ANNEX 3

to

REPORT ON PROJECT PD 107/90 (i)

Strategies for Sustainable Wood Industries in Sarawak

HARVESTING AND TRANSPORTATION COSTS

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28 March 1994

REPORT ON

HARVESTING AND TRANSPORTATION COSTS

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1. INTRODUCTION. With the main objective to collect input data on logging and transport costs a consultancy was commissioned by the Forest Department, Sarawak, Malaysia. The data should be used as one of the inputs for a forest sector development plan for the State. The consultancy was carried out during a six week period from 15 February to 28 March 1994. Terms of Reference for the consultancy are included in Appendix 1 and the itinerary for the consultant in Appendix 2.

The consultant visited all the eight planning units in Sarawak and had discussions with representatives for contractors and logging companies and with local officers from the Forest Department. Valuable assistance in the work was given by Forest Department officials, especially Mr. Elbson Marajan, who participated in most of the field trips and by Mr. Abdul Wahab, Forest Economist in Kuching.

The data presented in this report are averages for planning units. They should be used for overall planning purposes only, in order to identify alternatives for development. For later analyses of selected alternatives a separate set of data, specific to selected area, has to be used.

The costs for the operations from the forest to the export point (in most cases the log pond at the river mouth) was broken up in segments so that the accumulated operating costs of the logs later could be calculated at different points along the transport chain. Royalty, company overheads and fees and charges for the forest concessions were not included. Different calculation methods were used for hill forests and swamp forests. Appendix 6 and Appendix 7 show the cost components used.

The companies and persons contact showed a great interest and openness in discussing harvesting activities. There was, however, a wide variation in the cost figures received. The main explanation is that there is a considerable variation between logging areas, more depending on the terrain type than the than the geographical location. Felling and skidding, for instance, is contracted out at approximately the same price in an area near Miri and in area close to the Indonesian border, if the terrain condition is similar. The company cost for harvesting is, however, higher the further out in the forest the area is situated. Large companies can also benefit from economies of scale.

Other explanations for the great variation in the collected data include:

- Sub-contracts are frequently given out and the licensee or main contractor may not know the exact costs for individual components in a sub-contract.

- Due to the centralized administration in most of the companies the persons in the field are not informed how the costs are calculated and compounded.

- The companies use different methods to record, compile and control the field costs.

- The harvesting costs are considered as business secrets not to be communicated to outsiders.

A summary of forest areas and future logging volumes is presented in Appendix 5. Although the table is only a rough summary it is clear that planning units 3, 6 and 7 will play the major role in future logging.

A comprehensive study of harvesting costs of mixed dipterocarp forests of Sarawak was made by an FAO project in the early 1980's (reference 1 and 2). The methods for harvesting have not changed much since then and these reports can therefore be used as guidelines to show the relative costs for different components.

The logging industry in Sarawak consists of a large number of small enterprises. There is only one company that can be considered as large and a few are of middle size. Common for all is the centralized administration. Decisions are made by one person, or in some cases a small number of persons, in each company. Only the larger companies have professional foresters employed.

In 1993 Forest Department introduced a monthly quota for logging which significantly reduced the log outtake. This resulted in a surplus of machinery and personnel in the logging industry. There has hardly been any investment in new machinery the last years .

There is no shortage of forest labour, but several companies indicated that it was difficult to recruit qualified surveyors for planning of the forest activities.

There is no system in the administration for continuous follow-up of harvesting costs. It is recommended that a system is developed to objectively monitor the costs for harvesting and transport of forest products to serve as a base for decisions about utilization of the forest resources.

2. DEFINITION OF COST COMPONENTS.

The costs were grouped together in cost components, different for hill forests and swamp forests. Both direct and indirect costs in the field were included in the operation costs. The indirect field costs, camp costs and other support costs, had to be estimated, since most companies do not record these costs separately. Appendix 6 and 7 show the cost structure use for hill and swamp forests.

2.1 Hill forests.

Planning. Only the two largest companies have their own planning department for preparation of engineering plans, which are required by the Forest Department for starting logging on long term licenses. The other loggers use a consulting company, R & G Consultants, for the preparation of these plans. R & G has a base price list for their services, but each assignment has to be individually negotiated and the cost depends on the type of area and the size of operation.

Felling. Felling includes all activities for felling, de-limbing, crosscutting and clearing the area around the logs for removal by tractor.

Debarking. The removal of bark. It is normally done at the forest landing by the feller. The cost is often included in the contract price for felling.

Skidding. The terrain transport of logs to the forest landing for further transport by truck. Includes opening of skidtrails, terrain transport, off-loading at the landing and handling of the logs at the landing. The average skidding distance is around 600 metres, maximum 1½ kilometre.

Supervision. This cost is estimated, since few companies have separate recording. Includes supervision in the forest for felling, skidding and forest landing operation. General camp expenses are included under this heading.

Road transport. Includes loading of the truck at the forest landing, truck hauling to riverside and off-loading. One and two transit camps can be used where the logs are re-loaded. Reasons for using transit camps are: take advantage of different weather conditions along the route, regulate the log flow to the log yard where royalty is measured, differentiate the road standard (better roads and heavier trucks at the end of the route) and to break the monotony for truck drivers on long hauls. One transit camp is included for trucking distances between 75 and 110 km. For distances over 110 km two transit camps are included.

Loading and off-loading. These costs are included in the trucking costs. When charged separately they are estimated to be M$ 3.50/m^3 for loading and M$ 2.50/m^3 for off-loading. When transit camps are used a total cost for loading/off-loading of M$ 6.00/m^3 is added for each transit camp. The same costs are used for loading and off-loading barges.

Barging. Includes costs for loading on barge, hauling to log yard at river mouth and off-loading. Different sizes of barges are used, from 350 m^3 capacity on shallow rivers to 2 500 m^3 capacity on large rivers. The barging costs are the same regardless of barge size.

Rafting. Is an alternative to barging for floater logs. Includes costs for preparing of rafts, towing of rafts and lifting the logs to the log pond. The towing costs for rafts is about one third as compared to barging. There is a risk of loosing logs when rafting. The cost for preparing a raft is the same as for loading on a barge.

Delivery. Includes handling and sorting of logs at the final log pond at river mouth, loading of logs on barge for transport to ship and loading of logs onto the ship. Most logs are sold FOB. Total cost for these operations are estimated at M$ 7 per m^3.

Sea freight. Includes costs for loading logs on ship, transport within Sarawak, off-loading at destination and port charges.

Road construction. Includes all costs for constructing new roads. No road construction costs are included for re-logging areas.

Road maintenance. Includes all costs for maintenance of roads necessary for the logging. Since new logging areas are opened up further away from rivers a bigger road network has to be maintained every year. The average road transport distance for logs has almost doubled during the last 10 years.

2.2 Swamp forests.

Planning. Is normally done by the logger. Is easier and less costly than in hill forests.

Felling. Costs include felling of trees, pulling by hand to rail line (kuda-kuda) and loading on rail car. In some areas winching with metal boats has been introduced as an alternative to kuda-kuda. Excavators can be used for pulling out the logs on conversion areas.

Debarking. Is normally included in the felling contract and done at the forest landing after the rail transport. Debarking cost should be the same in hill forest and in swamp forest.

Rail transport. Is a cheap way of transporting the logs to the river side. Includes off-loading.

Barging. Same as for hill forests.

Rafting. Same as for hill forests.

Sea freight and delivery. Same as for hill forests.

Rail construction. Includes all costs for constructing the rail line and for investment in locomotive and rail cars.

Rail maintenance. Includes all costs for maintenance of rail line and rolling stock.

3. ESTIMATED COSTS. Average operating costs up to the export point for the different planning units are summarized in Appendix 8 and 9 for hill forests and swamp forests, respectively. The calculations are based on a logging volume of 40 m^3/ha in hill forests and 55 m^3/ha in swamp forests.

Cost for transport include empty return trip.

4. COSTS FOR ROAD AND SEA TRANSPORT.

Local transport of logs between rivers for local processing in Sarawak is now handled by a new company, HARWOOD Sdn. Bhd., which is a subsidiary to STIDC. HARWOOD will initially use chartered vessels. A price list is under preparation for different routes. Costs per m^3 will vary depending on distance but can be expected to be around:

- M$ 0.15 for distances up to 100 km
- M$ 0.08 for distances between 100 and 300 km
- M$ 0.05 for distance over 300 km.

Variations will occur depending on tides and river situation. Wharfage cost can be estimated at M$ 2.80/m^3 and stevedoring at M$ 8.60/m^3. Pilot fee and cost for tug boat have to be added.

Sawntimber and general cargo is normally cheaper to transport than logs. Sea freight of sawn timber Bintulu-Kuching (385 km) is charged M$ 50/Hoppus ton (=M$ 0.072/m^3km). Belian timber on the same route is charged M$ 0.087/m^3km. General cargo is charged about the same amount as ordinary sawn timber. Loading and port charges have to be added to these costs.

Road transport on public roads costs M$ 0.28/tonne. This figure is based on chartering a 6-wheel truck with a capacity of 7 tonnes. Transport of general cargo on logging roads is more expensive. Costs have to be negotiated in each case. The logging roads will generally allow a higher load than the public road network.

5. LOW IMPACT LOGGING. Increasing attention is given to harvesting methods that will be less harmful to the environment. The engineering plans now required by the Forest Department is an implementation of the planning methods proposed in the FAO reports 1981. Through preparation of topographic maps and detailed planning of roads and skidtrails the damage to the nature is reduced. It is expected that further improvement in the planning technique in tractor logging areas could further reduce the negative impacts to a certain extent. No estimates were made in this study about the costs and environmental benefits of such planning.

Helicopter logging was introduced in Sarawak in April 1993. It is still in an experimental stage and no official cost and production figures are available. From April 1994 three helicopter units will be operating in the State. A detailed report on helicopter logging was presented by Forest Department in August 1993 (reference 3).

It is not possible to make a direct comparison between helicopter and tractor logging since they are operating under different conditions and in different terrain. So far helicopters have been used only in terrain class IV, which now is closed for tractors. The volumes taken out from helicopter areas are outside the logging quota. It thus means an additional log volume for the logging company.

Since helicopter logging is expensive, only valuable logs can be extracted. Helicopter logging means "creaming" of the forest. More felled logs are also left in the forest for different reason after helicopter logging. There is, however, a 100% enumeration of the trees to be logged. On the average some 20 m^3/ha are marked for felling and some 16 m^3/ha are taken out. This should be compared with an average outtake of 40-45 m^3/ha in tractor logging.

More detailed studies are required to determine the volume that is economically feasible to take out by helicopter in a normal tractor area.

It is no doubt that helicopter logging is more environmentally friendly than tractor logging. There is less erosion due to fewer roads and no skidtrails are opened in the forest.

The planning for helicopter logging is, however, more costly. It is estimated that planning will cost around M$ 10/m^3, which is around 10 times the present cost in tractor logging. Felling is also more expensive because of the low volume per ha and the difficult terrain. Felling costs in helicopter areas is estimated to be over M$ 8.00/m^3, which is double the felling cost in tractor areas.

The costs for debarking and for other components from the forest landing onwards are the same in helicopter logging as for tractor logging.

If helicopter logging shall be recognized as an acceptable alternative it is necessary to present objective studies about the environmental effects. It is also necessary that the Forest Department finds practical ways of controlling the logging activities in the field.

6. PERSONNEL SITUATION. The main tasks of the Forest Department can briefly be summarized as approving of logging plans, control in the field that the logging plans are followed and measurement and collection of royalty. If any new activities are going to be added, like cost monitoring or introduction and control of new activities, the personnel has to be properly trained for the new tasks. It will probably also be necessary to increase the number of officers.

Any new development ideas to be introduced must first be fully explained and understood by the Forest Department personnel, since they are going to control the implementation in the field. After the limited contacts with local foresters during the consultancy it is the opinion of the consultant that Forest Department personnel has the qualification and interest in introducing new methods. Comprehensive training programmes for the entire personnel are, however, necessary if new ideas and working procedures should be presented. Unless full understanding is obtained by the entire personnel, new working methods in the forestry sector have little chance of being accepted.

Also on the logging industry side it will be difficult to introduce new initiatives without intensive training and information. Only the larger companies have professional foresters employed, who are likely to respond to new ideas without comprehensive training.

TERMS OF REFERENCE

SPECIALIST ON LOGGING AND TRANSPORT ACTIVITIES

Qualifications: University degree in forestry or engineering and a minimum of seven years experience of timber extraction in the tropics.

Timing: Duration, one month, starting mid February, 1994 or earlier.

Duty Station: Kuching, with travel to various locations in Sarawak

Remuneration: To be negotiated.

The consultant will work together with other international staff of the Project and with staff of the Forest Department and Sarawak Timber Industry Development Corporation in a cooperative effort to design a forest sector development plan for Sarawak. The consultant will specifically :-

1 Assist in collecting, compiling and analyzing data on costs of logging and transport in the swamp and hill forests in Sarawak.

2 Assist in making estimates of production costs in the forest industries of the state, including logging, processing, marketing, sales and product delivery.

3 Guide and assist in the assessment of the economic and financial viability of low impact logging methods, including helicopter logging.

4 Assess the technical and managerial skill of the personnel of the logging industry of Sarawak and propose measures for improvement.

5 Carry out any other tasks as directed by the Project Coordinator and relevant for the implementation of the Project.

6 Compile a report covering points 1 - 4 above.

ITINERARY AND EXCHANGE RATES

Tue 15/2	arrive Kuching by MH 642 from Singapore
Wed 16/2	office Kuching
Thu 17/2	office Kuching
Fri 18/2	office Kuching
Sat 19/2	office Kuching
Sun 20/2	
Mon 21/2	left Kuching 0800 by car for Lundu; visiting Sematan
Tue 22/2	in Lundu area
Wed 23/2	travel Lundu-Kuching by car, arrive Kuching 1115
Thu 24/2	office Kuching
Fri 25/2	left Kuching by air to Miri/Limbang; meetings in Limbang
Sat 26/2	travel Limbang-Lawas by air; meetings in Lawas
Sun 27/2	visit to logging camp in Lawas area
Mon 28/2	travel by air to Miri/Bintulu; meetings in Bintulu
Tue 1/3	visit to helicopter logging area near Bintulu
Wed 2/3	express boat Bintulu-Tubau; discussions with representatives from several logging camps
Thu 3/3	express boat Tubau-Bintulu; meetings in Bintulu
Fri 4/3	by car Bintulu-Miri; visit one logging camp
Sat 5/3	meetings in Miri with logging companies
Sun 6/3	
Mon 7/3	meetings in Miri
Tue 8/3	meetings in Miri
Wed 9/3	travel by air Miri-Kuching; work at hotel
Thu 10/3	office Kuching
Fri 11/3	office Kuching
Sat 12/3	office Kuching
Sun 13/3	
Mon 14/3	Hari Raya; work at hotel
Tue 15/3	Public Holiday; work at hotel
Wed 16/3	travel by air Kuching-Sibu; meetings in Sibu
	Sibu-Kapit by express boat
Thu 17/3	In Kapit area, meetings with logging companies
Fri 18/3	express boat Kapit-Sibu, meetings in Sibu
Sat 19/3	meeting in Sibu with logging contractor
	travel by air Sibu-Kuching
Sun 20/3	
Mon 21/3	office Kuching, meetings in Kuching
Tue 22/3	office Kuching, meetings in Kuching
Wed 23/3	office Kuching, meetings in Kuching
Thu 24/3	office Kuching
Fri 25/3	office Kuching
Sat 26/3	office Kuching
Sun 27/3	work at hotel
Mon 28/3	office Kuching/left Kuching at 1600 my MH 643

Exchange rates:

US$1 = SEK 8.06 (Swedish kronor)
= TBH 25.15 (Thai baht)
= S$ 1.56 (Singapore dollar)
= M$ 2.75 (Malaysian ringgit)

M$1 = US$ 0.0275
= SEK 2.93

S$1 = M$ 1.76
= SEK 5.17

THB 1 = USD 0.0398
= SEK 0.32

Appendix 3.

References.

1. Planning and Cost Studies in Harvesting in the Mixed Dipterocarp Forests of Sarawak. Field Document No.7, Forestry Development Project Sarawak. FAO.

   Part 1. Based on Maps Derived from Ground Survey, August 1981.

   Part 2. Based on Maps Derived from Available Air Photographs. September 1981.

2. Further Studies in Harvesting the Mixed Dipterocarp Forests of Sarawak, Including FMC Skidder Operation. January 1982. Field Document No 8, Forestry Development Project Sarawak. FAO.

3. A Case Study on Helicopter Harvesting in the Hill Mixed Dipterocarp Forests of Sarawak. Danny Chua Kee Hui, August 1993.

4. Strategies for Sustainable Woood Industries in Sarawak. Final Report of Forest Resource Specialist.
   Jay Blakeney, January 1994.

5. Logging Practices. Steve Conway, 1976 (second printing 1986).

6. Harvesting cost in natural forest. Cost data for logging and transport for Sarawak submitted in 1993 to Asia-Pacific Forestry Conference.

DISTANCES

			km
River:	Sibu	- Song	100
		- Kapit	145
		- Belaga	305
		- (Bakun Dam)	(340)
		- Sarikei	60
		- Tg. Manis	95
	Kapit	- Sibu	145
		- Sarikei	205
		- Tg. Manis	235
		- Belaga	160
	Bintulu	- Pandan	45
		- Labang	65
		- Tubau	95
	K. Baram	- Marudi	85
		- Long Lama	155
		- Long Miri	180
Sea:	Kuching	- Sri Aman	170
		- Tg. Manis	140
		- Sarikei	175
		- Mukah	275
		- Bintulu	385
		- Niah (sea)	610
		- Miri	665
		- Kuala Baram	685
		- Limbang	865
		- Lawas	865
	Tg. Manis	- Mukah	190
		- Bintulu	300
		- Niah (sea)	405
		- Miri	470
		- Kuala Baram	490
		- Limbang	670
		- Lawas	670
	Mukah	- Bintulu	110
		- Niah (sea)	225
		- Miri	280
		- Kuala Baram	300
		- Limbang	480
		- Lawas	480
	Bintulu	- Niah (sea)	115
		- Miri	170
		- Kuala Baram	190
		- Limbang	370
		- Lawas	370
	Miri	- Kuala Baram	20
		- Limbang	200
		- Lawas	200
	Kuala Baram	- Limbang	180
		- Lawas	180
		- Tatau	240
	Limbang	- Lawas	65

(cont'd)

Road:	Kuching	- Bau	32
		- Lundu	112
		- Sematan	142
		- Serian	61
		- Simunjan	146
		- Sri Aman	180
		- Betong	231
		- Saratok	277
		- Sarikei	330
		- Sibu	412
		- Kanowit	397
		- Bintulu	618
		- Miri	812
	Sri Aman	- Simunjan	115
		- Serian	120
		- Betong	71
		- Saratok	117
		- Sarikei	170
		- Kanowit	237
		- Sibu	252
		- Mukah	--
		- Tatau	367
	Sibu	- Sri Aman	252
		- Betong	201
		- Saratok	145
		- Sarikei	98
		- Kanowit	65
		- Mukah	--
		- Tatau	145
		- Bintulu	221
	Bintulu	- Mukah	--
		- Tatau	60
		- Tubau	86
		- Belaga	147
		- Bakun Dam	181
		- Niah	120
		- Miri	203
		- Tg. Kidurong	15
	Bakun Dam	- Belaga	34
		- Tubau	95
		- Bintulu	181
	Miri	- Niah	113
		- Marudi	(55)
		- K. Baram	20
		- Long Tuyot	125
		- Long Lama	240
	Limbang	- Long Lama	200 (est.)

SUMMARY OF FOREST AREAS

PLANNING UNIT	SWAMP FOREST [1]/		HILL FOREST [2]/		APPROX. LOGGING VOLUME [3]/			
	Forested	Unlogged	Forested	Unlogged	Swamp		Hill	
	1000 ha	1000 ha	1000 ha	1000 ha	1000 m³/yr		1000 m³/yr	
1	302	39	71	20	100	28%	77	1%
2	239	15	54	9	40	11%	23	0.3%
3	--	--	1 248	623	--	--	1 848	24%
4	166	30	137	27	75	21%	77	1%
5	177	34	798	173	85	24%	539	7%
6	--	--	1 500	900	--	--	2 618	34%
7	99	22	1 210	657	57	16%	1 925	25%
8	16	1	431	247	3	1%	693	9%
TOTAL	999	141	5 449	2 656	360	100%	7 700	100%

[1]/ From J. Blakeney, Jan/94

[2]/ From J. Blakeney, Jan/94

[3]/ Based on Scenario # 4, J. Blakeney, Jan/94. The total annual logging volume for the period 1995-2010 is distributed per planning unit in relation to the area of unlogged forest. With this assumption some 82 % of of the total logging in the hill forests is expected to come from planning units 3, 5 and 6.

COST COMPONENTS, HILL FORESTS

A	**PLANNING**	field planning of harvest; topo map and survey; inventory; road and skidtrail alignment
B	**FELLING**	felling; de-limbing; cross cutting; clearing for removal
C	**DEBARKING**	removal of bark, normally included in the felling cost and done at forest landing
D	**SKIDDING**	opening of skid trails; terrain transport of logs to forest landing; loading and off-loading on tractor; handling of logs at forest landing
E	**SUPERVISION**	supervision in the forest for felling and skidding; general camp costs and expenses
F	**ROAD TRANSPORT**	loading on truck; hauling; off-loading; sorting and handling of logs at transit camps (one or two transit camps can be used, especially if the total hauling distance is long)
G	**BARGING**	loading on barge, barging and off-loading at log pond at river mouth;
H	**RAFTING**	preparation of rafts; towing to log pond at river mouth; lifting of logs from water to log pond (rafting is an alternative to barging and refers to floater logs only; cost for rafting is approximately one third of the cost for barging)
I	**DELIVERY**	handling and sorting of logs at final log pond; loading on barge for delivery to ship; barging to ship; loading on ship
J	**SEA FREIGHT**	port charges at start and end of transport; freight cost by ship or barge within Sarawak
K	**ROAD CONSTRUCTION**	all costs for establishment of roads (primary, secondary, feeder)
L	**ROAD MAINTENANCE**	all maintenance of necessary roads

TOTAL OPERATING COST all operating costs up to export point (normally central log pond at river mouth)

COST COMPONENTS, SWAMP FORESTS

A	**PLANNING**	field planning of harvest; survey; inventory; alignment of rail lines
B	**FELLING**	felling; de-limbing; cross cutting; moving of logs to rail line (kuda-kuda or winch); loading on rail car
C	**DEBARKING**	removal of bark, normally included in the felling cost and done at forest landing
D	**RAIL TRANSPORT**	rail transport to riverside landing; off-loading
E	**SUPERVISION**	supervision in the forest for felling and rail transport; general camp costs and expenses
G	**BARGING**	loading on barge; barging; off-loading at log pond at river mouth; costs for sorting and handling of logs at log pond
H	**RAFTING**	alternative to barging and refers only to floater logs; includes preparation of rafts; towing to log pond at river mouth and lifting of logs from water to log pond
I	**DELIVERY**	handling and sorting of logs at final log pond; loading on barge for delivery to ship; barging to ship; loading on ship
J	**SEA FREIGHT**	port charges at start and end of transport; freight cost by ship or barge within Sarawak
K	**RAIL CONSTRUCTION**	all costs for construction of rail line; cost for locomotive and rail cars
L	**RAIL MAINTENANCE**	all maintenance of rail lines

TOTAL OPERATING COST	all operating costs up to export point (normally central log pond at river mouth)

SUMMARY HARVESTING COSTS, HILL FORESTS

(in M$ per m³)

COST COMPONENT	PLANNING UNIT							
	1	2	3	4	5	6	7	8
A PLANNING	1.12	1.12	1.34	1.12	1.12	1.34	1.34	1.23
B FELLING	4.30	4.30	5.20	4.30	5.00	5.20	5.20	5.00
C DEBARKING	0.90	0.90	0.95	0.90	0.90	0.95	0.95	0.95
D SKIDDING	30.00	30.00	33.00	30.00	30.00	33.00	33.00	33.00
E SUPERVISION	13.00	13.00	16.00	13.00	13.00	16.00	16.00	16.00
F ROAD TRANSPORT	16.50	20.00	52.00	16.50	40.00	138.00	66.00	30.50
G BARGING	—	20.00	32.50	18.00	18.00	27.00	60.00	—
H RAFTING	—	(10.50)	(14.85)	(5.00)	(5.00)	(8.00)	(20.00)	—
K ROAD CONSTRUCTION	13.00	13.00	16.00	13.00	16.00	16.00	16.00	16.00
L ROAD MAINTENANCE	10.00	10.00	13.00	10.00	10.00	13.00	12.00	12.00
TOTAL OPERATING COST:								
BARGING	89	112	170	107	134	250	210	115
(RAFTING)	--	(103)	(152)	(94)	(121)	(232)	(170)	—

SUMMARY HARVESTING COSTS, SWAMP FORESTS

(in M$ per m^3)

COST COMPONENT	PLANNING UNIT							
	1	2	3	4	5	6	7	8
A PLANNING	1.00	1.00	—	1.00	1.00	—	1.00	1.00
B FELLING	35.00	35.00	—	35.00	35.00	—	35.00	35.00
C DEBARKING	1.00	1.00	—	1.00	1.00	—	1.00	1.00
D RAIL TRANSPORT	2.00	2.00	—	2.00	2.00	—	2.00	2.00
E SUPERVISION	10.00	10.00	—	10.00	10.00	—	10.00	10.00
G BARGING	7.00	8.00	—	8.00	8.00	—	9.00	6.00
H RAFTING	(2.25)	(3.25)	—	(3.25)	(3.25)	—	(4.25)	(1.25)
K RAIL CONSTRUCTION	15.00	15.00	—	15.00	15.00	—	15.00	15.00
L RAIL MAINTENANCE	8.00	8.00	—	8.00	8.00	—	8.00	8.00
TOTAL OPERATING COST:								
BARGING	81	80	—	80	80	—	81	78
(RAFTING)	(76)	(72)	—	(75)	(75)	—	(76)	(73)