CHAPTER 5 : PROJECT DESCRIPTION

5.1 INTRODUCTION

As for this project, replant of rubber forest (*Hevea Brasiliensis* of the TLC variety), six (6) species of TLC have been shortlisted for planting and they are:

i. PB 350
ii. RRIM 926
iii. RRIM 929
iv. RRIM 2025
v. RRIM 2027
vi. RRIM 3001

The main criteria for the choice of clones are:

i. High latex yield.
ii. High wood potential.
iii. Good stem form, branching and crown structure.
iv. Good resistance to pest and wind damage.

To maximise on latex and timber yield based on the performance of the 6 clones, the rotation cycle is fixed at 25 years but may varies depending on market conditions and demand for both latex and timber at that time. In addition to the six (6) shortlisted clones, other recommended TLC clones may also be plant depending on availability of planting stocks and suitability.

Other factors that affect the development period include the extreme weather, soil types, stability of labour forces, availability of heavy machineries, management capability and the overall financial capability of the project proponent.

5.2 PROJECT CONCEPT

There are five (5) stages involve in this Project as shown in **Figure 5.1**. The details on each stage will be discuss in the next sub section.

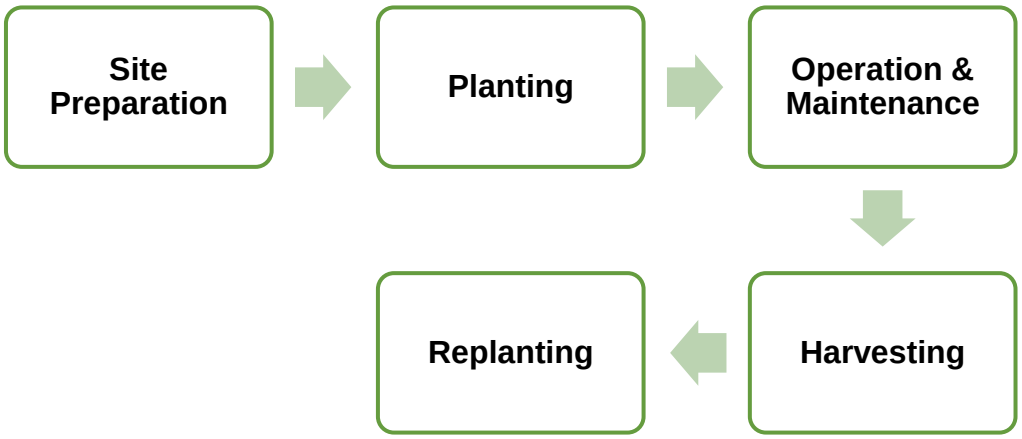


Figure 5.1 : Stages of Project

5.2.1 Site Preparation Stage

i. Site Suitability

The project proponent has identified the site as suitable for the proposed project activity. Based on the analysis conducted, the project proponent believes that the proposed project site is appropriate for the timber latex clone plantation project. The proposed project is economically feasible with an area of 1,600.00 Hectares (3,953.67 Acres) at Piah Forest Reserve, District of Hutan Kuala Kangsar, Perak Darul Ridzuan.

ii. Environmental Impact Assessment

A Detailed Environmental Impact Assessment (DEIA) study is carried out to identify potential environmental impact that would arise from the proposed activity. It will also provide recommendation on mitigation measures to be employed on site to minimise the anticipated potential impacts on the surrounding environment.

The report is submitted to the Department of Environment Headquarters (DOE HQ), the project proponent can undertake where approval is required before any of the plantation activity.

iii. Area Zoning

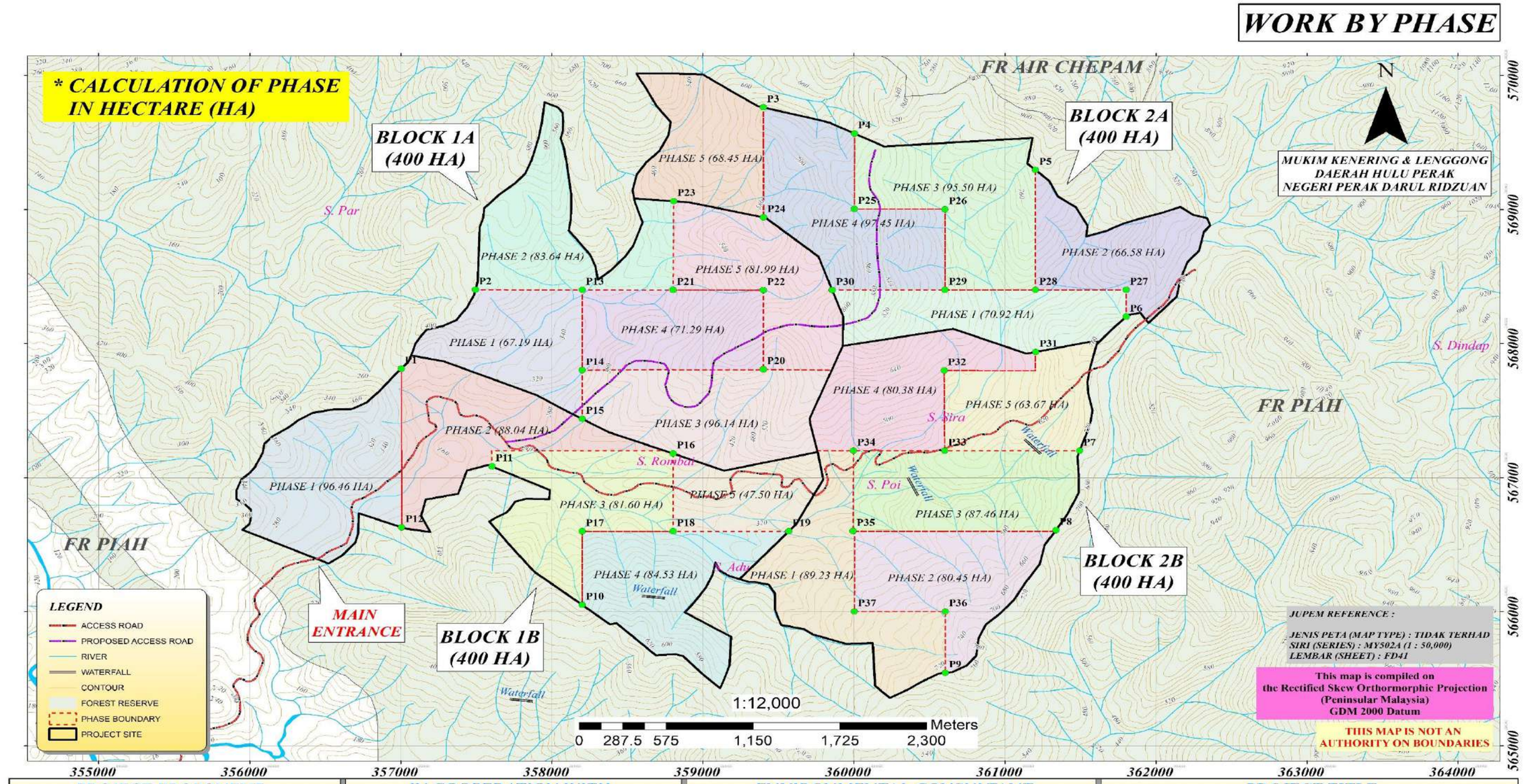
An important step at site preparation stage is that the area needs to be divided into different zones for site preparation and planting. This is required for control operation and maximising resource use within limited time frame. The project site has been divided into four (4) blocks with each block containing five (5) phases as shown in **Table 5.1** and illustrated in **Figure 5.2**. The idea of area zoning is due to the factors as highlighted below.

- To minimise any possible negative potential impact that may arise especially during clear felling, site clearance and earthwork activity.
- By undertaken respective plantation activity on zone by zone may assist project proponent in controlling and managing the overhead cost, financial transaction and machinery used in the overall plantation activity.
- To give an ample time for wildlife (if any) to naturally migrate to a new area nearby the proposed project site as well as to avoid any kind of wildlife (if any) from being trap within the proposed project site.
- Area which has not being cleared can be used or temporary develop as a natural buffer zone for noise, air, dust and erosion that may occur as a result of daily activity at active working zone.

Since Block 1B and 2B had been cleared, the development for site plantation will start from 1B and site clearing will start from Block 1A. Overall, the works sequence for site preparation shall progress from Block 1A (Phase 1) to Block 2A (Phase 5) while, planting shall start from Block 1B (Phase 1) to Block 2B (Phase 5). The proposed timeline will be discuss in the next subchapter (5.4: Project Schedule).

Table 5.1 : Area for Each Phase and Block Development

Block	Phase	Area (Hectares)
1A (400 ha)	1	67.19
	2	83.64
	3	96.14
	4	71.29
	5	81.99
2A (400 ha)	1	70.92
	2	66.58
	3	95.50
	4	97.45
	5	68.45
1B (400 ha)	1	96.46
	2	88.04
	3	81.60
	4	84.53
	5	47.50
2B (400 ha)	1	89.23
	2	80.45
	3	87.46
	4	80.38
	5	63.67



PROJECT PROPONENT	IN COOPERATION WITH	ENVIRONMENTAL CONSULTANT	PROJECT TITLE
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Figure 5.2 : Work by Phase Map

iv. Establishment of Site Office, Worker Quarters and Storage Facilities

A site office, worker quarters, storage facilities, nursery area, toilet facilities and workshop for machinery and equipment repair, will be built on site. The site office and workers quarters are normally constructed at relatively flat area and nearby the river (water sources) as to provide water supply to the operation. However, the natural buffer zone together with earth interceptor drain shall be developed at least 10 meters from the river or other water body. This is basically to prevent any direct discharge of effluent or other type of wastes generated from the site office and worker quarters daily activity to the respective river or water body. The proposed location and layout of the site office, worker quarters and storage facilities are shown in **Appendix 5-A.** This tentative area is basically an initial proposal and can be differed during actual overall project implementation.

Figure 5.3 exhibit the access road to the project side while **Figure 5.4** shows the proposed location for ‘matau’ and nursery.

Listed below are the initial arrangements that need to be prepared by the project proponent during the establishment of site office, worker quarters and nursery area.

- **Mobilisation of workforce** – worker quarters will be set-up for workers on-site within the project site. Significant employment particularly for locals is expected to be generated during the development of the timber latex clone plantation project. These opportunities are generally temporary. The number of workers during this stage is expected to be about 80 to 100 people. However, once the plantation project is fully operational, the number of workers needed would reduced to about 60 people.

- **Water Supply** – Since the proposed project is for timber latex clone plantation, demand for clean water supply is minimal. The water supply needs to be provided to the proposed site for workers daily uses. As for the plantation and nursery requirements, the raw water supply is not a problem. There are

several small rivers flowing within the proposed project area, which are capable to supply the raw water supply to the proposed project area using water pumping system. It is assumed that the existing several small rivers scattered within the proposed project site is adequate to serve the needs of the daily water consumption of the project activity.

- **Electrical Supply** – Since the proposed project area is located at a remote area, no electrical supply from the grid can reach the area. Therefore, the project proponent will use a mobile generator set as electrical supply for the proposed project area. The exact electrical loading will have to be determined by the respective consultant engineer in order to cater the overall operation of site office, nursery and worker quarters.

v. Extraction of Marketable Trees

The site of the proposed project has been classified as forest reserve area. The logging will be part of the timber latex plantation development approved by the Department of Forestry. The proposed project site which has been divided into four (4) major blocks will be sequentially logged and replanted with high commercial species of timber trees.

Felling of larger trees is unavoidable in plantation establishment to facilitate sun light penetration, which is required for promoting growth of young seedlings. The activities during logging involve are as highlighted below:

- Tree felling – Selected trees will be felled using chainsaws. All marketable and selected trees above 16.0 inches diameter (about 40.6 cm) will be felled under the logging operation.
- Bucking/debarking – Cutting of felled trees to lengths using chainsaws, crowbars and other simple tools.
- Skidding of logs – Bulldozers will be used to pull the logs onto a temporary storage area. The activity involves bulldozer movement and haulage of logs from felling area to the temporary storage yard.

- Log loading – Used of wheeled or track-type loaders fitted with log forks/hydraulic boom loaders/cranes for loading logs onto logging trucks.
- Transportation of logs – 'Clippers' (a type of bulldozer with clamp) will be used to transport logs from the temporary storage yard onto another storage area known as 'matau' close to a primary logging road. From there, 'San Tai Wong' will be used to transport the logs to a checking station managed by the Department of Forestry.

vi. Logging Track Road Construction

Well planned roads are vital in proposed rubber plantation project to facilitate transportation during various stages of development and operation. These roads should be properly planned and mapped out before development. This road will be constructed throughout the proposed project site to facilitate planting and maintenance. Three (3) types of roads are normally constructed for proposed rubber plantation project indicated as follow:

- Main roads - roads connecting the proposed project sites with the public roads to facilitate access. This main estate road shall be gravelled for all weather use. This can be progressively done as planting is being completed. This road is to be maintained permanently.
- Branch roads - arterial roads within each project site to facilitate easy movement of machinery and manpower for plantation establishment and maintenance. These roads are also to be maintained permanently which can be used later as harvesting road for plantation activity.

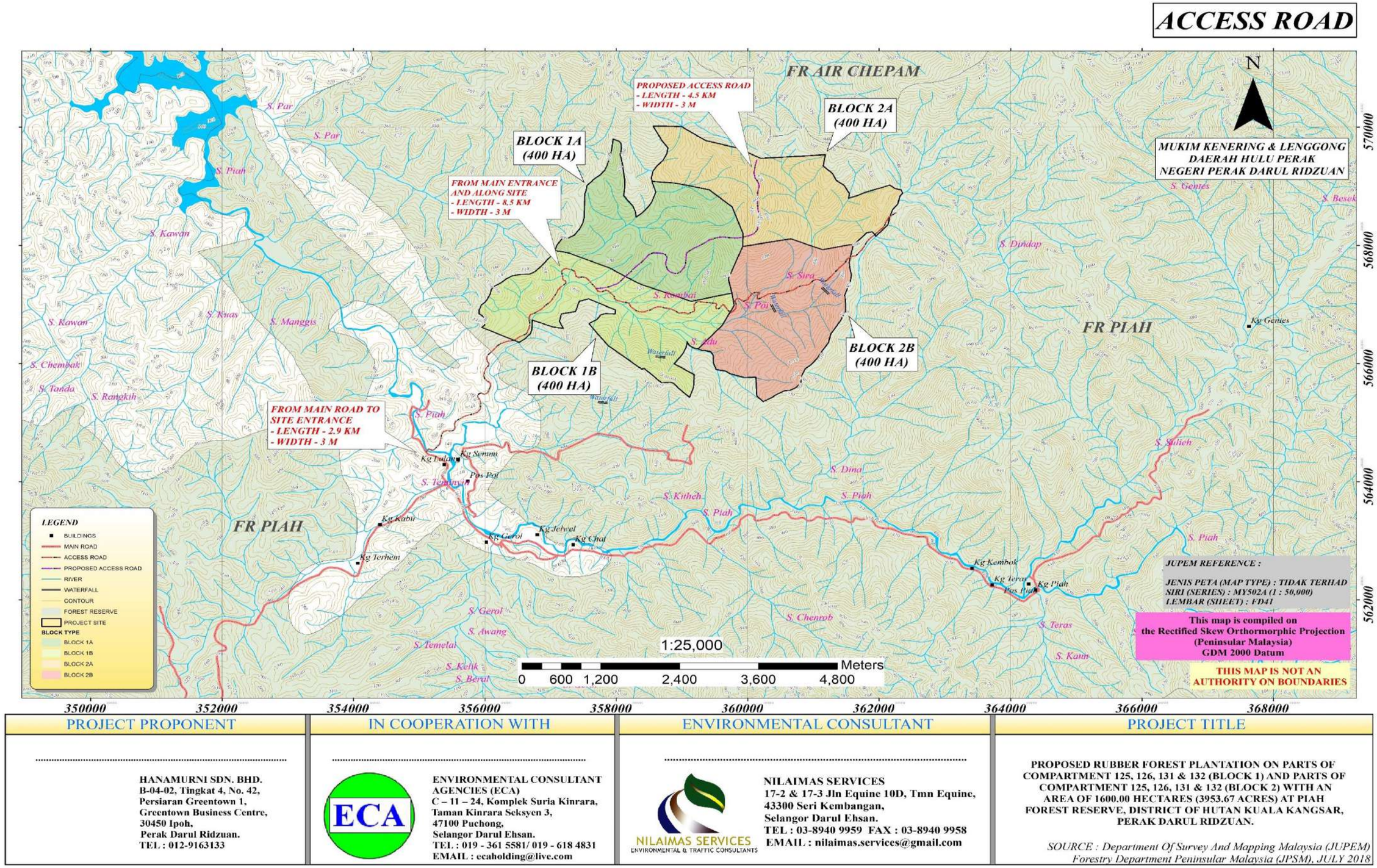

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Figure 5.3 : Access Road

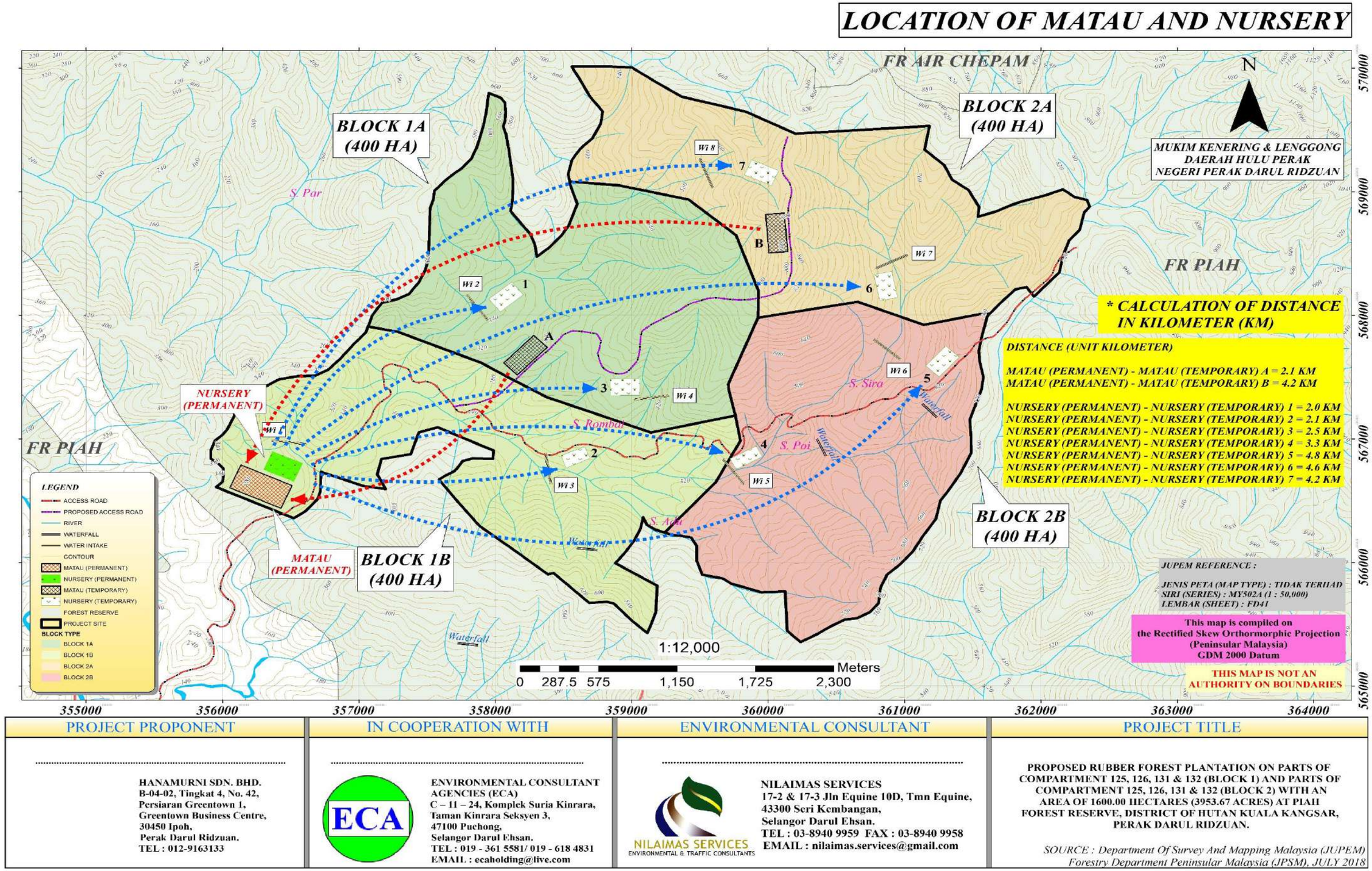

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Figure 5.4 : Proposed Location of *Matau* and Nursery

- Jeep tracks - tracks specifically constructed to facilitate easy transportation of seedlings and equipment during the establishment phase of the plantation. These tracks will normally not be maintained after the successful planting activities.

The detail specification on the plantation road construction to be used in the timber latex clone plantation project is based on the "**Spesifikasi Untuk Pembinaan Jalan Ladang – Ibu Pejabat Jabatan Perhutanan"** as highlighted in **Table 5.2** and **Table 5.3.** The project proponent however, is recommended to minimize the construction of new plantation road as to avoid and minimize the potential soil erosion problem. The project proponent is suggested to use as possible the existing logging track for their plantation road within the proposed project area.

Table 5.2 : Plantation Road Specification

No.	Description		Type of road		
			Main Roads	Branch Roads	Jeep Trucks
1	Road base	Width	6.0 m	4.3 m	3.7 m
2	Road surface	Width	4.3 m	3.0 m	2.5 m
3	Side road area	Width	1.0 m	0.6 m	0.6 m
4	Triangle side drain	Width	-	0.6 m	As require
		Depth	0.6 m or 0.5 m	0.5 m	As require
		Slope	2 – 6 %	2 – 6 %	As require
5	Slope	Ascend (max)	8 %	10 %	15 %
		Descend (max)	12 %	15 %	15 %
6	Chamber	Ratio	1 : 25	1 : 20	1 : 12

Source: Spesifikasi Untuk Pembinaan Jalan Ladang, Ibu Pejabat Jabatan Perhutanan, 1989.

Table 5.3 : Forest Road Specification

Description			Value/Material/Code Required
1. Compaction			≤ 40 m/ha
2. Road Surface			Single Lane
3. Design Speed*			≤ 20 km/h
4. Cross Section	a) "Hak Lalu Lintang (HLL)" (Maximum value will depend on slope height)		≤ 12 m
	b) Road Surface Width		≤ 5 m
	c) Road Surface Material		Stable Sub grade
	d) Road Chamber		≤ 1 : 20 (Straight) (5%)
	e) Cross Section Slope		≤ 1 : 33 (3%)
5. "Kelarian Tegak"	a) Road Slope		≤ 20% (11.3°)
	b) Slope Length		≤ 200 m
6. "Kelarian Ufuk"*	a) Curving Radius		≤ 20 m
	b) Curving Width		≤ 1 m
	c) Corner Ratio		1 : 20 (5%)
7. View Distance*	a) Stagnant		≤ 30 m
	b) Movement		≤ 50 m
8. Drainage Structure	Side Drain "V" Type (Soil)	Surface Width	≤ 0.5 m
		Depth	≤ 0.3 m
		Slope Base	≤ 2 %
	Culver with logging tree as retaining wall	Load	22 tonne
		Diameter	≤ 900 mm
		Type	Log Tree/Concrete/PLB/PKT
	Bridge with logging tree as retaining wall	Load	22 tonne
		Width	≤ 3.5 m
		Type	Wood/Concrete Box Culvert/Steel
	Surface Crossing Drainage (Hard Wood)	Width	≤ 0.5 m
		Depth	≤ 0.3 m
		Slope Base	≤ 1 : ½ (< 63°)
9. Side Slope	Cutting Height > 1.0 m	Stable Soil	≤ 1 : 1 ½ (< 34°)
	Bund	Soil with logging trees	

10. Earthwork	a) Overburden Soil	To be used at overtake area and road shoulder area
	b) Silt Trap	For easy eroded area
*Recommended parameter for safety purposes		

Source: Jabatan Perhutanan, 2005.

vii. Under Brushing

Under brushing involves manual slashing of undergrowth. All small trees up to a diameter 5 cm will be cut 15 cm above ground level. All creepers are to be slashed.

viii. Clear Felling

After the extraction of valuable trees, the area will be clear-felled. This is done to make access to the area easy and, in the cases mentioned above, to allow lining and holing to be carried out. The work is done with cutlasses and axes and will require between 10 and 20 man-days per hectare. According to the thickness of the undergrowth, all herbaceous undergrowth, lianas and young sapling 7.5 cm or less in diameter should be cut, the latter as low as possible. The exercise will involve under-brushing where remaining stands such as bamboo's and bertams will be cut and felled. Chainsaw will be used for felling trees but 'parang' is recommended for cutting bamboos. There are various conditions shall be observed by the project proponent during the clear-felling operation as highlighted:

- The felling needs to be done only in the area where planting is to be carried out.
- No felling is allowed on area steeper than 25° slope or at river buffer zone (as suggested in the report) or other areas not suitable for planting.
- No open burning (strictly prohibited) shall be carried out at all either by the project proponent or by the contractor and supplier involved in the plantation activity.
- It is recommended that all the felled trees shall be left to rot and degraded naturally within the project site area.

- No tree should be felled into or across water courses, swamps, drainage canals, bund or tracks.
- All trees shall be felled inwards from the perimeter boundaries area.
- Transportation of logs – 'Clippers' (a type of bulldozer with clamp) will be used to transport logs from the temporary storage yard onto another storage area known as 'matau' close to a primary logging road. From there, 'San Tai Wong' will be used to transport the logs to a checking station managed by the Department of Forestry.

ix. Drains, Bridges and Culvert

The preliminary works involved before any design of drainage system during the proposed project development is to locate, de-silt or deepen all possible natural water-ways which then serve as the main outlets. The best time to construct the drains is during the land preparation stage. The types of drains and their dimensions are listed as follow.

- Field drain - subsidiary drains which run parallel to rubber rows (dimension 1.0 m top x 1.3 m bottom x 0.9 m deep).
- Collection drain – drain collection water from the field drains normally running perpendicular to the field drain (2.0 m top x 0.6 m bottom x 1.2 m deep).
- Outlet drain - main drain carrying water from a number of collection drains and running either direct to outlets, rivers, Watergates (3.0 m top x 1.0 m bottom x 2.0 m deep).
- Ring drain - drain running parallel to the anti-flood bund, the spoil from which is used to construct the bund (size depends on situation).
- Perimeter drain - large drain normally dug in inundated area (e.g. Peat jungle) along the perimeter to allow preliminary drainage of excess water (size depend on situation).

x. Nursery Establishment

Timber latex clone planting materials are prepared in nursery preferably near the proposed plantation to reduce transportation cost.

The site must be flat to undulating with deep, good structured friable soil. It should be close to a reliable water source such as running stream. For better success, the sites need to be clear-felled and all sources of inoculums of root diseases such as wood remains and stumps eradicated. In areas where the planting materials are prepared from the ground, 250 grams of magnesium limestone is broadcast per hectare followed by 625 grams of rock phosphate per hectare. Fencing may be required to keep out animals and trespassers.

xi. Terracing and Platform

Terracing and platform is considered one of the methods of erosion control accomplished by constructing broad channels across the slope of rolling land. Inland areas often require terracing because of the steepness of terrain. This terracing and platform serve more as a place for the harvester to work than a means of erosion control, but nevertheless this method of planting is often quite satisfactory on the more stable inland soils. The platform is cut with a slight inward slope to reduce rainfall run-off. Terraces are constructed so that run-off water during heavy rains flows laterally to appropriate outlet drains, which lead the water to a suitable discharge point such as a stream or grassy slope.

The functions of terraces in humid areas are to decrease the length of the hillside slope, thereby reducing rill erosion; to prevent the formation gullies; and to allow sediment to settle from runoff water, thereby improving the quality of surface water leaving the field. Crop rows are usually parallel to the terrace channel, so terracing includes contouring as a conservation practice.

Since terracing requires additional investment and causes some inconvenience in farming, it should be considered only where other cropping and soil management practices, singly or in combination, will not provide adequate erosion control or water management. In drier areas, terraces serve to retain runoff and increase the amount of water available for crop production or for recharging of shallow aquifers. Such retention of water also reduces the risk of wind

erosion. Terracing can also be used as an aid in surface irrigation, particularly in rice-growing areas. The lateral slope of the terrace must be shallow (1/2 to 1%) so that the water movement is slowed down and a greater infiltration into the soil is possible. The distance between terraces will vary along the line as the slope increases or decreases.

5.2.2 Planting Stage

i. Green Budding

Although there are various techniques of rubber tree planting including vegetative propagation such as tissue culture, cutting and cleft grafting, rubber tree planting materials are mostly prepared from green budding. It involves bud grafting of a selected clone onto vigorous growing seedling stocks. These stocks are raised from seeds procured from selected clones during main seedling (August to September) as well as from secondary seed fall (February to March). These seeds are germinated in seedling beds filled with friable material such as coarse sand, loose soil and sawdust. Green budding is done when the seedling stick is about 5 to 6 months old. A strip of bark is removed from the stem of the seedling exposing the budding panel stock. Bud patch from the bud wood of the selected clone is inserted into the budding panel. The panel is protected with polythene tape wound around it; various planting materials can be prepared. The most popular planting materials produced by private and public nurseries are budded stumps and two-leaf poly bags.

ii. Budded Stumps

Budded stumps are prepared by first raising seedling stocks on the ground nursery. The planting distance preferred is 61 x 15 cm with a footpath 120 cm wide for every six (6) rows. The planted site must be sufficiently manure and clear of weeds as well as diseases. The 5 to 6 months old stock plants are green budded. Three (3) weeks later, the successful budded materials are extracted by lever jack s,

the taproots cut off to 30 to 40 cm and the stumps cut back at 4 to 5 cm above the budpatches. The cut ends of stumps are dipped in melted wax and bundled up for dispatched. The stumps are used for a preparation of polybag plants and not for field planting.

Polybag plants, widely used by rubber trees growers, are generally prepared from budded stumps. The poly bags of 18 x 38 cm (measured flat) are used land filled with suitable potting soil, mixed with 25 g of rock phosphate per bag. The bags are arranged in two (2) rows and held together with wires fixed around them. A spacing of 60 cm is required between the double rows as a working area. Soils in the poly bags are first made wet and later planted with budded stumps. To ensure good success of the polybag plants adequate manuring, watering, weeding and disease control are necessary. The polybag plants can be used for field planting when they have reached a minimum of two-leaf wort stage.

iii. Nursery Maintenance

Proper management practice of the nurseries is required in order to produce quality materials. Manuring, watering as well as weed, pest and disease control must be done accordingly and on schedule. The manuring schedule for ground and polybag plants in the nursery is shown in **Table 5.4.** Care should be taken when manuring to not allow fertilizer to come in contact with the plants. For a small nursery, manual watering is sufficient. In the case of the nursery that covers more than 2.0 hectares, a sprinkler system is required. As for the ground nursery, watering is to be carried out only during extreme dry weather. Weeds, pests and diseases can damage planting materials and hence should be controlled or eradicated. Weeds are controlled manually in the initial stage of planting and later with chemicals when the stem of the nursery plant has turned brown. The recommendations for chemical treatment of diseases and pest of rubber tree during nursery are shown in **Table 5.5**.

Table 5.4 : Manuring Schedule for Budded Stumps and Polybag Plants

Period	Type of Fertilizer	Rate of Application (kg ha-1)
Before planting	Magnesium limestone (plough in) CIRP (harrow in)	250 625
Months after planting on the ground		(g/running m)
2	Equivalent mixture Mag X*	56
3	Equivalent mixture Mag X*	56
4	NK mixture	56
5	Equivalent mixture X*	56
6	Budding and later cut back, extracted and transferred into polybag	
Months after transplanting in polybags		(g/polybag)
1	Equivalent mixture Mag X*	30
3	Equivalent mixture Mag X*	30

**Equivalent mixture Mag X contains 9% N, P_2O_5, 7% K_2O and 2% MgO where phosphate is in a soluble form. Slight variation in nutrient composition in other related fertilizers incorporating soluble P is permissible.*

Table 5.5 : Recommendations for Chemical Control of Diseases of Rubber Tree in Nurseries

Disease	Cause	Fungicide	Concentration (%)	Method of application	Remark
Colletotrichum leaf disease	*Colletotrichum gloeosporioides*	Deconil	0.2	Mistblower (knapsack portable or tractor-mounted)	Apply at least 4 rounds at weekly intervals as leaves are unfolding
Odium leaf disease	*Odium hevea*	Sulphur dust	9 kg ha^{-1}	Power duster (portable or tractor-mounted)	Apply at least 4 rounds at weekly intervals as leaves are unfolding

Bird's eye spot	*Helminthosporium hevea*	Zineb, Maneb	0.2	Knapsack sprayer	Spray expanding leaves at weekly intervals
Pink disease	*Corticium salmonicolor*	2% Calixin in latex concentration	Neat	Brush infected portion	Treated trees are not re-attacked for at least 3 months
Die-back	Various fungi	Daconil	0.2	Mistblower (knapsack, portable or tractor-mounted)	Apply at least 4 rounds at weekly intervals as leaves are unfolding
		Wound dressing (bituminous) tar	Neat	Brush over surface after pruning	Cover with white-wash if exposed to 8 cm

Source: A Manual for Forest Plantation Establishment in Malaysia, 2002

iv. Planting Options

In the establishment of timber latex clone agro-forestry, timber latex clone is planted as single, double or triple row with wide spacing or avenue of more than 18 meter in between the hedges. Timber species such as teak and sentang are planted in avenues at planting densities depending on thinning policies.

With thinning the appropriate initial density is 800 trees per hectare which is gradually reduced to a final stand of 144 trees per hectare, 20 year after planting.

Without thinning the preferred initial density of teak and sentang is 20 trees per hectare. The development of rubber tree plantation for timber production is new. Nevertheless, the combined silvicultural

techniques of forest plantation and agronomic practices of timber latex clone plantation may be used.

The planting cycle proposed is 15 to 20 years at an initial density of 1,100 trees per hectare. This density will encourage the development of straight bole. For girth and diameter growth, the density is thinned down to a final stand of 460 per hectare.

Manuring as well as weed and disease controls is essential to ensure success of timber latex clone tree establishment but these can be minimal.

v. Size Suitability

Timber latex clone tree can be planted in the tropics between latitudes 1,000 km north and 1,000 km south of the equator. It strives best in areas where the rainfall is between 125 and 180 cm per year and a temperature between 25 and 35°C. The highest altitude for rubber cultivation is 500 m above sea-level. But the most important aspect for timber latex clone tree cultivation is the site. It should be gentle undulating to rocking terrain with minimal soil erosion and surface run-off. The site has to be free from flooding and the water table deeper than 100 cm. Additionally, it must have soil that encourages good root development. Some of the main desirable soil properties are listed as follows.

- Soil depth up to 100 cm free from hardpan or rock outcrop.
- Soil texture with proportionate amount of sand, silt and clay.
- Good aeration and structure.
- Well-drained and absence of peat or acid sulphate layer.
- Good moisture retention.
- Moderate permeability and slight erodibility.
- High nutrient content of N, P, K and Mg.
- pH of around 4.5.

Generally, sites available for timber latex clone tree cultivation in Malaysia may have weaknesses but these can be overcome through

additional management inputs. However, there are sites that cannot be improved to the level where they can perform satisfactorily. Such areas with serious limitations must be avoided. Factors that render such sites unsuitable include the following matter.

- Slopes steeper than 20°
- Massive thick pan at or very close to the surface (within 25 cm) to the surface.
- More than 75% of rock outcrop in a unit area.
- Permanent water-table at or near (within 25 cm) the surface.
- Acid peat layer thicker than 25 cm near the surface.
- Area disturbed by mining activities (tin tailing).
- Very poor nutrient status.

vi. Nursery Pests and Disease

Young rubber plants are potentially being attacked by a number of pests and disease in the nursery stage. Failing to overcome this problem can make young rubber being damaged thus may interrupt the development of the project. Controls of these are outlined in **Table 5.6.**

Table 5.6 : Recommendations for Chemical Control of Pests of Timber Latex Clone Trees in Nurseries

Pest	Insecticide	Mammalian toxicity (mg kg^{-1})	Active ingredient (%)	Form available	Required dilution (g $litre^{-1}$)	Rate of application	Method of application	Remark
Termites	Dieldrin (CH) Aldrin (CH) Heptachlor (CH) Chlordane (CH)	100 50 130 500	0.0375 0.05 0.05 0.1	Emulsifiable concentrates: Dieldrex 15 Aldrex 2 Heptachlor 2E Chlordane	5 in 2 5 in 2 5 in 2 5 in 2	570 litre or more/tree depending upon size of tree	Pour around bole after making a runnel around it	Treated trees are not re-attacked for two years. Prophylactic treatment feasible. In peat areas use only Aldrin or Heptachlor, but at 4 times the concentration
Cockchafer grubs	Heptachlor (CH) Aldrin (CH)	30 50	0.1 0.1	Emulsifiable concentrates:	5 in 1 5 in 1	1-2 litre/tree, depending upon size	Pour around bole into holes made with a crow-bar, within a circle of 30 to 45 cm radius	Treatment feasible only for immature trees and in nurseries

				Heptachlor 2E Aldrex 2 Heptachlor granule: Heptachlor 10G	Neat 3 in 1 5 in 2 4 in 3	28 kg ha^{-1} 56 litre ha^{-1}	Broadcasting By high volume spraying with pressurized knapsack sprayers	 Spray thoroughly to cover all parts of the plant. Repeat one or twice at weekly intervals
Yellow tea mites and thrips	Dieldrin (CH) Endosulfan (CH)	100 110	0.05 0.05	Emulsifiable concentrates:	25 in 1 25 in 1	110 to 220 litre ha^{-1}	By high volume spraying with pressurized knapsack sprayers	Spray thoroughly to cover all parts of the plant
Scale insects and mealy bugs	Oil emulsion	Negligible	2.5	Dieldrex 15 Dieldrex Extra Thiodan	19 in 1	11 kg ha^{-1}	Bait with 1 oz. Ball at base of each tree in area affected	Repeat one or twice at weekly intervals
	Gamma BHC (CH)	125	0.065	Albolineum Kerosene-soap emulsion Albarol	1 kg in 100 kg of bran			Baiting may have to be repeated after rain

Source: A manual for Forest Plantation Establishment in Malaysia, 2002

vii. Land Preparation

As rubber tree is light-demanding species, its cultivation requires open land, the proposed site has to be clear-felled mechanically and the land free from all of vegetation including trees, bushes, bamboo, rattan and wild bananas. According to the Jabatan Perhutanan Negeri Perak had recommended controlled burning such as using burners to solve the problem of the waste wood such as branches, stumps and roots in the project area. Since burning practices are common practice in forest plantation management as it can reduces the risk of disease or outbreak.

Meanwhile, ash can be used as fertilizer for crops. All remaining large stumps need to be poisoned. Clearing are best done during the dry season between February and May. A reasonably good field road system is necessary to facilitate development, harvesting and transportation of plantation crops. It is envisaged that approximately 25 m and 50 m of roads are required for forest enrichment project respectively.

viii. Lining, Holing and Planting

Immediately after the land preparation activity, lining shall be carried out with proposed planting distances and densities as shown in **Table 5.7.** In the case of forestry involving rubber tree, the lining is done to be appeared as a hedge planting system.

In this system, planting distance of 2.4m x 2.4m will give initial density of 1,000 trees per hectare for rubber tree species. In addition, in the area which lots of obstacle, planting distance of 3.0m x 4.6m will be used thus will give density of 700 rubber trees for 1.0 hectares of area.

The planting holes can be prepared manually or mechanically and preferred dimensions are 30 cm square and 45 cm deep. At planting ensure that each hole is supplied with at least 115 gram of rock phosphate.

Table 5.7 : Proposed Planting Distances for Rubber Trees

Plantation	Planting distance	Density (tree per ha)
Rubber wood	2.4 × 2.4 m	1,000
Rubber wood – latex	3 × 4.6 m	700

ix. Establishment of Cover Crops or Legume Covers

After the planting process of rubber trees started, normally in a triangle pattern, cover crops will have to be planted at the bare land area immediately without further delay. The cover crops are for the control of soil erosion activity, to improve the nutrient quality in the soil especially nitrogen and to maintain the soil moisture content. The examples of recommended various cover crops which commonly available in the market and can be used by the project proponent are *Mucuna bracteata , Centrosema pubescens , Pueraria phaseoloides, Signal grass* and *Calopogonium mucunoiodes/ caeruleum*. The basic functions of cover crops, whether natural or leguminous, can be severally and varies listed as follow:

- **Conservation of soil humus** - Where soil at the proposed project site has been exposed to direct sunlight as a result of clearing and burning activity, the need for rapid establishment of a protective cover again favours the use of legumes.

- **Conservation of soil moisture** - Although the retention of adequate soil moisture is important under all conditions of soil and terrain, it becomes a critical factor when planting undulating or steep areas of light friable soil. Under the latter conditions, water loss can be effectively reduced by the establishment of a thick cover; this can be achieved most rapidly by sowing a legume cover. A more long-term effect of a vigorous leguminous cover would be the build-up of humus and the amelioration of soil structure with respect to its water holding capacity.

- **Prevention of soil erosion** - The importance of this particular function of a cover will depend on (i) the conditions under which

planting is taking place i.e. new clearing or replanting and (ii) the slope of the terrain. Where rubber trees are being planted after jungle clearing and on sloping land it is important to establish a cover that spread rapidly; for such conditions a leguminous cover has decided advantages over a natural cover. When planting following jungle clearing on flat land, the prevention of soil erosion is less important and hence the need for a rapidly spreading leguminous cover is reduced. The replanting of rubber trees with cover crops normally necessitates at the complete felling and burning of area. Under these conditions, cover requirements from the standpoint of prevention the soil erosion are similar to those applicable to planting after jungle clearing.

- **Reduction of competition from weed growths** – The establishment of a complete cover of desirable naturals or legumes should assist in restricting the growth of weeds. Selected legume covers can be planted in any given area, but the development of a natural cover of desirable species, will depend on the extent to which they occur in that area. Apart from the fact that final composition of the cover can be more accurately predetermined when using introduced legumes, weeding operations can be simplified where a policy of "retention of legumes only" is adopted.

- **Improvement of nutrient status** - The results from experiments carried out by the Rubber Research Institute, Malaysia (R.R.I.M) show that "large quantities of nutrient are mobilised by a cover of leguminous creepers". In these experiments, the nutrient returned to the soil as the covers died back between 34th and 47th month from sowing, were estimated as equivalent to 540 lbs. ammonium sulphate, 62 lbs. of rock phosphate, 53 lbs. of muriate of potash, 234 lbs. of limestone and 72 lbs. of kieserite (all expressed in lbs./acre). These figures can be considered as conservative as they do not consider the nutrient made available from the cover root system as they in turn die back.

- **Improvement of soil structure and aeration** -The establishment of good natural or leguminous cover should assist in improvement of soil structure in that (a) the addition of organic matter (humus) helps to build up crumb structure and (b) the development of an extensive root system improves soil aeration. On clay soil the colloidal material present in the humus helps to form aggregates of the fine clay particles thus improving the crumb structure. In view of the fact that the majority of Malaysians soils tend to be clays and clay loams, this function of a cover would seem to be of some importance.

The appropriate mixture of Calopogonium, Centrosema and Peuraria is at the ratio of 5:4:1 and these are planted at the end of land preparation. The general procedure of cover establishment and maintenance recommended by RRIM is as follows:

- Mix legume seeds and appropriate amount of Rhizobium compost in a plastic pail.
- Add equal amount of CIRP in the legume mixture.
- Prepare 2 to 3 drills in between the rubber rows 1.3 m apart.
- Sow the seed mixtures in the drills and cover the drills with soil.
- Two to three weeks after germination incorporate phosphorous fertilizer.
- Control weeds at frequent intervals especially during the first few months after sowing.

x. Electrical Fencing/Elephant Trenches

It is recommended to build up electrical fences or elephant trenches (2.0 m deep, 2.3 m across at the top and 1.6 m wide at the bottom) at boundary area which facing reserve forest. This shall be done upon completion of planting stage in which sufficient time has been given to the wildlife present in the proposed project site area to naturally migrate to the nearby reserve forest area.

This is one of the mitigating measure can be used in preventing wildlife such as elephant, wild pigs or other species from entering the

project site area, damaging rubber trees and threatening the plantation workers. A proper safety signage shall also be made at several locations along the fencing as to avoid any incident on the workers or other people who visited the proposed project site.

5.2.3 Maintenance Stage

i. Weeding

Weeds compete with the main crops for nutrients, moisture, sunlight and space. In addition, they harbour pest and diseases, which can damage and destroy cultivated plants. Thus, once the trees are planted, weed control is important particularly during the early phases of cultivation. The weed control program for rubber wood plantations for latex and timber production is given in **Table 5.8**.

As for the rubber forest plantation solely for wood, the weeding rate can be reduced and the proposed program is shown in **Table 5.9**. At the early stage of rubber tree establishment, manual weeding is done in both the tree rows and inter-rows. Chemical weeding can commence when there is at least 0.9 m (3ft) of brown bark on the trunk of rubber tree plant. The types the herbicide and the rates recommended in the control of common weeds under rubber tree plants are shown in **Table 5.10** and **Table 5.11**.

Table 5.8 : Proposed Weeding Program for Plantation Solely for Rubber Wood – Latex Production

Year	Weeding Program
Year 1	Manual once every 4 months
Year 2	Chemical once every 6 months
Year 3	Chemical once a year
Year 4 to 7	Chemical once every 2 years
Year 7	None

Table 5.9 : Weeding Program from Plantation Solely for Wood Production

Year	Ring (rubber)	Selective (cover)	Lalang* Wiping	Chemical strip Spraying
1	Monthly	Monthly	Monthly	-
2	-	Bimonthly	Bimonthly	Bimonthly
3	-		Quarterly	Quarterly
4	-		4-monthly	4-monthly
5	-		4-monthly	6-monthly
6	-		Annual	6-monthly
Mature				
7	Slashing inter row at 6-monthly intervals		Annually	6-monthly
8	Slashing inter row at 6-monthly intervals		Annually	Annually
9	Annually		Annually	Annually
10 and above	Annually		Annually	Annually

**Any sheet Lalang should first be sprayed until wiping stage*.

Table 5.10 : Recommendation for Chemical Control of Weeds during Immature Phase

Weed species	Herbicide/mixture	Rate ha^{-1}	Water ha^{-1} (litres)
i. *Mikania cordata*	2, 4-D amine	1 kg a.e.*	630 litres
ii. *Ottachloa nodosa*	2, 4-D amine + sodium chlorate	1 kg a.e. + 22.5 kg	450 – 670 litres
iii. *Paspalum conjugatum* (Dominant)	Amitrole-T followed 2 weeks later by Sodium chlorate	1.4 litres 5.5 – 11 kg	450 litres 450 – 670 litres
iv. *Axonopus compressus* *P. conjugatum* *O. nodosa* *M. cordata*	MSMA + 2, 4-D amine + sodium chlorate	1.9 kg a.e. + 1 kg a.e. + 11 kg	450 – 670 litres
	a) Gromoxone	0.6 – 2.2 kg a.e.	450 – 670 litres

v.	*Fern: e.g. Lygodium, Nephorolepis, Gleichenia Linearis*	b) 2, 3-D amine + sodium chlorate	1 kg a.e. + 22.5 kg	450 – 670 litres
vi.	*Digitaria spp. Eleusine indica, P. commersonii, Ischaemum-muticum*	Dalapon + 2, 4-D amine, followed 2-4 weeks later with sodium chlorate	2.2 kg + 1-1.5 litres 11 – 17 kg	450 – 670 litres 450 – 670 litres
vii.	*Cynodon dactylon E. indica*	Dalapon followed 2 weeks later with sodium chlorate + 2, 4-D amine	5.6 kg 11 kg + 1 kg a.e.	560 litres 560 litres
viii.	*Eupatorium odoratum, Mimosa pudica Mimosa invisa Macarangas*	a) Kuron b) Tordon 101 c) Esteron (2, 4-D/2, 4, 5-Ester) d) As under group v) (b)	3.5 litres 11.2 litre 5.6 litres	670 litres 1120 litres 1120 litres
ix.	*Imperata cylindric* (lalang)	a) Dalapon – followed after 3-4 weeks by spot spraying b) Round-up repeat after 30 days	17-23 kg 11 kg	1120 litres 900 litres 700 litres 450 litres
x.	*Wild bananas*	2, 4-D amine	Concentrate	Slashing and followed by a few drops of the concentrate into the pith of stump

Source: A Manual for Forest Plantation Establishment in Malaysia, 2002

Table 5.11 : Recommendation for Chemical Control of Weeds during Immature Phase

Weed species	Herbicide/mixture	Rate ha^{-1}	Water ha^{-1} (litres)
i. General mixed weeds-*O. nodosa dominant*	2, 4-D amine + sodium chlorate	1 kg a.e. + 16.8 kg	450 – 670 litres
ii. General mixed weeds-*P. conjugatum dominant*	MSMA + 2, 4-D amine + sodium chlorate	1.9 kg a.e. + 1 kg a.e. + 5.6 kg	450 – 670 litres
iii. General weed control-broad leaves herbaceous weed	a) As under i) or ii) b) Gramoxone + 2, 4-D amine	1.4 litres + 0.7 litres	225 – 335 litres
iv. Woody brush	As in i) in 1120 litres water or as recommended in Table B7-8 (viii) (a), (b) and (c) or slashing at regular intervals	1 kg a.e. + 16.8 kg	450 – 670 litres
v. *Tetracera scandens*	Kuron	2.8 litres	670 litres water followed by spot spraying
vi. (*Meplas)*	Tordon 101	5.6 litres	1120 litres
vii. Fern: *Nephrolepis etc.*	As in (i)		

Source: A Manual for Forest Plantation Establishment in Malaysia, 2002.

ii. Manuring

The performance of rubber production depends greatly on adequate fertilizer application used by project proponent. The suggested manuring programmes for rubber include type and rate of application are given in **Table 5.12** and **Table 5.13**. Fertiliser is applied to a small circle around the plant during initial stage of growth.

By the fourth year, when roots have extended into the inter row, the fertiliser application is confined to areas 60 to 300 cm from the rows. It is noted that for better rubber tree growth, frequent dressing of fertilizer is needed during early establishment. The rational is to reduce leaching losses and to ensure active development of root systems. Before fertilisers are applied to the trees, noxious weeds must first be eradicated.

However, fertilizer use is not the primary factor in downstream water quality. More important are the land management practices that are uses in crop production.

Table 5.12 : Proposed Manuring Schedule of Rubber for Both Latex and Timber Production

Time of application	Fertilizer	Dosage (g/tree)
In planting pole	Rock phosphate	300
	5 tablets of Woodace @ 17 g/tablet	85
After planting		
18 months	Mag X[a]	500
24 months	Mag X[a]	500
36 months	Mix Y	600
48 months	Mix Y	600
60 months	Mix J	700
72 months	Mix J	700

Table 5.13 : Proposed Manuring Schedule of Rubber for Timber Production Only

Time of application	Fertilizer	Dosage (g/tree)
In planting hole	Rock phosphate	110
	5 tablets of Woodace @ 17 g/tablet	68
After planting		
18 months		
24 months	Mag X[a]	400
	Mag X[a]	300
Thinning to 700 trees ha^{-1}		
36 months	Mix Y	300
48 months	Mix Y	300
60 months	Mix Y	280
72 months	Mix Y	280

Note: a – Phosphate component should be of soluble form.

Fertilizer mixture	Percent nutrient content			
	N	P_2O_5	K_2O	M_gO
Mag X	8.4	14.4	7.2	2.1
Mix Y	11.8	10.8	8.4	
Mix J	9.5	11.9	13.2	

iii. Pruning and Thinning

Branch pruning is necessary in order to achieve a smooth and unbranched trunk or a good wood bole. It must be done properly so as not to retard the growth of the plant. Two (2) kinds of pruning may be necessary namely corrective pruning (removal of unwanted branches leaving the main stem during the first to second year after planting) and late pruning (removal of all branches until minimum height of 6 m from fourth year onwards).

Early thinning is focused on removing unhealthy or stunted trees, which will enhance the growth of adjacent healthy trees. If planting points require re-supply of trees, this should be done as quickly as possible, that is before the main transplants reach the age of 2.0 to 2.5 years old. For wood and latex plantation, thinning out the trees for wood production can be done from the fourth year onwards.

For wood plantation it is suggested that the thinning be done in the fourth year and again in the sixth year. Thinning materials of the sixth year may be used for wood chip production. As the trees grow and become dense again, the thinning process is repeated. Depending on growth eaten and species, trees at this age may be large enough for timber milling. The final density of trees for wood production is expected to be around 500 trees ha^{-1} in the case of monoculture and 200 trees per hectare in the forestry system.

iv. Growth and Yield

A normal rubber plantation/smallholding would only reach harvest size after 25 to 30 years old. During this time not all the energy that has gone into each plant has been available for the growth of woody. Thus, the wood productivity from such an estate can be expected to be less compared to wood produced in a natural forest. It is estimated that one hectare rubber estate can yield around 57 m^3 usable log and 10 m^3 sawn timber. High productivity in any agricultural venture is largely determined by the quality of cultivars planted.

v. Pests and Diseases

Cultivated plants are often subject to attack by pests and diseases are no exception. The common diseases of proposed rubber plantation project are white, red and brown rot diseases caused by the fungi *Rigidoporous lignosus*, *Ganoderma pseudoferrum* and *Phellinus noxius* respectively. The occurrence of these diseases can be reduced by applying Garlon on all cut surfaces of stumps left during land clearing. The infected trees, characterized by shoot die-back, can be treated with Shell Collar Protectant or Calixin.

Another disease of importance is the pink disease, which generally attacks both trunk and brunches of young rubber trees. It is usually severe in humid areas where the rainfall is concentrated at certain seasons of the year. The preferred treatment of this disease is

brushing the affected parts with 2% Calixin. **Table 5.14** lists the common disease that affect the various parts of timber latex clone trees and their treatments.

Among the pests of rubber trees, those that feed on or damage roots and trunk require attention. The pests may be insects, plant diseases, fungi, weeds, nematodes, snails, slugs and numerous mammals such as rats, wild boars, elephants, etc. The treatment for control of some important pest of timber latex clone trees are shown in **Table 5.15**.

Therefore, insecticides, fungicides, herbicides, etc., are all types of pesticides. Generally, the project proponents are heavy users of pesticides that pollute waterways and affect local wildlife. Mammalian pests such as rats, squirrels, porcupines, monkeys and wild pigs may be controlled by shooting and more effective and less costly as poison bait, rather than as a surface spray. Project proponent can take a different approach by reduce chemicals used by focusing on biological control including use of beetles, birds and fungi to deal with common rubber pathogens.

Besides that, Project proponent can use another biological control for examples, snakes and barn owls are effective in controlling small mammals. Insect pests such as leaf eating caterpillars rhinoceros beetles, cockchafers are best controlled biologically by natural enemies such as predators and parasites. Insecticides should only be used judiciously. Many fungal diseases affect rubber trees thus decrease its capability in producing the latex.

Table 5.14 : Recommendation for Chemical Treatment of Diseases of Timber Latex Clone

Location	Disease type	Cause of disease	Fungicide	Concentration (%)	Method of Application	Remark
Root	White root Red root Brown root	Rigidoporus lignosus Ganoderma pseudoferrum Phellinus noxius	Fomac 2 and Shell Colar Protectant, Calixin	Neat	Apply with brush	Chemical applied after removal of infected tissues.
Panel	Black stripe Fungal rot Tapping panel necrosis	Phytophtora palmivora Ceratocystis fimbriata	Difolatan 4 Benlate or Difolatan 4	2.0 0.5 2.0	Brush or spray on panel	Apply after trapping weekly, if severe once every 4 days. Brush 4-6 times after tapping.
Trunk	Pink disease Bark necrosis Shoot die-back	Fusarium solani Coticium salmonicolor Phytopthora spp. Varied types	Difolatan 4 Bordeaux mixture 1kg $CuSO_4$ + 2kg lime + 100 litre water. 2% Calixin + latex Difolatan 4 Bituminous	2.0 Neat Neat 2.0 Neat	Spray using Knapsack sprayer. Apply to infected parts. Brush after. Removing Infected	This mixture is only for trees not opened for tapping yet. For tapped trees when chemical has dried, apply petroleum to encourage new bark growth. Brush trees with water-lime mixture.

			Chemicals		tissues. Brush onto cut parts.	
Leaves	Phytopthora leaf-fall	Phytopthora spp.	Copper oxychloride	1.7 kg / 8.4 l oil/ha	Fogging machine	Fog at 8.4 l ha^{-1}
	Colletotrichum leaf disease	Colletotrichum gloeosporioides	Copper oxychloride	5.5 kg + oil	Mist blower	Spray 33.4 l ha^{-1} before leaf-fall
			Daconil	4.5 kg/ha	Mist blower	Spray 4-5 times in a week
	Secondary leaf-fall	Colletotrichum gloeosporioides	Folex (defoliant)	3.5 kg a.i/ha	Aerial spray	Spray 351 ha^{-1} once month before leaf-fall
	Dusty rot	Oidium hevea	Sulphur dusting Calixin EC	9 kg/ha 0.5 kg a.i / 8.4 l oil	Power duster Fogging machine	Spray 4-5 times a week
	Oidium secondary leaf-fall	Oidium hevea	Folex (defoliant)	3.5 kg a.i / ha	Aerial spray	Spray 351 ha^{-1} once month before leaf-fall
	Bird's eye spot	Drechslera hevea	Dithane M-45 Zineb, Maneb	0.28 kg/ha	Fogging machine Knapsack sprayer	Fog or spray leaves once every week

Table 5.15 : Recommendation for Chemical Control of Pest in Timber Latex Clone Plantation

Pest	Insecticide	Mammalian toxicity (mg kg^{-1})	% Active Ingredient	Form Available	Required dilution (g l^{-1})	Application		Remark
						Rate	Method	
Termites	Dieldrin Aldrin Heptachlor Chlordane	100 50 130 500	0.04 0.05 0.05 0.10	Dieldrex 15 Andrex 2 Heotachlor Chlordane 30	2.5 2.5 2.5 2.5	0.61 / tree	Pour around after making a runnel around it	Treated trees are not attacked for two years. Prophylactic treatment feasible. In peat areas use Aldrin or Heptachlor at 4 times the concentration.
Cockchafer grubs	Heptachlor Aldrin	130 50	0.10 0.10	Heptachlor Aldrex 2	5 5	1 – 2 l ha^{-1}	Pour around bole into holes made within a circle of 12-18° radius	Treatment feasible only for immature trees and in nurseries
Yellow tea mites and thrip	Dieldrin Endosulfan	100 110	0.05 0.05	Dieldrex 15 Dieldrex Extra Thlodan 35	3 2.5 1.5	56 l ha^{-1}	By high vol. spraying with pressurized knapsack sprayers	Spray only top flushes, but cover both surfaces. Repeat once after 5 days.
Scale insects & mealy bugs	Oil emulsion	Negligible	2.50	Albarol white Oil	2.5	112-224 l ha^{-1}	By high vol. spraying with pressurized	Spray thoroughly to cover all parts of

				Kerosene-soap Emulsion	2.5		knapsack sprayers	the plants at weekly intervals
Caterpillars	Trichlorphon (OP) Carbaryl	625 560	0.40 0.40	Dipterex SP 80 Sevin 85 S	5 5	56-224 l ha^{-1}	By low volume spraying with mist blower	Repeat after a fortnight if necessary
Leaf-eating beetles	Carbaryl DDT Powder	560 113	0.40 0.50	Sevin 85 S 50% Mixture	5 9	56-224 l ha^{-1}	By low volume spraying with mist blower	Repeat after a fortnight if necessary
Grasshoppers	Dieldrin Malathion	100 1375	0.10 96	Dieldrex 15 Diederex Extra Malathion L.V Concentrate	6 5 Neat	112 l ha^{-1} 1 kg ha^{-1}	By low volume spraying with mist blowers. By ultra-low volume spraying with mist blowers.	Spray cover and rubber. Aerial spraying of concentrate recommended for large-scale outbreaks.
Crickets	Gamma BHC	125	0.07	Agrocide 6.5 DP	1 kg + 100 kg of bran	11 kg ha^{-1}	Balt with 28 g ball at base of each tree in area	Balting may have to be repeat after rain.

5.2.4 Harvesting Stage

i. Latex Extraction

Rubber trees are not tapped until five (5) years after planting since by then they can produce enough rubber to make tapping worthwhile. Latex extraction of rubber tree can be started when the circumference of the tree reaches 45 cm. On the average, it takes 4 to 5 years for the tree to reach the desired size. To extract the latex an incision on the bark is made by 'tapping' the tree thus severing the latex vessels, which are found in the bark.

Rubber trees that are 5 years old or more produce a whitish or yellowish latex that can be harvested by cutting into bark with a herringbone pattern, deep enough to reach the latex vessels but before phloem- the hard wood. The older the rubber tree gets, the more latex is expected to be produced.

ii. Tapping

The conventional tapping systems (1/2S d/2 or 1/2S d/3) is still widely practiced in both estates and smallholdings. Tapping is done early in the morning as long as it's not raining or the trees are not wet. Out of 365 days in a year a tapper may get around 100 tapping days. A tapper taps 500 trees in about 3 to 3 ½ hours, has a break, and them collects the latex after 4 to 5 hours. The tapping panel is half spiral and starting about 150 cm from the ground (about the height of the tapper).

Tapping is done from the left to right and downwards. Each tapping (shaving of the bark) is 1-2 mm thick. Using the conventional tapping method, on the average a rubber tree can be tapped for 25 years. With the tapping panel being half spiral, each half can be tapped for 5 years. Advances have been made with respect to length of cuts, periodic changing of panels, stimulation methods, puncture tapping and controlled upward tapping.

The Rubber Research Institute of Malaysia (RRIM) has introduced Low Intensity Tapping Systems (LITS) and also novel techniques such as REACTORRIM and RRIMFLOW which have been proven to improve tapping productivity. It should be encouraged to use stimulants for the older trees and in such cases the application of fertilizers is a necessity.

iii. Processing of the Latex

After 4 to 5 hours the plugging of latex vessels begin and the latex coagulates leaving a white strip of rubber on the tapping panel. The strip is known as “tree lace”. After collecting the latex into small containers, the latex is heated and smoked by burning wood, stirred and then acid or alkali is added to coagulate or thicken the latex, then it is pressed to remove water. The resultant flat “cakes” are hung to dry. After drying, it is ready to be shipped or transported to factories and made into various types of rubber tree products.

iv. Extraction of Rubber Tree

Until recently, most of the timber was used as fuel. With the depletion of tropical forests, leading to a shortage of timber for many industrial and engineering uses, attention has turned towards rubber as an alternative source of timber. Rubber trees grow to a height of 25 meter and generally have straight trunks.

At the time of felling, the girth varies in between 100 to 110 cm at a height of 125 cm from the ground and gives 0.62 m^3 of stump wood and 0.4 m^3 of branch wood: normally 180 to 185 trees will be available per hectare. Industrial articles made from rubber wood include bread broads, building components, block boards, cabinets, carving boards, cement boards, charcoal, fibreboards, furniture, garden equipment, pallets, panelling, paper, parquet flooring, plywood, etc.

Methods of extraction, conservation and transport of rubber wood have been generally standardised on plantations. The usual

implements for felling trees are used for crosscutting the stems and branches, power chain saws or bow saws are employed. The sites for conservation and storage are chosen to avoid interference with other plantation operations.

5.2.5 Replanting Stage

The rubber trees have an economic life span of 25 years. After 25 years, the trunk of the tree is used for furniture production and the branches are used for fibre board and other useful material. The tree trunk provides a medium density wood which is kiln dried. Clear felling will be undertaken as to clear up the project site from the rubber tree trunk residue. Replanting activity will be carried out following the same process as during the initial stage of proposed rubber plantation project overall development.

5.2.6 Completion and Abandonment

The proposed timber latex clone plantation project will be completed at the end of one rotation of timber latex clone, i.e. after approximately 25 years after which the project proponent is required either to rehabilitate the area to forest land or to replanting timber latex clone trees again. As future technical or political development cannot be foreseen, no detailed plans on how this conversion will take place. There is always a risk of pre-mature abandonment for technical, organizational, political or financial reasons during the implementation of timber latex clone trees plantation activity.

5.3 PROJECT ORGANISATION CHART

Hanamurni Sdn. Bhd. will manage the project site. The proposed organisation chart shows the hierarchy of the forest plantation activities as illustrated in **Figure 5.3.** this chart shall be amended if there are any changes to the project environmental management team.

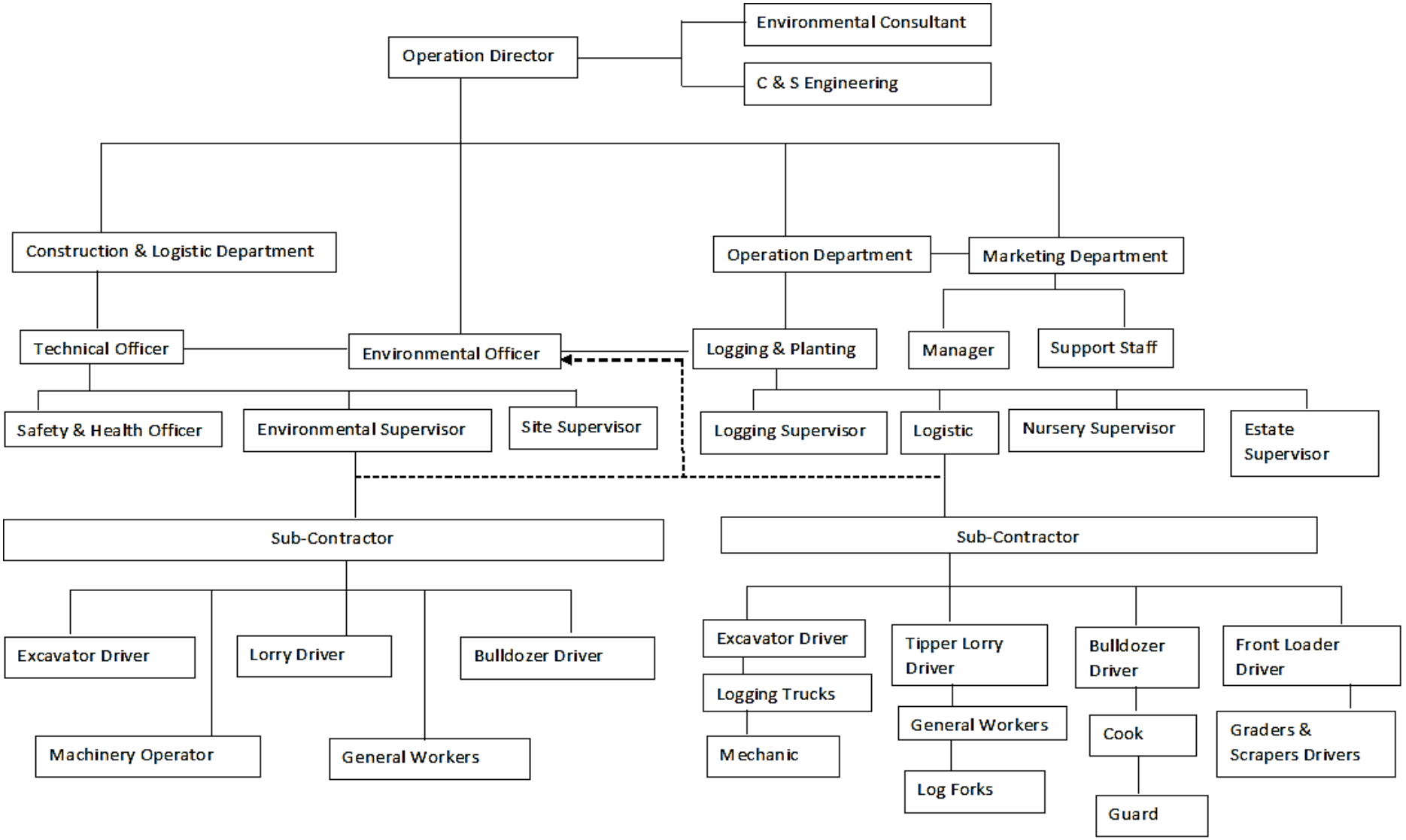


Figure 5.5 : Organisation Chart

5.4 MACHINERIES REQUIREMENT

During the project development, the following machineries should be in place in order to complete the work as the proposed project schedule. This is shown in **Table 5.16.**

Table 5.16 : Equipment during Development Period

No.	Machineries and Equipment Types	Estimated Number
1.	Excavators	2
2.	Tipper lorries	4
3.	Loaders	2
4.	Tractors	2
5.	Bulldozers	5
6.	Skidders	2
7.	Chainsaw	2
8.	Water Tank	4
9.	Portable Water Pumps	8
10.	60kVA Generator Set	5
	Total	36

During the operational period, the following machineries and equipments should be provide as shown in **Table 5.16.**

Table 5.17 : Equipment during Plantation/Maintenance Period

No.	Machineries and Equipment Types	Estimated Number
1.	Supervision Vehicles	2
2.	Multipurpose Van	2
3.	Tractors 4wd	3
4.	Trailers	7
5.	Water Tank	4
6.	Portable Water Pumps	8
7.	Mini Tractors	3

8.	Tractor Mounted Sprayer	2
9.	60kVA Generator Set	5
10.	Motograder	1
	Total	37

5.5 PROJECT SCHEDULE

The project schedule plays an important role in timber latex clone plantation project or any other type of agriculture project. It is a tool of managing and controlling various elements of the plantation activity such as workers, machinery, equipment, contractor, sub-contractor, supplier and financial.

An effective and proper project schedule may assist project proponent in controlling the cash flow, the main element of the project thus can indirectly increase the profit margin. The logging and planting activity for example, if can be done within an expected time frame and during the dry season period, it may possible reduce and minimize the potential erosion problem that may occur on site and indirectly reduce the cost involved. The proposed project schedule for the project implementation is as presented in **Figure 5.6 and Table 5.17** shows the expected first harvesting after 5 years of rubber forest plantation complete. It may differ during the actual implementation of activity on-site. However, the project proponent shall officially inform the Department of Environment Headquarters (DOE HQ) and DOE Negeri Perak on the matter.

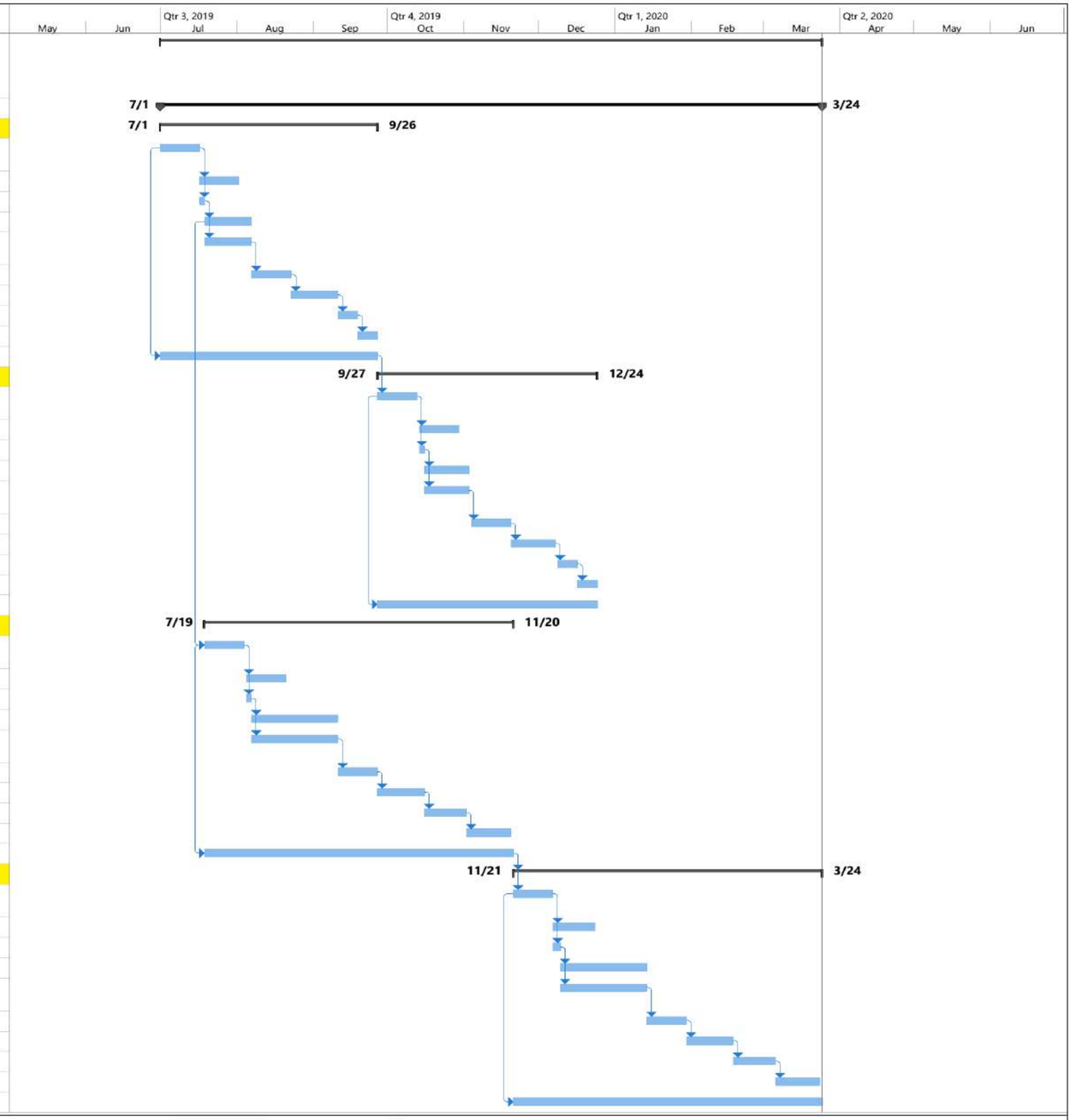
The Detailed EIA is part of the planning process to identify potential environmental impact of the activities associated with the proposed project, as well as to plan for measures to be taken to mitigate the anticipated impact. Nursery activity, logging, site preparation, planting and maintenance will be the most important of the overall timber latex clone plantation project and expected does not involve labour intensive activity. Maintenance will mainly be weeding, fertilizing and carrying out a replanting work if necessary. Regular environmental monitoring exercise is required as mode to detect any possible changes and potential impacts on the surrounding

environment. It also provides information of the effectiveness of mitigation measures adopted by the project proponent on every aspect of TLC plantation activity.

Table 5.18 : Expected First Harvesting after Five Years

Block	Estimated Harvesting Month
1A	November 2024
2A	March 2025
1B	October 2024
2B	January 2025

ID	Task Name	Duration	Start	Finish
0	**PROPOSED RUBBER FOREST PLANTATIONON PARTS OFCOMPARTMENT 125, 126,131 &132 (BLOCK 1) AND PARTS OF COMPARTMENT 125,126,131 & 132 (BLOCK 2) WITH AN AREA OF 1600.00 HECTARES (3953.67 ACRES) AT PIAH FOREST RESERVE, DISTRICT OF HUTAN KUALA KANGSAR, PERAK DARUL**	**230 days**	**Mon 7/1/19**	**Tue 3/24/20**
1	**JADUAL PELAKSANAAN PENGELUARAN SISA BALAK & PENANAMAN POKOK GETAH**	**230 days**	**Mon 7/1/19**	**Tue 3/24/20**
2	**BLOK 1B**	**76 days**	**Mon 7/1/19**	**Thu 9/26/19**
3	Kerja Pembersihan Tanah secara berperingkat Pembinaan Longkang Takungan (ESCP), Sistem Perparitan	14 days	Mon 7/1/19	Tue 7/16/19
4	Kerja Awalan Tapak	14 days	Wed 7/17/19	Thu 8/1/19
5	Pergerakan Tenaga Kerja & Pemasangan Penginapan Sementara Pekerja	2 days	Wed 7/17/19	Thu 7/18/19
6	Kerja Pembersihan Sisa Balak & Penebangan Pokok	16 days	Fri 7/19/19	Tue 8/6/19
7	Kemaskini Pembinaan Jalan Ladang, Tanaman& Sistem Perparitan/Pembahagian Fasa	16 days	Fri 7/19/19	Tue 8/6/19
8	Pemasangan Pagar	14 days	Wed 8/7/19	Thu 8/22/19
9	Penanaman Pokok Getah	16 days	Fri 8/23/19	Tue 9/10/19
10	Merumput, Meracun & Menanam "cover crop"	7 days	Wed 9/11/19	Wed 9/18/19
11	Pembajaan Pokok Getah	7 days	Thu 9/19/19	Thu 9/26/19
12	Pengurusan Sisa Di Tapak Projek	76 days	Mon 7/1/19	Thu 9/26/19
13	**BLOK 2B**	**76 days**	**Fri 9/27/19**	**Tue 12/24/19**
14	Kerja Pembersihan Tanah secara berperingkat Pembinaan Longkang Takungan (ESCP), Sistem Perparitan	14 days	Fri 9/27/19	Sat 10/12/19
15	Kerja Awalan Tapak	14 days	Mon 10/14/19	Tue 10/29/19
16	Pergerakan Tenaga Kerja & Pemasangan Penginapan Sementara Pekerja	2 days	Mon 10/14/19	Tue 10/15/19
17	Kerja Pembersihan Sisa Balak & Penebangan Pokok	16 days	Wed 10/16/19	Sat 11/2/19
18	Kemaskini Pembinaan Jalan Ladang, Tanaman& Sistem Perparitan/Pembahagian Fasa	16 days	Wed 10/16/19	Sat 11/2/19
19	Pemasangan Pagar	14 days	Mon 11/4/19	Tue 11/19/19
20	Penanaman Pokok Getah	16 days	Wed 11/20/19	Sat 12/7/19
21	Merumput, Meracun & Menanam "cover crop"	7 days	Mon 12/9/19	Mon 12/16/19
22	Pembajaan Pokok Getah	7 days	Tue 12/17/19	Tue 12/24/19
23	Pengurusan Sisa Di Tapak Projek	76 days	Fri 9/27/19	Tue 12/24/19
24	**BLOK 1A**	**107 days**	**Fri 7/19/19**	**Wed 11/20/19**
25	Kerja Pembersihan Tanah secara berperingkat Pembinaan Longkang Takungan (ESCP), Sistem Perparitan	14 days	Fri 7/19/19	Sat 8/3/19
26	Kerja Awalan Tapak	14 days	Mon 8/5/19	Tue 8/20/19
27	Pergerakan Tenaga Kerja & Pemasangan Penginapan Sementara Pekerja	2 days	Mon 8/5/19	Tue 8/6/19
28	Kerja Pembersihan Saki Baki Balak & Penebangan Pokok	30 days	Wed 8/7/19	Tue 9/10/19
29	Kemaskini Pembinaan Jalan Ladang, Tanaman& Sistem Perparitan/Pembahagian Fasa	30 days	Wed 8/7/19	Tue 9/10/19
30	Pemasangan Pagar	14 days	Wed 9/11/19	Thu 9/26/19
31	Penanaman Pokok Getah	16 days	Fri 9/27/19	Tue 10/15/19
32	Merumput, Meracun & Menanam "cover crop"	15 days	Wed 10/16/19	Fri 11/1/19
33	Pembajaan Pokok Getah	15 days	Sat 11/2/19	Tue 11/19/19
34	Pengurusan Sisa Di Tapak Projek	107 days	Fri 7/19/19	Wed 11/20/19
35	**BLOK 2A**	**107 days**	**Thu 11/21/19**	**Tue 3/24/20**
36	Kerja Pembersihan Tanah secara berperingkat Pembinaan Longkang Takungan (ESCP), Sistem Perparitan	14 days	Thu 11/21/19	Fri 12/6/19
37	Kerja Awalan Tapak	14 days	Sat 12/7/19	Mon 12/23/19
38	Pergerakan Tenaga Kerja & Pemasangan Penginapan Sementara Pekerja	2 days	Sat 12/7/19	Mon 12/9/19
39	Kerja Pembersihan Saki Baki Balak & Penebangan Pokok	30 days	Tue 12/10/19	Mon 1/13/20
40	Kemaskini Pembinaan Jalan Ladang, Tanaman& Sistem Perparitan/Pembahagian Fasa	30 days	Tue 12/10/19	Mon 1/13/20
41	Pemasangan Pagar	14 days	Tue 1/14/20	Wed 1/29/20
42	Penanaman Pokok Getah	16 days	Thu 1/30/20	Mon 2/17/20
43	Merumput, Meracun & Menanam "cover crop"	15 days	Tue 2/18/20	Thu 3/5/20
44	Pembajaan Pokok Getah	15 days	Fri 3/6/20	Mon 3/23/20
45	Pengurusan Sisa Di Tapak Projek	107 days	Thu 11/21/19	Tue 3/24/20



Date: Tue 2/12/19

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

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Figure 5.6: The Proposed Schedule for Project Implementation