

PESAMA TIMBER CORPORATION SDN BHD (PESAMA)

PUBLIC SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE SUSTAINABLE MANAGEMENT OF SECOND GROWTH NATURAL TROPICAL RAIN FOREST MANAGED UNDER THE SELECTIVE MANAGEMENT SYSTEM IN 20,243-HA CHERUL FOREST CONCESSION, TERENGGANU, MALAYSIA

**Kemaman, Terengganu,
Malaysia**

5 July, 2014

PUBLIC SUMMARY

1.0 Introduction & Background

This EIA report describes the sustainable management of the **second growth** natural tropical rain forest (TRF) within the 20,243-ha Cherul Forest Concession (CFC) area located in the State of Terengganu, Malaysia and its environment, encapsulating a comprehensive list of instructions that will be followed and actions to be taken, over the short and long terms, by the Project Proponent, PESAMA TIMBER CORPORATION SDN BHD (PESAMA). The tract of TRF had been largely selectively harvested for its timber during its first cycle of management under the Malaysian Selective Management System (SMS), and has now entered into its second, 30-year cycle effective from 2008. As one of the few key players in the production and trade of quality tropical timber products in the domestic and international marketplace, PESAMA is keen to be seen as a company that meets and fulfills all the relevant conditions and requirements pertaining to the business of natural TRF management, development and conservation.

The EIA Report is to serve to ensure that PESAMA as the Project Proponent is well guided in its effort to be transparent and environmentally friendly and meets the criteria as a business entity that subscribes to sound environmental protection protocols and Sustainable Forest Management (SFM) practices as propounded by the Forest Stewardship Council® (FSC®). The EIA report was prepared based on the wide and practical experience of the consultants as well as information and data gathered from field surveys on the area during 2011 and 2012 together with other sources. It was prepared following the general format as laid out in FRIM Technical Information Handbook No. 14 “EIA *Guidelines for Harvesting of Natural Forests*” which had earlier been approved by the Government of Malaysia, *albeit* with some minor adjustments where necessary, in order to suit with the natural TRF context. Among the salient points and recommendations contained in the Report are:

Project Concept & Design:

1. Reduced-Impact Harvesting (RIL) of selected and marked trees will be conducted within clearly demarcated felling blocks (FBs) of reasonable size of less than 100ha each;
2. Appropriate Environmental Management Plan (EMP) will be prepared for forest compartment being worked on.
3. RIL and construction of forest infrastructure will strictly follow the environmental protection guidelines, whereby removal of standing trees and vegetation will be kept to the minimum level, and only when absolutely necessary, whereas the loss and compaction of topsoil will likewise be minimized. Trees, vegetation and soils within buffer zones/strips, high conservation value forests (HCVFs), and other sensitive sites will be protected and open-burning of slash and felling debris will be strictly avoided;
4. Soil erosion control measures in FBs, the disposal of solid wastes and sewage, and the protection of wildlife will follow the designs as laid out and advice given by the relevant government agencies and non-governmental organizations (NGOs).

Compliance:

1. PESAMA undertakes to implement in earnest all the recommendations set out in this EIA report;
2. PESAMA will ensure that all access roads to FBs will be constructed to the standard specified by TSFD and in accordance with MC & I (Malaysian Criteria, Indicators and Standard of Performance for Sustainable Forest Management) and that these roads and access will be maintained regularly;
3. Buffer zones/ strips along permanent rivers, streams, lakes and other water bodies will be protected from any forms of violation;
4. All perimeter boundaries around Cherul Forest Concession will be accordingly marked and cleared;
5. PESAMA undertakes to observe all instructions as regards the use, discharge and disposal of solid wastes, chemicals and poisons and fertilizers. All workers' sewage, rubbish and wastes in CFC will be similarly dealt with;
6. The interest of the local community in the area and its immediate vicinity will be catered for by way of creating employment and business opportunities wherever appropriate, as well as protecting the natural environment and forest ecosystem.

Control of Water and Air Quality:

1. Measurements conducted during the preparation of this EIA have revealed that river water and the ambient air sampled within the Project Area were within the Malaysian National Guidelines for the respective parameters;
2. Regular monitoring and reporting of the quality of water in major rivers within the project sites will be conducted by PESAMA;
3. Storage, discharge and disposal of wastes into streams and rivers will be strictly controlled so as not to exceed the limits specified by the relevant authorities;
4. Open burnings of slash and felling debris and other materials within FBs will be strictly avoided.

Reporting:

1. During the course of the project, regular compliance reports will be prepared and submitted to the relevant authorities following agreed format.

Legislative Requirements

Under the Malaysian Environmental Quality (E.Q) (Prescribed Activities) Environmental Impact Assessment) Order, 1987 of the Environmental Quality Act (EQA) 1974 (Act 127), the following forestry and forestry-related activities have been identified as those projects that require individual environmental impact assessment (EIA) reports to be prepared before their commencement:

- a) conversion of hill forest land to other land use covering an area of 50 hectares or more;
- b) logging covering an area of 500 hectares or more;
- c) logging or conversion of forest land into other land uses within the catchment area or reservoirs used for municipal water supply, irrigation or hydro-power generation or areas adjacent to national and state parks and national marine parks;
- d) conversion of mangrove swamps for industrial, housing or agricultural uses covering an area of 50 hectares or more;
- e) clearing of mangrove swamps on islands adjacent to national marine parks.

Statement of Need

The whole of Cherul Forest Concession (CFC) lies within Cherul PRF which in turn constitutes part of the larger national network of PFE. For the purpose of this EIA, CFC area will be treated as a single and unique Forest Management Unit (FMU). On its part, PESAMA is unequivocal in stating its principal aim of becoming a leading force in integrated natural TRF concession management and development in Malaysia and the region. While producing high quality timbers, soundly managed natural TRFs function to mitigate for the degradation and loss of the natural TRF ecosystems caused by poor management and illegal logging, encroachment, illegal farming and human development activities while rehabilitating and re-greening these areas, thereby contributing towards ameliorating the negative effects of global warming. Under the circumstance, PESAMA management had determined as its objectives, to sustainably manage and rehabilitate the FMU and replant it with any approved indigenous timber species. PESAMA believes that given the right approach coupled with the right investment strategy and with close cooperation of the relevant government agencies and concerned NGOs, the management of natural TRF concession such as this would be able to proceed without much difficulty.

The “No Sustainable Management of the Natural TRF” Option

Evidence shows that the present impressive contribution of the Malaysian timber industry to the country's GDP as its 4th largest foreign exchange earner is set to continue during the years to come. Over the years, the supply of tropical timber has seen a consistently declining trend, which effectively led to firmer timber prices. This had in turn caused Malaysian timber and timber product exports to improve and reached RM23.4 billion in 2006, marking a 10.4 per cent increase from 2005. Export earning in 2007 was RM22.76 billion, which fell to RM20.5 billion in 2010. Under the Third Industrial Master Plan (2006 – 2020), Malaysian timber export has been forecast to grow at an annual rate of 4% to reach RM53 billion by 2020. In this context, a sustainable management of the natural TRF concession initiative by PESAMA could very well fulfil these expectations and enhance the image of the country, particularly more so when the Forest Management Unit (FMU) is so strategically located in the east coast of Peninsular Malaysia, and within easy access from the ports of Chukai and Kuantan. The FMU is also easily accessible by road from the Malaysian capital city of Kuala Lumpur as well as Port Kelang in Selangor.

Under the sound SFM practices of the natural TRF, not all parts of the forest compartment (or felling block) will be subjected to timber harvesting process and associated activities. Only very small numbers of large-sized trees will be selectively marked to be felled, leaving trees of sizes below the minimum felling limits to stay behind the form the next crop through to the next rotation, thereby ensuring the continuity of the operation in perpetuity. Buffer zones on sensitive slopes and sites and along permanent rivers and water bodies, areas containing pockets of high conservation value (HCV) species and protection forests, recreation and touristic areas and areas of special interests will be accordingly identified, delineated, marked on the ground and conserved for their other, non-timber values and services. In these areas, a strict "no felling and no disturbance" policy is followed and non-negotiable. In addition the “no felling option” will also be exercised by the management whenever and wherever is deemed appropriate, *i.e* upon appropriate consultation and careful consideration of all the various relevant factors and inputs.

2.0 Cherul Forest Concession (CFC): Location of Project Area and Physical Setting

Location, Physical Setting & Project Activities

The Project is located in the southern corner of the state of Terengganu Darul Iman, Malaysia, within Cherul Permanent Reserved Forest (CPRF), about 50km to the west of Terengganu's southern town of Chukai (Figs. 1, 2). It covers a total area of 25,243ha (approx. 50,000 acres) between the geographical coordinates that range from 4°05' 20"N and 103°06' 20"E to 4°06'N and 102°53.5"E in the south; and 4°16'N and 102°45' in the north, thereby giving it an almost triangular shape (Figs. 1 & 11). It consists largely of second growth natural TRF land of Cherul PRF which divided into a total of 59 forest compartments of varying sizes.

The land-use in the surrounding areas consists almost exclusively on all sides by vast oil palm estates and land development schemes of FELDA Cherul 3, Ladang RISDA Espek 6, Ladang Ban Hoe Espek 6, RISDA Cheneh Oil Palm Plantation and *Ladang Rakyat* Bukit Bandi, as well as Cherul Village (see Fig. 4 – 11).

To reach at the forest concession from Chukai Town by road, one has to take the Mak Lagam road and drive 30km westward toward Cheneh Rest & Recreation (R & R) station at Bandar Cheneh Baru. From there one should follow the Bukit Besi/ AlMuktafi Billah - bound trunk road, turning to the left upon crossing the Sungai Cherul bridge. From the Cherul junction, a 10-km drive takes one to the junction to CFC Base Camp which lies on the right just after crossing the Sungai Ban Hoe bridge. The journey to CFC Base Camp from this junction, on a gravel-earth plantation road which is maintained by PESAMA, takes about 14 km.

Fig 1: Map of Malaysia, locating the State of Terengganu

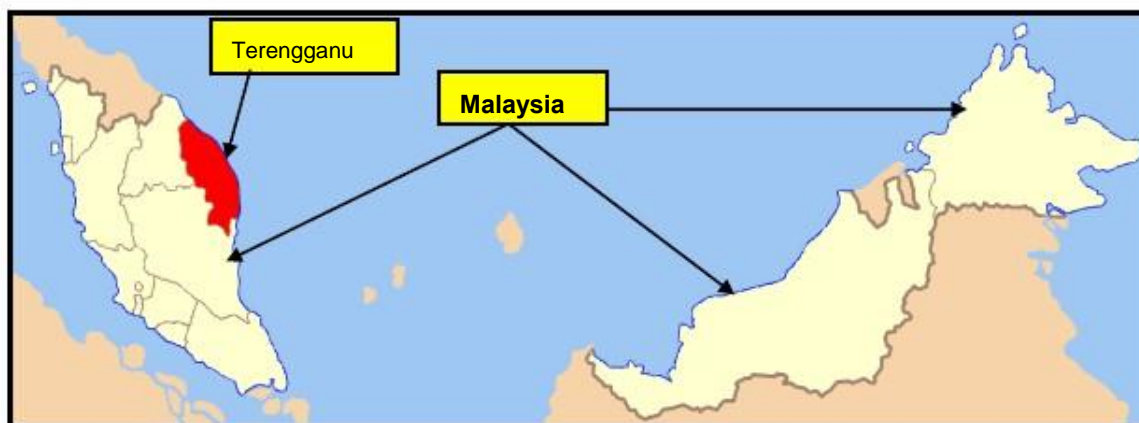
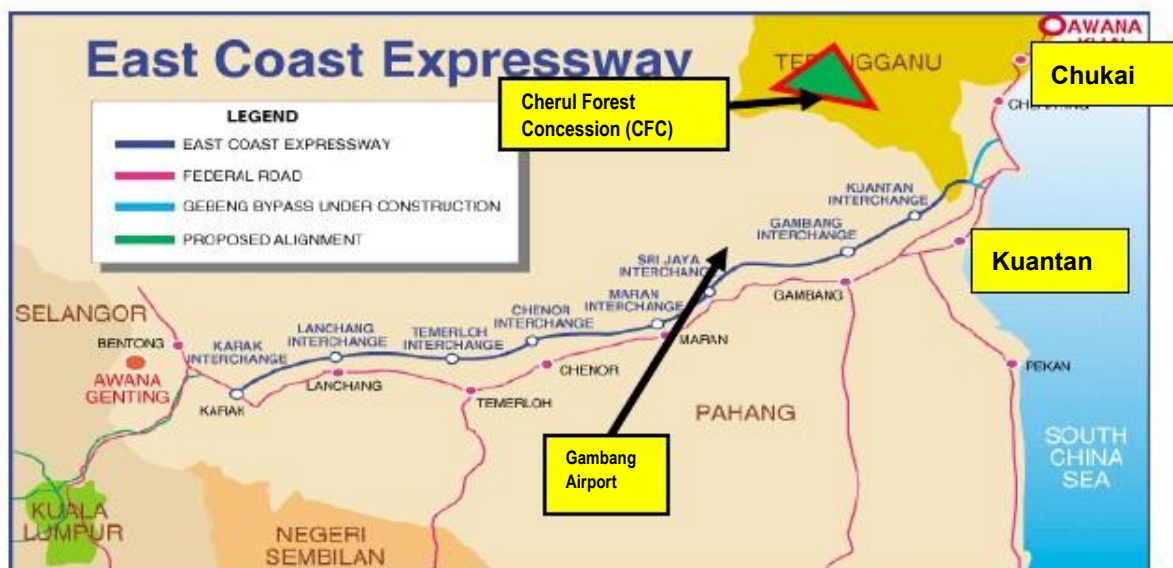




Fig. 2. Map of Terengganu showing the general location of the project area (Cherul Forest Concession (CFC)).

Malaysia's capital city of Kuala Lumpur.

Fig. 3. General access plan to Cherul Forest Concession from



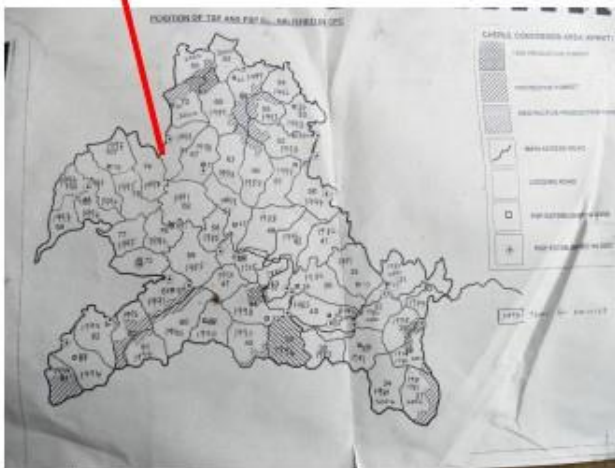
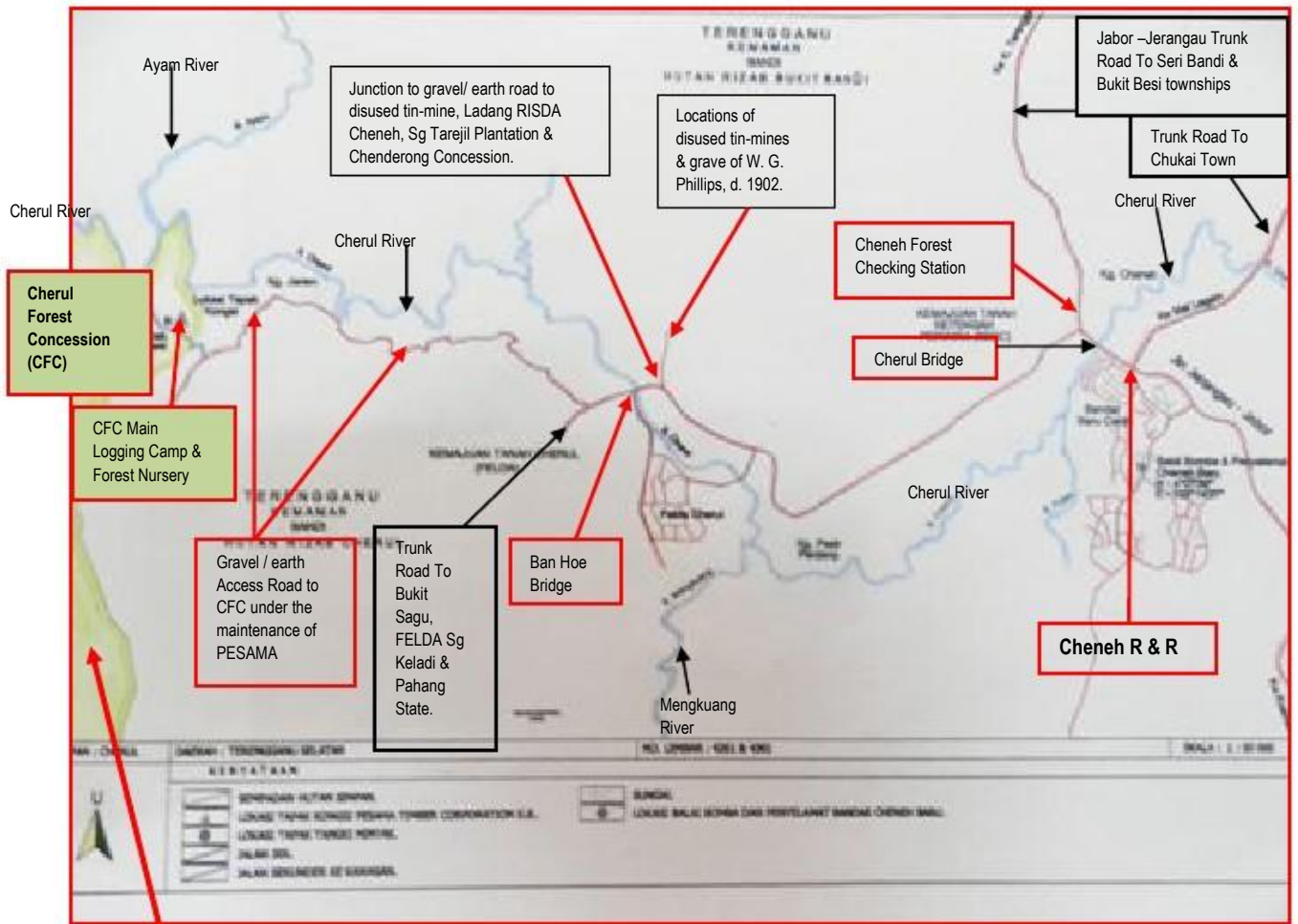


Fig. 4: General Access Plan to Cherul Forest Concession (CFC) From Chukai Town.



Fig. 5. Satellite image of Cherul Forest Concession (CFC) showing boundaries of forest compartments.



Fig. 6: Cherul Trunk Road To
(1) FELDA Cherul 3,
(2) Ladang RISDA Espek 6,
(3) Ladang Ban Hoe Espek 6,
(4) *Ladang Rakyat* Bukit Bandi,
(5) Cherul Village,
(6) Bukit Sagu as well as
(7) Cherul Forest Concession (CFC)



Fig. 7: Jabor – Jerangan Trunk Road to Seri Bandi and Bukit Besi Townships Showing Distances From Cherul Road Junction.



Fig 8: Junction to (1) Ladang Cheneh RISDA Oil Palm Plantation, (2) Sungai Terajul Oil Palm Plantation, and (3) Anglo-Eastern Oil Palm Plantation. The latter forms part of Chenderong Concession which borders Cherul Forest Concession (CFC) on the northwest and western sides. This junction lies on the right hand side along the Cherul Trunk Road to Bukit Sagu and CFC, just before the Ban Hoe Bridge.



Fig. 9: A view of Ladang RISDA Cheneh Oil Palm Plantation.



Fig. 10. Diused iin mines located along the road to Chenderong Concession.



Fig. 11: Bandi Hills viewed from the mining lakes.



Fig. 12: Grave of William George Phillips, died January 1902 located approx. 2 km from Sungai Ban Hoe Bridge, to the right side of Cherul – Bukit Sagu trunk road.

Cherul Permanent Reserved Forest (CPRF) is separated on its eastern side by these land development schemes by Sungai Jenaang, whereas CFC's boundary within Cherul PRF is marked by Sungai Kelih, *i.e.* after passing through a total of at least 4 logging license areas. Lying on the northwest of CFC and hugging all of its western fronts is Chenderong Concession (Oil Palm estates), whilst Remen-Chereh PRF of Pahang lies on its southeast.

Along the gravel/ earth road to Chenderong Concession lies the grave of Mr William George Phillips who was buried in January 1902 nearby some old disused tin mining pools. Apparently the area was mined for its tin towards the end of 1800 and early 1900. Both the grave and the tin mine lakes obviously carry significant high conservation value for the Cheneh and Bandi neighbourhoods. The mining lakes have touristic and recreational potentials which are yet to be developed.

It is to be noted that Chukai Town can be reached from Malaysia's capital city of Kuala Lumpur (in the west) by road via the East Coast Expressway (Fig. 3) which passes through Gambang as well as Kuantan areas. Kuantan city itself lies only about 1.5-hour drive to the south of Chukai. From the north, Chukai can be reached from Kuala Terengganu as well as Dungun by the state's coastal road. There are at least 4 airports that serve Chukai and thence the project area. These are the Kuala Lumpur International Airport (KLIA) and Gambang Airport to the west (Fig. 3) and Sultan Mahmud (Kuala Terengganu) Airport and the smaller Kertih Airport to the north of Chukai (Fig. 2).

Approches to TRF Management and Silviculture

The present approach by PESAMA in managing CFC follows the globally accepted principle of Sustainable Forest Management (SFM) which incorporates and balances up the three main components of SFM, namely; (1) economic and technical; (2) environmental protection and conservation; and (3) social responsibility. These 3 components of SFM are in line with FSC®'s 10 Principles of Forest Stewardship, to which PESAMA subscribes. .

Given the unique, diverse, multi-age and multi-species nature of the mixed TRF of CFC with its other, social and ecological ramifications, PESAMA had decided to adopt the Malaysian Selective Management System (SMS) concept in timber harvesting and ecological conservation. First introduced and borned in Trerengganu itself in 1979, SMS calls for the reduced impact logging (RIL) of the marked trees whereby the following criteria are applied:

- (1) Tree felling is done selectively based on a set of minimum diameter felling limit regimes whose calculations are done based on data collected from a 10% pre-felling inventory of the licensed area.
- (2) Tree felling is done on marked trees by applying established directional felling techniques with the use of safety equipment for forest workers being made mandatory.
- (3) Felling damage to the standing residual stand is kept to < 10%, by minimising yarding damages and make yarding/ skidding process more cost-effective

Logging Methods: Ground Skidding Operation

The RIL operational procedures and management standards for timber harvesting currently adopted by PESAMA is by using ground-skidding methods (tractor skidding – Fig. 13) as described by the FAO (2002), Jabatan Perhutanan Semenanjung Malaysia (JPSM) (2009) and Sabah Forestry Department (1998). The basic procedures are briefly summarised as

follows:

- a) skid trail alignment and mapping;
- b) production and use of harvesting map and stock sheet;
- c) training and briefing to staff and contractors;
- d) strict observance to RIL Guidelines;
- e) monitoring following completion of harvesting operations.

PESAMA is also actively considering the possibility of employing appropriate RIL methodologies other than the usual controlled ground skidding system, such as by using cable and log-winch systems (see **Fig. 14**). These systems offer greater potential of reducing damage to the forest ecology and compaction to the soils by minimising the need to construct skid trails.

These advantages however, will be weighed against other considerations such as the higher costs incurred and specific and intensive trainings, a more intensive and focused planning and ground surveys, as well as zoning of the operation area, not to mention the cost of the machine itself. During the first cycle of SMS, the gross annual “working areas” (WAs) within the concession area as stipulated in the original Concession Agreement was 800 hectares. The average annual timber production during this period was 27,340.21m³ per year, giving an average output of **33.24m³/ha** (7.46 ton/ac).



Fig. 13: Ground Skidding Operation In CFC Is Conducted With Discretion And Care

Fig. 14: Where appropriate, technically feasible and cost-permitting, PESAMA may also consider employing the Log-Winching Method such as The Log-Fisher which has proven to be much less damaging to the environment, to extract timbers from CFC.



Silviculture

PESAMA complies with silvicultural prescriptions formulated by TSFD. At present there are two main options in the silviculture of the mixed natural TRF, namely (1) enrichment planting; and (2) open-area planting.

Sequence of Silvicultural Operations

For the forest area within CFC the following sequence of operations and timing are planned to be implemented which is within the framework of SMS (see Table 1).

Table 1. Sequence and Timing of Operations in CFC Relative to SMS
("n" refers to "year of felling")

No	YEAR	SMS
1	n-2 to n-1	a. Pre-F inventory. b. Determination of cutting regime based on minimum DBH limit c. Road planning & delineation/ demarcation in the field.
2	n-1 to n	a. Tree Marking including Felling Direction b. Road construction using bulldozer; timber below cutting limit not utilised but pushed into the adjacent stands.
3	n	a. Felling of all trees as prescribed b. Roads & skid trails created by bulldozer as felling proceeds.
4	n+ ¼ to n+½	a. Survey on unfelled trees and on damage to residual trees (for determination of fines)
5	n + 2 to n+5	a. Post F1 Inventory to determine stocking and the appropriate silvicultural treatments.
6	n + 10 to n +15	a. Post F2 Inventory

3.0 Baseline Information

Area Description and Physical Environment

The concession forest area forms part of Cherul Permanent Reserved Forest (CPRF) covering an area of approximately 20,243ha (approx. 50,000acres). It is located about 50km to the west of the town of Chukai, in the Forest District of South Terengganu. Selective logging of tropical hardwood timbers from the mixed dipterocarp forests (MDFs) under the first cycle of the Selective Management System (SMS) in the area was started in 1978 in Compartment 29 and ended in 2000 in Compartment 70. As a matter of fact SMS had been successfully used to manage the rich TRF in the concession area on a continuous basis ever since the company's establishment in 1976. The whole area of approx. 20,243ha is treated as a single and unique Forest Management Unit (FMU) and located in the southern corner of the State of Terengganu Darul Iman, bordering the State of Pahang Darul Makmur to the south.

Natural Environment

Climate

The project area has a strong tropical monsoon climate with relatively uniformly high temperatures (from 21°C to 32°C). During January till April the weather is generally dry and warm with humidity consistently high, between 82 – 86% annually. Average rainfall is 2,030mm to 2,540mm to as high as 4,000mm per year with most rains falling between November till January. As a result of the heavy and often prolonged rainy season, the proportion of productive working days in the forest may range between 30% and 40% per year. Daily hours of sunshine are usually around 6 – 7 hours, but might reach 8 – 9 hours in February through April.

Geology, Soil and Topography

The geology of South Terengganu area bordering north Pahang consists of a continuum rock formation of three rock types represented by (1) Carbonaceous Slate, (2) Igneous Rock and (3) Metamorphic Rock. In Cheneh and Cherul areas, the following two rock formations are however more dominant:

- (1) The Charu or Cherul Formation; (2) The Taweh Formation.

The 11 soil series detected within the area fall under 3 soil groups, namely

- (1) soils developed on igneous and high-grade metamorphic rock;
- (2) soils which developed on sedimentary and low-grade metamorphic rocks, and
- (3) soils developed on recent riverine alluvium.

Topographically, the concession area has a very hilly topography ranging between 50 and 650 meters above sea level (a.s.l.) with majority of it lying within the range of 50 to 300 meters a.s.l., generally consisting of short and steep slopes. The predominant soil types were mainly Durian and Bungor series with a small portion of Batu Anam series. Durian series soils are moderately well drained with a clayey texture. They are moderately deep and sited on gently rolling hills, with generally low nutrient status particularly nitrogen and phosphorus.

Hydrology

Much of the area is drained by Cherul River which cuts through the concession area, flowing transversely from West to East (into the South China Sea at Chukai Town), almost dividing the concession into two equal halves. The other large river is Terajol River, which is the tributary of Cherul River and forms the north-eastern border of the concession, flowing from north of the concession area and separating the concession from the Chenderong Concession (oil palm plantation). Bakar River, which is the tributary of Terajol River on the north separates the northern part of the concession area from the rest of Cherul Permanent Reserved Forest. Mas River, which is also a tributary of Sungai Cherul forms the south-west border of the concession area.

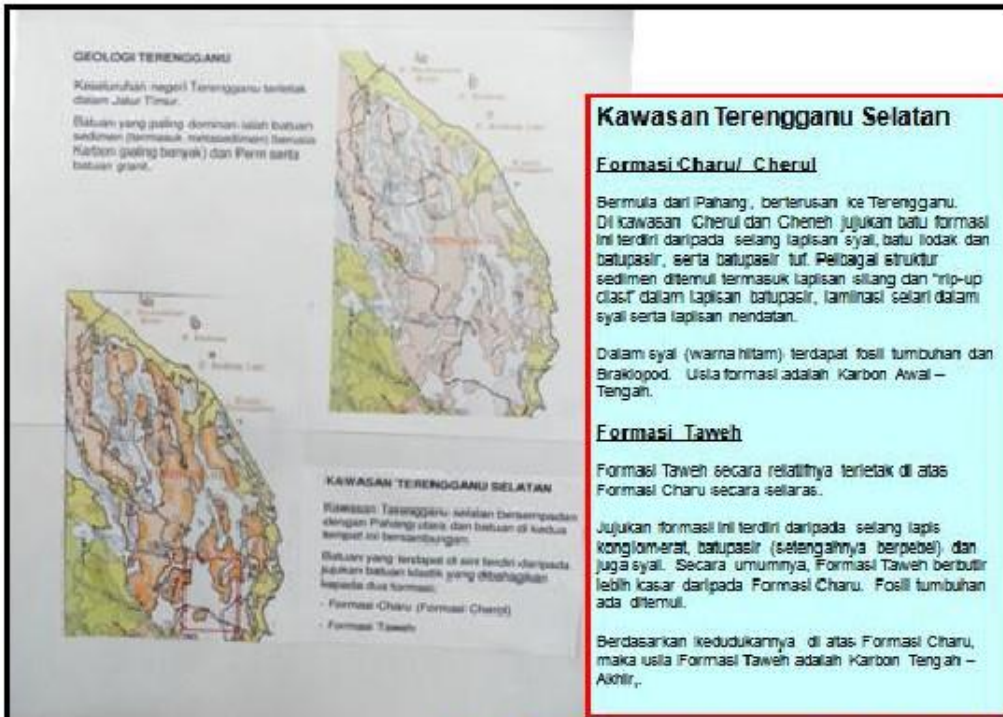
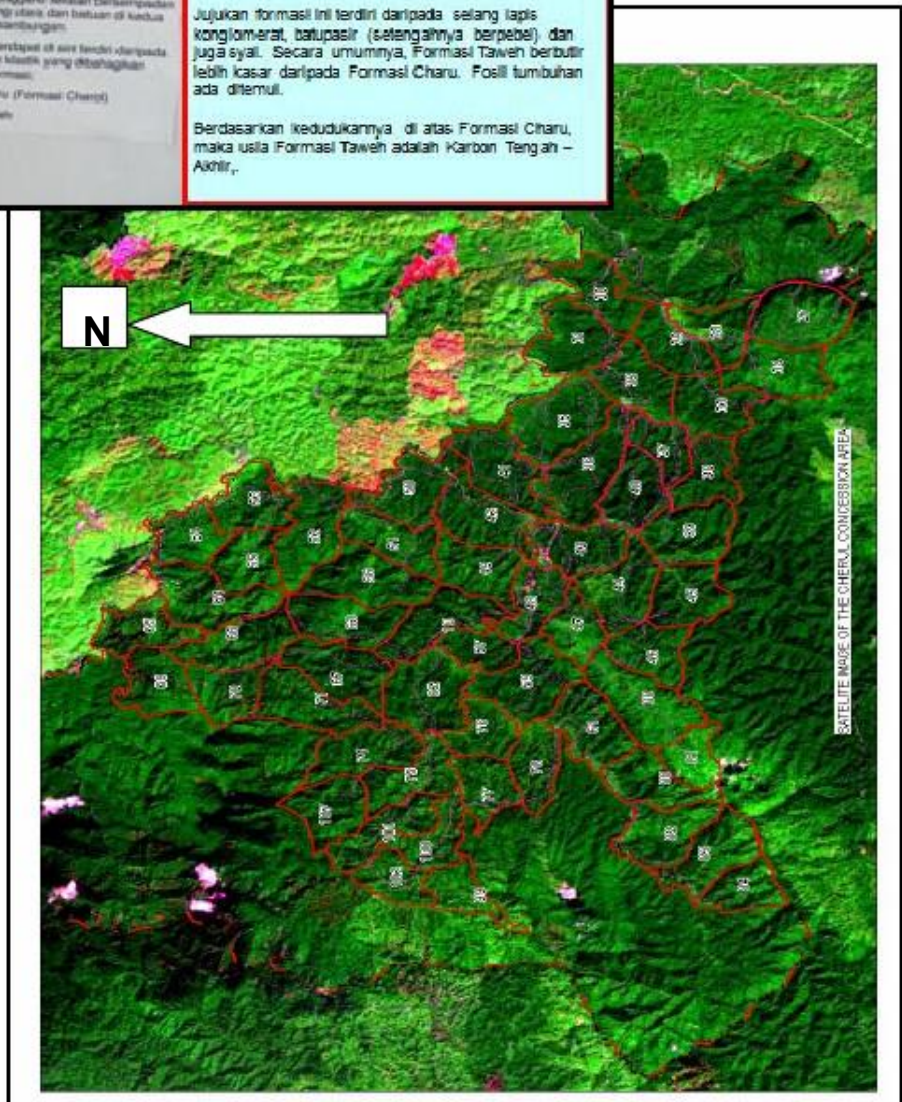


Fig. 15:
General
Geology of the
Project Area.

Fig. 16:
Satellite Image of
Cherul Forest
Concession
Showing Forest
Compartments
(2000)



Biological Environment

The general composition of the natural TRF in CFC is made up of the two main groups of tree species: the Dipterocarps and the non-Dipterocarps. Among the Dipterocarps, the following tree species were found: Meranti (*Shorea species*, e.g. incl. Meranti seraya (*Shorea curtisii*), Meranti sarang punai (*S. parvifolia*), Meranti rambai daun, Meranti langgung, Meranti tembaga (*S. leprosula*), and Damar hitam), Keruing (*Dipterocarpus species*), Balau (Heavy hardwood *Shorea species*, e.g. Balau laut merah), Merawan (*Hopea spp.*), Mersawa (*Anisoptera spp.*), and Chengal (*Neobalanocarpus heimii*). Among the non-Dipterocarps, the following families and species dominate the tree flora: Kelat (*Syzygium species*), Medang (*Lauraceae*), Kempas (*Kompassia malaccensis*), Merbau (*Intsia palembanica*), Sepetir (*Sindora spp.*), Rengas (*Gluta & Melanochylla species*), Bitis, Machang (*Mangifera sp.*), Mengkulang (*Heritiera sp.*), Jelutong (*Dyera costulata*), Durian (*Durio spp.*), Bintangor (*Callophyllum inophyllum*), Kembang semangkuk (*Scaphium spp.*), Melunak (*Pentacme spp.*), and Mahang (*Macaranga spp.*).

Land Use and Economic Activities

The district of Kemaman covers an area of 253,560ha involving 12 Mukims, constituting about 20% of the total area of the state of Terengganu. In terms of land use, more than half of the land in the district, particularly in the west, is still under forests of which Cherul PRF constitutes the largest portion (Table 2). About 39% of the land in the district is taken up by agriculture which comprises mostly rubber, oil palm and paddy. Industrial activities based on petroleum and gas tend to concentrate in Chukai and Kerteh areas. Petroleum and gas based industries form the economic backbones of the district in particular and the state as a whole. In agriculture, the KETENGAH, FELDA and Ladang Rakyat land development schemes, for decades has contributed a great deal towards the economic well-being of the local population. The region is endowed with fertile agricultural lands and abundant fisheries resources in the marine waters, besides having a great potential for recreation and tourism industries, particularly along the coastal region. However, the potential for eco-tourism development is yet to be fully exploited.

The total population of Kemaman in 2010 was estimated to be about 207,000 and is expected to decrease in 2015 to 253,000 caused mostly by labour outmigration to nearby towns like Kuantan and the Malaysian capital city of Kuala Lumpur. As a result, the employment opportunities in the district are slowly being taken over by foreigners, particularly in such sectors as agriculture (e.g. in KETENGAH, FELDA, Ladang Rakyat areas), fisheries, livestock and mining. However, at Pesama, employment opportunities both in the mill and in the forest are still filled up by local population.

Survey has shown that the three most popular forest produce collected from the forest by the locals for their own consumption were timber, rattan and fishes. Timber was used for house repair or construction of chicken coop, while rattan was for making fish traps. River fishes are a popular source of protein for the local communities. In general however, due perhaps to a sound economic condition, the local populace do not generally depend for the forest for their livelihood.

Environmental Parameters Monitoring

The three environmental components identified for measurement and long term monitoring

were (1) water quality, (2) ambient air quality and (3) boundary noise level. Results from the monitoring activities, summarised in Table 2, were evaluated against relevant standards and Guidelines.

The results indicate that the noise levels exceeded the DoE's The Planning Guidelines for Environmental Monitoring Noise, Limits and Control recommended limits of 70 dBA (LAeq) for daytime and 60 dBA (LAeq) for night time. Results of analyses on the sampled water show near neutral in acidity and chemically suitable for most domestic, industrial and agricultural requirements. It is also safe for human drinking. Hence, waters in the rivers can be classified as clean corresponding to Class II to Class I of the NWQS.

Table 2: Results of Ambient Air Quality Monitoring for Point A1 (Matau at Main Logging Camp) In Project Area

Parameters	Date: 25 January 2012	
	TSP ($\mu\text{g}/\text{m}^3$)	PM10 ($\mu\text{g}/\text{m}^3$)
A1 (Main Base Camp)	15	12
*MRAQG	260	150

*Malaysian Recommended Air Quality Guidelines

Table 3. Results of Noise Level Measurement

Locations	Date and Time of Sampling	Parameter (dB(A))					Major Noise Source
		L _{eq}	L _{Max}	L _{Min}	L ₁₀	L ₉₀	
N1 25 – 26 January 2012 (12:38:46 – 12:31:46)	Day Time	60.9	97.0	50.3	58.5	54.5	No major noise sources, except intermittent sound of vehicles passing through nearly road.
	Night Time	58.8	73.5	53.3	58.5	54.4	

Table 4. Results of Water Quality Monitoring at W1, W2 and W3

Parameters and date of Sampling	W1	W2	W3
	25 January 2012		
Weather	Sunny		
Temperature, C ^o	24.7	25.3	24.4
pH	6.62	6.45	6.63
DO (mg/l)	6.72	6.60	7.88
BOD _s (mg/l)	1	1	1
COD (mg.l)	17	17	17
TSS (mg/l)	19	4	2
E. coli (cfu/100ml)	3,700	1,900	1,300
NH ₃ – N (mg/l)	1.95	1.97	2.26
Oil & Grease	<1	<1	<1
Water Quality Index	80.5	1.2	83.3
Class	II	II	II

Wildlife Assessment

The technique used in assessing wildlife was simply based on sighting, animal calls (the distinctive cry of an animal or bird) and animal dropping (feces). The results of the simple observations made, during the forest inventory are as follows:

1. *Sightings* –*Elephant* (*Elephas maximus*), Tiger (*Panthera tigris*), Wild boar (*Sus scrofa*), Gibbon, Leaf monkey, Tapir, Hornbill and other small birds.
1. *Footprints* - Footprints of the following animals were seen: Wild Boar, Elephant, Tapir, Tiger, Sambar deer (*Cervus unicolor equines*), Barking deer (*Muntiacus muntjak*), Malayan sun bear (*Helarctos malayanus*), *Seladang* (Gaur) and Mouse deer, Varanus, Otter, Porcupine.
2. *Animal Calls* - Elephant, Gibbon, Argus pheasant, Sambar deer and Barking deer.
4. *Animal Feces* - Elephant, Barking deer and *Seladang* (Gaur).
5. *Feather* - Argus pheasant.

Sustainable Timber Production

Calculations on the annual working area (AWA) are based on the area of production forest after appropriate allowances have been made for the relevant management prescriptions, non-commercial forest types, high conservation value forest (HCVFs), areas which are inaccessible or too steep to harvest and *buffer zones*. Estimates of the AWA are constantly reviewed to take into account factors such as improving forest resource information and changing constraints on forest harvesting.

A quality standard system is in place at PESAMA in order to ensure that a high standard of operations is maintained over the entire CFC area. This involves the *five-year harvesting plan, annual harvesting plan and harvest supervision*, together with regular formal reviews and monitoring of performance against a set of prescribed standards. These standards incorporate results from research and operational experience, and are benchmarked against the standards used by national and international forest certification programmes. PESAMA subscribes and strives to comply with these standards, such as the Principles and Criteria of Forest Stewardship (P & C) of FSC® and Malaysian Criteria and Indicators and Standards of Performance for SFM (MC&I) of the Malaysian Timber Certification System (MTCS).

Under FSC® the 10 Principles and Criteria for Forest Stewardship are:

- **Principle 1:** Compliance with Laws and FSC® Principles (6 criteria)
- **Principle 2:** Tenure and Land Use Rights and Responsibilities (3 criteria)
- **Principle 3:** Indigenous Peoples' Right (4 criteria)
- **Principle 4:** Community Relations and Workers' Rights (5 criteria)
- **Principle 5:** Benefits from the Forest (6 criteria)
- **Principle 6:** Environmental Impact (10 criteria)
- **Principle 7:** Management Plan (4 criteria)
- **Principle 8:** Monitoring and Assessment (5 criteria)
- **Principle 9:** Maintenance of HCVFs (4 criteria)
- **Principle 10:** Plantations (9 criteria) – Presently not relevant to PESAMA.

Fig. 17.
Forestry Department's Hydrological
and Water Monitoring Station in
CFC.



Figs. 18. General Views of Cherul Forest Concession (CFC)



Fig. 19: Main Access Road To CFC

Figs. 20: Examples of Floral Biodiversity in CFC

(a) Forest Palm



(b) Riverine (Neram) Forests



.... Ctd Fig. 20: Examples of Floral Biodiversity



(c) *Tacca*



(d) *Globba cornerii*



(e) *Licuala factilexa*



(f) *Johannesteysmannia altifrons*

Figs. 21. Examples of Faunal Biodiversity in CFC.



(a) Tiger's Footprint



(b) Tapir's Footprint

(c) Elephant trail



(d) Otter's Footprint



(e) Mousedeer's Footprint



..... continued Faunal Biodiversity

(f) Porcupine's Footprint



(g) Wildboar's Footprint



(h) Kijang (Barking Deer),s Footprint



(i) Varanus,, Footprint



(j) Freshwater Fishes in CFC (Photo credit: Dr Mohamad Azani Alias)



Stakeholder Consultation and Workers' Welfare

Being sensitive and responsive to the concerns and needs of the surrounding community has been part of PESAMA's *modus operandi* in the Project Area. Based on our survey on the local villagers potentially affected by the project, it appeared that the people did not have any objection to the implementation and continuation of the project for it would benefit them through a better management of the forest environment and possible employment as well as business opportunities from the CFC project along with other benefits. PESAMA also takes care of its staff and workers and provides them the necessary cover (e.g. EPF and SOCSO) and protection as appropriate in line with existing legal provisions and ILO to which Malaysia subscribes.

4.0 Aspects of Impacts and Mitigation Measures

Aspects of SFM and RIL Activities and Impacts Identification

Table 5 presents a summary of the project's aspects and impact analysis.

Table 5: Impact Analysis

No.	OPERATION/ ACTIVITY	IMPACT ASPECT, SOURCES & CATEGORY
1	Sustainable Forest management (SFM) and RIL Planning/ Design	
1a	Preparation of (a) long term Forest Management Plan (FMP); (b) Environmental Assessment (EIA); (c) Environmental Management Plan (EMP). Impact ✓	<ul style="list-style-type: none"> ✓ Consumption of paper & stationery Logistics, travel & transport – repairs & spare parts ✓ Survey & research ✓ Consumption of energy ✓ Employment of consultants ✓ Stakeholders consultations
1b	<ul style="list-style-type: none"> ✓ Upgrading access to project area ✓ Topographic survey 	<ul style="list-style-type: none"> ✓ Logistics - Use of 4WD vehicles - smoke & noise: disturbance to wildlife – consumption of fuel, lubricants, spare parts Manpower – cutting of rentis lines: damage trees and destroy plants. Camping. ✓ Disturbance to wildlife & fishes. ✓ Accidents. ✓ Wastes
1c	<ul style="list-style-type: none"> - Vegetation cover survey/ inventory - Survey on wildlife - Survey on stakeholders 	<ul style="list-style-type: none"> Inventory design: stationery and energy consumption Field training: damage to habitats and plants Logistics - Consumption of energy and fuel.
1d	Establishing temporary base camp/ ✓ camp for reconnaissance survey teams.	<ul style="list-style-type: none"> Construction of camp – construction material: destruction of trees and habitats (terrestrial and aquatic) ✓ Noise & smoke ✓ Fire hazard ✓ Human waste: pollution ✓ Disturbance on rivers and water bodies: Lower quality of water due to contamination ✓ Rubbish, used plastics, metal & plastic containers, waste oils: pollution ✓ Consumption of wildlife and fishes – use of hunting equipment, snare and fish traps: affect biodiversity and habitats. ✓ Legal aspects ✓ Soil and bank erosion: pollution of rivers/ streams.

		✓ Diseases (malaria, dengue, water-born diseases, etc).
2	RIL (including detailed inventory/ survey)	
2a	Site plan ✓	Paper, stationery & energy consumption
2b	<ul style="list-style-type: none"> ✓ Logging license ✓ Boundary marking ✓ Sign boards ✓ Pre-Felling Inventory ✓ Determination of Minimum ✓ Felling DBH Limits ✓ Harvesting Plan 	<ul style="list-style-type: none"> ✓ Paper consumption ✓ Metals, plastics, concrete for boundary marking & sign boards ✓ Disturbance to site & wildlife ✓ Disturbance to soil. Soil erosion ✓ Pollution of rivers/ water contamination
2c	Selective Logging by RIL <ul style="list-style-type: none"> ✓ Tree Marking ✓ Stock Map ✓ Directional Felling ✓ Skidding ✓ Matau operations: bucking, de-barking 	<ul style="list-style-type: none"> ✓ Use of machine & equipmen ✓ Heaby machines: e.g. bulldozer & chainsaws: noise, smoke, vibration ✓ Disturbance to plants and wildlife – endanger high conservation value species (HCV) ✓ Soil compaction, loss of top soil ✓ Soil erosion, surface runoff, soil compaction ✓ Fire hazard ✓ Accidents
2d	Workers kongsi	<ul style="list-style-type: none"> ✓ Safety & hygiene ✓ Disposal of rubbish & sewage ✓ Workshop ✓ Stores ✓ Generators
2e	Construction <ul style="list-style-type: none"> ✓ Roads ✓ Matau ✓ Workers' kongsi ✓ Mitigation measures – erosion control, etc. ✓ Closing Report ✓ Post-F Inventory 	<ul style="list-style-type: none"> ✓ Soil compaction, lower water infiltration rate, soil and bank erosion. ✓ De-stabilisation of surrounding forest stand. ✓ Generators, fertilizer stores, plastics, waste oils, oil tanks, hydraulic fluids, fire hazards ✓ Fertilisers, herbicides, pesticides, etc ✓ Movement of plants & plant materials ✓ Fire hazard ✓ Wastes & waste disposal ✓ Diseases & infection ✓ Water use ✓ Construction materials
2e	Roads (primary, secondary, tertiary)	<ul style="list-style-type: none"> ✓ Soil compaction, higher surface runoff, soil and bank erosions ✓ Movement of heavy vehicles ✓ Accidents ✓ Pollution from waste oil & spare parts ✓ Disturbance to wildlife & their habitats
3	Nursery Practice	
3a	Nursery for timber trees and MAPs (Medicinal & Aromatic Plants)	<ul style="list-style-type: none"> ✓ Consumption of construction materials: timbers, metals, cement, plastics pipes, nettings, etc ✓ Generators & pumps ✓ Oil tanks, ✓ Waste oils ✓ Use of chemicals/ poisons to control pests and diseases: only under supervision. ✓ PVC bags ✓ Movement of plants & plant materials. ✓ Human wastes and food sullage ✓ Machine parts ✓ Noise and smoke ✓ Accidents
3b	Transportation/ conveyance of supplies and equipment ✓	<ul style="list-style-type: none"> Noise, smoke & dust particles from vehicles Waste oils Soil compaction & damage to roads, bridges & culverts
4	Silvicultural (TSI) Operations	
4a	Open Area Planting (Tanaman Kawasan Lapang)	<ul style="list-style-type: none"> ✓ Storage and Supply of seedlings ✓ Transport operation

		<ul style="list-style-type: none"> ✓ Plastic Wastes – PVC bags ✓ Fertilisers and Chemicals: Fertiliser bags, wheel-barrow & containers ✓ Weeding – disturbance and exposure of soils and plants
		✓
4b	Thinning & Thinning	<ul style="list-style-type: none"> ✓ Thinning can damage healthy trees but also can improve hygiene of natural forest concession. ✓ Movement of human and machines (chainsaws, heavy vehicles, etc) can cause disturbance: i.e. smoke, noise, soil compaction ✓ Pruning disposals/ wastes pose fire hazard ✓ Reduction of security cover and forage for wildlife. ✓ Security cover offers concealment from hunters and predators. ✓ Removal of wildlife trees
5	Cherul Forest Concession (CFC) Area Control and Safety Measures	
5a	Control against fire	Use of machines and tools to construct fire-breaks: noise and smoke pollution; de-stabilise soils; disturb plants and wildlife habitats
5b	Control against pests & diseases	Hygiene and cleanliness.
5c	Training	Movement of human & machines: noise, smoke, human wastes, accidents.
6	Non-timber Forest Produce and Services	<ul style="list-style-type: none"> ✓ Soil compaction & erosion ✓ Movement of plants & plant materials ✓ Fertilisers ✓ Machines & people ✓ Construction materials ✓ Potential Conflicts with other stakeholders

Sources of Impacts

From the foregoing, the types of SFM and RIL operations that may have significant impacts on the various components of the forest ecosystem and the environment within and around CFC can be summarized as follows:

- (1) SFM and RIL Planning including Reconnaissance and Topographic Surveys and Pre-RIL Activities and Pre-Felling Inventory
- (2) Forest Engineering, including forest road and matau construction and installation of bridges and culverts and mitigation measures.
- (3) Nursery Operation and Planting Stock Production
- (4) RIL Operation which involves Determination of Minimum Diameter Felling Limit, Tree Marking, Directional Felling, bucking and skidding of timbers.
- (5) Silvicultural Treatment, including re-planting of open spaces and Post-F Inventory
- (6) Transport Operations
- (7) Assessment, Maintenance, Protection and Control.

Mitigation Measures

Project Planning: Concept and Design

The undesirable consequences of SFM and RIL operations in terms of probable interferences to the ecosystem could be minimized through adherence by the company to relevant planning and instructions by the concerned authorities.

Management Zoning

The present forest management plan (FMP) identifies two levels of zoning for CFC area. The first level of zoning consists of all lands within the Primary Zone that defines whether the land concerned will primarily be managed either for (1) *Production* or (2) *Protection*, or as (3) *Conditional Zones*. At the second level, the High Conservation Value Forests (HCVFs) are identified within each of the above-mentioned classifications, wherein particular emphasis will be placed on management for HCVF or cultural values or important land management factors. The Management Classification zoning will be reviewed annually, and updated to incorporate extended and additional special values as they are identified from time to time.

Table 6. Forest Functions In CFC In Relation To The Functions Defined In The National Forestry Act.

National Forest Policy 1992 & National Forestry Act 1993		Forest Zonation in CFC	Area, ha
Production Forest	(1) Sustainable Timber Production, (2) Safeguarding of Water Resource, (3) Preservation of Biodiversity	Timber Production (TP), Water Catchment Conservation, HCVF (Gross Area)	17,968 (Gross Area)
Protection Forest	Soil Protection	Conditional zone Soil Protection	1,306
	Safeguarding of Water Resources	1. Non-Productive Area 2. Main & Secondary Forest Road (Approximation) 3. Matau in Compt 43	104
		Riparian Buffer Protection (RBP/ HCVF): (1) Sg Cherul (2) Sg Mas	72 24
	State Boundary	Kemaman - Kuantan	49
Amenity Forest	(1) Recreation; (2) Ecotourism; (3) Amenity, (4) Rare Ecosystem Protection	HOT SPRING IN C66, C69, C70	163ha
Research & Education Forest	ITTO Research Forest in Compartment 39		380ha
Mining concession	Parts of C28, C29, C43, C44		167ha
TOTAL			20,243

Forest Road Engineering

Road infrastructure will be planned in advance and placed adequately. **Figs. 22a & 22b** (below) depict a typical forest road cross section, showing road corridor width with cuts and fills on slopes. Forest road networks within the Project Area will be built to optimize industrial efficiency and minimize environmental impact while providing for user safety. Forest roads which have been properly designed, constructed and maintained in accordance to environmentally sound engineering practices should (Dykstra and Heinrich 1995):

- a) Utilize competent engineers/ foresters to conduct roadline surveys and supervise construction;
- b) Provide convenient, low-cost access to the forest for transport for management and protection purposes while at the same time benefiting local communities;
- c) Minimize soil erosion associated with roads and reduce sedimentation in streams;

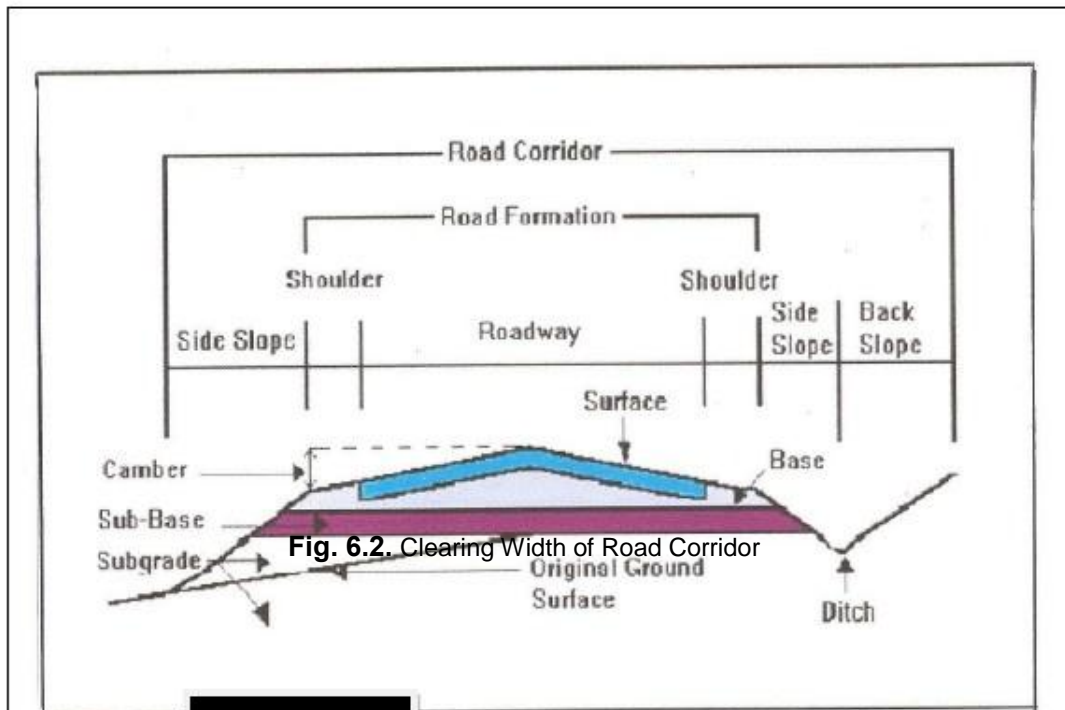


Figure 22a: A Typical Road Cross Section

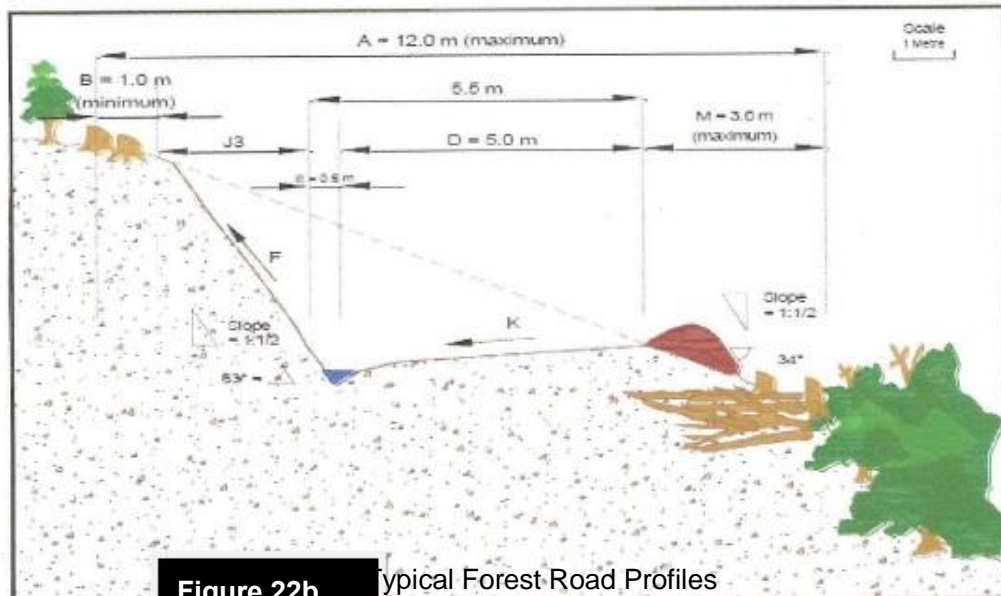


Figure 22b. Typical Forest Road Profiles
 Figure 5-10: A Typical Road Cross Section

- d) Utilize but protect natural drainage patterns;
- e) Avoid passing through areas of cultural, religious, or landscape significance, or areas where wildlife or indigenous people may be disturbed by traffic.

Bridges and Stream-crossings

Bridge construction follows the prescriptions made in the "Guidelines for road construction". As bridges will only be constructed on main, secondary, and feeder roads, they all should be regarded as permanent infrastructure.

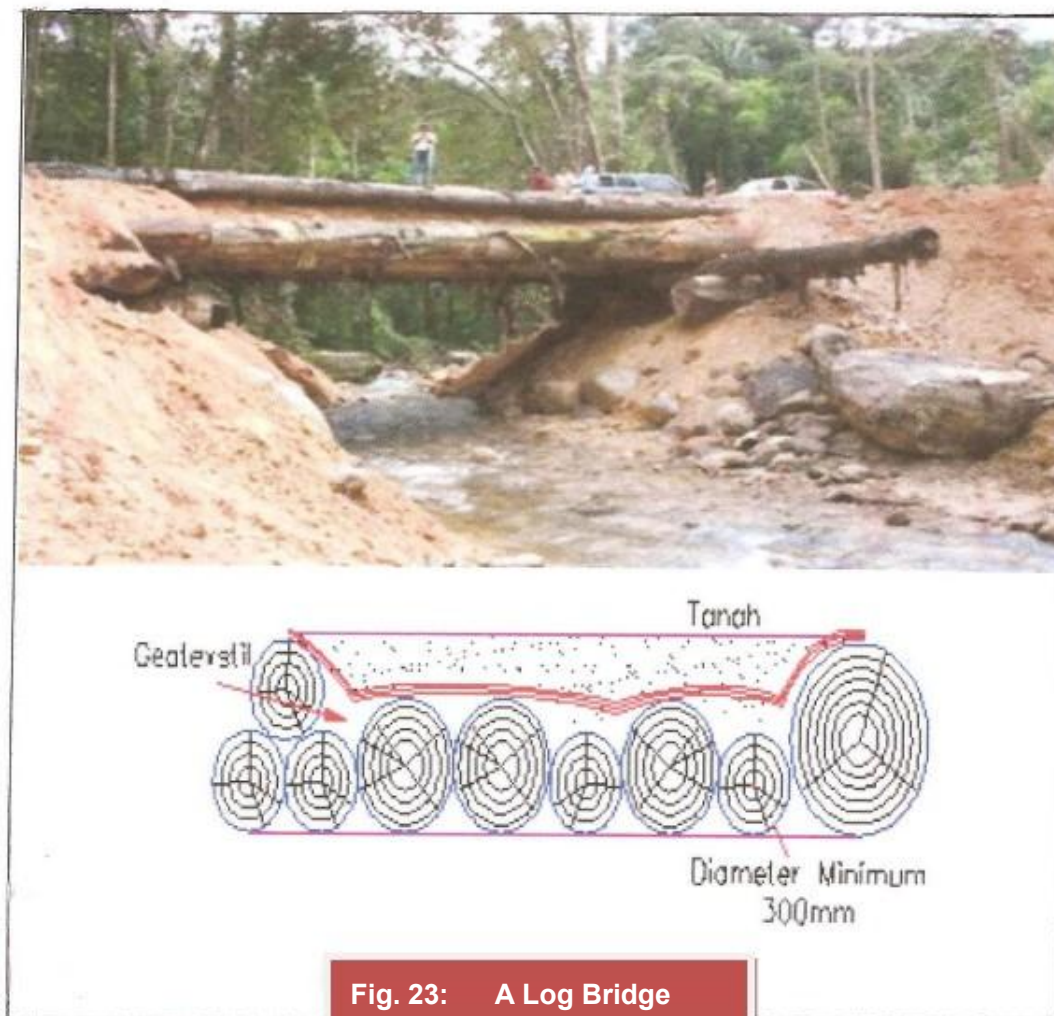


Fig. 23: A Log Bridge

Table 7. Distance Between Cross Drains by Road Gradient.

Road Gradient	Distance between Cross Drains
0 – 10%	60m
11 – 15%	30m
16 – 20%	15m

Monitoring and Maintenance of Bridges and Stream-crossings During SFM/ RIL Operations and After the Completion RIL

- a) Post-RIL monitoring and maintenance are critical to protect the structural integrity of the road prism and cleared area and to ensure that structures are operating as designed and installed.
- b) Road surface, side-drains, cross-drains, and stream crossings will be regularly and properly maintained;
- c) All roads considered essential for management or protection of the forests will continue to be maintained before being transferred to the FD for continuous use;
- d) Road surface will be free of stagnant water, man-holes and other damages at all times;
- e) PESAMA will ensure that that all side-drains and water exit points function at all times;

Road Density

- a) Total length of roads will be minimized in accordance with the MC & I standard;
- b) The total area opened for forest road and tracks will not exceed 8% of the total area of the forest compartment, or < 0.25 km/ha.

Bridges and Culverts

- a) A bridge should have enough span for water to pass underneath during heavy downpour;
- b) When culverts or similar structures are used for crossing drains or stream crossings, the proper size and spacing of the structures will be determined based on i) local rainfall patterns and intensity; ii) runoff rates; iii) detailed ground survey; iv) the need to minimize disturbance to the stream during construction.

Soil Erosion and Sedimentation

The undesirable impacts of roads will be minimised through a series of mitigation measures such as:

- a) In-sloping, out-sloping, crowing, surfacing and creating grade breaks. These measure will be incorporated into road design and construction to minimize surface water velocity and the potential for concentrated flows in the ditchline;
- b) Creation and maintenance of buffer zones/ strips with a minimum width of 20 m of buffer along permanent rivers to be maintained (see **Table 8**). . Buffer zones for permanent water bodies, such as wetlands, large ponds and lakes is at least 40 metres from the lake fringes.

Table 8 .
Size (Width) of Buffer Strips Along Permanent Rivers by Slopes of Riverbanks.

Slope of Riverbank (%)	Width of Buffer Strip (m)
0 < 20	20
20 < 40	25
40 < 60	35
> 60	50

- c) All compacted and bare soil areas on locations along roads and skid trails, log landings, cut and fill banks, within the ditchline and camp (kongsi) sites, etc will be re-vegetated with fast growing indigenous plant/ tree species;
- d) The running surface of permanent roads and drainage facilities will be continuously re-contoured and re-surfaced.

Hydrology and Water Quality

The following steps will be taken to protect water quality in the area:

- a) Install drainage structures as water is encountered;
- b) Avoid working in saturated soils;
- c) Construct stable cut and fill slopes;
- d) Avoid in-stream work as much as possible and, where it is absolutely necessary, the work will be carried out with prior approval from the relevant authorities;
- e) Install erosion-resistant aprons at the inlet and outlet of culverts;
- f) Construct sufficient cross-drains and ditch blocks to keep ditch water from eroding the ditchline;
- g) In ditches, use armouring, geotextile or silt fencing, Tenax geogrid, blocks or traps to minimize erosion. Armouring can be affected by using rip rap, sand bags, concrete, binwalls/ gabions;
- h) Revegetate exposed, erodible soils as soon as possible, by, e.g. seeding cut slopes and ditchlines.

Harvesting Operations

Tree felling

Selective felling of marked trees is done by applying established directional felling techniques. The use of safety equipment for forest workers is mandatory. The following management standards are followed during RIL:

- logging damages to the soil due to forest road, matau and skid trails, yarding and tree felling is kept to < 10% of the total area of the forest compartment;
- logging damages to the standing residual trees are kept to the minimum,
- yarding damages are minimise to make yarding process more cost-effective
- safety to be maximise and injury rates to be minimised.

Ground-skidding (Yarding) Operations

The basic procedures for ground-skidding operations are briefly summarised as follows:

- skid trail alignment and mapping;

- production and use of harvesting map and stock sheet;
- training and briefing to staff;
- strict observance to RIL Guidelines;
- monitoring following completion of harvesting operations.

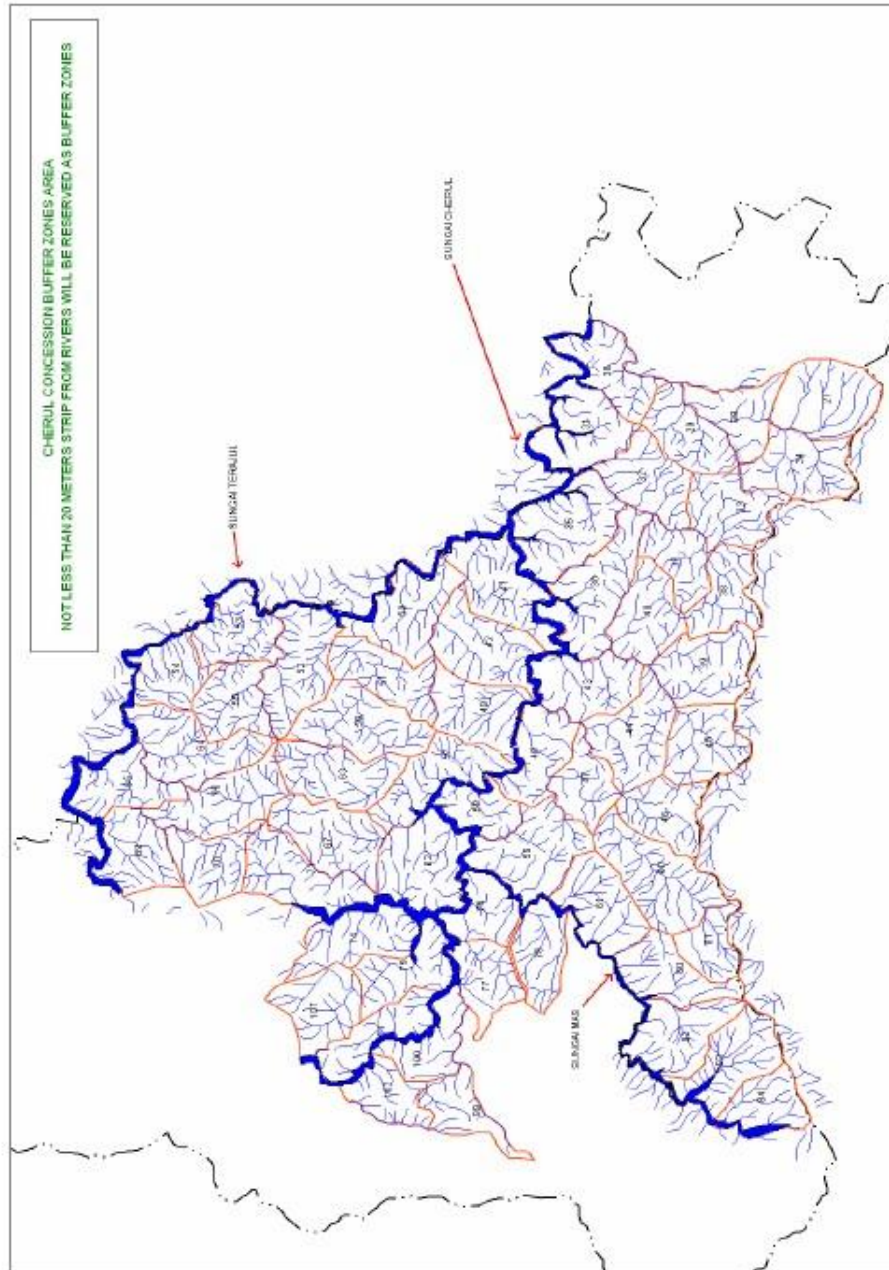


Fig. 24: Proposed Riparian Buffer Zones Within CFC.

Biodiversity: Flora

Forest operations on sensitive sites with great risks of erosion and mass flow, as well as buffer zones along rivers and water bodies and areas known to carry plant or animal species of high conservation value (HCV) or of special scientific and religious/ cultural significance will be strictly avoided. The silvicultural approaches to the logged-over stand will be tailored against the need of the individual trees as well as the local site situation with due consideration being given to the soil types and local climatic condition.

Biodiversity: Fauna

Experience has shown that after a few years subsequent to selective logging/ RIL operation, a logged area revert back to its original state, and will again be inhabited by animals and birds. Species such as *Scaphium spp.*, *Macaranga spp.*, *Dillenia spp.*, *Ficus spp.*, *Pinanga spp.*, etc, benefit animals such as mouse deer, deer and barking deer as well as birds. In addition, selective logging/ RIL operations will be carried out in stages in small and manageable LBs in such a way that necessary buffer strips and corridors will be kept intact in order to allow the animal life to adjust and disperse/ migrate accordingly particularly with regard to the anticipated change in fodder plant species and habitat constitution.

Workers' Health and Safety

PESAMA as a soundly managed and responsible company takes cognizance of the health and safety of its workers. Appropriate actions were taken to ensure a good and happy working and living environment for the workers. These include providing them with the necessary basic facilities and incentives such as building a *kongsi* or a temporary living quarters within a healthy, nice and beautiful setting. PESAMA promotes a high level of hygiene in the workers' kongsi in order to avoid any potential outbreak of diseases, such as malaria, typhoid and dengue.

Social Aspects

The local forest-dependent communities within the vicinity of the project area will be given priority to be employed by the company on a long term basis in order that they can benefit from the economic activities in the forest while at the same time actively participating and contributing towards resource understanding, conservation, protection and sustainable development efforts. Given proper training and guide they can help greatly in minimising the negative impacts of logging activity in the project area while at the same time assisting in protecting the forest from encroachment and other undesirable activities.

Monitoring and Protection

Protection from Encroachment

Access to unused forest roads will be blocked or obliterated through ripping and planting vegetation or through the installation of gates or berms that would reduce the potential for encroachment and wildlife harassment. These measures will be strengthened through regular patrol with the help of the enforcement division of TSFD and the relevant authorities concerned.

Protection from Pests and Diseases in Forest Nursery

In the nursery, the crowding and close proximity of the seedlings favour the spread of disease from one host plant to the next. Because of the ease with which disease spreads among seedlings, it is pertinent that nursery conditions be carefully controlled and monitored to ensure that seedlings are successfully raised. This can be done through proper drainage or placement of seedling beds on well drained sites and proper watering. Increased spacing distance between seedling rows would also prevent the spread of disease while prompt detection of disease symptoms and judicious and timely use of fungicides would affect better disease control.

Protection from Fire

The control and protection of CFC from fire require several important steps that need to be clearly understood and followed by the management. These are:

- a) The provision of a good fire plan;
- b) Demarcation of clear and well-defined boundaries;
- c) Establishment of permanent firebreaks;
- d) Provision of standing instructions to staff and workers;
- e) Provision of good fire control maps;
- f) Provision of good and working fire fighting equipment;
- g) Establishment of communications channel;
- h) Development of fire risk rating system; and
- i) Provision of training in fire fighting skill for staff and workers.

Soil Management and Conservation

Depending on the practicality of the particular situation, the soil type and the solutions desired, as well as budget availability the following approaches could be also be adopted for the purposes of soil management and conservation:

1. planting of cover crops;
2. use of gabions;
3. hydroseeding;
4. mulching;
5. planting fast-growing indigenous perennial plants on sensitive slopes;
6. using polyacrylamide polymer;
7. planting in blank patches;
8. use of ripraps
- 9.

Waste Management

Standard Operating Procedures on storage and disposal of scheduled wastes:

1. Use containers that are durable and able to prevent the spillage or leakage of the wastes into the environment;
2. Label containers with appropriate identification and warning tags set forth in third schedule of the regulations;
3. Separate containers containing incompatible scheduled wastes;
4. Design, construct and maintain storage areas in such a way as to enable it to function in preventing spillage or leakage of scheduled wastes from containers into the environment;

5. Facilities may utilize either on- or off-site schedule waste storage areas. On-site scheduled waste storage areas must be located:
 - in a designated area within the premises;
 - away from any on-site manufacturing or process areas;
 - in an area not subject to flooding.
6. An off-site storage area must be located:
 - in an area not subject to flooding;
 - downstream of water intake points;
 - away from residential areas;
 - in an area compatible with surrounding land use;
 - in an area with good roads and other infrastructural facilities
7. Regardless of whether storage is conducted on or off-site, the facility shall maintain records that indicate the date, type and quantity of wastes brought into or removed from the storage area.
8. The facility shall develop an emergency procedures manual and distribute the manual to all employees with access to the storage area.

Summary of Mitigation Measures

Table 9 provides a summary of the mitigation measures to be undertaken in the project area by PESAMA.

Table 9: Summary of Mitigation Measures in the Project Area

No.	Significant Impacts	Mitigation Measures & Compliance
1	<u>Project Concept</u>	<p>Selective Logging following strict RIL procedures will be carried out in LBs of manageable sizes. Tree felling and removal will be based on "RIL" with the long term objective of achieving SFM.</p> <p>Tree felling and Timber harvesting will proceed from the sides of LB before moving on to cover the whole LB in order to allow ample opportunity for wildlife to react and adjust and accordingly migrate to safer areas.</p>
2	<u>Project Design</u>	
2.1	<u>Soils</u>	<p>The design for soil erosion control will conform with "Manual <i>Saliran Mesra Alam Malaysia</i>" by DID (2000), "Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE, 1996) and "Guideline for Erosion and Sediment Control in Malaysia" (DID, 2010).</p>
a)	Erosion of soil surface	<p>Proper engineering practices will be followed by installing culverts, side ditches, cross drains, diversion ditches, sediment basins, rip rap, silt traps or other facilities. Minimise total length of roads and area of disturbance and proper maintenance. Forest roads and forest tracks to follow the specifications laid out by the Forestry Department.</p> <p>All forest roads will be closed when not in active use.</p>
b)	Landslip	<p>Benching of slopes, diversion, dykes, retention of buffer strips, seeding of grass or cover vegetation. Minimisation of cutting and filling.</p>
c)	Slope stability	<p>Use and movement of heavy machinery will be strictly controlled.</p>
2.2	Hydrology and Water Quality Control and Supervision	

	<p>a) Water yield, dry season flow and flood response</p> <p>b) Sediment load and turbidity</p> <p>c) Physical, chemical and biological qualities</p>	<p>Conservation of catchment areas; keep density of roads and tracks to a minimum.</p> <p>Proper engineering practices by dumping loose material at designated area; adequate compaction of permanent roads and provision of culverts, cross-drains; silt traps; buffer zones; revegetate slopes with fast growing indigenous species and bamboo.</p> <p>Efforts will be made to ensure that the total suspended solid (TSS) in surface water run-off from the project site is kept below 150 mg/l.</p> <p>Proper storage of gasoline or engine oil; proper waste disposal site; reforestation. Prohibit the use of poison. Control the use of fire for open burning during site preparation</p> <p>Appropriate enclosure/ barrier will be constructed around liquid fuel storage site to avoid leakage/ spillage. The enclosure will be built to the "Malaysian Standard MS 761 – Code of Practice for Storage and Handling of Flammable and Combustible Liquids" (SIRIM, 1982) with its flooring made from non-porous material such as concrete.</p> <p>Appropriate toilet facilities built to the specifications of the <i>Jabatan Perkhidmatan Pembentungan</i> will be provided for the forest workers at or near their kongsis.</p> <p>All sewage and kitchen sullage from the workers" kongsis will be handled to comply with "Standard Limit A" under the Environmental Quality Regulations (Sewage and Industrial Effluents) 1979 before being released to any water courses.</p> <p>A regular monitoring of the quality of water released from silt traps and that in the major rivers within Project Area. This will involve parameters such as BOD, DO, TSS, and O & G.</p>
2.3	<u>Drainage</u>	<p>Utilise natural drainage patterns to reduce sedimentation; maintain riparian vegetation. Facilitate water flow by clearing streams and culverts from rubbish, waste timbers and silt.</p> <p>All natural water courses, rivers and their tributaries will not be used as silt trap or sediment trap.</p> <p>No activity whatsoever will be conducted within river reserve and buffer strips</p>
2.4	<u>Groundwater</u>	<p>a) Recharge, quality and aquifer characteristics</p> <p>b) Existing uses</p> <p>Conservation and maintenance of catchment areas; minimum disturbance to aquifer.</p> <p>Avoid spillage/ seepage of fuels, engine oil or other similar pollutants on soil. Proper disposal of unused fuels, engine oil, rubbish and sewage. Proper storage of fuel and engine oil (see above)</p> <p>Disposal of Scheduled Wastes will be undertaken in accordance with the Environmental Quality Regulations (Scheduled Wastes) 1989.</p>
2.5	<u>Atmospheric Quality Control</u>	<p>a) Climate</p> <p>Selective Felling and Yield Regulation to follow Forest Management Plan (FMP). Use less polluting machines (bulldozers, excavators, trucks, 4-wheeled drives, chainsaws). These machines need to be regularly checked and maintained.</p>

	<p>b) Air pollution</p> <p>c) Noise</p>	<p>Open burning will be strictly controlled and supervised.</p> <p>Air pollution from dust from transportation tends to be localised and temporary. But its continued generation may cause severe problems to health and safety of workers, plants and animals.</p> <p>Provide mechanisms to slow down the speed of running vehicles going downhill by building bunds and other mechanisms. Improve surface grade of main roads. Stop all engines from running when not in use, as they will only emit pollution and noise.</p> <p>Similar to air pollution – noise tends to be localized and temporary in nature. Sources of noise come from chainsaws, heavy machines (bulldozers, excavators, trucks, generators, pumps, etc) particularly those old machines which are not only extremely noisy and produce a lot of smoke but also a safety hazard and dangerous to use. Continued exposures to noises such as old generators, bulldozers and excavators may seriously impair hearing ability of workers and disturb hibernating animals.</p> <p>Workers should wear safety gears such as ear plugs and machines and engines should not be allowed to run when not in use. New and well-serviced machines should be preferred whenever possible.</p> <p>No open burning will be done on any combustible material or rubbish except those allowed under the Environmental Quality Order (Prescribed Activities) (Open Burning) 2000.</p>
2.6	<u>Land Use</u>	All external boundaries of CFC area will be marked and cleared of all vegetation to the width as specified by the Forestry Department.
2.7	<u>Habitats, Species and Population</u>	<p>An appropriate survey will be conducted to document the fauna in CFC covering those animal species which are thought be threatened, rare and endemic to the site.</p> <p>a) Terrestrial/ Aquatic Habitat</p> <p>b) Endangered, endemic or protected plant species</p> <p>c) Birds</p> <p>d) Mammals, reptiles and amphibians</p> <p>e) Fish and other aquatic life</p> <p>f) Fruit trees</p> <p>Proper sustainable forest management practice; protection of catchment areas; proper erosion control measures. Avoid harvesting in area identified as containing high conservation value (HCV) species.</p> <p>Avoid felling of nesting trees or felling of timber trees on nesting trees. Avoid felling fruiting trees whose fruits are useful to birds and other wildlife.</p> <p>Plan site preparation in stages (start from fringes of planting block) to allow animals to move and migrate to other forested areas. Create and maintain corridors for animal passage.</p> <p>Implement erosion control measures; preserve catchment areas. Never use poison and explosives to catch fish.</p> <p>Prohibit workers from cutting down fruit trees and trees known to support animals and birdlife.</p>
2.8	<u>Human and Socio-Economic</u>	<p>a) Domestic water supply</p> <p>b) Physical safety and health</p> <p>Ensure proper erosion control measures; preserve water catchment areas. Prohibit use of poison.</p> <p>Enforce safety rules for all workers; safety of planting and transportation; maintenance of machines.</p>

	c)	Employment	Enforce high area and personal hygiene standard to avoid possible spread of diseases Maintain cleanliness in Base Camps and living quarters Employ local residents and Orang Asli as far as possible
	d)	Cultural/ Historical site	Avoid planting in these areas; report findings to Museum Department or relevant agencies.
	e)	Local communities	Avoid logging near local settlements.
	f)	Hunting and poaching	Prohibit workers from hunting and poaching of wild animals as well as destroying nesting sites.
	g)	Public access	Measures must be taken to prohibit/ limit access of public into CFC area as this may only complicate safety arrangement: their own safety from felling trees and branches, running machines and passing vehicles; protection of the forest against fire, theft of forest produce, etc.
3	a)	Natural forest concession Protection	Protection against Pests and Diseases. Prepare and implement Pest and Disease Protection Plan Minimise use of chemicals but encourage use of biological means to control pests and diseases. Protection against Fire Prepare and implement Fire Management Plan

Figs. 25: Open-area Planting



5.0 Residual Impacts and Post-EIA Environmental Management Plan (EMP)

Residual Impacts

Potential residual impacts may generally require further studies and long term monitoring. The main impacts of the Project are summarised below:

a) Positive Impacts:

- i. The Project will ensure the continuation of the SFM programme in the region as a model project which constitutes part of a national strategy to demonstrate the workability and feasibility of the sustainable management of natural TRF over a time continuum – apart from the national strategy to guarantee an adequate supply of timber raw material and the continued production of value-added timber products;
- ii. The Project will continue to generate the needed employment opportunity in the region, whilst generating revenue for the State of Terengganu Darul Iman;
- iii. The Project will continue to stimulate more economic activities, especially in the district of Kemaman, and the neighbouring district of Kuantan in the State of Pahang Darulmakmur;
- iv. The Project has no significant noise, water and pollution emissions into the air and rivers in the area;
- v. Through its compliance with established resource management and conservation protocols, the Project will contribute towards strengthening the nation's effort in the field of SFM of the TRF.

b) Negative Impacts:

- i. There will be erosion, siltation and sedimentation from certain forestry activities such as construction of forest roads and matau (log landings) on slopes;
- ii. There will be both short and long term effects on the timber stand as a result of selective harvesting of the of trees. Some localised and limited modification of the ecosystem will be unavoidable which, in the short and long terms will recover and grow into stands which may resemble, or even surpass the original rainforest stand in terms of appearance and quality;
- iii. Interference by movement of forestry vehicles and timber trucks with other users of the Kemaman – Bandi trunk road as well as the nearby residents.

Responsibilities During Project Implementation

In managing the natural environment of CFC, the responsibilities and actions required of PESAMA and its contractor(s) include, *inter alia*: -

- a) To provide suitable managerial and administrative mechanism for planning and management of environmental requirements, and to apply the results of the EIA for the benefit of the project.
- b) To identify and establish line of command and delegation of responsibilities to execute mitigation actions to the relevant personnel and/ or the responsible contractors
- c) Design and implement programme to monitor the effectiveness of abatement/ mitigation measures, and to identify areas for improvement;

- d) Appoint relevant expertise or outsource consultants in relevant fields where needed;
- e) Ensure that the recommended mitigation measures are incorporated into the detailed design and contract documents;
- f) Allocate adequate budget for implementing the EMP.

Environmental Management Plan (EMP)

As mentioned earlier, PESAMA will prepare separate EMP for each of the forest compartment or group of compartments that will be selectively logged and rehabilitated.

The EMP should incorporate the following:

- a) The environmental management team and their respective area of expertise and responsibility;
- b) Approach to the management of soil erosion and river siltation;
- c) Approach to the management of surface water runoff to minimize floods;
- d) Regulation of the types of activities allowed during SFM/ RIL management project implementation and operation;
- e) Conservation of high conservation value (HCV) habitats and species;
- f) Management of fuels, lubricants, liquid, solid and hazardous wastes generated by the project;
- h) Details of environmental quality monitoring requirements;
- i) Responsibilities and role of the company (PESAMA) in environmental protection.

The Organisation and Management of EMP

The likely setup for implementing the EMP is described briefly below.

- 1) Establishment of a Coordinating Body
- 2) Implementation of the construction works
- 3) Operation of the SFM and RIL Projects (inc. Selective logging) and maintenance of the CFC.

The EMP shall monitor that there is compliance with the EIA guidelines and FSC® P&C. The organisation and management for the EMP should be integrated into the set up responsible for the Monitoring and Evaluation (M&E) formed by PESAMA.

Consultative Services

The EMP is recommended to engage the following consultative services:

- 1) At least one advisory environmental specialist from an external source, such as the universities or private sector;
- 2) Environmental monitoring and laboratory analyses for water, soils, noise, pollution, etc.;

Training

It is very necessary that the personnel of the Project EMP as well as the relevant contractors be thoroughly familiar with environmental principles and philosophy embodied within SFM and SMS.

Monitoring

The purposes of the post-EIA monitoring programme are as follows:

- 1) To compare the impacts predicted in the EIA with those of which actually occur in the field during implementation,

- 2) To provide means for examining compliance,
- 3) To provide means for auditing the environmental impact,
- 4) To assess the adequacy and effectiveness of prescribed mitigation measures.

The schedule and frequency of monitoring depend largely on the nature and extent of the project involved. Among key parameters to be monitored are residual stocking, biodiversity (flora and fauna), soil erosion, noise, water quality and sedimentation.

Monitoring System and Monitoring Activities

In accordance with FSC® Criterion 9.4, annual monitoring shall be conducted to assess the effectiveness of the measures employed in order to maintain or enhance an applicable mitigation as well as conservation attributes. The followings are some of the aspects and activities that can be included to form part of the monitoring strategy:

- 1) Forest concession Boundary.
- 2) Water yield and quality.
- 3) Soils.
- 4) Rainfall.

6.0 Summary and Recommendation

Summary

The following statements identify the objectives for the management of CFC by PESAMA.

- 1) To enhance the long-term growth potential and sustainability of the timber, and other non-timber produces and services in the Project Area and the viability of the business;
- 2) To maintain and enhance the long-term health of the watershed;
- 3) To enhance wildlife habitat and genetic diversity;
- 4) To maintain or improve the riparian conditions for the benefit of fish, herpetofauna, wildlife, and plants;
- 5) To conduct RIL under SMS protocols, and re-planting and maintenance activities through sound ecological, silvicultural and engineering approaches where there are known resource concern;
- 6) To enhance contribution to the economy and health of the stakeholders.

Recommended Line of Actions

General Recommendations

The following recommended line of actions would meet (at least in part) some of the stated objectives by:

- 1) Reducing the potential for sediment delivery through the protection of buffer strips along rivers, restoration of bare soil areas through open-area planting (*Tanaman Kawasan Lapang*) and maintenance of roads and drainage facilities;
- 2) Develop and maintain good and working database and environmental and management information system (MIS)
- 3) Invest in human resource development and public relations.
- 4) Invest in research on specific issues that have been identified as having

important bearings towards a successful SFM, at minimum cost but at highest chance of achieving success.

Specific Recommendations – Taking the EIA Report Further

- 1) **Project Concept:**
 - i) Meticulous, selective and guided RIL operations will be conducted within Felling Blocks (FBs) whose layout and sizes within a Forest Compartment will be determined by the company management in consultation with the Terengganu State Forestry Department (TSFD) (usually less than 100ha).
 - ii) Construction of forest roads and skid trails, as well as selective felling of trees will take place in gradual manner and in stages before completing the entire area with the objective of facilitating and providing ample opportunities and space for animals and avifauna to move and migrate to nearby areas, and, subsequently adjust with the new environment, at a later stage.

- 2) **Project Design:**
 - i) The design for soil erosion control in the area will be prepared based on the (a) "Manual *Saliran Mesra Alam Malaysia* (2000)" published by the Department of Drainage and Irrigation, Malaysia; (b) "Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia" published by DOE, October 1996; and (c) "Guideline for Erosion and Sediment Control in Malaysia", published by DID, October 2010.

- 3) **Compliance:**
 - i) PESAMA endeavours to fully comply with all the mitigation and control measures and guidelines as have been laid out in this EIA report.
 - ii) The company will ensure that all access and forest roads in the area are built to the standards specified by the Forest Department Headquarters, Peninsular Malaysia.
 - iii) All forest roads and tracks will be closed when not in active use;
 - iv) River reserves and buffer strips along permanent rivers will be fully protected from any unnecessary intrusion or activity;
 - v) Boundaries will be marked and cleared in accordance with the Forestry Department's specifications, i.e. 1 metre wide for Forest Compartment and 3 metres wide for CFC's external boundaries;
 - vi) PESAMA will be responsible and will cooperate with the authorities concerned on the security of CFC area and to report to the relevant authorities on any encroachment and illegal activities in the area;
 - vii) All sewage, effluents as well as kitchen sullage from the workers' *kongsis* within CFC will be appropriately handled before being released to any streams or rivers;
 - viii) Appropriate toilet facilities will be duly provided at the workers' *kongsi* before the start of the Project;

- 4) **Control and Monitoring of Water Quality:**
 - i) Appropriate enclosure in the form of a barrier or dam will be constructed around fluid fuel storage facilities in order to contain any possible spillage or leakage. The enclosure will be built to the

“Malaysian Standard MS 761 – Code of Practice for Storage and Handling of Flammable and Combustible Liquids” published by SIRIM (1982) and capable of accommodating at least 110 per cent of the contents of the largest tank. The flooring within the enclosure will be made of non-porous materials such as concrete. Only tanks containing similar liquid fuels will be kept within any one enclosure. The enclosure will also be equipped with appropriate pumping facilities to drain out any spill/ leakage;

- ii) PESAMA will ensure that any water or surface runoff water leaving the project site does not contain suspended sediment in excess of 150 mg/l.
- iii) All rivers and their tributaries will not be used as silt trap or mud trap. All silt or mud trap facilities will be constructed and dealt with separately from natural water courses;
- iv) Water quality in the major rivers within the area will be monitored regularly for parameters such as BOD, DO, TSS and O & G.

5) **Control of Air Pollution:**

- i) PESAMA endeavours to abstain from all open burnings of rubbish and felling debris except those open burnings that are permitted under the EQO (Prescribed Activities) (Open Burnings) 2000.

6) **Handling of Scheduled Wastes:**

- i) Any scheduled wastes from the logging activities will be handled in accordance with the E.Q Regulations (Scheduled Wastes) 1989.

7) **Control and Protection against Pests and Diseases and Forest Fire**

- i) Control and protection against pests, diseases and forest fires will be affected according to the respective plan to protect CFC against those threats;
- ii) The use of chemicals/ poisons to control pests and diseases will be done away with and the use of biological methods of control will be encouraged and given priority.

Submission of EIA Report and Subsequent Reportings

- 1) During the course of the Project, appropriate compliance reports will be prepared and submitted to the relevant authorities and certification body stating that all conditions in respect to the compliance with FSC® P & C have been fulfilled and that mitigation and control measures have been accordingly implemented;
- 2) The following reports will be prepared and submitted to TSFD:
 - i) Regular reports on the monitoring and assessment of the water quality in the identified major rivers giving such parameters as analysed by accredited laboratories,
 - ii) Periodic reports on the results of the monitoring of suspended solids released into the major rivers.

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