type and number		
			A	B	C
I	70.3	108.3	10	17	34
II	60.8	150.9	7	28	65
III	30.5	135.7	9	17	33
Total	116.6	394.9	26	62	132

The alignment of the main and working forest roads are shown on the Attached Industrial Forest Implementation Maps. Table 4-22 gives the forest road construction standards.

Table 4-22 The Standard of Forest Road

Classification / Item	Main forest Road	Working Forest Road
Designed Speed	40 Km/h	25 Km/h
Minimum Curve Radius	30 m	20 m
Safe Sight Distance	40 m	20 m
Maximum Longitudinal Grade	7 %	10 %
Particular Place	9 %	12 %
Bed Height	Gravel 20 cm	Gravel 20 cm
Banking Slope	Sodding Work	Sodding Work
Under drain	Corrugated Pipe or Bridge	Corrugated Pipe or Bridge

(2) Forest Road Construction Standards

1) Earth Work

The earth volume required for the construction of a forest road for 1m is calculated to be 6.7m³ for a main forest road and 4m^3 for a working forest road.

(Main Forest Road)
1m(length) x 10m(width) x 0.6m(depth) x 1.11* = 6.7m³

(Working Forest Road)
1m (length) x 6m (width) x 0.6m (depth) x 1.11* = 4.0m³

* conversion factor

Assuming the use of a 155 HP bulldozer, a daily earth work volume of 1,440m³ will be required with an estimated dozing production of 300m³/hour, job efficiency of 80% and actual working hours of 6 hours/day. Assuming the use of the same type of bulldozer for the construction of both the main forest roads and working forest roads, the bulldozer production volume would be 216m/day in the case of a main forest road and 360m/day in the case of a working forest road.

2) Road Maintenance

A motor grader will be used for the maintenance of the forest roads covering some 10km with a return trip/day.

3) Gravelling

Gravel or soil solidifier will be used in those places where he longitudinal grade exceeds 10% and the gravel bed thickness will be 20cm.

(3) Annual Forest Road Construction Plan

The annual construction plan for the forest roads, prepared taking the land conditions of the Study Area and the Planting Plan, etc. into consideration, is shown in Table 4-23.

(4) Labour and Equipment Plan

The labour and equipment required for the forest road construction is shown in Table 4-24.

Table 4-23 Forest Road Construction Plan by Year

(Unit: km)

Working unit	Class	Years							Total*
		1	2	3	4	5	6	7	
I	Main forest road	16.1	4.8	4.7	9.3	10.9	13.2	11.3	70.3
	Working forest road	16.5	16.9	18.6	19.1	13.5	10.6	12.9	108.3
II	Main forest road	8.7	7.5	12.6	19.7	6.3	2.4	3.6	60.8
	Working forest road	32.4	12.7	15.2	15.7	25.5	22.0	27.3	150.9
III	Main forest road	2.6	1.9	7.4	2.9	6.9	6.6	2.1	30.5
	Working forest road	30.7	21.8	13.3	17.2	17.1	14.7	20.9	135.7
Grand Total	Main forest road	27.4	14.2	24.7	31.9	24.1	22.2	17.0	161.6
	Working forest road	79.6	51.4	47.1	52.0	56.1	47.3	61.1	394.9

Note: * As we round off the construction distance by each year, these distance was not agreement with the total distance.

Table 4-24 Summary of Materials and Inputs for Forest Road Work

Year	Amount of work (persons)	Machinery				Bridge		
		Bulldozer (unit)	Motor grader (unit)	Backhoe type excavator (units)	Blash breaker (units)	A (15m)	B (10m)	C (5m)
1	11	3	2	3	0	5	15	30
2	11	0	0	0	0	5	7	16
3	13	1	0	0	0	0	10	15
4	15	1	0	0	0	5	8	14
5	17	1	0	0	0	7	7	20
6	17	0	0	0	0	1	10	16
7	19	1	0	0	0	3	5	21
8	14	0	0	0	0	0	0	0
9	14	3	0	0	0	0	0	0
10	14	0	0	0	0	0	0	0
11	14	1	0	0	0	0	0	0
12	14	1	0	0	0	0	0	0
13	14	1	0	0	0	0	0	0
14	14	0	1	0	0	0	0	0
15	14	0	0	0	0	0	0	0
16	14	0	0	0	0	0	0	0
17	14	3	0	1	0	0	0	0
18	14	0	0	0	0	0	0	0
19	14	1	0	0	0	0	0	0
20	14	1	0	0	0	0	0	0
21	14	1	0	0	0	0	0	0
22	14	0	0	0	0	0	0	0
23	14	0	0	0	0	0	0	0
24	14	0	1	0	0	0	0	0
25	14	3	0	0	0	0	0	0
26	14	0	0	0	0	0	0	0
27	14	1	0	1	0	0	0	0
28	14	1	0	0	0	0	0	0
29	14	1	0	0	0	0	0	0
30	14	0	0	0	0	0	0	0

4-3-5 Felling Plan

(1) Felling Method

The felling of grown trees will be conducted by work groups, each consisting of a chainsaw operator and an assistant. The standard felling position will be 30cm above ground and branching will be conducted on the felling site for efficient skidding.

(2) Annual Felling Plan

The felling volume (including the volume obtained by salvage cutting and thinning) by year has been decided based on the planting Plan (4-3-2) and the growth estimate (4-2-5).

The planned annual felling volumes from the existing man-made forests and industrial plantation sites are shown in Tables 4-25 and 4-26.

(3) Labour and Equipment Plan

The labour and equipment required for felling related work are given in Table 4-27.

4-3-6 Skidding and Logging Plan

(1) Skidding and Logging Methods

The felled trees from the plantation sites will be temporarily accumulated at timber yards and will then be transported to 2 dumping places located on the left bank of S. Lematang and further to Palembang by river. The following logging methods will be adopted.

Table 4-25 Felling area and yield volume from the existing man-made forests

(Unit: Area ... ha, Volume ... m^3)

Year	Working Unit I		Working Unit II		Working Unit III		Total		Remarks
	Area	Volume	Area	Volume	Area	Volume	Area	Volume	
1	43.37	4,596	58.32	11,804			101.60	16,400	The yield volume is the total volume of the tree which has more than 7 cm in D.B.H. As to the tree younger than 4 years, the yield volume is assumed to be 0 m^3.
2	117.38	22,126	110.71	18,501			228.09	40,627	
3			108.33	19,716	146.50	26,201	254.83	45.917	
4			336.27	61,202	206.67	34,103	542.94	95,305	
5			314.34	56,018	494.56	74,206	808.90	130,224	
6	1.48	157			59.27	9,780	60.75	9,937	
7	23.17	2,457	530.67	12,051			553.84	14,508	
8			986,91	142,715	17.48	3,601	1,004.39	146,316	

Table 4-26 Thinning and felling plan

(Unit: Area ... ha, Volume ... m^3)

Year	Felling								Thinning					
	Acacia mangium		Acacia auriculiformis		Albizzia falcataria		Peronema canescems		Swietenia macrophylla		Schima wallichii var. bancana		Total	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume
1														
2														
3														
4														
5														
6														
7														
8														
9	617.59	101.903	617.59	101.903	594.73	98,130							1,829.91	301,936
10	927.83	153.092	927.83	153.092	893.46	147,421							2,749.12	453,605
11	954.68	157,522	954.68	157,522	919.32	151,687							2,828.68	466,731
12	969.60	159,985	969.60	159,985	933.71	154,062							2,872.91	474,032
13	1,044.10	172.276	1,044.10	172,276	1,005.42	165,895							3,093.62	510,447
14	1,065.18	175,755	1,065.18	175,755	1,025.74	169,248							3,156.10	520,758
15	973.33	160.600	973.33	160,600	937.26	154,647							2,883.92	475,847
16	1,229.15	202,810	1,229.15	202,810	1,183.63	195,299							3,641.93	600,919
17	1,236.62	220,118	1,236.62	220,118	1,190.83	211,968							3,664.07	652,204
18	954.68	169,933	954.68	169,933	919.32	163,639							2,828.68	503,505
19	969.60	172,589	969.60	172,589	933.71	166,201							2,872.91	511,379
20	1,044.10	185,849	1,044.10	185,849	1,005.42	178,965							3,093.62	550,663
21	1,065.18	189,601	1,065.18	189,601	1,025.74	182,582	160.11	38,266					3,316.21	600,050
22	973.33	173,253	973.33	173,253	937.26	166,833	240.54	57,490					3,124.46	570,829
23	1,229.15	218,788	1,229.15	218,788	1,183.63	210,826	247.51	59,155					3,889.44	707,417
24	1,236.62	220,118	1,236.62	220,118	1,190.83	211,968	251.38	60,081					3,915.45	712,285
25	954.68	169,933	954.68	169,933	919.32	163,639	270.70	64,697					3,099.38	568,202
26	969,60	172,589	969.60	172,589	933.71	166,201	276.16	66,003	160.11	7,565	137.25	6,485	3,446.43	591,432
27	1,044.10	185,849	1,044.10	185,849	1,005.42	178,965	252.34	60,309	240.54	11,366	206.20	9,743	3,792.70	632,081
28	1,065.18	189,601	1,065.18	189,601	1,025.74	182,582	238.61	57,628	247.51	11,695	212.14	10,024	3,854.36	641,131
29	973.33	173,253	973.33	173,253	937.26	166,833			251.38	11,878	215,46	10,039	3,350.76	535,256
30	1,229.15	218,788	1,229.15	218,788	1,183.63	210,686			270.70	12,791	232.00	10,962	4,144.63	672,015

Table 4-27 Summary of materials and inputs for salvage cutting, thinning and felling

Year	Amount of work (persons)	Machinery Chainsaw (units)
1	0	5
2	0	6
3	0	7
4	0	34
5	0	24
6	0	5
7	0	25
8	0	40
9	0	66
10	0	78
11	0	68
12	0	72
13	0	87
14	0	74
15	0	78
16	0	108
17	0	91
18	0	66
19	0	100
20	0	76
21	0	105
22	0	69
23	0	139
24	0	72
25	0	100
26	0	88
27	0	112
28	0	83
29	0	85
30	0	122
計		2,085

1) Felled trees will be skidded by tractor.

2) The timer will be loaded onto a logging truck by log loader at the timber yards, brought to the dumping place.

3) Since the river transportation of timber is more economical than transportation by land, S. Lematang which is the nearest river to the Study Area with an abundant flow will be used.

4) 2 logging routes are planned to S. Lematang, one of which will be used as a logging road constructed by the Swoody concession near the southern part of the Study Area while the other will connect the south bank of S. Lematang with Jirak via Pendopo (Fig. 4-8).

(2) Labour and Equipment Plan

As part of the Skidding and Logging Plan, the Labour and Equipment Plan has been prepared based on the Felling Plan (4-3-5) and other relevant plans and is given in Table 4-28. As the skidding and logging volumes fluctuate throughout the project period, the purchase of equipment is planned based on the minimum requirement. Lease agreements will be made for other necessary equipment which is not purchased.

Table 4-28 Summary of Materials and Inputs for Skidding and Transportation

Amount of work		Machinery				
Year	(persons)	Tractor (units)	Log loader (units)	Logging truck (units)	Tug boat (boats)	Barge (barges)
1	12	1	1	1	1	1
2	21	2	1	2	0	0
3	23	0	0	1	0	0
4	44	4	1	4	0	2
5	63	2	2	3	1	3
6	12	0	0	0	0	0
7	12	0	0	0	0	0
8	67	3	2	6	1	3
9	133	12	6	15	1	4
10	207	11	6	13	2	5
11	209	0	0	5	0	0
12	213	3	1	1	0	0
13	227	2	2	9	0	1
14	229	5	1	15	0	1
15	214	0	0	10	0	0
16	269	12	6	15	1	4
17	287	15	8	5	1	4
18	224	1	0	0	0	0
19	229	1	1	16	0	0
20	242	5	2	13	0	1
21	269	6	4	19	2	4
22	258	0	0	0	0	0
23	312	9	1	11	1	4
24	316	12	11	16	1	4
25	254	5	3	1	0	0
26	269	4	1	22	0	1
27	287	4	4	4	0	1
28	291	6	2	12	1	3
29	244	0	0	7	0	1
30	309	9	5	13	4	9

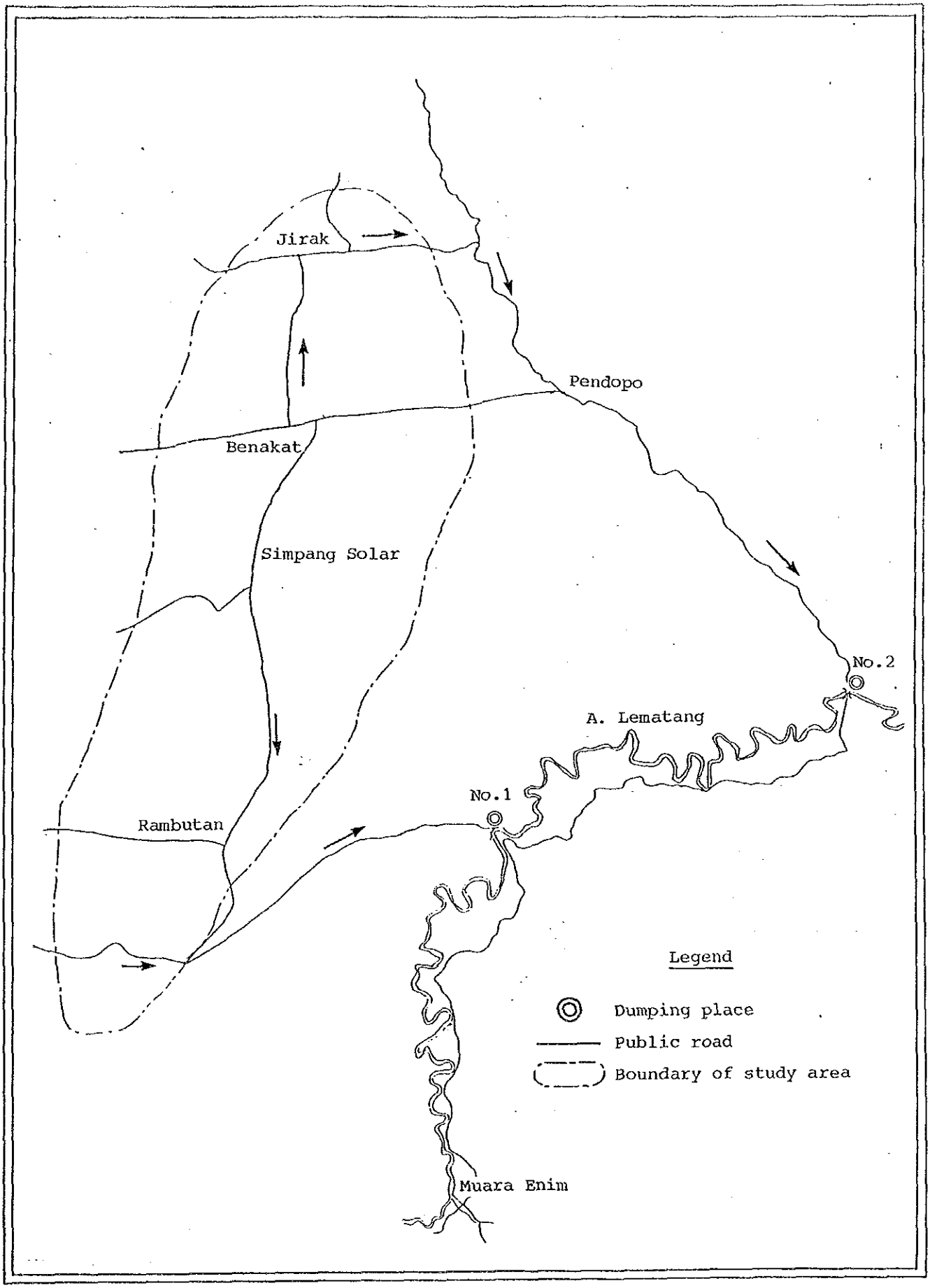


Fig. 4-8 Logging Route

4-3-7 Marketing Plan

(1) Merchandise

As described in 3-6 and 3-7, corridor type man-made forests and other man-made forests of the Provincial Forestry Service are existed in the Study Area and the marketing of timber from these man-made forests is planned as part of the Project. The harvesting and marketing of timber from the plantation sites will commence in the 9th year of the Project.

The total volumes of A. mangium and A. auriculiformis obtained from the existing man-made forests and new plantations will be used as pulp wood. In the case of A. falcataria, 83% of the volume will be used as pulp wood and 17% will be used as timber. The remaining 3 species, i.e. P. canescens, S. macrophylla and S. bancana, will be used as timber and 85% of the volume will be marketed (Table 4-29).

(2) Target Market

As described earlier, all the estimates in the Plan are based on the assumption that Palembang is the end market and, therefore, the target market for both timber and pulp wood is naturally Palembang.

As to the large-scale wood processing industry in and around Palembang, there is a plywood factory managed by P.T. SUKESES SUMATRA TIMBER, which produces using the woods transported from Kalimantan Island. The draft in Palembang Port is said to be approximately 10m.

In addition, construction of a pulp factory is planned by P.T. Barito Pacific in South Sumatera Province. The Planned production is 300,000 ton/year. Construction plans of pulp factory in the whole Indonesia is shown in Attached Table 1-6.

Table 4-29 Marketing Plan

Year	Amount of Sale: Pulp Existing man-made forest	Materials: A	B	C	Total	C	D	E	F	Total	m^3 Total
1	16,400	0	0	0	16,400	0	0	0	0	0	16,400
2	40,627	0	0	0	40,627	0	0	0	0	0	40,627
3	45,917	0	0	0	45,917	0	0	0	0	0	45,917
4	95,305	0	0	0	95,305	0	0	0	0	0	95,305
5	130,224	0	0	0	130,224	0	0	0	0	0	130,224
6	9,937	0	0	0	9,937	0	0	0	0	0	9,937
7	14,508	0	0	0	14,508	0	0	0	0	0	14,508
8	146,316	0	0	0	146,316	0	0	0	0	0	146,316
9	0	101,903	101,903	81,448	285,254	16,682	0	0	0	16,682	301,936
10	0	153,092	153,092	122,359	428,543	25,062	0	0	0	25,062	453,605
11	0	157,522	157,522	125,900	440,944	25,787	0	0	0	25,787	466,731
12	0	159,985	159,985	127,871	447,841	26,191	0	0	0	26,191	474,032
13	0	172,276	172,276	137,693	482,245	28,202	0	0	0	28,202	510,447
14	0	175,755	175,755	140,476	491,986	28,772	0	0	0	28,772	520,758
15	0	160,600	160,600	128,357	449,557	26,290	0	0	0	26,290	475,847
16	0	202,810	202,810	162,098	567,718	33,201	0	0	0	33,201	600,919
17	0	220,118	220,118	175,933	616,169	36,035	0	0	0	36,035	652,204
18	0	169,933	169,933	135,820	475,686	27,819	0	0	0	27,819	503,505
19	0	172,589	172,589	137,947	483,125	28,254	0	0	0	28,254	511,379
20	0	185,849	185,849	148,541	520,239	30,424	0	0	0	30,424	550,663
21	0	189,601	189,601	151,543	530,745	31,039	32,526	0	0	63,565	594,310
22	0	173,253	173,253	138,471	484,977	28,362	48,867	0	0	77,229	562,206
23	0	218,788	218,788	174,869	612,445	35,817	50,282	0	0	86,099	698,544
24	0	220,118	220,118	175,933	616,169	36,035	51,069	0	0	87,104	703,273
25	0	169,933	169,933	135,820	475,686	27,819	54,992	0	0	82,811	558,497
26	0	172,589	172,589	137,947	483,125	28,254	56,103	[illegible]	[illegible]	[illegible]	579,424
27	0	185,849	185,849	148,541	520,239	30,424	51,263	[illegible]	[illegible]	[illegible]	619,869
28	0	189,601	189,601	151,543	530,745	31,039	48,474	[illegible]	[illegible]	[illegible]	628,719
29	0	173,253	173,253	138,471	484,977	28,362	0	[illegible]	[illegible]	[illegible]	532,038
30	0	218,788	218,788	174,869	612,445	35,817	0	[illegible]	[illegible]	[illegible]	668,452

A: Acacia mangium B: Acacia auriculiformis C: Albizzia falcataria

D: Peronema canescens E: Swietenia macrophylla F: Schima wallichii var. barcana

4-3-8 Project Implementation Organization and Personnel

(1) Project Implementation Organization

In view of the fact that the present plantation project will be conducted in 3 working units, an office will be established in each working unit for project implementation, plantation maintenance and to deal with personnel matters.

While each office is expected to conduct the assigned work in a systematic and efficient manner, the establishment of a higher organization (tentatively named the South Sumatera Industrial Plantation Centre) is planned to coordinate between and control the work of the 3 offices.

The South Sumatera Industrial Plantation Centre will be responsible for the efficient operation of the Project by coordinating between the 3 offices and controlling the financial matters of the Project, including those of the 3 offices.

Each office will be responsible for the direct management and supervision of the work relating to the nursery, plantations and forest roads, etc. In addition, its assignments will include the supervision of the fire prevention patrols, the supervision and control of vehicle operation and repair and the control of workers' performance and their welfare.

The planned organization (Fig. 4-9) is expected to contribute to the smooth implementation of the Project taking the current conditions of Indonesia into consideration. Table 4-30 shows the number of staff for each office.

Table 4-30 Number of Staff by Office

	Industrial Plantation Center	Working Unit I Management Office	Working Unit II Management Office	Working Unit III Management Office	Total
Director	1				1
Section Chief	3				3
Unit Manager		1	1	1	3
Engineering and Administrative employee	10	12	12	12	46
Subtotal	14	13	13	13	53
Driver	1	1	1	1	4
Total	15	14	14	14	57

(2) Project Implementation Organization

The PT INHUTANI II, one of the national forestry companies is supposed to be as the Project Implementation Organization by Ministry of Forestry. This company is considered adequate for the Project implementation organization from the view point of past achievement at Subanjeriji, South Sumatera. The organization, management, financial matters as well as activities and achievement are presented in the separate report.

(3) External Consultants

The following external consulting work will be retained for the smooth and efficient implementation of the Project.

1) Consulting work (I)

The following consultants will be provided to deal with the preparatory works such as the detailed designing, procurement of equipments and materials, and tender prior to the initiation of the works of the Project.

The periods of the every consultants' assignments from the selection of the consultants to the completion of the bidding are proposed to be 6 (six) months.

o Project manager (one):

Responsible for general supervision and administration of all works related to the detailed designing.

o Financial and procurement expert (one):

Responsible for all works related to tender, procurement, and all financial matters.

o Engineer in charge of building and facilities construction (one):

Responsible for designing of the nursery facilities and administration center.

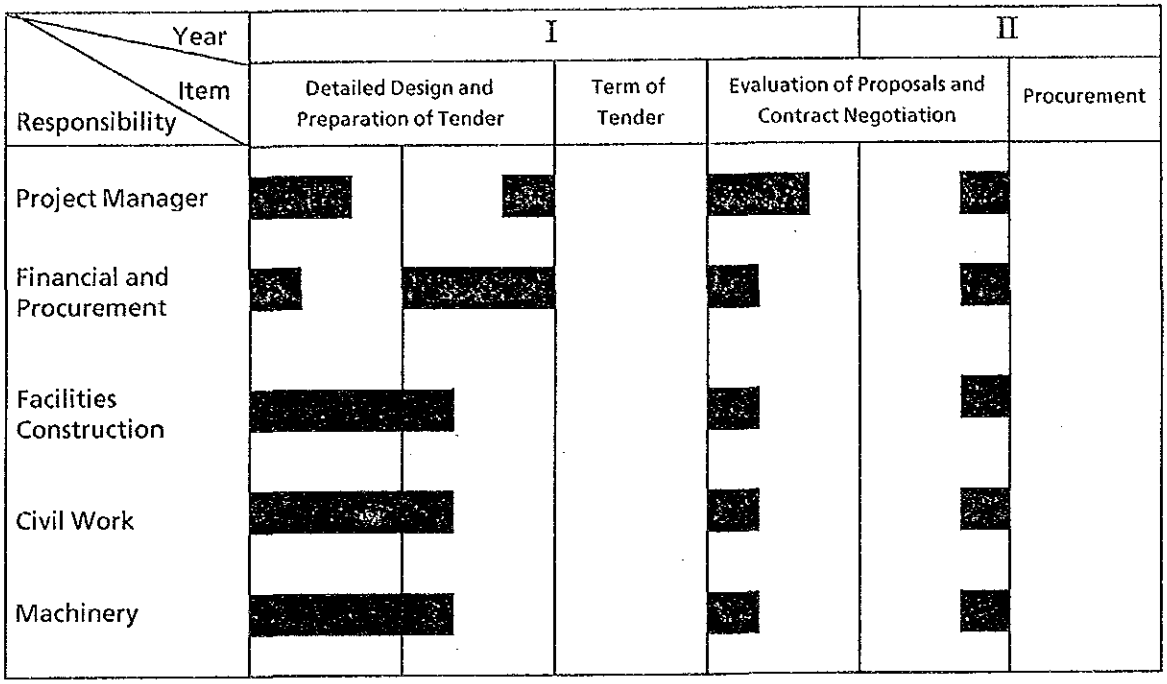
o Civil engineer (one):

Responsible for all detailed designing of the forest roads and nursery construction.

o Mechanical engineer (one):

Responsible for preparation of the specification of mechanical equipment related to the Project.

SCHEDULE OF CONSULTANT (I)



2) Consulting works (II)

The supervision of the construction works will be mainly performed from the initiation of the Project construction and the following consultants will provide advice to the director of the industrial plantation center, South Sumatera. This supervisory works will be performed for 8 (eight) years up to the completion of the first planting.

o Management (General Administration) (one):

to provide advice on the general aspects of management

o Nursery and Planting (one)

to provide advice on the general aspects of nursery and plantation works while coordinating with the South Sumatera Reforestation Technical Centre

o Forest Roads, Felling, Skidding and transportation (one):

to provide advice on forest roads (design, construction and maintenance), felling, skidding and transportation

o Equipment (one):

to provide advice on the use and maintenance of equipment and machinery required for the construction and maintenance of forest roads and also for felling, skidding and transportation

o Forest Management (one):

to provide advice on forest protection and management

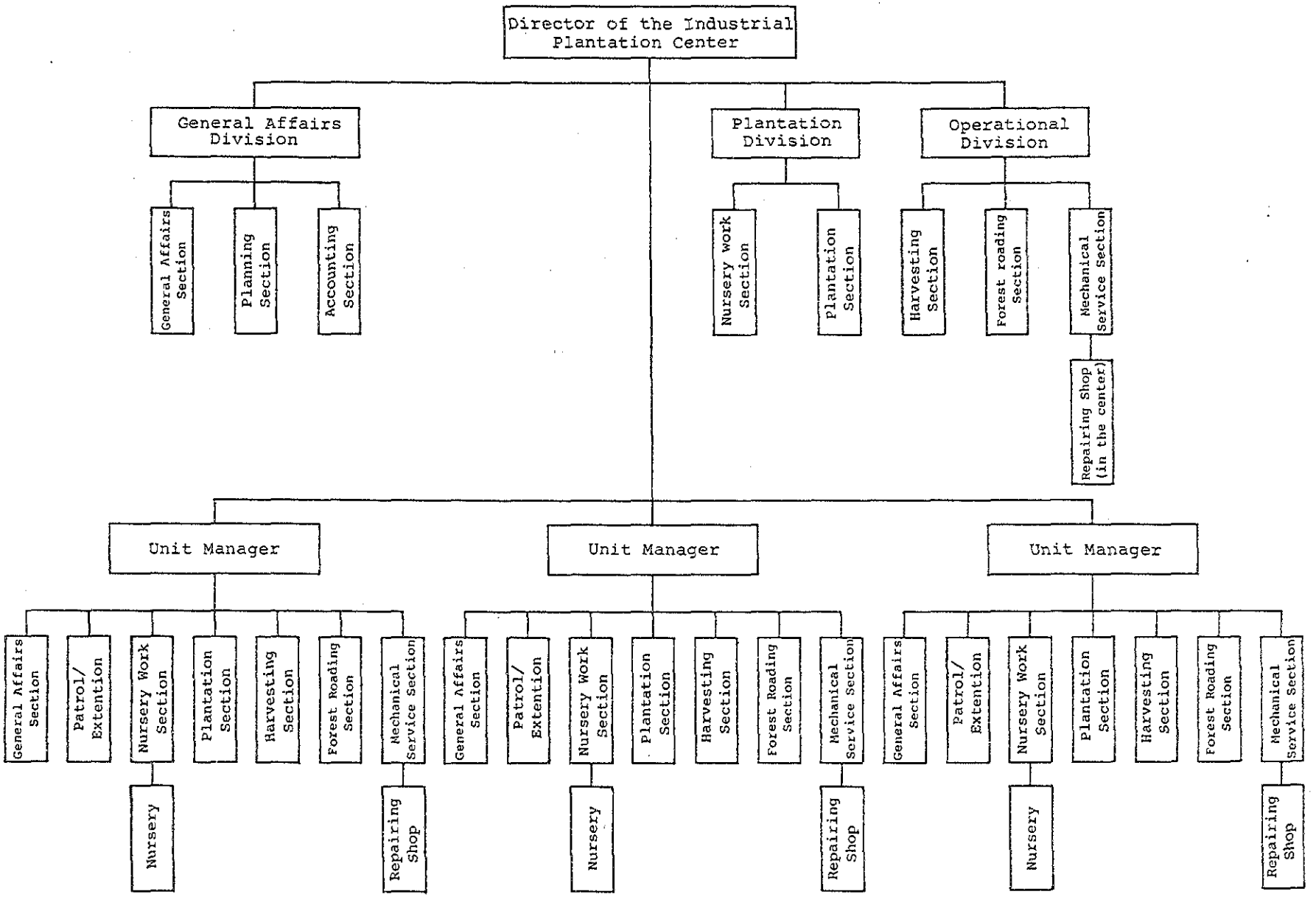


Fig. 4-9 Implementation Organization for Industrial Plantation Project in South Sumatera

(3) Labour

A large labour force will be required for the Project which involves the plantation of some 27,000ha in view of smoothly conducting the planting and production of nursery stock, forest road works and hervesting, etc. Table 4-31 shows the required labour by year for the main component of the Project, i.e. production of nursery stock and planting. The total labour requirement will be some 158,000 workers and a daily average employment of some 660 workers can be expected assuming 240 annual working days.

Table 4-31 Amount of Work Required for Project Component

(Unit: 1,000 man-day)

Operation / Working unit / Year	Nursery work				Plantation work				Remarks
	I	II	III	Total	I	II	III	Total	
1	7.2	9.7	6.5	23.4	19.0	25.5	17.1	61.6	Including
2	12.1	12.0	11.2	35.3	34.5	35.2	32.0	101.7	operators
3	12.0	11.8	12.5	36.3	39.1	39.9	39.7	118.2	
4	12.6	12.3	11.9	36.8	45.4	45.4	43.1	133.9	
5	12.8	14.9	12.1	39.8	48.4	53.8	46.1	148.3	
6	12.0	15.9	12.6	40.5	47.1	58.0	48.1	153.2	
7	11.1	16.5	9.4	37.0	44.6	61.1	40.0	145.7	
8	10.6	15.6	8.8	35.0	42.8	60.3	37.4	140.5	
9	5.8	7.8	5.2	18.8	29.2	40.1	26.6	95.9	
10	9.7	9.6	9.0	28.3	37.0	42.0	33.7	112.7	
11	9.6	9.4	10.0	29.0	36.4	39.0	36.0	111.4	
12	10.1	9.9	9.5	29.5	37.2	37.7	35.2	110.1	
13	10.2	11.9	9.7	31.8	38.4	42.7	36.6	117.7	
14	9.6	12.7	10.1	32.4	37.0	45.7	37.9	120.6	
15	8.8	13.2	7.5	29.5	35.2	48.5	31.5	115.2	
16	11.4	16.3	9.7	37.4	41.4	58.0	36.3	135.7	
17	12.6	13.5	11.6	37.7	44.9	52.3	41.3	138.5	
18	9.6	9.4	10.0	29.0	38.2	41.6	37.5	117.3	
19	10.1	9.9	9.5	29.5	39.7	41.9	37.3	118.4	
20	10.2	11.9	9.7	31.8	39.5	44.1	37.6	121.2	
21	10.1	13.4	10.5	34.0	38.3	47.5	39.0	124.8	
22	9.7	14.1	8.3	32.1	37.4	50.7	33.5	121.6	
23	12.2	17.2	10.6	40.0	43.5	60.0	38.5	142.0	
24	13.5	14.3	12.4	40.2	47.5	54.7	43.8	146.0	
25	10.5	10.5	10.8	31.8	41.6	45.5	40.7	127.8	
26	11.0	11.0	10.4	32.4	43.2	41.6	40.8	127.6	
27	11.0	13.0	10.3	34.3	42.8	48.5	40.7	132.0	
28	10.4	13.8	10.7	34.9	40.3	50.1	40.7	131.1	
29	8.8	13.2	7.5	29.5	36.3	49.9	32.5	118.7	
30	11.4	16.3	9.7	37.4	42.2	59.2	37.1	138.5	
Total	316.7	381.0	297.7	995.4	1,188.1	1,423.5	1,118.3	3,729.9	
Mean	10.6	12.7	9.9	33.2	39.6	47.5	37.3	124.4	

The Study Area has an estimated population of 14,000. As the general population statistics in Indonesia give a working population rate (20 - 60 years old) of over 40%, the working population in the Study Area can be estimated to be around 6,000 which is large enough or the local provision of the labour force required by the Project.

The required labour force by working unit will be some 210 workers/day for Working Unit I, some 250 workers/day for Working Unit II and some 200 workers/day for Working Unit III. While the local recruitment of these workers is feasible in the case of Working Units I and II which have relatively large populations, special recruitment measures will be employed in the case of Working Unit III which has few settlements and where the local recruitment of the necessary labour force is currently difficult. Labour recruitment for Working Unit III will, therefore, be conducted from the other Working Units. Moreover, accommodation for these workers will be required.

Many of the Study Area's inhabitants are engaged in oil field-related work or agriculture. Therefore, their employment will be coordinated with their current work status by the adjustment of the Annual Work Plan so that the current work can be continued as much as possible.

Further, it is necessary to train and secure the skilled labors for the efficient implementation of the Project. The systematic training to develop the forestry technique is extremely important.

(4) Administrative Facilities

The facilities required to operate and maintain the Project and their locations have been planned as follows (see Fig. 4-3).

1) South Sumatera Industrial Plantation Centre

The Centre will play a central role in the Project and will be located on the nursery premises in Working Unit II due to the following reasons.

- central location in the Study Area
- good transportation prospect
- proximity to South Sumatera Reforestation Technology Centre in view of solving technical problems when they arise for smooth project implementation.

The main facilities of the Centre will be as follows.

- office building (to be shared by the office for Working Unit II)
- staff housing
- accommodation facilities
- warehouse
- fuel storage
- garage
- generator building
- water tanks
- water supply and drainage facilities
- clinic

2) Working Unit Management Office

Each unit will have a working unit management office which will be located in the nursery of the respective unit and which will also act as a nursery office. In the case of Working Unit III, housing will be constructed to secure workers.

The construction of a church, mosque and/or leisure facilities will be considered in view of providing both staff and workers with better facilities.

Although through safety measures vis-a-vis all types of work will be imperative, a clinic will also be constructed at the Centre to deal with accidents. In addition, each unit office will be capable of providing first aid.
In view of the above functions of the unit offices, the required main facilities are as follows.

- office building
- housing
- warehouse
- fuel storage
- generator building
- water tanks
- water supply and drainage facilities
- garage

(5) Annual Building and Facility Construction Plan

The number and sizes of the buildings and facilities to be constructed each plan year are shown in Tables 4-32, 4-33 and 4-34.

(6) Repair Shop Plan

A large amount of machinery, including heavy machinery, will be used for the implementation of the Projet and, therefore, it is believed that the provision of a repair shop is necessary. All repairs from the 1st year to the 8th year will be conducted using the repair equipment. The provision of new heavy machinery will be required from the 9th year in view of the commencement of felling at the plantation sites and also the commencement of the second planting.

Table 4-32 General specification of buildings

Industrial plantation center

Building	Size (m^2)	Description
Center building	466	Shared by the management office and the nursery office for the working unit II.
Warehouse	400	Shared by the management office for the working unit II.
Fuel storage	50	"
Garage	150	"
Generator building	40	"
Housing	2,120	29 houses. Including houses for staff of the management office for the working unit II.
Guesthouse	270	
Total	3,496	

Working unit management office (in the working unit I and III)

Building	Size (m^2)	Places	Total area (m^2)
Office building	176	2	352
Warehouse	150	2	300
Fuel storage	20	2	40
Garage	100	2	200
Generator building	20	2	40
Housing	65	28	1,940
Total			2,872

In the working Unit III, the prefabricated laborers lodge will be constructed. Assuming 3.3 m^2 shared by a person, total area will be 528 m^2 accommodating 160 persons.

Table 4-33 Building construction and facility installment plan for the administration and other general

Year	Building construction								Facility installment				
	Office building in the Industrial Plantation Center	Office building in the working Unit Management office	Warehouse	Fuel Storage	Garage	Generator bilding	Housing	Guesthouse	Water storate tank	Water works	Electric works	Fencing	Laborers' lodge
1	1	3	3	3	3	3	57	1	3	3	3	3	6
2													
3													
4													
5													
6													6
7													
8													
9													
10													
11											3	3	6
12													
13													
14													
15													
16									3	3			6
17													
18													
19													
20													
21											3	3	6
22													
23													
24													
25													
26	1	3	3	3	3	3	57	1					6
27													
28													
29													
30													
Total	2	6	6	6	6	6	114	2	6	6	9	9	30

Table 4-34 Summary of materials and inputs for the administration and other general

Year	Vehicle and machinery				Others		
	Jeep (jeeps)	Motorcycle (motor-cycles)	Gen-erater (sets)	Water (pumps)	SW radio (sets)	VHF radio (sets)	Air condi-tioner (air conditioners)
1	4	12	4	4	2	3	8
2							
3							
4							
5							
6							8
7							
8	4	12	4	4			
9							
10							
11					2	3	8
12							
13							
14							
15	4	12	4	4			
16							8
17							
18							
19							
20							
21					2	3	8
22	4	12	4	4			
23							
24							
25							
26							8
27							
28							
29	4	12	4	4			
30							
Total	20	60	20	20	6	9	48

In view of the above, a repair shop will be constructed at the facility site in Working Unit II (Industrial Plantation Centre) to meet the repair requirements upto the 8th year and additional repair shops will be constructed in the 9th year at the facility sites in Working Units I and III.

4-3-9 Local Development Promotion Measure

As describe earlier, inhabitants of 1,200 houses among 2,300 houses located in the Study Area are mostly dependent on the shifting cultivation for their livelihood. The understanding and cooperation of the local inhabitants, especially these shifting cultivator are indispensable for smooth and efficient implementation of the present Project. They can be utilized as the work force necessary to implement the industrial plantation through the efforts to have them understand that the implementation of the Project will contribute to the increase of the income of local inhabitants and development of the infrastructure. The necessary work force for the present Project implementation is approximately 150,000 man-day in a year in average. Above figures correspond to 600 labors on the assumption that they work 250 days in a year. This means that the workforce covering 400 houses can be utilized exclusively for the plantation work on the assumption that 1.5 persons can work as daily wage earners. The following introductive measures will be taken for the remaining 800 houses to deal with the fixed farming.

(1) Organizing of Local Inhabitants

The organizing of the local inhabitants is indispensable to deepen their understanding on the present Project, and to secure the stable work force necessary of the smooth implementation of the Project which requires a large work force and shift of agricultural land in the forests. Accordingly the Project Implementation Organization should positively

make efforts to create the organization of the local inhabitants incorporating heads of villages and chiefs of neighborhood association as the nucleus of the organization.

(2) Contribution to Infrastructure for Local Inhabitants Use

A number of various infrastructure systems are required to be developed for the implementation of the Project such as the establishment of forest roads, water supply and power supply as well as communication systems. The locations, layouts and quantities have been schemed in the development of such systems with paying attention to provide the convenience for local inhabitants and improve local living environments.

(3) Inducement to Fixed Farming

In connection with shifting cultivation and forestry, the method (tumpangsari) to allow the intercrop in the forests and coexistence of agriculture and forestry is practiced in Java island where population density is high and agricultural land is not sufficient. On the other hand, the method to induce the shifting cultivation in the permanent forests such as Protection Forest toward outside fixed farming are prevalent in the other islands with low population density and sufficient land. Therefore, the measures such as utilization of the shifting forest are taken to provide or develop new agricultural land, housing and materials.

The inducement of fixed farming is also a basic policy in the Study Area as described earlier. The actual situation of the shifting cultivators was observed and it was found that generally the cultivators have their houses in existing villages and cultivating fixed farmland of 0.5ha (around villages) and shifting cultivation land of 2ha (within 5km in average from villages).

Accordingly it was planned in the Project to provide the exclusive land use for agricultural purpose around main villages and shift the cultivation land in the forest in prior to the implementation of plantation works.

As described earlier, the objected area is a cultivation land for about 800 houses which are remaining of 1,200 houses after reduction of 400 houses employed exclusively for plantation works and shifting is planned to be completed in 8 years up to the completion of the firat planting.

As the primary schools and mosques were mostly completed in the Study Area, the civil works such as construction of the farm roads, demarcation of farmland, land preparation are mainly planned and provision of seedlings and fertilizer are also planned when necessary.

In the implementation of the following main works, the careful consideration is indispensable taking into account the inhabitants' intentions and situations through the mutual negotiation. The inflexible and standardized approach should be avoided.

1) Housing and civil work

- (Housing) : The most of farmers performing shifting cultivation own their houses in the villages and the detached huts for the shifting cultivation
- Meeting hall : To be studied if necessary
- Clinic : "
- (Mosque) : Mostly completed
- (Primary school) : "

- Farm road : Mainly for farm roads to be newly provided, utilizing forests roads, public roads for trunk road
- Dam : To secure water for agricultural purpose
- Demarcation : Including supply of materials such as fence.
- Land preparation (land adjustment, ploughing): The machines are to be utilized for the agricultural land to be shifted (about 16,000ha)

2) Supply of materials for production

- Seedlings and seeds (fruits, fodder and other cash crop)
- Tools (hoe, parang)
- Fertilizer, agrochemicals

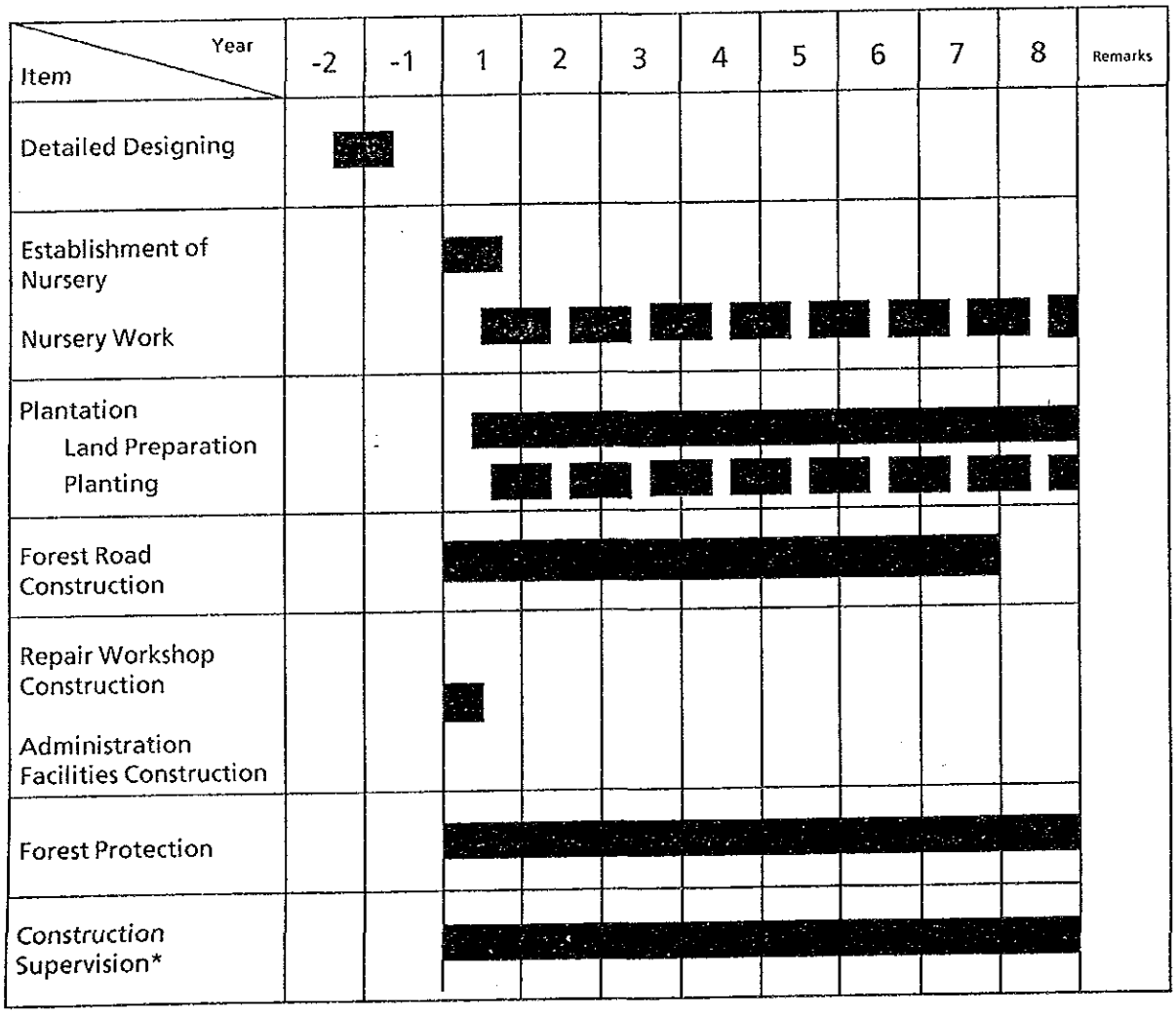
3) Training

- Establishment of pilot agricultural land
- Technical training system (in coordination with agencies related to agriculture)

4-3-10 Implementation Schedule

1) Outline of the Project Implementation Schedule is shown below though full and detailed examination is temrs of smooth and efficient implementation will be needed before implementing.

2) The Implementation Schedule Table is consisted mainly of the plantation work and the construction for 8 years up to completion of the first planting.



* : Construction supervision belongs to the consulting work (II).

4-4 Project Cost

Project cost of the works described 4-3 were calculated during the 30 years from the project commencement.

4-4-1 Preconditions for Estimates

(1) Estimates of the local and foreign currency were based on the 1989 exchange rates of 1,780 Rp./US$ and 140 Yen/US$.

(2) The foreign currency portion for procurement of machinery and equipment have been made based on CIF prices.

(3) Price escalations of local and foreign currency was 9.7%, 3.0% respectively.

(4) The residual value of the assets subject to depreciation at the end of the fiscal year has not been included in calculations.

(5) Expenditure such as loan interest, commission and reserve carried forward as operating capital for the following year are not accounted for in the Project costs.

(6) The physical contingency, insurance and others fees have been calculated as follows.

1) Contingency
Calculated at 10% of machinery, equipment and fixture costs.

2) Transportation and Travelling Costs
Calculated at 10% of personnel and labor costs.

3) Insurance Fee

Calculated at 1.5% of the general administration (excluding personnel costs), machinery, equipment and construction costs of the facilities at the time of purchase and construction.

4) Social Insurance

10% of personnel and labor costs are to be borne by the employer.

5) Miscellaneous Costs

The annual miscellaneous costs are estimated at 178,000,000 Rp. (10,000US$).

4-4-2 Project Cost Estimate

The annual funds required for each type of work have been estimated based on the work plan as detailed in the previous item 4 - 3 and estimate basis presented in the annex report (Table 4-35). The project cost estimations have been made in local and foreign currencies in each classified item such as machinery and facility, personnel, general administration in the annex report.

The project cost during the initial 8 years will be 32.7 million US$ (base cost) and the cost during the 30 years inclusive of price escalation is shown in Table 4-36.

Table 4-35 Finance Plan by Work and Year (Base Cost)

(US$)

Year	Nursery Cost	Planting Cost	Forest Protection Cost	Forest Road Cost	Felling Cost	Skidding & Logging Cost	Repair Shop Cost	General Administration Cost	Reserve	Transportation & Travelling Cost
1	187,200	1,151,985	488,205	1,627,698	10,374	1,598,217	624,319	1,387,525	533,795	3,948
2	104,398	914,438	34,235	669,898	28,621	565,359	23,168	198,451	191,443	5,498
3	103,478	678,976	31,745	494,798	24,822	227,211	23,493	203,573	118,194	6,874
4	99,884	673,013	34,933	572,532	89,650	1,892,341	23,493	203,573	282,514	6,944
5	103,074	827,422	39,103	674,831	114,618	556,553	23,493	203,573	169,912	7,728
6	154,212	747,207	101,725	418,434	52,434	69,235	23,493	388,573	100,638	6,933
7	134,717	789,451	41,731	468,497	65,474	76,887	23,493	206,533	97,585	6,732
8	91,881	653,828	75,830	185,863	134,313	3,317,514	23,493	362,973	378,221	7,523
9	47,114	368,851	272,688	496,963	228,136	5,972,115	1,272,131	201,197	800,341	7,734
10	75,465	911,779	24,579	185,863	293,497	7,336,988	69,827	203,573	800,883	9,491
11	99,657	539,723	95,386	267,963	291,859	1,585,683	70,803	754,165	212,655	9,572
12	96,551	573,296	24,778	219,563	282,674	1,584,489	70,803	204,256	201,633	9,586
13	131,948	681,635	37,691	267,963	323,289	2,373,188	70,803	211,953	292,336	10,152
14	85,238	526,153	24,976	174,763	328,168	2,879,095	70,803	208,993	318,445	10,296
15	73,232	485,827	70,822	153,463	346,933	2,667,056	70,803	368,393	237,776	9,838
16	154,691	779,146	97,088	185,863	382,874	4,474,398	639,443	447,556	561,367	11,478
17	111,335	594,327	273,427	576,463	396,452	3,859,683	70,803	206,858	481,657	11,986
18	72,948	567,364	25,318	185,863	369,896	1,369,892	70,803	207,816	188,573	10,875
19	100,882	557,857	31,318	267,963	344,829	2,865,811	71,453	218,776	335,627	10,159
20	84,588	785,927	25,318	219,563	347,981	3,132,818	71,453	207,816	374,317	10,573
21	124,939	556,393	103,293	267,963	371,784	4,137,268	71,453	819,188	464,724	11,127
22	97,381	536,388	71,858	185,863	348,225	1,529,197	71,453	362,478	188,366	10,798
23	126,218	822,639	25,318	153,463	438,456	3,874,219	71,453	295,448	439,173	12,469
24	99,119	658,762	25,318	112,833	405,813	3,688,939	1,208,734	207,816	585,132	12,714
25	103,192	587,328	282,412	283,371	353,526	1,926,231	71,453	218,776	256,787	10,932
26	152,985	537,196	97,251	154,971	375,528	4,818,973	103,314	809,745	444,751	11,235
27	98,931	643,816	25,318	225,633	409,914	2,232,832	70,803	208,589	266,622	11,738
28	100,555	626,582	25,318	191,546	384,294	2,661,973	71,128	204,751	301,364	11,755
29	88,373	598,314	74,958	254,258	337,863	2,545,598	71,128	366,527	383,799	10,492
30	96,157	635,132	25,318	199,898	427,828	3,627,488	71,128	204,751	398,868	12,263

(Continued)

(US$)

Insurance Fee	Social Insurance Cost	Miscellaneous Cost	Consultancy Cost	Local Development Promotion Measure	Countermeasure for Environmental Impact	Total
36,549	39,483	10,000	1,350,026	56,180	2,809	9,880,893
26,576	54,976	10,000	450,209	56,180	2,809	3,319,519
14,353	60,739	10,000	450,209	56,180	2,809	2,490,646
27,534	69,441	10,000	450,209	56,180	2,809	3,615,950
21,529	77,279	10,000	450,209	56,180	2,809	3,338,312
15,690	69,326	10,000	450,209	56,180	2,809	2,667,891
12,522	67,321	10,000	450,209	56,180	2,809	2,429,661
55,237	75,232	10,000	450,209	56,180	2,809	5,800,186
114,431	77,348	10,000	0	0	0	9,861,041
111,471	94,918	10,000	0	0	0	10,846,646
31,452	95,725	10,000	0	0	0	4,864,563
21,492	95,863	10,000	0	0	0	3,384,984
34,768	101,529	10,000	0	0	0	4,467,236
38,497	102,956	10,000	0	0	0	4,778,383
29,291	98,377	10,000	0	0	0	3,982,465
77,863	114,704	10,000	0	0	0	7,855,987
68,823	119,864	10,000	0	0	0	6,772,790
16,209	108,748	10,000	0	0	0	3,073,815
41,259	101,585	10,000	0	0	0	4,948,719
46,553	105,728	10,000	0	0	0	5,422,627
68,135	111,266	10,000	0	0	0	7,111,526
18,957	107,583	10,000	0	0	0	3,441,251
53,255	124,694	10,000	0	0	0	6,358,889
63,888	127,141	10,000	0	0	0	7,115,880
28,123	109,324	10,000	0	0	0	4,153,366
64,948	112,351	10,000	0	0	0	6,891,237
28,549	117,363	10,000	0	0	0	4,341,160
33,808	117,548	10,000	0	0	0	4,741,842
38,315	104,328	10,000	0	0	0	4,788,439
47,372	122,628	10,000	0	0	0	5,877,933

Table 4-36 Comprehensive Finance Plan
(Price Escalation)

(US$)

Year	Price Escalation L/C	F/C	Total
1	2,573,607	6,936,898	9,510,505
2	1,792,650	1,941,315	3,733,965
3	1,686,931	1,325,262	3,012,193
4	2,083,859	2,450,247	4,534,106
5	2,577,086	1,989,482	4,566,568
6	2,417,712	1,528,158	3,945,870
7	2,602,117	1,314,232	3,916,349
8	3,212,179	5,407,209	8,619,388
9	3,652,844	10,795,601	14,448,445
10	4,698,320	11,000,075	15,698,395
11	5,437,747	2,907,641	8,345,388
12	5,759,834	2,122,361	7,882,195
13	6,667,319	3,621,629	10,288,948
14	7,415,031	4,147,025	11,562,056
15	7,753,419	3,191,782	10,945,201
16	10,486,763	8,780,676	19,267,439
17	11,498,280	7,255,689	18,753,969
18	10,481,296	1,861,910	12,343,206
19	11,580,517	5,180,498	16,761,015
20	13,252,014	6,036,412	19,288,426
21	16,095,106	8,944,675	25,039,781
22	16,589,418	2,447,077	19,036,495
23	21,292,169	7,536,865	28,829,034
24	24,462,157	9,074,456	33,536,613
25	22,086,844	4,126,411	26,213,255
26	30,463,104	8,943,654	39,406,758
27	28,430,381	4,457,254	32,887,635
28	31,397,790	5,469,965	36,867,755
29	30,262,023	6,418,121	36,680,144
30	39,967,914	8,232,950	48,200,864

CHAPTER 5

PROJECT EVALUATION

CHAPTER 5 PROJECT EVALUATION

5-1 Cost and Benefit

The project evaluation is made based upon the financial analysis and economic analysis as described in 4-1-6. The project costs represent the initial investment cost and related operation and maintenance costs for 8 years up to the completion of the first planting. The project benefits represent the revenues to be obtained from the yields of the plantation. The project period for evaluation is assumed 43 years up to the termination of the yielding from the first planting.

(1) Costs

Project costs have been estimated based on the investment for the 8 years needed for the 1st planting, related operational and maintenance costs during 43 years needed for harvesting of 1st plantation. The details of the above initial investment costs are mainly composed of building construction, procurement of machinery and equipment. The operation and maintenance costs are assumed to include the costs for tending, repair of road surface, fuel and renovation of machinery.

The result of cost estimation is summarized as follows. The details are shown in the Annex Report.

(Unit: 1,000 US$)

	INVESTMENT	OPERATION	TOTAL
Nursery Cost	975	134	1,109
Planting Cost	5,622	1,141	6,763
Forest Protection Cost	451	1,495	1,946
Forest Road Cost	4,549	3,130	7,679
Repair Shop Cost	601	598	1,199
General Administration Cost	1,205	5,394	6,599
Miscellaneous Cost, etc.	7,837	0	7,837
Total	21,240	11,892	33,132

(2) Benefits

The yield to be obtained from the first planting and existing forest are assumed to be benefits. The wood prices of new man-made forest has been estimated after deduction of felling costs and skidding and logging costs. Wood prices of the new man-made forests are shown in Table 5-1.

Table 5-1 Wood Prices of New Man-Made Forest

(Unit: Rp.)

Pulp Wood			General-use Timber	
Am	20,000	Thinning	Sm	70,000
Aa	20,000		Sb	70,000
Af	15,000		Af	35,000
		Felling	Pc	70,000
			Sm	70,000
			Sb	70,000

Am: Acacia mangium
Aa: Acacia auriculiformis
Af: Albizzia falcataria
Pc: Peronema canescens
Sm: Swietenia macrophylla
Sb: Schima wallichi var. bancana

In the calculation of benefits, total yield from the existing forests has been assumed to be pulp woods. The annual benefit as per tree species is detailed based on the sales plan in the Annex Report.

5-2 Financial Analysis

The financial internal rate of return was obtained from the annual benefits and costs estimation as presented in 5-1 and relevant sensitivity analysis has been conducted to assess the feasibility of the Project.

(1) Financial Internal Rate of Return

The financial internal rate of return (FIRR) was calculated based on the benefits and costs flow as indicated in Annex III-4. As a result of this calculation, the financial internal Rate of return was identified to be 9,45%.

(2) Sensitivity Analysis

The sensitivity analysis was conducted to examine how changes of preconditions affect the feasibility of the Project. The trial calculations have been made in the following assumed cases. As a result of this analysis, the FIRR was found to be 8.24% in case the preconditions of income and expenditure are changed to -10% and ±0% respectively and in a final analysis the Project remains feasible even in case the assumed preconditions change.

Table 5-2 Sensitivity Analysis

(%)

	Standard	Case 1	Case 2	Case 3	Case 4
Income	0	-10	0	+10	0
Expenditure	0	0	+10	0	10
FIRR	9.45	8.24	8.35	10.61	10.74

5-3 Economic Analysis

The Project intends to meet the domestic demand for timber as well as the demand for timber and wood products which are important export items for Indonesia and is expected to contribute to the development of the Indonesian economy, including the improvement of the international balance of payments through plantation activities.

Since the Project requires a long implementation period, it will affect not only the subject areas but also neighbouring areas in terms of land use and employment, etc. It was, therefore, decided to calculate the economic internal rate of return (EIRR) using the efficiency price to evaluate the direct and indirect effects of the afforestation to determine the degree of the efficient utilization of resources in these areas.

In conducting the economic analysis,

1) The salvage cutting wood is assumed to be of benefit to the local area. The price of wood is referred to be 5,000 Rp./m^3 taking into account the local market prices.

2) The personnel cost in the general adminsitration were excluded from the Project costs.

3) The following economic evaluations were conducted and the economic prices were computed.

(1) Price Evaluation

The Price used in Financial analysis was applied except the following efficiency price.

1) Shadow Wage Rate (SWR)

Many inhabitants of the Project Area also have income from other part-time or full-time work, including farming assistance (1,000 Rp/day), rice harvesting work (2,000 Rp/day) planting or weeding work (1,500 Rp/day) and oil field-related work (3,000 - 3,500 Rp/day). An average of the above mentioned wages is 2,000 Rp./day equivalent to 0.67 of the 3,000 Rp./day assumed in the present Project. Therefore, SWR was determined to be 0.67

2) International Price Factor of Pulp Wood and Construction Timber

a) Pulp wood

As Japan's import share of chips in world trade is as large as some 80%, the international price factor was examined using figures relating to Japan's imports.

Indonesian exports of hardwood chips to Japan in the period between January and October, 1989 (cited from Monthly Trade Report of Japan) was equivalent to 310,000 m^3 of logs (CIF price: 3,685 million yen). The average dollar-yen exchange rate during this period was 136.27 YEN/m^3 with a resulting chip price in dollars of 87.25 US$/$m^3$. Based on this figure, the price

at Palembang port were estimated as follows (all figures are estimates except the CIF price).

CIF	87.25 US$/m³
Freight	30.00 US$/m³
Insurance	10.00 US$/m³
Price at Palembang Port	47.25 US$/m³

The log price for domestic use at Palembang Port has been decided to be 16.85 US$/m³ for the Project. With the addition of an afforestation fee of 8.00 US$/m³, royalty fee of 1.43 US$/m³, export tax of 1.2 US$/m³ and chip processing cost of 12.65 US$/m³, the chip price becomes 40.13 US$/m³. The resulting international price factor for Indonesian chips at Palembang is 1.18.

b. Timber

P. canescens, S. macrophylla and S. bancana have been selected as the species for timber production and part of the production volume of A. falcataria will also be used for the same purpose.

There is no recent FOB price data due to the prohibition of log exports since 1985 and no relevant data concerning timber prices of these species. As a result, the marketing of the timber of these species is examined here based on the Indonesian export performance in 1984.

The average export price of Indonesian timber in 1984 was 95.72 US$/m³ FOB (Statistik Kehutanan Indonesia 1987/88). It has been decided that the Palembang port price based on an exchange rate of 1,780 Rp/US$ of 44.94 US$/m³ for P. canescens, S. macrophylla and S. bancana and 25.28 US$/m³ for A. falcataria will be

used. With the estimated afforestation fee of 7.00 US$/m³, royalty of 1.43 US$/m³ and export tax of 1.20 US$/m³, the international price factors for P. canescens, S. macrophylla, S. bancana and A. falcataria are, therefore, 1.75 and 2.74 respectively.

As a result benefits from new man-made forests are estimated using the prices calculated by the International Price Factor.

(2) Economic Internal Rate of Return (EIRR)

The EIRR, calculated using the aforegoing data, is 13.93% (Annex III-8).

(3) Effects Not Quantified

Some project effects cannot be quantified. The following elements were excluded from the economic analysis due to limited data and problems associated with their evaluation methods although large impact in these fields can be anticipated.

1) The motivation for further afforestation efforts can be expected. That will lead to the promotion of the local forestry and the forestry industry in all.

2) Afforestration will help in soil conservation and conservation of water catchment areas and therefore agricultural production will stabilize and grow.

3) Development of the infrastructure will follow.

4) Employment in the forestry works will increase and consequently the income of local inhabitants will also rise.

(4) Conclusion of Economic Analysis

Despite the exclusion of many favourable elements which cannot be quantified to maintain the calculation efficiency, a high EIRR of 13.79% has been obtained. The Project should, therefore, contribute to socioeconomic development not only in the Benakat Area but also in Indonesia as a whole through a number of favourable effects taking into consideration effect of external economies.

5-4 Environmental Impact Assessment

(1) Environmental Impact Study

As described in 4-1 Basic Policy, harmony between the development of an improved standard of living and the environment is the basic idea of Indonesia's Basic Act on Control of the Living Environment (Law No. 4 of 1982). Pursuant to this idea, the Environmental Assessment Act (Regulation No. 29 of 1986) and other regulations have been enforced to establish the environmental assessment procedure and to deal with other aspects of environmental conservation.

The Environment Committee has been established at the Ministry of Forestry with the Directorate General of Forest Protection and Nature Conservation at its core in response to these laws to prepare standards for environmental impact assessment in addition to all aspects of forest development, including industrial plantation.

Based on the above understanding, it has been decided that the environmental impact assessment procedure shown in Fig. 5-1 below should be followed.

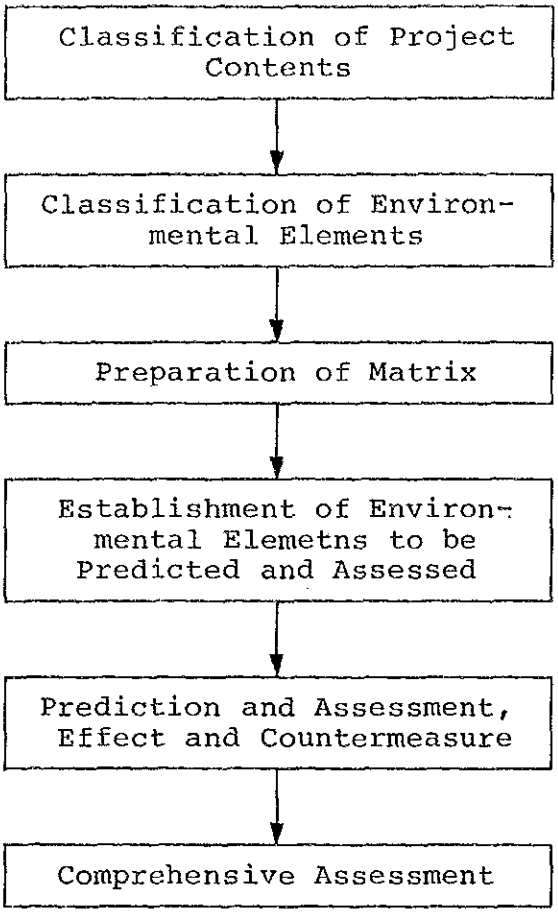


Fig. 5-1 Flow Chart of Environmental Impact Assessment

1) Identification of Impact Factors by Clarification of Project Contents

As the Project involves a wide range of work, from nursery work to planting, forest road construction and harvesting, etc., the factors with possible impact on the environment are also as diverse as land preparation, earth work following forest road construction, introduction of exotic species and plantation and felling or harvesting in a large-scale area, large-scale employment, etc.

2) Possibly Affected Environmental Elements

Natural Environment	:	air, water, topography, soil, noise level and fauna and flora, etc.
Social Environment	:	land use, employment and water utilization, etc.

3) An environmental matrix is often used to clearly define the relationship between the impact factors and the environmental elements. This matrix method has, therefore, been employed to identify those environmental elements which could be largely affected.

4) The prediction and assessment of the possible impact on the environmental elements identified in process 3 above has been conducted using collected data and other reference materials for the preparation of environmental protection measures.

(3) Prediction of Environmental Impact and Assessment

1) Summary of Project Contents

The Project contents are summarized below to examine the factors affecting the environment of the Study Area.

Study Area	some 50,000ha
Area of Operation Sites	some 43,800ha
Area of Planting Sites	some 27,700ha (Bush land and grassland)
Species to be Planted	Short Rotation Period: 8 years - A. mangium - A. auriculiformis - A. falcataria Medium or Long Rotation Period: 20 years or 35 years - P. canescens - S. macrophylla - S. bancana
Planting Area	some 3,500ha/year
Nursery and Office	9.5ha 3 place
Total Length of Forest Roads (Main and Working)	556.5km
Required Manpower	some 150,000 person days/year
Afforestration Work	mechanical afforestation using bulldozers, tractors and trucks

2) Summary of Environmental Factors

The natural environment and socioeconomic environment of the Project Area are summarized below based on the field survey results.

a. Natural Environment

Climate

The mean annual temperature and rainfall are approximately 26°C and 2,000 mm respectively. In general, the rainy season is from November to March and the dry season is from April to October. The annual rainfall largely fluctuates from year to year.

Hydrology

Although the water level differs between the rainy season and dry season, no drought occurs.

Water Quality

The water of most rivers is turbid due to the siltation.

Topography and Soil

In general, the Study Area is characterized by gentle hills with a large proportion of flat land and numerous rivers running between the hills. The soil is clayey with poor permeability and aeration, and over-saturation is observed in the rainly season.

Flora

Although the Study Area belongs to the tropical rain forest zone, half of the area is occupied by either alang-alang grassland or bush land. The forests are secondary forests and man-made forests and no virgin forests exist.

Fauna

The presence of elephants, monkeys, snakes, lizards and birds, etc. is confirmed, mainly in the secondary forests.

b. Socioeconomic Environment

Land Use

In addition to the alang-alang grassland and bush land mentioned above, settlements, oil fields, farmland and shifting cultivation sites are also observed. The main pillar of local life is agriculture.

Farming

Many farmers cultivate dry field rice and maize, etc. near their homes and are also engaged in shifting cultivation in the forest. While stock raising is conducted on a relatively small-scale, burning is conducted to maintain the grassland. Farmers collect firewood and wood for agricultural purposes from the nearby forests.

Water Supply

The local inhabitants use rivers in the vicinity of the villages as the source of domestic water. There is hardly any farmland irrigation.

Scenery

There is no specific scenery to be preserved. The alang-alang grassland common in hilly areas of South Sumatera is characteristic scenery of the Study Area.

Transportation

The roads constructed to connect the oil fields provide the main transportation network for the local inhabitants.

Employment Conditions

The population in the study area is approximately 14,000 and labor supply potential is large; however, actual employment opportunity is low while some employment in oil field operation and afforestation works are observed.

3) Preparation of Environmental Assessment Matrix

The environmental assessment matrix has been prepared to clarify which types of the planned work will affect which environmental factors. Using this matrix (Table 5-3), the environmental impact has been predicted and assessed for those factors where the impact is assumed to be large.

Table 5-3 Environmental Assessment Matrix

	Factor \ Work	Nursery Operation	Planting (Afforestation)	Forest Protection	Forest Roads	Yielding	Transportation	Project Management
Natural Environment	Climate		o					
	Water Quality	o	o		o			
	Hydrology		o					
	Topography & Soil	o	o		o			
	Flora		o	o	o	o		
	Fauna		o	o	o	o		
Socioeconomic Environment	Land Use		o	o	o			
	Farming	o	o					
	Water Supply	o			o			o
	Employment	o	o					o
	Transportation				o		o	
	Scenery		o		o	o		

4) Impact Prediction, Assessment and Countermeasures

The impact prediction and assessment for the natural and socioeconomic environments have been compiled in Tables 5-4 and 5-5.

Further, in-depth consideration of the environment (natural, social and economic) was made according to the basic policy of the present Project as mentioned previously, and various measures were presented in the project content. Various measures aiming at preventing ill effects on the environment have been examined and steps to develop positive effects are summarized in Tables 5-4 and 5-5.

Table 5-4 Prediction of the Impact on Natural Environment: Assessment and Countermeasures

Environmental factors	Prediction	Assessment	Countermeasures and Effects
Climate	As the grass land and bush land occupying about 50% of study area will be turned to forests, the extremely changeable climate will become a mild forest climate.	A mild climate will provide a favorable environment for peoples' living and production activities.	Since according to the Project, planting will be completed in 8 years, early change of the present climate into a mild one can be soon expected.
Hydrology	The change from a grass land into a forest will increase the permeability of the soil thus resulting into less flooding in the rainy season and higher water levels in the dry season. Afforestation will also increase the volume of transpiration.	The improved function of water catchment conservation resulting from forest establishment will contribute to stable river. The increased water evaporation will not pose a serious problem in this Area of large annual rainfall.	The forest which will be permanently maintained by the Project will have a favorable effect on the hydrology of the area.
Water Quality	The sediment discharge may increase temporarily as a consequence of planting works, construction of nurseries and forest roads performed without paying attention to topography and soil quality. The extensive use of agrochemicals and fertilizers may increase their discharge and pollute the domestic water supply.	The sediment discharge will be reduced generally by the forest establishment on the bare grassland, and the water quality from the water resources in the forest will be secured.	All types of work in the Project will be conducted with particular attention to prevention of sediment discharge, topography and soil quality. The sediment discharge will be controlled by the introduction of riparian preserved zones, the conservation forests in the harzous areas for collapse and by the stoppage of shifting cultivation. The use of agrochemicals and fertilizers is minimized by the Project to prevent the water pollution. The water quality in the Area and tributary area will be secured by the above measures.
Topography and Soil	From a scientific point of view, there is no specific area within the limits of the Project Area which should be preserved. There will be some change of topography and land productivity will become lower by various works.	Sediment discharge and water pollution are the same as above mentioned. The transformation of grass land and bush land to forest land will improve land productivity.	The countermeasures for sediment discharge and water pollution are the same as above mentioned. The land productivity will be maintained and improved by the forest management in the Project to increase the forest products which will contribute to the development of the local economy.

Table 5-4 (Cont.)

Environmental factors	Prediction	Assessment	Countermeasures and Effects
Flora	There is no specific vegetation i.e. a virgin forest to be preserved in the Project Area. The number of plant types at the beginning of plant succession will decrease as a result of forest establishment in grass land and bush land.	The man-made forest flora is simpler than natural forest flora, but richer than grass land flora. It is desirable to have various types of vegetation such as natural forest, man-made forest, grass land and agricultural land in order to preserve the local flora.	The grass land and bush land will be turned to forest land by the Project, but grass land flora will be maintained even after felling, planting species and felling time will be diversified and forest, man-made forest land will be limited to about 55% of the Area. The primarily natural flora will be maintained because the natural secondary forest will not be transformed into man-made forest. The vairous vegetation will be maintained as explained above and the flora of the Area will scarcely be changed.
Fauna	The animals of rare species in the natural secondary forest will move out of the Area. Grass land animals will also decrease due to the effects of the afforestation.	The fauna will be abundant due to various types of vegetation serving as a rich nutritive resource and also as an effective breeding and hiding place.	As the various types of vegetation will be maintained in natural forest, man-made forest, grass land and agricultural land as mentioned above, the fauna will scarcely be changed. Especially, the secondary forest will be changed more closely to natural forest, therefore there will be no problem for the protection of animals of rare species.

Table 5-5 Prediction of the Impact on Socioeconomic Environment: Assessment and Countermeasures

Environmental factors	Prediction	Assessment	Countermeasures and Effects
Land use	Land use for agricultural purposes will be limited in the Area due to the development of man-made forest and establishment of forest management.	The clear division of the production forest and farm land associated with fixed farming around the villages and productive industrial plantations will contribute to local development in the Project.	The land use division will be designed for local development and coexistence with agriculture in the dedicated agricultural land is planned.
Farming	The shifting cultivation and grazing in the forests will be regulated and disorderly forest use will be controlled.	The opportunity to change from shifting cultivation to fixed farming will be provided.	In the Project, the current shifting cultivation will be gradually changed into fixed farming through various measures. An increase in income will be expected through concentrated farming.
Water use	The function of water catchment conservation will be improved and water quality will be secured by the forest establishment and water use will be made more convenient.	As the domestic water and agricultural water will easily be available in sufficient quantity and quality, residents' daily life and agricultural activities will substantially improve.	The convenient use of water will be facilitated through the measures to meet inhabitants' demands.
Employment	Significant increase of employment opportunities can be expected in the industrial plantation such as nursery, planting, tending work, etc.	The required manpower for the employment will be provided within the Area, therefore the income of the inhabitants in the Area will increase resulting in the development of the local economy. The level of forestry skills and mechanical skills will be developed with increase of specialized employee.	Increase and stabilization of employment opportunities are attempted in the Project and the employment of 150,000 persons-day/year is considered to be maintained in order to greatly contribute to the development of the Area. Various technical training will be conducted during the execution of the Project to improve the level of the labor force.

Table 5-5 (Cont.)

Environmental factors	Prediction	Assessment	Countermeasures and Effects
Transportation	Public roads related to the Project and Project's roads will be developed and will be opened for public transportation. In case of forest roads, public use will be restricted.	The local transportation will be improved. The forest roads can be utilized as agricultural roads.	The distribution of goods and human transportation will be improved by the development of road network, contributing to the development of the Area associated with the increase of income as mentioned above.
Scenery	Although the scenery of vast tracts of alang-alang grass land will disappear, the forest and farm land will provide new scenery.	There is no specific scenery to be preserved in the Area.	The devastated scenery of alang-alang grassland will be changed to a new scenery composed of tidy and rich forests and farmlands.

5) Comprehensive Evaluation

The Project has given sufficient consideration to and provides appropriate measures for the possible impact on the natural environment at the initial planning stage. The Project is comprehensively assessed to have no negative impact on the local natural environment.

With regard to the possible impact on the socioeconomic environment, the Project will provide employment opportunities for local inhabitants and will also contribute to the local communities by means of an improved transportation network (forest roads) and other aspects. Although shifting cultivation and cattle raising in the forests will be restricted, this restriction will facilitate the settlement of farmers and will encourage the intensification of agriculture.

In conclusion, the comprehensive assessment of the Project's impact on the environment is that hardly any adverse effects on the local environment will be caused. Nevertheless, it will be necessary to implement the environment monitoring and to continually pay strict attention to any unexpected adverse impact on the environment throughout the implementation period and to quickly respond to any problem.

It must be noted that any measure relating to environmental conservation will require coordination between the forestry related organizations and other government agencies as well as the related local organizations and people.

CHAPTER 6

RECOMMENDATIONS

CHAPTER 6 RECOMMENDATIONS

1. Priority in Every Works

The project is large scaled and mechanized plantation while the understanding and cooperation of local shifting cultivators in the Study Area are required to be obtained during the project implementation.

Accordingly,

1) It is necessary for the project implementation to employ a large number of skilled workmen and ordinary labors among the local inhabitants. However, they are mostly unskilled for the plantation works, therefore, it is necessary to perform training for them before or during the project execution.

2) The understanding of local inhabitants (especially shifting cultivators) should be secured through the cooperation of heads and chiefs of the villages in prior to the project implementation and the coordination with the Ministry of Agriculture and related agencies will be necessary for the implementation of every measures.

3) In this Project, the works of every fields as nursery facilities construction and forest road construction will start approximately same time. The prior preparatory examination will therefore be necessary to achieve the coordination among the staff in respective fields of the Project Implementation Organization to prevent the conflicts among the fields.

2. Consideration for Inhabitants

As described earlier, one of the main factors indispensable for the smooth implementation of the Project is the understanding and cooperation of the local inhabitants. Therefore, this Project should be implemented to provide the benefits not only for the Project Implementation Organization but also for the local inhabitants.

In this context,

1) It is necessary to institute the employment plan so that a stable employment would be provided for the local inhabitants in the Study Area of poor employment situation.

2) The careful consideration should be given for the intention of the local inhabitants and an examination should be made also for the layout in the execution of the construction and locating of the necessary facilities of the Project such as forest roads and water supply systems in order that such construction would contribute to the development of the local infrastructure in conformance with the local situation.

3) The considerate implementation of the measures of consideration for inhabitants incorporated in the Project will be necessary in conformance with the intention of local inhabitants and a uniform and standardized approach for the implementation should be avoided to the extent possible so that the fixed and highly productive farming can be achieved based on the long ranged perspectives.

3. Dealing with Exhibition Forest and Seed Collecting Forest in Experimental Forest at Benakat

The forests created by South Sumatera Reforestation Technical Center (The Technical Cooperation for the Trial Plantation Project in Benakat) is the plantation achieved by the first mechanized planting on the grass land in South Sumatera and is presently administered and monitored by South Sumatera Reforestation Technical Center. Therefore, this forest has been excluded form the planned plantation in the present Project.

Therefore,

1) The continuous observation and collection of various data for the grass land plantation should be made in the various experimental stations already provided.

2) In this plantation, trees of scores of species are planted as exhibition and model forest. These forests should be utilized as precious pilot forests for the future plantation works.

3) In the experimental agroforestry site, the plan has not completed yet and plantation works are in progress. Therefore, the experimental plantation should be continued from now on in coordination with the settlers and this plantation should be used to examine the future possibility of coexisting of agriculture and forestry.

4. Implementation of Training Program for Large Scale Plantation

As described earlier, this Project is a large scaled plantation project introducing a large number of machine of various types. Therefore, some supports will be necessary from

the comprehensive view points in addition to the consultants' advice and construction supervision for the smooth implementation of the Project.

In other words,

1) A comprehensive supporting system should be provided including technical training and provision of experts for project management and operation of large scale forestry under the international assistance program.

2) The forests created by the Technical Cooperation for the Trial Plantation Project in Benekat is the most important data source from which the useful data can be obtained for the implementation of the present Project. Therefore, it is considered necessary to continue and strengthen the above mentioned supports also for these forests.