Asrama Raya Sdn Bhd

(ARSB)

Environmental

Monitoring

Report

2025

December 2025

	ASRAMA RAYA SDN BHD
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	ENVIRONMENTAL MONITORING REPORT

1. MONITORING OF VULNERABLE AND STEEP AREAS AND ENCROACHMENT IN THE CONCESSION

Monitoring activities for vulnerable and steep areas within the ARSB HS Petuang concession are carried out through the following approaches:

i. Topographic Mapping

- Satellite imagery and digital topographic maps (**Figure 1 and Figure 2**) are utilized to assess the topography and land conditions of the concession area.
  - Refer Monitoring of Protected Area through Satellite Image File.

- Prior to any harvesting operations, Forest Manager examined the maps to identify sensitive areas, particularly steep slopes exceeding 40 degrees. These areas are strictly avoided for forest road construction and harvesting activities.

- Based on the periodic reviews of satellite images and digital maps, **no unusual land cover changes or patterns** detected which indicate no illegal encroachment or unauthorized land use within the concession area.

ii. Field examination

- ARSB also collaborates with the Terengganu State Forestry Department (TSFD) to carry out field inspections and ground-based observations of vulnerable soil conditions and steep terrain.

- The Forest Manager monitored the construction of forest roads and all harvesting operations (Figure 5).
  - All of the forest operation activities were **not conducted on sensitive or steep slopes of more than 40 degrees and steep areas at elevations greater than 1,000 m above sea level (a.s.l**).
  - All the forest operation activities were conducted and compliance with the Garis Panduan Jalan Hutan 2024 and Guidelines for Reduced Impact Logging in Peninsular Malaysia (Revised 2020) from Forestry Department Peninsular Malaysia (FDPM).
  - Field visits are also detected that is **no signs of encroachment**, such as illegal land clearing, farming, or unauthorized settlements.

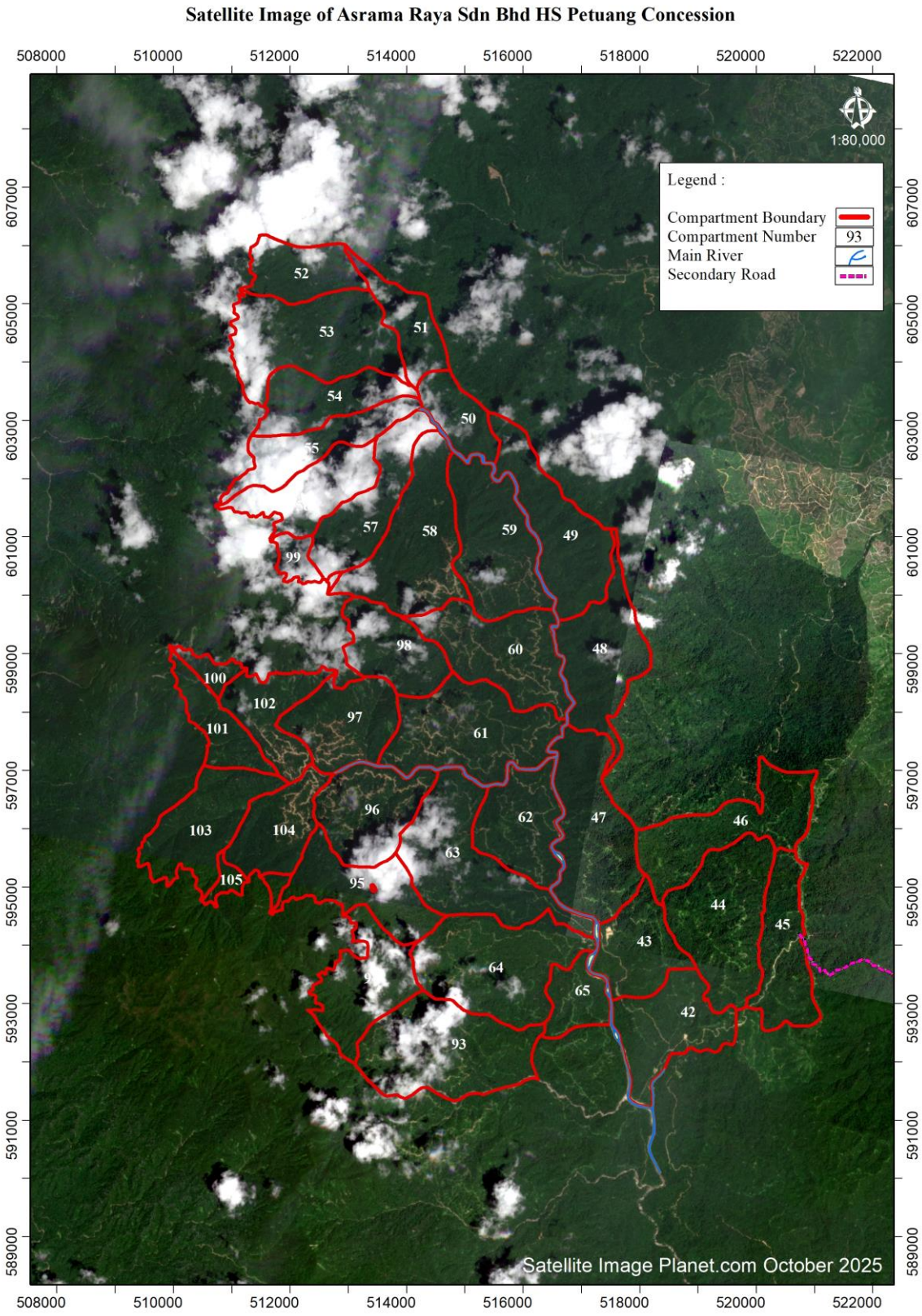


Figure 1. The satellite image of the 10,000 ha of ARSB HS Petuang concession in October 2025. *Note: Map is not being to scale.

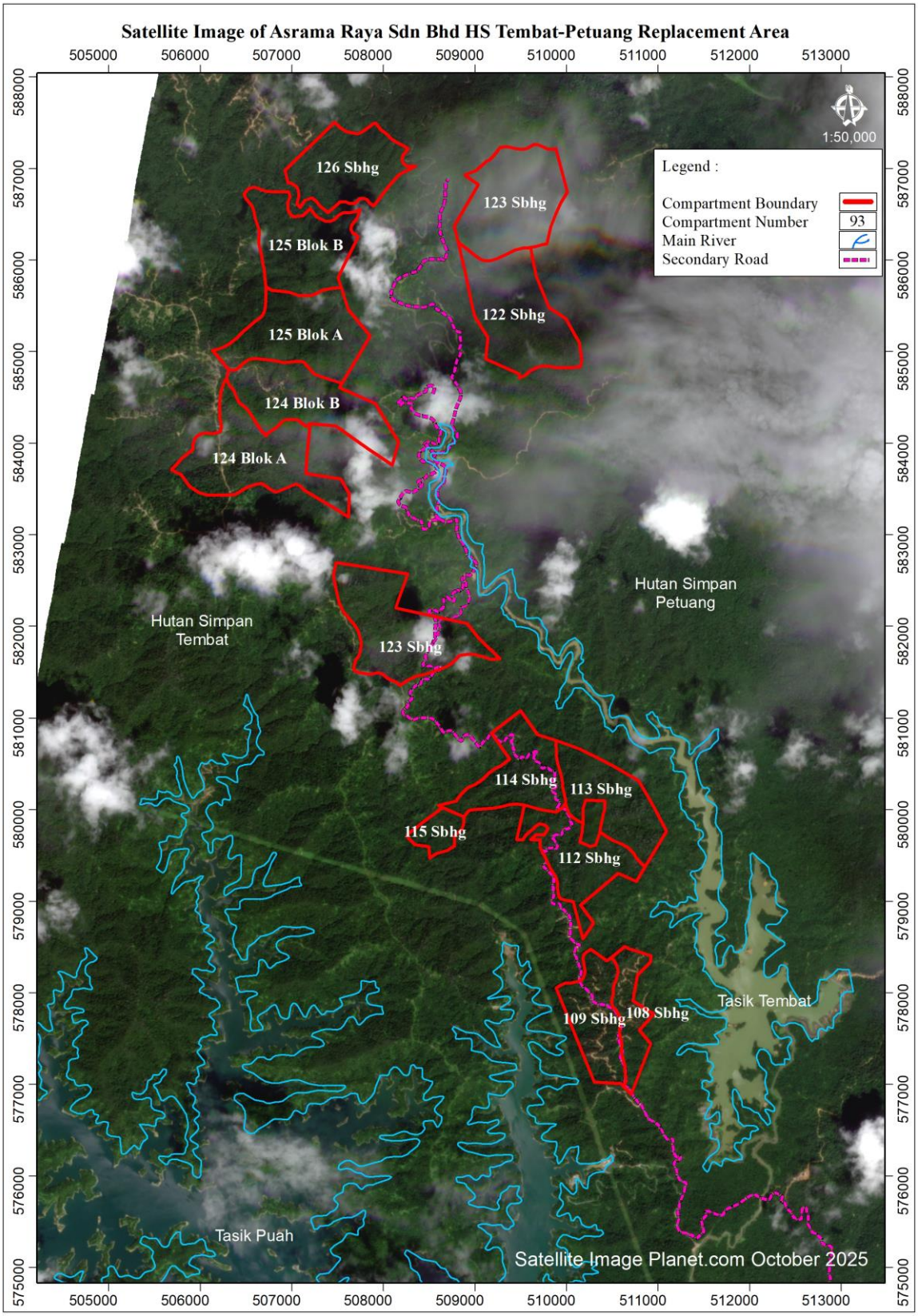


Figure 2. The satellite image of ARSB HS Tembat-Petuang Replacement Area in October 2025. *Note: Map is not being to scale.

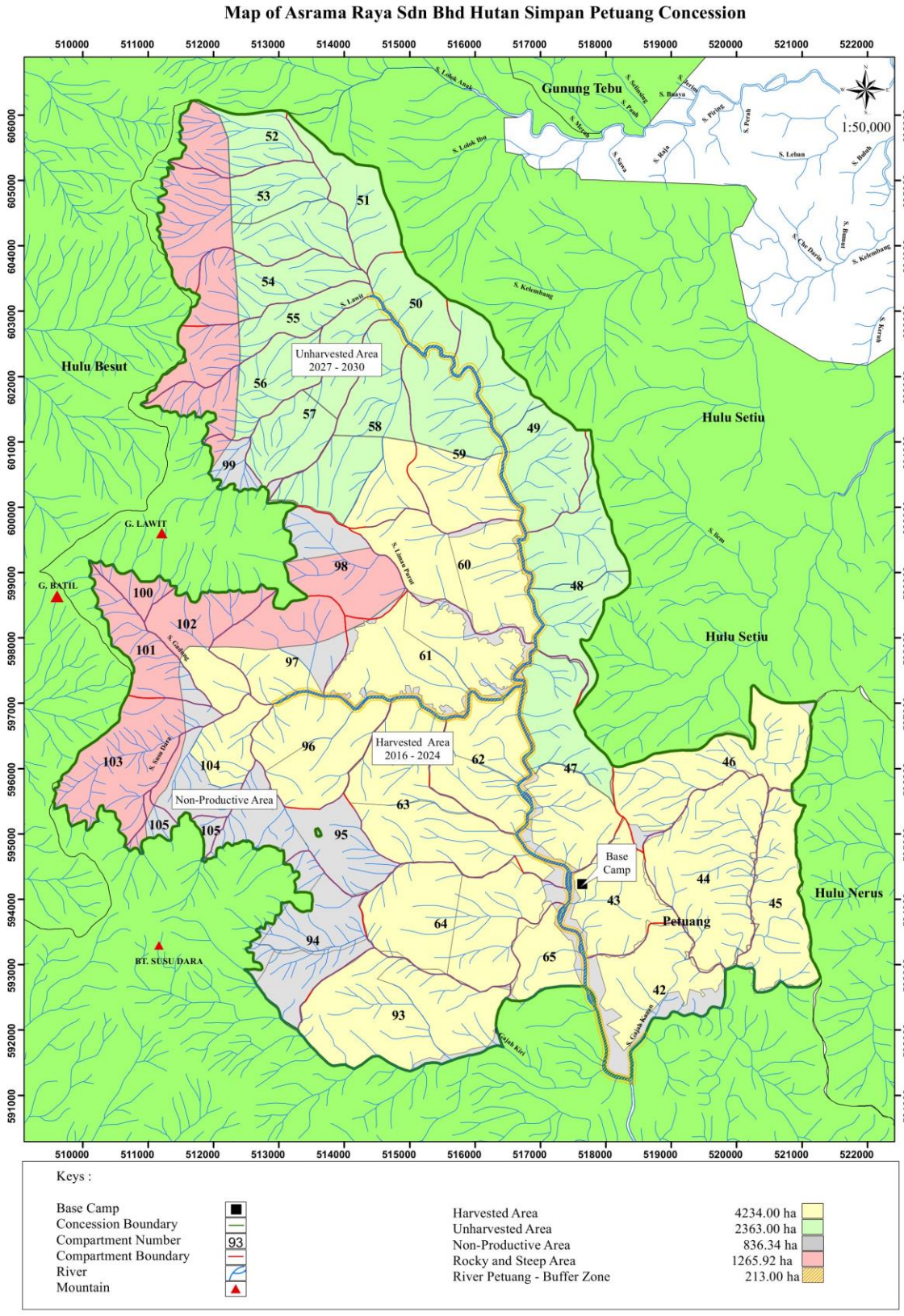


Figure 3. Map of ARSB HS Petuang concession. *Note: Map is not being to scale.

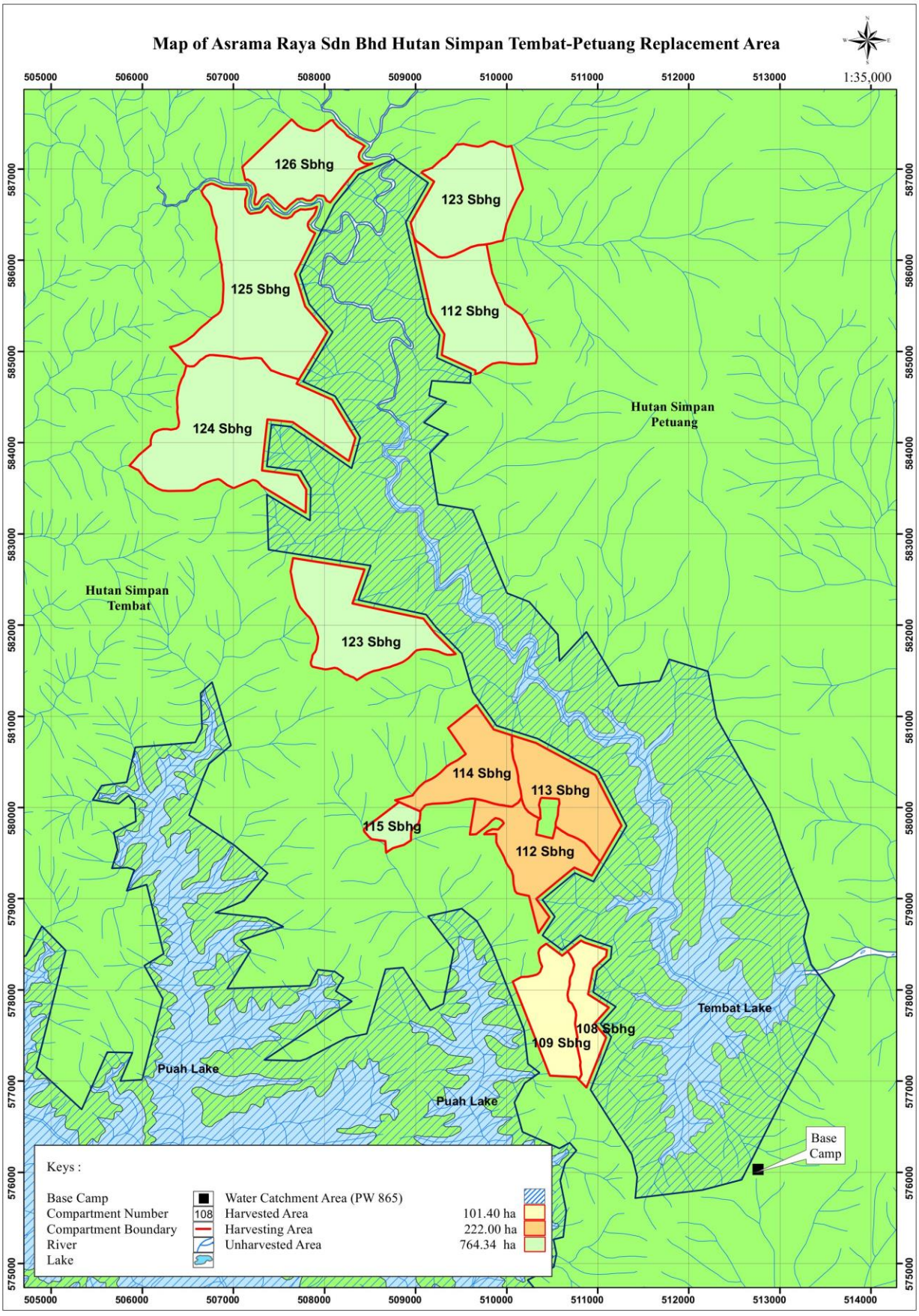


Figure 4. Map of ARSB HS Tembat-Petuang Replacement Area. *Note: Map is not to scale.

Figure 5. Forest manager is monitoring the forest harvesting activities.

2. LOGGING BASE CAMP AND LOGGING WORKSHOP MONITORING

- Forest manager and forest supervisor monitored the cleanness and conditions of the logging base camp and logging workshop to ensure they are well maintained.

  Observation and monitoring record

  - The logging base camp and logging workshop were clean and well maintained (Figure 6 and 7).
  - All the hazardous substances for forest harvesting operations were handled, stored and disposed based on the standard of procedure (SOP).
  - The conditions and usage of fuel tank and lubricant oil were recorded and under controlled condition.
  - All the wastes and scheduled wastes were taken out from ARSB HS Petuang concession / forest for disposing.

Figure 6. Logging camp of ARSB HS Tembat-Petuang Replacement Area is clean and well maintained.

Figure 7. Scheduled waste - used engine oil was properly stored in of ARSB HS Tembat-Petuang Replacement Area.

3. WATERCOURSE AND WATER QUALITY MONITORING

- Forest manager monitored the buffer zones of watercourse and identified watercourses which needed for protection.
  Observation and monitoring record
  - The trees located along the border of buffer zones are not harvested.
  - The trees located along the are painted with one (1) yellow ring at not more than 10 meter intervals.
- Forest manager and forest supervisor always monitor and ensure all the buffer zones of watercourse are established in accordance with the FDPM standard and Garis Panduan Jalan Hutan 2024.

- ARSB also monitored water quality of river in ARSB HS Petuang concession once per year.
  Observation and monitoring record
  - Most of the rivers in ARSB HS Petuang concession are clean and river shows greenish colours (Figure 8).

Figure 8. The river at ARSB HS Tembat-Petuang Replacement Area appears greenish in colour.

Water Quality Monitoring Record

ARSB used topographic maps and digital topographic data to identify the watercourse areas within ARSB HS Tembat-Petuang Replacement Area. AutoCAD and ArcGIS software were used to determine the watercourse areas and river length. ARSB was required to establish buffer zones to the watercourse based on the width of watercourse specified by Forestry Department Peninsular Malaysia (FDPM, 2024).

A total of five water sampling stations were selected in June 2025. Water sampling was only conducted once in each point as we only want to determine the water quality status of Tembat River before forest harvesting. Two stations were conducted at Compartment 114, while another two stations are conducted at Compartments 123 and 124. (Table 1).

Table 1. Location of water sampling stations in 2025.

Station	Compt.	GPS Coordinates
S1	123	N : 582671 , E : 509159
S2	124	N : 583635 , E : 508557
S3	114	N : 580030 , E : 510071
S4	114	N : 580523 , E : 509908

In situ measurement was conducted for temperature, pH and dissolved oxygen (DO) and turbidity. Temperature and pH were measured using Horiba LAQUA pH210 pH/ temperature meter, dissolved oxygen (DO) was measured using YSI 550A dissolved oxygen instrument and turbidity was measured using Eutech Tn100 turbidity meter. Water for total suspended solid (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and ammoniacal nitrogen (NH_3-N) analysis was collected using plastic bottle. All samples were preserved using ice (<4 °C) before being taken to the laboratory for analysis.

Figure 9. Horiba LAQUA pH210 pH/ temperature meter was used for measuring pH and temperature directly at site.

Figure 10. YSI 550A dissolved oxygen instrument was used for measuring dissolved oxygen directly at site.

Figure 11. Eutech Tn100 turbidity meter was used for measuring turbidity at site.

Water Quality Monitoring Result

Result of water quality parameters (DO, BOD, COD, NH3-N, TSS, pH and turbidity) measured at ARSB HS Tembat-Petuang Replacement Area shown in Table 2. Dissolved oxygen (DO) measures the amount of oxygen dissolved in the water. It is a vital indicator in supporting aquatic life as aquatic organisms need oxygen to survive in the river. Lowest DO value obtained was 5.24 mg/L recorded at S3, highest DO value was 7.57 mg/L recorded at S2 (Table 2). The DO value which is above 7 mg/l showed that the rivers are categorized as healthy river with good water flow (Ibrahim & Kutty, 2013). The DO for Station 2 was fell within the Class I category of the National Water Quality Standards (NWQS), Malaysia. For Station 1, 3 and 4, the DO was fell within the Class II category. The water temperature obtained recorded that the minimum value of temperature was 24°C and maximum value was 28°C. The water temperature levels for all stations were within the normal temperature value for river water. Increases of the river temperature also can cause problems to sensitive organisms as the oxygen demand increased which in turn lowered the oxygen saturation and increase the toxicity of river with harmful materials and effect the aquatic life (Chapman,1996). However, the correlation analysis in this water sampling has indicate temperature has no correlation with dissolve oxygen ($r = 0.37$).

The pH value for all the stations ranged from 5.8 to 7.20. The pH recorded for Station 1 was 7.20 which is neutral and fell within Class I category of the NWQS, Malaysia. However, the pH for Station 2, 3 and 4 were fell within Class II category of the NWQS, Malaysia. The pH in the river effect types of organisms can live in the river, water in neutral pH is optimal for most organisms (Murdock et al., 2001).

Biochemical oxygen demand (BOD) measures the amount of oxygen used by microorganisms in decomposing organic matter in the water. The BOD values for all sampling stations were fell within Class I category of the NWQS, Malaysia. Low BOD values indicate that the water is uncontaminated with microbes as when there are low levels of organic waste in the water, there are fewer bacteria present (Giller & Malmqvist, 1998).

Chemical Oxygen Demand (COD) refers to the amount of oxygen required for the oxidation of a compound material (Nurain & Ang 2015). All COD values from the sampling stations fall within Class I according to NWQS, indicating COD concentrations are consistently below 10 mg/L, the threshold defining Class I status. This classification reflects excellent water quality, suitable for the conservation of sensitive aquatic species and minimal treatment if used for human consumption. The relatively low COD levels suggest that limited inputs of organic pollutants, such as domestic waste or logging residues into the river. This condition is indicative of a largely undisturbed, virgin forest ecosystem with intact riparian zones that function effectively as natural filters, intercepting and decomposing organic matter before it enters the river system (Mamun & Zainudin, 2013).

Total suspended solids (TSS) refer to small solid particles which remain in suspension in water as a colloid or due to the motion of the water. TSS for all eight stations were < 2 mg/L which show that low suspended solid in the river water. TSS for four rivers were categorized under Class I water category of the NWQS, Malaysia.

Ammoniacal nitrogen is a measure for the amount of ammonia in the water which associated with pollution compound of animal and human waste, domestic waste and cleaning agents (Ahmad et al., 2015). Ammoniacal nitrogen level in all rivers was below 0.2 mg/L. The

ammoniacal nitrogen presented in four rivers were fell within Class II water category of the NWQS, Malaysia. At all events, higher NH3-N values can be toxic to fish, but in small concentrations, it could serve as nutrients for excessive growth of algae (Corwin et al., 1990).

The values of turbidity were ranging from 4.7 to 6.2 mg/L. The turbidity values obtained for all the four stations were classified as Class II water category of the NWQS, Malaysia. The turbidity of the water could be due to the suspended solids or particles from the soil transported through surface run-off from the watershed (Mohd-Asharuddin et al., 2016). Turbidity of water is highly dependent on seasonal variations specially raining season (Yisa & Jimoh, 2010).

Malaysian's water quality index (WQI) formula was used to calculate the subindex six water parameters (DO, BOD, COD, NH3-N, TSS and pH) as shown in Table 3. Based on Malaysian WQI formula, all the four stations showed high water quality index (WQI), ranged from 90 to 94 (Table 3). All these rivers were classified as Class I with status as clean river. Sg. Petuang is classified as very clean and can be used for conservation of natural environment. The rivers are very sensitive for aquatic species and practically no treatment is needed for the water.

Table 2. Result of water quality parameter measured for the water sampling stations conducted in ARSB HS Tembat-Petuang Replacement Area (June 2025).

Sampling station	Compt.	Temp (°C)	DO (mg/L)	DO (%)	BOD (mg/L)	COD (mg/L)	NH3-N (mg/L)	TSS (NTU)	pH	Turbidity (NTU)
S1	123	28	6.82	86.3	0.90	4.00	0.19	1.90	7.20	4.70
S2	124	25	7.57	90.1	0.90	3.90	0.19	1.90	6.90	6.20
S3	114	24	5.24	60.9	0.90	3.90	0.19	1.90	6.00	6.20
S4	114	24	6.60	76.7	0.90	3.90	0.19	1.90	5.80	5.80

Table 3. Subindex and water quality index (WQI) for four water sampling stations in conducted in June 2025.

Station	siDO	siBOD	siCOD	siNH3-N	siTSS	sipH	WQI	Class
S1	95	97	94	81	96	99	93	I
S2	97	97	94	81	96	99	94	I
S3	100	97	94	81	96	91	94	I
S4	86	97	94	81	96	88	90	I

4. PLANT MONITORING

- Forest manager conducted the plants / trees monitoring and make sure all the protected tree species, rare and endangered tree species, mother trees are not harvested.

Permanent Sample Plot (PSP)

In order to manage ARSB HS Tembat-Petuang Replacement Area efficiently, the forest growth dynamics must be studied, eg. how the trees grow and stands change over times. A precise method to determine the tree growth and yield is through Permanent Sample Plot (PSP). The growth of tree stand can be estimated by taking measurements of the same trees after several years. Each selected tree was properly tagged with species identification and plot numbers. The PSP trees were also marked with a red paint ring at breast height, and their diameters were recorded using a diameter tape at the point of the marking.

ARSB has established two PSPs within the ARSB HS Tembat-Petuang Replacement Area, one in compartment 108 and another in compartment 109 (Figure 12). Each PSP covers an area of approximately 1 ha. The PSP in compartment 108 was established on 22 June 2025, with diameter remeasurements conducted after three years, in 2028. A second PSP was established in compartment 109 on 25 June 2025. ARSB plans to establish a total of ten PSPs throughout the Forest Management Unit (FMU) in the coming years.

Each PSP consists of a 100 m x 100 m plot size (Figure 13). All mature trees with a diameter at breast height (DBH) larger than 15 cm were measured within every 20 m x 20 m subplot. The small trees, saplings and seedlings were only measured in plot 1, 7, 13, 19 and 25. Seedlings ranging from 0.15 m to 1.5 m in height were measured within 2 m x 2 m quadrats. Saplings with a height of more than 1.5 m but less than 5 cm DBH were assessed in 5 m x 5 m plots. Trees with a DBH between 5 cm and 15 cm were measured in 10 m x 10 m plots.

All PSP trees were systematically tagged with species names and their corresponding diameter measurements (Figure 14). The PSP trees were painted with one (1) red ring and labelled with the numbering and plot number. The diameter at breast height (DBH) of all tagged trees was recorded for further analysis. Additionally, species composition was documented by distinguishing between dipterocarp and non-dipterocarp species. Data collection is conducted every three years to monitor tree growth and to calculate the Mean Annual Increment (MAI), which serves as an important indicator of forest productivity.

PSP monitoring record

- The tree DBH and stand volume were recorded and calculated.
- The PSP were monitored annually and the measurement of tree growth will be conducted after 3 years.
- **Refer permanent sample plot (PSP) data for PSP monitoring records.**

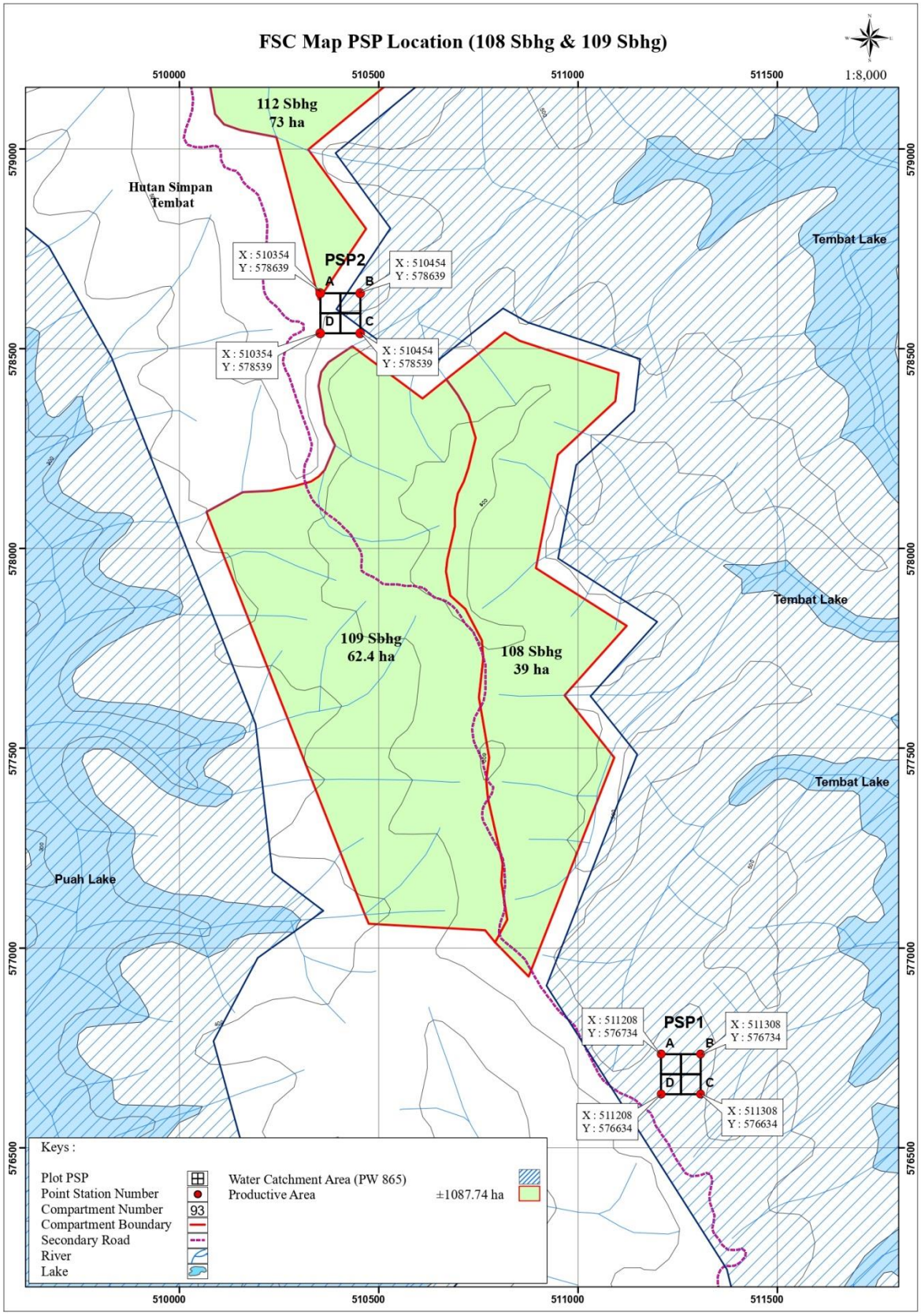
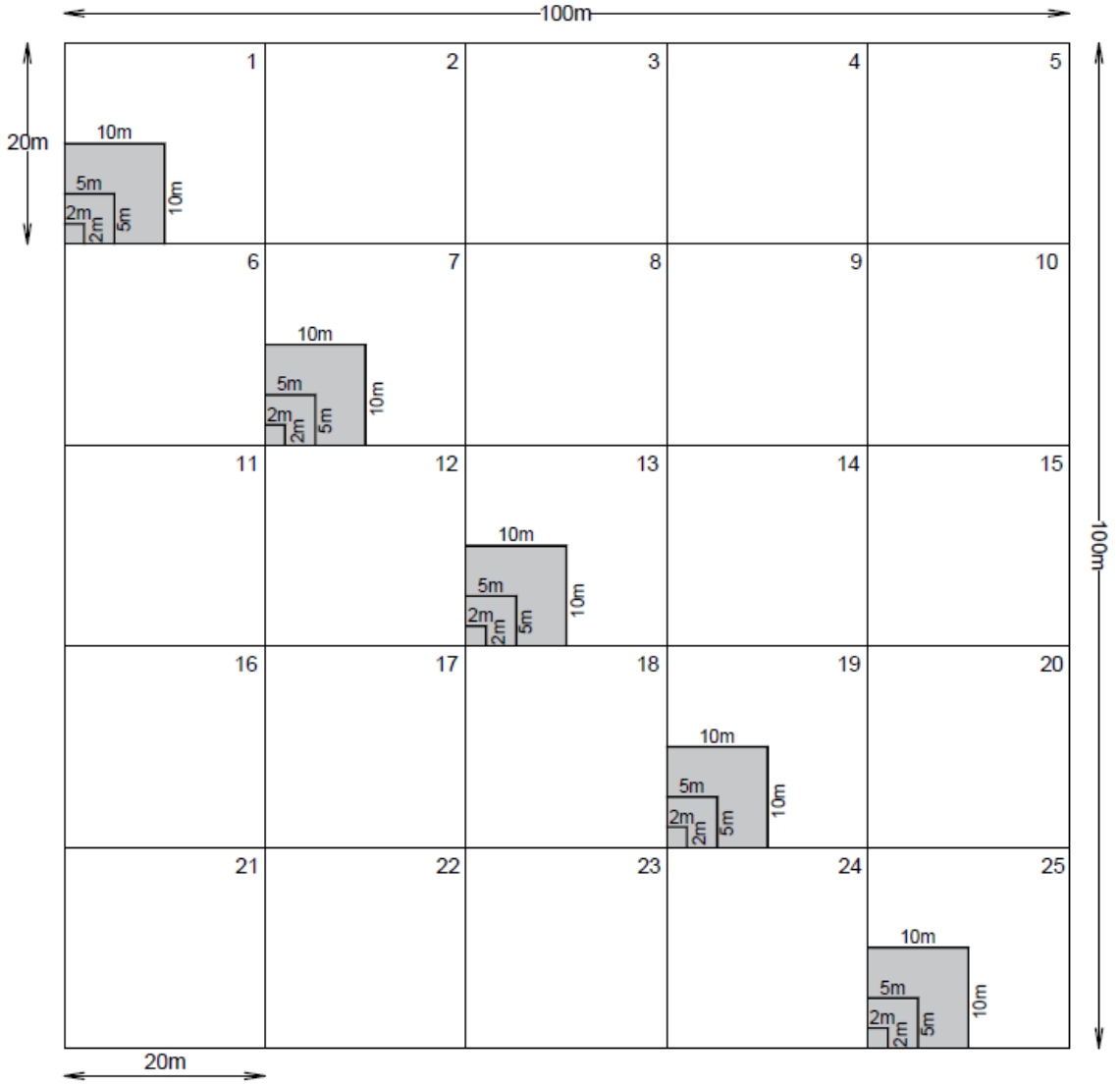


Figure 12. Map of PSP set up in compartment 108 & 109 of ARSB HS Tembat-Petuang Replacement Area. *Note: Map is not to scale.



Petak 2m x 2m (Banci anak pokok 15cm tinggi - 1.5 meter tinggi)
Petak 5m x 5m (Banci anak pokok 1.5 meter tinggi - 5cm diameter)
Petak 10m x 10m (Banci pokok jaras kecil 5cm diameter - 15cm diameter)
Petak 20m x 20m (Banci pokok jaras besar, pokok kecil dan pokok besar 30cm perepang keatas)

Figure 13. Set up plot of PSP with 100 m x 100 m plot size.

Figure 14. PSP setup and tree inventory

5. WILDLIFE MONITORING

- ARSB regular monitor ARSB HS Petuang concession from encroachment, illegal activities and hunting.

- ARSB engaged with local community of Kg. Petuang and TSFD for helping in monitoring ARSB HS Petuang concession from encroachment and hunting.

- ARSB conducted periodic monitoring of wildlife.
  I. Monitored the occurrence of animals through camera trapping.
     - **Refer camera trapping data and results for monitoring results.**

  II. Monitored the occurrence of animals through opportunistic sightings.
     - **Refer opportunistic sightings data for monitoring results.**

Figure 15. Forest supervisor/ 'Kepala Hutan' set up the camera trap by mounting up the camera at the tree.

Table 4. List of wildlife found in ARSB HS Petuang concession and ARSB HS Petuang concession based on camera trap result in 2025.

No.	Common name	Species name	IUCN
1	Malayan tapir	*Tapirus indicus*	Endangered
2	Southern pig-tailed macaque	*Macaca nemestrina*	Vulnerable
3	Horse-tailed squirrel	*Sundasciurus hippurus*	Near Threatened
4	Banded Linsang	*Prionodon linsang*	Least Concern
5	Barking deer	*Muntiacus muntjak*	Least Concern
6	Lesser mouse-deer	*Tragulus kanchil*	Least Concern
7	Malayan civet	*Viverra tangalunga*	Least Concern
8	Malaysian wood rat	*Rattus tiomanicus*	Least Concern
9	Malaysian wood rat	*Rattus tiomanicus*	Least Concern
10	Plantain squirrel	*Callosciurus notatus*	Least Concern
11	Wild boar	*Sus scrofa*	Least Concern

Table 5. List of wildlife found in ARSB HS Petuang concession and ARSB HS Tembat-Petuang Replacement Area based on camera trap result in 2025.

No.	Common name	Species name	IUCN
1	Asian elephant	*Elephas maximus*	Endangered
2	Malayan tapir	*Tapirus indicus*	Endangered
3	Binturong	*Arctictis binturong*	Vulnerable
4	Sun bear	*Helarctos malayanus*	Vulnerable
5	Horse-tailed squirrel	*Sundasciurus hippurus*	Near Threatened
6	Banded Linsang	*Prionodon linsang*	Least Concern
7	Barking deer	*Muntiacus muntjak*	Least Concern
8	Common palm civet	*Paradoxurus hermaphroditus*	Least Concern
9	Malayan civet	*Viverra tangalunga*	Least Concern
10	Malaysian wood rat	*Rattus tiomanicus*	Least Concern
11	Plantain squirrel	*Callosciurus notatus*	Least Concern
12	Wild boar	*Sus scrofa*	Least Concern

- Refer camera trapping data for more details.
- The camera trapping did not record any wildlife habitat and pattern of wildlife distribution or diversity in ARSB HS Petuang concession.

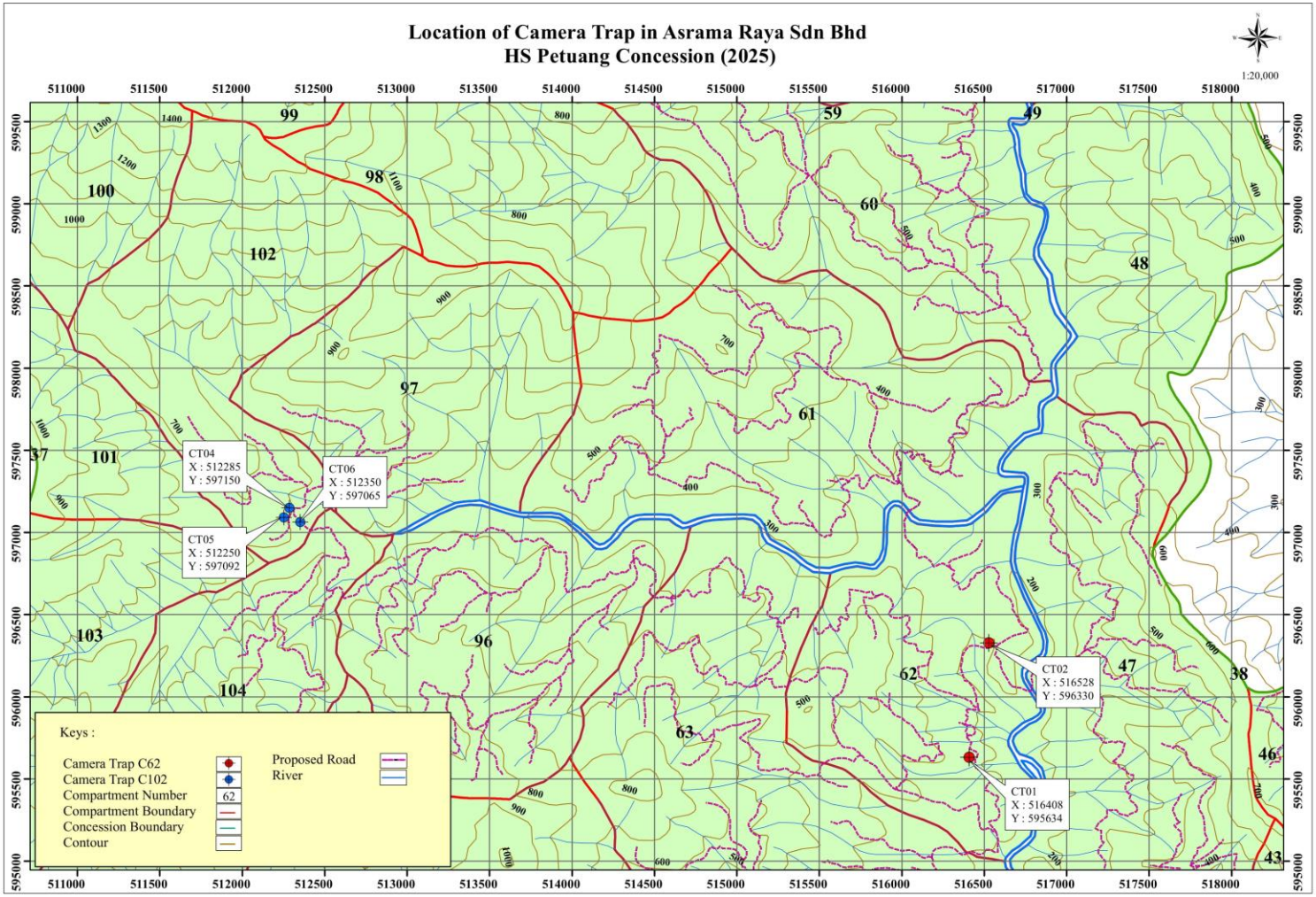


Figure 16. Location of camera traps in ARSB HS Petuang concession in March and April 2025. *Note: Map is not being to scale.

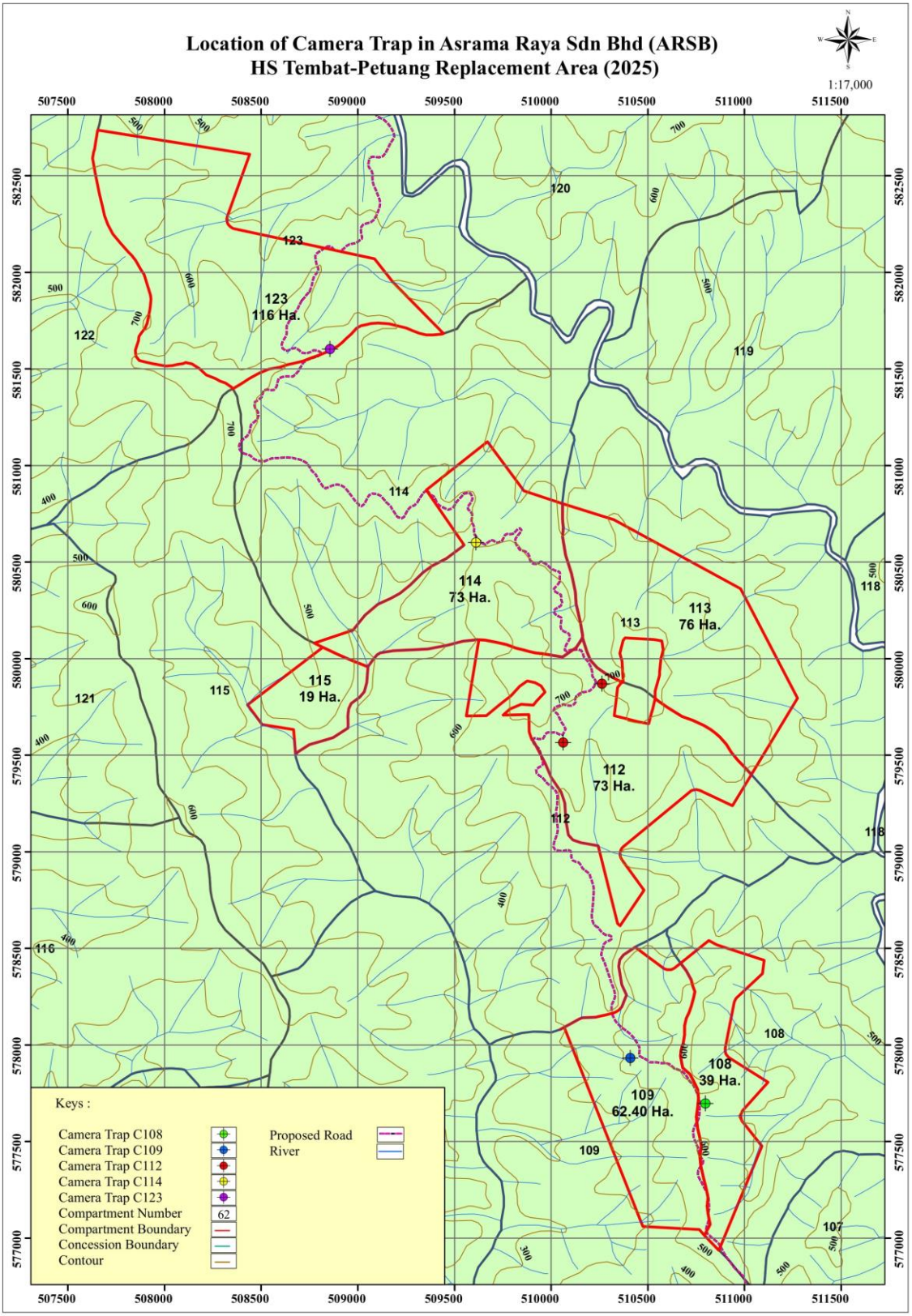


Figure 17. Location of camera traps in ARSB HS Tembat-Petuang Replacement Area in June to October 2025. *Note: Map is not being to scale.

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Appendix 1. Environmental Risk Matrix for 2025

Potential Significant Environment Impacts	Mitigation Measures	Actions taken
Soil erosion and surface runoff	– Erosion is controlled through RIL method. – Logfisher is used for pulling logs from deep ravine to reduce soil damage. – None of the forest operations activities will be conducted at the areas at elevations more than 40 degree.	– Monitored road construction and harvesting activities.
Subsequent sediments pollution in river	– Mark buffer zones along large river and streams to reduce the suspended sediments directly entering the streams.	– Monitored buffer zones and identified watercourses needed for protection on map and field. – Monitored water quality
Increased Access to the Forest Concession by Hunter or Poacher	– Control of access by constructing boom gate – Engage with local community of Kg. Petuang and forest ranger (TSFD) for helping in monitoring of ARSB HS Petuang concession from encroachment and hunting.	– Boom gate constructed at the main entrance of ARSB HS Petuang and HS Tembat-Petuang Replacement Area. – Local community report the illegal activity and submit the form 'Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB (Kg. Payong)' to Forest Manager. – Forest worker report the illegal activity case and submit the form 'Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam

		Konsesi ARSB' to '*Kepala Hutan*'.
Health Problems and Contagious Diseases among Forest Workers and Local Community	– Proper management and maintenance of logging camp, workshop and store.	– Monitored logging camp and waste. – Recorded usage of fuel and lubricants oil. – Recorded collection and disposal of scheduled waste.
Reduction of flora diversity in the forest Changes in Forest Canopy Structure	– Practice selective logging under RIL methods. – Not conduct clear-cutting. – Not harvest seed trees and the protected trees species listed by TFSD.	– Conducted RIL. – Conducted selective cutting tree. – Recorded tree species and PSP data.
Loss of shelter and food supply for animals Changes in animal species composition	– Do not permit any hunting and poaching of wildlife. – Any trees with bird nests would not be disturbed and harvested.	– Monitored wildlife through camera trapping and opportunistic sighting.