

**ALIEN INVASIVE PLANT SPECIES
MANAGEMENT AND REHABILITATION PLAN**

Appendix E4 – Environmental Management
Programme





TABLE OF CONTENTS

1. INTRODUCTION.....	4
1.1 Overview	4
1.2 Purpose	4
2. LEGAL FRAMEWORK	5
2.1 Conservation of Agricultural Resources Act (Act No. 43 of 1983)	5
2.2. National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004).....	5
2.3 Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947)6	
3. RESPONSIBLE PERSONS.....	7
3.1 The Developer	7
3.2 The Engineer	7
3.3 The Environmental Control Officer (ECO).....	7
3.4 The Contractor	7
4. CONTROL GUIDELINES	8
4.1 Prevention.....	8
4.2 Early identification and eradication.....	8
4.3 Containment and control.....	8
4.4 Construction phase activities required	8
4.5 Operational phase activities required.....	9
4.6 Decommissioning phase activities required	10
5. CONTROL METHODS	11
5.1. Mechanical Control.....	11
5.2. Chemical Control.....	11
5.3. Biological Control	12
6. HABITAT MANAGEMENT.....	14
7. SAFETY STANDARDS AND GUIDELINES	15
8. MONITORING PROGRAMME	17
9. CONCLUSION.....	19
10. REFERENCES / FURTHER READING.....	20



LIST OF TABLES

Table 1: Construction phase activities required	9
Table 2: Operational phase activities required	10
Table 3: Decommissioning phase activities required	10
Table 4: Mechanical control advantages and disadvantages	11
Table 5: Chemical control advantages and disadvantages	12
Table 6: Biological control advantages and disadvantages	13
Table 7: PPE items.....	16
Table 8: Construction phase monitoring	17
Table 9: Operational phase monitoring	18
Table 10: Decommissioning phase monitoring.....	18



1. INTRODUCTION

1.1 Overview

This document presents the Alien Invasive Plant Species Management and Rehabilitation Plan for the proposed development. The Basic Assessment (EIA) process for the proposed development is undertaken by Environamics Environmental Consultants. An Alien Invasive Plant Species Management and Rehabilitation Plan has been included as part of the Environmental Management Programme (EMPr), to address any alien invasive species that could occur on the project site.

1.2 Purpose

The purpose of an Alien Invasive Plant Species Management and Rehabilitation Plan is:

- to ensure that alien plants do not become established on site.
- to ensure that alien plant species do not become dominant in all or parts of the landscape.
- to implement a monitoring programme to detect the presence of alien plant species as well as to monitor the success of the alien management plan.
- To rehabilitate disturbed areas to decrease the risk of alien invasive plant species establishing on the project sit.



2. LEGAL FRAMEWORK

2.1 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens must be effectively controlled. Landowners are legally responsible for the control of invasive alien plants on their properties. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:

- Category 1: Prohibited and must be controlled.
- Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.
- Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

2.2. National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)

The National Environmental Management: Biodiversity Act (NEMBA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this Act and the regulations, any species designated under section 70 cannot be propagated, grown, bought or sold without a permit. Below is an explanation of the three categories:

- Category 1a: Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

It is important to note that alien species that are regulated in terms of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) as weeds and invader plants are exempted from NEMBA. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEMBA.



2.3 Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947)

According to Government Notice No. 13424 dated 26 July 1992, it is an offence to “acquire, dispose, sell or use an agricultural or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or on such a container”.

Contractors using herbicides need to have a valid Pest Control Operators License (limited weeds controller) according to the Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). This is regulated by the Department of Agriculture, Land Reform and Rural Development.



3. RESPONSIBLE PERSONS

Effective management of alien plant species during the construction and operational phases of the project will be dependent on a number of project personnel. These are listed below:

3.1 The Developer

This refers to the project proponent. They will be responsible for the following:

- Ensure that the requirements set out in this management plan are adhered to and implemented;
- Allocate the responsibilities assigned to the Environmental Control Officer (ECO) to an independent suitably qualified individual prior to the start of construction activities on site; and
- Provide all principal contractors working on the project with a copy of this management plan as part of tender contract documentation to allow the contractors to cost for its requirements within their respective construction contracts.

3.2 The Engineer

The engineer of the proposed development will be responsible for the overall implementation of the management plan during the construction phase of the project. To effectively implement the Alien Invasive Species Management and Rehabilitation Plan, the engineer must be aware of the findings, mitigation measures and conclusions of the Final EIA report, the EMPr, the requirements of the EA, and this management plan.

3.3 The Environmental Control Officer (ECO)

The ECO is responsible for monitoring and verifying the implementation of the management plan during the construction phases of the project. To effectively implement the management plan, the ECO must be aware of the findings, mitigation measures and conclusions of the Final EIA Report, the EMPr, the EA, and this management plan.

3.4 The Contractor

The contractor, being any directly appointed company or individual undertaking the implementation of works, will be responsible for complying with the management plan at all times during the construction phase.



4. CONTROL GUIDELINES

This section provides an outline of the overall approach that should be adopted at the site in order to minimize the probability of invasive alien plants becoming established and ensuring that any outbreaks are managed quickly to ensure that they do not become a long-term problem on site. The establishment of any dense infestations will be expensive to eradicate and will require more complex control measures than would be necessary for low density invasions.

4.1 Prevention

A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas. Prevention could also include measures such as washing the working parts and wheels of earth-moving equipment prior to it being brought onto site, visual walk-through surveys every three months and other measures, as listed in the section below (“Habitat management”).

4.2 Early identification and eradication

Monitoring plans should be developed which are designed to catch Invasive Alien Plant Species shortly after they arrive in the project area. Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When new Invasive Alien Plant Species are spotted an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

4.3 Containment and control

If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Separate plans of control actions should be developed for each location and/or each species. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The key is to ensure that no invasions get out of control. Effective containment and control will ensure that the least energy and resources are required to maintain this status over the long-term. This will also be an indicator that natural systems are impacted to the smallest degree possible.

4.4 Construction phase activities required

The following management actions are required to minimize soils and vegetation disturbance during the construction phase, as well as reducing the probability that invasive alien plants will become established on site:

**Table 1:** Construction phase activities required

Action	Frequency
The Environmental Control Officer (ECO) is to provide permission before any natural vegetation is to be cleared for development.	Daily / when required
Clearing of vegetation must be undertaken as the work front progresses. Mass clearing is not preferred.	Weekly
Should revegetation not be possible immediately, the cleared areas must be protected with packed brush or appropriately battered with fascine work (fixing horizontal branches along the ground using vertical pegs to create resistance to down-slope flow of water/materials). Alternatively, jute (Soil Saver) may be pegged over the soil to stabilize it.	Weekly
Organic matter used to encourage regrowth of vegetation on cleared areas should not be brought onto site from foreign areas. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments should not be used as this would encourage invasion.	Weekly
Care must be taken to avoid the introduction of alien invasive plant species to the site. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
ECO to survey site once a month to detect aliens and have them removed.	Monthly
Alien vegetation regrowth must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best practice for the species concerned. Such information can be obtained from the Working for Water website as well as herbicide guidelines.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into adjacent no-go areas. No-go areas should be clearly demarcated prior to construction.	Daily

4.5 Operational phase activities required

The following management actions are aimed at maintaining non-invaded areas clear of invasive alien species as well as reducing the abundance of any aliens on site:

**Table 2:** Operational phase activities required

Action	Frequency
Surveys for alien species should be conducted regularly. All aliens identified should be cleared.	Every 3 months for 2 years and biannually thereafter.
Re-vegetation with indigenous, locally occurring species should take place in areas where natural vegetation is slow to recover or where repeated invasion has taken place.	Biannually, but revegetation should take place at the beginning of the rainy season.
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected.	When necessary
No alien species should be cultivated on site. If vegetation is required for aesthetic or other purposes, then non-invasive locally occurring species should be used.	When necessary

4.6 Decommissioning phase activities required

The following management actions are aimed at preventing invasion by invasive alien species of re-vegetated areas created during decommissioning activities:

Table 3: Decommissioning phase activities required

Action	Frequency
All damaged areas shall be re-vegetated upon completion of activities.	Once-off
Re-vegetation with indigenous, locally occurring species should take place in disturbed areas. Reseed with locally sourced seed of indigenous grass species that were recorded on site prior to construction.	Once off, with annual follow-up revegetation, if necessary
Maintain alien plant monitoring and removal programme for 2 years after rehabilitation.	Annually for 2 years (Option for extension if the re-vegetation was not satisfactory).



5. CONTROL METHODS

This section provides an outline of existing control measures that have been published for various alien plant species, that have occurred on similar sites. This section only provides a summary of control measures, more detailed control measures are available.

The various means of managing alien invasive plant species are listed below:

5.1. Mechanical Control

This entails damaging or removing the plant by physical action. Different techniques could be used, e.g., uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive and could cause severe soil disturbance and erosion. For sites with no existing dense stands of alien invasive plant species, hand-pulling or manual removal using hand tools will be the most appropriate methods.

Table 4: Mechanical control advantages and disadvantages

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

5.2. Chemical Control

Chemical control should only be used as a last resort, since it is hazardous for natural vegetation. It should not be necessary if regular monitoring is undertaken, which should be effective for controlling invasive alien plants.

Chemical control involves the use of registered herbicides to kill the target weed. Managers and herbicide operators must have a basic understanding of how herbicides function. The use of inappropriate herbicides and the incorrect use of the appropriate herbicides are wasteful, expensive practices and often do more harm than good, especially when working close to watercourses. Some herbicides can quickly contaminate fresh water and/or be transported downstream where they may remain active in the ecosystem.



Contractors using herbicides are required to have a permit according to Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). Herbicides are either classified as selective or non-selective. Selective herbicides are usually specific to a particular group of plants, e.g., those specified for use on broad leaf plants, but should not kill narrow-leaf plants such as grasses. Non-selective herbicides can kill any plant that they come into contact with and are therefore not suitable for use in areas where indigenous vegetation is present.

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

Table 5: Chemical control advantages and disadvantages

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

5.3. Biological Control

Biological weed control consists in the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plant's reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilized. All of these outcomes will help to reduce the spread of the species.

To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Land Reform and Rural Development can be contacted.



Table 6: Biological control advantages and disadvantages

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



6. HABITAT MANAGEMENT

The best way to prevent invasion by alien invasive plant species is to manage the natural vegetation in such a way as to reduce the opportunity for these plants becoming established. The general principle is to not disturb any areas beyond the footprint of the proposed infrastructure and to also ensure that the natural processes that maintain vegetation patterns are not disrupted.

6.1. Post-removal follow-up and rehabilitation

Re-establishment of indigenous vegetation needs to be undertaken to reduce the probability of re-emergence of invasive alien plants and to reduce the risk of soil erosion where the soil surface is poorly vegetated. In most soils, the seeds and other propagules of the plants of the former natural habitat still survive, thus natural regeneration without the need for planting may be possible in many cases. However, if natural regeneration is not likely due to the length of time since disturbance or if the soil has been disturbed to such a degree that seeds and propagules no longer survive then planting or seeding may be required. Rehabilitation should follow these steps:

1. Monitor cleared areas on a regular basis (monthly during construction and three-monthly during operation) for emergent seedlings of invasive alien species and remove these (hand pulling or chemical control).
2. All areas of exposed soil should immediately be protected by placing packed brush on the slope, or creating erosion control barriers using branches, sticks or logs placed horizontally across the slope at 1m intervals (the steeper the slope the closer the barriers should be placed to one another). If topsoil has been lost, rehabilitation of indigenous vegetation will be a difficult and expensive process.
3. If the soil remains relatively undisturbed and the area has some indigenous vegetation left intact, the natural regeneration process of the indigenous vegetation on the site should be managed. This involves regular follow-up to remove emerging invasive alien plants and protecting the area from other forms of disturbance (heavy grazing, trampling, disturbance by vehicles, etc.) while the vegetation re-established naturally.
4. If required, indigenous vegetation can be planted on the cleared areas. This can be in the form of a seed mix or plants rescued from previous clearing.



7. SAFETY STANDARDS AND GUIDELINES

Safety is of the utmost importance when working with invasive alien plant control. Staff is likely to be working in remote areas with potentially dangerous equipment and chemicals. Proper safety training and equipment is therefore required.

7.1. Herbicide safety

Herbicides must be stored in a dedicated storeroom. The Herbicide Storeroom needs to comply with national Occupational Health and Safety standards. Some important safety rules are set out as follow:

- An herbicide storeroom must have adequate ventilation. If the air is stagnant or there is a smell of herbicides when opening up the storeroom then it is a good indication that there is not enough ventilation.
- Clean water needs to be available in close proximity to the storeroom.
- The floor must be non-porous. This is important because when the floor is cleaned (which must be done regularly), no residue of herbicides must remain. Place herbicide containers on wooden pallets to increase ventilation and make mopping up after spillage easier.
- 'No Smoking' and 'No Fire' signs should be posted on the door of the storeroom as well as a sign stating that it is a chemical store and who the responsible person is for the store.
- Keep the storeroom locked to prevent herbicide getting into the wrong hands.
- A spill kit needs to be kept in the storeroom to mop up any spill. The spill kit must contain a bucket with sand and a spade. The sand is to be placed on the spill to absorb the liquid. Once the sand has absorbed the spill, it is to be collected and disposed of where it cannot contaminate the environment. It is preferable to keep contaminated sand in a container and dispose of it with empty containers at a certified chemical recycling plant.
- Obtain the Material Safety Data Sheet from the supplier of the herbicide and ensure that you are familiar with the product before using it. Keep the Material Safety Data Sheet in the storeroom in case of an emergency.
- Always store herbicides in the original labelled container to avoid confusion with other products. Do not store other products in the store, such as protective clothing, food, etc., as they can become contaminated.
- All empty herbicide containers, or herbicides that have reached their expiry date, need to be safely disposed of. This can be done at a registered chemical recycling company. It is important that all empty containers are spiked before disposal. This ensures that they cannot later be used for carrying drinking water, food, etc.
- The contact number for the nearest Poison Control Centre should be posted nearby.

7.2. Personal Protective Equipment (PPE)

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

**Table 7:** PPE items

Item	Specification
Overall	100% cotton, two-piece overalls are best for absorbing perspiration, they last longer and are cooler.
Rubber gloves	Standard, wrist-length rubber gloves are sufficient.
Leather gloves	Standard wrist-length leather gloves are appropriate.
Safety boots	Gumboots or standard safety boots, which support the ankles, are sufficient. Steel toecaps are recommended for workers that are working with heavy equipment or large trees.
Hat	If working with large trees, on steep gradients or if any other safety risk may be present, then wearing a hardhat is advisable. Otherwise, a wide-brim hat can be used to protect the worker from the sun.
Safety glasses	Large, clear safety glasses, which allow air to pass through, are acceptable.
Face mask	A face mask which covers the nose and mouth is essential when mixing herbicides and for foliar spraying.



8. MONITORING PROGRAMME

In order to monitor the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide an assessment of the magnitude of alien invasion on site as well as an assessment of the success of the management programme. The baseline conditions of the site will be determined in a detailed pre-construction walk-through survey. In general, the following principles apply for monitoring:

- Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.
- Simple records must be kept of daily operations, e.g., area/location cleared, labour units and, if ever used, the amount of herbicide used.
- It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

8.1. Construction phase monitoring

The following monitoring is required during the construction phase of the project:

Table 8: Construction phase monitoring

Monitoring action	Indicator	Timeframe
Document alien species present on site	Alien species list	Pre-construction & monthly thereafter
Alien plant distribution	Distribution maps, GPS coordinates	Monthly
Document and record alien control measures implemented	Record of clearing activities	6-monthly
Review alien control success rate	Decline in abundance of alien plant species over time	Annually



8.2. Operational phase monitoring

The following monitoring is required during the construction phase of the project:

Table 9: Operational phase monitoring

Monitoring action	Indicator	Timeframe
Document alien species distribution and abundance on site	Alien species distribution maps	Annually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate.	Annually
Document rehabilitation measures implemented, and success achieved in problem areas	Decline in vulnerable bare areas over time	Annually

8.3. Decommission phase monitoring

The following monitoring is required during the decommissioning phase of the project:

Table 10: Decommissioning phase monitoring

Monitoring action	Indicator	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 2 years after decommissioning and rehabilitation (The option exists for extending the monitoring, if the area has not been rehabilitated to satisfactory standards.)	Alien plant surveys and distribution map	Annually until natural vegetation has recovered sufficiently to resist invasion
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 2 years after decommissioning and rehabilitation.	Alien plant surveys and distribution map	Annually for 2 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate.	Annually for 2 years



9. CONCLUSION

It is important to take into consideration working according to national laws to ensure compliance and to avoid prosecution. Responsible entities should ensure compliance and developers, or contractors should source qualified personnel to help with implementation and compliance.

Designated environmental personnel should be able to identify alien vegetation or vegetation related to bush encroachment. Proper monitoring and eradication should be implemented as set out in this document. Furthermore, companies are available all over the country that can help with the eradication of alien species as well as supplying the necessary advice, herbicides and services.

Best practice is prevention rather than eradication.



10. REFERENCES / FURTHER READING

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