AN ALIEN INVASIVE MANAGEMENT PLAN FOR THE PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON THE FARM RHODES 269, NORTHERN CAPE PROVINCE

An EOH Company

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ECOLOGICAL REPORT

April 2016

Conducted on behalf of:
Miko Energy (Pty) Ltd

Compiled by:

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Reviewed by:

Ms. E. Grobler (EAP.)

REPORT DISTRIBUTION LIST

Name	Institution
	Miko Energy (Pty) Ltd
Ms. E. Grobler	AGES Limpopo

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April 2016	2.0	Final
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1 ASSIGNMENT

Exigo3 was appointed by Ages Limpopo to compile an alien invasive management plan for the proposed establishment of a solar energy generation facility on the farm Rhodes 269, Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province.

The assignment is interpreted as follows: Compile a management plan to control Invasive Alien Species (IAS) occurring on the proposed development site. The study will be done according to guidelines stipulated by the Department of Environmental Affairs and Tourism (DEAT), South Africa.

1.1 INFORMATION SOURCES

The following information sources were obtained:

1. IAS distribution data according to databases to ascertain which species occur in the study area;
2. All relevant maps through Geographical Information Systems (GIS) mapping, and information (previous studies and environmental databases) on the IAS of the site concerned;
3. Requirements regarding the management plan as requested by DEAT;
4. Information on the micro-habitat level was obtained through obtaining a first-hand perspective from the ecological study compiled by Henning (2014) was also utilized for this study.

1.2 REGULATIONS GOVERNING THIS REPORT

1.2.1 National Environmental Management Act Regulation 543 Section 32

This report has been prepared in terms of Regulation 32 of the National Environmental Management Act (No. 107 of 1998) Regulations GN 33306 GNR 543 for environmental impact assessment. Regulation 33 states that a specialist report must contain:

1. An application or the EAP managing an application may appoint a person to carry out a specialist study or specialized process.
2. The person referred to in sub-regulation 1 must comply with the requirements of regulation 17 (General requirements for EAPs or a person compiling a specialist report or undertaking a specialized process).
3. A specialist report or a report on a specialized process prepared in terms of these regulations must contain:

a. Details of

   i. The person who prepared the report; and Letter of Appointment

   ii. The expertise of that person to carry out the specialist study or specialized process.

b. A declaration that the person is independent in a form as may be specified by the competent authority;

c. An indication of the scope of, and purpose for which, the report was prepared;

d. A description of the methodology adopted in preparing the report or carrying out the specialized process;

e. A description of any assumptions made and any uncertainties or gaps in knowledge;

f. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

g. Recommendations in respect of any mitigation measures that should be considered by the applicant and competent authority;

h. A description of any consultation process that was undertaken during the course of carrying out the study;

i. A summary and copies of any comments that were received during any consultation process;

j. Any other information requested by the competent authority.

1.3 TERMS OF REFERENCE

1.3.1 Objectives

1. Determine the IAS occurring in the study area;
2. Describe the management principles and specific methodology on the control of specific IAS occurring in the study area.

1.3.2 Limitations and assumptions

1. In order to obtain a comprehensive understanding of the dynamics of IAS, surveys and monitoring should ideally be replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible;
2. The large study area did not allow for a finer level of assessment that can be obtained in smaller areas. Therefore, data collection in this study relied on data from representative sections, as well as general observations, generic data and a desktop analysis;

2 INTRODUCTION

Invasive alien species (plants, animals and micro-organisms) are species that occur outside of their natural habitat or country of origin and due to their ability to outperform and outgrow indigenous species; they establish themselves in these non-native habitats. Invasive alien species (IAS) have also been called weeds, pests, encroachers, aliens, invasives, exotics or non-indigenous. They are native to a particular area or region, but have been introduced elsewhere, either by accident or on purpose. Invasive alien species can be animals (e.g. rats), plants (e.g. lantana) and micro-organisms (e.g. cholera). IAS can be found in households as decorative plants, pets or pests or on land as terrestrials and in water as aquatics. The most aggressive invaders can spread far from parent plants and cover large areas.

South Africa has a long history of problem plants. Alien plants were first introduced in South Africa in more than thousand years ago. These were plants mainly from central and northern African origin and were associated with human activities. Plants from other continents were introduced by colonists from 1652 onwards. Invasive alien plants (IAPs) pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate. Figure 1 indicates the distribution and percentage cover of IAS in South Africa.

Vehicles often transport many seeds and some may be of invader species, which may become established along the roads inside the study area, especially where the area is disturbed. The construction phase of developments in the area will almost certainly carry the greatest risk of Invasive Alien Species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. Continued movement of personnel and vehicles on and off the development sites, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

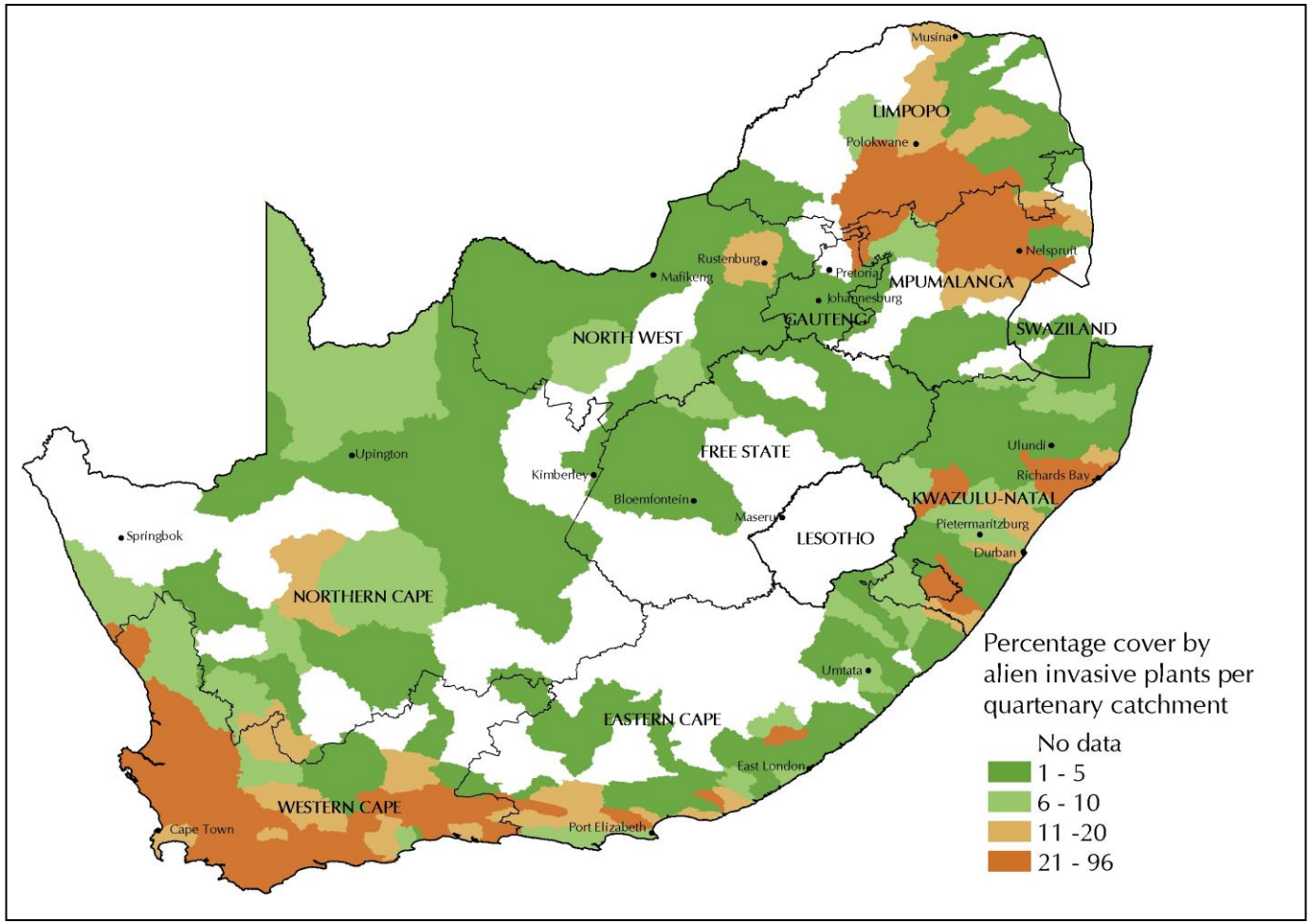

FIGURE 1. DISTRIBUTION AND PERCENTAGE COVER OF IAS IN SOUTH AFRICA

3 STUDY AREA

3.1 LOCATION AND DESCRIPTION OF ACTIVITY

The project entails the development of a Photovoltaic (PV) Power Plant and is located on the farm Rhodes 269, Kuruman RD, Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province (Figure 2).

The proposed project is situated directly north of the town of Hotazel and 50 kilometers to the North of the town of Kathu, with the footprint planned to the east and west of Eskom's "Hotazel - Heuningvlei" 132 kV power line.

The solar project is called RHODES 2 SOLAR PARK and it envisages the establishment of a Photovoltaic (PV) Power Plant having a maximum generating capacity up to 120 MW.

The PV power plant will have a footprint (fenced area) up to 250 ha, within a study area of 1380 ha in extent.

The Rhodes 2 Solar Park will deliver the electrical energy to the "Hotazel - Heuningvlei" 132 kV power line (preferred connection solution). The Eskom's power line will loop in and out of the 132 kV busbar of the new on-site substation, via two new sections of 132 kV.

Access to the Rhodes 2 Solar Park will be from a local upgraded farm road diverted of the regional road R31, which runs parallel to the eastern boundary of the property.

The chosen site is suitable for the installation of a photovoltaic (PV) power plant. It is appropriate morphologically (flat terrain) and regarding the favourable radiation conditions. The available radiation allows a high rate of electric energy production, as a combination of latitude-longitude and climatic conditions.

The aerial image of the site is indicated in figure 3. The footprint of the PV plant layout is planned in the central section of the site.

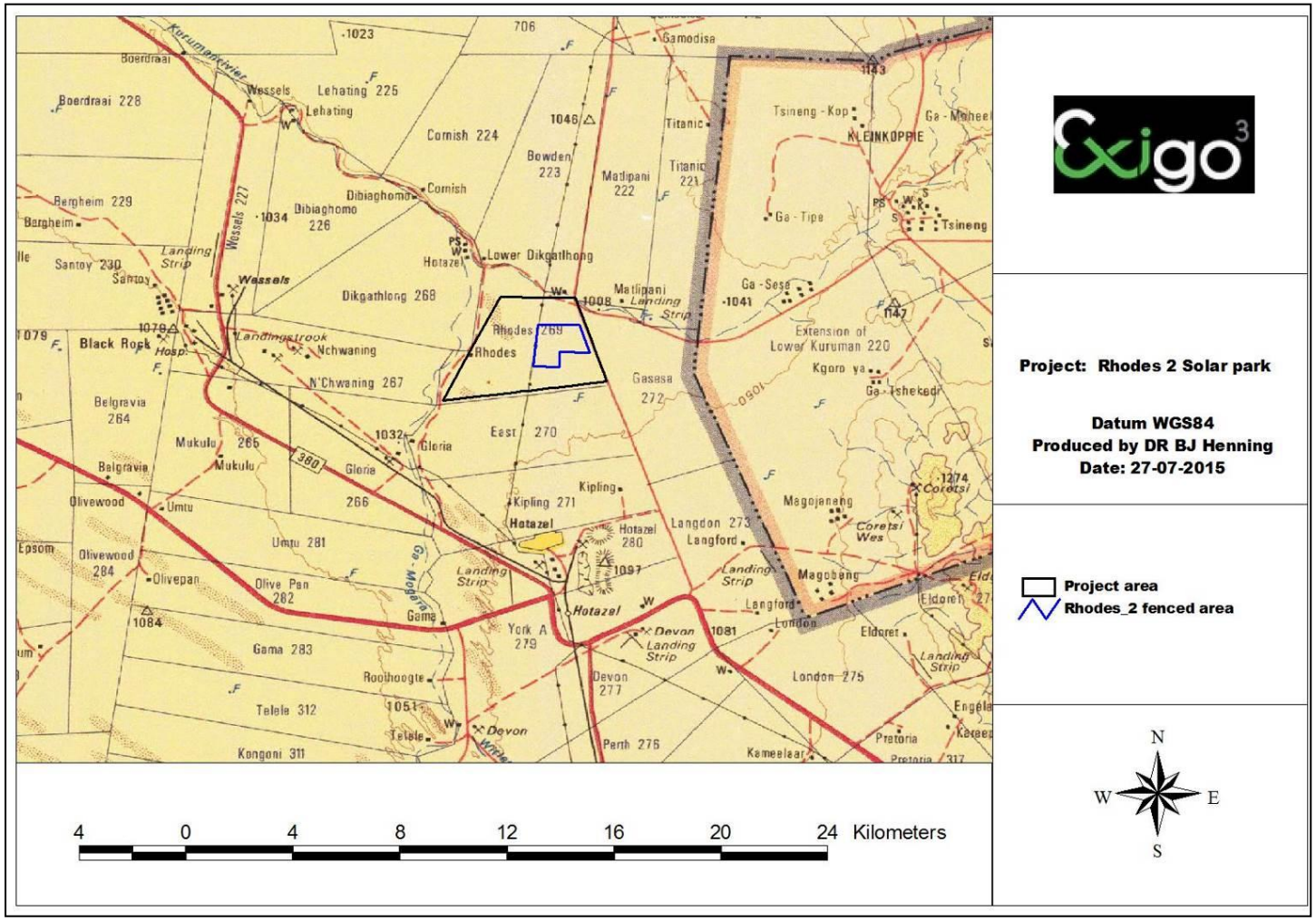

Figure 2 **Regional Locality Map**

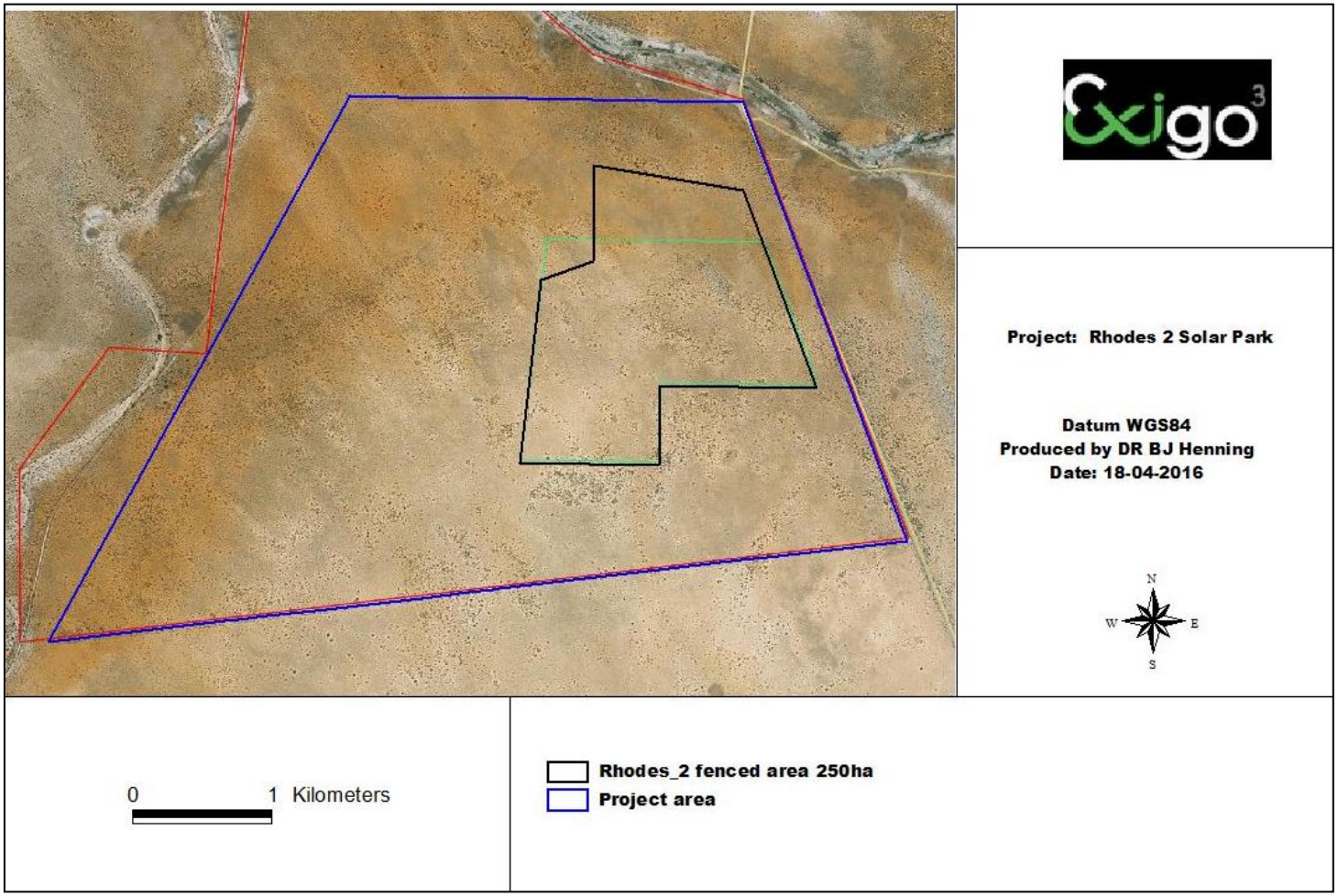

Figure 3 Aerial Image Map

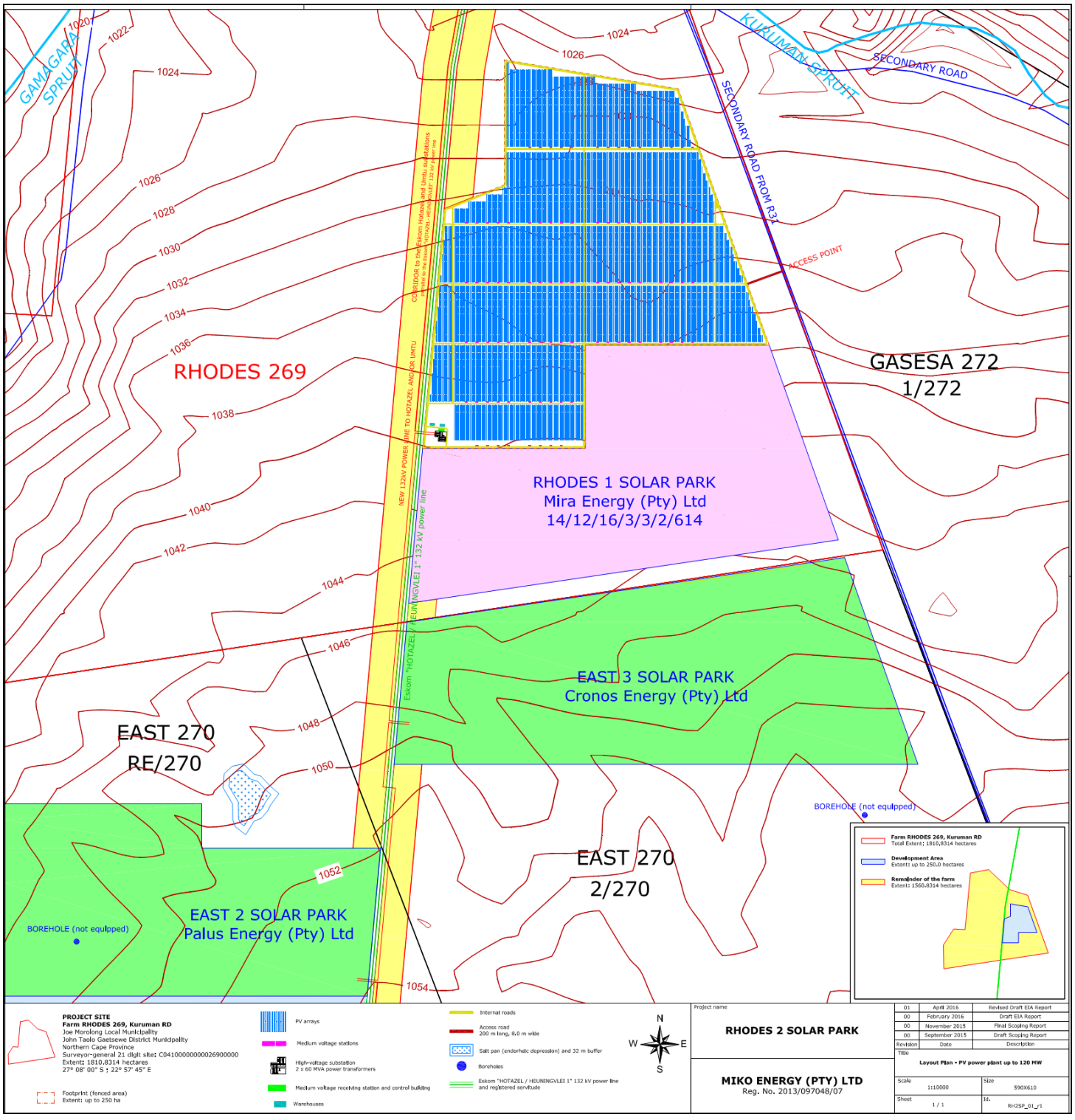

Figure 4. Layout Map Alternative 1

4 LEGISLATION PERTAINING TO THE CONTROL OF IAS

4.1 BACKGROUND

The only currently active legislation on weeds and invasive plants in South Africa forms part of the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA). Regulations 15 and 16 under this Act, which concern problem plants, were amended during March 2001. CARA is currently (2011) in the process of being revised.

The National Environmental Management: Biodiversity Act (Act No 10 of 2004) (NEMBA) also has a chapter dealing with alien species and invasive species, relevant to this subject. The regulations in terms of this chapter have not been finalized, and as a result this chapter cannot be implemented yet.

A lot of useful information on CARA can be found on the website of the Working for Water Programme.

Legislation regarding noxious weeds is nothing new in South Africa. As early as 1860, spiny cocklebur (*Xanthium spinosum*) was declared a noxious weed in the Cape Peninsula, and even before the promulgation of the Noxious Weeds Act, No 42 of 1937, the various Provincial Administrations were charged with the enforcement of legislation on the compulsory eradication of weeds.

4.2 CARA REGULATIONS

There is a legal requirement to control all "Declared Weeds" listed in the Conservation of Agricultural Resources Act, (Act 43 of 1983). This Act recognised two categories of plants, namely "Declared Weeds" and "Declared Invader Plants" (currently under revision). The former are all invasive alien plants, while the latter are a mixture of alien and indigenous species. An important item of legislation was published in the Government Gazette of 26 July 1991 (Notice R.1716). The new legislation "...prohibits the acquisition, disposal, sale or use (of the herbicide)... in a manner other than specified on the label...." This means that the user may not use herbicides for any purpose other than that specified on the label.

The present legislation under the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA), regulation 16, states that certain exotic plant species should be cleared or prevent from spreading. Three different category plants are stipulated in the act as follows:

1. Category 1 species (e.g. Lantana) are generally the worst offenders. As declared weeds, they may not occur on any land or on any inland water surface throughout SA. No person may sell, advertise, exhibit, transmit, send and deliver for sale, exchange or dispose of any weed. It is also illegal to cause or permit the dispersal of any weed from one place to another. These are prohibited plants that will no longer be tolerated, neither in rural nor urban areas, except with the written permission of the executive officer or in an approved bio-control reserve.

These plants may no longer be planted or propagated, and all trade in their seeds, cuttings or other propagative material is prohibited. They may not be transported or be allowed to disperse. Plant species were included in this list for one or more of the following reasons: they might pose a serious health risk to humans or livestock, cause serious financial losses to land users, be able to invade undisturbed environments and transform or degrade natural plant communities, use more water than the plant communities they replace or be particularly difficult to control. Most of the plants in this category produce copious numbers of seeds, are wind or bird dispersed or have highly efficient means of vegetative reproduction. Whereas some of these plants were introduced inadvertently, have no obvious function to fulfil in South Africa and are generally regarded as undesirable, many of them are popular garden or landscaping plants. What they all have in common, however, is the fact that their harmfulness outweighs any useful properties they might have. Care was taken not to include a plant in this category if part of the population of South Africa would suffer because of its absence. The ornamentals in this category ought to be reasonably easy to replace with less invasive substitutes.

2. Category 2 species (such as pine and gum) are also problematic but are more commonly grown for commercial purposes or any viable and beneficial function, such as woodlots, fire belts, building material, animal fodder and soil stabilization. The land user also has to ensure that steps are taken to curb the spread of propagating material of the invader plants to land and inland water surfaces outside the demarcated areas. The species are regarded as weeds outside of these demarcated areas, and landowners are required to take steps to control the species where they occur on their properties. These are plants with the proven potential of becoming invasive, but which nevertheless have certain beneficial properties that warrant their continued presence in certain circumstances. CARA makes provision for Category 2 plants to be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas have to be controlled. The exception is that Category 2 plants may also be retained or cultivated in biological control reserves, where the plants will serve as host plants for the breeding of biological control agents. The growing of Category 2 plants in a demarcated area qualifies as a water use, and is subject to the requirements of section 21 of the National Water Act, 1998 (Act No. 36 of 1998). An area can only demarcated for the growing of Category 2 plants by the Executive Officer.

   The land user needs to obtain a water use license; the plants have to primarily serve a commercial or utility purpose, such as a woodlot, shelter belt, building material, animal fodder, soil stabilisation, medicinal or own consumption; the conditions under which they are cultivated, have to be controlled; all reasonable steps have to be taken to curtail the

spreading of seeds or vegetative reproducing material outside the demarcated area, and all specimens outside the demarcated area have to be controlled. The Executive Officer has the power to impose additional conditions to ensure the adequate control of Category 2 plants in demarcated areas. Seed or other propagative material of Category 2 plants may only be sold to, and acquired by, land users of areas demarcated for the growing of that species, or for the establishment of a bio-control reserve. Category 2 plants may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. The Executive Officer has the power to grant exemption from some of the above requirements.

3. Category 3 plants (such as Syringas and Morning Glory) are generally ornamental plants, which may be retained, but no new planting or trade or propagating of these plants is permitted. If weeds or invader plants occur contrary to the provisions of these regulations, the land user must control them by means of any of the control methods that are appropriate for the species concerned. Any action taken to control weeds or invader plants must be executed with caution and in a manner that will have minimal environmental impact. These plants are undesirable because they have the proven potential of becoming invasive, but most of them are nevertheless popular ornamentals or shade trees that will take a long time to replace. A few of them were placed into this category instead of into category 1 because they do not cause problems in all situations. In terms of Regulation 15 of CARA, Category 3 plants will not be allowed to occur anywhere except in biological control reserves, unless they were already in existence when these regulations went into effect. The conditions on which these already existing plants may be retained are that they do not grow within 30 m from the 1:50 year flood line of watercourses or wetlands, that all reasonable steps are taken to keep the plant from spreading, and that the Executive Officer has the power to impose additional conditions or even prohibit the growing of Category 3 plants in any area where he has reason to believe that these plants will pose a threat to the agricultural resources. Propagative material of these plants, such as seeds or cuttings, may no longer be planted, propagated, imported, bought, sold or traded in any way. It will, however, be legal to trade in the wood of Category 3 plants, or in other products that do not have the potential to grow or multiply. The Executive Officer will have the power to grant exemption from some of the above requirements.

A list of the declared IAS for South Africa and their classes are included as Appendix A.

5 CONTROL OF INVASIVE ALIEN SPECIES

5.1 BACKGROUND

Goals for addressing the problem of Invasive Alien Species (IAS) on the site should include:

- Prevention: Keeping an IAS from being introduced onto the site ecosystem. Ideally, this usually means keeping alien plants from entering the development site;
- Early detection: Locating IAS before they have a chance to establish and spread. This usually requires effective, site-based inventory and monitoring programmes;
- Eradication: Killing the entire population of IAS. Typically, this can only be accomplished when the organisms are detected early;
- Control: The process of long-term management of the IAS' population size and distribution when eradication is no longer feasible. This can be done by implementing the following strategies:
    - Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase;
    - Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines;
    - Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish;
    - Institute a monitoring programme to detect Invasive Alien Species early, before they become established and, in the case of weeds, before the release of seeds;
    - Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented;

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;
- Maintenance control: sustain low alien plant numbers with annual control.

Scientists and field workers use a range of methods to control invasive alien plants. These include:

- Mechanical methods - felling, removing or burning invading alien plants.
    - 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;
    - Once plants have been removed, banks and slopes should be stabilised by erosion protection measures (such as geotextiles or other suitable materials);
    - When stacking materials, take note of fire protection measures and remember to always stack the material in rows;

- Chemical methods - using environmentally safe herbicides. The following general principles apply when using this method:
    - 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;
    - 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;

- See next section on the appropriate herbicides to be used for treatment of specific plants;

- Biological control - using species-specific insects and diseases from the alien plant's country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species. The following general principles apply when using this method:
  - This method 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
  - It allows the natural vegetation to recover gradually in the shelter of the dying weeds.

- Integrated control - combinations of the above three approaches. Often an integrated approach is required in order to prevent enormous impacts.

Detailed descriptions of the control methods are included in Appendix B of this management plan.

6 SPECIES SPECIFIC CONTROL

Table 1 indicate specific control methods for the different IAS that occurs on the proposed development site as identified by Henning (2014):

Table 1. Invasive Alien Species with a distribution centred within the study area and also documented during the ecological surveys (Henning, 2014) in arid regions of the country and their control

Species	Control Method
Opuntia ficus-indica	**Mechanical control:** Seedlings -Mature plants (not cost effective if there are large numbers of individuals): • Can be hoed out if small, or dug out if mature. It is recommended that stout gloves be warn whilst working with this species as the spines will cause injury. **Herbicide control** Saplings/Mature plants: • Inject into 4 – 12 premade holes per plant any one of the following: MSMA (720g/l) Il mixed with 1l water and injected at 2ml per dose. Mamba (Glyphosate 360g/l) 1l mixed with 2l water and injected at 2ml per dose. Touchdown (Glyphosate 480g/l) 330ml mixed with 10l water and injected at 2ml per dose. It is recommended that stout gloves be warn whilst working with this species as the spines will cause injury. **Biological control:** • This is a very cost effective way of removing this species. Although the spiny variety of this cactus is invasive and regarded as a problem, the spineless variety of the same species – known as cactus pear – is cultivated as cattle feed and a valuable crop plant. The cochineal, *Dactylopius opuntiae* (indigenous to Mexico, Texas and Arizona), and the cactus moth, *Cactoblastis cactorum* (a native of South America) were introduced during the 1930s, when Parliament declared prickly pear a national disaster. These two bio control agents attack both prickly pear and cactus pear. They are still keeping prickly pear under effective control, preventing outbreaks such as those during the 1930s. Although cactus pear growers regard them as a pest, it is only the continued presence of these bio control agents in South Africa that makes the cultivation of cactus pear possible, by removing the risk of invasion. Cultivated cactus pear can be protected against the bio control agents by applying chemicals that were registered for this purpose.)
Prosopis glandulosa	Mechanical control: Mechanical site clearance involves tractor operations developed for removing trees, in which the roots are severed below ground level to ensure tree kill, and has been frequently used against *P. glandulosa*. These operations include root ploughing and chaining, which are often the most effective mechanical means, using a mouldboard plough pulled behind a Caterpillar tractor, or a heavy chain pulled between two machines. For root ploughing, large trees must first be felled by hand, but this treatment has been used to remove stumps of up to 50 cm in diameter without difficulty and has a treatment life of 20 years or more (Jacoby and Ansley, 1991).

Species	Control Method
	Other advantages are that only a single pass is required, while site cultivation is effected leading to improved soil water conservation, and there is a chance to reseed with improved forage species. However, this method is one of the most expensive control treatments and is recommended only on deep soils that have a high potential for subsequent increased forage production (Jacoby and Ansley, 1991). The soil should be neither too wet nor too dry for effective root ploughing. Chaining involves pulling a heavy chain between two slow moving Caterpillar tractors, with the effect of pulling over and uprooting larger trees. A second pass in the opposite direction ensures that roots on all sides are severed to ease tree removal (Jacoby and Ansley, 1991). Soil moisture is again important, with soil that is dry on the surface but moist below giving the optimal conditions. If the soil is too dry, the tree stem breaks leading to coppicing, if too wet, the soil and understorey is damaged (Jacoby and Ansley, 1991). Smaller, unbroken trees have to be removed by other means. Although this is an expensive treatment, it is effective where there are many mature trees. It is most widely used following herbicide application to remove dead standing trees. Clearance with a biomass harvester produces wood chips that can be sold for energy production offsetting the operational costs (Felker et al., 1999). Chemical control: Chemical treatments involve the use of herbicides to kill trees, with the most effective being stem or aerial applications of systemic herbicides. Effectiveness is dependent upon chemical uptake, which *in P. glandulosa* is limited by the thick bark, woody stems and small leaves with a protective waxy outer layer. The formulation and application of chemicals for trees of mixed ages and sizes within a stand is difficult. Many herbicides and herbicide mixtures have been tested on *P. glandulosa*. The most effective chemical for high tree kill of P. glandulosa is clopyralid, but dicamba, picloram and triclopyr have also been successfully used, either alone or in combination (Jacoby and Ansley, 1991).
Argemone ochroleuca	Chemical control: Plants of *A. ochroleuca* should be destroyed or removed before they produce seeds. Seedlings are readily controlled by light tillage. Long cultivated fallow or vigorous perennial pastures will control large infestations (Parsons and Cuthbertson, 1992). Herbicides which control A. ochroleuca include 2,4-D, 2,4-DB, dicamba, diuron, fluroxypyr, hexazinone, isoproturon, karbutilate, MCPA, metribuzin, oxadiazon, picloram and terbutryn. Biological control: A biological control programme of A. ochroleuca has been initiated in Australia. This native of Mexico is naturalized in most warm countries of the world in sub-humid as well as semiarid regions. This project sought natural enemies in Mexico and identified several predatory insects including an extremely damaging species of root-breeding and leaf-feeding weevil (CSIRO, 1999; Julien, 2002).

7 REFERENCES

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APPENDIX A. DECLARED WEEDS AND INVADER PLANTS

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Kolom 1 / Column 1		Kolom 2 / Column 2	Kolom 3 / Column 3
Acacia baileyana F. Muell.	Bailey-se-wattel / Bailey's wattle	Indringer / Invader	3
Acacia cyclops A. Cunn. ex G. Don	Rooikrans / Red eye	Indringer / Invader	2
Acacia dealbata Link	Silwerwattel / Silver wattle	Indringer / Invader	2
Acacia decurrens (J.C. Wendl.) Willd.	Groenwattel / Green wattle	Indringer / Invader	2
Acacia elata A. Cunn. ex Benth. (*A. terminalis* misapplied in S.A.)	Peperboomwattel / Pepper tree wattle	Indringer / Invader	3
Acacia implexa Benth.	Screw-pod wattle	Onkruid / Weed	1
Acacia longifolia (Andr.) Willd.	Langblaarwattel / Long-leaved wattle	Onkruid / Weed	1
Acacia mearnsii De Wild.	Swartwattel / Black wattle	Indringer / Invader	2
Acacia melanoxylon R. Br.	Australiese swarthout / Australian blackwood	Indringer / Invader	2
Acacia paradoxa DC. (=A. armata R. Br.)	Kangaroo wattle	Onkruid / Weed	1
Acacia podalyriifolia A Cunn.	Vaalmimosa / Pearl acacia	Indringer / Invader	3
Acacia pycnantha Benth.	Gouewattel / Golden wattle	Onkruid / Weeds	1
Acacia saligna (Labill.) H.L. Wendl.	Port Jackson / Port Jackson willow	Onkruid / Weeds	1
Agave sisalana Perrine	Garingboom / Sisal hemp, Sisal	Indringer / Invader	2
Alhagi maurorum Medik. (=*A. camelorum* Fisch.)	Kameeldoringbos / Camel thorn bush	Onkruid / Weed	1
Anredera cordifolia (Tenore) Steen. {*A. baselloides* (H.B.K.) Baill. Misapplied in South Africa}	Madeira vine, Bridal wreath	Onkruid / Weed	1
Araujia sericifera Brot.	Motvanger / Moth catcher	Onkruid / Weed	1
Argemone ochroleuca Sweet subsp *ochroleuca*	Witblom bloudissel / White flowered Mexican poppy	Onkruid / Weed	1
Arundo donax L.	Spaanse riet / Giant reed, Spanish reed	Indringer / Invader	3
Atriplex lindleyi Moq. subsp. *inflata* Wilson (Muell.)	Blasiesoutbos / Sponge-fruit saltbush	Indringer / Invader	3
Atriplex nummularia Lindley subsp. *Nummularia*	Oumansoutbos / Old man saltbush	Indringer / Invader	2
Azolla filiculoides Lam.	Rooiwatervaring / Azolla, Red water fern	Onkruid / Weeds	1

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Caesalpinia decapetala (Roth) Alston (= *C. sepiaria* Roxb.)	Kraaldoring / Mauritius thorn	Onkruid / Weed	1
Campuloclinium macrocephalum (Less.) DC. (=Eupatorium macrocephalum Less.)		Onkruid / Weed	1
Cannabis sativa L.	Slegs hemp, nie dagga nie / Hemp only, not dagga	Indringer./ Invader	2
Cardaria draba (L.) Desv.	Peperbos / Pepper-cress, Hoary cardaria, White top	Onkruid / Weed	1
Cardiospermum grandiflorum Swartz	Blaasklimop / Balloon vine	Onkruid / Weed	1
Casuarina cunninghamiana Miq.	Kasuarisboom / Beefwood	Indringer / Invader	2
Casuarina equisetifolia L.	Perdestertboom / Horsetail tree	Indringer / Invader	2
Cereus jamacaru DC. (*C. peruvianus* misapplied in S.A)	Nagblom / Queen of the Night	Onkruid / Weed	1
Cestrum aurantiacum Lindl.	Oranjesestrum / Yellow or Orange cestrum	Onkruid / Weed	1
Cestrum laevigatum Schlechtd.	Inkbessie / Inkberry	Onkruid / Weed	1
Cestrum parqui L'Hérit	Inkbessie / Chilean cestrum	Onkruid / Weed	1
Chromolaena odorata (L.) R.M. King & H. Robinson (=*Eupatorium odoratum* L.)	Paraffienbos, Chromolaena / Triffid weed, Chromolaena	Onkruid / Weed	1
Cirsium vulgare (Savi) Ten. (=*C. lanceolatum* Scop.)	Skotse dissel, Speerdissel / Scotch thistle, Spear thistle	Onkruid / Weed	1
Convolvulus arvensis L.	Akkerwinde, Klimop / Field bindweed, Wild morning-glory	Onkruid / Weed	1
Cortaderia jubata (Lem.) Stapf	Pampasgras / Pampas grass	Onkruid / Weed	1
Cortaderia selloana (Schult.) Aschers. & Graebn.	Pampasgras, Silwergras / Pampas grass	Onkruid / Weed	1
Cotoneaster franchetii Bois.	Dwergmispel / Cotoneasters	Indringer / Invader	3
Cotoneaster pannosus Franch.	Silwerdwergmispel / Silver-leaf cotoneaster	Indringer / Invader	3
Cuscuta campestris Yunck.	Gewone dodder / Common dodder	Onkruid / Weed	1
Cuscuta suaveolens Ser.	Luserndodder / Lucerne dodder	Onkruid / Weed	1
Cytisus monspessulanus L. (=*C. candicans* (L.)DC., *Genista monspessulana* (L.) L. Johnson)	Montpellier broom	Onkruid / Weed	1
Datura ferox L.	Grootstinkblaar / Large thorn apple	Onkruid / Weed	1
Datura innoxia Mill.	Harige stinkblaar / Downy thorn apple	Onkruid / Weed	1
Datura stramonium L.	Gewone stinkblaar / Common thorn apple	Onkruid / Weed	1

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Echinopsis spachiana (Lem.) Fiedr. & Rowley {=*Trichocereus spachianus* (Lem.) Riccob.}	Orrelkaktus /Torch cactus	Onkruid / Weed	1
Echium plantagineum L. (= *E lycopsis* L.)	Pers echium / Patterson's curse	Onkruid / Weed	1
Echium vulgare L.	Blou – echium / Blue echium	Onkruid / Weed	1
Egeria densa Planch. (= *Elodea densa* (Planch.) Casp.	Waterpes / Ditch moss, Water thyme	Onkruid / Weed	1
Eichhornia crassipes (Mart.) Solms-Laub.	Waterhiasint / Water Hyacinth	Onkruid / Weed	1
Elodea canadensis Michaux	Canadian water weed	Onkruid / Weed	1
Eucalyptus camaldulensis Dehnh.	Rooibloekom / Red river gum	Indringer / Invader	2
Eucalyptus cladocalyx F. Muell.	Suikerbloekom /Sugar gum	Indringer / Invader	2
Eucalyptus grandis Hill ex Maid (*E. saligna* Sm. (p.p.))	Salignabloekom / Saligna gum, Rose gum	Indringer / Invader	2
Eucalyptus lehmannii (Schauer) Benth.	Spinnekopbloekom / Spider gum	Indringer / Invader	3
Eucalyptus paniculata Sm.	Grysysterbasbloekom / Grey ironbark	Indringer / Invader	2
Eucalyptus sideroxylon A. Cunn. ex Woolls	Swartysterbasbloekom / Black ironbark, Red ronbark	Indringer / Invader	2
Gleditsia triacanthos L.	Amerikaanse driedoring, Soetpeulboom / Honey locust, Sweet locust	Indringer / Invader	2
Hakea drupacea (Gaertn.f) Roemer & Schultes (=*H. suaveolens* R. Br.)	Soethakea / Sweet hakea	Onkruid / Weed	1
Hakea gibbosa (Sm.) Cav.	Harige hakea / Rock hakea	Onkruid / Weed	1
Hakea sericea Schrad.	Syerige hakea / Silky hakea	Onkruid / Weed	1
Harrisia martinii (Lab.) Britton	Toukaktus, Harrisia kaktus /Moon cactus, Harrisia cactus	Onkruid / Weed	1
Hypericum perforatum L.	Johanneskruid / St. John's wort, Tipton weed	Indringer / Invader	2
*Ipomoea indica (*Burm.f.) Merr. (=*I. Congesta* R. Br.)	Purperwinde / Morning glory	Indringer / Invader	3
Ipomoea purpurea (L.) Roth	Purperwinde / Morning glory	Indringer / Invader	3
Jacaranda mimosifolia D. Don	Jakaranda / Jacaranda	Indringer / Invader	3
Lantana camara L. en enige entiteit wat deels of geheel ontstaan het uit die *Lantana camara* kompleks deur verbastering of seleksie op natuurlike of kunsmatige wyse / and any entity which has partly or wholly been derived from the *Lantana camara* complex by means of hybridisation or selection under natural or artificial conditions	Lantana / Lantana, Tickberry	Onkruid / Weed	1

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Leptospermum laevigatum (Gaertn.) F. Muell.	Australiese mirt / Australian myrtle	Onkruid / Weed	1
Leucaena leucocephala (Lam.) De Wit	Reuse wattel / Leucaena	Indringer / Invader	2
Ligustrum japonicum Thunb.	Japanese liguster / Japanese wax – leaved privet	Indringer / Invader	3
Ligustrum lucidum Ait.	Chinese liguster / Chinese wax – leaved privet	Indringer / Invader	3
Ligustrum ovalifolium Hassk.	Kaliforniese liguster / Californian privet	Indringer / Invader	3
Ligustrum sinense Lour.	Chinese liguster / Chinese privet	Indringer / Invader	3
Ligustrum vulgare L.	Gewone liguster / Common privet	Indringer / Invader	3
Litsea glutinosa (Lour.) C.B. Robinson (=*L. sebifera* Pers.)	Indiese lourier /Indian laurel	Onkruid / Weed	1
Lythrum salicaria L.	Purple loosestrife	Onkruid / Weed	1
Macfadyena unguis-cati (L.) A. Gentry	Katteklouranker /Cat's claw creeper	Onkruid / Weed	1
Melia azedarach L.	Maksering, Bessieboom / "Syringa", Persian lilac	Indringer / Invader	3
Metrosideros excelsa Soland. Ex. Gaertn. (=*M. tomentosa* A. Rich.)	Nieu-Seelandse perdestert / New Zealand bottle brush	Indringer / Invader	3
Mimosa pigra L.	Giant sensitive plant	Onkruid / Weed	1
Morus alba L.	Witmoerbei, Gewone moerbei / White mulberry, Common mulberry	Indringer / Invader	3
Myoporum tenuifolium Forst. F. (*M. acuminatum* misapplied in S.A.)	Manatoka	Indringer / Invader	2
Myriophyllum aquaticum (Vell.) Verdc.	Waterduisendblaar / Parrot's feather	Onkruid / Weed	1
Myriophyllum spicatum L.	Spiked water-milfoil	Onkruid / Weed	1
Nassella tenuissima (Trin.) Barkworth (=*Stipa tenuissima* Trin.)	Witpolgras / White tussock	Onkruid / Weed	1
Nassella trichotoma (Nees) Hack. ex Arech. (=*Stipa trichotoma* Nees)	Nassella polgras / Nassella tussock	Onkruid / Weed	1
Nerium oleander L.	Selonsroos / Oleander	Onkruid / Weed	1
Nicotiana glauca R.C. Grah.	Wildetabak / Wild tobacco	Onkruid / Weed	1
Opuntia aurantiaca Lindl.	Litjieskaktus / Jointed cactus	Onkruid / Weed	1
Opuntia exaltata Berger	Langdoringkaktus / Long spine cactus	Onkruid / Weed	1

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Opuntia ficus-indica (L.) Mill.	Boereturksvy, Grootdoringturksvy / Mission prickly pear, Sweet prickly pear	Onkruid / Weed	1
Opuntia humifusa (Raf.) Raf. (= *O. compressa* (Salisb.) (Macbride)	Large flowered prickly pear, Creeping prickly pear	Onkruid / Weed	1
Opuntia imbricata (Haw.) DC. {=*Cylindropuntia imbricata* (Haw.) Knuth}	Imbrikaatkaktus, Kabelturksvy / Imbricate cactus, Imbricate prickly pear	Onkruid / Weed	1
Opuntia lindheimeri Engelm.	Klein rondeblaarturksvy / Small round-leaved prickly pear	Onkruid / Weed	1
Opuntia monacantha Haw. (=*O vulgaris* Mill.)	Suurturksvy, Luisiesturksvy / Cochineal prickly pear, Drooping prickly pear	Onkruid / Weed	1
Opuntia rosea DC.	Roseakaktus / Rosea cactus	Onkruid / Weed	1
Opuntia spinulifera Salm-Dyck	Blouturksvy, Groot rondeblaar turksvy / Saucepan cactus, Large roundleaved prickly pear	Onkruid / Weed	1
Opuntia stricta (Haw.) Haw.	Suurturksvy / Pest pear of Australia	Onkruid / Weed	1
Orobanche minor Sutton	Klawerbesemraap, Bremraap / Lesser broomrape, Clover broomrape	Onkruid / Weed	1
Paraserianthes lophantha (Willd.) Nielsen (=*Albizia lophantha* (Willd.) Benth.)	Australiese Albizia, stinkboon / Australian Albizia, Stink bean	Onkruid / Weed	1
Parthenium hysterophorus L.	Parthenium	Onkruid / Weed	1
Passiflora coerulea L.	Siergrenadella / Blue passion flower	Onkruid / Weed	1
Passiflora edulis Sims	Grenadella / Purple granadilla, Passion fruit	Indringer / Invader	2
Pennisetum setaceum (Forssk.) Chiov.	Pronkgras /Fountain grass	Onkruid / Weed	1
Pennisetum villosum R. Br. ex Fresen.	Veergras / Feathertop	Onkruid / Weed	1
Pereskia aculeata Mill.	Pereskia /Barbados gooseberry	Onkruid / Weed	1
Pinus elliotti Engelm.	Basden / Slash pine	Indringer / Invader	2
Pinus halepensis Mill.	Aleppoden / Aleppo pine	Indringer / Invader	3
Pinus patula Schlechtd. & Cham.	Treurden / Patula pine	Indringer / Invader	2
Pinus pinaster Ait.	Trosden / Cluster pine	Indringer / Invader	2
Pinus radiata D.Don	Radiataden / Radiata pine	Indringer / Invader	2

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Pinus taeda L.	Loblollyden / Loblolly pine	Indringer / Invader	2
Pistia stratiotes L.	Waterslaai / Water lettuce	Onkruid / Weed	1
Pittosporum undulatum Vent.	Australiese kasuur, Soet Pittosporum / Australian cheesewood, Sweet pittospormum	Onkruid / Weed	1
Pontederia cordata L.	Pickerel weed	Indringer / Invader	3
Populus alba L.	Witpopulier / White poplar	Indringer / Invader	3
Populus deltoides Bart. ex. Marsh	Vuurhoutjiepolpulier / Match poplar	Indringer / Invader	2
Populus x canescens (Ait.) J. E. Sm.	Vaalpopulier / Grey poplar	Indringer / Invader	3
Prosopis glandulosa Torr. var *torreyana* (Benson) Johnston and hybrids / en hibriedes	Heuningprosopis / Honey mesquite	Indringer / Invader	2
Prosopis velutina Wooton and hybrids / en hibriedes	Fluweelprosopis / Velvet mesquite	Indringer / Invader	2
Psidium guajava L. and hybrids / en hibriedes	Koejawel / Guava	Indringer / Invader	2
Psidium guineense Swartz	Brasiliaanse koejawel / Brazilian guava	Indringer / Invader	3
Psidium littorale Raddi var *longipes* (O. Berg)Fosb. (=*P. cattleianum* Sab.)	Aarbeikoejawel / Strawberry guava	Indringer / Invader	3
Pueraria lobata (Willd.) Ohwi	Kudzuranker / Kudzu vine	Onkruid / Weed	1
Pyracantha angustifolia (Franch.) C.K. Schneid.	Geelbranddoring / Yellow firethorn	Indringer / Invader	3
Pyracantha crenulata (D. Don) M.J. Roem.	Rooivuurdoring / Himalayan firethorn	Indringer / Invader	3
Ricinus communis L	Kasterolieboom / Castor-oil plant	Indringer / Invader	2
Robinia pseudoacacia L.	Witakasia / Black locust	Indringer / Invader	3
Rorippa nasturtium – aquaticum (L.) Hayek (=*Nasturtium officinale* R. Br.)	Bronkors / Watercress	Indringer / Invader	3
Rosa rubiginosa L. (=*R. eglanteria* L.)	Wilderoos / Eglantine, Sweetbriar	Indringer / Invader	3
Rubus cuneifolius Pursh. and hybrid *R x proteus* C.H. Stirton	Amerikaanse braam, / American bramble	Onkruid / Weed	1
Rubus fruticosus L agg.	Braam / European blackberry	Indringer / Invader	2
Salix babylonica L.	Treurwilger /Weeping willow	Indringer / Invader	3
Salix fragilis L.	Crack or brittle willow	Onkruid / Weed	1
Salvinia molesta D. S. Mitchell and other species of the Family Salviniaceae	Watervaring / Kariba weed	Onkruid / Weed	1

Soort plant / Kind of plant		Tipe / Type	Kategorie/ Category
Botanical name	*Gewone naam / Common name*		
Schinus terebinthifolius Raddi	Brasiliaanse peperboom / Brazilian pepper tree	Indringer / Invader	3
Sesbania punicea (Cav.) Benth.	Rooi sesbania / Red sesbania	Onkruid / Weed	1
Solanum elaeagnifolium Cav.	Satansbos / Silver-leaf bitter apple	Onkruid / Weed	1
Solanum mauritianum Scop.	Luisboom / Bugweed	Onkruid / Weed	1
Solanum seaforthianum Andr.	Aartappelranker / Potato creeper	Onkruid / Weed	1
Solanum sisymbrifolium Lam.	Wildetamatie, Doringtamatie / Wild tomato, Dense-thorned bitter apple	Onkruid / Weed	1
Spartium junceum L.	Spaanse besem / Spanish broom	Onkruid / Weed	1
Tamarix ramosissima Ledeb.	Perstamarisk / Pink tamarisk	Indringer / Invader	3
Tamarix chinenis Lour.	Chinese tamarisk / Chinese tamarisk	Indringer / Invader	3
Tecoma stans (L.) H.B.K.	Geelklokkies / Yellow bells	Onkruid / Weed	1
Tipuana tipa (Benth.) Kuntze	Tipoeboom / Tipu tree	Indringer / Invader	3
Tithonia diversifolia (Hemsl.) A. Gray	Mexikaanse sonneblom / Mexican sunflower	Onkruid / Weed	1
Tithonia rotundifolia (Mill.) S.F. Blake	Rooisonneblom / Red sunflower	Onkruid / Weed	1
Toona ciliata M.J. Roem. (=*Cedrela toona* Roxb. ex Rottl. & Willd.)	Toonboom / Toon tree	Indringer / Invader	3
Ulex europaeus L.	Gaspeldoring / European gorse	Onkruid / Weed	1
Xanthium spinosum L.	Boetebos / Spiny cocklebur	Onkruid / Weed	1
Xanthium strumarium L.	Kankerroos / Large cocklebur	Onkruid / Weed	1

APPENDIX B

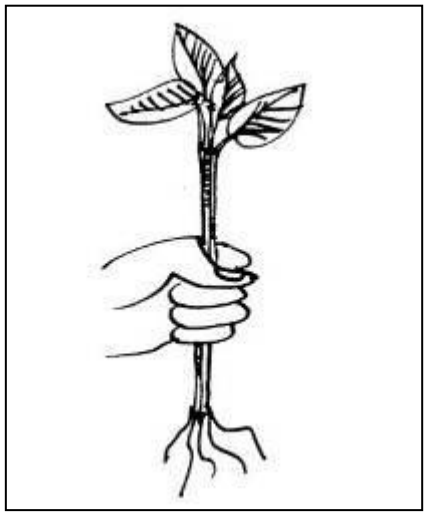
Control methods

The diiferent control methods are discussed in the following section of this management plan as stipulated by the Nature Conservation Corporation (2008):

1. **Mechanical Methods**

    a. **Hand pulling**

- Hand pulling is most effective where plants are small (30cm), immature or shallow rooted
- Use the following method:
    - Use a pair of gloves and grip the plant firmly around the stem just above the root (see figure below)



    - Pull hard and remove the plant, roots & all
    - Kicking around the root area of the plant may assist in loosening root system, making it easier to pull out.
    - Shake the excess sandy material from the plant, this makes the plant easier to stockpile and lighter to transport
    - Stack removed material into piles or spread out evenly if it is not going to be a fire hazard, or
    - Stack the seedlings on brush piles or rows along contour lines, to facilitate easy follow-up.

b. Chopping/ cutting/ slashing

- 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-re-sprouters or in the case of re-sprouters (coppicing), if done in conjunction with chemical treatment of the cut stumps
- Use implements such as pangas (slashers), handsaws, bow-saws, chainsaws, brush cutters and axes. Remember to wear protective clothing.
- Use the following method:
    - Cut/slash the stem of the plant as near as possible to ground level
    - Paint re-sprouting plants (i.e. black wattle, lantana and port jackson) with an appropriate herbicide immediately after they have been cut;
    - Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.

c. 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.
    - Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.

d. Basal bark

- 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.

e. Ring barking

- 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;

- For better control of aggressively coppicing species pull off the bark below the cut to ground level (bark stripping), to avoid the use of herbicide.

Note: that 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.

Frill

- Using an axe or bush knife, make a series of overlapping cuts around the trunk of the tree, through the bark into the softwood (approximately 500mm from ground level). The thickness of the blade should force the bark open slightly, ensuring access to the cambium layer;
- Ensure to affect the cuts around the entire stem;
- Immediately apply the registered herbicide to the cuts by spraying into the frill'. The frill needs to be deep enough to retain the herbicide.

f. Bark stripping

- 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.
- 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.

2. Chemical control

a. Injection

- Drill/punch downward slanting holes into a tree around entire circumference of the stem
- Inject the chemical directly into the plant

b. Foliar spray

- This method is not recommended, but may be used under certain circumstances. Best results are obtained if the solution is sprayed on a large leaf area on an actively growing plant.
- Use a solid cone nozzle that ensures an even coverage on all leaves and stems to the point of run off.
- 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.
- Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.

c. Cut stump application

- This is a highly effective and appropriate control method for larger woody vegetation that has already been cut off close to the ground.
- The appropriate herbicide should be applied to the stump using a paintbrush within 30 min of being cut.
- Stems should be cut as low as practical as stipulated on the label. 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.

d. Stacking

- Stacking the cut material in heaps, or in windrows along mountain 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 that fire meters apart, this is naturally dependant on the size of the stack & 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.
- Do not make stacks under trees, power and telephone lines, within 30 meters of a fire belt or near watercourses, houses and other infrastructure.

e. Safety

- 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 veld. ALWAYS READ THE HERBICIDE LABEL and observe instructions for safe use of herbicide.

3. Biological Control

a. What is biological control?

Biological control is an attempt to introduce the plants natural enemies 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. Natural enemies that are used for biological control are called bio control agents. In the control of invasive plant s, 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 causing the most damage that are available. 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.), no 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.

b. How effective is biological control?

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 regrowth 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 itself 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 be 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.

c. Advantages of biological control

Bio control is:

- Environmentally friendly because it causes no pollution and affects only the target (invasive) plant
- Self-perpetuating or self-sustaining and therefore permanent
- Cost-effective
- 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. Instead, it allows the natural vegetation of the area to recover gradually in the shelter of the dying weeds.