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## Reduced-Impact Logging Guidelines for Lowland and Hill Dipterocarp Forests in Indonesia

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# **REDUCED-IMPACT LOGGING GUIDELINES FOR LOWLAND AND HILL DIPTEROCARP FORESTS IN INDONESIA**

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## **Executive Summary**

*This report describes Reduced-Impact Logging (RIL) which will be implemented in the lowland and hill dipterocarp forests of the Bulungan Model Forest project in East Kalimantan, Indonesia. It is anticipated that through the implementation and supervision of the RIL practices described in this document, the timber concession operators (INHUTANI II) can expect to: reduce disturbances to soil and residual vegetation by at least 50% in comparison with conventional logging operations where these guidelines are not applied; limit overall direct impacts to the forest to < 25%; conserve wildlife and other forest resources, including non timber forest products (NTFPs), threatened and endangered species, keystone plant resources, and water; diminish direct logging costs by at least 15%; and protect the long-term integrity and value of the permanent forest estate.*

## **INTRODUCTION**

International awareness of escalating deforestation rates has caused many tropical countries, including Indonesia, to give priority to the attainment of the International Tropical Timber Organisations (ITTO's) year 2000 objective to bring the forest estate under sustainable management. Progress towards sustainable forest management will promote the implementation of reduced-impact logging (RIL) techniques, which aim to reduce soil disturbance, impacts on wildlife, and damage to residual trees. RIL has been recently implemented and tested in various tropical regions, particularly Southeast Asia (Sabah: Pinard and Putz 1996; East Kalimantan: Bertault and Sist 1995, 1997; Sist *et al.* 1998).

In Indonesia, forest management and harvesting operations are regulated under the Tebang Pilih Tanam Indonesia (TPTI) selective logging system (Armitage and Kuswanda 1989). This system allows for all commercial trees > 50-60 cm dbh (the minimum harvest diameter depends on the type of production forest, see glossary) to be removed within a felling cycle of 35 years. RIL practices are recommended under the TPTI; however, these are seldom applied in the field for numerous reasons, including: 1) lack of control over harvesting practices; 2) limited specificity in how to conduct RIL measures; and 3) high financial costs of RIL if combined with enrichment planting.

The RIL guidelines proposed in this document expand upon those outlined in the FAO's Model Code of Forest Harvesting Practices (Dykstra and Heinrich 1996), the RIL specifications developed for the INNO-

PRISE concession in Sabah (Pinard *et al.* 1995), and are in accordance with TPTI regulations. They will be tested in the Bulungan Research Forest (Sist 1997; Wollenberg and Sist 1997) in an effort to refine the methods and establish their costs, at a concession scale. These procedures are general by necessity, and will have to be adapted to local concession conditions if RIL is to be successfully implemented.

## **1. HARVESTING PLANS**

The success of RIL in significantly reducing logging damage on forest ecosystems cannot be achieved without the planning of harvesting operations. Harvesting plans must be included in a broader forest management plan, which is a long term (> 20 years) land use plan designed to ensure sustainable management of the forest resource. The harvest planning process takes into account the ecological, environmental, and socio-economic features of the concession, and are of two types: strategic (Figure 1) and tactical (Figure 2.)

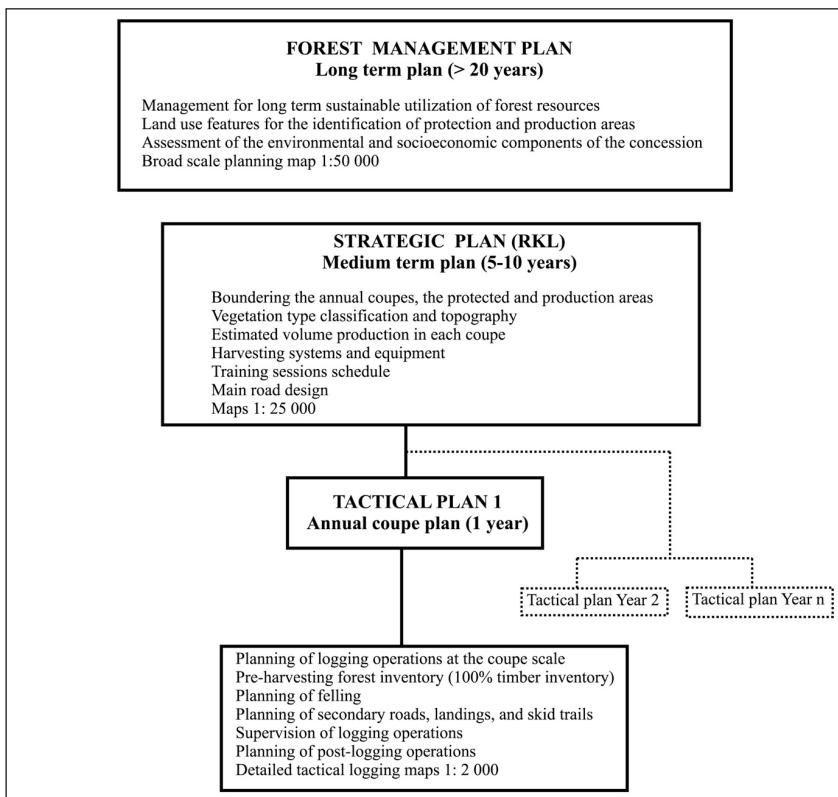
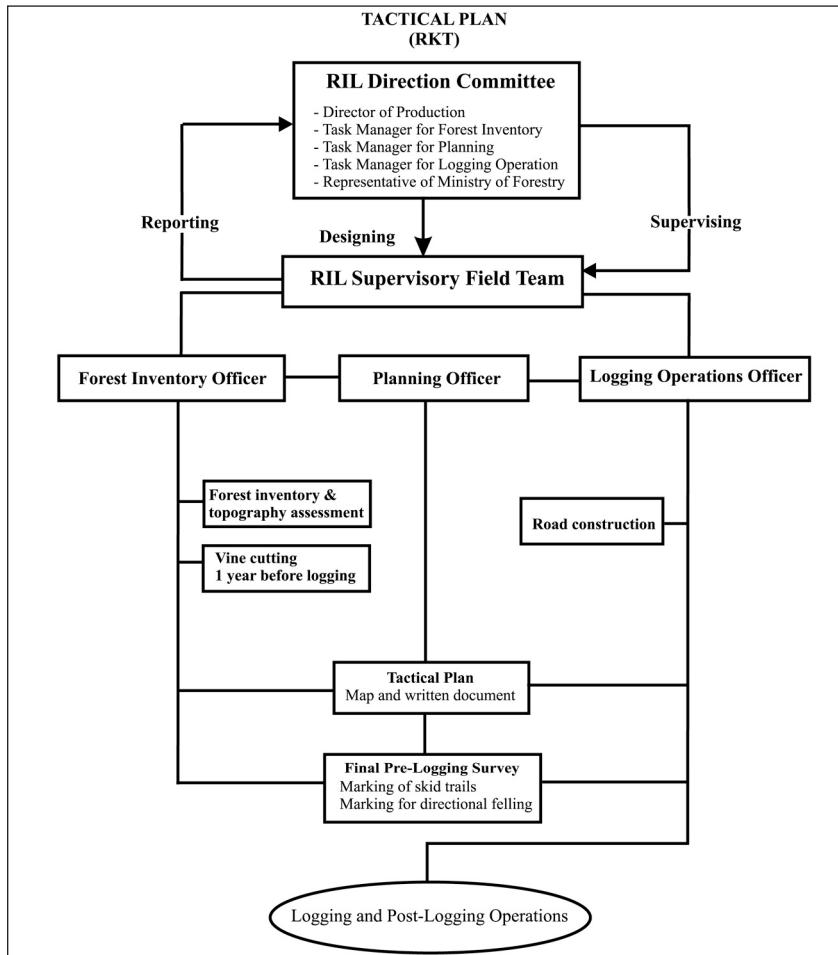
### **1. 1. Strategic plan**

Strategic harvesting plans are components of the forest management planning process, and should be designed by an interdisciplinary planning team including foresters, ecologists, logging specialists, engineers, wildlife biologists, and experts in social science. Strategic plans are medium term plans which, under TPTI regulations, are for a 5-year period and are called Rencana Kerja Lima tahun (RKL). In other countries, strategic plans may be for longer periods (10-20 years). The strategic plan provides the following information in written documents and 1:25 000 scale maps:

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**Figure 1:** Forest management and harvesting plans**Figure 2:** Tactical plan operations sequences

- vegetation types of the area covered by the plan;
- areas selected for timber harvesting and areas to be excluded from silvicultural activities;
- approximate boundaries and size of the annual coupes;
- estimated standing and harvestable volume in each coupe;
- approximate road location for main transportation routes;
- extraction techniques to be used; and
- special conservation measures to be applied.

One important task of the strategic plan is to define the type of extraction, which is primarily topography dependent.

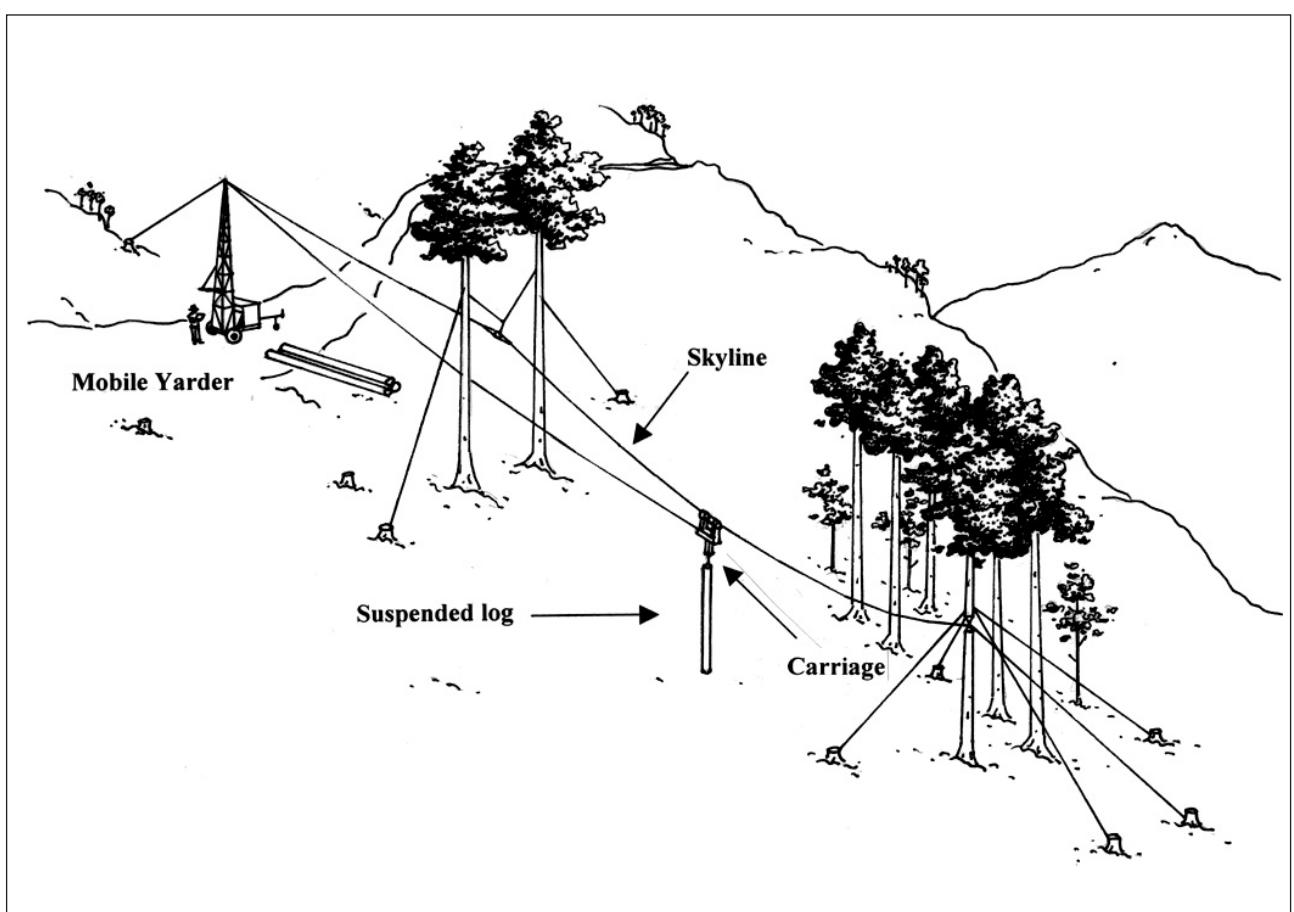
- In areas where slopes are mostly <30% (see glossary), ground skidding is permitted.
- In coupes where the slopes mainly range from 30–70%, ground skidding is prohibited because of the extensive damage to both soil and vegetation which results under these conditions. In this range of slopes, skyline yarding systems are an appropriate extraction system (Figure 3).

The decision to use cable extraction must be based on a pre-harvesting plan, taking into account the

technical feasibility, the investment required, and the commercial profitability. Cable systems require special training and expertise to be successfully implemented, especially in Indonesia where cable extraction systems have rarely been used (e.g., in the Sumalindo concession in East Kalimantan, Aulerich 1995). While many different cable extraction systems are available to accommodate different terrain conditions and forest types, skyline systems are considered to have the lowest impact on both soil and forest (Figure 3). This is particularly true when logs are fully suspended to eliminate soil disturbance. Thus, it is very important that sufficient time is allotted to the planning of these cable systems, so that the operation can meet its environmental objectives at a reasonable cost. Finally, according to the terrain condition, extraction planning may suggest the use of both ground skidding and cable extraction in different parts of a coupe.

- Areas with slopes > 70% must be excluded from cutting and should be identified as protection forest. The same is true for riparian zones and areas of unique forest habitat.

**Figure 3:** Example of skyline with fully suspended logs



## 1. 2. Tactical plan

Tactical plans provide technical procedures and planning details for the harvesting operations to be carried out in the annual coupe. In TPTI, tactical plans are called Rencana Kerja Tahunan (RKT). Planning and implementation procedures of RIL are included in this operational plan (Figure 2).

## 2. DEVELOPING RIL GUIDELINES WITHIN THE TACTICAL PLAN

### 2. 1. Supervising RIL

The harvest design and cutting operations outlined in the tactical plan require careful supervision if RIL measures are to succeed. To accomplish this, a ‘RIL Committee’ must be developed, with the responsibility of verifying that logging operations are conducted in accordance with RIL guidelines and schedules. This committee should be comprised of the company director, a representative of the Ministry of Forestry, and senior company managers responsible for inventories, planning, and logging operations (Figure 2).

The committee’s primary task is to provide direction to a ‘RIL Supervisory Field Team’ (SFT), who controls and supervises both logging planning and operations in the field. The SFT should be comprised of the forest officers responsible for inventories, harvest planning, and logging operations (Figure 2). The main tasks and responsibilities of the SFT are to:

- control and supervise all the pre-harvesting operations;
- control and supervise the implementation of RIL procedures in the field;
- provide technical expertise and advice to the operators during logging;
- make prompt decisions in the field when RIL guidelines cannot be fulfilled or require interpretation; and
- report regularly to the RIL Committee on the progress of logging operations.

The success of RIL implementation will depend largely on the technical skill of the SFT, which must take the lead in implementing logging operations in accordance with the RIL guidelines. For this reason, forest officers of the SFT need to be trained in RIL techniques and forest engineering.

### 2. 2. Pre-harvesting operations

Pre-harvesting activities aim to collect all essential biophysical data to prepare for logging operations in the annual coupe. This information leads to the con-

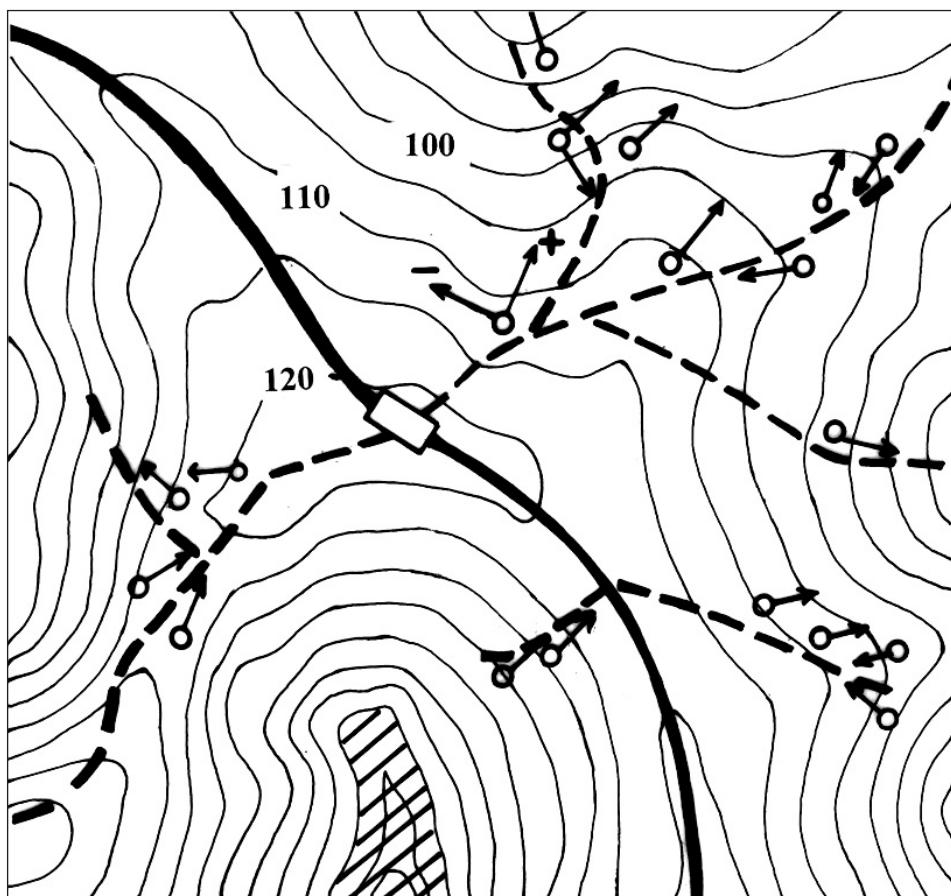
struction of a tactical logging map and tactical logging plan document (Figures 2 and 4).

### 2.2.1. Stock survey

The stock survey describes the frequency and distribution of important commercial, ecological, and non-timber forest product (NTFP) tree species across the annual coupe. The list of species to be described for a particular harvest area are stipulated during the forest management planning process (Figure 1), and includes the following categories:

- *All harvestable timber trees (dbh ≥ 50 cm or dbh ≥ 60 cm according the type of the production forest)*. Commercial species and harvesting diameter limits are stipulated in TPTI. Dipterocarps are the dominant commercial species, with stems ≥ 50-60 cm dbh considered harvestable. The minimum harvestable dbh varies with the type of forest (production forest or limited-production forest). Where timber trees have low or no commercial value because of unsuitable shape or external sign of wood rot, these individuals are marked in the field and on the stock map to exclude them from the harvest. Trees presenting risk of splitting are also identified and marked to be excluded from felling.
- *All potential crop trees (PCT)*. PCT are commercial timber species with  $20 \text{ cm} \leq \text{dbh} \leq 50 \text{ cm}$ , which are likely to comprise the next harvest. PCT are marked in the field and mapped in an effort to protect them during felling operations.
- *Protected tree species: rare, threatened, or endangered species*. TPTI regulations exclude the felling of certain species (e.g., *Eusideroxylon zwagerii*, *Koompassia excelsa*, *Dyera costulata*). Stems of these and other IUCN Red Book listed species (IUCN 1990), > 20 cm dbh, should be marked, recorded, and mapped to ensure their protection during logging operations.
- *Trees with dbh ≥ 10 cm known by local people to provide non timber forest products (NTFPs)*. Local cruisers with a good knowledge of trees providing NTFPs must be part of the stock survey team. The same data as those collected for timber trees must be collected for these trees by the forest inventory team. These trees should be marked, numbered, and their position shown in the map.
- *Important wildlife resource trees*. A select group of tree species that serve as important food resources for wildlife should be marked,

**Figure 4:** Example of a tactical logging map (Scale 1:2 000, 5 m contour lines) issued after pre-harvesting inventory. The arrows indicate planned directional felling. Logs should be laid at approximately a 30° angle with the skid trail. (+ = Good directional felling, angle with skid trail < 30°; - = Unacceptable, angle with skid trail > 30°). Buffer zone in hatches. Solid line indicates forest road and dashed lines present skid trails.



recorded, and mapped to protect them during the harvest. The species to be included in this list will be site specific (e.g., MacKinnon *et al.* 1996, provide a table of important food trees for wildlife and people in the forests of Kalimantan).

During the stocking survey, data to be recorded for each tree included in the inventory are:

- tree number;
- commercial or local name;
- position in the cutting block; and
- estimated diameter class (in cm) above the buttresses.

In order to be in line with TPTI forest inventory procedures, all harvestable trees (Group 1 above) will be marked with red labels while PCT and protected species will be marked with yellow labels. The labels must indicate the:

- annual coupe and cutting block (petak);

- number of the tree;
- diameter class; and
- commercial name.

In addition to this marking procedure required by Indonesian forest regulations, it is recommended that marks that can be easily identified in the forest be used. Therefore, harvestable trees should be marked with a painted red ring on the bark, while PCT and protected species should receive a yellow ring.

Finally, the stock survey will be carried out at least 6 months before logging by teams composed of both foresters (for timber) and local cruisers (for NTFPs). Their activities will be supervised by the Forest Inventory Officer of the SFT.

### 2. 2. 2. Climber cutting

Climbers can seriously compromise both feller safety and directional felling. Therefore, all climbers  $\geq 2$  cm dbh that are attached to the canopy of harvestable

stems should be cut at least 6 months before logging. Climber cutting should normally be done in conjunction with the stock survey, and under the supervision of the Forest Inventory Officer of the SFT.

### **2. 2. 3. Topography assessment**

Because the road and skidding trails network will be mainly designed and planned according to the terrain, it is essential to produce accurate topographic maps using all the modern methods and tools available (e.g., aerial photos, satellite images, radar images). However, if the remote sensing images are not sufficient to produce maps at a suitable scale for logging planning (1:2000), topographic maps must be prepared by an intensive field survey (Klassen 1998). This is often done in conjunction with the stock survey, where the maximum contour interval for a tactical logging map is 5 m, with contour intervals of 1 m or 2 m being preferred.

### **2. 2. 4. Protected areas**

Within the cutting block, all areas are to be harvested except those reserved as:

- **Unworkable areas:** areas that are too steep (> 30% for ground skidding and > 70% for any other logging system), rocky, and/or have very low commercial timber.
- **Sacred areas:** areas that have cultural or religious value for the local residents. Sacred areas must be defined in consultation with local populations and clearly marked as protected areas on the logging plan maps.
- **Conservation areas:** areas that preserve unique and/or fragile habitats, and areas of high biodiversity. These areas must be representative of the different ecosystems occurring in the concession and can only be defined through an assessment of the wildlife community and its habitat within the cutting block (Annex 1). Conservation areas may include unworkable and sacred areas.

- **Stream buffer zones:** areas adjacent to streams (permanent watercourses) where logging activities are not permitted. Streams are considered to be watercourses if they flow for at least 2 months in most years. Stream buffer zones vary in width from 20-200 m according to the size of the watercourse (Table 1). Stream buffer zones must be recorded during the topography assessment and drawn on the tactical plan maps.

All areas appearing to merit protection are noted during the stock survey and/or topography assessment, and subsequently delineated on the tactical plan maps. The following harvesting practices pertain to these areas:

- No trees are to be felled within these protected areas. Trees immediately outside these areas must be felled in a direction away from the protected areas.
- Machine access is normally prohibited in these areas, but can be occasionally permitted, as necessary, by forest engineers in charge of the logging operation. Where permitted, access must cross by the shortest possible distance.
- If a tree has been inadvertently felled into a watercourse, all debris must be removed without disturbance to the watercourse bank.
- No harvesting debris is to be pushed into areas excluded from harvesting.

### **2. 2. 5. Road, landing, and skid trail planning**

#### **2.2.5.1. Road design**

Road planning aims to develop an optimal road network that minimises road density while providing access to all harvest areas. The location of the major roads is specified as part of the strategic plan, while secondary roads are addressed in the tactical plan. Major road design may be modified and improved,

**Table 1.** Total width of stream buffer zones (SBZ) based on stream width

Stream width between banks	SBZ width in metres (width on both sides of the stream and from its centre)	
< 1 m	No buffer zone	
1-10 m	20	(10)
11-20 m	50	(25)
21-40 m	80	(40)
> 40 m	200	(100)