TJA NALEDI INVESTMENT HOLDING (PTY) LTD

BARRAGE BULK SAND MINE

MINING OF SAND, AGGREGATE AND ALLUVIAL DIAMONDS ON PORTION 4 OF THE FARM WOODLANDS 407, NGWATHE LOCAL MUNICIPALITY, FREE STATE PROVINCE

ALIEN INVASIVE MANAGEMENT PLAN

OCTOBER 2017

REFERENCE NUMBER: FS 30/5/1/3/2/10020 MR

PREPARED FOR:

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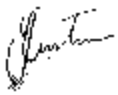
I. DECLARATION OF INDEPENDENCE

I, **Yolandie Coetzee,** in my capacity as a specialist consultant, hereby declare that I:-

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of this project, other than remuneration for the work performed in terms of the National Environmental Management Act 107 of 1998;
- Have and will not have vested interest in the proposed activity nor will I engage myself in any conflicting interest associated with this project
- As a registered member of the South African Council for Natural Scientific Professions, I will undertake my profession in accordance with the Code of Conduct of the Council as well as other associates to which I am a member;
- I undertake to disclose and provide to the competent authority any material or information at my disposal regarding this project as required in terms of the National Environmental Management Act 107 of 1998;
- Based on the information provided to me by the client and in addition to information obtained during the course of this study, I have presented the results and conclusion with regard to this project to the best of my professional ability;
- I reserve the right to modify aspects pertaining to this study should additional information become available through ongoing research and further work on this field;
- I undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study.



11 October 2017

II. CLIENT REVIEW AND COMMENT

I reviewed and understand the contents of this report. I acknowledge that this Alien Invasive Management Plan is a work in progress.

NB: The proposed control methods are only recommendations based on information available to the environmental consultant at the time. The environmental consultants employed at Greenmined Environmental are not registered Pest Control Operators (PCO) and in the circumstances the site should ensure that the expert advice and opinion of a registered PCO is sought prior to the commencement and implementation of control methods pertaining to invasive species.

_____ _____

Print Name **Signed**

_____

Date

LIST OF 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 trans located 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.

LIST OF ABBREVIATIONS

AIP	Alien Invasive Plants
AIP EDRR	Alien Invasive Plants Early Detection and Rapid Response
ARC-PPRI	Agricultural Research Council - Plant Protection Research Institute
ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CEBA	Community-based Ecosystem Adaptation Programme (under EPCPD)
CRM	Crocodile River Mine
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EC	Electrical Conductivity
EMP	Environmental Management Plan
EMPr	Environmental Management Plan report
GIS	Geographic Information System
GPS	Garmin Global Positioning System
IAP	Invasive alien plant
IAPs	Interested and Affected Parties
MPRDA	Mineral Petroleum Resource Development Act
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NEMWA	National Environmental Management Waste Act
NWA	National Water Act
PPE	Personal Protective Equipment
ROM	Run of Mine
SANS	South African National Standards
SANBI	South African National Biodiversity Institute
SLP	Social and Labour Plan
Stats SA	Statistics South Africa
ToR	Terms of Reference

1. INTRODUCTION

This document has been prepared by Greenmined Environmental (Pty) Ltd as an independent environmental consultancy firm appointed by Tja Naledi Beafase Investment Holdings (Pty) Ltd, to develop an Alien Invasive Plants (AIPs) management and rehabilitation plan for Barrage Bulk Sand Mine, Portion 04 of the farm Woodlands 407, Ngwanthe Local Municipality, Free State Province.

The farm Woodlands 407 is situated approximately 3.98 km southwest of Vaal Oewer, 22.26km north-east of Parys, 21.6km east of Sasolburg, Free State Province. The area is currently being mined by SPH Kundalila (contractor), under the old mining right (FS30/5/1/2/2/10020MR). The mining method to be used on Barrage Bulk Sand Mine will be strip mining. Mining will take place via a contractor (SPH Kundalila) who will load the material via a front end loader and hauled out of the excavation to the mobile crushing and screening plant. From the plant the material will be loaded via front end loader directly onto client's trucks. The material will be mined in strips with two strips being open at any given time. The maximum depth of the excavations will be 10 meters in some areas (building sand and gravel) and 5 meters in other areas (plaster sand). All activities will be contained within the boundaries of the site.

The proposed mining area is approximately 437.8330ha is extent and the applicant, Tja Naledi – Barrage Bulk Sand Mine, intents to win material from the area for at least 10 years. Silica Sand and Gravel (aggregate) to be removed from the mine will be used for building material in the vicinity. Application is also being made for alluvial diamonds, in the case that these minerals will be found during mining. The proposed mine will therefore contribute to the building industry in and around Parys, Vanderbijlpark and Sasolburg area.

The mining activities will consist out of the following:

- Stripping and stockpiling of topsoil;
- Excavating;
- Crushing and Screening;
- Stockpiling and transporting;
- Sloping and landscaping upon closure of the site; and
- Replacing the topsoil and vegetation the disturbed area.

The mining site will contain the following:

- Two Front end loaders;
- One ADT;
- One water bowser;
- One container office;
- One caravan for admin purposes;

- Storage yard for storing equipment; and
- Mobile crushing and screening plant.

A generator will be used to power the infrastructure on site until an Eskom connection can be secured. Water from the two boreholes on site (registered via the farmer) will be used dust suppression and drinking water on site.

The study area is located in a sparsely populated location whose land use feature is mainly agricultural farms. Invasive species know no boundaries; they span landscapes, land ownerships and jurisdictions. Their consequences cost the country / public millions of rands each year (ARC-PPRI, 2007). They are a significant drain on the national economy. Private landowners and small communities are some of the hardest hit by invasive species infestations. They can be exceptionally damaging in urban environments where ecological systems are already stressed. Invasive species threaten the quality of life and the property values of millions of metropolitan residents across the country. Alien invasive plant species populations have depleted water supplies, poisoned wildlife and livestock, and directly impacted thousands of hectares of natural forests and rangelands. Public recreational opportunities and experiences have become severely degraded by rapid infestations of invasive species, in many cases hampering access, reducing recreational quality and enjoyment, and decreasing the aesthetic values of public lands.

Control of invasive plant species and weeds is an important aspect during all phases of the proposed activities. Therefore, an alien invasive management plan was developed for the site to be implemented during the construction/site establishment-, operational-, decommissioning phase and 12 months' aftercare period of the mining activity.

Figure 1: Regional Location of Tja Naledi – Barrage Bulk Sand Mine

Most of the information was gathered from the Department of Water and Sanitation (DWS), the Agricultural Research Council (ARC) and the Working for Water web-sites. There are around 379 listed alien invasive species, which have been listed as Category 1, 2 or 3 alien invasive species in the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) and Category 1a and b, 2 and 3 under the National Environmental Management Biodiversity Act (NEM:BA). This clearly does not include all the exotic species that can be found in South Africa, which would go into the thousands of species, but lists the species which have become problematic within South Africa and require attention and control.

This document focuses mainly on alien invasive species which are listed under legislation and that are typically associated with the Grassland Biome or those that have in the past been observed within Tja Naledi - Barrage Bulk Sand Minemining boundaries. Other problem plants, whether exotic or indigenous species known as indicators of bush encroachment, on Tja Naledi - Barrage Bulk Sand Mine property, have also been included where relevant, but do not form the focus of this document. The document has been compiled in such a way that other species can be added, should they be discovered on the properties concerned, or should they become problematic plants within the area.

The format includes a summary on the legislation, a brief overview of the problems associated with alien invasive species establishment, various control and eradication methods available, a list of chemicals that are registered and can be utilised against alien invasive species and information sheets for the alien invasive species of concern.

The information sheets indicate the category the alien invasive species belongs to, the growth form of the species, the control measures that can be used against the species, the monitoring methodology that should be applied and, finally, indigenous species that can be utilised for rehabilitation of areas where large infestations occurred. The use of the information sheets allows for easy update of the various information as research uncovers newer, improved control measures against species and as biological control agents become available on the market.

Global trade and transportation have increased the opportunities for plants and other invasive species to cross geographic boundaries like never before. The invasive species problem is expanding rapidly because of the introduction of an increased variety of non-native species and many new types of infestation pathways. Natural controlling processes and limiting factors that kept species in check in their native ecosystems are not present in their new habitats, thereby enabling their populations to thrive. Alien invasive plants species (AIPs) can out-compete native species, especially when ecosystem health is stressed by factors such as drought, fire, pollution, resource over-utilization and landscape disturbances.

Lack of knowledge about how invasive species function in their new environment, significantly inhibits the ability to detect and eradicate new or small infestations. Efforts to find and eliminate new infestations are hampered by the lack of an effective early warning and rapid response systems. In addition, there is a shortage of safe and effective techniques to limit the impact on non-target areas or sensitive natural species. Furthermore, control efforts can be hampered when they extend across multiple political jurisdictions and ownerships especially in urban areas.

Rehabilitation and restoration efforts require new and expanded sources of endemic plant materials and improved techniques to repair damaged ecosystems.

1.1. Terms of Reference

The environmental authorisation compliance audits have recommended and requested that the mine compile and implement the Alien Invasive Plants Control and Management as part of their Environment Management Plan compliance requirements. During auditing, it was observed that alien vegetation is not being controlled and managed on site. Therefore, the proponent was instructed to develop an alien vegetation management plan which sets out actions, with accompanying timeframes, to be taken. The management plan includes alien plant species removal, control and management procedures. The following aspects are listed and discussed below:

1. Alien plant identification and listing;
2. Control of alien species;
3. Methods of removing alien species;
4. Alien plant material disposal;
5. Site specific guidelines:
6. Checklist of alien eradication; and
7. Early detection and rapid response to alien infestation.

NB: The proposed control methods are only <u>recommendations</u> based on information available to the environmental consultant at the time. The environmental consultants employed at Greenmined Environmental are not registered Pest Control Operators (PCO) and in the circumstances the site should ensure that the expert advice and opinion of a registered PCO is sought prior to the commencement and implementation of control methods pertaining to invasive species.

1.2. Reference Documents

The following list of documentation was reviewed prior to the audit and was used to formulated the objectives for the AIP management plan:

I. National Environmental Management Act No. 107 of 1998 (as amended) [NEMA];
II. National Environmental Management: Biodiversity Act No. 10 of 2004 [NEMBA];
III. National Water Act No. 36 of 1998 [NWA];
IV. Conservation of Agricultural Resources Act No. 43 of 1983 (as amended) [CARA];
V. The Department of Water Affairs and Forestry Environmental Best Practice Specifications of 2005; and
VI. Policies on alien invasive eradication methods.

2. OBJECTIVE

This document describes the potential sources of AIP infestation and provides a method for their control and management. Furthermore, it aims to provide methods to minimise and also monitor the AIPs infestation as a result of vegetation clearance due to the activity.

The primary objective of this document is to provide a AIPs control and management plan that focuses on AIPs control measures to be implemented by the client on the site.

This objective will be met through the implementation of the management measures specified in this plan, including:

- Effective management of existing alien species;
- Control and rehabilitation of open or unused areas at the site where possible; and
- Minimize re-invasion through preventative measures such as regular monitoring and planting of plant species like grasses in open areas.

3. WHAT ARE ALIEN INVASIVE PLANT SPECIES?

According to the book, Problem Plants of South Africa (Bromilow 2001) a weed is a plant in the wrong place at the wrong time. Problem plants are described as vigorous growers that are easily adaptable and mostly exotic or foreign in origin. Weeds usually are pioneer plants that invade disturbed areas such as stockpile areas, overburden and topsoil stockpiles and firebreaks. Invasive plants are plants that have been imported and has the ability to invade the natural vegetation.

Alien invasive plants and alien invasive infestations have several repercussions, which includes environmental, social and economic. Some of the more obvious issues are:

- They absorb and transpire a large amount of water, which gets wasted and removed for utilisation by other water users. This leads to reduction in water flow if in the vicinity of water bodies and alters aquatic ecosystems.
- In situations where the invasive species are very close to watercourses the plants may alter riverbanks and highly increase the potential of erosion, which could impact on the integrity of the stream or river and alter flood lines. This has negative consequences on associated ecosystems and all downstream water users.
- Large stands of alien invasive species result in loss of land which may potentially be productive resulting in associated negative economic and social impacts.

- Large infestations also reduce the land, which would otherwise be inhabited by indigenous species. This has implications for ecology, where biodiversity is directly impacted and socially, where natural resources that could have been harvested are no longer present.
- Many alien invasive species consist of dry material, which causes fire hazards with regard to fire intensities in areas where natural fire incidences are not frequent or intense.

The benefits, therefore, of eradicating and controlling alien invasive species would extend to the social, economic and environmental aspects of South Africa.

Invasive species have been characterized as a "catastrophic wildfire in slow motion". Thousands of invasive plants have infested hundreds of millions of hectares of land and water across the country causing massive disruptions in ecosystem function, reducing biodiversity and degrading ecosystem health. Forests, mountains, wetlands, rivers health and functioning have been affected by plant invasion which outcompete indigenous or endemic plant species and drain the water resources.

A species is considered invasive if it meets these two criteria:

- It is non-native to the ecosystem under consideration; and
- Its introduction causes or is likely to cause economic or environmental harm or harm to human health.

Annexure 1 of this document highlights listed alien invasive species common in the Grassland Biome (mixed Bushveld) and those that have been identified on the Tja Naledi – Barrage Bulk Sand Mine property that need to be eradicated and controlled and eradication and control methods that can be applied.

4. OTHER PROBLEM PLANTS

Other problem plants may exist in a particular area. Some exotic species are locally invasive and will need to be eradicated and controlled in the same way as the listed alien invasive species. Some indigenous species will also need to be controlled in certain situations. The CARA regulations name some of these species as indicators of bush-encroachment; these need to be managed in specific areas to maintain the biodiversity of these areas. Furthermore, a fourth class has been established and is also regulated by CARA, and identified as Bush encroachment. This term is used to describe a phenomenon induced by human impact on their environment. Certain species of indigenous bushes and shrubs tend to become problematic as they quickly respond to the ecological changes such as overgrazing thus increase their density. There are many species that have a potential to encroach and such plants are regulated under Regulation 16(A) of the Act.

4.1. Bush Encroachment

Bush-encroachment is defined as a situation where the plants grow at densities at least three (3) times higher than under natural circumstances (thus stands of plants that are closer to each other than three times the mean crown diameter), therefore reducing suitable habitat available to other species resulting in altered ecosystems and

biodiversity of these areas. These species also need to be managed in much the same way as one would with alien invasive species, however, the species should not be eradicated if they naturally occur in the area. Usually some underlying factors contribute to bush-encroachment, the most common being poor land management practices. These factors need to be targeted as part of the control and management processes to reduce the risk in bush-encroachment reoccurring in areas where managed.

Declared indicators of bush encroachment concern only landowners in rural areas. Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded by e.g. overgrazing or injudicious fires. A list of indigenous plants that might indicate bush encroachment in specified areas of the country appears in Regulation 16. The list includes plants such as sickle bush (*Dichrostachys cinerea*) and sweet thorn (*Acacia [Vallechia] karroo*). The plants themselves are not the problem, but they can be regarded as a symptom of poor land management practices. Therefore, CARA does not outlaw these plants, but instead prescribes management practices aimed at preventing bush encroachment and at combating it where it already occurs.

5. LEGAL FRAMEWORK

5.1. National Acts

5.1.1. The Constitution of the Republic of South Africa Act (Act No. 108 of 1996) – Section 24

The Constitution is South Africa's overarching law. It prescribes minimum standards with which existing and new laws must comply. Chapter 2 of the Constitution contains the Bill of Rights in which basic human rights are enshrined. Section 24 of this chapter states that "*Everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*." Government's commitment to give effect to the environmental rights enshrined in the Constitution is evident from the enactment of various pieces of environmental legislation since 1996, including the National Water Act, the National Environmental Management Act, etc.

5.1.2. National Environmental Management Act (Act No. 107 Of 1998) (NEMA), As Amended

NEMA replaces a number of the provisions of the Environment Conservation Act, 1989 (Act No. 73 of 1989). The Act provides for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions. The principles enshrined in NEMA guide the interpretation, administration and

implementation of the Act with regards to the protection and / or management of the environment. These principles serve as a framework within which environmental management must be formulated. Section 2(4) specifies that *"sustainable development requires the consideration of all relevant factors including the following aspects specifically relevant to biodiversity":*

- The disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimized and remedied;
- The development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardized;
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimized and remedied.

The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.

Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Of particular importance are the Environmental Impact Assessment (EIA) regulations of the Act, which identify activities that may have a substantial detrimental effect on the environment. The identification of these activities results in the activity being prohibited unless the competent authority has granted a written authorization after the consideration of an environmental impact assessment or basic assessment.

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

South Africa has numerous problematic alien invaders, such as black wattle, lantana and queen of the night. CARA sets out to combat invasive plants. The Act categorizes weeds into three categories, with varying degrees of action required for each category of weeds. CARA is currently in the process of being revised. In addition, the new regulations on alien and invasive species for the National Environmental Management: Biodiversity Act (NEMBA), Act 10 of 2004 has been published on 1 August 2014.

The Conservation of Agricultural Resources Act, No. 43 of 1983, (CARA) as amended in March 2001, sets out the regulations regarding the control of invasive plants and weeds under Regulations 15 and 16 and provides lists of species declared as invasive plants and indicators of bush encroachment. The Regulations classify the listed alien invasive plants into three categories. The categories can be described as follows:

Category 1 (CARA) plants are alien invasive species and must be eradicated and controlled. These species have little economic or social value and there invasive habits outcompete indigenous species, severely alter ecosystems and threaten local biodiversity.

Section 15A of CARA states that:

1) Category 1 plants may not occur on any land or inland water surface other than in biological control reserves.
2) A land user shall control any Category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
3) No person shall, except in or for purposes of a biological control reserve –
    a. establish, plant, maintain, multiply or propagate Category 1 plants;
    b. import or sell propagating material of Category 1 plants or any Category 1 plants;
    c. Acquire propagating material of Category 1 plants or any Category 1 plants.
4) The executive officer may, on good cause shown in writing by the land user, grant written exemption from compliance with the requirements of sub-regulation (1) on such conditions as the executive officer may determine in each case.

Category 2 (according to CARA) species have commercial or utility value and may only be grown in demarcated areas, in a controlled manner and under a permit.

Section 15B of CARA states that:

1) Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve.
    a. The executive officer may on application in writing demarcate an area as an area where Category 2 plants may occur, be established and be maintained.
    b. An area in respect of which a water use license for stream flow reduction activities has been issued in terms of section 36 of the National Water Act, 1998 (Act No. 36 of 1998) shall be deemed to be a demarcated area.
2) The executive officer shall demarcate an area for the occurrence, establishment and maintenance of Category 2 plants only if –
    a. The Category 2 plants in the area are cultivated under controlled circumstances; and
    b. The land user concerned has been authorised to use water in terms of the National Water Act, 1998 (Act No. 36 of 1998); and
    c. The Category 2 plants or products of Category 2 plants in the area are demonstrated to primarily serve a commercial purpose, use as a woodlot, shelter belt, building material, animal fodder, soil stabilisation, medicinal or other beneficial function that the executive officer may approve; and

d. All reasonable steps are taken to curtail the spreading of propagating material of the Category 2 plants outside the demarcated areas.

3) When an area is demarcated for the occurrence, establishment and maintenance of category 2 plants the executive officer may impose such additional conditions as may reasonably be deemed necessary to keep the Category 2 plants in the area in check.
4) No person shall sell propagating material of Category 2 plants or any Category 2 plants to another person unless such other person is a land user of a demarcated area or of a biological control reserve.
5) No person shall acquire propagating material of Category 2 plants or any Category 2 plants unless such material or such plants are intended for use in a demarcated area or in a biological control reserve.
6) Propagating material of Category 2 plants or Category 2 plants shall only be imported or sold in accordance with the provisions of the Plant Improvement Act, 1976 (Act No. 53 of 1976), the Agricultural Pests Act, 1983 (Act No. 36 of 1983) and the environment conservation regulations.
7) A land user shall control any Category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
8) Unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.
9) The executive officer may, on good cause shown in writing by the land user, grant written exemption from compliance with one or more of the requirements of sub-regulations (1), (3), (5), (6), (8) and (9) on such conditions as the executive officer may determine in each case.

Category 3 (CARA) species often have ornamental value and may be grown where they currently exist but cannot be ***planted,*** propagated or traded.

Section 15C of CARA states that:

1) Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve.
2) Subject to the provisions of sub-regulation (3), the provisions of sub-regulation (1) shall not apply in respect of Category 3 plants already in existence at the time of the commencement of these regulations.
   a. No land user shall allow Category 3 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.
   b. The executive officer may impose such additional conditions as may reasonably be deemed necessary with regard to Category 3 plants already in existence at the time of the commencement of these regulations.

c. A land user must take all reasonable steps to curtail the spreading of propagating material of Category 3 plants.
d. The executive officer may, after consultation with the land user, issue a direction in terms of section 7 of the Act that Category 3 plants in existence at the time of the commencement of these regulations must be controlled by means of the measures prescribed in regulation 15F.

3) No person shall, except in or for purposes of a biological control reserve –
   a. plant, establish, maintain, multiply or propagate Category 3 plants;
   b. import or sell propagating material of Category 3 plants or any Category 3 plants;
   c. acquire propagating material of Category 3 plants or any Category 3 plants.
4) The executive officer may, on good cause shown in writing by the land user, grant written exemption from compliance with one or more of the requirements of sub-regulations (1), (3) and (4) on such conditions as the executive officer may determine in each case.

Further to this, Regulation 16 discusses indigenous species which are indicators of bush encroachment and how such species must be regulated.

1) Indigenous plants of the kinds specified [in the Act] are regarded as indicator plants indicating bush encroachment in the areas specified.
2) A land user of an area in which natural vegetation occurs and that contains communities of indicator plants shall follow practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs.
3) One or more of the following practices shall be followed with regard to communities of indicator plants contemplated in sub-regulation (2) in order to remove the cause of the deterioration of the natural resources and to improve and maintain the production potential of the natural pastoral land:
   a. Uprooting, felling or cutting;
   b. Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;
   c. The application of control measures regarding the utilisation and protection of veld in terms of regulation 9;
   d. The application of control measures regarding livestock reduction or removal of animals in terms of regulations 10 and 11;
   e. Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive.

CARA has also released a list of plant species which are under surveillance and may in future become listed species requiring attention.

The National Department of Agriculture is responsible for administering the CARA regulations and landowners having alien invasive species on their property may be penalised. Penalties can be in the form of fines or

imprisonment. It is therefore important to have an alien invasive management plan in place that aims at primarily eradicating and secondly controlling alien invasive species. It is also important to keep records of all procedures followed and to have photographic records, as many alien invasive species are difficult to completely eradicate.

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

NEMBA provides for the management and conservation of biological diversity and components thereof; the use of indigenous biological resources in a sustainable manner; the fair and equitable sharing of benefits rising from bio-prospecting of biological resources; and cooperative governance in biodiversity management and conservation within the framework of NEMA. The Act also gives effect to international Strategic Review of the Status of Biodiversity Management in the South African Mining Industry agreements relating to biodiversity. The Act states that the Minister of Environmental Affairs and Tourism may identify any process or activity in a listed ecosystem as a threatening process and will, thereafter, be regarded as an activity contemplated in Section 24(2)(b) of NEMA which states that:

a) Specified activities may not be commenced without prior authorization from the Minister or MEC and specify such activities. This Act allows for any person, organization or organ of state to contribute to biodiversity management. Such a party may submit to the Minister a draft management plan for an ecosystem or species. Should the Minister approve the management plan, an agreement can be entered into regarding the implementation of the plan.
b) The NEMBA established the South African National Biodiversity Institute (SANBI) and gave it a mandate regarding monitoring, advising and co-coordinating biodiversity issues in South Africa.

Furthermore, an Alien and Invasive Species Regulation, as well as a new list of invasive species under the National Environmental Management: Biodiversity Act 10 of 2004 has come into effect in August 2014, and amended in July 2016, further assigning new categories for species designated under section 70 of the Act that cannot be propagated, grown, bought or sold by any industry without a permit. The National Environmental Management: Biodiversity Act 10 of 2004 categories are as follows:-

- **Category 1a:** Invasive plant species requiring compulsory control. These plants must be removed and destroyed and any species falling within this category is by law required to be eradicated from the environment. No permits should be sought or given to keep or propagate plant species falling within this category. Any form of trade or planting is strictly prohibited.
- **Category 1b:** Invasive plants requiring compulsory control as part of alien invasive plant species control programme. These plants are considered to have high invasive potential, thus require removal and eradication. Plants falling within this category qualify for governmental sponsored alien invasive plants control and management programmes. Furthermore, no permits will be issued to keep or sell plant falling within this category.
- **Category 2:** The plants falling within this category are alien invasive plants regulated by area or locality. These alien invasive plant species requires a demarcation permit in order to import, grow,

breed, sell, buy or accept as gifts. However, no permit will be issued for invasive plant species within this category existing in riparian areas or zones.

- **Category 3:** These alien invasive plant species are regulated by activity, thus an individual plant permit is required to import, grow, breed, possess, sell, buy, or move these plants. No permit is issued for Category 3 alien invasive plant species existing in riparian areas.

In order to identifying invasive plants or weeds that need to be controlled/eradicated from site, the plants specified in these groups were used as a guideline.

5.1.5. National Environmental Management Protected Areas Act (Act No. 57 of 2003) (NEMPAA), As Amended

NEM:PAA provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; for the continued existence, governance and functions of South African National Parks; and for matters in connection therewith.

5.1.6. Mineral and Petroleum Resources Development Act (Act No 28 of 2002) (MPRDA, Section 37(1))

According to the MPRDA, any prospecting or mining operations must not result in unacceptable pollution, ecological degradation or damage to the environment and must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of projects. Section 37 (1) of the MPRDA acknowledges that the principles set out in Section 2 of the NEMA, apply to all prospecting and mining operations and serve as guidelines for the interpretation, administration and implementation of the environmental requirements of this Act. In addition, mining right holders must give effect to the objectives of integrated environmental management as laid out in Chapter 5 of the NEMA. The MPRDA also obliges the owner of the mining right to rehabilitate disturbed areas and holds the owner responsible for any environmental degradation on his/her site.

5.1.7. National Water Act (Act No. 36 of 1998) (NWA)

The mining industry is itself dependent on key resource inputs such as water, the provision of which depends on the health and integrity of ecosystems.

The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially

against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations.

5.1.8. National Forests Act (Act No. 84 of 1998) (NFA)

The Act protects State Forests, Forest Nature Reserves and Wilderness Areas, and the plant and animal life contained therein. In addition the Act allows for management programmes to be established in order to prevent soil erosion and fire, maintain the natural genetic and species diversity and control plants and animals which are harmful to a particular area. The Act provides for the control and reasonable access to State Forests for the purposes of recreation, education, culture or spiritual fulfilment as well as prohibiting any person from damaging State Forests or contributing to the threat of fire. Forest officers are empowered to arrest any person who has contravened this Act and may seize such person's property. This act also refers to the protected trees that are listed and the licencing permits that is needed to remove, or relocated if needed.

5.2.Provincial Acts, Plans, Policy and Environmental guidelines

5.2.1. Bioregional plans

The Bioregional plans aim to provide maps of biodiversity priorities with accompanying land-use planning and decision making guidelines in order to inform decisions associated with land-use planning, environmental assessment, natural resource management and authorization.

5.2.2. Biodiversity management plans (BMP)

BMP's ensure the long term survival in nature of species; to provide the responsible person or organ of state effective monitoring and reporting on species progress and to be consistent with acts, frameworks and applicable bioregional plans or any plans issued in terms of Chapter 3 of the NEMA or any municipal integrated development plans etc.

5.2.3. National biodiversity strategy and action plans (NBSAP)

NBSAP goal is to conserve and managed terrestrial and aquatic biodiversity to ensure a sustainable and equitable benefits

5.2.4. National biodiversity assessment (NBA)

Formerly known as National Spatial Biodiversity Assessment (NSBA) which is a systematic biodiversity planning approach that aims to give a comprehensive biodiversity assessment (previously it focused on spatial only) throughout the country. Its focus is to mainstream biodiversity priorities throughout the economy and making links between biodiversity and socio-economic development.

5.2.5. Mining and biodiversity guideline

The mining industry plays a vital role in the growth and development of South Africa and its economy. Since the earliest discoveries of minerals in the region, this rich endowment of mineral resources has been a key driver of

South Africa's social and economic development. Mining continues to be one of the most significant sectors of the country's' economy, providing jobs, growing our GDP and building relations with international trading partners.

On par with this mineral wealth are exceptional endowments of biodiversity and ecosystems. South Africa is globally renowned as a mega-diverse country that harbours an exceptional number of species in relation to most other countries. This rich biodiversity and ecological infrastructure underpin and support the social and economic development in numerous direct and indirect ways. It is currently impacted upon by mining and other land uses in ways that are not sustainable.

Sustaining the goods and services that flow from ecosystems, and the benefits that these provide over the long term, will require limits in mining and other activities in certain areas. South Africa's Constitution and the laws stemming from it recognise the vital role of both ecological and mineral resources in a development path built upon the socially just, environmentally sustainable and economically efficient use of these resources.

The Guideline offers six principles that should be applied towards good decision making when addressing biodiversity issues and impacts in a mining context:

- Apply the law
- Use the best available biodiversity information
- Engage stakeholders thoroughly
- Use best practice environmental impact assessment (EIA) to identify, assess and evaluate impacts on biodiversity
- Apply the mitigation hierarchy in planning any mining-related activities and to develop robust environmental management programmes (EMP)
- Ensure effective implementation of the EMP, including adaptive management.

A range of tools and guidelines exist to support the application of these six principles. Considerations with respect to the six principles are described for each stage of the mining life cycle, including the implications for mining companies and decision makers.

6. ROLES AND RESPONSIBILITIES

Tja Naledi - Barrage Bulk Sand Mine is the responsible proponent who owns the mine and will play a major role in ensuring that this plan is effectively implemented. This plan is environmental legally binding and must be implemented to fulfil the requirements of relevant legislations and recommendation.

7. CONTROL OF ALIEN INVASIVE AND PROBLEM PLANT SPECIES

Alien plant invasions cause a decline in species diversity, local extinction of indigenous species and ecological imbalance. Thus, preventing the onset of an alien invasion and management of further spreading is required as

they outcompete the indigenous plant species and quickly establish themselves in an area. Therefore, a national strategy has been compiled and identifies four primary categories of programs to address the management of alien invasive plant species and they are as follows:-

- **Prevention**—Keep the invasive species out;
- **Early detection and rapid response**—Detect and eradicate invasive species to stop them from spreading;
- **Control and management**—Eliminate or control the problem of invasive species; and
- **Rehabilitation and restoration**—Heal, minimize, or reverse the harmful effects from invasive species.

The occurrence of alien invasive plants not only affect the growth and distribution of natural endemic plants, they also use more water than indigenous plants, some have toxic fruits or leaves which when consumed could be poisonous and lead to fatality. Therefore, alien invasive plant species need to be controlled or removed and the following section contains different methods that could be used to control AIP.

The ultimate aim of an alien invasive species management programme is to eradicate species completely. This is often very difficult as many of the species have seeds that remain viable for a very long time and even after physical removal of plants, the seeds germinate to form new infestations. An alien invasive management programme therefore must be an ongoing practice over many years and should follow the following phases:

A. The initial bulk eradication of alien invasive species by chemical or mechanical means, and in some instances biological control agents. This may also require rehabilitation if large stands of alien invasive species are removed. Local, indigenous species should be planted in the disturbed areas;
B. There should also be immediate follow up and all seedlings should be pulled out and removed. This should be done regularly, although the timeframes will vary from species to species depending on their growth forms and rates; and
C. Finally, areas that appear to be under controlled must continue to be managed and observation of these sites should continue on at least an annual basis. Rehabilitation at sites should also be monitored and action taken immediately if issues occur.

Various control methods are available for control of alien invasive species, including mechanical, chemical and biological control. In most instances, mechanical means are utilised and include physical removal of plants. Research on use of herbicides has been conducted on many species and can be applied in conjunction with mechanical methods. For some species, herbicides have not yet been fully researched and/or herbicides have not been registered and these need to be mechanically controlled. The Department of Water and Sanitation's Working for Water section provides guidelines to the preferred clearing methods for most problem plants. This information

can be obtained from their website: http://www.dwaf.gov.za/wfw/Control/. The selection of appropriate methods of control shall be based on the species to be controlled, the size of the plants, the density of the stand, the accessibility of terrain and environmental safety.

Biological control of alien invasive species is also an ongoing process and some biological control agents have been released on various alien invasive species and show varying degrees of success. Biological control options need to be carried out with specialist advice from academic or research institutes involved in research of alien invasive species.

Control options utilised must take into account the species being controlled and should take into account the ecosystem in which the control options are being applied. Some of the herbicides registered for control of alien invasive species should not be used in riparian areas, and some should be preferably used over others in areas where natural grass cover occurs. Some herbicides should only be utilised after consultation with a Working for Water technical advisor.

The control options are discussed below as individual actions, but in many cases integrated measures (more than one (1) control measure) are taken for more effective control of alien invasive species. As already mentioned, research with regard to herbicide application and biological control is lacking for certain alien invasive species and these, especially if listed as Category 1 invasive species, need to be managed and mechanical control of these species should be considered as a default control option.

The Department of Water and Sanitation proposes that the following methods of control for age or size target plants:

Seedlings

Hand pulling or hoeing:

- Hand pulling/hoeing should be carried out in sparse stands.
- Seedlings should be severed below the soil surface or removed from the soil. Soil disturbance should be minimized to reduce re-germination.

Herbicides:

- Herbicides can be used on dense stands.

Saplings

Hand pulling or hoeing:

- Where appropriate saplings can be removed manually as described above.

Herbicides:

- Foliar sprays can be carried out depending on the density of the stand. Fan nozzles should be fitted for overall spraying and solid cone nozzles for individual plant treatment. Spraying should be restricted to plants waist high or lower. Ensure there is sufficient foliage to carry the herbicide to the root system.
- Basal stem treatments of suitable herbicides in diesel can be carried out to the bottom 250 mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle.
- Cut stump treatments can be used where stems are cut as low as practical. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

Mature Trees (trees above shoulder height or robust bushes 12 – 1 months or older)

Ring Barking:

- Bark must be removed from the bottom of the stem to a height of 0.75 – 1.0 m. All bark must be removed to below ground level for good results.
- Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatment should be carried out.

Frilling or partial frilling:

- Cuts should be made through the bark into the sapwood by means of a light axe and a suitable herbicide must be applied into the cuts.

Basal stem treatments:

- Suitable herbicides should be applied in diesel to the base of the stem and to any exposed roots. Stems with a diameter up to 50 mm should be treated to a height of 250 mm and stems above 50 m diameter to a height of 500 mm. This method is only suitable for stems up to 100 mm in diameter.

Cut stump treatment:

- Stumps should be cut as low as practical and the herbicide applied. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

When herbicides are chosen as the preferred control method the guidelines of Working for Water (DWS) as stipulated in the Policy on the Use of Herbicides for the Control of Alien Vegetation should be followed:

- Herbicides selected for control shall be registered for use on that species under the conditions specified.
- Protection of the environment is of prime importance. Riparian areas must be protected and only herbicides that are approved may be used. Washing of equipment or disposal of waste spray mixture is prohibited in or near water courses where contamination of water can occur.
- Empty herbicide containers must be disposed of as hazardous waste and may not be used for any other purpose.
- Equipment must be washed where there is no danger of contamination of a water source or natural vegetated area. It is proposed that washing be restricted to the wash bay.

- Product and spray mixtures should be stored so that it is inaccessible to the public. Site management must ensure that the Safety Data Sheet of the product is available on site.

7.1. Chemical Control

Chemical control requires the application of chemicals which can be highly selective or non-selective (inhibit certain plants or toxic to all plants respectively) or can be localised or systemic (act on the area where they are applied or attack areas of growth respectively). In most cases, herbicides utilised against alien invasive species are systemic.

Certain herbicides have been registered against some alien invasive species (plant names will be found on labels). Many alien invasive species, however, do not have registered herbicides. In general herbicides such as Garlon 4 (used with wetter Actipron when applied as spray) Roundup, Mamba, Clearout, Tumbleweed (the latter 4 on less woody species) can be tested out on these but success is not guaranteed. Should these be tested and found to be successful then this should be communicated to various research institutes (reference http://www.wessa.org.za).

The advantages of chemical control are that at times it is the only viable option for the control of invasive species and more often than not is more cost effective and less time-consuming than mechanical control options. If used incorrectly, chemical control can be damaging to the receiving environment and affect indigenous species negatively. Specialised equipment and training and/or supervision and, in some cases, technical advice are required.

7.1.1. Control methods, equipment and safety precautions

When applying herbicides always follow dosage recommendations and application procedures described on the labels. Increasing dosages may result in negative impacts on the receiving environment and may reduce the efficacy of the herbicide.

When using Chemical Control method in controlling alien invasive plants, it is important to consider the following aspects:-

- Chemical control of alien plants is not recommended in aquatic systems due to the risk of pollution, but may be used on the floodplain in conjunction with cutting or slashing of plants;
- Chemicals should only be applied by qualified personnel;
- Only approved chemicals should be applied;
- Follow the manufacturer's instructions carefully;
- Appropriate protective clothing must be worn;
- Chemicals to be applied immediately after cutting;
- Only designated spray bottles to be used for applying chemicals; and
- Decanting of chemicals and cleaning of equipment should be undertaken at a designated location using drip trays and ground sheets to prevent spillage and contamination of the soil.

Do

- Spray when plants are actively growing;
- Ensure that herbicide is mixed according to label application rates (info on herbicides to use can be requested from Department of Agriculture, Forestry and Fisheries (DAFF) or National Department of Agriculture (NDA) or relevant entities);
- Ensure correct wearing of safety gear at all times;
- Plan the application of herbicides before the operation commences;
- Spray when the sun is shining;
- Use a drip sheet and keep herbicide in a demarcated area in the veld, out of direct sunlight;
- Apply spray to the canopy and stems;
- Include dye to assist in the identification of areas that have been cleared; and
- For certain species mainly, for foliar application, a wetting agent should be added to the herbicide mix to allow for better absorption.

Do not

- Spray during strong wind, or where there is the slightest evidence of drift;
- Spray when it is very hot;
- Spray when plants are stressed or dormant;
- Spray plants that are over 1m;
- Apply herbicide in the rain or on wet, damp leaves; and
- Spray near children, animals or water bodies.

In addition, it is always best to control invasive alien plants when the plants are young, rather than waiting until they are woody and difficult to remove by hand. Furthermore, it is sometimes difficult to distinguish between young invasive species and natural species, so care should be taken at all times. Consider engaging an experience alien clearing team (Department of Water Affairs - Working for Water unit could offer assistance and expertise on how best to remove and manage alien plants on the property).

7.1.1.1. Foliar Application

This method requires the herbicide to be sprayed onto leaves and stems. The herbicide is sprayed in quantities on these plant parts to the extent just prior to running off the leaves and stems. In some instances other agents are applied to increase the adhesiveness of the herbicide or to increase the liquidity of the herbicide. Enough foliage needs to be present for the herbicides to be effective and in cases of re-growth, minimum heights of 0.5 m need to be reached prior to application. Equipment will require adequate spray packs, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks. Do not

spray just before rain (a rainfall-free period of 6 hours is recommended) or before dew falls. Avoid spraying in windy weather as the spray may come into contact with non-target plants; and Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.

7.1.1.2. Basal Stem

This method is used for the smaller woody species with thin stems (< 20 cm) and bark. The herbicides are mixed with diesel at dosages recommended on labels and applied to the stems from ground level to at least 0.3 m with a paint brush. Spraying can be used as an alternative. This method should also be applied to bark remnants left on the stem during strip-barking. Equipment will require adequate spray packs or paintbrushes, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks.

7.1.1.3. Frilling

This method has been described in the mechanical control measures and is repeated here as this method is always accompanied by application of herbicides. Herbicides are mixed with water at the recommended dosage and applied with a hand-held syringe or sprayer. Equipment will require adequate spray packs or syringes, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks.

7.1.1.4. Stem Injection

This method is limited for use on cacti. Four (4) holes (for a 2 m plant) are made near the base of the stem and around 2 ml of water-soluble herbicide solution, mixed at recommended dosage is poured in each hole. Equipment will require adequate syringes, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks.

7.1.1.5. Stump Application

This entails the application of herbicides to the cut stumps of felled trees. The stump should be short, level and smooth with all bark in place. Stems should be cut as low as practical as stipulated on the label. The herbicide should be mixed to the correct dosage and applied no later than twelve (12) hours after the felling. For cut stump applications, the herbicide should be closely sprayed onto the outer rings of the stump and the entire stump for stems < 50 mm wide. In specific instances herbicide will need to be applied to the cut surface, the sides and any exposed roots. Equipment will require adequate spray packs, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks. Herbicides are applied in diesel or water as recommended for the herbicide; and Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

7.1.1.6. Stalk Immersion

There are currently no alien invasive species which have herbicides registered against them for this particular method. It may be successful on climbers and should be tried if mechanical control options are unsuccessful or difficult. The method includes the cutting of main stems at < 1 m height, the digging up of roots or treatment of roots with herbicide and the placement of an inverted plastic bottle containing herbicide over the stem. The bottle should be secured in place and checked regularly to see if herbicide is still present. The generic herbicides mentioned above can be tested for this method. A hazardous sign or tape should be placed around the bottle. Equipment will require adequate plastic bottles, proper measuring equipment to mix correct doses and safety gear, which will include at least rubber gloves, safety glasses and masks.

7.1.1.7. Soil application

This requires the application of herbicides to soils and should only be utilised by technical specialists.

7.1.2. Herbicides which are registered and can be utilised

Various herbicides are mentioned in Table 1 below. Many alien invasive species haven't got registered herbicides which have been properly researched and tested. In these instances only mechanical measures have been discussed but the herbicides in Table 1 which have been stated as general herbicides can be tried against these species, although success may not be guaranteed.

Table 1: List of herbicides, which can be used for control of alien invasive species and problem plants

Trade Name	Active Ingredient	Active Ingredient	General Comments
Mamba 360 SL	Glyphosphate isopropylammonium salt	360 g/l	Can be used as a general herbicide.
Touchdown Forte	Glyphosphate trimesium	480 g/l	
Viroaxe	Triclopyr butoxyethyl ester	480 g/l	Do not apply in riparian areas. Use preferentially in grassy areas.
Garlon 480 EC	Triclopyr butoxyethyl ester	480 g/l	Can be used as a general herbicide. Use preferentially in grassy areas. Use Actipron for wetter spray applications.
Timbrel 360 SL	Triclopyr triethylammonium salt	360 g/l	Do not apply in riparian areas. Consult working for water technical advisor.
Stumpout	Mycoherbicide		
Chopper SL	Imazapyr	100 g/l	Do not apply in riparian areas
Access 240 SL	Picloram potassium salt	240g/l	Needs to be used in selected areas only. Consult working for water technical advisor.
Roundup	Glyphosphate isopropylammonium salt	450 g/l	Can be used as a general herbicide.
Clearout	Glyphosphate isopropylammonium salt	360 g/l	Can be used as a general herbicide.
Tumbleweed	Glyphosphate isopropylammonium salt	240 g/l	Can be used as a general herbicide.
Taskforce	Flupropanate, present as sodium salt	745g/l	
Starane 200	Fluroxypyr	200 g/l	

N.B.: A PCO should always be consulted before applying herbicides to the environment. Always wear the appropriate safety clothing when working with herbicides. Mix all herbicides on a drip groundsheet when working in the veld. Keep away from watercourses. Do not rinse herbicide equipment in the veld.

Always read the herbicide label and observe instructions for safe use of herbicide.

7.1.3. Mycoherbicides

A mycoherbicide is applied as an herbicide but is not a chemical agent. It is instead a mixture of fungal spores which tend to be host-specific and on application theses spores penetrate the plant where the fungus germinates. The pathogen may result in the killing of the undesirable plant. One (1) mycoherbicide, Stumpout, has been registered for application to various wattle species stumps.

7.2.Mechanical Control

Mechanical control means the physical removal of plants from the area. It is often accompanied by chemical control although these are further discussed below. Some common physical control methods include uprooting, hand pulling, felling, slashing, mowing, ring barking, bark stripping and frilling. It is an effective method if applied regularly in an area, but is labour intensive due to the need to revisit areas and during times when infestation levels are high or occupy a large area. Another advantage is that minimal technical knowledge or advice is required and little training and/or supervision is required. Also, with effective rehabilitation of areas concerned, the disturbance to the environment is minimal, as no other active agents are introduced to the environment.

7.2.1. Control Methods, Equipment and Safety Precautions

- Always start at the highest point and work downwards i.e. downhill or downstream;
- Start from the edge of the infestation and work towards the centre;
- Take care to prevent the spread of cuttings, which could take root further downstream;
- Ensure all root material is removed;
- Once plants have been removed, banks and slopes should be stabilised by erosion protection measures (such as geotextiles or other suitable material); and
- When stacking material, take note of fire protection measures and remember to always stack the material in rows.

7.2.1.1. Uprooting and Hand Pulling

Hand pulling is most effective where plants are small (30cm), immature or shallow rooted. This entails the physical removal of plants by grabbing them at their base and pulling them out of the ground with their roots. In some situations the root systems will need to be dug out, and hoes, spades and pick-axes may be required. This process should preferably be conducted when plants are not seeding. If this is not possible, the seed heads should be

carefully removed and disposed of prior to the control method being applied. Thick leather gloves and safety glasses should be worn during this process.

7.2.1.2. Felling

In situations where trees are on a slope or in a precarious situation, control species in situ and do not fell. This control option entails the physical removal of woody plants utilizing chainsaws, axes or machetes. Preferably de-branch cut trees. Generally, the plants are cut as low to the ground as possible, but this does vary with some species. Again, gloves and safety glasses should be utilized during this process and training may be required with felling of large trees as safety precautions will need to be adhered to. Apply herbicide immediately (no later than 30mins) to the cambium layer; and ensure all the cuts in the cambium layer are treated. This control measure may be accompanied with chemical control measures where applicable.

7.2.1.3. Slashing and mowing

This method is most effective for plants in the immature stage, or for plants that have relatively woody stems/ trunks. This is an effective method for non-resprouters or in the case of resprouters (coppicing), if done in conjunction with chemical treatment of the cut stumps. This is the physical removal of herbaceous plants from the base using machetes or lawn mowers. This process should preferably be conducted when plants are not seeding. If this is not possible, the seed heads should be carefully removed and disposed of prior to control method being applied. Gloves and safety glasses should be worn during this process. Use implements such as pangas (slashers), handsaws, bow-saws, chainsaws, brush cutters and axes.

7.2.1.4. Ring barking and bark stripping

This entails the removal of bark from the base of the stem (from below the soil layer) to a height of about 1 m. In some instances the cambium (include the cork layer) is also removed in a 30 cm wide band around the stem at a height of around 50 cm. Bush knives or hatchets should be used for debarking and safety gear should include at least gloves and safety glasses. This control measure may be accompanied with chemical control measures where applicable.

Application of suitable herbicide in diesel can be carried out to the bottom 250mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush. If multi stemmed, then each stem needs to be treated. Remove the bark and cambium around the trunk of the tree for a continuous band around the tree at least 25cm wide, starting as low as possible. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out; and for better control of aggressively coppicing species pull off the bark below the cut to ground level (bark stripping), to avoid the use of herbicides.

Note: Since this method means that the tree is left standing, it is only recommended for single trees, not for stands.

Slashers or axes should be used for debarking. Where bark stripping is used, then all the bark shall be stripped from the trunk between the ground level and 1 meter above ground level; and application of suitable herbicide can also be used with this method. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush.

7.2.1.5. Frilling

This method uses an axe or bush knife which cut into the bark and cambium layer at angles in a ring around the tree. The cuts are made around 0.5 m above ground. The cuts should be right through the cambium layer and form a solid ring of cuts around the trunk of the tree. Immediately apply the registered herbicide to the cuts by spraying into the 'frill'. The 'frill' needs to be deep enough to retain the herbicide.

This method is always accompanied by chemical control measures. Safety glasses and gloves should be worn.

7.2.1.6. Grubbing/ hoeing/ digging out/ tree poppers

Grubbing, hoeing, or digging involves the use of a hoe, stick, tree popper or spade. The entire plant and root must be removed. Use the following method:

- Dig around the plant making sure the sand is loosened around the root system;
- Dig down, under the roots, applying pressure, and wrench the entire plant out;
- Kicking the plant may help to dislodge it, however, care should be taken if the plant is seeding, as dry seeds may be dislodged; and
- Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.

7.3. Biological Control

Biological control is an attempt to introduce the plant's natural enemies (such as pathogens, invertebrates and vertebrates) to its new habitat, with the assumption that these natural enemies will remove the plant's competitive advantage until its vigour is reduced to a level comparable to that of the natural vegetation.

This method is being considered because:

- It is environmentally responsible as it does not cause pollution and affects only the target plant;
- It is cost-effective;

- It does not disturb the soil or create large empty areas where other invaders could establish, because it does not kill all the target plants at once; and
- It allows the natural vegetation to recover gradually in the shelter of the dying weeds.

Natural enemies that are used for biological control are called bio-control agents. In the control of invasive plants, the bio-control agents used most frequently are insects, mites and pathogens (disease-causing organisms such as fungi). Bio-control agents target specific plant organs, such as the vegetative parts of the plant (its leaves, stems or roots) or the reproductive parts (flowers, fruits or seeds). The choice of bio-control agents depends on the aim of the control project. If the aim is to get rid of the invasive plant species, scientists select the types of bio-control agents available which will cause the most damage. In such projects, scientists may use agents that affect the vegetative parts of the plant as well as agents that reduce seed production. However, if the target plant is useful in certain situations but becomes a pest when uncontrolled, conflict of interests arises regarding biological control.

This conflict is usually resolved by avoiding bio-control agents that have the ability of causing damage to the useful part of the plant, and instead using only seed-reducing agents. These reduce the reproductive potential of the plants, curb their dispersal and reduce the follow-up work needed after clearing, while still allowing for the continued utilisation of the plant. For instance, trees are normally grown for their wood, but the seeds are seldom utilised. If seeds are needed to replant a plantation, a seed orchard can be specially protected against the bio-control agents in the same way as other crops are protected against insect pests.

If, on the other hand, the pods are the most valuable part of the tree, as in the case of mesquite (*Prosopis* spp.), bio-control agents can be selected that will prevent pod production. The seed-feeding beetles that were introduced against mesquite prevent only the germination of seeds from the animal droppings, without significantly reducing the nutritional value of the pods. They do not prevent pod or seed production. Bio-control agents are mostly introduced from the country of origin of the plant. The Bio-control method is considered to be the safe and environmentally friendly control method due to the methodology and care taken into implementing it.

7.3.1. Implementing Biological Control

Before the official release of a bio-control agent in South Africa, extensive studies are carried out in a quarantine facility to ensure that the agent will not damage other, non-target plants.

A bio-control agent is only released once it has been proved as sufficiently host-specific for release in this country. Tested and approved bio-control agents therefore do not pose a threat to our own crops or indigenous vegetation, or to those of neighbouring countries. No cases have occurred of weed bio-control agents changing their host plant affinities after their release in a new country to include plants other than those known to be acceptable hosts.

7.3.2. Effectiveness of Biological Control method

Probably without exception, bio-control agents do not completely exterminate populations of their host plants. At best, they can be expected to reduce the weed density to an acceptable level or to reduce the vigour and/or reproductive potential of individual plants. The fact that a few host plants always survive, in spite of the attack by a bio-control agent, actually ensures that the agent does not die out as a result of a lack of food. The small population of bio-control agents that persists will disperse onto any re-growth or newly-emerged seedlings of the weed. For this reason, bio-control can be regarded as a sustainable control method. Biological control works relatively slowly. On average, at least five years should be allowed for a bio-control agent to establish successfully before causing significant damage to its host plant. Unfortunately, not all growth of invasive plant species can be curbed purely by biological control. It could happen that effective bio-control agents do exist, but cannot be released in South Africa because they are not sufficiently host-specific.

Alternatively, the invasive plant might be a man-made hybrid between two or more species, and is no longer an acceptable host to the natural enemies of either of the parent plants. It could also happen that the natural enemies of some plants are not adapted to all the climatic regions in which the plant is a problem in South Africa, or that the habitat already contains predators or parasitoids that attack the bio-control agents. In such cases, biological control will have to be replaced or supplemented by chemical or other control measures.

7.3.3. Integrating Biological Control into Weed Management

In some instances, bio-control agents may effectively control a weed on their own. In other cases, the bio-control agents should be incorporated into a more comprehensive weed control programme that might include other methods of control such as chemical and mechanical control as well as utilisation of products of the weed. To make optimal use of the available bio-control agents, the following points should be considered:

- The possible use of bio-control agents should already be kept in mind during the planning phase of any weed control program; and
- The person in charge of planning must find out which agents are available, what they do and how to use them. One then has to consider how best to integrate the use of the bio-control agents with the other control methods.

7.3.4. Biological Control Agent Reserves or Refugia

The mechanical or chemical clearing of large weed infestations may eliminate any bio-control agents present on the weed in that area. It is therefore essential to establish small reserves of healthy, mature plants on which the agents can survive and reproduce and from which they can spread onto plants that may have escaped the clearing process.

Some agents disperse rapidly on their own and can readily colonise extensive areas, while others; such as **cochineal** insects and **mealy bugs** have to be collected manually from the reserves and released in the target areas. Therefore, a person involved in cactus bio-control should always remove some insect-infested cactus plant material and distribute it to healthy cactus before the cochineal or mealy bugs have destroyed their host plants in a specific area. This will ensure that the bio-control agents do not become extinct locally, but maintain their presence in the area to colonise re-growth.

7.4.Handling and disposal of plant debris or material

The unwanted plant material from mechanical or chemical clearing should not be kept on site as they could potentially cause fire out breaks. Therefore, the following handling and disposal method could be utilized as some of the debris can offer services and some can be completely disposed of:-

7.4.1. Stacking

- Stacking the cut material in heaps, or in windrows along slope contours to reduce erosion, facilitates easy access for follow-up. It also assists in containing the resulting fuel load and therefore the risk of uncontrolled fire;
- Keep stacks well apart to prevent fires from crossing easily – not less than five meters apart, this is naturally dependant on the size of the stack and the resulting fire intensity when they burn. Stockpile removed material into piles of 2m high, 3m wide windrows/stacks;
- Stack light branches separately from heavy timber (75mm and more). Preferably remove heavy branches to reduce long burning fuel loads that can result in soil damage from intensely hot fire; and
- Do not make stacks under trees, power and telephone lines, within 30 meters of a fire belt or near watercourses, houses and other infrastructure.

7.4.2. Disposal

- Plant material should be used beneficially wherever possible, as opposed to disposing it at a landfill site where it takes up valuable airspace;
- Woody and dry material, provided no seeds are present, can be chipped and used as mulch or made available to the local community for firewood; and
- Wet material and aquatic weeds should be combined with other organic matter and composted.

Alternatively, it may be possible to use it for basket making, animal feed or other uses.

- Material which cannot be used beneficially must be disposed of at a registered and approved disposal site; and
- When removing material, take care to remove all debris, including shoots and seeds.

7.5. Control Phases

Alien Invasive Plant Species removal should ideally adopt hands on approach. The combination of 2 or all three control methods could prove more effective than using one control method in combating the problematic plant species. Therefore, it is advisable that the:-

- Landowners should not allow conditions to develop on their land that will contribute to the spread of a wildfire;
- Landowners should remove invasive alien plants that create large fuel loads or cause fires to burn intensely; and
- Landowners should take steps to fireproof their property and possessions. These apply especially to those living on the edge of open areas or in close proximity to fire prone areas.

Furthermore, any control programme for alien vegetation must include the following 3 phases;

- **Initial control:** drastic reduction of existing population;
- **Follow-up control:** control of seedlings, root suckers and coppice growth; and
- **Maintenance control:** sustain low alien plant numbers with annual control.

The initial control in most cases, involves mechanical methods and the case of heavy infestation machinery equipment could be utilized. The initial control is a drastic measure to reduce the number of adult and large invasive plants.

The follow-up control serves as measures to reduce the ability of the mechanically removed plant species from coppice or having the infestation proliferate such as to negate the efforts of initial control. Therefore, follow up control of alien seedlings and coppice re-growth is essential to achieve and sustain the progress made with initial control work.

Maintenance control entails the regular monitoring to prevent the occurrence of re-colonisation or re-infestation. The monitoring should take place timeously so to prevent infestation of the cleared area by another alien invasive plant species.

8. ALIEN INVASIVE PLANT ERADICATION PROGRAMME

Working for Water provides the site manager with an implementation tool to control problem species and keep the site free of invasive plants and/or weeds:

Step 1: Conduct Site Assessment;

- Identify areas where alien invasive species need to be eradicated and controlled. Take pictures of these sites so as to have a pre-control photographic reference of the site. In this way comparisons can be made at later stages to see if control measures are adequate.

Step 2: Set objectives based on resources available and priorities:

- Prioritize management of plants according to the categories stipulated in the AIS regulations;
  - Consider control options that will be applied in these areas. Consider integrated approaches and ensure approaches are not conflicting with each other. Also consider safety aspects such as trees on a slope which should not be felled but treated by other means in situ.

Step 3: Develop and implement an action plan to achieve objectives:

- The plan must be long term and should include a clearing plan that includes follow up actions for rehabilitation of the cleared area;
- The site plan should include a map showing the areas invested with problem plants;
- Lighter invested areas should be cleared first to prevent the build-up of seed banks, while the eradication plan works progressively towards the areas with denser stands;
- Educate workers on the species that needs to be eradicated, as well as the specific method to be used;
- Conduct eradication of weeds;
- Remove eradicated weeds to a suitable disposal area;
- Prevent dispersal of seeds;
- Strive for collective management and planning with neighbors to prevent seed dispersal of problem plants across boundaries;
- When removing alien invasive species from infested areas, always work from lower infested areas towards more infested areas and from higher-lying areas to lower areas;
- Try to remove alien invasive species when they are not seeding. If seeding, then seed heads should first be carefully removed and disposed of in a sealed bag so as not to spread the seeds;

- If soils are disturbed during the process, then these should be carefully levelled, slightly pressed down and covered with leaf litter or cut vegetation that is seed-free. Some alien invasive species release chemicals that suppress growth of other plants and these should not be utilised as leaf litter under any circumstances. The soil can also be re-seeded with indigenous vegetation;
- To reduce the risk of spread via seeds, flowers should be removed from the plants prior to seeding. To prevent further infestations, remove seeds, fruits, bulbs, corms, tubers and any other vegetative parts that may root from the site in sealed bags and dispose of safely. In some instances, these parts should be burnt on site immediately;
- Consider herbicide practices to integrate with physical removal where possible, with use of generic herbicides on alien invasive species without registered herbicides;
-

Step 4: Monitor performance and change actions if necessary

- Conduct monthly inspections to enable early detection of grow back.
    - Regularly follow up on areas where infestations were treated and reapply control measures if necessary. Once again, take photographs of sites regularly and keep records of actions that were taken so that evidence is in place with regard to control measures that were successful and those that were not.
    - Consider rehabilitation of area cleared of invasive species at every stage of the control programme and consider the need to re-introduce local indigenous species to help the natural ecology stabilise within the areas.

- Consider sending employees on courses. Courses range from introductory and awareness courses, to those that qualify individuals as alien invasive control officers.
- Finally, consider the uses of plants that will be removed. Options are potential for compost heaps (as long as it is seed free), potential as leaf litter (as long as it is seed free) and possible options for timber and cork markets. As stated earlier, some alien invasive species release chemicals that suppress growth of other plants and these should not be utilised as leaf litter under any circumstances

Table 2 : AIPs rehabilitation plan to be implemented by the proponent

ALIEN INVASIVE PLANTS REHABILITATION PLAN		
Method / Procedures	**Equipment**	**Responsibility**
1. Plant identification and listing		
• The site must be visually inspected for alien plant species and the observed AIPs must be listed. • All observed and identified plant species should be categorised according to the list contained in **Error! Reference source not f ound.** and be removed according to the methods stipulated under heading 2 and 3 of this table.	• Camera; • Garmin Global Positioning System (GPS); and • Alien Invasive Plants and Problem plants identification guides such as Bromilow 2001's Problem Plants of South Africa: A guide to the identification and control of invasive plants as well as Henderson 2001's Alien Weeds and invasive plants – Complete guide to declared weeds and invaders in South Africa.	**Stage 1:** Identification and listing should be done by the proponent or contractor utilizing the suggested guides under "equipment" and as was recorded. • Time frame – for the duration of the activity at the site. • N.B. AIPs are opportunistic species that will use the gap created by project disturbance to spread and establish themselves. Therefore, a two (2) weekly monitoring regime, to assess alien invasion, should be maintained
2. Control of AIPs		
• The proponent shall appoint a suitably qualified specialist and/or contractor who will be able to distinguish between the invasive and indigenous plant and clear the alien invasion. • Three methods can be applied for alien infestation clearing as stipulated by the Department of Water Affairs - Working for Water (DWA-WfW) program (at http://www.dwaf.gov.za/wfw) which are:- ○ Mechanical control which is felling and removal of invasive species; ○ Chemical control which is the use of registered herbicides to spray the foliage or treat felled tree stumps; ○ Biological control which is using natural enemies of the plants such as insects or viruses/pathogens to reduce the AIP population and minimise the ability to distribute/spread; and ○ Integrated control which is the combination of the two or all the control methods (Mechanical, Chemical and Biological) to control alien infestation.	• It is advised that an experienced alien invasive removal contractor be appointed as there is a need to: ○ Train personnel on how to handle machinery used in mechanical control; ○ Train personnel to handle, mix and apply the herbicides used for chemical control; and ○ Provide guidance on which insects or pathogens to use if the proponent opts for the biological control.	**Stage 2: -**The proponent is advised to liaise with the South African National Biodiversity Institute (SANBI) Alien Invasive Plants Early Detection and Rapid Response (AIP EDRR) Unit (contact: 021 799 8837 or alienplants@sanbi.org.za) on the management of AIPs found on the farm. • Furthermore, liaison could be established with the Agricultural Research Council - Plant Protection Research Institute (ARC-PPRI) based in Rietondale with regards to guidance on the use of biological control organisms (contacts: Dr. Stefan Neser at nesers@arc.agric.za or Dr. David Simelane at simelaned@arc.agric.za or Dr. Alan Urban at urbana@arc.agric.za or call 012 356 9800. • Lastly, the proponent can access the DWA-WfW website to download treatment guides for terrestrial AIPs or those identified at the site. Or, to request a clearing form/application for their personnel to clear the site. • Time frame: Concurrently with the current activity.

ALIEN INVASIVE PLANTS REHABILITATION PLAN		
Method / Procedures	**Equipment**	**Responsibility**
3. Removal methods for AIPs		

• All species listed under category 1 shall be removed from the site on a continuous basis.
• However, seedlings and new sprouts should be removed by hand and seedlings should not be allowed to grow and reach seed bearing age.
• For this project it is strongly advised that chemicals (herbicides and pesticides) used for Chemical control be avoided, since, the use of these could have detrimental impact on the indigenous or unintended plant species establishment.
• Methods:
  ○ <u>Seedlings:</u>
  ▪ Seedlings should be removed by hand while they are still young;
  ▪ Seedling should be removed when the soil is wet, preferably after a rainfall as this moisten the soil and allow the roots to dislodge easily;
  ▪ First loosen the soil to dislodge the roots;
  ▪ Remove whole plant with its roots.
  ○ <u>Mature plants: -</u> Mature plants must be cut off using a chainsaw or brush cutter close to the ground and utilise a chemical for application to the stump.
	• Chainsaw or brush cutter are recommended (N.B. Training is crucial for operating these machines).	**Step 3:** The proponent / contractor will be responsible for removal of all AIPs by hand as indicated in the methods.
		• For mechanical removal of mature plants, a trained and experienced individual should be used to operate the equipment.
		• Time frame: Concurrently with the current activity

4. Disposal of AIP cuts or material		

• All alien plants removed from the site are to be disposed of at an approved or licensed waste disposal site;
• Mature plant logs or wood could be cleared and be disposed at a disposal site;
• Non-seeding woody aliens can be retained and used for dust control purposes (i.e. act as windbreakers if they are tall) or soil stabilisers;
• No cut alien material should be left on the site for more than three days, it has to be removed to the disposal site to prevent fire incidents; and
• No burning of dried alien vegetation will be allowed on the site.
	• Preferably a contractor should be appointed for this aspect.	**Step 4:** The proponent should seek a contractor to oversee this phase.
		• Record keeping:
		  ○ There should be a record of the dates the disposal truck collects the plant waste material;
		  ○ License for the disposal site; and
		  ○ License for the company tasked with collecting and disposing of the plant waste material.
		• Time frame: Throughout or when deemed necessary or fortnightly.

5. Early detection and rapid response (EDRR)		

ALIEN INVASIVE PLANTS REHABILITATION PLAN		
Method / Procedures	**Equipment**	**Responsibility**
• This aims to allow the proponent to detect and respond to new alien infestation before it escalates; • A two weekly inspection should be established to monitor AIP infestation in areas that were re-vegetated. • Seedlings should be removed as explained under heading 2 and before they establish and start to produce seeds; • EDRR should be applied in all the project areas and mostly in areas that are newly disturbed; and • AIPs should not be allowed to establish and mature as the bigger they become they more expensive it becomes to control.	• GPS; • Camera; and • Garden fork and gloves for loosening the soil and removing the seedlings.	**Step 5:** The proponent / contractor will be responsible to ensure that the area is protected from alien invasion.

9. REHABILITATION

Follow-up inspections are required in order to establish whether follow-up operations are required. It is preferable to follow up on an area and remove all seedlings or treat resprouting plants, rather than treat a new area. Therefore, follow-up should commence as soon as the initial control has been done to prevent coppice and further infestation by other problematic plants. The rehabilitation measures such as replanting should be implemented. It is important that concurrent to alien plant species removal, the soil should be re-vegetated immediately. This is particularly important where large area is cleared. The re-vegetation should be a choice of indigenous vegetation compromise of herb layer, young and established indigenous trees and shrubs instead of seeds.

Furthermore, the monitoring and maintenance is necessary to ensure that the indigenous plants are establishing themselves and no trace of alien re-infestation or new infestation is observed at the site. This is important due to the ability of alien invasive plants being dormant in the soil until favourable conditions allow them to sprout and germinate. The removal methods herewith should be stringently undertaken to ensure that alien invasive plant species are effectively removed.

N.B. Ensure that your operation has received approval from the relevant authority. Accurate records of maintenance actions and associated costs should be compiled to assist with future planning.

10. References:

- **Bromilow C**. 2001. Problem Plants of South Africa. Briza Publications. South Africa
- **Invader Plant Specialists (Pty) Ltd.** 2017. Herbicide Applicators Course. Durbanville
- **Todd S**. 2012. Alien Invasive Plant Management Plan: Solar Direct Graspan Solar Energy Facility
- **Working for Water**. Indigenous Replacement Plants in the KZN region. Department of Water Affairs. South Africa
- **Working for Water**. Policy on the Use of Herbicides for the Control of Alien Vegetation. Department of Water Affairs. South Africa

Annexure 1: Listed Alien Invasive Species which could occur in the Area

Pictures and information were obtained from the following websites: www.tshwane.gov.za; www.nature.org; www.arc.agric.co.za; www.biodiversity.explorer.co.za; www.sanbi.org; www.dwaf.gov.za; www.bayercropscience.co.za; www.gardeningeden.co.za and www.britannica.com.

Please refer to Conservation of Agricultural Resources Act (Act No. 43 Of 1983) (CARA) and the National Environmental Management Biodiversity Act (NEM:BA) for a complete list of alien invasive species found in South Africa.

Species are predominantly of northern temperate origin and the tropics; members of the Rosaceae, Fabaceae and Salicaceae; woody trees and shrubs, followed by herbs; perennial evergreen/deciduous and deciduous; seed-producers, but a greater percentage of species coppice and sucker than in other vegetation categories; water and bird dispersed; barriers, ornamentals and agricultural crops.

Acacia dealbata (Silver wattle)


Category:	2 – Invasive species with commercial value. Can only be grown in demarcated areas and must be controlled outside such areas and may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands.
Form:	Tree
Control Measures:	Biological control: Acacia seed weevils Mechanical and Chemical: **Seedlings & Saplings:** Hand pull or hoe. Foliar sprays: Garlon 480 EC or Viroaxe (25-50 ml/10l water) at 0.5 to 2 l/ha. **Trees up to 1.5 m:** Foliar sprays with Garlon 480 EC or Viroaxe (75 ml/10l water) at 3 l/ha. **For mature trees:** Cut stump and apply Timbrel 360 SL (300 ml/10l water) at 1.5 l/ha or Mamba 360 SL (200 ml/10l water) at 6 l/ha to freshly cut areas. Frill and apply Mamba 360 SL (2 l/10l water) at 6 l/ha.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	*Rhus lancea*

Acacia mearnsii (Black wattle)

Category:	2
General Description:	An evergreen tree growing 5-10m high, black wattle has dark olive-green finely hairy leaves. Bark: Rough, greyish bark Leaves: Dark olive-green short leaflets (1.5-4.0mm), with fine hairs. Flowers: Small pale yellow to cream, globe-shaped flowers in large, fragrant sprays, August to September. Fruit/seeds: Finely haired, dark brown pods.
Form:	Tree
Control Measures:	Biological control: Acacia seed weevils Mechanical and Chemical: Seedlings & Saplings: Hand pull or hoe. Foliar sprays of Mamba 360 SL (150 ml/10l water) for saplings up to 1 m at 3 l/ha; Garlon 480 EC or Viroaxe (25-75 ml/10l water) for saplings up to 1.5 m at 0.5 to 1.5 l/ha; or Touchdown Forte for saplings up to 2 m at 3 l/ha. Young trees: Foliar sprays with Garlon 480 EC or Viroaxe (75 ml/10l water) at 3 l/ha. For mature plants: Cut or frill and apply Timbrel 360 SL (300 ml/10l water) at 1.5 l/ha to freshly cut areas. Cut and apply mycoherbicide (Stumpout) to freshly cut stumps. Use triclopyr butoxyethyl ester (Garlon 480 EC or Viroaxe) in areas where grasses occur.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	*Rhus lancea*

Argemone ochroleuca (White flowered Mexican poppy)

Category:	1b – Declared weed. Destroy.
Form:	Herb
General Description:	A very spiny annual herb growing up to 90cm high with stems that exude a yellow sap when cut. Grey or bluish-green spiny leaves with prominent white veins. Pale yellow or creamy white flowers appear from September to January. Spiny, oblong green fruit capsules turn .
Control Measures:	Biological control: Various insect agents are being tested. Chemical: Herbicides containing picloram are affective against seedlings. Mechanical: Physical removal of plants prior to seeding. Removal of seed heads prior to seeding. Light tillage can destroy seedlings.
Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly (more frequent if necessary) to cut back stems that are starting to flower and for any re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses or indigenous.
Replacement Species:	Indigenous grasses or herbs

Argemone Mexicana L. (Yellow flowered Mexican Poppy)

Category:	1b
Form:	Herb
General Description:	A very spiny annual herb growing up to 90cm high with stems that exude a yellow sap when cut. Grey or bluish-green spiny leaves with prominent white veins. Pale yellow or creamy white flowers appear from September to January. Spiny, oblong green fruit capsules turn .

Control Measures:	**Mechanical eradication**
	• Pull out during seedlings stage **(before seed ripens)**
	• Disposal of eradicated plants:
	  ◆ Dispose with general waste,
	  ◆ Use in areas prone to erosions,
	• If seeds have ripened, pull out plants while making sure seeds do not fall out.
	• Place plants in a black plastic bag and dispose of at an incineration facility to be destroyed.
	• File proof of delivery to the facility.
	• Alternatively, the removed plants can be buried in a trench of at least 1m deep. Grow-back will need to be controlled in this area, preferably with herbicides.
	
	Herbicides
	Apply as specified by supplier
	Foliar Spray: Access 240 SL
	These plants are annual and die once seeds have ripened. Still it is very important to remove the dead plants as leaving them will result in vigorous grow-back the following season.

Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly (more frequent if necessary) to cut back stems that are starting to flower and for any re-growth.

	With the removal of plants soils may become exposed and should be re-vegetated with grasses or indigenous.
Replacement Species:	Indigenous grasses or herbs

Cestrum laevigatum (Inkberry)

Category:	CARA Category 1; NEMBA Category 1b
Form:	Herb
General Description:	nkberry is an evergreen shrub or tree growing 1-2m high, but reaching 15m or more along the coastal regions. This poisonous plant has lance-shaped leaves and greenish-yellow, tube-shaped flowers, which appear from October to May. Evergreen shrub or tree growing 1-2m high, but reaching 15m or more along the coast. Leaves:Lance-shaped, 150mm long and 50mm wide; releases an unpleasant smell when crushed. Flowers: Greenish-yellow in axillary clusters. Each flower is tube-shaped with five small petals and appear during summer from October to May. Fruit/seeds:Green 10mm long berries which turn purple-black.
Control Measures:	Chemical: Herbicides containing picloram are affective against seedlings. Mechanical: Physical removal of plants prior to seeding. Removal of seed heads prior to seeding.
Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly (more frequent if necessary) to cut back stems that are starting to flower and for any re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses or indigenous species of the genera below.
Replacement Species:	Hazel pomaderris (*Pomaderris aspera), Escalonia, Azalea.*

Cirsium vulgare (Spear/Scotch thistle)

Category:	1b – Declared weed. Destroy.
Form:	Herb
General Description:	Spiny, herbaceous biennial which forms a large, flat rosette of leaves and a deep tap root in the first year and numerous branched stems up to 1,5m high in the second year. Stems have spiny wings. Dark green leaves with stiff hairs above and white woolly beneath. Pink to mauve thistle-like flowers surrounded by spiny bracts appear from September to April. This plant invades grassland, roadsides, vlei and dam margins and river banks in cool, high rainfall areas General description: Branching, erect biennial growing up to 1,5m tall. Leaves: Leaves are deeply lobed and hairy - there are coarse hairs on the leaf tops and woolly hairs on the underside. Flowers: Flower heads are 'gumdrop' shaped and spines extend all around the base of the flower heads. Flowering occurs from September to April. Fruit/Seeds: Grey with longitudinal darker markings, smooth
Control Measures:	<u>Chemical:</u> Herbicides containing picloram are affective against seedlings. <u>Mechanical:</u> Physical removal of plants prior to seeding. Removal of seed heads prior to seeding.
Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly (more frequent if necessary) to cut back stems that are starting to flower and for any re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses or indigenous species of the genera below.
Replacement Species:	*Ceratotheca triloba* *Vernonia sp.*

Datura ferox (Large thorn apple)

Category:	1b – Declared weed. Destroy.
Form:	Herbaceous shrub
General Desciption:	General description: An erect, sub-herbaceous annual growing up to 1,5m high. The stem is sparsely hairy and pale green in colour. Leaves: Relatively large leaves up to 200mm long with an irregular strongly toothed margin, dark green upper surface and paler underneath the surface of the leaves. Flowers: Funnel-shaped white flowers up to 65mm long appear during summer from October-March. Fruit/Seeds: Produces brown fruit capsules covered with hard spines and numerous tiny black seeds.
Control Measures:	Mechanical: Physical removal of the plants, including the underground parts. This should be done when not seeding. If seeding then the seed heads should be carefully removed and burnt. Chemical: *Datura ferox* is susceptible to glyphosate herbicides.
Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly to cut back any re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses and/or indigenous species mentioned below.
Replacement Species:	Indigenous, local grasses.

Datura stramonium (Common thorn apple)


Category:	1b – Declared weed. Destroy.
Form:	Herbaceous shrub
General Description:	General description: Sparsely hairy, green, brown or purple, erect annual herb growing up to 1,5m in height. Leaves: Dark green or purple and paler underneath with the margins coarsely and irregularly toothed or lobed, bad-smelling. Flowers: White, mauve or purplish, narrowly funnel-shaped flowers. Fruit/Seeds: Brown, hardened capsules covered with slender spines.
Control Measures:	Mechanical: Physical hand-pulling removal of the plants. This should be done when not seeding. If seeding then the seed heads should be carefully removed and burnt. Tillage will work to some extent with seedlings. Chemical: *Datura stramonium* is susceptible to a range of soil and foliar herbicides available for agricultural markets.
Monitoring Measures:	Photographic evidence should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited monthly to cut back any re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses and/or indigenous species mentioned below.
Replacement Species:	Indigenous, local grasses.

Eucalyptus camaldulensis (Red River Gum)


Category:	a. 1b within i. Riparian areas ii. A protected area as declared by the protected areas act iii. Within a listed ecosystem or an ecosystem identified for conservation in terms of a bioregional plan or biodiversity management plans published under the act b. Not listed in the Nama-Karoo, Succulent Karoo and Desert biomes, excluding within any area mentioned in (a) above. c. Category 1b in fynbos, grassland, savanna, Albany thicket, forest and Indian ocean belt biomes but i. Category 2 for plantations, woodlots, bee-forage areas, wind rows and the lining of avenues ii. Not listed within cultivated land that is at least 50m away from untransformed land, but excluding within any area in (a) above iii. Not listed within 50m of the main house of a farm but excluding in (a) above iv. Not listed in urban areas for trees with a diameter of more than 400mm at 1000m height at the time of publishing this notice.
Form:	Tree
Control Measures:	Mechanical & Chemical **Seedlings:** Hand pull **Coppice/woody growth:** Foliar sprays of Brush Off at 200 g/ha and Mamba 360 SL at 3 l/ha. **Felled trees:** Cut stumps apply Chopper (1250 ml/10 l water) at 6 l/ha.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Indigenous, local grass species in low infestation. Specialists input may be required in heavily infested areas.

Eucalyptus grandis (Salinga Gum)

Category:	a. 1b within iv. Riparian areas v. A protected area as declared by the protected areas act vi. Within a listed ecosystem or an ecosystem identified for conservation in terms of a bioregional plan or biodiversity management plans published under the act b. Not listed in the Nama-Karoo, Succulent Karoo and Desert biomes, excluding within any area mentioned in (a) above. c. Category 1b in fynbos, grassland, savanna, Albany thicket, forest and Indian ocean belt biomes but v. Category 2 for plantations, woodlots, bee-forage areas, wind rows and the lining of avenues vi. Not listed within cultivated land that is at least 50m away from untransformed land, but excluding within any area in (a) above vii. Not listed within 50m of the main house of a farm but excluding in (a) above Not listed in urban areas for trees with a diameter of more than 400mm at 1000m height at the time of publishing this notice.
General Description:	Tall, evergreen tree with shaft-like trunk, 25-55m high; bark smooth, except butt up to 4m, peeling in long, thin strips to expose a powdery, white, grey-white or blue-grey surface. Leaves: Dark green and glossy above, paler below; adult leaves 130-200 mm long, similar to juvenile leaves. Flowers: Cream with long-exerted stamens, buds, to 8mm long, pear-shaped with conical lids. Fruit/Seeds: Brown capsules with bluish-grey bloom, pear-shaped, 7-10mm long, with protruding valves that arch inwards.
Form:	Tree
Control Measures:	Mechanical & Chemical **Seedlings:** Hand pull **Coppice/woody growth:** Foliar sprays of Brush Off at 200 g/ha and Mamba 360 SL at 3 l/ha. **Felled trees:** Cut stumps apply Chopper (1250 ml/10 l water) at 6 l/ha.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.

Replacement Species:	Indigenous, local grass species in low infestation. Specialists input may be required in heavily infested areas.

Ipomea alba (White Moonflower)


Category:	1b
General Description:	A sub-woody, glabrous, annual or perennial climber with milky latex, somewhat prickly stems and growing up to 5 m long. Leaves: Bright green, oval to heart-shaped leaves 60-200 mm long. Flowers: White, often banded with green, fragrant and opening at night; outer sepals with a long awn-like appendage at the apex. Flowers mainly from October-June, but throughout the year in tropical climates. Fruit/Seeds: Produces ovoid capsules.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	*Mandevilla splendens* or for perfume *Mandevilla laxa*

Ipomea indica (Purple Morning Glory)

Category:	1b
General Description:	Herbaceous perennial twiner with hairy stems growing to 3 m or more. Leaves: Bright green, sparsely hairy, oval to heart-shaped leaves 40-150 mm long. Flowers: Purplish-blue, reddish, magenta or white, sometimes with contrasting stripes, funnel-shaped, with flattened hairs at base. Flowers mainly during November-May, but throughout the year in tropical climates. Fruit/Seeds: Produces small capsules.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Indigenous morning glories or large flowered *Clematis*

Ipomea purpea (Common Morning Glory)


Category:	1b
General Description:	Herbaceous twining annual with hairy stems up to 3m or more The bark is brown-grey to blackish, and fissured at the base. Leaves: Bright green, sparsely hairy, heart-shaped leaves. Flowers: Purplish-blue, reddish, magenta or white, sometimes with contrasting stripes, funnel-shaped, to 85mm long; sepals pointed but not long-tapering, 10-15 mm long, bristly at base. Flowers usually appear in November-May, but throughout the year in tropical regions. Fruit/Seeds: Produces globose capsules of 10mm measured across.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Indigenous morning glories or large flowered *Clematis*

Lantana camara (Lantana)

Category:	1b
General Description:	An untidy spreading shrub with four-angled stems and often with thorns growing up to 2m or higher. Leaves: Oval, dark green, rough, hairy leaves which are paler below. Flowers: Small, clustered, pink, red, crimson, orange, yellow or white flowers appearing from September to April. Fruit/seeds: Glossy green fruits which turn purplish-black.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Natal bauhinia (*Bauhinia natalensis*), September bush (*Polygala myrtifolia*), plumbago (*Plumbago auriculata*), pink sage (*Orthosiphon labiatus*), wild pomegranate (*Burchellia bubalina*).

Melia azedarach (Syringa Asia)

Category:	1b 3 in urban areas
General Description:	A large spreading tree growing up to 23m high with reddish-brown, smooth bark. Leaves: Serrated dark glossy green leaves which turn yellow in autumn. Flowers: Clustered purple to lilac flowers and heavily scented appearing from September-November. Fruit/Seeds: Green berries which turn yellow and wrinkled at the end of the season.
Form:	Tree
Control Measures:	Biological control: Acacia seed weevils Mechanical and Chemical: Seedlings & Saplings: Hand pull or hoe. Foliar sprays: Garlon 480 EC or Viroaxe (25-50 ml/10l water) at 0.5 to 2 l/ha. Trees up to 1.5 m: Foliar sprays with Garlon 480 EC or Viroaxe (75 ml/10l water) at 3 l/ha. For mature trees: Cut stump and apply Timbrel 360 SL (300 ml/10l water) at 1.5 l/ha or Mamba 360 SL (200 ml/10l water) at 6 l/ha to freshly cut areas. Frill and apply Mamba 360 SL (2 l/10l water) at 6 l/ha.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Cape chestnut (*Calodendrum capense*), pompom tree (*Dais cotinifolia*), mountain seringa (*Kirkia wilmsii*), white seringa (*Kirkia acuminata*), lowveld chestnut (*Sterculia murex*), lavender tree (*Heteropyxis natalensis*)

Morus alba (White mulberry)

Category:	3
General Description:	A deciduous tree growing up to 15m high with a round canopy and greyish branches. Leaves: Light green leaves with finely serrated margins which turn yellow in autumn. Flowers: Small greenish flowers forming in cylindrical spikes appearing in spring. Fruit/Seeds: Juicy bulbous reddish-black edible fruits.
Form:	Tree
Control Measures:	Biological control: Acacia seed weevils Mechanical and Chemical: Seedlings & Saplings: Hand pull or hoe. Foliar sprays of Mamba 360 SL (150 ml/10l water) for saplings up to 1 m at 3 l/ha; Garlon 480 EC or Viroaxe (25-75 ml/10l water) for saplings up to 1.5 m at 0.5 to 1.5 l/ha; or Touchdown Forte for saplings up to 2 m at 3 l/ha. Young trees: Foliar sprays with Garlon 480 EC or Viroaxe (75 ml/10l water) at 3 l/ha. For mature plants: Cut or frill and apply Timbrel 360 SL (300 ml/10l water) at 1.5 l/ha to freshly cut areas. Cut and apply mycoherbicide (Stumpout) to freshly cut stumps. Use triclopyr butoxyethyl ester (Garlon 480 EC or Viroaxe) in areas where grasses occur.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	white mulberry (*Morus alba 'pendula'*), Forest Fever-berry (*Croton sylvaticus*), Wild mulberry(*Trimeria grandifolia*), Cape Fig (*Ficus sur*)

Opuntia fisus indica (Sweet Prickly Pear)

Category:	1b
General Description:	Succulent, branched shrub or tree up to 3m high which forms a sturdy trunk with age. Leaves: Minute leaves. Flowers: Bright yellow or orange showy flowers appearing from October to December. Fruit/seeds: Yellowish turning reddish edible fruit covered with minute spines.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	*Euphorbia* spp. and *Aloe* spp

Pennisetum clandestinum (Kikuya grass)

Category:	a. 1b in protected areas and wetlands in which it does not already occur b. Not listed elsewhere
Form:	Grass
Control Measures:	Chemical: Taskforce at 0.56 and 0.75 kg/ha for mature grass Mechanical: Physical removal of the plants, including the underground parts. This should be done when not seeding. If seeding then the seed heads should be carefully removed and burnt.
Monitoring Measures:	Photographic records should be kept and photographs taken on each site visit in areas of heavy infestation. Sites will need to be revisited, monthly to cut back and re-growth. With the removal of plants soils may become exposed and should be re-vegetated with grasses or indigenous species, mentioned below.
Replacement Species:	*Themeda triandra* *Melinis repens*

Pinus patula (Patula Pine)

Category:	2 – Invasive species with commercial value. Can only be grown in demarcated areas and must be controlled outside such areas and may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands.
Form:	Tree
Control Measures:	Mechanical **All trees:** Cut down close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 4 months after treatment. Heavily infested areas should be revisited and treated if and as necessary at annually.
Replacement Species:	Indigenous, local grass species in low infestation. Specialists input may be required in heavily infested areas.

Populas canescens (Grey poplar)

Category:	2
Description:	Trees to 20 m tall, suckering freely; bark greyish or bluish grey, smooth, rough at base of trunk; crown spreading. Branchlets terete, often glabrous; short branchlets brownish, tomentose. Buds ovoid, brown tomentose. Leaves of short branchlets with petiole slightly compressed, nearly as long as blade, glabrous; leaf blade ovate-orbicular, ovate-elliptic, or rhombic- to ovate-orbicular, 4-8 × 3.5-6 cm, both surfaces glabrous or sometimes thinly tomentose abaxially, base broadly cuneate or rounded, margin with obtusely notched teeth, apex obtuse. Leaves of sprouts and long shoots with petiole grey tomentose; leaf blade broadly elliptic, abaxially grey tomentose, adaxially green, glabrous or sparsely tomentose, irregularly dentate. Male catkin 5-8 cm. Male flower: stamens 8-10. Female catkin 5-10 cm. Female flower: ovary glabrous; stipe short. Capsule long ovoid, 3-4 mm, 2-valved.
Form:	Tree
Control Measures:	<u>Mechanical and Chemical:</u> **Seedlings:** Foliar sprays of Garlon 480 EC (consult WFW technical advisor) or Viroaxe (150 ml/10l water) at 2 l/ha. Cut stumps and apply Chopper (500 ml/10l water) at 1.5 l/ha. **Large trees:** Cut or frill and apply Chopper (500 ml/10l water) at 1.5 l/ha.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	*Leucosidea sericea* *Combretum erythrophyllum*

Pyracantha koidzumii (Formosa firethorn)

Category:	1b
Description:	The Formosa firethorn is an evergreen shrub with spiny branches and glossy green leaves. White flowers appear in spring, followed by bright red berries. It can form dense thickets, which compete with indigenous vegetation and impede the movement of animals and people. Leaves: Leaves are glossy and green above, with the undersides sparsely hairy when young. The margin is slightly scalloped, and the leaf blades at their widest below the middle. Flowers: Flowers are white with the calyx slightly down. The flowers appear in spring. Fruit/seeds: Fruits are bright red berries.
Form:	Shrub
Control Measures:	<u>Mechanical:</u> Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	

Ricinus communis (Castor-oil plant)

Category:	2
General Description:	A very distinctive plant with green, spreading star-shaped leaves and tall, spiky fruit capsules. Leaves: Shiny, star-shaped dark green or reddish leaves that are paler below with serrated margins. Flowers: Upper flowers are reddish and lower flowers cream. Fruit/seeds: Green, brown or reddish, three-lobed capsules covered with soft spines protruding from the top of the plant.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	

Robinia pseudoacacia (Black locust)



Category:	1b
General Description:	A deciduous tree reaching up to 25m high, but often smaller with dark brown and deeply furrowed bark. Leaves: Small, bright green leaves above and paler beneath which become yellow in autumn and rounded at the tips. Flowers: White, fragrant flowers in drooping clusters appear from September to November. Fruit/seeds: Reddish-brown pods.
Form:	Tree
Control Measures:	Biological control: Acacia seed weevils Mechanical and Chemical: Seedlings & Saplings: Hand pull or hoe. Foliar sprays of Mamba 360 SL (150 ml/10l water) for saplings up to 1 m at 3 l/ha; Garlon 480 EC or Viroaxe (25-75 ml/10l water) for saplings up to 1.5 m at 0.5 to 1.5 l/ha; or Touchdown Forte for saplings up to 2 m at 3 l/ha. Young trees: Foliar sprays with Garlon 480 EC or Viroaxe (75 ml/10l water) at 3 l/ha. For mature plants: Cut or frill and apply Timbrel 360 SL (300 ml/10l water) at 1.5 l/ha to freshly cut areas. Cut and apply mycoherbicide (Stumpout) to freshly cut stumps. Use triclopyr butoxyethyl ester (Garlon 480 EC or Viroaxe) in areas where grasses occur.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Ankle thorn (*Acacia robusta*), hook thorn (*Acacia caffra),* weeping wattle (*Peltophorum africanum*)

Rubus spp (Exotic brambles)

Category:	1a and 1b
General Description:	**Rubus** is a large genus of flowering plants in the rose family, Rosaceae, subfamily Rosoideae. Raspberries, blackberries, and dewberries are common, widely distributed members of the genus. Most of these plants have woody stems with prickles like roses; spines, bristles, and gland-tipped hairs are also common in the genus.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	

Schinus terebinthifolius (Brazilian Pepper)

Category:	Existing legislation: CARA 2002 – Category 1 Proposed legislation: NEMBA – Category 1b KwaZulu-Natal, Mpumalanga, Limpopo and Eastern Cape, 3 in rest of South Africa
Description:	General description: A bushy evergreen tree or shrub reaching a height of 6m. Leaves: Dark green and shiny leaves with prominent, pale veins above and paler and smoother below. Flowers: Small creamy white flowers situated in tightly branched terminal clusters appearing from September to March. Fruit/seeds: Fruits are bright red and fleshy spherical drupes containing one seed
Form:	Tree

Control Measures:	**<u>Mechanical eradication</u>**
	• Pull out during seedlings stage **(before seed ripens)**
	• Disposal of eradicated plants:
	  ◆ Dispose with general waste,
	  ◆ Use in areas prone to erosions,
	• If seeds have ripened, pull out plants while making sure seeds do not fall out.
	• Place plants in a black plastic bag and dispose of at an incineration facility to be destroyed.

	✸ File proof of delivery to the facility. ✸ Alternatively, the removed plants can be buried in a trench of at least 1m deep. Grow-back will need to be controlled in this area, preferably with herbicides. **<u>Herbicides</u>** Apply as specified by supplier
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	

Sesbania punicea (Red sesbania)

Category:	1b
Description:	
Form:	

Control Measures:	**Mechanical eradication**
	• Pull out during seedlings stage (before seed ripens)
	• Disposal of eradicated plants:
	  ◆ Dispose with general waste,
	  ◆ Use in areas prone to erosions,
	• If seeds have ripened, pull out plants while making sure seeds do not fall out.
	• Place plants in a black plastic bag and dispose of at an incineration facility to be destroyed.
	• File proof of delivery to the facility.
	• Alternatively, the removed plants can be buried in a trench of at least 1m deep. Grow-back will need to be controlled in this area, preferably with herbicides.
	
	Herbicides
	
	Apply as specified by supplier
	Foliar Spray (Seedlings <1m): Roundup 360 SL, Roundup Max 680 WG, Glyph 360 SL, Mamba 360 SL, Mamba Max 480 SL, Springbok 360
	Foliar Spray (Seedlings 1 – 2 m): Roundup Max 680 WG, Glyph 360 SL, Mamba 360 SL, Roundup 360 SL; Garlon 4 EC
	Foliar Spray (Adult): Roundup Max 680 WG, Chopper 100 SL, Hatchet 100 SL

Solanum elaeagnifolium (Silver-leaf bitter apple)

Category:	Existing legislation: CARA 2002 – Category 1 NEMBA – Category 1b
General Description:	General description: An herbaceous shrub growing up to 60cm high with felty leaves and stems. Leaves: Greyish or silvery-green leaves, often wavy and folded upwards along their midribs. Flowers: Mauve, blue or white flowers appear from October to March. Fruit/seeds: Shiny green berries with white patches, eventually turning yellow
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.

Solanum maurutianum (Bugweed)

Category:	1b
General Description:	Evergreen shrub or small tree growing up to 4m high. Leaves: Leaves are bright green above, paler below, with sharply toothed margins Flowers: Bright yellow, showy, trumpet-shaped flowers in terminal sprays from October to May. Fruit/seeds: Brown, shiny fruit capsules 12-20cm long that split open to release papery winged seeds.
Form:	Shrub
Control Measures:	Mechanical: Seedlings & saplings: Hand pull. All plants: Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	Cape honeysuckle (*Tecoma capensis*), yellow bauhinia (*Bauhinia tomentosa*), weeping wattle (*Peltophorum africanum*).

Solanum sisymbrifolium (Wild tomato)

Category:	1b – Declared weed. Destroy.
Form:	Shrub
Control Measures:	Mechanical: **Seedlings & saplings:** Hand pull. **All plants:** Cut close to ground.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after treatment. Heavily infested areas should be revisited and treated if and as necessary every 6 months.
Replacement Species:	Indigenous, local grass species.

Xanthium strumarium (Large cocklebur)

Category:	1b – Declared weed. Destroy.
Form:	Herbaceous shrub
Control Measures:	Mechanical: Hand pull. Remove underground parts preferably when not seeding. Remove seed heads carefully and dispose of. Chemical: Susceptible to a range of soil and foliar herbicides available for agricultural markets.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after treatment. Heavily infested areas should be revisited and treated if and as necessary every 6 months.
Replacement Species:	Indigenous, local grass species.

Xanthium spinosum (Spiny Cocklebur)

Category:	1b – Declared weed. Destroy.
Form:	Herbaceous shrub
Control Measures:	Mechanical: Hand pull. Remove underground parts preferably when not seeding. Remove seed heads carefully and dispose of. Chemical: Susceptible to a range of soil and foliar herbicides available for agricultural markets.
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after treatment. Heavily infested areas should be revisited and treated if and as necessary every 6 months.
Replacement Species:	Indigenous, local grass species.

Schinus terebinthifolius (Brazilian Pepper)

Category:	Existing legislation: CARA 2002 – Category 1 Proposed legislation: NEMBA – Category 1b KwaZulu-Natal, Mpumalanga, Limpopo and Eastern Cape, 3 in rest of South Africa
Description:	General description: A bushy evergreen tree or shrub reaching a height of 6m. Leaves: Dark green and shiny leaves with prominent, pale veins above and paler and smoother below. Flowers: Small creamy white flowers situated in tightly branched terminal clusters appearing from September to March. Fruit/seeds: Fruits are bright red and fleshy spherical drupes containing one seed
Form:	Tree

Control Measures:	**<u>Mechanical eradication</u>**
	• Pull out during seedlings stage **(before seed ripens)**
	• Disposal of eradicated plants:
	  ◆ Dispose with general waste,
	  ◆ Use in areas prone to erosions,
	• If seeds have ripened, pull out plants while making sure seeds do not fall out.
	• Place plants in a black plastic bag and dispose of at an incineration facility to be destroyed.

	✸ File proof of delivery to the facility. ✸ Alternatively, the removed plants can be buried in a trench of at least 1m deep. Grow-back will need to be controlled in this area, preferably with herbicides. **<u>Herbicides</u>** Apply as specified by supplier
Monitoring Measures:	Photographic records should be kept of infested areas and should be taken at each visit. Re-growth should be monitored 2 and 4 months after chemical application and treated as required. Heavily infested areas should be revisited and treated if and as necessary at least every 6 months.
Replacement Species:	