General Invasive Alien Plant Control

Insight into Best Practice, Removal Methods, Training & Equipment

I Guideline Document **I**

Environmental Planning and Climate Protection Department, eThekwini Municipality
166 K.E Masinga Road, Durban, 4001 | PO Box 680, Durban, 4000
Tel + 27 31 311 7875 | **Fax** +27 31 311 7134

Acknowledgments
This document was produced by the eThekwini Municipality's Environmental Planning and Climate Protection Department with input from the following individuals:
Kathryn Terblanche, Nicci Diederichs, Errol Douwes, Colette Terblanche, Trafford Petterson, Jo Boulle, Krissie Clark, Wayne Lotter

Photography credits
Geoff Nichols, Kay Montgomery (EP), Michael Cheek (SANBI), Errol Douwes (EPCPD), Richard Boon (EPCPD), Rael Hughes (WOF) and Denise Gillespie (SASRI)

Above: *Ardisia crenata* (Coral Bush) – a popular garden plant that has become invasive in KZN and the Eastern Cape.

TABLE OF CONTENTS

ACRONYMS, ABBREVIATIONS & SYMBOLS

CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CEBA	Community-based Ecosystem Adaptation Programme (under EPCPD)
CESCM	eThekwini Coastal Engineering Stormwater Catchment Management Department
DAEA	Department of Agriculture and Environmental Affairs (Provincial)
DAFF	Department of Agriculture, Forestry and Fisheries (National)
DEA	Department of Environmental Affairs (National)
DUCT	Duzi-uMngeni Conservation Trust
DWA	Department of Water Affairs (National)
EHS	eThekwini Environmental Health Services
EM	eThekwini Municipality
EMA	eThekwini Municipal Area
EMIAS	eThekwini Municipality Invasive Alien Strategy
EPCPD	eThekwini Environmental Planning and Climate Protection Department
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EWS	eThekwini Water and Sanitation Services
GIS	Geographic Information System
IAP	Invasive Alien Plant
IAS	Invasive Alien Species (plants and animals)
IASP	Invasive Alien Species Programme (Provincial, under DAEA)
IUCN	International Union for the Conservation of Nature
NEMA	National Environmental Management (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
PLCD	eThekwini Parks, Leisure and Cemeteries Department
PPE	Personal Protective Equipment
RSWM	eThekwini Roads and Stormwater Maintenance Department
SANBI	South African National Biodiversity Institute
WFE	Working for Ecosystems Programme (Local, under EPCPD)
WFW	Working for Water Programme (National, under DEA)
WFWet	Working for Wetlands Programme (National, under DEA)

CARA Category

NEMBA Category

Herbicide

Biocontrol

Hand Pulling

Foliar Spraying with Knapsack

Foliar Spraying by Boat

Aerial Spraying

EXECUTIVE SUMMARY

Invasive alien plants (IAPs) are plant species that have been introduced, either intentionally or unintentionally, to South Africa. They can reproduce rapidly in their new environments and tend to out-compete indigenous plants. The result usually includes a variety of negative ecological, social, and economic impacts.

This Guideline aims to provide information on best practice methods for IAP control in the eThekwini Municipal Area. Options for IAP eradication, containment, monitoring as well as the necessary requirements for training, equipment and personal protective equipment (PPE), are included.

In terms of Section 4(2)(a) of the National Environmental Management: Biodiversity Act (NEMBA), all municipalities are required to manage and conserve biological diversity. This includes taking steps to control and eradicate Invasive Alien Species (IAS) in areas that they own or manage. In response to this, the eThekwini Environmental Planning and Climate Protection Department has prepared an Invasive Alien Species Framework and Strategy. However, there is a need for a variety of municipal departments whose responsibilities include managing land and water resources to implement the required IAP control as part of their management programmes.

The costs associated with IAP control, especially for well-established populations, can severely drain budgets and resources. As IAPs spread, so the costs of control continue to escalate, and the likelihood of complete eradication diminishes. This is especially the case if IAP species are present which produce seeds that remain viable for many years (e.g. Black Wattle), and if the plants have spread into areas that are difficult to access. As such, a strategic and collaborative approach, which ensures appropriate budget allocation, needs to be adopted.

"It is envisaged that, through the application of the principles outlined herein, optimum field techniques will be adopted by all."

An efficient way of reducing future costs of IAP control is to invest resources not only in control of well-established populations of IAPs, but also in the early detection and removal of emerging weeds. Emerging weeds are plants that are already present, but not yet naturalized (i.e. able to sustain self-replacing populations without direct intervention by people). They may have horticultural, agricultural or other economic value but if allowed to become established, they will spread or become invasive. Ultimately, they will have a negative impact on natural ecosystems, biodiversity and livelihoods.

Examples of invasive alien plants introduced to South Africa for horticultural purposes. Above: *Cortaderia selloana* (Pampas Grass); Above right: *Aristolachia elegans* (Dutchman's Pipe); Bottom right: *Solanum seaforthianum* (Potato Creeper).

The information provided in this booklet is for employees of the eThekwini Municipality, who are involved in IAP control as part of their duties. This includes both the planning and budgeting for IAP control, as well as active control in the field. Key departments that may need to be involved in such activities include eThekwini Water and Sanitation, Environmental Health Services, Roads and Stormwater Maintenance, Coastal Engineering Stormwater Catchment Management, Parks Leisure and Cemeteries, and the Environmental Planning and Climate Protection Department. It is envisaged that, through the application of the principles and techniques outlined herein, optimum field techniques will be adopted by all, and a more coordinated approach will be implemented. This will help to reduce future IAP control costs and lead to improved and fully functional natural areas and ecosystems in the eThekwini Municipal Area.

1 WHAT ARE INVASIVE ALIEN PLANTS (IAPs)?

Invasive alien plants (IAPs) are plant species that have been introduced, either intentionally or unintentionally, to South Africa. They can reproduce rapidly in their new environments and tend to out-compete indigenous plants.

Plant species are only considered invasive when they occur outside of their natural distribution range, and pose a threat to ecosystems, other species, the economy or human health.

Invasive alien plants (IAPs) are characterised by being able to reproduce rapidly in their new environments, and this is usually due to a combination of factors, including:

- A lack of natural enemies in the new environment
- Resistance to local diseases and other plant pathogens
- Highly competitive growth and colonising strategies that provide them with a competitive edge, and an ability to out-grow local indigenous plants

Definitions

Invasive Alien Plant (IAP)	A plant species not indigenous to a location, area, or region, which has either been accidentally or intentionally introduced and whose presence threatens habitats, ecosystems or other species. Their presence may result in economic or environmental harm, or harm to human health.
Alien Species	A species that is not indigenous; or an indigenous species translocated outside its normal distribution range in nature, but that has not spread outside its normal range without human intervention.
Weed	Any plant, indigenous or alien, invasive or otherwise, which is growing where it is not desired.
Emerging weed	Plants with invasive tendencies already present outside of their natural distribution range, but not yet widely so. They often have horticultural value, but can impact negatively on natural ecosystems, biodiversity, livelihoods or human health if allowed to continue to expand to outside of their natural range and become naturalised.

Above: *Pereskia aculeata* (Barbados Gooseberry) smothering natural vegetation on a hillside in Amanzimtoti.

2 WHY DO THESE PLANTS NEED TO BE CONTROLLED?

2.1 Impacts on Ecosystems, People and the Economy

IAPs can significantly alter the composition, structure and functionality of ecosystems. As a result, they degrade the productive potential of the land, intensify the damage caused by veld fires and flooding, increase soil erosion, and impact on the health of rivers and estuaries. Indigenous species may be reduced in numbers/coverage, or may be lost as a result of IAP infestations, posing a threat to South Africa's natural heritage in sensitive locations.

IAP infested natural habitats suffer reduced capacity to produce ecosystem services that help support a healthy and productive living environment for people. Availability of natural products, such as medicinal plants, fodder and building materials is decreased, and disease-carrying pests such as mosquitoes and rats may be more numerous due to a reduction in natural predators with declining ecosystem functioning.

The aesthetic, recreational and cultural values of the natural environment are also significantly decreased where IAPs take over. IAPs also threaten local and national water security. The notable reduction of South Africa's water resources from IAP infestations has far-reaching ecological, economic and social implications.

In KwaZulu-Natal, IAPs have been estimated to use approximately 576 million m^3 of water per annum. This is 5% of the province's Mean Annual Run-off (MAR), and is equivalent to 230mm of rain falling across KZN per year being used up by IAPs.

Every large invasive alien tree, such as *Eucalyptus grandis*, can use between 100 and 1,000 litres of water per day – which is significantly more than the average indigenous tree. Considering that South Africa is a drought-prone country that already uses 98% of its available water resources, the increasing loss of water through IAPs is a serious issue.

"South Africa's water resource losses from IAP infestations has far-reaching ecological, economic and social implications."

Above: *Eucalyptus grandis (Blue Gum)* is a commercially important tree in South Africa, but is also a major threat to the country's water resources when invading river catchments outside of commercial forestry plantations.

"The aesthetic, recreational and cultural values of the natural environment are significantly decreased where IAPs take over."

2.2 Legislative and Policy Framework governing IAP Control

2.2.1 Conservation of Agricultural Resources Act No. 43 of 1983 (CARA)

The Conservation of Agricultural Resources Act (CARA) regulates and restricts the propagation, harbouring and sale of invasive alien plant and weed species listed in a set of Regulations published in terms of the Act. CARA was revised in 2001 and is administered by the National Department of Agriculture, Forestry and Fisheries. All listed IAPs are divided into three categories as described on these pages. The full list of CARA regulated species is included in Appendix 4: Listed Invasive Alien Plants (CARA).

Category 1

These are prohibited plants, i.e. are illegal to grow or keep, and must be controlled or eradicated. These plants possess characteristics that can prove harmful to humans and/or have detrimental impacts on people or the economy. These plants are only allowed in biological control reserves that are designed for the breeding of bio-control agents.

Lantana camara

Eichhornia crassipes

Chromolaena odorata

Tecoma stans

Solanum mauritianum

Category 2

Declared invader plants with a commercial or utility value. These are plants with certain useful qualities, including commercial use for timber, food, animal fodder, soil stabilisation etc. These plants are permitted in demarcated areas under controlled conditions and in bio-control reserves. They are, however, not permitted within 30m of the 1:50 year floodline of a watercourse or wetlands unless authorised by the National Department of Water Affairs.

Eucalyptus grandis

Ricinus communis

Psidium guajava

Acacia mearnsii

Leucaena leucocephala

Category 3

These are primarily ornamental or 'exotic' horticultural plants that have escaped from gardens. They may not be planted and propagative material may not be traded (except with permits in place). Eradication of existing plants is not required, except within 30m of the 1:50 year floodlines of watercourses or wetlands. The spread of these plants must be prevented.

Pontederia cordata

Jacaranda mimosifolia

Melia azedarach

Plectranthus barbatus var. *grandis*

Morus alba

2.2.2 National Environmental Management: Biodiversity Act No. 10 of 2004 (NEMBA)

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA categorises and regulates the control of invasive and alien species as follows. Please see Annexure 5 for full list of species regulated in terms of NEMBA.

National List of Invasive Species

(Government Notice R.507 of 2013):

Category 1a

Invasive plants requiring compulsory control. Plants are to be removed and destroyed. Any Category 1a listed plants must be eradicated.

Category 1b

These are invasive plants requiring control as part of an invasive species management programme. Permits must be issued for these plants to be kept on a property, and their management and control must be in terms of an approved invasive species management plan.

Prohibited Alien Species

(Government Notice R.508 of 2013):

Species for which permits may not be issued for propagation, trade or cultivation.

Exempted Alien Species

(Government Notice R.509 of 2013):

Species that are exempted from the provisions of the Act, including:

- Dead specimens of alien species;
- Alien species legally introduced to South Africa prior to the Regulations coming into effect, and which are not on the National List of Invasive Species, including species imported for agricultural purposes;
- Alien species that are also indigenous species, including those regulated in terms of the 2007 Threatened and Protected Species Regulations promulgated under NEMBA;
- Alien species that are regulated in terms of the Conservation of Agricultural Resources Act (Act 43 of 1983) as weeds and invader plants. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEMBA.

2.2.3 eThekwini Municipality Framework Strategy and Action Plan for the control of Invasive Alien Species

In terms of Chapter 5, Section 76(2)(a) of the National Environmental Management: Biodiversity Act (NEMBA), all organs of state in all spheres of government must prepare an invasive species monitoring, control and eradication plan for land under their control. This plan must form part of a municipality's environmental plans, and be part of a municipality's Integrated Development Plan.

In response to this legislation, in 2011 the Environmental Planning and Climate Protection Department (EPCPD) prepared a Framework Strategy and Action Plan for the control of Invasive Alien Species (IAS) in the eThekwini Municipal Area (EMA). The strategy's mission is to establish a cooperative means for preventing the establishment of new IAS and for the effective control of IAS already established in the EMA. The complexity and difficulty of managing IAS in the EMA requires that a strategic and collaborative approach be adopted to boost and coordinate efforts to control IAS.

This Strategy and Action Plan aims to direct IAS control in the municipal area towards achieving faster, more efficient outcomes and sets realistic targets that can be measured and assessed. It promotes the need for IAS control to become a more integral part of the ongoing sustainable management practices that the EMA is already engaged in. This approach aims to ensure that public funds are used effectively and that municipal investment in IAS control supports the well-being and health of residents through securing a healthy and functional natural environment. The Strategy and Action Plan clarifies the responsibilities of various municipal departments and provides direction on how they can coordinate their efforts with respect to IAS control. The Strategy and Action plan forms part of the eThekwini Municipality's Integrated Development Plan (IDP) for 2012/2013.

"This Strategy and Action Plan aims to direct IAS control in the municipal area towards achieving faster, more efficient outcomes and sets realistic targets that can be measured and assessed."

DOWNLOADABLE RESOURCES

The Strategic Action Plan provides an immediate operational and practical outline of how the Strategy is to be implemented, and will be updated as necessary. The IAS strategy is available online at: **www.invasives.org.za**

3 ADOPTING AN INTEGRATED APPROACH TO CONTROLLING IAPS

Integrated control is the use of a combination of IAP control methods in a coordinated management approach.

Above: *Tithonia diversifolia* (Mexican Sunflower), a common IAP found throughout the EMA.

For example, a programme may make use of mechanical control through the felling of large trees as well as chemical control through the spraying of herbicides on the leaves of small shrubs.

State-assisted clearing of IAPs is often seen as the 'fix all' that everyone is waiting for, but while the benefits may be clear, there is a danger that public funds can be wasted if operations are not carefully coordinated. As such, state funded programmes should be used to boost the development of coordinated IAP management to ensure optimal long-term benefits. Effective integration of various IAP management activities within and between municipal departments, as well as with external partners, will allow for better and wider implementation at lower costs. New projects should be aligned with existing projects to enhance control programmes already underway. This requires better and ongoing communication between departments, resulting in effective control over larger, more contiguous areas.

Municipal departments should collaborate to implement a 5 year plan that optimises resources and effort in order to ensure optimal efficiency and impact.

Above: Example of municipal control of IAPs.

Effective control requires clearing the entire catchment of IAPs and therefore needs all relevant land-owners/managers involved, including the public. There also needs to be increased synergies within the different EMA departments, as well as between partner organisations such as KZN Department of Agriculture and Environmental Affairs (DAEA), Department of Environmental Affairs (DEA), Department of Water Affairs (DWA), Ezemvelo KwaZulu-Natal Wildlife (EKZNW), Department of Agriculture, Forestry and Fisheries (DAFF), South African National Biodiversity Institute (SANBI), and Duzi-uMngeni Conservation Trust (DUCT). Collaborative action results in higher removal success through increased knowledge sharing and dovetailing of projects. All partners should coordinate their planning efforts to minimise overlaps. Municipal departments should collaborate to implement a 5 year plan that optimises resources and effort in order to ensure optimal efficiency and impact.

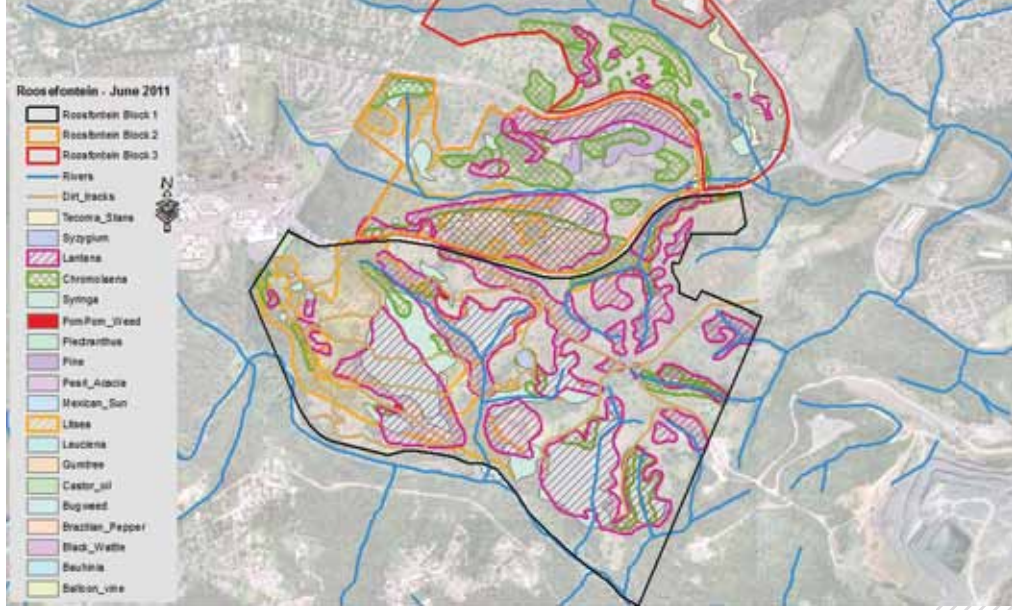
It is important that a clearing programme does not remain static but that it is reviewed from time to time and adapted to fit changing circumstances.

KZN INVASIVE ALIEN SPECIES FORUM

The KZN Invasive Alien Species Forum is a platform that was established aiming to improve invasive alien plant control, through active collaboration between municipal departments, provincial and national government, parastatals, private land-owners, NGOs, conservancies etc. This enhances coordination, reduces duplication and increases the areas under efficient management. The forum meets quarterly and there is no restriction on who attends. For more details, or if you are interested in attending this forum, contact the Working for Water office situated outside Howick.

Contact: Ryan Brudvig – Rbrudvig@environment.gov.za
Reshnee Lalla – r.lalla@sanbi.org.za

Above: *Diplocyclos palmatus* (Lollipop Climber) fruit collection.



Above: An example of IAP coverage mapping.

4 GUIDELINE FOR CONTROL OF INVASIVE ALIEN PLANTS

4.1 Planning and Preparations

Proper planning and preparations are fundamental to achieving cost-effective and successful IAP control. This section provides principles and step-by-step guidance on the many aspects of planning that need to be undertaken prior to clearing work starting.

"Proper planning is essential to achieving cost-effective and successful IAP control."

Once there is a formalised work plan for clearing IAPs, preparation for clearing can begin.

These preparations include procuring the required equipment and materials, having staff undergo the required training, and ensuring that the relevant land-owners and neighbours are notified of the clearing activities before they are undertaken – if they are to be impacted by this in any way.

Planning

1. 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 very large areas, mapping of IAP coverage is essential, but for small sites this is not usually necessary. Photographs of the site should be taken to assist the process of monitoring the impact of the clearing programme.
2. An IAP clearing plan should be prepared based on the following principles:

i. 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 located in dense stands near settlements, powerlines etc.

ii. Riparian areas (rivers, streams, wetlands) are a priority when planning the phasing of IAP clearing work. However, clearing needs to start from the head of the catchment (or 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.

iii. 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 authorization from relevant government departments.

iv. Indigenous vegetation – including individual indigenous trees located amongst 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.

Above: *Leucaena leucocephala* (White Leadtree), was introduced to South Africa as a livestock fodder resource.

"Indigenous vegetation must be protected from damage during the IAP clearing process."

v. 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.

vi. Invasive trees located away from any structures or roads can be ring-barked, poisoned and left standing rather than felled. They will slowly collapse over time and will be a wonderful habitat for 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.

Above: *Sagittaria platyphylla* (Delta Arrowhead) is an invasive aquatic plant that has started invading waterbodies in Durban in the last five years.

vii. 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 3m in width along the slope contour; the cut material should then be rolled back so that it forms a "frill" along the band. This will help slow down water run-off. A 2m swath of uncut material should be left before starting on the next 3m wide band. As the cut bands start to re-vegetate, work on the uncut bands can begin.

viii. 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.

ix. 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

Above: *Dolichandra unguis-cati* (Cat's Claw Creeper) clinging roots.

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 local 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).

3. Identify the clearing methods that are best for the specific project site and target species, as well as associated field equipment and personal protective equipment (PPE) required.

4. 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.

5. 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.

Preparations

1. If the area where IAP clearing will take place is not municipal-owned land, the land-owner needs to be notified of the clearing activities that will be taking place. If there are neighbours that may be negatively affected by noise, road and pathway closures, or herbicide spraying associated with the clearing activities, they should also be notified prior to the work starting.

2. Herbicides, equipment and PPE should be procured and be on site before the work starts.

3. A safe storage area for the herbicides must be established which is bunded to contain any leaking containers (i.e. herbicide should not be able to leak into the soil, any watercourse or wetland, stormwater drain, an area of natural vegetation or a human settlement area). Herbicide storage areas must be secured to ensure that children and animals cannot access the chemicals, and that the chances of theft are minimised.

4. A site camp may be set up to accommodate vehicles bringing workers onto the site, herbicide and equipment storage areas, ablutions and changing areas for workers. The site camp must be located outside of sensitive natural areas, must not restrict access routes or points for local residents and businesses, and must not damage private property or community gardens. If the site camp is on private property, the land-owner must have given permission for use of this area.

5. All necessary staff and worker training must be completed prior to the clearing activities being started.

Above: *Salvinia molesta* (Kariba Weed) is an aquatic fern, native to south-eastern Brazil.

4.2 Budgeting

Good budgeting is a critical component of successful IAP control. Any plan to manage IAPs should have a section that unpacks the costs of all requirements, including labour, equipment, herbicides, PPE etc. Furthermore, if a plan to clear IAPs on a given site is structured correctly, with regular follow-up events, the overall management costs will quickly decline. Always do sufficient research into the types of weeds present. Large gum trees will require significantly more resources to clear than a few bugweed plants. As such, a survey to determine species density and distribution, together with a table that assigns approximate costs to clearing each type of IAP present, is essential.

If specialised IAP clearing contractors are to be used, be sure to compare quotations and qualifications/experience. If a team is not qualified or experienced, it is unlikely that they will implement effective IAP control. Identify the budgetary requirements to implement the necessary Management Specifications. Obtain quotations where necessary.

Above: Team of workers in safety gear ready to start clearing.

4.3 Control Methods

4.3.1 Mechanical Control

Mechanical control involves the physical destruction or total removal of plants. Mechanical techniques vary, and include hand-pulling, felling, uprooting, ring-barking, cutting/slashing, strip-barking or mowing. Mechanical methods are not feasible in dense infestations as these can be labour intensive and time-consuming. Removing all IAPs using mechanical control methods in a densely infestated area can also cause severe soil disturbance and erosion. These methods are generally more appropriate for sparse infestations and for species that do not coppice after cutting.

"Hand pulling is only recommended when an area is sparsely invaded."

4.3.1.1 Hand pulling

Hand pulling is the removal of plants by hand, ensuring that the root is also removed. Hand pulling is only recommended when an area is sparsely invaded, has a high rainfall (the soil should ideally be damp or soft), warm temperatures, and sandy soils; and the plants are small enough to be pulled out successfully with the roots in tact.

Hand pulling does create soil disturbance, but if the area is sparsely invaded such disturbances are unlikely to be ecologically damaging.

Above: Examples of hand pulling.

"Invasive trees located away from any structures or roads can be ring-barked, poisoned and left standing rather than felled."

Top: Cut-stumping method; **Above:** Ring-barking is useful for killing large invasive alien trees.

4.3.1.2 Manual removal using hand tools

Manual removal using hand tools such as cane knives, tree loppers and slashers can be used to remove IAPs. The use of hand tools is probably the most widely adopted, and often the most effective, of all the methods. This method is particularly popular in the Expanded Public Works Programmes (EPWP), as it is labour intensive, and numerous jobs can be created. Methods of cutting the plants include:

- **Ring-barking:** Useful for killing large trees. A cane knife or axe is used to remove the tree's bark and cambium, in a horizontal band about 30cm wide (about 50cm from the ground). Herbicide, if used, should be applied immediately after ring-barking on the cut area.
- **Cut-stumping:** Plants with a stem/trunk diameter larger than 10mm can be cut as low to the ground as possible with a saw or cane knife. Herbicide, if used, should be applied to the cut surface immediately after cutting.
- **Slashing:** The seed stalks/branches of annuals (plants that die each year after they set seed) can be slashed with a cane knife, mattock, bill hook or slasher before the seeds have matured. This is an effective method significantly reducing the presence of viable seeds that will germinate in the new season. Costs are generally low for controlling annuals in this way, as no herbicide is required.
- **Strip-barking:** With the use of a cane knife or axe, the bark of large trees can be stripped completely, from waist height down to the base of the trunk. Herbicide, if used, should be applied to the stripped surface immediately after strip-barking. This is an effective but time-consuming method.
- **Frilling:** Small trees can be frilled by cutting an angled groove into the bark and cambium, right the way around the tree trunk. This can be achieved with either a cane knife or axe, depending on how hard the bark and cambium layers of the tree are. Herbicide is then applied into the groove, which kills the tree as it seeps into the cambium tissue. This is the preferred method of killing small trees, as it is usually much quicker and therefore more cost-effective than ring-barking or strip-barking.

Above: The method of slashing is effective in reducing the presence of viable seeds of IAPs in a new season; **Top right:** Example of ring-barking; **Bottom right:** Frilling is the preferred method of killing smaller trees.

Table 1 Advantages and disadvantages of manual removal using hand tools

Advantages	Disadvantages
Effective method in areas with low infestations	Not an effective method for dense infestations, as the cost of clearing is extremely high, with little or no impact
High job creation and associated poverty alleviation potential	Time consuming – may be slower to complete than other forms of control
No contamination of water with herbicides as these are applied directly to the tree	If no herbicides are used then the manual control techniques must be very well executed to ensure success

Above: Tree that has been ring-barked and treated with herbicide.

4.3.1.3 Manual removal using mechanised tools

A variety of mechanised tools can be used for IAP clearing. They include:

- **Brush-cutter:** Heavy duty motorised brush-cutters that are usually powered by a small two-stroke engine are popular for controlling low-growing thickets of IAPs (e.g. bramble). Importantly, a suitable blade must be fitted to the brush-cutter, for example, fitting a steel blade will allow for cutting of stems that are up to 15cm in diameter.

  Use of the standard nylon cutting head for plants such as Montanoa, results in excess vibration to the drive shaft and bearings which leads to excessive gearbox wear. Overloading the machine in this way soon leads to gear or bearing failure or a reduced life of certain other moving parts. The expenses that result from ongoing repair costs are obvious.

  Ideally, herbicide application to the cut stems should follow immediately after cutting. A team effort can work well in such instances, with one or two team members each applying herbicide as they follow in the path of the machine operator. Stems with a diameter smaller than 10mm are easy to miss, hence the advantage of having several herbicide applicators.

"Motorised brush-cutters are popular for controlling low-growing thickets of IAPs."

Above: A worker using a brush-cutter.

Above: Chainsaw operator felling a Pine tree.

- **Chainsaw:** A chainsaw is ideal for felling large trees and can be used to cut logs and branches into shorter lengths. This allows ground crew members to move the logs more easily, or load them onto a vehicle if they are to be carted away. Common target species for felling include large specimens of Syringa, Pine, Gum and Wattle. Training for chainsaw operators is essential. Operators need to understand the techniques of felling, i.e. ensuring that the tree falls in the desired direction. Each operator must also understand and be able to apply the necessary safety precautions during the felling process. Understanding the effective use and operation of the chainsaw itself is critical. The operator should also have the means and knowledge to undertake any required onsite servicing of the motor and sharpening of the chain. It is advisable that no other persons be working in close proximity to where a tree is being felled.

Table 2 Advantages and disadvantages of manual removal using mechanised tools

Advantages	Disadvantages
Dense stands of IAPs can be cleared.	The cost of the equipment, fuel and servicing – although this may be balanced by reduced labour costs.
May be possible to clear very large areas of IAPs faster than without mechanised tools.	Requires specialised training and more safety equipment than non-mechanised methods.
	Possible pollution caused by bar oil.

4.3.2 Chemical Control

Chemical control of IAPs involves the use of herbicides (plant poison) to kill targeted plants. Managers and herbicide operators must have a basic understanding of how herbicides function, as this will guide the correct selection of herbicides for different purposes and plants. The use of inappropriate herbicides and the incorrect use of the appropriate herbicides are wasteful, expensive practices. They often do more harm than good. This is especially problematic when working in close proximity to watercourses. Some herbicides can quickly contaminate fresh water systems and/or be transported downstream where they may remain active in the ecosystem. This is especially the case for herbicides with a high soil residual effect, i.e. herbicides that remain active after contact with soil.

"The use of inappropriate herbicides and the incorrect use of appropriate herbicides are wasteful, expensive practices."

Herbicides are classified as either selective or non-selective. Selective herbicides are usually specific to a particular group of plants, e.g. those specified for use on broad leaf plants will be effective on most broad leaf plants, but should not kill narrow leaved species such as grasses. Non-selective herbicides can kill any plant they come into contact with, and are therefore not suitable for use in areas where indigenous plants are present.

Above: Plenum* 160 ME
(a systemic micro-emulsion herbicide)

Herbicide licenses & permits

If clearing teams are to work with herbicides the contractor needs to have a valid **Scheduled Trade and Occupations Bylaws Permit** from the eThekwini Municipality, which registers them for the storage and commercial use of herbicides.

For information on how to obtain this permit, contact the Environmental Health Services Department of the eThekwini Municipality on **+27 31 311 3555.**

The contractor also needs to have a valid **Pest Control Operators Licence** (limited weeds controller) according to the "Fertilizers Farm Feeds, Agricultural Remedies and Stock Remedies Act", Act No. 36 of 1947. This is regulated by the Department of Agriculture, Forestry and Fisheries. The act is available online at: **http://www.gov.za**

Above: Safety gear should be used during foliar application of herbicide.

4.3.2.1 Chemical Application Training

Protective gear must be used at all times and the Guidelines provided in this handbook for mixing and storing of herbicides must be adhered to.

Herbicide applicators should have completed a certified training course. Alternately, contractors with four or more years of experience can be nominated for a certificate if they receive a letter from a Registered Pest Control Operator that states the nature and duration of their relevant experience.

Herbicide applicators need to understand the implications of splash and drift. When a plant is sprayed with herbicide, it is almost certain that excess herbicide will leave the target area. This might not be problematic in areas of high-density infestations: excess herbicide will either drift or drip onto other target IAPs, it is however problematic when there are many non-target species close by. The misting effect, where tiny droplets drift *via* a breeze to non-target species, often occurs when using high velocity nozzles. Ideally, low velocity and high volume nozzles should be used for drenching, while high velocity, low volume nozzles should be used for misting.

DOWNLOADABLE RESOURCES

More information on training is available online at **www.invasives.org.za**. Alternatively, contact the Project Manager of WESSA Stop the Spread on **031 266 2603** or at **stopthespread@wessakzn.org.za**.

"Foliar spraying is generally regarded as cheaper than cut stump treatment."

4.3.2.2 Chemical Application Techniques

Chemical application techniques include foliar (leaf) application, stem applications (basal stem, total frill, stem injection) and stump applications (cut stump, total stump, scrape and paint):

Foliar spraying

This method uses a knapsack sprayer to spray IAPs below 1 metre in height. Leaves are sprayed to the point of run-off. Correct training and certification is essential before a team member uses this method. It is advisable to invest in good quality knapsack sprayers and ensure replacement parts can be purchased. Regular servicing and cleaning of working parts is critical, as leaking sprayers can result in herbicide seeping onto workers, or onto the ground and thereby impacting on indigenous vegetation. Foliar spraying is generally regarded as a cheaper method than cut stump treatment, because fewer people are required to treat larger areas. It does, however, require large amounts of clean water (for mixing with herbicides), and therefore only practical where water is available.

Above: A team member using a knapsack to foliar spray IAPs.

Top: A team member using a handheld sprayer to treat a stump.
Above: An example of high pressure spraying from a boat.

Handheld spraying

Handheld spraying is a means to apply herbicide after cut stumping, ring-barking, frilling and strip-barking. The most common and convenient handheld sprayer has a 1.5 litre capacity and a nozzle that can be set to achieve the correct spray width. As with knapsack sprayers, it is advisable to invest in a good quality handheld sprayer for which replacement parts can easily be purchased. Always ensure workers receive training on how to maintain handheld sprayers properly. Handheld sprayers are cheap, and application of herbicide is accurate.

"As with knapsack sprayers, it is advisable to invest in a good quality handheld sprayer for which replacement parts can be purchased."

High pressure spraying

This is generally undertaken from a boat, to spray aquatic weeds such as Water Hyacinth, but can also be achieved from a vehicle if a tank and high-pressure pump have been fitted. The method is generally only used if the densities of IAPs are very high and no indigenous vegetation is present. Extreme care should always be taken, as it is almost impossible to spray selectively.

Above: Example of aerial application of herbicide.

Aerial spraying

Application of herbicides from a fixed wing craft, or helicopter is primarily used for spraying very high densities and large areas of aquatic IAPs present in dams or rivers that might otherwise be difficult to reach or control. The results are good, but aerial spraying is expensive and selectivity is impossible. Aerial spraying is only used in severe cases of infestation. Careful consideration of the herbicide type and mix are essential, given the risks of contaminating water and the impacts to fish and other aquatic biodiversity as well as impacts on human health. Only highly trained pilots, registered as crop sprayers with the National Department of Agriculture (NDA) and Civil Aviation Authority (CAA), should be used for this work. The pilots will need to ensure a high level of precision and ensure that a proper flight plan is lodged.

Table 3 Advantages and disadvantages of herbicide control

Advantages	Disadvantages
Achieve results over a short period (within 6 weeks of application).	Herbicides are expensive.
Large areas can be treated quickly.	The use of herbicides may contaminate sites used for drinking water, for washing and for fishing, and can therefore threaten human and animal health.
Complements mechanical control methods, increasing the effectiveness of IAP control activities.	May kill non-target plants or species.
	Specialised training and certification is required for use of herbicides.

Above: A tree stump that has been treated with herbicide containing a blue dye.

4.3.2.3 How to choose the correct herbicide

Choose the most appropriate herbicide by considering the following:

- **Active ingredient**
  Each herbicide has a chemical compound or active ingredient that makes it effective. Herbicides sold under different brand names may have the same active ingredient. It is critical that a herbicide with the correct active ingredient is selected. The concentration of the active ingredient can also differ from one product to the next. As such, the mixing ratios may differ. It is critical that the recommended mixing ratios are adhered to and the guideline document and label supplied with the product should always be consulted prior to calibration.
- **Residual effect**
  The residual effect is the length of time that a herbicide will remain active once in the soil. Some herbicides denature immediately on contact with soil, while others can remain active in the soil for up to two years. The shorter the residual effect of an herbicide, the less likely it is that non-target species will be killed. The residual effect of an herbicide should be checked before purchasing.
- **Dye**
  Dye is often mixed with herbicides to ensure a clear visual indication of which plants have been treated and which have not. This allows workers to see where they have applied the herbicide, and allows for easy inspection of work a few days later. Some herbicides contain a pre-mixed dye that eliminates the need for on-site mixing of dye. If a dye must be added, ensure that it is of good quality and that it is chemically compatible with the active ingredient and adjuvant. The use of different colour dyes for different herbicides is a useful approach. It makes it very easy for workers to differentiate which herbicide to apply to which plants where such a distinction is required (e.g. red dye can be selected for herbicide used to treat Lantana, and blue for Blue Gum, etc.).

"The use of different colour dyes for different herbicides makes it easier for workers to differentiate which herbicide to apply to which plants."

- **Registered herbicides**
  A large variety of herbicides and their supporting products such as dyes, wetting agents, etc. are available on the market, which have been registered for a range of IAPs. Beware of cheap imports that do not carry a South African registration number.
- **Recommended Adjuvants**
  Some herbicides require the use of a "wetter", or adjuvant, to be effective. Always check if a product has a recommended adjuvant or if an adjuvant must be added for targeting specific IAPs. Herbicides applied to leaves by foliar application often require a specific adjuvant, as do those applied to trees with very waxy stems. Always check with the manufacturer if there is any uncertainty regarding adjuvants.
- **Environmentally friendly**
  Always aim to select the most environmentally friendly product.
- **Bulk buying**
  Buying in bulk often reduces costs.
- **Choosing the correct 'carrier'**
  Either water or diesel can be used as a "carrier" for certain herbicides. However, water is the preferred carrier, because diesel is expensive and can have very negative impacts on the natural environment. There is also often a risk of diesel theft. Diesel should never be used for foliar applications due to its very negative impact on the environment. Diesel should only be used in direct application to stems, and run-off is to be minimised.
- **In and off-field advice**
  It is advisable to purchase herbicide from a reputable supplier who can offer in and off-field advice on the product. This can result in substantial savings, e.g. there will be an increased likelihood of using the correct mixing ratios, and a decreased incidence of over-application. A common misconception by users of herbicide is that by increasing the dosage of the chemical they will also be increasing its efficacy. Mixing ratios quoted by the manufacturer are tested for optimum results and it is important that these ratios be adhered to. Overdosing wastes expensive herbicide, is unlikely to have any discernible effect on the target species, and may impact negatively on the surrounding (i.e. non-target) plants.

DOWNLOADABLE RESOURCES

Recommended Herbicides
A list of common IAPs found in the eThekwini Municipality Area and the herbicides registered for use on these species is available online at **www.invasives.org.za** or in the WESSA handbook (see reference list for full details). Contractors should use only the herbicides registered for a target species.

"Only use herbicides that are registered for use on the specific species to be treated."

Above: Examples of team workers mixing herbicide using the necessary precautions.

HERBICIDE TIPS AND PRECAUTIONS

- Only use herbicides that are registered for use on this specific species to be treated.
- Spray plants during the active growing period. When leaf colour starts to turn for winter, it is too late to apply herbicides.
- Spray plants before the seeds are produced, namely, between flowering and fruit set.
- Avoid using herbicides on drought-stressed or diseased plants or in extremely hot or cold conditions.
- Herbicide should not be applied during wet conditions, before or after rain. If it rains after application, it is important to monitor the effect as one may need to re-apply.
- Carefully read and understand the instructions on the label prior to initiating chemical control. Most selective herbicides will lose selectivity at a high enough dose, highlighting the importance of adhering to instructions on the label.
- Always store herbicides in the original container and in secure storage areas out of reach of children and animals.
- All persons must wear the required personal protective equipment when working with herbicides. These include overalls, rubber gloves and a face mask.
- Avoid skin contact with herbicides and avoid breathing in the vapour.
- Herbicide should always be applied immediately after the selected mechanical control method (e.g. after frilling, ring-barking, cut stumping or strip- barking). Once the stem has dried it will not absorb the herbicide. However, if for some reason this is not done, and one needs to apply the herbicide a few days or a week or two later, it is imperative to remove any callous tissue that has formed. Once the living cells are exposed, the herbicide should be applied.
- Remember to keep herbicide in the shade while at the work site to keep it cool.
- To avoid spills, keep herbicide containers on a waterproof tarpaulin, or inside a big plastic bucket. When mixing herbicides, ensure that you use a funnel to avoid spilling. Should you spill the herbicide, it can be poured back into the container from the plastic bucket.
- Containers containing mixed herbicide should be clearly marked (e.g. 'glyphosate mix'). Likewise, containers filled with water to be used for mixing herbicide should also be clearly marked to ensure that people do not drink from them.
- Always use a measuring jug to measure the correct quantity required.
- To mix herbicides, half fill the appropriate size container with water, and then add the herbicide using the measuring jug. Secondly, close the container and shake, and then fill the rest of the container with water.
- Remember to keep the herbicide away from food.

4.3.3 Biological Control

IAPs thrive and spread in an exponential manner partly due to the lack of natural enemies (e.g. browsers or pathogens) that might occur in their land of origin. Biological control, or biocontrol, is the introduction of these natural enemies to remove the plants' competitive advantage, and reduce population vigour to a level comparable to that of the natural vegetation.

These natural enemies are termed 'biological control agents' and most include insects, mites and micro-organisms such as fungi or bacteria. Biological control agents usually attack specific parts of the plant. They can either attack the reproductive organs directly, e.g. on the parent plant (flower buds, flowers, or fruit), or the seeds after they have dropped. The 'stress' caused by a biocontrol agent may kill a plant outright, or it might impact on the plant's reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is thus effectively sterilized. All of these outcomes will help to reduce rates of spread of the species. This is useful in areas where plant populations need to be contained until resources can be mobilised to implement other control measures.

Table 4 Advantages and disadvantages of biological control

Advantages	Disadvantages
Most environmentally friendly and most sustainable of all IAP control methods.	Generally slow, especially initially.
Usually does not require high or long-term maintenance.	Low levels of infestation, with occasional outbreaks, will remain a feature of systems under biological control.
Relatively low cost implication over the long term.	Any use of chemicals around biocontrol agent colonies may adversely affect the potency of this control method.
	Cannot be used where the biocontrol agent would threaten commercial populations of the target species that may exist nearby. This includes community woodlots.
	Biocontrol agents are not available for all target IAP species in the eThekwini Municipal Area.

In order to obtain and release biocontrol agents, it is important to first contact the relevant authorities. In KwaZulu-Natal, the first port of call is the provincial representative of the Working for Water Programme who will be able to advise on what biocontrol agents have been successfully established in the eThekwini Municipal Area, and if additional control agents are in stock and available for release.

The National Department of Agriculture, Forestry and Fisheries (DAFF) Directorate: Land Use and Soil Management (LUSM) can also be contacted. The South African Sugar Research Institute (SASRI) has a mass rearing programme for weed biocontrol agents and is based in Mount Edgecombe. All the biocontrol agents will be provided free of charge and can either be posted or collected from SASRI.

Pictured below are examples of some successful biocontrol agents released in the Durban area.

Top left: *Lixus aemulus* larvae damage.
Top right: *Lixus aemulus* attacks the stems of *Chromolaena odorata.*
Left: *Neochetina bruchi* damage on the leaves of *Eichhornia crassipes.*
Above: *Neochetina bruchi* attacks the leaves of *Eichhornia crassipes.*

AGRICULTURAL RESEARCH COUNCIL'S PLANT PROTECTION RESEARCH INSTITUTE

The Agricultural Research Council's Plant Protection Research Institute (ARC-PPRI) conducts host specificity research during biocontrol agent selection. This lengthy process can take several years to be completed. Although time consuming, the process ensures that a biocontrol agent is not only effective but that it does not become an invasive species itself. The Working for Water Programme is responsible for release and monitoring of biocontrol agents nationally. Working for Water has appointed a Biocontrol Manager in each province to assist with making the appropriate biocontrol agents available.

4.3.4 Habitat Management

There are many challenges of managing IAP invasions in the EMA. The warm, moist conditions present in the EMA are ideal for the spread of many IAPs. Such species threaten the balanced ecological functioning of local habitats. Managing IAPs in the EMA is a complex task that must include a wide range of stakeholders. Whilst many efforts have been made in the past to deal with IAPs, most have been done on a fairly *ad hoc* and opportunistic basis. Although well-meant and perhaps even sometimes successful, such efforts can be wasteful as IAPs are often able to re-infest areas if ongoing and thorough follow-up control is not maintained. Correct management of open space areas, nature reserves, parks and gardens, and nurseries is therefore important if IAPs are to be successfully controlled. As such, it is important to understand which practices to adopt for a particular area. For example, it might be inappropriate to use fire to control IAPs in a nursery, but essential for managing them in a grassland site.

Fire is an excellent tool for reducing the IAPs present in grassland areas, and if the fire is the correct intensity and duration, it can kill certain IAP species. Other IAP species will coppice and produce new shoots from ground level, after a fire has passed, and these are easier to control with chemical or manual clearing methods. Black Wattle seeds are stimulated to germinate by fire. Once the re-invading seedlings have grown or plants have coppiced and they are at a height of not less than 15 cm, a suitable foliar spray can be used. It is important to note that while fire is a cheap method of control, care must be taken to follow correct precautions and burning procedures.

Working on Fire

Working on Fire (WoF) is a national sustainable development programme that aims to alleviate poverty and develop skills by employing people to manage fires and other environmental issues such as IAP control. In April 2009, a dedicated Working on Fire team, with the adopted name 'Igagasi Hotshots', was appointed to operate within the boundaries of the eThekwini Municipal Area. After a very successful year of Open Space Management, it was decided that a second team would be appointed. A rope access team, or high altitude team (HAT) was also added, although funding for that operation is now covered by national government (DEA). The total staff component is currently 60 people. The EPCPD have a schedule of sites wherein WoF implements IAP control, including through fire application.

"Fire is an excellent tool for reducing the IAPs present in grassland areas, and if the fire is the correct intensity and duration, it can kill certain IAP species."

Working for Ecosystems

The EPCPD initiated a programme in late 2006 called 'Working for Ecosystems' which is a poverty alleviation and IAP control initiative that hires economically disadvantaged individuals from local communities to eradicate IAPs through mechanical and chemical means. The project currently employs 148 people to work in the Ntshongweni, Mzinyathi, Paradise Valley, Drummond, Hulett's Bush, Ngonweni, Mdloti River catchment and Roosfontein areas. In the 2012/2013 financial year, 214 hectares of initial clearing and 845 hectares of follow-up IAP control took place with over 13,201 person-days worked.

Top & above: The use of fire to eradicate IAPs.

4.4 Post Removal Follow-up and Rehabilitation

There will always be some measure of regeneration of the cleared IAPs after the initial clearing work has been done. Proper follow-up work is thus essential and should be conducted regularly. If follow-up clearing is not done, the progress made in the initial clearing exercise will be lost within a few years as the IAPs become re-established. Research has shown that if follow-up IAP clearing is executed properly and consistently, the costs and time expended on each consecutive follow-up reduces drastically. The "maintenance" stage can then be reached, where regular monitoring will be required for any seedlings that may have germinated.

Where dense stands of IAPs have been cleared, the re-establishment of indigenous vegetation needs to be supported to help reduce the re-emergence of IAP species and to reduce the risk of soil erosion where the soil surface is poorly vegetated. This rehabilitation process needs to focus on two types of interventions:

a. Restoring a "natural" management regime for the habitat (for example protecting forests from fire, or controlled burning of grasslands), and

b. Giving a little help to speed the rehabilitation process up where appropriate (for example planting trees to speed up forest regeneration).

In most soils, the seeds from the plants of the former natural habitat that occupied the area prior to IAP infestation still survive. So, natural regeneration without the need for planting may be possible in many cases. However, if natural regeneration is not likely owing to the length of time that IAP infestation has been in place, or if the soil has been disturbed so that the natural seed stocks are destroyed, planting/seeding is required.

"Research has shown that if follow-up IAP clearing is executed properly and consistently, the costs and time expended on each consecutive follow-up reduces drastically."

When planting for restoration purposes, it is not always easy to continue to access these areas to water/maintain the plants. It is thus important to use only plants that have been properly hardened off from the nursery production system to minimize the loss of plants.

Complex restoration projects (for example involving the stabilization of major erosion areas and wetland rehabilitation projects involving the construction of weirs), it is necessary to contract the services of a specialist environmental rehabilitation professional to provide a plan and guidance on implementation.

Above: Restoration of woodland and forest at Buffelsdraai.

IAP Follow-ups

1. Monitor cleared areas on a regular basis for emergent seedlings and remove these (hand pulling or chemical control).
2. Maintenance work should be done in late summer when seedlings can be seen amongst the other plants.
3. Follow-up work can be undertaken on a 3 to 6 monthly basis, depending on the rate of re-growth.

Rehabilitation

1. All areas of exposed soil should immediately be protected by placing packed brush on the slope, or creating erosion control barriers using branches, sticks or logs placed horizontally across the slope at 1m intervals (the steeper the slope the closer the barriers should be placed to each other). If topsoil has been lost, rehabilitation of indigenous vegetation will be a difficult and expensive process.

2. If the soil remains relatively undisturbed and the area has some indigenous vegetation left in tact, the natural regeneration processes of the indigenous vegetation on the site should be managed. This involves regular follow-ups to remove emergent IAPs; protecting the area from other forms of disturbance (uncontrolled fire, heavy grazing/ browsing pressure, vehicles accessing the area etc.) while the vegetation re-establishes naturally.

   i. Grassland restoration may be supported by controlled burning at the correct time of year. This should be done under the guidance of an ecological professional, or the EPCPD. Note, however, that if the area has been cleared of Black Wattle, burning will stimulate germination of the seeds and a significantly increased IAP follow-up requirement.

   ii. Forest and woodland regeneration will be supported by keeping fire out of the area and limiting grazing/browsing pressure in the area until the trees have reached 1.5 – 2m in height.

3. If required, indigenous vegetation can be planted on the cleared areas. If the cleared patch is in a forest or woodland then it is advisable to plant a number of fast growing pioneer species. If it is a grassland area then it is advisable to either hydroseed with an indigenous mix or sow seeds *in situ*.

   i. An ecological specialist/EPCPD should provide guidance on the habitat type that the cleared site should be reinstated to. A suitable planting list should be drawn up and approved by the specialist/EPCPD.

   ii. Plants used for rehabilitation purposes must be sourced from within 50km of the rehabilitation site to ensure that the genetic composition of the introduced plants is not significantly different from that of naturally occurring indigenous plants in/around the rehabilitation area.

"An ecological specialist/EPCPD should provide guidance on the habitat type that the cleared site should be reinstated to."

4.5 Monitoring

In order to assess the impact of the clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken.

1. Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during the initial clearing activities. Similarly, photographic records should be kept of the area from immediately before follow-up clearing activities, and after. Rehabilitation processes/efforts must also be recorded.

2. Simple records must be kept of daily operations, e.g. area/location cleared, number of labour units and amount of herbicide used. This will assist with planning as each site will require work, once or twice a year, for a number of years and of evaluating the costs against the benefits of the work.

Top left: Aerial photo of Mamba Hill before the removal of a *Eucalyptus* plantation;
Above left: Aerial photo of Mamba Hill after the removal of *Eucalyptus* and rehabilitation of the grassland;
Top Right: Photo of Edgecliff before the removal of *Eucalyptus;*
Above right: Photo of Edgecliff after the removal of *Eucalyptus*.

5 SAFETY STANDARDS & GUIDELINES

Safety is of the utmost importance when dealing with IAP control. Staff often work in remote areas and with potentially dangerous tools and chemicals. The proper safety training and equipment is therefore required.

Above: A clearly marked drinking water container.

5.1 General Safety Standards

- Ensure that each person carries at least two litres of drinking water with him/her each day. Alternatively bring 25 litre containers filled with clean water and clearly mark that it is drinking water.
- Ensure that there are emergency procedures in place and that the team is aware of what to do in case of an emergency.
- Make sure there is cellphone reception in the area the team is working in. If there is none, a vehicle parked close by will be useful to drive to a cellphone reception area in case of an emergency, or to transport anyone who may be injured.
- If it is fire season, ensure that the workers are aware of the risks, have been trained in basic fire fighting and have the correct equipment available.

5.2 Herbicide Safety

The Herbicide Storeroom needs to comply with national Occupational Health and Safety standards, as well as the municipal Scheduled Trade and Occupational Bylaws. Section 'H' in the bylaw is triggered if there is "Herbicide manufacture, and bulk blending, storage and commercial usage of herbicides". Contractors who trigger these requirements will therefore need to be in possession of a permit for these purposes and will need to produce evidence to the municipality that they have satisfied all the requirements of the bylaw (note that municipal staff managing clearing operations also need to meet these requirements).

"A Herbicide Storeroom should have adequate ventilation, thus allowing fresh air to circulate."

- A Herbicide Storeroom should have adequate ventilation, thus allowing fresh air to circulate within. Whirlybirds and windows can provide sufficient ventilation. If the air is stagnant or if there is a smell of herbicides when opening up the storeroom then it is a good indication that there is not enough ventilation.

Above: A herbicide and equipment storeroom.

- Clean water needs to be available in close proximity to the storeroom.
- The floor must be non-porous. This is important so that when the floor is cleaned (which needs to be on a regular basis), no residue of herbicides remain. Place herbicide containers on wooden pallets to increase ventilation and make mopping up after spillages easier.
- 'No Smoking' and 'No Fire' signs should be posted on the door of the storeroom, as well as a sign stating that it is chemical store, and who the responsible person is for the store.
- Keep the storeroom locked to prevent herbicide getting into the wrong hands, e.g. children.
- A spill kit needs to be kept in the storeroom to mop up any spill. The spill kit must contain a bucket with sand and a spade. The sand is to be placed on the spill to absorb the liquid. Once the sand has absorbed the spill, it is to be collected and disposed of where it cannot contaminate the environment. It is preferable to keep contaminated sand in a bucket and dispose of it with empty containers at a certified chemical recycling plant.

Above: An empty container being spiked for disposal before being sent to be recycled.

"'No Smoking' and 'No Fire' signs should be posted on the door of the storeroom."

- Obtain the Material Safety Data Sheet from the supplier of the herbicide and ensure that you are familiar with the product before using it. Keep the Material Safety Data Sheet in the storeroom in case of an emergency.
- Always store herbicides in the original labelled container to avoid confusion with other products. Do not store other products in the store, such as protective clothing, food, etc. as they may become contaminated.
- All empty herbicide containers, or herbicides that have reached their expiry date, need to be safely disposed of. This can be done at a registered chemical recycling company. It is important that all empty containers are spiked before disposal. This ensures that they cannot later be used for carrying drinking water, food etc.
- The contact number for the St. Augustine's Poison Control Centre should be posted nearby (0800 333 444).

5.3 Personal Protective Equipment (PPE)

The use of Personal Protective Equipment (PPE) by staff controlling IAPs in the field is required by law. The PPE specifications differ for the different types of control. Mechanised control includes the use of a chainsaws and brush-cutters and will therefore require slightly different PPE from someone using manual control (cane knife, slasher, knapsack sprayer, etc.).

Table 5 PPE for manual control

Item	Specification
Overall	100% cotton, two-piece overalls are the best for absorbing perspiration; they last longer and are cooler. However, various cotton/polyester blends are available and suitable.
Rubber gloves	Standard rubber gloves for fieldwork are sufficient. Wrist length gloves are preferable over elbow length gloves for a warm climate.
Leather gloves	Standard wrist length leather gloves are appropriate.
Safety boots – (with/without steel cap)	Investing in a good quality safety boot might save you in the long run. Gumboots or standard safety boots, which support the ankles, are acceptable. Steel toecaps are recommended for workers working with hand tools or with large trees.
Hat – (hardhat/ wide brim hat)	If working with large trees, on steep gradients or if any other safety risks may be present, then wearing a hardhat is advisable. Alternatively, a wide brim hat can be used to protect the worker from the sun.
Safety glasses	Large, clear safety glasses, which allow air to pass through, are acceptable. Glasses with elastics, (e.g. welding glasses) are not acceptable as they tend to fog when a person perspires.
Face mask	A face mask which covers the nose and mouth is essential when mixing herbicides and for foliar spraying.
Raincoat	A raincoat is necessary in case workers are caught in the rain, or can be worn early morning to avoid getting wet from dew.

Note: Several firms in Durban supply PPE. Some of these may specialise in overalls and hats, whilst others might specialise in boots and goggles. The 'yellow pages' is a great starting place to search for suppliers.

Left: Team member in his full PPE kit for manual control.
Right: A team member in his full mechanical PPE kit felling a tree with a chainsaw.

Table 6 PPE for mechanised control

Item	Specification
Chainsaw safety pants	Standard safety chainsaw and long pants that provide protection against the chainsaw.
Leather gloves	Standard wrist length, leather gloves.
Safety boots with steel cap	Steel toecaps are essential for safety of the workers. Safety boots, not gumboots, are to be worn as they provide support around the ankle.
Hardhat	A hardhat with a visor and earmuffs are necessary for all mechanised control.
Safety glasses	Chainsaw safety glasses provide total cover around the eye area, thus preventing wood chips, stones, etc. entering.
Raincoat	A standard two-piece raincoat. However, it is better not to use mechanised control when it is raining.

5.4 Health and Safety Representatives and First Aiders

For every 20 people employed, one person needs to be trained as a First Aider and a separate person as a Health and Safety Representative. Appointments need to be made in writing and the person needs to clearly understand his/her responsibilities before signing. Persons appointed can be one of the workers, with these appointments bearing additional responsibilities. It is advisable to train an extra person as people can resign, or be absent which leaves no first aider in field.

Table 7 First Aider and Health and Safety Representative Responsibilities

First Aider Responsibilities	Health & Safety Rep Responsibilities
Management of the First Aid Kit	Recording all near misses and, minor and major injuries.
Keeping record of all items issued from the first aid kit: the name of the person issued to, the item issued and the date issued.	Reporting injuries.
Applying first aid when an injury occurs.	Reporting any unsafe act/condition in the workplace.
Attending Health and Safety Meetings when required.	Attending Health and Safety Meetings when required.
Reporting when stock is low in the first aid kit.	Speaking to workers regularly on healthy, safe working procedures and encouraging workers to report unsafe conditions.

6 EMERGING WEEDS

Emerging weeds are plants with invasive tendencies that are already present outside of their natural distribution range, but not yet widely so. They often have horticultural value, but can impact negatively on natural ecosystems, biodiversity, livelihoods or human health if allowed to continue to expand outside of their natural range and become naturalised.

The cost of managing and controlling IAPs once they are firmly established, i.e. reproducing and spreading, can be enormous. As IAPs spread, so costs will escalate. Complete eradication, which means the removal of every single plant and seed, is even more costly, primarily due to the difficulty of finding all plants in all areas, and because seed banks in the soil can often last for many years. Investing resources in early detection and removal of emerging weeds is an excellent way of reducing future weed control needs. The recognised emerging weeds in the eThekwini Municipal Area are listed in Annexure 3.

The South African National Biodiversity Institute (SANBI) has taxonomic expertise based at the KwaZulu-Natal Herbarium in Durban. Unknown plant specimens gathered by teams can be identified, confirmed and verified by taxonomists at this Herbarium.

SANBI has an Early Detection Rapid Response (EDRR) programme that focuses on the early detection of new or emerging IAPs, identification and verification of these IAPs, risk assessment, response planning and rapid response actions. **More information on SANBI's EDRR programme is available online at www.sanbi.org**

The eThekwini Municipality, in partnership with SANBI and others, has also recently launched a website where 'spotters' can record the emerging weeds they have seen. This is available online at www.durbaninvasives.org.za **More information on emerging weeds in Durban is contained within the Emerging Weeds document, which can be found online at www.invasives.org.za.**

"Investing resources in early detection and removal of emerging weeds is an excellent way of reducing future weed control needs."

7 REFERENCE MATERIALS AND FURTHER READING

Acts

- National Environmental Management: Biodiversity Act, Act 10 of 2004. Department of Environment Affairs, Pretoria.
- The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, Act 36 of 1947. Department of Agriculture, Pretoria.
- The Conservation of Agricultural Resources Act (CARA), Act 43 of 1983. Department of Agriculture, Pretoria.
- The Occupational Health and Safety Act, Act 85 of 1993. Department of Labour, Pretoria.

Reference Books and Guides

- Henderson, L. (2001). Alien Weeds and Invasive Plants: A Complete Guide to Declared Weeds and Invaders in South Africa. Plant Protection Research Institute Handbook no. 12. Agricultural Research Council, Pretoria.
- WESSA-KZN. (2008). Invasive Alien Plants in KwaZulu-Natal: Management and Control. A Wildlife Handbook. WESSA-KZN, Durban.
- Bromilow, C. (2010). Problem Plants and Alien Weeds of South Africa. Briza Publications, Pretoria.
- eThekwini Environmental Planning and Climate Protection Department (2013). Water Hyacinth Control Guideline Document. eThekwini Municipality, Durban. http://www.durban.gov.za/City_Services/development_planning_management/environmental_planning_climate_protection

Websites

- Invasive Species South Africa: http://www.invasives.org.za/
- Relevant legislation and regulations for South Africa: http://www.gov.za/
- Durban's Early Detection and Rapid Response website: http://www.durbaninvasives.org.za
- Plant Protection Research Institute website: http://www.arc.agric.za

ANNEXURE 1
IAP Control Programme Checklists & Budgeting Tables

PROJECT PRE-FEASIBILITY/PLANNING CHECKLIST

No.	Question:	Yes	No
1	Is the area a priority in the eThekwini Municipality's fine-scale systematic conservation plan (available from EPCPD)?		
2	Have other departments (e.g. EPCPD) been consulted, or input received before selecting this site?		
3	Has the area recently been mapped, or is the following information available: size of the area, IAP species present, density of the species, size of the species (seedlings, 2 metre trees etc.), and are there any other conditions you need to be aware of e.g. dangerous area to work, long walking distance? NB: The above information is important in order to identify the appropriate treatment method and calculate the amount of days required to clear the area.		
4	Is there funding available for follow-up clearing? NB: Follow-up treatments are required in eThekwini Municipal Area, twice a year for the first year at least. First follow-up clearing is normally budgeted at half the initial clearing cost.		
5	What clearing methods will be used and have I researched the best options available?		
6	Does the team leader/contractor hold a valid Pest Control Operators Certificate?		
7	Is there an appointed First Aider and a Health and Safety Representative with a valid certificate in the clearing team?		
8	Has the team received training to identify the IAPs they will be clearing? Have they attended an herbicide application course?		
9	Will any mechanized tools be used, and have the relevant persons attended training? E.g. chainsaw/brush cutter training.		

PROJECT BUDGETING TABLES

Table 1 Training, PPE and equipment for mechanised control

No.	Management Specifications	Quantity	Unit cost	Total
1	Staff training			
2	Staff person-days			
3	Personal protective equipment			
4	Application equipment			
5	Mechanical control equipment			
TOTAL COST (per month)				
TOTAL (per annum)				

Table 2 Estimated cost to clear 1 Ha of IAP infested land depending on infestation rate

Infestation rate (mixed species)	Cost: Rands / Ha
Light	**R 3 357.52**
Medium	**R 4 648.88**
High	**R 8 633.60**
Very High	**R 20 145.10**

*Once costs have been budgeted for IAP clearing, separate costs for removal of emerging weeds may be necessary. These costs are often higher per unit area as emerging weeds are often scattered across the municipality rather than concentrated in one area.

Table 3 Estimated areas that can be cleared daily per person and per 12 member team

Control method	Extent (m^2) cleared by 1 person per day	Extent (m^2) cleared by 12-member team per day
Light (mechanical & chemical)	850 – 900	10,800
Medium (mechanical & chemical)	550 – 650	7,800
Heavy (mechanical & chemical)	250 – 350	4,200
Extra heavy (mechanical & chemical)	100 – 150	1,800
Special weeds (eg Pereskia)	As required	–

PROJECT BUDGETING TABLES

Table 4 Equipment required for the various control methods

Control method	Amount Required	Specifications
Funnel	1 per team	An industrial funnel with a wide neck, not bigger than a 25 litre container opening.
Measuring jug	1 per team	Sufficient to measure herbicide quantities: have to be able to measure millimetres up to 1 litre.
Sharpening stone	2 per team	A standard sharpening stone with a handle (not a sharpening file) is ideal for sharpening cane knifes and slashers.
25 litre container	2 x containers per team for drinking water if they do not carry their own. If using handheld sprayers – then additional 2x containers required per team for mixing.	Transparent, plastic 25 litre containers with screw-on lids.
Tarpaulin/basin	1 tarpaulin/basin per team	A non-leak tarpaulin is required, no more than 2m x 2m. Alternatively, a plastic basin can be used. It is easier to throw spills from a basin back into a container, than using a cloth to mop up spills from the tarpaulin. The basin should be wide enough to fit two 25 litre containers.
Soap, bucket & towel	1 soap, bucket and towel per team	Any type of soap bar, a 5 litre bucket with handle and a hand towel is sufficient.
First Aid Kit	1 per team	A standard basic first aid kit which is made for field use, e.g. in a carrier bag.
Fire beaters	2 per team	This is optional but useful if in an area where fires could ignite.
Cane knife	1 each per person + 1 spare.	A cane knife with a short plastic handle with a broad blade end.
Handheld sprayer	1 each per person + 1 spare.	A 1.5 litre sprayer which has replacement parts available. Rather buy known name brands than cheap sprayers, as you need sturdy sprayers that will last.
16 litre sprayer	1 each per person + 1 spare.	16 litre sprayers of reputable brands which have replacement parts are ideal.
Chainsaw, maintenance tools & spares	1 per chainsaw operator	Buy well-known name brands, and visit a reputable stockist that can assist you with purchasing the right type for your use. Make sure it comes with maintenance tools and get assistance from the stockist on how to maintain it.
Brush-cutter, maintenance tools & spares	1 per brush-cutter operator	As above
Herbicide spill kit	1 per herbicide storage area	Bucket, sand, broom

TRAINING CHECKLISTS

The table below describes the courses that are compulsory, courses that help with the performance of the team's duties, and additional courses for employee development.

Training courses	Length of course & how often required	General worker/ herbicide applicator	First aider	Health & safety rep.	Chainsaw/ Brushcutter operator	Supervisor	Manager
Compulsary Courses (to be legally compliant)							
Basic First Aid Course	±4 day course – to be renewed every two years		X			X	X
Health & Safety Representative Course	±3 day course – to be renewed			X		X	X
Pest Control Operators Course	Dependant on service provider and experience of person					X	X
Chainsaw Operator Course	±3 day course / annual refresher course				X	X	
Brush-cutter Operator Course	±2 day course / annual refresher course				X	X	
Basic Fire Fighting Course (where relevant to project site & activities)	1 day course	X	X	X	X	X	X
Courses to enable employees to perform their duties							
Induction Training*	1 each per person + 1 spare.	X	X	X	X	X	X
Herbicide Application Training**	1 each per person + 1 spare.	X	X	X	X	X	
Invasive Alien Plant Identification Training	1 per chainsaw operator	X	X	X	X	X	X
Additonal courses							
Incident Investigation Course	1 day course			X		X	X
COIDA Training Course	3 day course					X	X
Basic Ecological Principles	3 day course	X	X	X	X	X	
HIV/Aids Awareness	1 day course	X	X	X	X	X	
Basic Health Care	1 day course	X	X	X	X	X	
Personal Finance Management Skills	3 day course	X	X	X	X	X	
Banking Skills	1 day course	X	X	X	X	X	

*Induction Training can be conducted by eThekwini staff or by a service provider. What is important to note is the course content. Examples of items to cover include: contract, type of work to be performed, hours of work, payment, what is required of the employee and employer, emergency procedures, protective clothing and equipment issuing and responsibility thereof, introduction to manager, first aider and health and safety representative, transportation procedures and safety in the workplace.

**Herbicide Application Training covers the following: Control methods and various herbicides and their application as well as the correct protective clothing and equipment for the task.

ANNEXURE 2
Registered Herbicides for IAP Species common to the eThekwini Municipal Area (EMA)

The following table presents the three primary herbicides used in the eThekwini Municipal Area. The full list of registered herbicides is available online at www.invasives.org.za or in the WESSA handbook (see list of Reference Materials and Further Reading in this Guideline).

Species	Herbicide registration status	Size class	Treatment method	Herbicide	Trade name	Estimated product (L/ha or kg/ha)
Chromolaena odorata	Registered	Young	Foliar spray	Fluroxypyr 80 + Picloram 80 g/L ME	Plenum	2.25
				Metsulfuron methyl 600g/kg WP	Brushoff	0.75
				Triclopyr (as butoxy ethyl ester) 480 g/L EC	Garlon	1.125

ANNEXURE 3
Emerging Weeds in the EMA

In 2008, the proposed NEMBA list of IAPs was reviewed by the eThekwini EPCPD and all known emerging weeds that are a specific problem in eThekwini were flagged. This list has subsequently been expanded upon and the current shortlist is included below:

1. *Acacia saligna* (Port Jackson Willow)
2. *Ageratina adenophora* (Crofton Weed)
3. *Ageratina riparia* (Creeping Crofton Weed)
4. *Ailanthus altissima* (Tree of Heaven)
5. *Callisia repens* (Dwarf-striped Inch Plant)
6. *Campuloclinium macrocephalum* (Pompom)
7. *Clerodendrum ugandense*
8. *Clusia rosea* (Scottish Attorney)
9. *Coreopsis lanceolata* (Tickseed)
10. *Diplocyclos palmatus* (Lollipop Climber)
11. *Duranta erecta* (Pigeon Berry)
12. *Furcraea foetida* (Mauritius Hemp)
13. *Jacaranda mimsifolia* (Jacaranda)
14. *Lilium formosanum* (St Joseph's lily)
15. *Maranta leuconeura* (Banded Arrowroot)
16. *Mimosa albida*
17. *Mirabilis jalapa* (Four-o-clock)
18. *Parthenium hysterophorus* (Parthenium weed)
19. *Pennisetum clandestinum* (Kikuyu Grass)
20. *Petiveria alliacea* (Guinea-hen weed)
21. *Pueraria montana var. lobata* (Kudzu vine or Kudzuranker)
22. *Sagittaria platyphylla* (Delta Arrowhead)
23. *Schefflera actinophylla* (Queensland Umbrella Tree)
24. *Schefflera arboricola* (Dwarf Umbrella Tree)
25. *Schefflera elegantissima* (False Aralia)
26. *Senna occidentilis* (Stinking Weed)
27. *Strobilanthes isophyllus* (Bedding conehead)
28. *Syzigium jambos* (Rose Apple)
29. *Triplaris americana* (Ant Tree)

ANNEXURE 4
Listed Invasive Alien Plants (CARA)

Category 1: These are prohibited plants, i.e. are illegal to grow or keep, and must be controlled or eradicated.

Category 2: Declared invader plants with a commercial or utility value. These plants are permitted in demarcated areas under controlled conditions and in bio-control reserves. They are, however, not permitted within 30m of the 1:50 year floodline of a watercourse or wetlands unless authorised by the National Department of Water Affairs.

Category 3: These plants may not be planted and propagative material may not be traded (except with permits in place). Eradication of existing plants is not required, except within 30m of the 1:50 year floodlines of watercourses or wetlands. The spread of these plants must be prevented.

Botanical name	Common Name	Category
Acacia baileyana	Bailey's Wattle	3
Acacia cyclops	Rooikrans	2
Acacia dealbata	Silver Wattle	• Category 1 plant in Western Cape • Category 2 plant in the rest of South Africa
Acacia decurrens	Green Wattle	2
Acacia elata	Pepper tree Wattle	3
Acacia implexa	Screw-pod Wattle	1
Acacia longifolia	Long-leaved Wattle	1
Acacia mearnsii	Black Wattle	2
Acacia melanoxylon	Australian Blackwood	2
Acacia paradoxa	Kangaroo Wattle	1
Acacia podalyriifolia	Pearl Acacia	3
Acacia pycnantha	Golden Wattle	1
Acacia saligna	Port Jackson Willow	2
Achyranthes aspera	Burweed	1
Agave sisalana	Sisal Hemp, Sisal	2
Ageratina adenophora	Crofton Weed	1
Ageratina riparia	Mistflower	1
Ageratum conyzoides	Invading Ageratum	1
Ageratum houstonianum	Mexican Ageratum	1
Ailanthus altissima	Tree-of-heaven	3
Albizia lebbeck	Lebbeck Tree	1
Albizia procera	False Lebbeck	1

Botanical name	Common Name	Category
Alhagi maurorum	Camel Thorn Bush	1
Anredera cordifolia	Madeira Vine, Brida Wreath	1
Araujia sericifera	Moth Catcher	1
Ardisia crenata	Coralberry Tree, Coral Bush	• Category 1 plant only in the Northern Province, KwaZulu-Natal & Mpumalanga
Argemone mexicana	Yellow – Flowered Mexican Poppy	1
Argemone ochroleuca	White – Flowered Mexican Poppy	1
Arundo donax	Giant Reed, Spanish Reed	1
Atriplex lindley	Sponge – Fruit Saltbush	3
Atriplex nummularia	Old Man Saltbush	2
Azolla filiculoides	Red Water Fern	1
Bauhinia purpurea	Butterfly Orchid Tree	3
Bauhinia variegata	Orchid Tree	3
Bryophyllum delagoense	Chandelier Plant	1
Caesalpinia decapetala	Mauritius Thorn	1
Campuloclinium macrocephalum	Pom Pom Weed	1
Canna indica	Indian Shot	1
Cardiospermum grandiflorum	Balloon Vine	1
Casuarina cunninghamiana	Beefwood	2
Casuarina equisetifolia	Horsetail Tree	2
Cereus jamacaru	Queen of the Night	1
Cestrum aurantiacum	Yellow or Orange Cestrum	1
Cestrum elegans	Crimson Cestrum	1
Cestrum laevgatum Schtdl	Inkberry	1
Cestrum parqui	Chilean Cestrum	1
Chromolaena odorata	Triffid Weed, Chromolaena	1
Cinnamomum camphora	Camphor Tree	• Category 1 plant only in the Northern Province, KwaZulu-Natal & Mpumalanga
Cirsium vulgare	Spear Thistle, Scotch Thistle	1
Convolvulus arvensis	Field Bindweed, Wild Morning Glory	1
Cortaderia jubata	Pampas Grass	1
Cortaderia selloana	Pampas Grass	1
Cotoneaster franchetii	Coloneaster	3
Cotoneaster pannosus	Silver-leaf Cotoneaster	3
Cuscuta campestris	Common Dodder	1
Cuscuta suaveolens	Lucerne Dodder	1
Cytisus monspessulanus	Montpellier Broom	1
Cytisus scoparius	Scotch Broom	1
Datura ferox	Large Thorn Apple	1
Datura innoxia	Downy Thorn Apple	1
Datura stramonium	Common Thorn Apple	1
Dolichandra unguis-cati	Cat's Claw Creeper	1
Echinopsis spachiana	Torch Cactus	1
Echium plantagineum	Patterson's Curse	1
Echium vulgare	Blue Echium	1
Egeria densa	Dense Water Weed	1
Eichhornia crassipes	Water Hyacinth	1
Elodea canadensis	Canadian Water Weed	1

Botanical name	Common Name	Category
Eriobotrya japonica	Loquat	3
Eucalyptus camaldulensis	Red River Gum	2
Eucalyptus cladocalyx	Sugar Gum	2
Eucalyptus diversicolor	Karri	2
Eucalyptus grandis	Saligna Gum, Rose Gum	2
Eucalyptus lehmannii	Spider Gum	• Category 1 plant in Western Cape • Category 2 plant in rest of South Africa
Eucalyptus paniculata	Grey Ironbark	2
Eucalyptus sideroxylon	Black Ironbark, Red Ironbark	2
Eugenia uniflora	Pitanga, Surinam Cherry	• Category 1 plant in the Northern Province, KwaZulu-Natal and Mpumalanga • Category 3 plant in rest of South Africa
Gleditsia triacanthos	Honey Locust, Sweet Locust	2
Grevillea robusta	Australian Silky Oak	3
Hakea drupacea	Sweet Hakea	1
Hakea gibbosa	Rock Hakea	1
Hakea sericea	Silky Hakea	1
Harrisia martinii	Moon Cactus, Harrisia Cactus	1
Hedychium coccineum	Red Ginger Lily	1
Hedychium coronarium	White Ginger Lily	1
Hedychium flavescens	Yellow Ginger Lily	1
Hedychium gardnerianum	Kahili Ginger Lily	1
Hypericum perforatum	St.Johns' Wort, Tipton Weed	2
Ipomoea alba	Moonflower	• Category 1 plant in the Northern Province, KwaZulu-Natal and Mpumalanga • Category 3 plant in the rest of South Africa
Ipomoea indica	Morning Glory	• Category 1 plant in the Northern Province, KwaZulu-Natal & Mpumalanga • Category 3 plant in rest of South Africa
Ipomoea purpurea	Morning Glory	3
Jacaranda mimosifolia	Jacaranda	3
All seed producing species or seed producing hybrids of Lantana that are non-indigenous to Africa	Lantana/Lantana, Tickberry, Cherry Pie	1
Lepidium	Pepper-cres, Hoary Cardaria, White Top	1
Leptospermum laevigatum	Australian Myrtle	1
Leucaena leucocephala	Leucaena	• Category 1 plant in the Western Cape
Ligustrum japonicum	Japanese Wax-leaved Privet	3
Ligustrum lucidum	Chinese Wax-leaved Privet	3
Ligustrum ovalifolium	Californian Privet	3
Ligustrum sinense	Chinese Privet	3
Ligustrum vulgare	Common Privet	3
Lilium formosanum	St Joseph's Lily, Trumpet Lily, Formosa Lil	3
Litsea glutinosa	Indian Laurel	1
Lyrthrum salicaria	Purple Loosestrife	1
Melia azedarach	"Syringa", Persian Lilac	3
Metrosideros excelsa	New Zealand Christmas Tree	3
Mimosa pigra	Giant Sensitive Plant	3

Botanical name	Common Name	Category
Montanoa hibiscifolia	Tree Daisy	1
Morus alba	White Mulberry, Common Mulberry	3
Myoporum tenuifolium	Manatoka	3
Myriophylum aquaticum	Parrot's Feather	1
Myriophyllum spicatum	Spiked Water-milfoil	1
Nassella tenuissima	White Tussock	1
Nassella trichotoma	Nassella Tussock	1
Nephrolepis exaltata	Sword Fern	3
Nerium oleander	Oleander	1
Nicotiana glauca	Wild Tobacco	1
Opuntia aurantiaca	Jointed Cactus	1
Opuntia exaltata	Long Spine Cactus	1
Opuntia	Mission Prickly Pear, Sweet Prickly Pear	1
Opuntia humifusa	Large Flowered Prickly Pear, Creeping Prickly Pear	1
Opuntia imbricata	Imbricate Cactus, Imbricate Prickly Pear	1
Opuntia lindheimeri	Small Round-leaved Prickly Pear	1
Opuntia monacantha	Cochineal Prickly Pear, Drooping Prickly Pear	1
Opuntia rosea	Rosea Cactus	1
Opuntia spinulifera	Saucepan Cactus, Large Roundleaved Prickly Pear	1
Opuntia stricta	Pest Pear Of Australia	1
Orobanche minor	Lesser Broomrape, Clover Broomrape	1
Paraserianthes lophantha	Australian Albizia, Stink Bean	1
Parthenium hysterophorus	Parthenium	1
Passiflora caerulea	Blue Passion Flower	1
Passiflora molissima	Banana Poka, Bandadilla	1
Passiflora suberosa	Devil's Pumpkin, Indigo Berry	1
Passiflora subpeltata	Grandina	1
Pennisetum setaceum	Fountain Grass	1
Pennisetum villosum	Feathertop	1
Pereskia aculeata	Pereskia/Barbados Gooseberry	1
Phytolacca dioica	Belhambra	3
Pinus canariensis	Canary Den	2
Pinus elliotti	Slash Pine	2
Pinus halepensis	Aleppo Pine	2
Pinus patula	Patula Pine	2
Pinus pinaster	Cluster Pine	2
Pinus radiata	Radiata Pine, Monterey Pine	2
Pinus roxburghii	Chir Pine, Longifolia Pine	2
Pinus taeda	Loblolly Pine	2
Pistia stratiotes	Water Lettuce	1
Pittosporum undulatum	Australian Cheesewood, Sweet Pittospormum	1
Plectranthus comosus	Abyssinian' Coleus, Wooly Plectranthus	3
Pontederia cordata	Pickerel Weed	3
Populus alba	White Popular	2
Populus x canescens	Grey Popular, Matchwood Popular	2
Prosopis glandulosa	Honey Mesquite	2
Proposis velutina	Velvet Mesquite	2
Psidium cattleianum	Strawberry Guava	3

Botanical name	Common Name	Category
Psidium guajava	Guava	2
Psidium guineense	Brazilian Guava	3
Psidium x durbanensis	Durban Guava	1
Pueraria lobata	Kudu Vine	1
Pyrancantha angustifolia	Yellow Firethorn	3
Pyrancantha crenulata	Himalayan Firethorn	3
Rhus succedanea	Wax Tree	1
Ricinus communis	Castor-oil Plant	2
Rivina humilis	Rivina, Bloodberry	1
Robinia pseudoacacia	Black Locust	2
Rorippa nasturtium – aquaticum	Watercress	2
Rosa rubiginosa	Eglantine, Sweetbriar	1
Rubus cuneifolius	American Bramble	1
Rubus fruticosus	European Blackberry	2
Salix babylonica	Weeping Willow	2
Salix fragilis	Crack Or Brittle Willow	2
Salvinia molesta	Kariba Weed	1
Schinus terebinthifolius	Brazilian Pepper Tree	• Category 1 in KwaZulu-Natal • Category 3 in rest of South Africa
Senna bicapsularis	Rambling Cassia	3
Senna didymobotrya	Peanut Butter Cassia	3
Senna pendule		3
Sesbania punicea	Red Sesbania	1
Solanum elaeagnifolium	Silver-leaf Bitter Apple	1
Solanum mauritianum	Bugweed	1
Solanum seaforthianum	Potato Creeper	1
Solanum sisymbriifolium	Wild Tomato, Dense-thorned Bitter Apple	2
Sorghum halepense	Johnson Grass, Aleppo Grass	2
Spartium junceum	Spanish Broom	1
Syzygium cumini	Jambolan	3
Syzygium jambos	Rose Apple	3
Tamarix chinensis	Chinese Tamarisk	• Category 1 plant in Northern, Western & Eastern Cape • Category 3 plant in rest of South Africa
Tamarix ramosissima	Pink Tamarisk	• Category 1 plant in Northern, Western & Eastern Cape • Category 3 plant in rest of South Africa
Tecoma stans	Yellow Bells	1
Thelechitonia trilobata	Singapore Daisy	• Category 1 in KwaZulu-Natal • Category 3 in rest of South Africa
Thevetia	Yellow Oleander	1
Tipuana tipu	Tipu Tree	3
Tithonia diversifolia	Mexican Sunflower	1
Tithonia rotundifolia	Red Sunflower	1
Toona ciliata	Toon Tree	3
Triplaris americana	Indian Almond	1
Ulex europaeus	European Gorse	1
Xanthium spinosum	Spiny Cocklebur	1
Xanthium strumarium	Large Cocklebur	1

ANNEXURE 5
Listed Invasive Alien Plants (NEMBA)

NATIONAL LIST OF INVASIVE PLANT SPECIES

Category 1a: Invasive plants requiring compulsory control. Plants are to be removed and destroyed. Any Category 1a listed plants must be eradicated.

Category 1b: These are invasive plants requiring control as part of an invasive species management programme. Permits must be issued for these plants to be kept on a property, and their management and control must be in terms of an approved invasive species management plan.

Scientific Name	Common Name	Category
Acacia adunca	Cascade Wattle	1a
Acacia stricta	Hop Wattle	1a
Agrimonia procera	Akkermonie, Geelklits/Scented Agrimony	1b
Alisma plantago-aquatica	Wateralisma, Padda Lepel/Mud Plantain, Water Alisma	1b
Antigonon leptopus	Koraalklimop/Coral Creeper	1b
Ardisia elliptica	Shoebutton Ardisia	1b
Aristolochia elegans	Sisblom/Dutchman's Pipe	1b
Atriplex inflata	Blasiesoutbos/Sponge Fruit Salt Bush	1b
Austrocylindropuntia subulata	Langdoringkaktus/Long Spine Cactus	1b
Azolla pinnata R.Br. subsp. asiatica	Mosquito Fern	1b
Bartlettina sordida	Bartlettina	1b
Billardiera heterophylla	Bluebell Creeper	1a
Bryophyllum delagoense	Kandelaarplant/Chandelier Plant	1b
Cabomba caroliniana	Cabomba, Carolina Fanwort	1a
Caesalpinia gilliesii	Paradysvoëlblom/Bird Of Paradise Flower	1b
Callisia repens	Creeping Inch Plant	1b
Calotropis procera	Calotropis, Giant-milkweed	1b
Catharanthus roseus	Begraafplaasblom/Madagascar Periwinkle	1b
Cestrum spp	Spanish Broom	1
Excluding approved cultivars as listed: None listed	Sestrum Spp./Cestrum Spp.	1b
Chondrilla juncea	Skeleton Weed	1a
Cirsium japonicum	Japanese Thistle	1b
Cotoneaster glaucophyllus	Bloudwergmispel/Late Cotoneaster	1b
Cotoneaster salicifolius	Willow-Leaved Showberry	1b
Cotoneaster simonsii	Himalayan Cotoneaster, Simon's Cotoneaster	1b
Crotolaria agatiflora	Voeltjiebos/Canarybird Bush, Bird Flower	1a
Cryptostegia madagascariensis	Madagascar Rubber Vine	1a
Cylindropuntia fulgida	Roseakaktus/Rosea Cactus, Chain-fruit Cholla	1b
Cylindropuntia imbricata	Imbrikaatkaktus, Kabelturksvy/Imbricate Cactus, Imbricate Prickly Pear	1b
Diplocyclos palmatus	Lollipop-Climber	1a
Duchesnea indica	Wilde-Aarbei/Wild Strawberry	1b
Echinodorus cordifolius	Creeping Burhead	1b
Echinodorus tenellus	Amazon Sword Plant	1b
Equisetum hyemale	Rough Horsetail, Common Scouring-rush	1a
Euphorbia esula	Leafy Spurge	1a
Euphorbia leucocephala	White Poinsettia	1b
Fallopia sachalinensis	Giant Knotweed	1a
Flaveria bidentis	Smeltersbossie/Smelter's-Bush	1b
Galium tricornutum	Three-Horned Bedstraw, Corn-cleavers	1b
Genista monspessulana	Montpellierbrem/Montpellier Broom	1a
Grevillea banksii	Australiese Rooi-Eik/Australian Crimson Oak, Red Flowering Silky Oak	1b
Homalanthus populifolius	Gebrokehartjieboom/Bleeding-Heart Tree	1b
Hydrilla verticillata	Hydrilla	1a
Hydrocleys nymphoides	Water Poppy	1a
Hylocereus undatus	Night-Blooming Cereus	1b
Hypericum androsaemum	Tutsan	1b
Ipomoea carnea subsp. fistulosa Excluding approved cultivars as listed: None listed	Morning Glory Bush	1b
Iris pseudacorus	Geel Iris/Yellow Flag	1a
Jatropha gossypiifolia	Cotton-leaf Physic Nut	1b
Kunzea ericoides	Burgan, White Teatree	1a
Lantana – All seed producing species or seed producing hybrids of Lantana that are not-Indigenous to Africa	Lantana/Lantana, Tickberry, Cherry Pie	1b
Linaria dalmatica	Dalmatian Toadflax, Broadleaf Toadflax	1b
Linaria vulgaris	Common Toadflax, Butter-and-eggs	1b
Ludwigia peruviana	Water-Primrose, Peruvian Primrosebush	1a
Lythrum hyssopifolia L.	Hyssop Loosestrife	1b
Malva dendromorpha	Mak Kiesieblaar/Tree Mallow	1b
Malva verticillata	Kiesieblaar/Mallow	1b
Malvastrum coromandelianum	Prickly Malvastrum	1b
Marsilea mutica	Nardoo, Australian Water-clover	1a
Melaleuca hypericifolia	Red-Flowering Tea Tree	1a
Mirabilis jalapa	Vieruurtjie/Four-o-clock, Marve-of-Peru	1b
Nicandra physalodes	Basterappelliefie/Apple-of-Peru	1b
Nuphar lutea	Yellow Water-lily	1a
Nymphaea mexicana	Geel Waterlelies/Yellow Water Lilies	1b
Nymphoides peltata	Gringed Waterlily, Yellow Floating-heart	1a
Opuntia engelmannii	Klein Rondeblaarturksvy/Small Round-leaved Prickly Pear	1b
Opuntia microdasys	Yellow Bunny-ears, Teddy-bear Cactus	1b
Orobanche ramosa	Blouduiwel/Blue Broomrape, Branched Broomrape	1b
Parkinsonia aculeata	Mexikaanse Groenhaarboom/Jerusalem Thorn	1b
Paspalum quadrifarium Lam.	Tussock Paspalum	1a
Passiflora tripartita	Piesangdilla/Banana Poka, Bananadilla	1b

Botanical name	Common Name	Category
Paulownia tomentosa	Keiserinboom, Prinsesboom/Empress Tree, Princess Tree, Royal Paulownia	1a
Pennisetum purpureum	Olifantsgras/Elephant Grass, Napier Grass	1b
Persicaria capitata	Knoopkruid/Knotweed	1b
Phytolacca americana	Inkbos, Karmosynbos/American Pokeweed	1b
Phytolacca icosandra	Bobbejaandruif, Inkbessie/Forest Inkberry	1b
Prunus serotina	Swartkersie/Black Cherry	1b
Psidium 'durbanensis	Durbanse Koejawel/Durban Guava	1b
Pueraria montana	Kudzuranker/Kudzu Vine	1a
Pyracantha coccinea *Excluding approved cultivars as listed:* *None listed*	Rooibranddoring/Red Firethorn	1b
Pyracantha crenatoserrata *Excluding approved cultivars as listed:* *None listed*	Chinese Firethorn, Broad Leaf Firethorn	1b
Pyracantha koidzumii *Excluding approved cultivars as listed:* *None listed*	Formosa Firethorn	1b
Pyracantha rogersiana *Excluding approved cultivars as listed:* *None listed*	Firethorn	1b
Rubus flagellaris	Braam/Bramble	1b
Rubus niveus	Ceylon Raspberry, Mysore Raspberry	1b
Rumex usambarensis	Oos-Afrikaanse Tongblaar/East African Dock	1b
Salsola kali	Rolbossie/Tumbleweed	1b
Salsola tragus	Russiese Rolbossie/Russian Tumbleweed	1b
Salvia tiliifolia	Lindenleaf Sage	1b
Sambucus canadensis	Kanadese Vlier/Canadian Elder	1b
Sambucus nigra	Europese Vlier/European Elder	1b
Senna hirsuta		1b
Senna occidentalis	Stinking Weed, Wild Coffee	1b
Senna septemtrionalis	Arsenic Bush, Smooth Senna	1b
Solanum chrysotrichum	Giant Devil's Fig	1b
Solanum pseudocapsicum	Jerusalemkersie/Jerusalem Cherry	1b
Tamarix aphylla	Woestyntamarisk/Athel Tree, Desert Tamarisk	1b
Tamarix gallica	Franse Tamarisk/French Tamarisk	1b
Tephrocactus articulatus	Pine Cone Cactus, Paper-spine Cholla	1a
Toxicodendron succedaneum	Wasboom/Wax Tree	1b
Tradescantia fluminensis	Wandelende Jood/Wandering Jew	1b
Tradescantia zebrina	Wandelende Jood/Wandering Jew	1b
Verbena bonariensis	Blouwaterbossie/Wild Verbena, Tall Verbena, Purple Top	1b
Verbena brasiliensis	Brazilian Verbena	1b
Vinca major *Excluding approved cultivars as listed:* *None listed*	Gewone-opklim/Greater Periwinkle	1b
Vinca minor *Excluding approved cultivars as listed:* *None listed*	Gewone-opklim/Greater Periwinkle Lesser Periwinkle	1b
Vitex trifolia	Indian Three-leaf Vitex	1b

PROHIBITED ALIEN SPECIES

Species for which permits may not be issued for propagation, trade or cultivation.

Scientific Name	Common Name
Acaena pallida	Pale Biddy-Biddy
Achnatherum caudatum	Spear Grass
Achnatherum brachychaetum	Puna Grass
Aegilops spp.	Goat Grasses
Aegilops cylindrica	Jointed Goat Grass
Aegilops geniculata	Ovate Goat Grass
Aegilops triuncialis	Barb Goat Grass
Aeginetia spp.	Aeginetia Species
Aeschynomene	Rough Joint-vetch
Allium paniculatum	Panicled Onion
Allium vineale	Wild Garlic
Alternanthera philoxeroides	Alligator Weed
Ambrosia trifida	Giant Ragweed
Andropogon bicornis	West Indian Foxtail Grass
Andropogon virginicus	Broom-sedge
Annona glabra	Pond Apple
Artemisia verlotiorum	Mugwort
Arundinaria spp.	Arundinaria Reeds/Bamboos
Azolla spp. except A. pinnata var. africana which may be indigenous	Azolla Species
Baccharis halimifolia	Groundsel Bush
Berberis glaucocarpa	Barberry
Bifora testiculata	Bifora
Cabomba spp.	Cabomba Species
Callistachys lanceolata)	Oxylobium
Carduus nutans	Musk Thistle
Calluna vulgaris	Heather
Calotis lappulacea	Bur-daisy
Carduus acanthoides	Plumeless Thistle
Carduus pycnocephalus	Italian Thistle
Carthamus leucocaulos	White-stem Distaff Thistle, Saffron Thistle
Carthamus oxyacanthus	Wild Safflower
Cassinia arcuata	Chinese Shrub, Drooping Cassinia
Caulerpa taxifolia	Notched Caulerpa, Feather Caulerpa
Celastrus orbiculatus	Climbing Spindleberry, Oriental Bittersweet
Cenchrus echinatus	Southern Sandbur Grass, Mossman River Grass
Cenchrus longispinus	Mat Sandbur, Spiny Bur Grass
Centaurea stoebe . subsp. micranthos	Spotted Knapweed
Centaurea diffusa	Diffuse Knapweed
Centaurea iberica	Iberian Star Thistle
Centaurea sulphurea	Sicilian Star Thistle
Centaurea virgata	Squarrose Knapweed
Cereus hildmannianus	Queen-of-the-night, Peruvian Apple, Hedge Cactus, Spiny Tree Cactus
Chorispora tenella	Purple Mustard

Scientific Name	Common Name
Chrysopogon aciculatus	Pilipiliula
Cirsium ochrocentrum	Yellow-spine Thistle
Cirsium undulatum	Wavy-leaf Thistle
Clematis vitalba	Old Man's Beard
Clidemia hirta	Koster's Curse
Coccinia grandis	Ivy Gourd
Cortaderia richardii	New Zealand Pampas Grass
Crassula helmsii	Swamp Stonecrop
Crataegus sinaica	Azzarola
Crupina vulgaris	Common Crupina, Bearded Creeper
Cupaniopsis anacardioides	Carrotwood
Cuscuta indecora	Large-seeded Dodder
Cuscuta reflexa	Giant Dodder, Indian Dodder
Cymbopogon refractus	Barbwire Grass
Datura leichhardtii	Leichhardt's Thorn Apple
Datura wrightii	Hairy Thorn Apple
Diplotaxis tenuifolia	Sand Rocket
Dipsacus fullonum	Wild Teasel
Dioscorea alata	White Yam
Drymaria arenarioides	Alfombrilla, Lightningweed
Echium italicum	Italian Bugloss
Eichhornia azurea	Anchored Water Hyacinth
Eichhornia spp.	Water Hyacinth Species
Elephantopus mollis	Elephantopus, Elephant's Foot
Emex spinosa	Spiny Emex, Devil's Thorn, Lesser Jack
Equisetum arvense	Field Horsetail, Common Horsetail
Erica lusitanica	Spanish Heath, Portuguese Heath
Euphorbia oblongata	Oblong Spurge
Euphorbia terracina	Geraldton Carnation
Fallopia japonica	Japanese Knotweed
Fallopia X bohemica	Japanese Knotweed Hybrid
Gaura drummondii	Drummond's Gaura
Gmelina asiatica	Badhara Bush
Gymnocoronis spilanthoides	Senegal Tea Plant, Temple Plant
Halimodendron halodendron	Russian Salt Tree
Halogeton glomeratus	Halogeton
Harungana madagascariensis	Harungana, Haronga, Dragon's-blood-tree
Helianthus ciliaris	Blueweed, Texas Blueweed
Hieracium aurantiacum	Orange Hawkweed
Hieracium pilosella	Mouse-ear Hawkweed
Hieracium praealtum	King Devil
Hydrocharis morsus-ranae	Frog's-bit
Hydrodictyon reticulatum	Water Net
Hygrophila costata	Hygrophila
Hygrophila polysperma	Miramar Weed, Hygrophila
Hymenachne amplexicaulis	Olive Hymenachne, West Indian Marsh Grass
Hypericum X inodorum	Tall St John's Wort, Tall Tutsan

Scientific Name	Common Name
Hypericum triquetrifolium	Tangled Hypericum
Hyptis capitata	Knobweed
Hyptis pectinata	Comb Hyptis
Hyptis suaveolens	Wild Spikenard, Hyptis
Imperata brasiliensis	Brazilian Satin-tail
Imperata brevifolia	Satin-tail
Ipomoea triloba	Little-bell, Aiea Morning Glory
Ischaemum rugosum	Murain-grass
Iva axillaris	Poverty Weed
Iva axillaris subsp. robustior	Poverty Weed
Juncus acutus subsp. acutus	Spiny Rush
Lagascea mollis	Acuate
Lepidium appelianum	Globe-pod Hoary Cress
Lepidium draba subsp. chalepense	Lens Podded Hoary Cress
Lepidium latifolium	Perennial Pepperweed/Perennial Peppercress
Limnobium spongia	American Spongeplant
Limnocharis flava	Sawah Flowering Rush, Yellow Burrhead
Limnophila indica	Ambulia
Limnophila sessiliflora	Ambulia
Ludwigia peploides	Primrose Willow, Creeping Water-primrose
Malachra alceifolia	Malachra
Malvella leprosa	Alkali Mallow, Alkali Sida
Martynia annua	Devil's Claw
Medinilla venosa	
Melastoma malabathricum	Indian-rhododendron
Melastoma spp.	Melastoma Species
Menyanthes trifoliata	Bog Bean
Miconia spp.	Miconia
Mikania cordata	Mile-a-minute
Mikania micrantha	Mile-a-minute, Climbing Hempweed
Mikania scandens	Climbing Hempweed
Mimosa diplotricha	Giant Sensitive – Plant
Miscanthus floridulus	Giant Chinese Silver Grass, Japanese Silver Grass
Monochoria hastata	Arrow-leaf Monochoria, Hastate-leaf-pondweed
Monochoria vaginalis	Oval-leaf Monochoria, Oval-leaf-pondweed, Pickerel-weed
Muhlenbergia schreberi	Nimblewill
Myagrum perfoliatum	Muskweed
Najas guadalupensis	Southern Naiad
Nassella charruana	Lobed Needlegrass
Nassella hyalina	Cane Needlegrass
Nassella leucotricha	Texas Needlegrass
Nechamandra alternifolia	
Neyraudia reynaudiana	Burma Reed
Nymphoides geminata	Entire Marshwort
Oenanthe pimpinelloides	Water Dropwort, Corky-fruit Water-dropwort
Ononis alopecuroides	Foxtail Restharrow
Onopordum acaulo	Stemless Thistle
Onopordum illyricum	Illyrian Thistle
Onopordum tauricum	Taurian Thistle, Taurean Thistle

Scientific Name	Common Name
Orobanche cooperi	Cooper's Broomrape
Oryza rufipogon	Red Rice, Perennial Wild Red Rice
Ottelia alismoides	Duck-lettuce, Water-plantain Ottelia
Oxyspora paniculata	
Paederia cruddasiana	Sewer Vine
Paederia foetida	Skunk Vine
Panicum antidotale	Blue Panic Grass
Parietaria judaica	Wall Pellitory
Passiflora bicornis	Wingleaf Passionfruit
Pennisetum alopecuroides	Chinese Pennisetum, Swamp Foxtail Grass
Pennisetum pedicellatum	Kyasuwa-grass
Pennisetum polystachion	Mission Grass, Thin Napier Grass
Persicaria perfoliata	Devil's Tail Tearthumb, Mile-a-minute-vine, Mile-a-minute-weed
Persicaria wallichii	Himalayan Knotweed
Physalis longifolia	Long-leaf Ground-cherry
Picnomon acarna	Soldier Thistle
Piper aduncum	Spiked Pepper, Piper
Potamogeton perfoliatus	Clasped Pondweed
Pontederia rotundifolia	Tropical Pickerel-weed
Prosopis alpataco	Mesquite
Prosopis argentina	Mesquite
Prosopis bukartii	Mesquite
Prosopis caldenia	Mesquite
Prosopis calingastana	Cusqui, Mesquite
Prosopis campestris	Mesquite
Prosopis castellanosii	Mesquite
Prosopis denudans	Mesquite
Prosopis elata	Mesquite
Prosopis farcta	Syrian Mesquite
Prosopis ferox	Mesquite
Prosopis fiebrigii	Mesquite
Prosopis hassleri	Mesquite
Prosopis humilis	Mesquite
Prosopis kuntzei	Mesquite
Prosopis palmeri	Mesquite
Prosopis reptans	Mesquite
Prosopis rojasiana	Mesquite
Prosopis ruizlealii	Mesquite
Prosopis ruscifolia	Mesquite
Prosopis sericantha.	Mesquite
Prosopis strombulifera	Argentine Screwbean, Creeping Mesquite
Prosopis torquata	Mesquite
Pueraria phaseoloides	Tropical Kudzu
Ranunculus acris	Giant Buttercup
Ranunculus sceleratus	Celery-leaf Buttercup
Reseda phyteuma	Rampion Mignonette
Rorippa austriaca	Austrian Field Cress
Rorippa sylvestris	Creeping Yellow Field Cress
Rubus anglocandicans	Blackberry

Scientific Name	Common Name
Rubus argutus	Prickly Florida Blackberry
Rubus ellipticus	Yellow Himalayan Raspberry
Rubus moluccanus	Wild Blackberry, Wild Raspberry
Rubus sieboldii	Molucca Raspberry
Saccharum spontaneum	Wild Sugarcane
Sagittaria montevidensis	Giant Arrowhead
Sagittaria platyphylla	Sagittaria, Delta Arrowhead
Salsola collina	Spineless Russian Thistle, Tumbleweed
Salsola paulsenii	Barbwire Russian Thistle
Salsola vermiculata	Wormleaf Salsola, Wormleaf Saltwort
Salvia aethiopis	Mediterranean Sage
Salvia virgata	Meadow Sage
Salvinia auriculata	Salvinia, Giant Salvinia
Salvinia biloba	Giant Salvinia
Salvinia herzogii	Giant Salvinia
Sclerolaena birchii	Galvanised Burr
Scolymus hispanicus	Golden Thistle
Scolymus maculatus	Spotted Golden Thistle
Senecio jacobaea	Tansy Ragwort, St James' Ragwort
Senecio squalidus	Oxford Ragwort
Senna tora	Java Bean, Sicklepod Senna
Setaria faberi	Chinese Foxtail, Giant Foxtail
Setaria palmifolia	Palm Grass
Solanum carolinense	Horse Nettle, Carolina Horse Nettle
Solanum dimidiatum	Torrey's Nightshade
Solanum lanceolatum	Lance-leaf Nightshade
Solanum marginatum	White-margined Nightshade, White-edged Nightshade
Solanum robustum	Silver-leaf Nightshade
Solanum tampicense	Wetland Nightshade
Sonchus arvensis	Perennial Sow Thistle
Sorghum hybrid	Silk Forage Sorghum
Sorghum X almum	Columbus Grass
Sparganium erectum	Exotic Bur-reed, Bur Reed
Spermacoce alata	Borreria, Buttonweed
Sphaerophysa salsula	Austrian Peaweed
Sporobolus indicus	Giant Parramatta Grass
Stratiotes aloides	Water-aloe, Soldier Plant, Water-soldier
Symphytum asperum	Prickly Comfrey, Rough Comfrey
Taeniatherum caput-medusae	Medusa-head, Medusa's-head
Themeda quadrivalvis	Grader Grass, Habana Grass
Themeda villosa	Lyon's Grass
Thunbergia annua	Thunbergia
Thunbergia fragrans	Fragrant Thunbergia, White Thunbergia
Tribulus cistoides	Caltrop
Triumfetta semitriloba	Sacramento Bur
Vallisneria gigantea	Eelgrass
Verbascum thapsus	Mullein, Great Mullein
Viscum album	European Mistletoe
Zizania latifolia	Manchurian Wild Rice
Zygophyllum fabago	Syrian Bean-caper

NOTES

ENVIRONMENTAL PLANNING & CLIMATE PROTECTION DEPARTMENT

BIODIVERSITY | CLIMATE | PEOPLE

Environmental Planning and Climate Protection Department
Development Planning, Environment and Management Unit
P. O. Box 680, Durban, 4000, South Africa
Telephone: +27 31 311 7875 | www.durban.gov.za