

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

1.1.1 Project Title

Liput Raya Sdn. Bhd. has been granted an approval from Department of Forestry Perak to develop forest plantation development with an area of 400.00 Hectares (988.42 Acres) at Bukit Slim Forest Reserve, Perak Darul Ridzuan.

Therefore, the title of the project is *“Cadangan Pembangunan Ladang Hutan Seluas 400 Hektar (988.42 Ekar) di Sebahagian Kompartment 78 & 79 Hutan Simpan Bukit Slim, Mukim Slim, Daerah Muallim, Perak Darul Ridzuan.”*

Hereafter in this report, it shall be referred to as “the project”.

1.1.2 Project Location

The project site is located in Bukit Slim Forest Reserve with an area of 400.00 hectares (988.42 acres) within part of compartment 78 and 79, Mukim Slim, District of Muallim, Perak Darul Ridzuan. The project site (**Plate 1.1**) is located approximately within the coordinate point as shown in **Table 1.1** and **Figure 1.1**.

Table 1.1: Coordinate Point of the Project Site

| Points | Coordinates | |
|--------|--------------------|------------------|
| | X | y |
| 1 | 101° 32' 46.396" E | 3° 56' 26.942" N |
| 2 | 101° 34' 12.728" E | 3° 56' 15.717" N |
| 3 | 101° 34' 17.154" E | 3° 55' 48.351" N |

| Points | Coordinates | |
|--------|--------------------|------------------|
| | X | Y |
| 4 | 101° 33' 39.676" E | 3° 55' 45.705" N |
| 5 | 101° 33' 39.495" E | 3° 55' 33.213" N |
| 6 | 101° 32' 2.165" E | 3° 55' 14.411" N |
| 7 | 101° 32' 22.348" E | 3° 55' 50.988" N |
| 8 | 101° 33' 0.123" E | 3° 55' 54.192" N |
| 9 | 101° 32' 56.753" E | 3° 56' 3.795" N |
| 10 | 101° 32' 58.176" E | 3° 56' 10.627" N |
| 11 | 101° 32' 41.488" E | 3° 56' 13.234" N |

The nearest town is Slim River which is approximately 30 km from the project site. While the nearest settlement areas around the site is located about 3 km radius from the boundary of the project site called Kampung Orang Asli Sg Gesau and Kampung Orang Asli Pos Bersih.



Plate 1.1: View of the Project Site

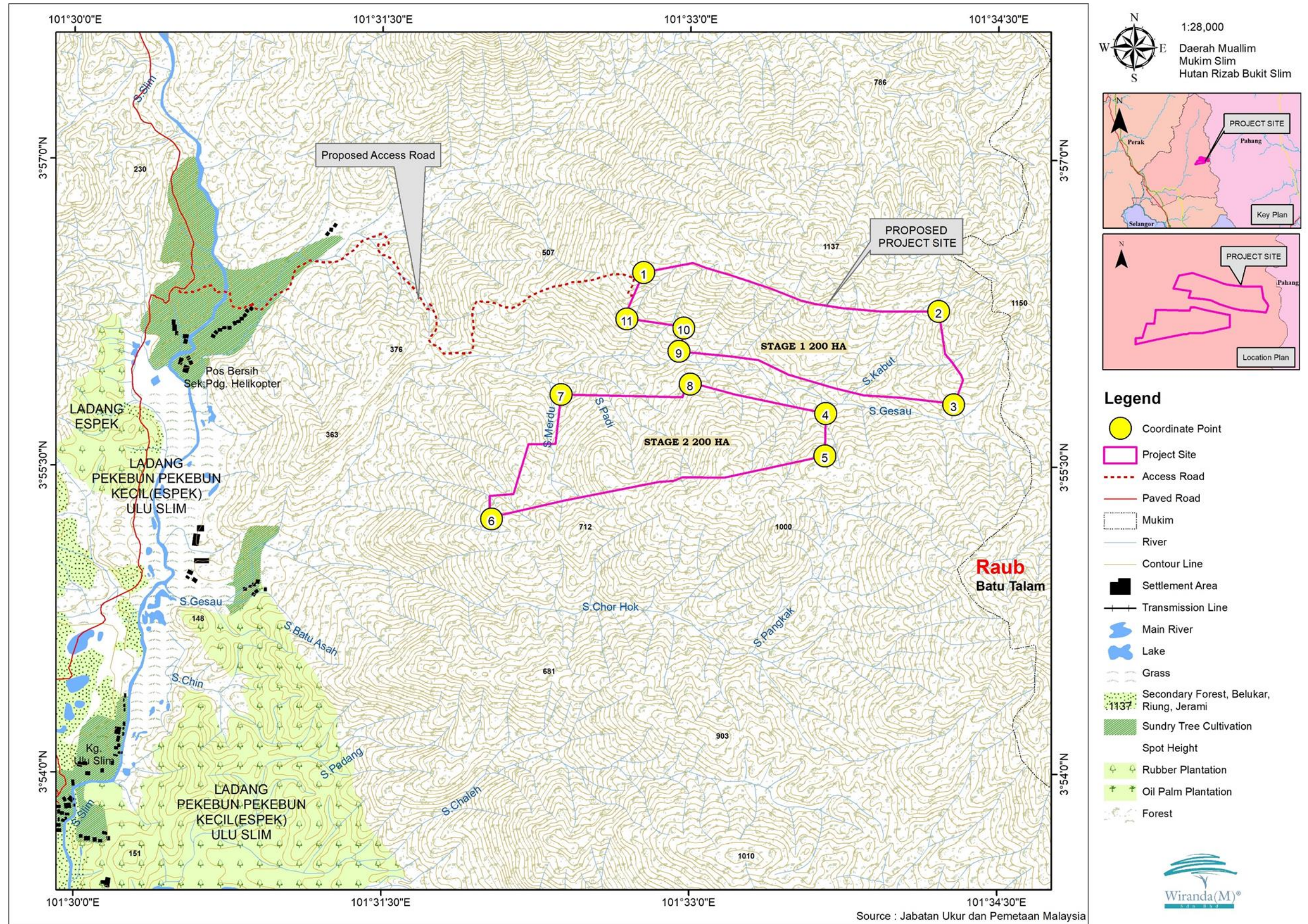


Figure 1.1: Map of location plan of the Project site

1.1.3 Access Road and Existing Log Yard

The Project site can be accessed from Slim River town by following through Jalan Slim River – Tg. Malim (**Plate 1.2**) for about 10 km and turn left to Jalan Ulu Slim (**Plate 1.3**) for about 12 km. Then turn right to the existing unpaved logging road located at the west of the Project site (**Plate 1.4**) and will be used during the development and operation phase.



Plate 1.2: Jalan Slim River – Tg. Malim



Plate 1.3: Jalan Ulu Slim



Plate 1.4: Existing unpaved logging road (Yellow line)

The consent letter for the Project Proponent (PP) uses the logging road is attached in **Appendix A (II)**. In addition, the access road will not go through other private roads such as ESPEK RISDA and MB Inc.

Project Proponent will be constructing a bridge crossing Sg Slim (**Plate 1.5**) and will obtain approval from JPS Negeri Perak before the construction starts. **Figure 1.2** shows the access road of the Project site.



Plate 1.5: Bridge to be constructed crossing Sg Slim

As the access road will be using paved roads under the implementation of the Kementerian Pembangunan Luar Bandar, Project Proponent will ensure the process of transporting logs outside the project site will be carry out during non-peak hours and avoiding school opening and closure time.

There is one existing log yard that is located outside forest reserve. The location of the log yard is shown in **Figure 1.3**.

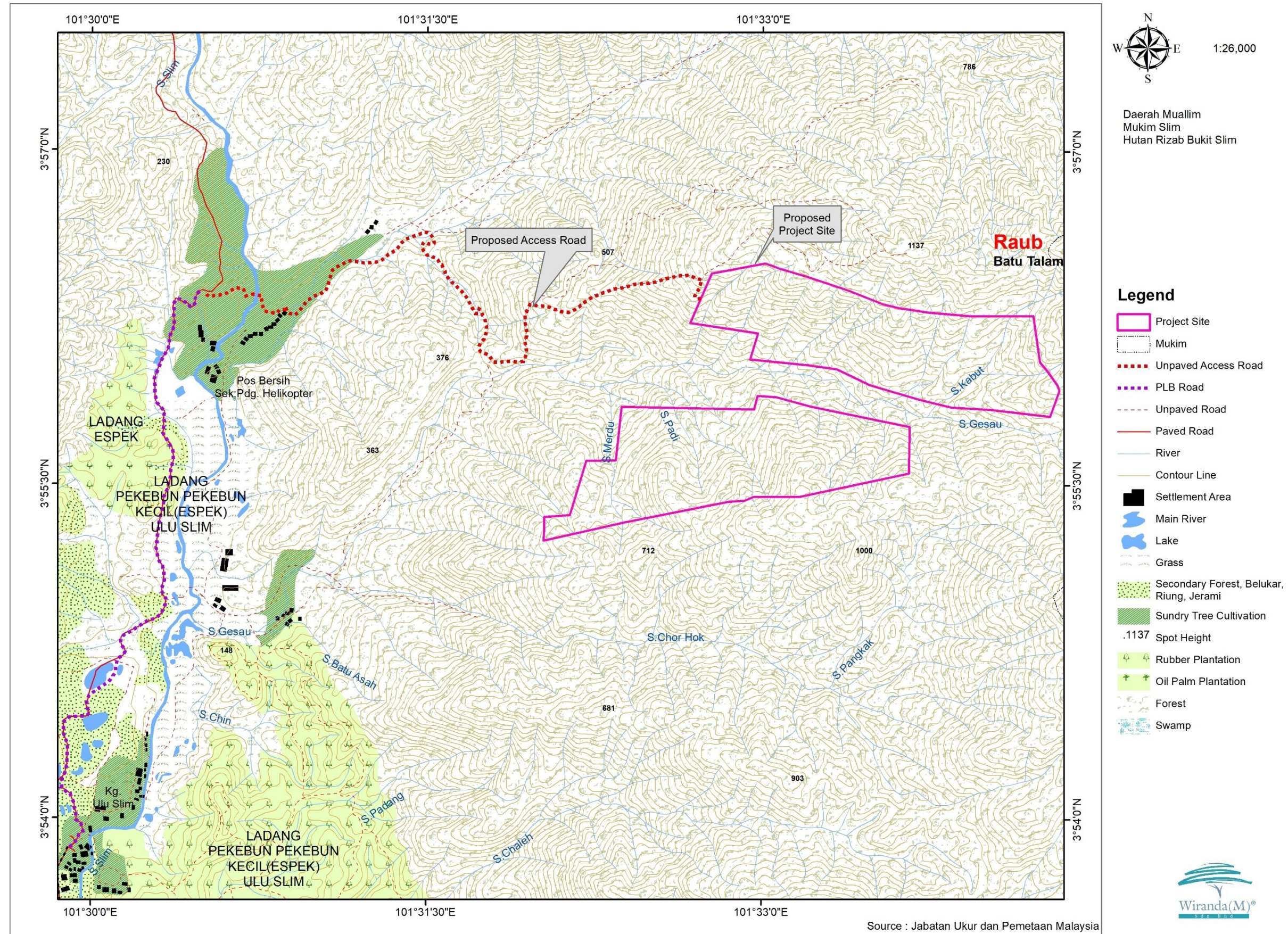


Figure 1.2: Map of access road of the Project site

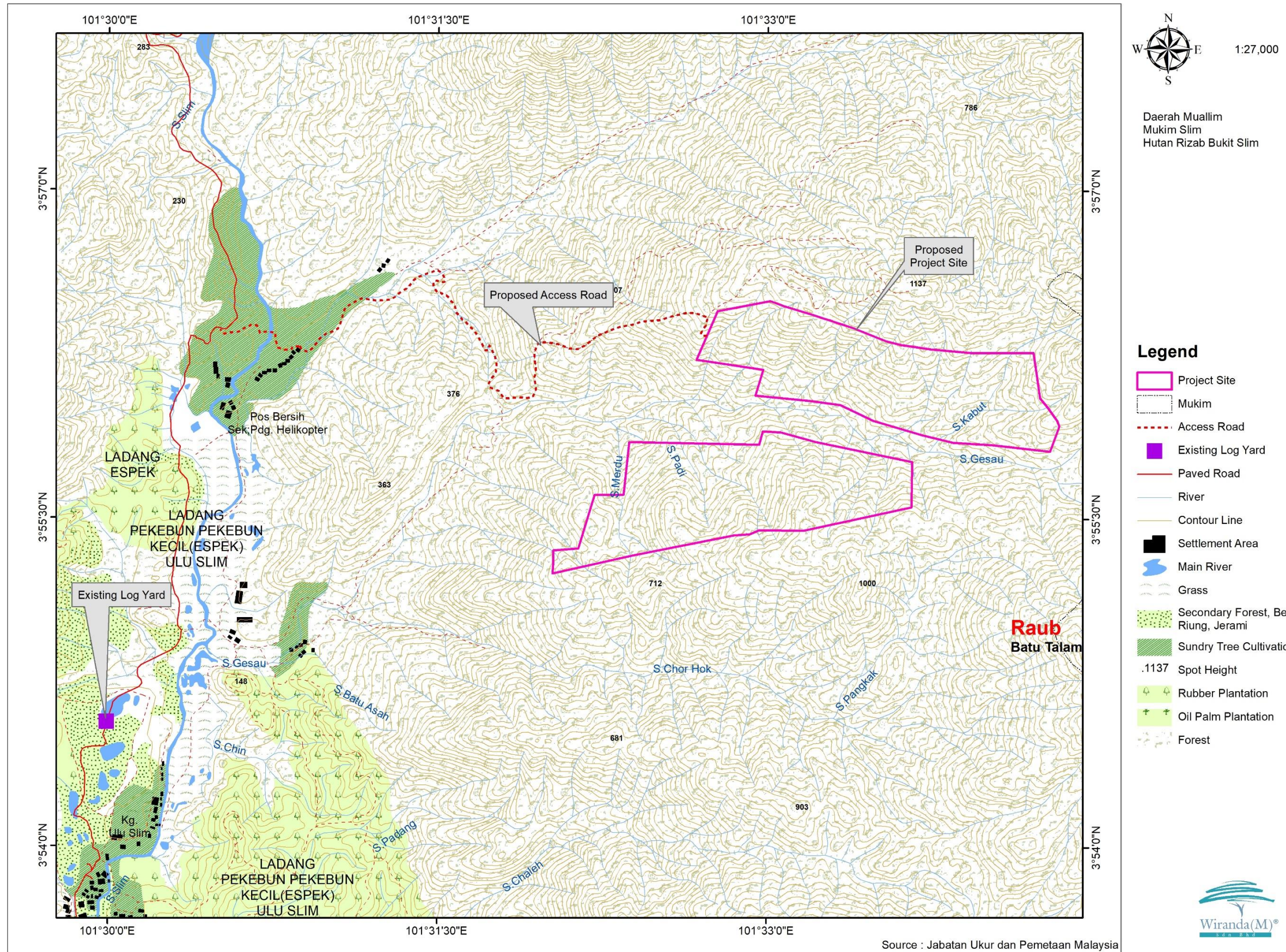


Figure 1.3: Location of Existing Log Yard

1.2 PROJECT PROPONENT, PROJECT DEVELOPER AND ENVIRONMENTAL CONSULTANT

Liput Raya Sdn. Bhd. is a private organization which granted approval by Perak Forestry Department to develop forest plantation for the project and has appointed **Samasuka Sdn. Bhd.** to develop and manage the site. The address and the management contact addresses are as follows:

PROJECT PROPONENT (LIPUT RAYA SDN BHD)

Address : Suite 30, 3A Floor,
IOI Business Park,
47100 Puchong,
Selangor Darul Ehsan
Contact Person : Dato Wei Chuan Beng
Telephone : 016-503 3152

PROJECT DEVELOPER (SAMASUKA SDN BHD)

Address : Suite 30, 3A Floor,
IOI Business Park,
47100 Puchong,
Selangor Darul Ehsan
Contact Person : Mr Thomas Cheah
Telephone : 016-503 3152

The PP has appointed a team of Environmental Consultants from W iranda (M) Sdn Bhd to conduct and submit an Environmental Management Plan (EMP). The EMP Consultants can be contacted at the following address:

ENVIRONMENTAL CONSULTANT (WIRANDA (M) SDN BHD)

Address : No. 3374, Jalan 18/31,
Taman Sri Serdang,
43300 Seri Kembangan,
Selangor Darul Ehsan.

Contact Person : Dr Mohammad Ismail bin Yaziz (Director)
Amirul Asyraf bin Azizan

Telephone : 03-8957 4940

Facsimile : 03-8948 5912

Email : wiranda_sdnbhd@hotmail.com

1.3 PROJECT DESCRIPTION

1.3.1 Size and Capacity

The project site is located in Bukit Slim Forest Reserve, Mukim Slim, District of Muallim, Perak Darul Ridzuan, with acreage of 400 hectares (988.42 acres). The capacity of the project site is depends on the planting specification including the species, type of the harvesting rotation, condition suitability and etc.

1.3.2 Land Requirements

The Project site is a secondary forest. The Project Proponent has been granted a permit from Jabatan Perhutanan Negeri Perak to develop a forest plantation over the site (**Appendix A(I)**). Based on *Pelan Cadangan 2035 Rancangan Tempatan Daerah* (RTD) *Muallim & Sebahagian Daerah Batang Padang* (**Figure 1.4**) the Project site is located under *Blok Perancangan (BP) 2* where the land was classified as a forest. For forest classification, this area falls under production forest in National Forestry Act 1984.

CADANGAN PEMBANGUNAN LADANG HUTAN SELUAS 400 HEKTAR (988.42 EKAR) DI SEBAHAGIAN KOMPARTMENT 78 & 79 HUTAN SIMPAN BUKIT SLIM, MUKIM SLIM, DAERAH MUALLIM, PERAK DARUL RIDZUAN

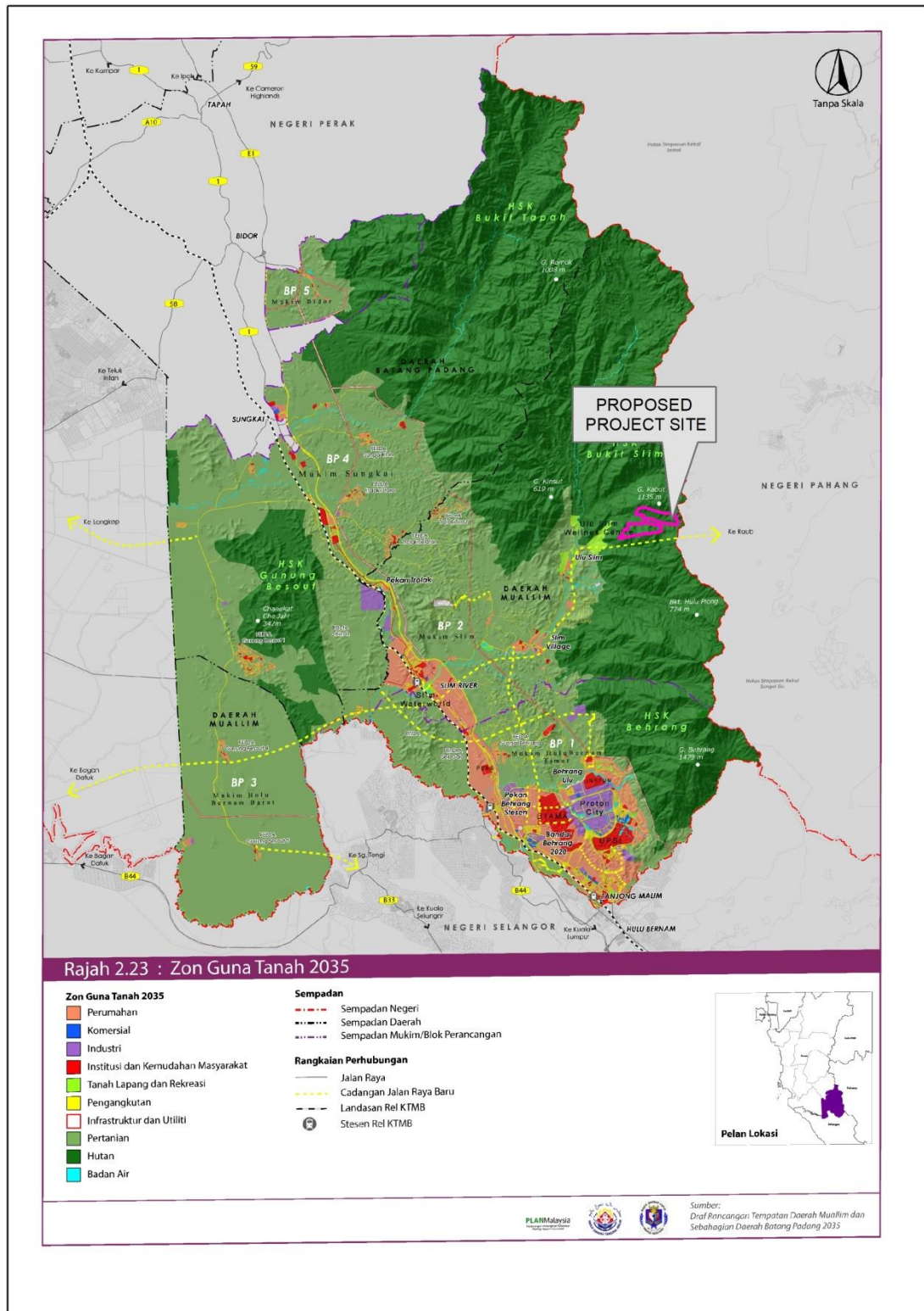


Figure 1.4: Rancangan Tempatan Daerah (RTD)

1.3.3 Planting Materials

The availability of raw materials should be taken into account before the development of forest plantation begins. The planting materials are seeds, seedling or sapling in which good seedlings may result good trees. The selections of tree species were based on the characteristics below:-




- Fast growth species; which can be achieved at least >30cm diameter timber tree in 15 years.
- The wood can use for multipurpose product.
- Easy to plant as forest plantation species.
- The seed/seedling easy to get and in abundance stock.




The main planting material species for the project are *Kelempayan*, *Jati* and *Meranti*. The project proponent is suggested to plant recommended species of the area with the permission from the Department of Forestry for the conservation of the area after the logging is complete. These conservation practices involve an enrichment planting activities with approved species by Forestry Department of Perak as tabulated in **Table 1.2** and **Appendix A(I)**.




These selection species for this enrichment planting is based on several factor, which include the ease of handling of the species in the nursery, high rate of germination, high and fast growth rates particularly at the initial stage, shade tolerance, able to withstand competition between trees, good self-pruning and not highly prone to disease, insect and fungus attacks.

There is no terracing for the development for the area. The enrichment planting will be carry out by silviculture practice.

Table 1.2: Recommended Tree Species

| NO. | SPECIES | DESCRIPTIONS | |
|-----|---|---|--|
| 1. | <i>Paraserianthes falcataria</i> | Batai - Fast-growing species and can grow up to 45m in height. Nitrogen fixing: Nodulates and fixes atmospheric nitrogen (Orwa et. al. 2009). The woods can be used for plywood, matchstick, board, carving and pulp & paper. |  |
| 2. | <i>Neolamarckia cadamba</i> | Kelempayan - Fast-growing species and suitable for planted forests. Has been planted in Sabah and Sarawak and Negeri Sembilan (Ahmad et. al. 2013). Survive in lowland area up to 1000m above sea level. This species is light-hard wood and can be used for pulp & paper manufacturing and light construction. |  |
| 3. | <i>Khaya ivorensis</i> | Khaya - tree is hardwood and fast-growing. This species grows up to 35m height (Orwa et al., 2009). Widely planted for landscaping (M. Sreetheran, 2006) and plantation (Arnold, 2004). Its wood suitable for carpentry, joinery, furniture manufacturing, cabinet work, shipbuilding and in decorative veneer production. |  |

| NO. | SPECIES | DESCRIPTIONS | |
|-----|----------------------------|--|--|
| 4. | <i>Azadirachta excelsa</i> | Sentang - Tree can grow 50 m tall; has been planted in lowland forest and villages, better growth in flat land area (Dorthe Jøker, 2000). Used for light construction, furniture, panelling and veneer. The seeds contain azadirachtin, which is used as an insecticide. Recommended for agroforestry, young plantations of <i>A. excelsa</i> are used for intercropping with rice, peanuts, mung beans, soybeans and vegetables. |  |
| 5. | <i>Octomeles sumatrana</i> | Binuang - has been planted in Sabah and Sarawak and Negeri Sembilan (Ahmad et. al. 2013). It grows in lowland areas up to 1000 m (a.s.l) and suitable to be planted in an alluvial, clay or sandy clay soil. As the wood is light hard wood, it can be used for light construction and pulp & paper manufacturing. |  |
| 6. | <i>Tectona grandis</i> | Jati - is also categorized as fast-growing species and grows up to 85m in height. Teak is one of the most valuable woods in Southeast Asia. Its durable and natural color wood makes teak very attractive and suitable for manufacturing of high quality furniture. |  |

| NO. | SPECIES | DESCRIPTIONS | |
|-----|------------------------|--|--|
| 7. | Aquilaria spp. | Karas - species under the family <i>Thymelaeaceae</i> . Five (5) species namely; <i>Aquilaria malaccensis</i> , <i>Aquilaria microcarpa</i> , <i>Aquilaria hirta</i> , <i>Aquilaria beccariana</i> and <i>Aquilaria rostrate</i> are being identified in Peninsular Malaysia. |  |
| 8. | Eucalyptus | Eucalyptus is known as the fast-growing species and recognized as a potential plantation species. Pulp and paper, sawn timber, laminate timber, woodchip, plywood and veneer were identified as the preferred final products. <i>Eucalyptus</i> is expected to progress as an important species in Malaysia with future opportunities for growth. |  |
| 9. | Dyera costulata | Jelutong - normally found in lowland to hilly up to 600m. it is light weight to medium heavy hardwood. Basically, for light to medium heavy construction, flooring and furniture. |  |

Source: Forest Department Peninsular Malaysia

1.3.4 Energy Source and Consumption

Generators will be provided for the workers' quarters. The usage of generators will necessitate obtaining prior approval from the relevant authority. The usage of large generator sets in the site must comply with the Environmental Quality (Clean Air) Regulations 2014, Regulation No. 5. Written notification must be forwarded to the DOE using the form attached in **Appendix F**.

1.3.5 Water Source and Consumption

As for the project site, the main source of water supply is from the river nearby. The water consumption is supplied for the nursery and workers quarters. Water is used for watering plants in the nursery while for workers camp, water is used for daily basis. Nevertheless, direct consumption of water from the river should be avoided unless it is treated.

1.3.6 Labor Requirement

Basically, the number of workers are determined by the size of the project site and approved by project proponent. Recommended number of workers are 20 including administrative and operational workers. However, the amount of worker needed is differ from stages in the forest plantation, for example, during site preparation higher number of labour is needed compared to during operation process. Nevertheless, during operation and timber harvesting also need number of labour.

1.3.7 Transportation

The development of forest plantation required transportation. Vehicles and machineries are among the main necessities involved during the development and operational phases of the project. Vehicles are needed for transporting planting materials to the targeted area and machineries are needed for the purpose of preparing the forest plantation site. The existing log trails will be used for the transportation access.

During site preparation, the types of vehicles used are small lorry, 4x4 vehicles, bulldozer and excavator. Minimum number of vehicles is needed to conduct land preparation and development of nursery to reduce the impact on soil as well as to avoid any soil compaction ahead.

For the planting session vehicles such as small lorry, 4x4 vehicles and pickup truck are used to transport the seedlings and saplings within the project site. Transportation of these planting materials will be conducted manually for the area that is difficult to reach by vehicles (**Plate 1.6**).

At the end of the during development phase, all the internal roads including skid trail and access road are suggested to be planted with saplings. **Table 1.3** summarized the types of vehicle and machineries used during each development activities as well as the estimation of minimum unit to be used.



Plate 1.6: Example of Transportation of Seedling and Sapling to the Project Site

At the end of the development phase of the forest plantation, all of the internal roads including skid trails and access roads shall be planted with saplings.

Table 1.3: List and Units of Vehicles/Machineries Used for Each Development Activities

| ACTIVITY | TYPES | UNITS |
|------------------|--------------------|-----------|
| Site Preparation | Bulldozer | 2 |
| | Excavator | 2 |
| | Small Lorry | 2 |
| | Toyota Hilux (4x4) | 4 |
| | Chainsaw | 2 |
| TOTAL | | 12 |
| Planting Session | Small Lorry | 1 |
| | Pickup Truck | 2 |
| | Toyota Hilux (4x4) | 4 |
| TOTAL | | 7 |

**estimation from the Project proponent*

5.1.8 Support Facilities

Facilities should be prepared and built by the project proponent. The facilities include guard house, office, quarters, sanitary toilet and bathroom with septic tank, water tank, generator set, watch tower, nursery area, pond area for water storage and plantation roads. Layout plan for the support facilities shown in below.

a) The Project Layout Plan of Forest Plantation

Figure 1.5 shows the overall plantation layout plan that is designed for forest plantation development.

Guard House

A guard house should be constructed at the entrance of the project site. Guardhouse will be a checkpoint for monitoring and maintaining the access control into the forest plantation to avoid intruders pass by the project site.

Nursery

Nursery will be constructed in an area more than 0.40 ha for seedlings supply. The nursery will be located near the water source to supply adequate amount of water for seedlings. The water source will be channelled to a man-made pond and the water from the man-made pond will be used during dry season (insufficient amount of water) and also can be used while emergency such as extinguish fire on site.

The selection of an appropriate nursery site is the most important decision for efficient production of good quality plants (**Plate 1.7**). Some technical factors are needed to be considered are as described in **Table 1.4**.

Table 1.4: Technical Factors for Selection of an Appropriate Nursery

| No. | ITEM | TECHNICAL FACTORS |
|-----|---------------|--|
| 1 | Water supply | A reliable and adequate source of water supply is essential for all forest nurseries. The amount of water requirement is different for each species of plants. |
| 2 | Man-made pond | A pond should be built as close as possible to the water supply in which the water from the water supply will be channelled to the pond as a reserve during dry season and also used as prevention if there is fire accidental in the plantation area. |

| No. | ITEM | TECHNICAL FACTORS |
|-----|--------------------------------------|--|
| 3 | Availability of labor/workers | Usually the nursery located near to the quarters so that the workers can easily to take care of the plants. |
| 4 | Availability of suitable soil | The plants will be raised in poly bags. Hence, large quantity as well as suitable type of soil is needed. The best seedling planting materials will be raised in poly bags for about 12 months before the area is ready for transplanting. |
| 5 | Access road | The nursery should be as close as possible to the centre of the area where plants are to be planted later. The access road can be used for both dry and wet season of the year. |



Plate 1.7: Example of Nursery for the Project

The advantages of establishing nurseries in the project site are as follows:

- To reduce damage to the seedlings during handling and transporting;
- The cost of setting up the nursery will be offset by the cost of transporting the seedlings from an outside supplier;
- The nursery can be maintained for a number of years to raise seedlings for future projects; and
- Commercial seedlings for sale to third parties can also be raised when the nursery is not fully utilized.
- The nursery location will be turned into a log yard during harvesting stage.

It is essential to have a good nursery stock in order to make good plantation. Poor seedlings are likely to have slower growth, to be less able to compete with weeds, and to be more liable to be damaged by insects and pests. Furthermore, in a poor nursery, fewer seedlings will be raised from a given quantity of seed, and there will be

considerable waste of money and time. After planting stage, monitoring and maintenance of the planted seedlings should be done since the plants are immediately exposed to a harsh environment, and are at their most susceptible to damage from drought, grazing, fire, insects etc.

Quarters and Site Office

The quarters and site office will be constructed on a stable platform level which is not prone to a flood risk and landslide if necessary.

Storage Area

The fertilizer and pesticide storage located in the nursery area so that the work of fertilizing and planting is easier to be handled.

Skid Tank

The skid tank will be placed near the parking area and at least 50m away from the waterway. Whereas, the construction of the secondary containment must be accommodated at least 110% of the contents of the largest tank of fuel tank that will be used at the Project site. Besides, the base of the secondary containment shall be concrete. The facilities to pump in the oil spill must be provided.

Fire Observation / Watch Tower

A fire observation/watch tower is proposed to be built on the highest point of the project site that can cover the overland view of the project area (**Plate 1.8**). This approach is practical for monitoring an open burning incident on site and wildlife encroachment into the plantation area. Besides that, the location of the fire observation/watch tower must be near to access road since so that applicable for an easy access by workers on site.



Plate 1.8: Example of Watch Tower

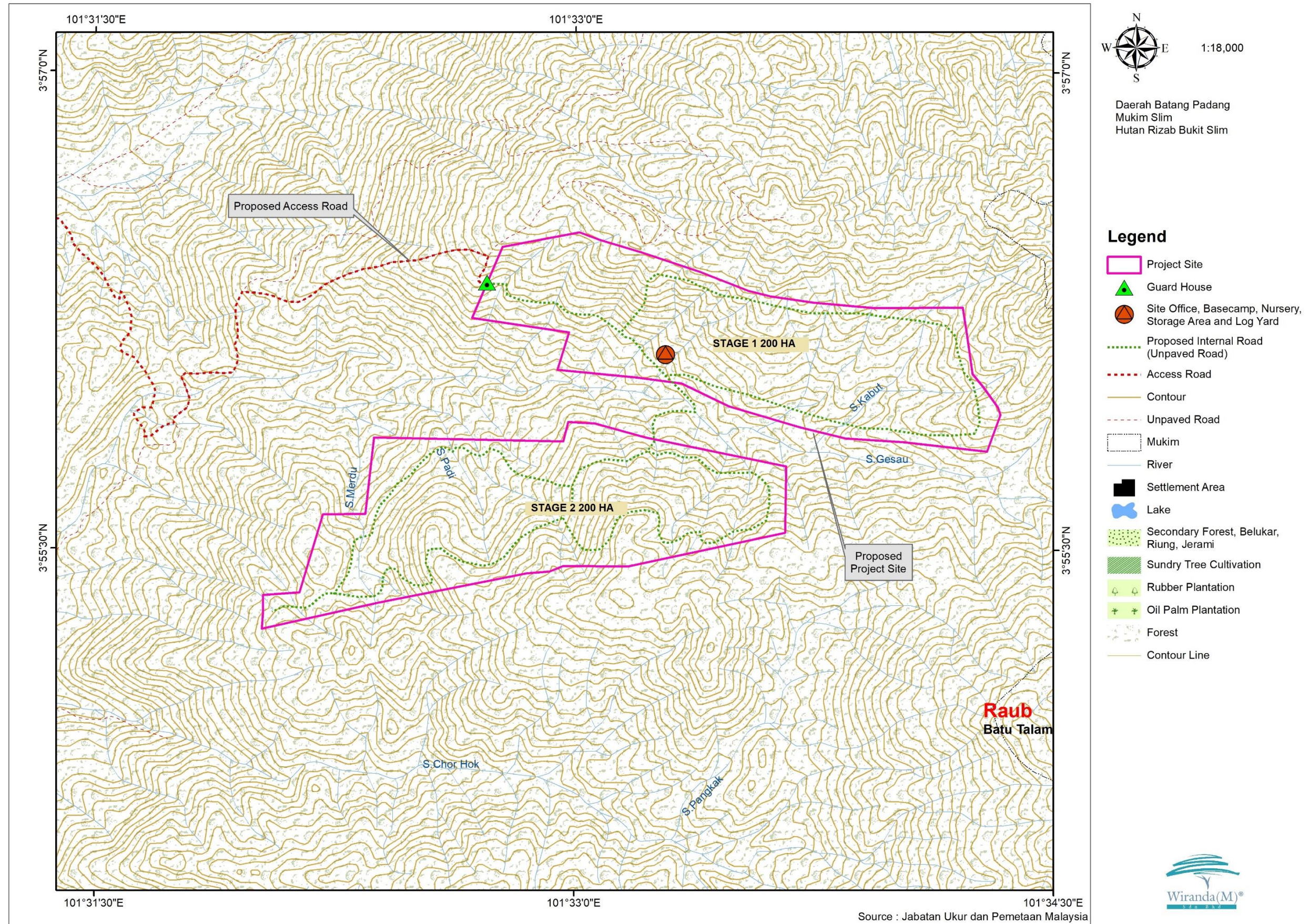


Figure 1.5: Layout Plan for the Project Site

1.4 IMPLEMENTATION SCHEDULE

The development for this proposed project will adopt a sustainable plantation which applied zero burning technique as an environmentally friendly land preparation method to minimize the impact to the environment. The proposed species for forest plantation is *Kelempayan*, *Jati* and *Meranti* and the plantation will follow the existing ground condition. The forest plantation process will be executed in four petak (phases). The stages and areas of each petak is as shown in **Table 1.5** below.

Table 1.5: Area of Phase Development

| STAGE | PETAK | AREA (ha) |
|------------------------------------|-------|------------|
| STAGE 1 (200 ha) | 1 | 100 |
| | 2 | 100 |
| STAGE 2 (200 ha) | 3 | 100 |
| | 4 | 100 |
| TOTAL | | 400 |

Based on Development Schedule (**Table 1.6**), Stage 1 is estimated to be started on December 2021. The development will start from Petak 1 (starting from the western part to the eastern part of the project site) followed by Petak 2, Petak 3 and Petak 4 due to the availability of the access road. This approach will allow time for any fauna and avifauna in the project site to migrate to the adjacent forest. This approach also helps in reducing the bare area on site at one time. The phases of development are as shown in **Figure 1.6**.

Work progress for forest plantation will starts once site preparation activities are been completed from one petak to another petak. It also will involve the construction of access road(s), waste removal, stacking, preparation of drainage systems, planting rows, planting seedlings and cover crops. Earthworks activities will be avoided during rainy season due to as an initiative in reducing adverse impacts attributable to soil erosion and sedimentation in the rivers and streams in the project area.

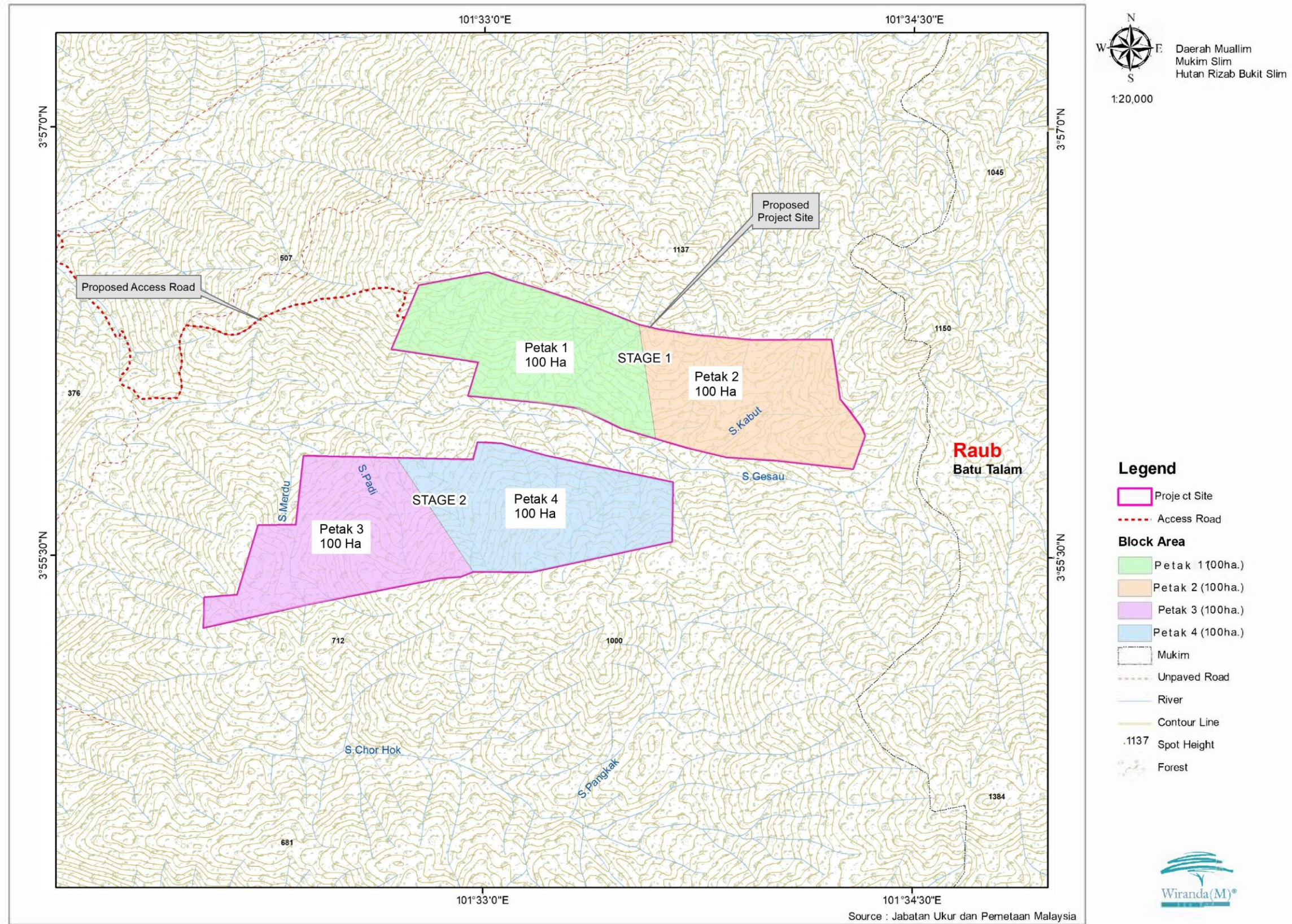


Figure 1.6: Phase Development of the Project Site

Table 1.6: Development Schedule for the Project

| YEAR | 2021 | | | | | | | | | | | | 2022 | | | | | | | | | | | | 2023 | | | | | | | | | | | | | |
|---------------------------------------|------|---|---|---|---|---|---|---|---|----|----|----|-------------------|---|---|---|---|--------------------------------------|---|---|---|----|----|----|------|---|---|---|---|---|---|---|---|----|----|----|--|--|
| DEVELOPMENT PHASE | | | | | | | | | | | | | Stage 1 (P1 & P2) | | | | | Stage 2 (P3 & P4) | | | | | | | | | | | | | | | | | | | | |
| ACTIVITY / MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| Pre – Development Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Boundary Survey | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Road Construction | | | | | | | | | | | | X | X | X | | | | X | X | X | | | | | | | | | | | | | | | | | | |
| Reforestation Block | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Development Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Logging Activity | | | | | | | | | | | | | X | X | X | | | | X | X | X | | | | | | | | | | | | | | | | | |
| Land Clearing | | | | | | | | | | | | | X | X | X | X | | | X | X | X | X | | | | | | | | | | | | | | | | |
| Office & Workers Quarters Setup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nursery Setup | | | | | | | | | | | | | X | X | X | | | | X | X | X | | | | | | | | | | | | | | | | | |
| Planting Selection Species & C. Crops | | | | | | | | | | | | | X | X | X | X | | | X | X | X | X | | | | | | | | | | | | | | | | |
| Mitigation Measures | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| Operation Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| Pesticides & Fertilizers Usage | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | |
| Monitoring Work | | | | | | | | | | | | | X | | | X | | | X | | | | X | | | | | | X | | | X | | | X | | | |
| Harvesting Activities | | | | | | | | | | | | | | | | | | Expected to Carry Out after 10 years | | | | | | | | | | | | | | | | | | | | |

| YEAR | 2024 | | | | | | | | | | | | 2025 | | | | | | | | | | | | 2026 | | | | | | | | | | | | | |
|---------------------------------------|--------------------------------------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|---|---|---|---|-------------------------------------|----|----|----|--|--|
| DEVELOPMENT PHASE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ACTIVITY / MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| Pre – Development Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Boundary Survey | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Road Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reforestation Block | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Development Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Logging Activity | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Clearing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Office & Workers Quarters Setup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nursery Setup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Planting Selection Species & C. Crops | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mitigation Measures | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | | | |
| Operation Stage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | X | Will continue until end of 50 years | | | | | |
| Pesticides & Fertilizers Usage | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | | | x | | | |
| Monitoring Work | | | x | | | x | | | x | | | x | | | x | | | x | | | x | | | x | | | x | | | x | | | | | | | | |
| Harvesting Activities | Expected to Carry Out after 10 years | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

1.5 FOREST PLANTATION DEVELOPMENT ACTIVITIES

Before any forest plantation development activities carried out, the project proponent must comply with the guidelines that have been issued by the Forestry Department of Peninsular Malaysia under the “*Manual Perhutanan Jilid 3 (Ladang Hutan)*” for the development of forest plantations.

The project activities involved is categorized under three stages, namely:

- Pre - development stage
- Development stage
- Operation and maintenance stage.

Details of the activities involved during the stages are describe in the following subsections :

1.5.1 Pre-development Stage

1.5.1.1 Preliminary Site Investigation

Before the project site development begins to operate, preliminary site investigation must be conducted. The purpose of preliminary site investigation is to study the physical and biological system at the project site. In this stage, site survey is conducted to determine the boundary marking and river buffer zone marking for the project site. Boundary marking of the project site is important for project planning and management in order to determine the development phases of the project site.

During the site survey, identification of access road is done for the project development. Access road must be taking into account as it is among the core components for the project. Any access road in the forest reserve area is under jurisdiction of Forestry Department. Therefore, the permission or any maintenance for the access road shall apply for “*Permit Jalan – Borang 7* under Section 50(1) *Akta Perhutanan Negara 1984*” by the project proponent.

Physical survey includes survey on the existing condition of topography, soil, climate, air, noise and water quality as well as socio–economy study at the project site. Biological study includes of survey on the existing condition of biological system such as flora and fauna survey at the project site. The purpose of conducting both physical and biological

system study at the project site is to study of the current conditions in order to predict the impacts that might be occurred after the development activities take place.

1.5.2 Project Planning / Management

The total area for the proposed project is 400 hectares. The activities that will be done at each phase are road construction, base camp establishment, felling and stacking which are proceeded simultaneously to reduce time and soil erosion problem.

Establishment of site boundary is important to determine the logging area limitation. Preparation of the site boundary should be implemented carefully and properly to avoid any confusion, boundary changes and facilitates monitoring and control process.

Site signage will be installed at proposed project site boundary. The signage will include:

- i) License No.
- ii) License area
- iii) Size of the project site area
- iv) License holder
- v) Name of the contractor
- vi) Validity of license period

All trees that are located inside the buffer zone are considered as protected tree in which they cannot be fall. Area that been classified as buffer zone also include the area for both sides of river bank. The width of the buffer zone is calculated by using this formula:

$7.6 \text{ m} + (0.6\% \times \text{percentage of minimum slope})$

- With minimum width of 20 meters, depending on the width of river and condition of the project site

For river with more than 7.0 m width, the buffer zone should be 3 times of the river width for both sides of the river bank. As for river with less than 7.0 m of width, the minimum width for the buffer zone must be 20 m depending on condition of the project site.

1.5.2 During Development Stage

1.5.2.1 Logging Activities (Site clearing)

Logging can also be classified as site clearing in which the logged area will be converted to forest plantation soon after the logging activity done. Conventional logging method will be done for area. Existing natural vegetation will be preserved after valuable timber has been extracted. Selected site clearing will be carried out for the planting area, establishment of base camp, drainage and irrigation works, establishment of barriers, utilities and culvert installation. The logging activities will consist of the following activities:

Construction of Road and Field Drainage System

a) Access Road and Road Track

The access roads will be constructed at the early stage before the clearing activity takes place. The main access roads and track have to be built for the movement of tractors and heavy vehicles. Within the project area, the roads and tracks are built for the movement of tractors and heavy vehicles which will be used during the log loading and trucking process. The road that will be constructed should be more than 50 feet from the river or stream. This is important in order to reduce the potential water pollution that might occur especially during the rainy season. In addition, the road needs to comply with *Garis Panduan Jalan Hutan* 2010.

The maximum road density recommended is 40m/ha. The logging track will be constructed with minimum level in which the right of way will not exceed more than 12 m. The road formation will be constructed with minimum width of not more than 4 m. The layby area will be constructed at a strategic place. The main skid trail (Lorong Penarikan Utama) is a track that is being used as the main track for the logs pulling process to platform. The maximum length of this track is 1.2 km. On the other hand, the minor skid trail is a track that is used to pull logs from the original location of the logged timber to the main skid trail. The maximum length of this track is 20 m. There are no rigid rules on the road alignment as it could be considered as an art of designing. Factors such as optimum road density, effective road gradient and erosion control should be

taken into account in the construction of road. The following criteria must be taken into consideration when planning the design of the road:

- Roads must tie up with mechanization
- Roads must be functional
- Roads must be “all-weather”

Table 1.7: Logging Roads Geometrics to Be Complied During Logging

| | DESCRIPTIONS | LOGGING ROADS |
|--|--------------------------------|--|
| ** Road Density | Permanent Roads | <40 m/ha |
| Vertical Alignment | Road Gradient (Permanent Road) | <= 20 % |
| | Length of Slope | <= 200% |
| Cross Section | Canopy Opening | <= 20 m |
| | Right of Way | <= 12 m (20 m) + |
| | Road Formation | <= 4 m (7 m) + |
| | Pavement Material | Forest Floor |
| | Road Camber | 1:20 (Straight) |
| Drainage System | Side Drain (Earth) | 0.6 m X 0.2 m (Min) |
| | Culverts (Concrete/Log) | 900 mm Diameter (Located at Valleys, Stream Crossing etc.) |
| Side Slope | Cut Earth | 1:1 (Max) |
| | Fill Earth | 1:1 ½ |
| Earth Works | Excess Earth | Disposed to Approved Dump Site |
| | Silt Traps | To Erosion Prone Areas |
| Rainy Weather | Wet Road | Traffic Prohibited |
| * All skidding activities shall be confined to predetermine skid trails ** A road map of scale 1: 5000 + For access road and main road in concession areas | | |

Source: Kod Amalan Pengusahaan Hutan Darat Asli Semenanjung Malaysia, Jabatan Perhutanan Semenanjung Malaysia

Buffer zone is required between road and river. The width of the buffer zone is calculated by using this formula:

$$7.6 \text{ m} + (0.6\% \times \text{percentage of minimum slope})$$

- With minimum width of 20 meters as shown in the table below:

Table 1.8: Specification for Buffer Zone Guideline

| Land Slope | | Width of the road buffer zone (m) |
|------------|----------------|--------------------------------------|
| Angle (°) | Percentage (%) | |
| 0-11 | 0-20 | 20 |
| 11-16 | 20-30 | 20-30 |
| 16-22 | 30-40 | 30-45 |
| 22-27 | 40-50 | 45-55 |
| 27-31 | 50-60 | 55-70 |
| 31-40 | 60-84 | 70-95 |
| >40 | >84% | Protected area |

*Source: Kod Amalan Pengusahaan Hutan Darat Asli Semenanjung Malaysia,
Jabatan Perhutanan Semenanjung Malaysia*

Field Drainage System

The early stages of logging operations require the penetration of roads into previously undisturbed forest. Heavy logging equipment is used to cut, bulldoze and push earth during the initial and subsequent extraction phases of logging activity. This will affects the water quality especially to the nearby water body. Besides that, the water quality will also be impacted if there is soil erosion occurrence. Exposure and compaction of soil leads to hydrological change, increased erosion rates and water quality problems. Due to those situations, drainage system should be established where it can reduce the possibility of water pollution.

Roadside drains are normally not constructed along the feeder roads. However, it is necessary to construct roadside drains along the main roads of low lying areas where the excavated drain spoil is used to raise up the road surface before gravelling. The slope of the side drain recommended is 1:1 ½ with minimum base slope of 2%. The shape of the roadside drain will be in V or U shape in which the size will not exceed 0.6mx0.2m (Kod Amalan Pengusahaan Hutan Darat Asli Semenanjung Malaysia, Jabatan Perhutanan Semenanjung Malaysia).

Cross ditch is a drainage structure or ditch which built across the skid trail and temporary road. It is being constructed to intercept the water flow, thus divert the water flow out of the skid trail or side ditch. The water will flow to vegetative area as a way to reduce the soil erosion.

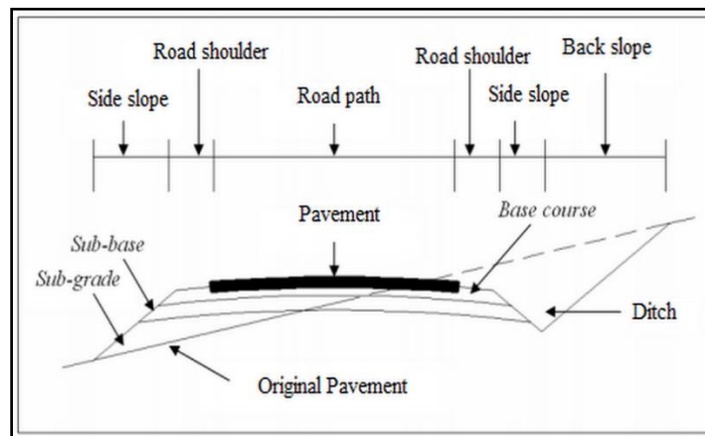


Figure 1.7: Cross Section of Logging Track



Plate 1.9: Example of Logging Track

Installation of LD-P2M2 Tools

During site preparation, the installation of Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) tools are being conducted. The discussion on installation of LD-P2M2 can be refer in **Appendix E**.

Establishment of Log yard

The construction of main log yard and arrangement of the logged timber must comply with the following criteria:

- Construction of the main log yard should be centralized which will be used by other logging license holders as well
- The main log yard must be accessible by vehicle throughout the season
- The log yard should be constructed on flattened land surface
- The size area of the main log yard should not more than 0.5 ha for each 100 ha licensed logging area and should not been constructed less than 40 meters from the river bank

Existing Log yard

There is one existing log yard that is located outside forest reserve. The location of the log yard is within lot number 660 and 661 as shown in **Plate 1.10** and **Figure 1.8**. Mitigation measures will be implemented to control the erosion and sedimentation problem. The consent letter for the project proponent used the existing log yard is attached in **Appendix A (II)**.



Plate 1.10 Existing log yard

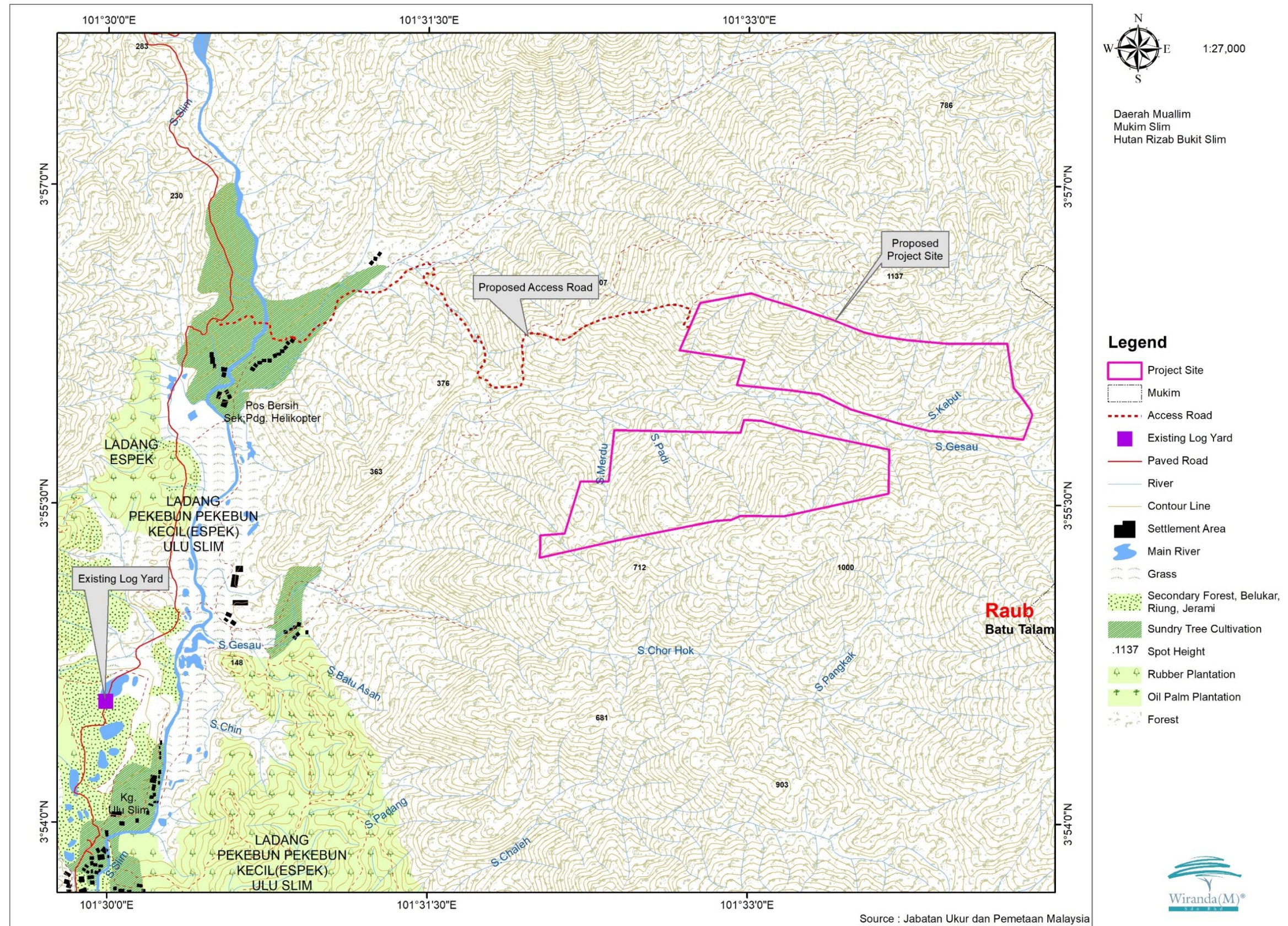


Figure 1.8: Existing Log Yard

Timber Biomass Residue Management

Forest Research Institute Malaysia FRIM reported that around 30% to 40% from the total tree volume will be left behind during logging operation which consists of stumps, branches, leaves, defect-cuts, saw dust and invaluable trees. Normally, the biomass residue will be managed via two options, which are in option 1, the invaluable biomass will be buried in the ground within the project site or option 2 the invaluable biomass will be shredded and then converted into chipping board.

But in recent years, the application of the residue has expanded greatly in Malaysia, the residue has been converted into fodder, fertilizer, fibre, feedstock and as an option for a sustainability of energy sources. The production of energy from woody biomass has become profound in Malaysia as supported by National Biomass Strategy 2020 (*National Biomass Energy*).

1.5.2.2 Site Preparation of Forest Plantation

Site preparation of forest plantation is done during development activities stage. There are several activities will be conducted during this development stage which are land preparation, construction of field road, construction of drainage system and bridge/culvert, installation of P2M2 tools (i.e. silt trap, sediment trap, etc.), planting cover crop and construction of animal trench.

i. Land Preparation

Land preparations for forest plantation is consisting of stabilize and rehabilitate the project site. The project proponent should be bound to undertake the preparation activities in their respective phases. Land preparation activity comprises as follows:

- a) Construction/ Stabilize existing access tracks/roads and field drainage system
- b) Rehabilitate skid trail and log yard area by friable the soil in the area
- c) Planting cover crop

ii. Upgrading of Access Road and Construction of Field Road

a. Access Road

Access roads will be upgraded and field road will be constructed in the early stage before the development activity takes place. The main access roads and tracks will be built to cater for the movement of tractors and heavy vehicles that will be used during development operations. The roads that will be constructed needs to be more than 50 feet away from any rivers and streams in the Project site. This is important in order to reduce potential water pollution problems that might occur especially during the rainy season.

Some general principles to be considered in the layout of the road system are:

- Use existing roads wherever possible.
- Minimize the changes in the natural stability of the land - place roads on high ground; keep out of streamside management zones and wet areas; keep off the toe of banks and slopes.
- Set road gradient as low as possible, with maximum of 20% (11.3 degree) and continuous uniform slope distance not exceeding 200 m for extreme condition.
- Where possible, the road should follow the natural contour of the land. This will avoid the need for extensive cut and fill.
- Allow the Right of Way (RoW) to not more than 12 m, according to terrain.
- Minimize the number of stream crossings.
- Keep road gradient as low as possible. The steeper the grades, the greater the velocity of the runoff. If steep grades are needed for short distances, follow by stretches of lesser grades to reduce runoff velocity.
- Determine the appropriate standard of road needed for the type of equipment; volume of traffic; and length of use. Selection of the appropriate road surfacing material will minimize erosion and reduce maintenance costs.

iii. Construction of Drainage System and Bridge/Culvert

a. Field Drainage System

Roadside drains are normally not constructed along the feeder roads as they hamper future harvesting operation. However, it is necessary to construct roadside drains along the main roads of low lying areas where the excavated drain spoils are used to raise up the road surface before gravelling.

Foothill drains are a form of trench constructed at the fringes of hills where the slope gradient changes abruptly. Water from surface runoff will be trapped in the drains during the rainy days. This drain acts as a breaker for surface runoff as well as conserving moisture.

An excavator is normally used to construct the drains. On wide ravines, the system of foothill drains regularly channeling water into one or more main drains has been found to be superior to other system such as 'herring bone' drainage pattern.

For the foothill drain, it must be correctly located at the foothill. A depth of 60 – 90cm is normally sufficient but the width has to take into account the water flow down the hills. Narrow ravines can be drained easily with a central main drain, but occasionally scupper drains lead to water from localized low spots are required. Proper drainage enhances aeration, microbial activity, ground cover establishment and helps in the development of an extensive root system. **Table 1.9** shows the specification and justification of drains in the forest plantation.

Table 1.9: Specification and Justification of Drains

| Type of Drain | Top Width (m) | Bottom Width (m) | Depth (m) |
|-------------------------------------|---------------|------------------|-----------|
| Large drain (Border)/ Animal trench | 4 | 3 | 2 |
| Foothill drain | 0.3 | 0.15 | 0.6 – 0.9 |
| Roadside drain | 1.2 | 1.0 | 0.6 |

Sources: Department of Wildlife and National Parks Peninsular Malaysia

b. Bridge/ Culvert

Bridge will be constructed when crossing rivers and streams. Culvert will be constructed for smaller streams like tributaries. For both, bridges and culverts, the access road to the

structure must be straight and flat with at least a minimum distance of 10 meters on both sides of the bridge or culvert.

The bridge's floor will be made of durable wooden board or other material that will not decay such as clean stone stockpile. In order to avoid from being washed away, the bridge must be tied up properly. The river bank at the crossing must be stabilized using bridge wing structures made of durable wood, stone or other suitable construction materials (Refer **Figure 1.9**, **Figure 1.10** and **Plate 1.11**).

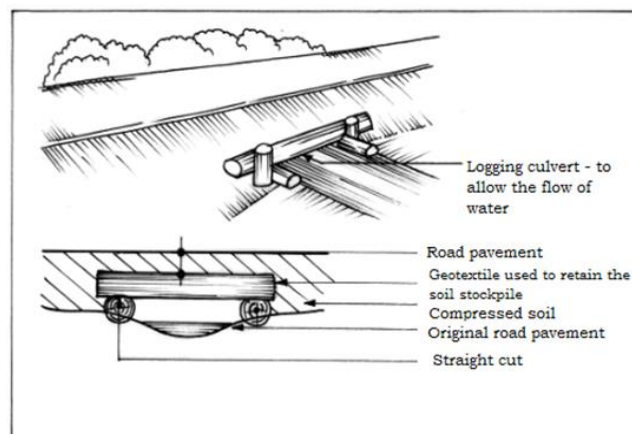


Figure 1.9: Installation of Temporary Bridge



Plate 1.11: Example of Bridge from logs

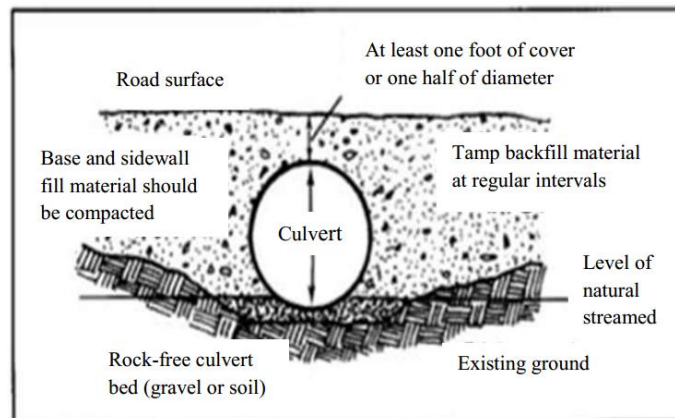


Figure 1.10: Cross Sectional of Culvert

There are some general principles that will be taken into account in constructing the stream crossings such as:

- Crossing must be designed to protect the water quality.
- The construction's time should be shorter as possible in order to protect the water quality.
- Crossing should be designed to handle peak runoff and flood waters.
- Stream crossings should be at the right angles to the stream channel and should be included the erosion protection measures.
- Crossings should be designed to protect the approach to the stream at the stream banks and stream bottom.

The project contractor must alert that federal, state or local agencies may require permits for construction of stream crossings.

For the purpose of Forest Plantation development, there are few bridges/culverts will be built within the project site. **Table 1.10** shows the proposed unit of bridges/culverts will be built in the project site. The proposed bridges/culverts in the Project site are as shown in **APPENDIX E**.

Table 1.10: Proposed Unit of Bridge/Culvert for the Project Site

| ITEM | RIVER NAME | NO. OF BRIDGE/ CULVERT |
|--------------|--------------------------|------------------------|
| 1 | Tributaries of Sg. Gesau | 31 |
| TOTAL | | 31 |

Source: Consultant's estimation

iv. Planting Cover Crop

a. Leguminous Cover Crop

Leguminous Cover Crop (LCC) (**Plate 1.12**) such as *Mucuna sp.* will be planted in bare area after field establishment. The LCC is necessary to control weed competition during immature and mature phases. It also helps in soil conservation and helps develop good microclimate which conserves the soil moisture. Cover crop also increases the rate of decomposition of stacked woody vegetation which will increase the organic matter in the soil. For flat and undulating areas, *Mucuna* will be planted at 15 feet apart. About 30 gm of Rock Phosphate (RP) should be put in the hole just before planting.



Plate 1.12: Cover Crops for Soil Conservation Measure Establish at Forest Plantation

b. Inter-Cropping (Taungya System)

Rather than using typical LCC for covering soil to retreat the soil and soil protection in plantation area, the integration of forest tree plantation with agriculture crops (inter-cropping) will increase the land productivity, which will enhance the timber and food productivity. Besides, the application of the Taungya system (Brandis, 1890) will give side income within the growth period of planted tree. Nowadays, the Taungya systems are known as 'agrosilviculture' method which involves the inter-planting crop like lemongrass, black pepper, peanut and etc.

v. Construction of Animal Trench

The project proponent should refer to the PERHILITAN for the development of a ditch or fencing at the boundary of project site taking into account the most efficient protection measure and costs. The size of the trench is usually 3m x 2m. Once constructed, the ditch or any other structural control system should be well maintained to ensure its' effectiveness.

Figure 1.11 shows the mitigation strategies for wildlife. **Plate 1.13** shows the example of animal trench to protect from wildlife encroachment.

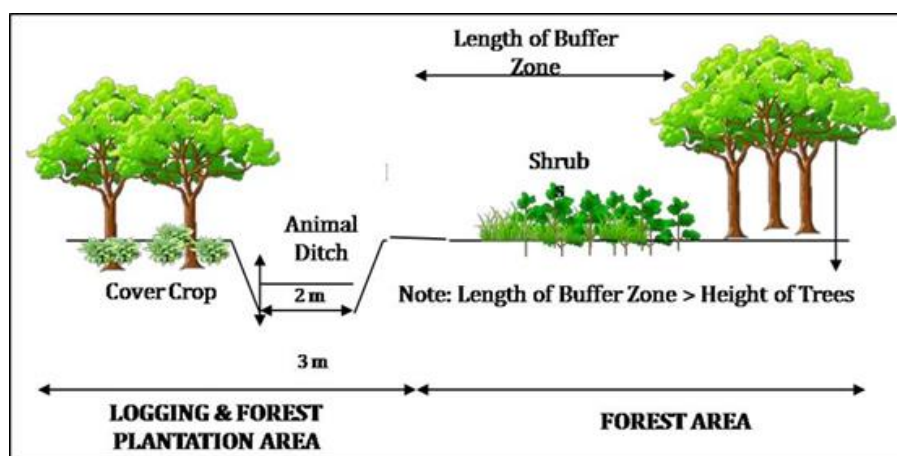


Figure 1.11: Ditch for Human-Wildlife Conflict Prevention



Plate 1.13: Example of Animal Trench

1.5.2.3 Establishment of Temporary Base Camp

Construction of Workers Camp

The Project proponent should set up a temporary base camp in his site for the development activity. The base camp will be established as soon as a suitable area is found and approved. The base camp should be provided with basic facilities such as electricity, water supply, toilets and a waste management system. It will consist of at least two 40 footer cabins to cater a workforce of about 20 people. The facilities that will be provided at the base camps will include:

- a) Accommodation
- b) Power supply
- c) Toilets with septic tank
- d) Kitchen
- e) Canteen
- f) Signboards (eg: housekeeping notices, prohibition of open burning, etc)
- g) Wash area

The location of base camp also needs to consider these following factors:

- a) At an area that can be used by several logging licenses
- b) Able to be reached by vehicles at all times
- c) At a distance of at least 50 m away from any permanent watercourse
- d) Use suitable methods for disposal of waste

1.5.2.4 Nursery Establishment and Maintenance

The development of nursery together with construction of quarters and site office are conducted during stage of development activities.

1.5.2.5 Field Establishment

Field establishment consists of preparation of the lining, planting holes and planting of polybag seedlings.

a) Lining

Lining is usually commenced soon after completion of land preparation or 1 to 2 months prior seedlings being planted in the plantation area. Lining objectives are to provide an evenly spaced of trees, to give each tree has the same access to nutrients, water and sunlight and to achieve optimum stand per hectare, the systematic irrigation and harvesting, efficient transportation and to ensuring high yield in the future.

The general consideration for lining that we have to remember is an alignment. It should be in a generally East-West orientation. This will enable optimization of sunlight. An alignment should be parallel to the irrigation canal and perpendicular to roads. The straight lining is usually use in flat area. All lining distances should be by horizontal measurement. Lining sticks will be applied as a marker of planting hole. Sticks should be 0.6 m in height. **Table 1.11** shows the recommendations of planting distance of forest trees depending on topography. If there has any barrier such as fell tree or stumps, planting should be remove more than 0.3 m from the barrier.

Table 1.11: Planting Distance

| Topography | Planting Distance (m) | Trees/Hectare |
|-------------------------|-----------------------|---------------|
| Flat and terracing area | 3 x 3 | 1100 |
| Steep land(25° - 35°) | 3 x 3.75 | 900 |

Source: Manual Perhutanan Jilid III, 2005

b) Holing

Planting hole will be dug mechanically or manually (mostly for the high degree of slope area). The holes should be dug about 15 cm (6") deeper than the height of the soil core in the polybag to assist initial root penetration and when necessary, the sides of the broken to allow lateral root penetration (**Table 1.12**).

Table 1.12: Hole Planting Measurement for Seedling

| Specification | Manual / Mechanical Method |
|---------------|----------------------------|
| Diameter | 0.20 m |
| Depth | 13 cm |

Source: Manual Perhutanan Jilid III,2005

c) Transportation seedling to plantation area

Planting is carried out within 2 months after planting rows is established. The seedlings should be planted immediately after the lining and holing had been done. The seedlings in polythene will be lifted for transportation to the field for planting. The seedlings will be lifted carefully from the ground to prevent breakage of the bags and carried to and loaded onto the transport for conveyance to the field. Seedlings with damaged/ torn polythene bags will be wrapped and tied with a Hessian bag to prevent the earth clod from disintegrating.

d) Planting Seedling

- Field Planting of Seedlings

The developer will apply 75 g of Christmas Island Rock Phosphate (CIRP) must be sprinkled into the planting hole and thinly covered with loose soil just before planting. The seedlings will be planted on the very day they are delivered to the field. The seedling will be placed into the planting hole by carefully and stable. The soil for filling the hole will be compacted. At completion of planting, the seedling should be in an upright position. The torn empty polythene bag will then be used as mulch around the collar of the seedling and held in place by few large clods of soil.

The plantation is being designed for easy and cost-effective management in accordance with the following objectives:

- i. Uniform size of blocks and fields for easy job allocation and monitoring.
- ii. Optimum road density for minimum road construction and maintenance cost.
- iii. Efficient and cost-effective transport system.

- Planting density

The planting density of the project site is 900 to 1100 trees per hectare, it is varies according to the soil type on which the trees are planted. Set the rows of the seedling at east-west orientation to get minimum exposure to sunlight if possible. The longest straight boundary line along the east-west orientation is made a convenient baseline. The optimal planting density of the seedling depends largely on the availability of sunlight. A proper planting technique plays an important role in early growth stages of trees and reduces the cost of replanting. The advantages of higher density planting are:

- i. Earlier high return
- ii. Shorter loan repayment period
- iii. Lower upkeep (weed management) cost
- iv. Shorter life span
- v. Taking full advantage of R&D on better planting materials

▪ Planting time

All planting must be carried out during the rainy seasons and planting should stop when three consecutive dry spell days (24 hour period during which rainfall is less than 0.255 mm) occur (DOF, 2003).

Based on **Table 1.13** and **Figure 1.12**, the total area for development is 345.66 ha (86.41%) and 54.34 ha (13.59%) will not be developed. According to *Manual Perhutanan Jilid III*, harvesting of forest trees will not be performed in the area above 40° and while referring to slope class III (25° - 35°), there will be no total clearing in that area as some trees will be left on site especially mother trees for reproduction purposes.

Table 1.13: Development Area of the Project Site

| Total Area = 400 ha | Area (ha) | Percentage (%) |
|---|------------------|-----------------------|
| Slope 0° - 25° (activity and development area) | 239.36 | 59.84 |
| Slope 25° - 35° (activity and development area) | 117.51 | 29.38 |
| Slope 35° - 40° (activity and development area) | 3.68 | 0.92 |
| Slope >40° (Retained, no development & activity area) | 0.35 | 0.09 |
| Riparian Reserved (20m both sides) | 53.99 | 13.50 |
| Road Reserved (4m width) | 11.33 | 2.83 |
| Overall Undeveloped Area (Riparian Reserved and >40°) | 54.34 | 13.59 |
| Total Balance Developed Area | 345.66 | 86.41 |

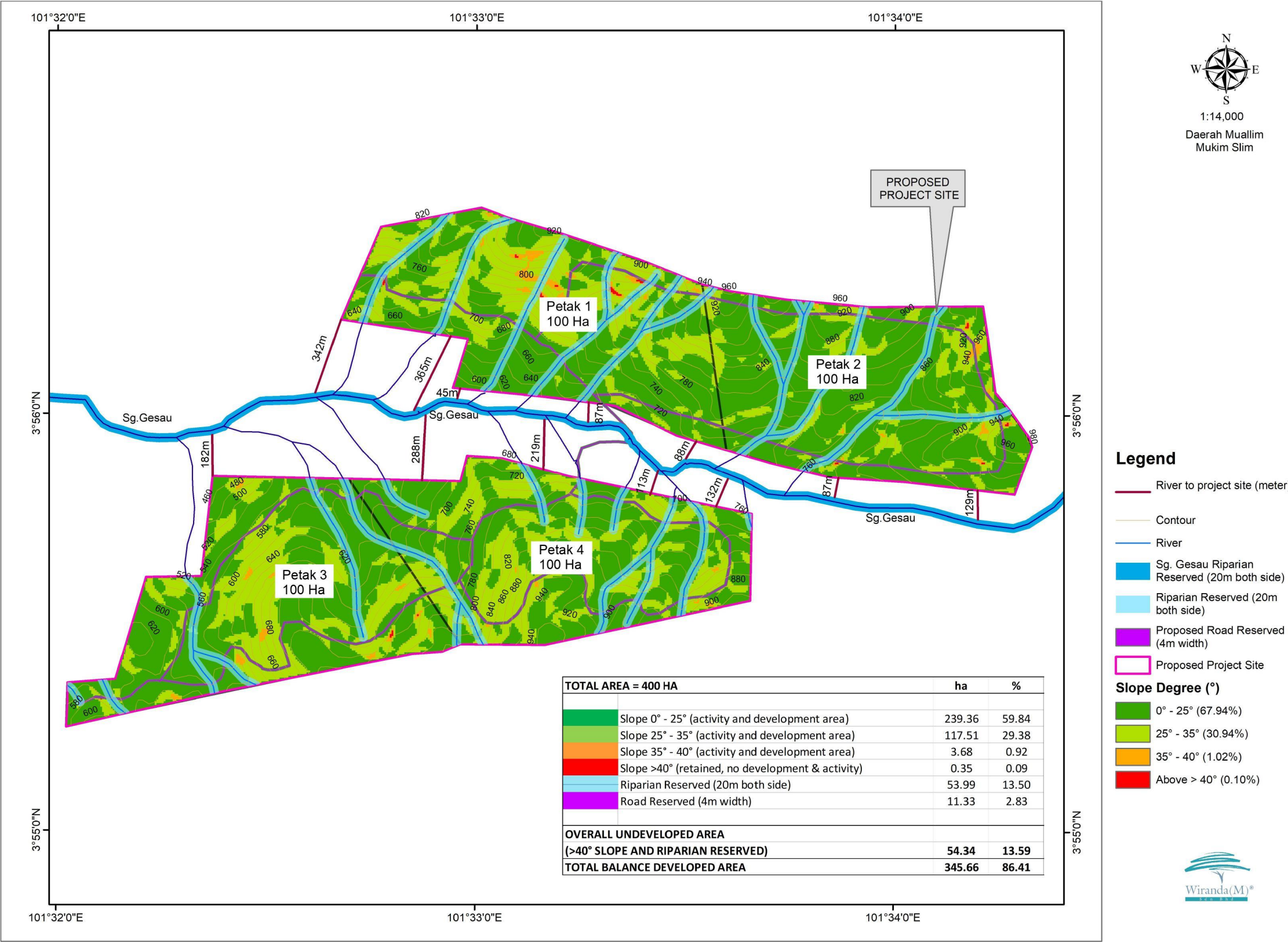


Figure 1.12: Developed and Undeveloped Area

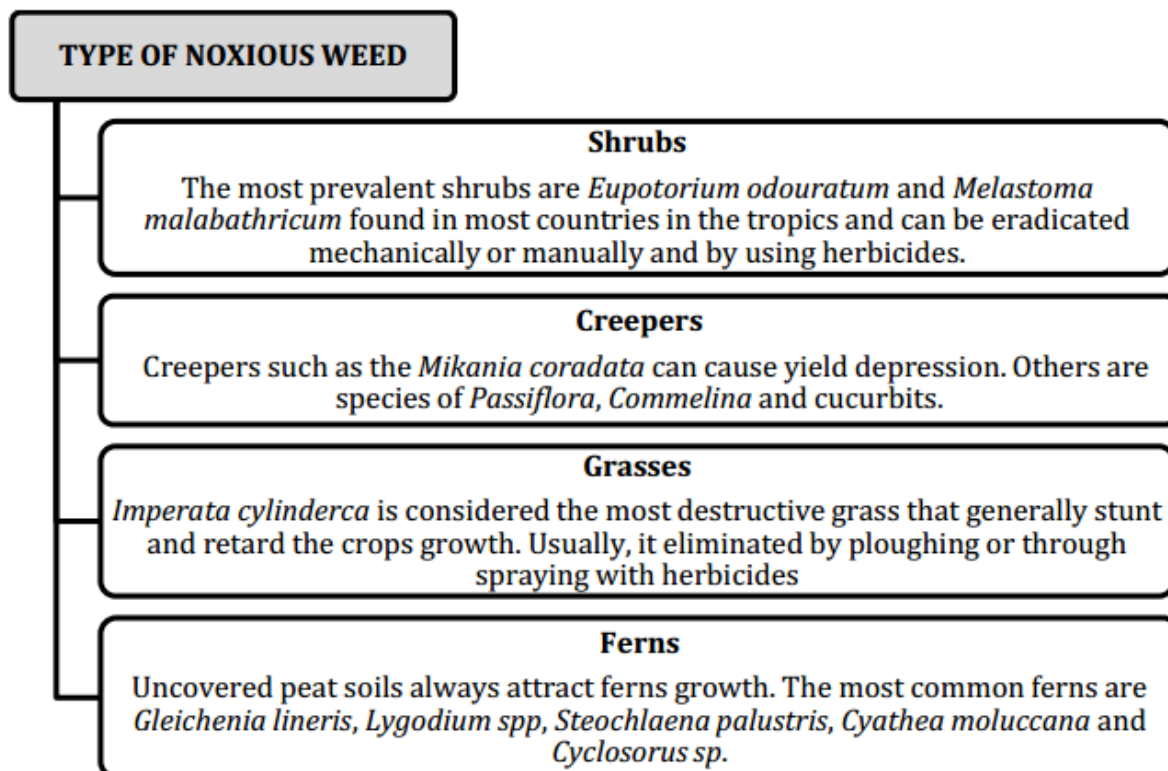
1.5.3 Operation and Maintenance Stage

1.5.3.1 Field Maintenance

The field maintenance operations include weed management, replanting, water management, pruning, branch induction, pest & disease management, and manuring process. Structure maintenance such as road repair, desilting and clearing of drains will reduce erosion and dust.

i. Weed Management

Weeds are commonly known as the unwanted plants, especially in planted areas which create nuisance since they compete with the planted trees for nutrients and sunlight. Weeds also provide protection against pest and complicate the fertilizing process and disease control. For this purpose, the weed management controlled by removing all noxious weeds in ranges 0.45m – 2m around the seedling (circle weeding). Plants considered noxious weeds can be grouped into four categories as follow.



The biological method and herbicide are the most effective method that commonly applied for weeding control in the forest plantation. When handling the herbicide, the spray operators must be provided with the mouth and nose protective masks and required to wear hats, long pants, shoes, and long-sleeved shirts. The following guidelines will helps to control weeds:

For year 1-4:

| | | |
|--------------------------|---|---------------|
| Circle weeding/ spraying | - | 6 rounds/year |
| Selective/ LCC weeding | - | 6 rounds/year |

For year 5 onwards:

| | | |
|--------------------------|---|---------------|
| Circle weeding/ spraying | - | 3 rounds/year |
| Selective/ LCC weeding | - | 3 rounds/year |

- Change from circle to strip spraying from year 5 onwards i.e. to coincide with the use of fertilizer spreaders.
- Incorporate several follow-up rounds to ensure complete eradication of weeds.
- Incorporate 4 rounds of strip spraying and 3 rounds spot/selective spraying/year.
- The LCC or Mb need to be retained or to have 100% of the ground vegetation comprising of soft grasses such as *Paspalum*, *Axonopus* or *Ottochloa*.

ii. Replanting of Dead Trees

The replacement seedling must carry out within 3 months after planting, and replanting of the dead trees is done up to the second year of the plantation developed where the trees can develop fully before the closing of the canopy. The replanting process will use the polybag budding which is the same type as already planted in the fields.

iii. Water Management

The best water conservation management at the hilly and undulating plantation area should be practiced to maintain the soil moisture and also prevent the soil erosion. Furthermore, the maintenance of drains and culvert also will help to conserve water for the plantation area.

iv. Desilting and Clearing Drains

The drainage system is required to drain out the water, especially during the rainy season. Water drainage is important to ensure that water does not stagnate too long in the project area. The drain is also will be used as animal trench to avoid any wildlife encroachment within the plantation area. Therefore, desilting and clearing of drains is required during the field maintenance.

v. Pruning

Pruning allows the development of a balanced canopy and helps to control the height of the plant. During pruning, branch induction is introduced to allow only 4 to 5 vigorous and well-spaced branches to develop. The pruning standards to be observed are:

- Pruning to a height of 2.0 m - 2.5 m allows the development of a smooth trunk without branches or large scars.
- All branches that less than 1.5 cm diameter from trunk should be pruned by using secateurs and more than 1.5 cm branches were prune by using saws trimmers.
- Wound seedling should cover with shell coat.
- Felling branches are stacked in planting row.
- In polybag budding; allow the plant to grow without branches until 2.0 – 2.5 m from union, then prune.
- Maintain 4 - 5 well-spaced branches to avoid wind damage.

vi. Pest and Disease Management

Managing pest and disease in mix forest plantation is more complex than manage a monocrop plantation because of the natural environment in which the trees are planted. The using of chemical in controlling pests is undesirable because it could harm wildlife and have other negative planting consequences on ecology and environment of natural forest ecosystem. However the common methods to control the disease are the agronomic method and some forms of control using chemicals were applied at times when the infestation becomes serious (**Table 1.14** and **Table 1.15**).

Therefore, according to Chan *et al.* (2008) the management of pest and disease can rely on physical and cultural methods of control, which are listed below;

- Particularly important that plants are adequately hardened before they are transplanted from the nursery to field.
- Transplanting should be conducted during rainy periods of the year so that the plants will not be subject to water stress that further predisposes them to disease or pest problems such as termites attack.
- Minimize damage to the roots during transplanting.
- Chosen a suitable site with suitable species to enhance the growth of sapling.

Trees can be affected by a disease which may become serious if left unchecked. Early disease detection helps prevent their spread and damage both in nurseries and plantations. Same goes to pest, the control measures that were implemented depend on the nature and seriousness of the infestation. The information about pest and disease as shown below are obtained from An In-Depth Look at Enrichment Planting from FRIM (2008).

a. Pest

Pest of seed was commonly affected by:

- Seed boring - Lepidophora (moths) species and Coleoptera (beetles) species.
- Sap-feeding – Homoptera groups (e.g aphids, white flies, scale insect, mealy bugs, plant hoppers) and Hemiptera groups (e.g. grasshoppers, locusts, stick insect)

Pest of nursery stage commonly affected by:

- Lepidopteran defoliator and shoot borers (moths and butterflies).
- Sucking insect- scale insect and mealy bugs.
- Stem borers- such as *Zeuzeracoffeae* is a stem borer's moth that burrows in woody stem of saplings in larval stages.

Pest of transplanted sapling commonly affected by:

- Termites - attacked the root and basal stems of transplanted seedlings.
- Defoliators and shoot borers - lepidopteran larvae and adult beetles.
- Plant sucking insect- stink bugs (Pentatomidae)

Pest of planted trees

- Termites
 - *Coptotermescurvignathus* damage of root systems.
 - *Microcerotermesdubius* which build nesting structures it forms on the bole of trees.
- Defoliator and stem borers – Lepidopteran (moths).

b. Disease

- Seed diseases
 - Fungi attack because of high moisture which can cause seed rot and deterioration.
- Nursery diseases
 - Foliage disease which commonly cause by species of *Cylindrocladium*, *Nigrospora*, *Pestalotiopsis* and *Phomopsis*.
 - Damping-off commonly due to seed and soil-borne fungi such as species of *Fusarium*, *Macrophomina* and *Phythium*.
- Transplanting shock
 - Usually occurs during seedling are transferred from nursery to field which is attacked by microorganisms when the root wounded.
- Field diseases
 - Wilting, which cause by *Phythium sp.*
 - Foliage disease such as leaf spots and lesions.
- Diseases of mature trees
 - Canker, which cause by fungus (*Fusarium sp.*) attack.
 - Brittle heart, the primary factors has not been determined but the primary causal factor has been contributed to this disease, such as senescence, physiological stress and infection by decay fungi.

Table 1.14: Chemical Control of Tree Diseases

| Type of Disease | Fungicide | Rate | Control Measures |
|--|--------------------------|----------------------------|---|
| Oidium Leaf Disease | Sulfur | 9kg/ha | Mature leaves (4-6 times) |
| | Folex | 10% active ingredient | Spray from the air at rate of 35 l/ha to drop the leaves before the deciduous season. |
| | Calixin 75 EC | 0.5kg active ingredient/ha | Spray the oil within the period for 7 to 10days until the leaves mature. |
| Anthrachnose leaf spot (Nursery and young trees) | Daconil 2787 Antracol | 0.2% 0.2% | Spray once a week until mature |

| Type of Disease | Fungicide | Rate | Control Measures |
|-----------------|--------------------|------------------------------------|--|
| Black stripe | Copper oxychloride | 20% in oil | Spray from the air at a rate of 35 l/ha before the monsoon season. |
| | Copper oxychloride | 1.2 kg active ingredient/ha in oil | Spraying is done before the monsoon season begins. |
| Seedling bright | Antracol | 0.2% | Spray once a week using a pump bearing until the leaves mature |
| | Dithane M 45 | 0.2% | |

Source: Penyakit-Penyakit Utama Pokok Getah. (Malaysia Rubber Board, 2010)

❖ Pest Management

Table 1.15: Pest of Tree and Their Control

| No | Type of Pest | Control Measures |
|----|---|---|
| 1 | <p>Termites</p> <ul style="list-style-type: none"> - Termites eat the taproot to the trunk - Makes nest in the trees and eat bark | <ul style="list-style-type: none"> - New control methods had been introduced recently, one which is baiting. The traditional method of inspection once every three months must be implemented. - Practice good sanitation in plantation area. - Destroy early colonies of termites. - Regularly inspect termite tunnels and destroy them. - Dioldrex 15@0.025% = 8 ml + 5 liter water - Aldrex 2@0.05% = 15 ml + 6 liter water - Heptachlor 2E@0.05% = 15 ml + 6 liter water - Chlordane 40@0.1% = 15 ml + 6 liter water - Loosen the soil around the base of the tree; - The trees flushes with 0.5 liters of any of the above mixture in place loosened; - The pesticides will enter the soil under the base of the tree; - The nest must be removed; - The pesticides effects may last for 2 years. |

| No | Type of Pest | Control Measures |
|----|---|--|
| 2 | <p>Barnacles Trees</p> <ul style="list-style-type: none"> - It clings strongly on young stems and branches of young trees - Live in a group of black scales - It lives by sucking plant fluids - If a severe attack, impotence can occur - Severe attack can kill young trees | <p>Controlled by spray pesticides 3 to 4 times as:</p> <ul style="list-style-type: none"> - Shell miscible white oil = 125 ml + 5 liter of water - Mixture of soil + soap = 120 ml + 5 liter of water - Mixture of kerosene + soap can be made by mixing 28 ml of kerosene + 0.5 kg of soap + 4.5 liter of water. <p>100 to 120 liter per ha mixture of pesticides.</p> |
| 3 | <p>Caterpillars</p> <ul style="list-style-type: none"> - There are three (3) types of caterpillars which often attacks the leaves: <ul style="list-style-type: none"> a) <i>Triacola plagiata</i> attacks on the rotation of second and third tough new leaf. b) <i>Adoxophyes privatana</i> attacks the young shoots and stem aged 1 to 4 weeks. c) Other caterpillars (<i>Prodenia litura</i>, <i>Mocis undata</i>, <i>Clania variegata</i>) - The caterpillars attack and eat the new leaf. - They do not eat the leaves that are too mature - The caterpillar also attacks the leaves of leguminous cover crops (LCC). - Some species have larvae that feed on the green stems and cause abrasion. - Sometimes the LCC are rolled | <p>The pest can be controlled by chemical pesticides such as:</p> <ul style="list-style-type: none"> a) Dipterix 95 sp@0.2% = 11 gm + 5 liter of water. b) Seving 85% @0.2% = 10 gm + 5 liter of water <p>55 to 220 liter of pesticide mixture can cover a hectare of the nursery.</p> |

| No | Type of Pest | Control Measures |
|----|--|---|
| | up and eaten from the inside. | |
| 4 | <p>Beetles</p> <p>- <i>Apogonia sp.</i> or local name <i>Kumbang Kaboi</i> attacks the root of trees, especially in the nursery and LCC.</p> | <p>- Trapped with light trap</p> <p>- Pesticides used:</p> <p>a) Heptachlor 2E@0.1% = 30 ml + 6 liter of water.</p> <p>b) Aldrex 2@0.1% = 30 ml + 6 liter of water.</p> <p>- Stump holes at the base of the tree (30 to 45 radius) and pour 1 to 2 liters of the mixture of pesticides into the hole for each tree.</p> |
| | <p>- <i>Epilachna indica</i> also known as <i>Kumbang Kura-Kura</i> among the local population.</p> <p>- <i>Epilachna</i> damage the LCC. Both larvae and beetles consuming the tissue between leaf veins and causing the leaves full of holes.</p> | <p>This beetles can be controlled with Sevin 85% Wp at 100 g + 25 liter of water and 55 to 220 liter of the mixture enough to spray the leaves of attacked plants per hectare</p> |
| 5 | <p>Wild boars</p> <p>There are two types of wild boar:</p> <p>i. <i>Sus scrofa</i></p> <p>ii. <i>Sus barbatus</i></p> <p>Attack young trees aged from 1 to 3 years. The roots are bitten to break and high stumps were bitten in the end of the taproot.</p> | <p>- Install fencing around the plantation area.</p> <p>- Implementation of Wild boar Management issued by the Department of Wildlife and National Parks</p> |
| 6 | <p>Squirrel</p> <p>- <i>Callosciurus notatus</i></p> <p>- <i>Callosciurus caniceps</i></p> | <p>- Can be controlled using fruit trap.</p> <p>- Used baiting</p> |
| 7 | <p>Porcupine</p> <p>- <i>Hystrixbrachyura</i> is known as a pest at the plantation</p> <p>- The body is covered with long</p> | <p>Controlled with orange flesh or forced out from the nest.</p> <p>Porcupine is a protected animal under Wildlife Conservation Act, 2010 (Act 716) and should be handed in to DWNP for further action.</p> |

| No | Type of Pest | Control Measures |
|----|--|---|
| | spines and lives in the holes. - Rodents eat roots and barks of young trees. | |
| 8 | Monkey - The monkeys eating the young shoot and fruits of the trees. - Breaks the branch and bitten the barks. | Can be controlled using trap. |
| 9 | Tapir and Sun bear | - Install fence around the plantation area and trench. - Make report to DWNP for translocation or further action. |
| 10 | Slugs/ Snails | - Bait with metaldehyde if the population is high. - Collect and destroy slugs/snails in nurseries. - Reduce growth of cover crops during wet season. |

vii. Manuring

Fertilizer is applied during these stages of tree growing:

- Nursery seedlings (ground and polybag seedlings)
- Immature plants from fields transplanting;
- Mature trees.

During the immature stage, compound and mixture fertilizer is used as it can improve the efficiency of nutrient uptake and minimize nutrient losses, particularly in the sandy and hilly areas. To further improve the fertilizer application, timing of application should be properly determined.

Application during too wet or too dry condition should be avoided. The best time for fertilizer application was during sprouting until the next 5 months. The nitrogen absorption was expected to be high within the month of January until July. Application in October, November and December are not recommended. The recommended manuring is as shown in **Table 1.16**. The fertilizer contains of N and K component.

Table 1.16: Field Fertilizer Application Program

| Time of Application | | Type of Fertilizer and Rate (g/tree) | Method of Application |
|--|----------|--|---|
| 1 st year | 0 | 75g Christmas Island Rock Phosphate (CIRP) | Sprinkle in planting hole and cover by loose soil |
| | 6 month | 200g of 8:4:4:2*:3(%CaO) + TE | Ring applied evenly about 20 cm from plant base |
| | 12 month | Repeat | |
| 2 nd year | 6 month | 200g of Phosphate rock (PR) + 200g 12:12:17:2 + TE | Ring applied evenly about 40 cm from plant base |
| | 12 month | Repeat | |
| 3 rd year | 6 month | 300g of Phosphate rock (PR) + 500g 12:12:17:2 + TE | Ring applied evenly about 80 cm from plant base |
| | 12 month | Repeat | |
| 4 th year and above repeat as the 3 rd year with additional of 500g of PR during alternate years | | | |

*Ratio of N: P: K: Mg

Source: *Manual of Forest Establishment and Silvicultural Treatment for Degraded Natural Forest.2003.*

1.5.3.2 Harvesting (During Harvesting Activities)

After 10 years of planting, it is expected that the trees will reach maturity and ready to be harvested. At this stage, timber harvesting activities will be conducted.

1.6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The Environmental Management Plan consists of a comprehensive set of integrated approaches and procedures to be implemented by the contractor during the pre-construction, construction, commissioning and operation phase of the project development. It includes detailed accounts and methods to prevent, manage, mitigate, conserve and rehabilitate all environmental impacts associated with the project development. The EMP also outlines all relevant rules and regulations stipulated in the Environmental Quality Act 1974 including the time frame for the environmental monitoring, auditing and reporting for submission to the relevant authorities such as DOE. The EMP had been prepared by **Wiranda (M) Sdn Bhd** as per request by the project proponent.

1.6.1 Objectives of EMP

This EMP has been designed to ensure appropriate measures are taken to handle issues that have been identified as significant and that are most likely to arise. The implementation of this plan will facilitate effective management issues pertaining to control soil erosion and discharge of silt into watercourses particularly during the land clearing and earthworks. The plan calls for systematic monitoring of water quality, the control of the quality of discharge silt and control mechanisms, and ambient air quality and noise level monitoring at nearest receptors. The data shall be analyzed and interpreted to present the environmental impact and compliance with the respective law and regulations.

1.6.2 Scope of the EMP

A comprehensive environmental management plan that form the basis for the implementation of environmental mitigation measures, environmental monitoring and environmental auditing of the project which includes the followings:-

- To submit the Environmental Management Plan together with all necessary documentations to Department of Environmental Pahang.
- To ensure works are carried out in compliance with environmental standard and guidelines, legislatives requirements. Limit value and other relevant conditions related to the Environmental Quality Act 1974 in the implementation project.

- To comply with all the condition as stipulated under the Environmental Impact Assessment (EIA) approval conditions during development.
- To set out various environmental protection/conservation measures that conform to the environmental conditions recommended by relevant authorities.
- To specify a detailed environment monitoring and auditing programmed to ensure works carried out in accordance with the related requirements throughout the duration of the project.
- To streamline the different function and various sections and authorities related to the environmental matters during the development phase