APPENDIX 2
GUIDELINES FOR THE PREPARATION OF AN IAP CONTROL PLAN

CONTENTS

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INTRODUCTION

A suitably qualified/experienced person should survey the areas that are to be cleared and have the IAPs which occur there identified and – where relevant – mapped. For large areas, mapping of IAP coverage is essential, but for small sites this may not be necessary. Photographs of the site should be taken to assist the process of monitoring the impact of the clearing programme.

An IAP control plan should be prepared based on the following principles:

- Areas of IAPs that pose a fire risk to houses or infrastructure should be targeted as a priority. Creating an effective “fire break” is important where woody/fire prone IAPs are in dense stands near settlements, powerlines, etc.
- Riparian areas (rivers, streams, wetlands) are a priority when planning the phasing of IAP clearing work. However, clearing needs to start from the head (highest point in a valley) and move downstream/downslope to ensure that any potential sources of IAP seeds and other regenerative plant material are minimised/eliminated from upstream of the working area.

  Moderate to low IAP infestations in wetland areas can be treated by implementing controlled burning at the beginning of autumn, followed by mechanical removal or herbicide application in mid-spring. Please note, however, that as wetlands are protected by the National Water Act and the National Environmental Management Act, no heavy machinery may be used to remove IAPs in wetland areas without prior authorisation from the relevant government departments.
- Indigenous vegetation – including individual indigenous trees located among stands of IAPs – must be protected from damage during the IAP clearing process. If necessary, indigenous trees and vegetation can be cordoned off or marked using danger tape to assist workers to be constantly aware of what needs to be protected.

- Where there are large alien trees which provide aesthetic appeal or some other useful function (windbreak or slope stabilisation), a phased approach to their removal is recommended whereby indigenous trees are planted below/around the alien trees at the start of the project, and the alien trees are removed as late as possible in the project process, or once the indigenous trees are starting to become established. Note that this approach is not appropriate where the alien trees are highly invasive and are a priority for removal. Furthermore, felling of large alien trees in areas where one needs to avoid damaging the emerging indigenous trees that have been planted can be difficult and expensive – so careful planning is required.
- Invasive trees located away from any structures or roads can be ring-barked, treated with herbicide, and left standing rather than felled. They will slowly collapse over time and will be a wonderful habitat for hole-nesting birds such as woodpeckers and barbets. If trees are felled, particularly on slopes, then they should be felled across the slope to act as natural barrier lines against soil erosion.
- To avoid the threat of soil erosion when clearing dense infestations of IAPs on steeper slopes, work should progress horizontally along the contours. IAPs should be cut in bands of approximately 3 m wide along the slope contour; the cut material should then be rolled back so that it forms a “frill” along the band. This will help to slow down water run-off. A 2 m swathe of uncut material should be left before starting on the next 3 m wide band. As the cut bands start to revegetate, work on the uncut bands can begin.
- On gentle gradients, clearing should start from the outside of a work block and move inwards towards the centre, to assist in containing potentially invasive plant material and seeds within a confined area.

  Disposal of the cut IAP material needs to be carefully considered. Options may include burning on site (note this comes with serious risks that need to be managed); chipping and composting (note that this is not appropriate if the plant material contains seeds); use of the woody biomass for charcoal manufacture (local SMME opportunity); use of the cut material to generate electricity (if there are facilities available for this); transportation of the material to a garden refuse or landfill site for disposal. Whatever disposal method is selected must meet all legal requirements and must not create risk for residents and infrastructure. Also note that burning of some types of IAPs stimulates seed release (e.g. pine trees) or rapid seed germination (e.g. black wattle).
- Identify the clearing methods or combination thereof that are best for the specific project site and target species, as well as associated field equipment and personal protective equipment (PPE) required.
- Identify the required herbicides for IAPs if chemical control is to be used. Only herbicides registered for use on the target species may be used.
- Identify training needs for project workers and supervisors based on the nature of the area to be cleared, the target IAPs and identified clearing methods. This may include: IAP identification; safety training for use of specialised equipment, such as chainsaws; specialised training for working in difficult or sensitive terrain.

BASIC POINTERS WHEN DRAWING UP A PLAN

- To calculate person days:

Person days
= Area of polygon/treatment area x norm

- To calculate herbicide cost:

Herbicide cost per polygon/treatment area
= Area of polygon/treatment area (ha) x herbicide cost (R/litre) x alien density x herbicide dilution factor (litre/ha)

(**Note:** This cost does not include sticking agents, e.g. actipron and dye.)

Important points to remember

- To judge **alien density classes**, consider how many stems can be fitted into a hectare and convert this to a percentage. This is most easily assessed by visually dividing the area into four quadrants and imagining whether all the stems could be fitted into one of those quadrants. If so, this would be a 25% density rating. However, if you are applying a foliar spray, then just the canopy cover could be assessed, and not the stem density.
- It is best to **walk** the area (see completing a field verification) to be assessed, and not just rely on viewing the area from a distance or assessing remotely with an aerial photo.
- If polygons/treatment areas are prioritised so that clearing will only begin in five years' time (for example), then remember to consider what the new density of the area will be with five years of growth to determine an accurate calculation of costs.
- For **mechanical clearing**, small areas of a polygon/treatment areas can be done over time, as labour resources are available. However, if **herbicides** are used, then it is best not to begin clearing unless you are sure that you have sufficient resources to finish the first clearing. In this case, beginning and not finishing clearing an area can create more of a problem.
- The best seasons to apply a herbicide spray is in **spring** and **autumn.**
- The use of **fire** in an integrated alien clearing programme is recommended, provided adequate firebreaks are in place. Fire is best suited to treating **Acacia species** (e.g. black wattle, rooikrans) as fire flushes the seedlings. A foliar spray can then be used to kill the germinated seedlings.

- For **pine and hakea,** fire should rather be used to clear the mechanically felled material. If applied 18 months after clearing, fire will also kill seedlings and seed stored in the soil. **Blue gums** can be controlled without fire, by simply ringbarking the stems and applying herbicide to the stripped area.
- Landowners should keep a note of all expenses incurred from alien clearing as these are tax deductible!

COMPLETING A FIELD VERIFICATION

It is essential to walk through the treatment area in a pattern that enables you to study the complete area prior to starting the work. This allows you to form a good understanding of the area to be cleared and to develop a clearing strategy linked to time and costs. In the process of field work, you will use transects to explore key characteristics of the polygon/treatment area you intend to clear.

A transect is a system of walking in straight lines spaced at regular intervals through a given area to estimate plant species, densities, and composition. While walking along the transect line, plant information is gathered at pre-determined intervals. This exercise gathers information about:

- Size of area in hectares
- Species
- Growth form of species
- Species age composition
- Density structures

Other factors to consider include:

- Terrain (slope, valleys, etc.)
- Underfoot conditions (debris, sand, rocks)
- Height of obstructive vegetation (indigenous vegetation one needs to move through to get from IAP to IAP)
- Walk in time.
- Hazards (weather conditions, snakes, or wild bee nests) that can affect productivity.
- Stacking of cut IAP material

Size of area in hectares

The size of the area in hectares will affect the number of working days needed to complete the treatment area. Ensure that the boundaries are clearly marked in order orientate the team.

Species

Managing IAPs cannot be done at any level if the species have not been identified. This is not just identification of the species but also their composition, i.e., the ratio of one species to the other. Only once the species in the work area have been identified can you start to understand the work area and put the appropriate control measures in place. Understanding the IAPs helps to establish suitable control strategies.

Growth forms

How the IAP grows is known as form or habit. There are many different growth habits for plants, each with different control strategies. Some examples include:

- **Dormancy:** When does the IAP grow? (annual or perennial). Poplars are dormant in the winter, so treatment with herbicide during this time will not be effective.
- **Root suckering:** How does the IAP grow? Does it have root suckers or have rhizomes? Saplings of a Poplar are connected to the parent tree by root suckers and both need to be treated.
- **Leaf coverage:** Some species (e.g. *Prosopis* spp) may lose their leaves in the heat of summer, making foliar spray inappropriate.
- **Bark thickness:** This will determine what method of control that is used. The bark of eucalyptus is thick, so a ring frill, rather than a common frill is used. Common frills would be used on species with a thin bark, e.g. acacias.
- **Root system:** The type of root system, whether it has a taproot or an adventitious root, is also important. Port Jackson, which has a tap root system, cannot be hand-pulled as the plant generally breaks off at the root collar and the plant will coppice.
- **Coppice growth:** Some species of IAPs do not need herbicide, e.g. most of the pine species, hakea, rooikrans and longleaf wattle. The tendency to produce coppice growth will also determine methodology. Ring barking on standing pines and mechanical felling of rooikrans and longleaf wattle are feasible as these species do not generally produce coppice growth.
- **Seed survival:** Plants have developed various methods to ensure the survival of their seeds. A good example of seed survival mechanisms is found in the hakea species. Hakea seedpods do not fall off the tree. As the pods dry out due to fire and death, they crack open and the winged seeds are dispersed by the wind. Hakea needs to be mechanically cut and stacked in round heaps to confine the seeds in specific areas. A large portion of the seeds lying within the stacks are scavenged by field mice, thus reducing the seed bank.
- **Vegetative regrowth:** Plants rely not only on their seeds for survival. Some species have developed vegetative growth whereby new plants develop from non-sexual plant parts such as leaves or stems. Cactus species are a good example of plants that display this ability. When treating opuntia (prickly pear), stem injection is used, as the plant needs to be killed while still standing. Each leaf (or preferably cladode) has the potential to grow into a new plant if it comes into contact with the ground.

Species age composition

Plant or vegetation age will determine the type of clearing method. Generally, anything lower than shoulder height (classified as young or seedling) can be controlled by foliar spray techniques. This stage of a species' life, at its optimum growth period, allows for good facilitation of systemic herbicides through the plant. If the leaves and stem are young and green, it allows for good absorption of herbicide.

Species also have good leaf coverage at this stage, allowing for a greater platform for herbicide application. Hand pulling of seedlings is also possible on some species, but is not widely recommended for a variety of reasons:

- Seedlings can break at the stem below the soil, resulting in coppicing.
- It is not a cost-effective method in areas of high density, due to it being time consuming.

- If plant densities are high, the damage to the soil can result in erosion or re-establishment of IAPs.

If the species is taller than shoulder height, then a mechanical or integrated approach is needed. Ground-based foliar spraying is not effective, as it is difficult to reach the leaves in the canopy. The control method used will depend on the objectives of the clearing process, the stem thickness and whether it is a multi- or single-stemmed plant. The contractor must use the methods stipulated in the contract. When conducting private work, the contractor may have to determine the most efficient method to use based on the objectives of the clearing.

Select the quickest way to effectively kill a plant. Time is money! If the plant has a stem diameter of approximately 150 mm or less, then a cut stump approach using hand tools is better. Beware of falling into the habit of cutting saplings using a chainsaw. The repeated revving of the chain saw will result in damaging the trigger mechanism, the motor and leave an untidy cut stump. Clearing saws, brush cutters, loppers and bowsaws should be used for small trees. Frilling, ring-frilling and ring barking on smaller diameter stems is ineffective and it would be quicker to just cut it down. Also, the flexibility of the younger plants does not lend itself to these methods. Frilling, ring-frilling and ring barking would be used on trees with stem diameters greater than 150 mm, where the time taken to fell, de-branch and stack would be excessive.

Age classes

Once the species has been identified, the next step is to determine the age class. The age of a species is usually divided up into the following classes:

- Seedling (diameter at ankle height 0–15 mm)
- Young (diameter at ankle height 16–50 mm)
- Adult (diameter at ankle height > 50 mm)

This is just an estimate and does not need to be measured accurately but classifying the age structure of the IAPs is important as it will have an impact on the control measures used and thus the cost. Remember that size does not equate to age as some mature plants do not grow very tall. Overlying age classes is the fact of previous control attempts, natural damage (fire or wood collecting) and growth habit.

Density structures

The density refers to the ground cover or stems per hectare of the IAPs. This is expressed in percentage ranging from 0% (meaning no IAPs) to 100% (meaning an area that is fully covered with IAPs).

Estimate the total percentage of all the IAPs to be controlled within the area, then look at the species with the fewest plants, break these up into groups (seedlings, young and adults) and estimate how much of the area they occupy as a percentage of the total percentage cover estimated. Do this with the next species until all species have been included. Your total may not reach 100% cover as there will always be some bare ground. If this method is used at numerous sites across the work area, a reasonably accurate assessment of the plant density will be achieved.

REMEMBER: Include indigenous plants in your estimation as these must be considered in any control plan. It is important to learn to estimate plant cover.

The data on the species, growth form, age and density are then collated to give the required information on the site.

DETERMINING WORKING DAYS FOR COSTING

The steps for calculating person days are given in Box 1 on page 9. The time and procedures needed to implement a control plan for a polygon/treatment area is determined by estimating the total person days needed to complete the task based on the factors identified during your field verification. The total person days is then converted into working days. A person day is ***the amount of work that one person can do in a day***.

Using the field verification sheet (see page 10 and Appendix 3), allocate the person days against each species, plus their age and density. This is at first recorded as a person day per hectare (Pd/ha) value, which can be found in the ***Guidelines to clearing time*** (see page 11 and Appendix 4) and then ultimately converted to the number of working days for a clearing team.

BOX 1: STEPS FOR CALCULATING WORKING DAYS

Walk transects through the treatment area and list/complete the following steps:

STEP 1: Time for cutting and herbicide application for growing trees.
- List all species to be controlled.
- Identify the age classes: Seedling = 0–15 mm; Young = 16–50 mm; Adult = > 50 mm
- Estimate total collective density of all species to be controlled. One would never get a 100% cover as all plants need space to grow.
- Divide collective density into listed species and age classes (starting with the species with the lowest density)
- Density is an estimate, so use groups of 5 (5%, 10%, 15%, 20%, 25%, etc.)
- Calculate the PD/ha norm for each species based on species type, age class and density using the *Guidelines to clearing time* (Appendix 4).
- Use the logging table for adult species to account for cutting of the canopy.
- Calculate collective total PD/ha value.

STEP 2: If obstructing work, calculate time for cutting and logging of dead material (PD/ha)
- Estimate density of dead material in the treatment area.
- Use logging tables to calculate PD/ha.

STEP 3: Add step 1 and step 2 PD/ha values together to get a total

STEP 4: If working in a riparian zone calculate time for carrying material out
- Total PD/ha x 50% (add to total PD/ha)

STEP 5: Calculate time for stacking branches.
- Total PD/ha x 20% (add to new total PD/ha)

STEP 6: Calculate the person days.
- Total PD/ha x size of the treatment area (ha) = Person days

STEP 7: Calculate the working days.
- Person days ÷ team size = Working days

WORK SHEET FOR FIELD VERIFICATION

SIZE OF TREATMENT AREA: _____ TOTAL ESTIMATED DENSITY (%): _____

TREATMENT AREA NAME: _____ SLOPE (%): _____

SPECIES NAME	AGE CLASS	DENSITY (%)	PERSON DAYS PER HECTARE (PD/ha)

DENSITY (%) OF DEAD BRANCHES TO BE CUT:

DEAD BRANCHES:……..... PD/ha

RIPARIAN ZONE:……..... PD/ha (extra 50%)

STACKING:……. PD/ha (extra 20%)

TOTAL PD/ha:……

EXAMPLE OF GUIDELINES FOR CLEARING TIME (person day/ha NORMS)

Trees that do not coppice: No herbicide required

Percentage infestation					
AGE	Scarce	Scattered	Moderate	Dense	Closed
	1–5	**5.1–25**	**25.1–50**	**50.1–75**	**75.1–100**
***a**	1.00	3.25	6.50	15.00	20.00
y	0.61	1.30	3.97	9.15	12.20
s	0.30	0.98	1.95	4.50	6.00

*Adults trees with small canopies

Trees that coppice: Herbicide required

Percentage infestation					
AGE	Scarce	Scattered	Moderate	Dense	Closed
	1–5	**5.1–25**	**25.1–50**	**50.1–75**	**75.1–100**
***a**	1.72	5.60	11.20	25.84	34.45
y	1.34	2.30	8.71	20.10	26.80
s	0.38	1.22	2.44	5.63	7.50

*Adults trees with small canopies

Bushy species (bramble, lantana, etc.)

Percentage infestation					
AGE	Scarce	Scattered	Moderate	Dense	Closed
	1–5	**5.1–25**	**25.1–50**	**50.1–75**	**75.1–100**
a	1.00	3.25	6.50	15.00	20.00
y	0.50	1.63	3.25	7.50	10.00
s	0.75	1.63	3.25	7.50	10.00

Follow-up

Percentage infestation					
AGE	Scarce	Scattered	Moderate	Dense	Closed
	1–5	**5.1–25**	**25.1–50**	**50.1–75**	**75.1–100**
Hand pulling	0.38	1.22	2.44	5.63	7.50
Foliar spray	0.30	0.98	1,95	4.50	6.00

Adult trees with medium to large canopies: Actions include cut stump, crosscut and logging. Debris needing to be cut fall within this category.

Percentage infestation					
AGE	Scarce	Scattered	Moderate	Dense	Closed
	1–5	**5.1–25**	**25.1–50**	**50.1–75**	**75.1–100**
A	2.58	8.40	16.80	38.76	51.68