



Harmony Gold: Moab Khotsong Alien Invasive Plant Assessment and Management Plan

MAY 2019



Prepared for: Harmony Gold Mining Company Ltd

Prepared by: Agreenco Environmental Projects (Pty) Ltd

PROJECT INFORMATION

Project Title	Harmony Gold: Moab Khotsong Alien Invasive Plant Assessment and Management Plan
Client	Harmony Gold mining Company Limited
Contact person	Kelebogile Lecoge Senior Environmental Coordinator T: 018 478 4000 E: Kelebogile.lecoge@harmony.co.za
Service Provider	Agreenco Environmental Projects (PTY) Ltd Reg number: 2012/157824/07 VAT number: 4460236146
Physical Address	Unit 3 Eulophia Corner 38 General van Reyneveld Street Persequor Park Pretoria 0020
Postal Address	PO Box 19896 Noordbrug 2522
Project Number	C0177
Document Compiled by:	Neels Bornman (BSc Hons)
Document Approved by:	Adrian Haagner (M.Sc., Pr.Sci.Nat)
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EXECUTIVE SUMMARY

Agreenco Environmental Projects (Pty) Ltd were requested by Harmony Gold mining company limited to conduct an invasive alien plants (IAPs) assessment on a number of farming units that form the combined operational footprint of the Moab Khotsong mine. From this assessment a Management plan was compiled detailing the control methods and schedule for the identified AIP's. The presence of invasive alien plants on land or water is known to result in adverse environmental impacts

It is recommended that the control of all Category 1 and Category 1b species be deemed a high priority, regardless of their densities.

The fieldwork was conducted in the week of 1-5 April 2019 and included the identification and GPS-tagging of all declared IAPs as individual points or plant clusters on the targeted area. Species densities, distribution, height (trees only) and diameter at breast height (trees only) were also recorded. The next step included analysing the data and presenting it visually in maps.

The findings for the mine's operations are summarised in the table below:

Farm Portion Name	Total number of species	Total number of Category 1 species	Management Priority
Mispah 274	15	14	Medium
Moab 279	6	6	Low
Zaaiplaats 190	4	4	Low
Hoekplaats 598	9	8	Low
Anglo 593	2	2	Low
Doornkop West 446	19	5	Medium
Chrystalkop	20	15	High
Zuiping 394	23	20	High

From the assessment, a management plan was compiled detailing the eradication methodologies and schedule for the identified AIP's. Lists are provided with the recommended treatment methods and the control of each vegetation type is discussed.

A phased approach is recommended for implementing the eradication plan. This approach consists of four phases with various eradications scheduled during each phase, targeting specific growth stages during the season. After completion of the fourth phase of eradication it is recommended that the area be re-assessed to update the Management Plan for continued control of AIP's.

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DECLARATION OF INDEPENDENCE AND QUALITY

This report is free from any external prejudice or influence and is dedicated to accurately and precisely assessing the distribution of listed invasive alien plant species and recommending required management options to effectively manage these species. All of the work herein has been conducted by Agreenco Environmental Projects (Pty) Ltd.

TERMS OF REFERENCE

Agreenco Environmental Projects (Pty) Ltd (Agreenco) was granted the opportunity to conduct an Invasive Alien Plant (IAP) assessment within the footprint of the Moab Khotsong mine. The purpose of the assessment was to create a baseline report for the degree of infestation of Alien Invasive Plants, their locations and densities within the targeted footprint area. From the assessment, a Management Plan was compiled detailing the treatment methodologies recommended implementation schedule and monitoring framework.

LIMITATIONS AND ASSUMPTIONS

The occurrence of Alien Invasive Plant species is dependent on climatic conditions. Results represented in this report should serve as an indication of plants present at the time of the inspection. It is expected that additional plants may germinate after completion of the inspection. Therefore, eradication and control should be conducted by suitably qualified individuals that will be able to assess the occurrence of these plants on site.

1 INTRODUCTION

Invasive alien plants have been introduced into South Africa either intentionally or unintentionally, where they have become naturalised i.e. are capable of reproducing and spreading without direct assistance from people (Henderson, 2001; Nel *et al.* 2004). The spread of invasive alien plants can result in biotic homogenisation where the native biodiversity is suppressed and replaced by invasive species (McKinney and Lockwood, 1999). This can result in natural ecosystems as well as those inhabited and/or utilised by humans to be placed under pressure from a growing number of destructive invasive alien species that erode natural capital, compromise ecosystem stability and threaten economic productivity (National Strategy for dealing with Biological Invasions in South Africa (DEA, 2014)). Aliens or invader plants are defined by the Conservation of Agriculture Resource Act (CARA), 1983 (No 43 of 1983) as a kind of plant which has under section 2 (3) been declared an invader plant, and includes the seed of such plant and any part of such plant which reproduces itself asexually. The South African legislation under CARA and the National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) states that landowners are legally responsible for the control of alien species on their properties.

According to the National Strategy for dealing with Biological Invasions in South Africa (DEA, 2014), almost 9000 alien plant species have been introduced to South Africa. However, not all alien plants are considered problem (invasive) plants and only those listed as invasive alien plants (IAPs) under CARA and NEMBA will be focused on in this report.

IAPs are highly adaptable, vigorous growers (Working for Water, 2011) that quickly invade disturbed areas. The uncontrolled spread of IAPs can have adverse effects on natural ecosystem function. These adverse effects can include the following:

- A loss of biodiversity and ecosystem resilience as alien species out-compete indigenous flora and in doing so reduce complex ecosystems to mono-cultures therefore destroying habitats for both plant and animals;
- Through increased evaporative transpiration rates 'alien thickets', reduce the amount of ground water thus reducing the volume of water entering our river systems;
- Alien invasive species dry out wetlands and riparian areas thereby increasing the potential for erosion in these areas;
- The loss of potentially productive land, and the loss of grazing potential and livestock production;
- Poisoning of humans and livestock;
- An increase in the cost of fire protection and damage in wildfires due to alien invasive stands being denser than natural vegetation and the wood more resinous, creating hotter fires;
- An increased level of erosion, following fires in heavily invaded areas, as well as the siltation of dams.

The management of invasive alien plants has become a legal requirement for which mining houses are held responsible. Failing to implement management actions to control and eradicate invasive alien plants on one site can therefore be seen as a non-compliance on which the Department of Mineral Resources (DMR), Department of Agriculture (DAFF; CARA), Department of Water Affairs (DWA) and the Department of Environmental Affairs (DEA; NEMBA) can take action. Although this is a legal requirement, the control and eradication of alien plant species should also be seen as an important part of fulfilling Harmony's environmental vision.

This assessment forms the baseline assessment for the distribution of Alien Invasive Plants on the Moab Khotsong mine. From this assessment, a management plan detailing the different management units, unit eradication and control programme based on the density and composition of Alien Invasive Plants, schedule and control plan may be compiled.

2 DESCRIPTION OF STUDY ENVIRONMENT

2.1 Scope of Works

The initial project scope of works was limited to the assessment of Alien Invasive Plants in accordance with the Guidelines for Monitoring, Control and Eradication Plans as required by Section 76 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) for species listed in terms of Section 70 of the Act as per the supplied Tender Scope dated 6 February 2019. This document identified the following farm portions for assessment:

- Mispah 274
- Moab 279
- Zaaipplaats 190
- Hoekplaats 598
- Anglo 593
- Doornkop West 446
- Chrystalkop 69
- Zuiping 394
- Pretoriaskraal (excluded as it does not form part of Harmony Gold operations)

The farm portion named Pretoriaskraal was included in the initial tender document and proposal, but was subsequently excluded from the project scope as it did not form part of Harmony's operational area. The request for tender did not include the compilation of an Alien Invasive Management Plan but was limited to the identification, mapping and cover estimation of plants within the targeted areas.

An additional order was granted on 02 May 2019 (P.O. Nr 214061-CEN) to expand the existing assessment to include a Management Plan which details treatment methodologies, scheduling and a Monitoring framework. The Management plan is included in this report under section 6.

2.2 Study site

Harmony's Moab Khotsong Operations footprint includes eight farms and covers a total area of approximately 3000 ha. The operations include the Great Nologwa processing plant, Moab Khotsong shaft and the Moab Khotsong tailings complex which comprises the Mispah 1, Mispah 2 and Kopanang TSF's. The footprint includes approximately 3 km of river front to the north where the Vaal River forms part of the property boundary. The plant and shaft areas, comprising of active operational areas, were not included in the assessment on request of the client as these areas require special permission to access. Each of the farm areas, the plant, shaft and TSF boundaries are depicted in Figure 2-1.

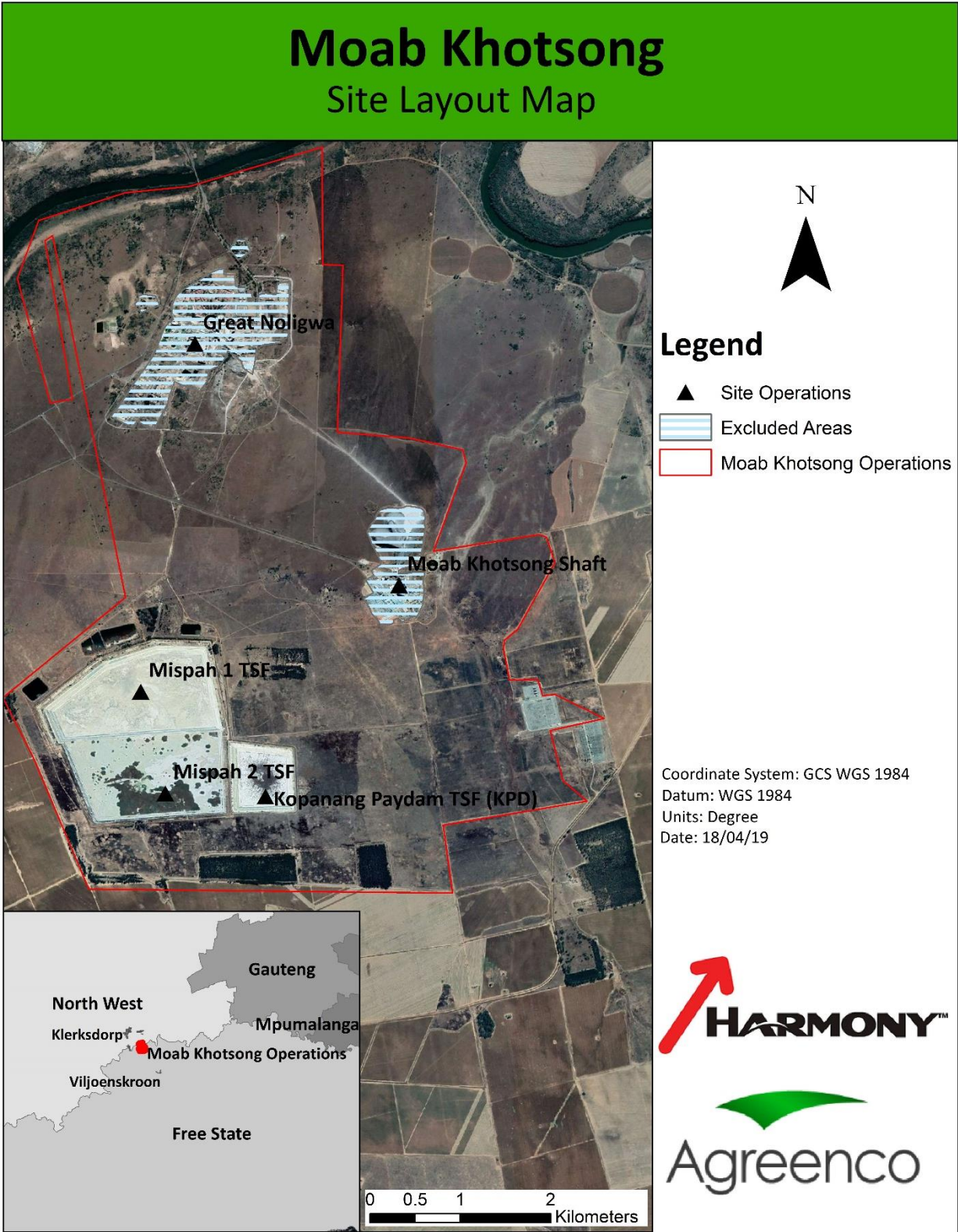


Figure 2-1: Moab Khotsong operations and assessment target areas

2.3 Survey methodology

On site assessments were conducted to assess the distribution, densities (degree of infestation, DoI) and species composition of listed invasive alien plants across the defined study area. The surveys consisted of a qualified and experienced observer, systematically walking the full study site and recording all listed plant species observed. Listed species were defined as all species legally listed in accordance to either (or both) the National Environmental Management of Biodiversity Act of 2004 (NEMBA) and the Conservation of Agricultural Resources Act of 1983 (CARA). All listed plants observed were recorded, noting GPS location, density, plant height (woody plants only, Table 2-2) and diameter at breast height (woody plants only). The density of species was assigned a score out of 5, with a score of less than 2 denoting low densities, a score of 3, denoting moderate densities and a score of greater than 4 denoting moderately high to high densities (Table 2-1).

Table 2-1:Rationale used to score species densities

Density score	Herbs/reeds/ferns/climbers	Woody plants/succulents
5 -(High)	>80% cover	>50 adult plants/>70 younger plants
4 -(Moderately high)	61-80%	36-50 adult plants/51-70 younger plants
3 -(Moderate)	31-60% cover	21-35 adult plants/31-50 younger plants
2 -(Moderately low)	11-30% cover	6-20 adult plants/11-30 younger plants
1 -(Low)	<10% cover	<5 adult plants/<10 younger plants

Table 2-2: Rational used to assign height classes to trees

Height class	Height (m)
1	<1
2	1-2
3	3-5
4	6-10
5	>10

All of the data collected was then used to develop a map of areas of concern, ranked “High”, “Medium” and “Low” (Table 2-3).

The ranking of areas was related to two components, the first being the presence, category and density of listed species and the second being the likelihood of these areas to act as sources for further infestation of listed plants to neighbouring areas. Ranks were defined as follows:

Table 2-3: Ranking of areas in accordance to their composition of listed alien plants

RANK	CRITERIA	CONTROL URGENCY
High	Moderate to High abundance of Category 1 species, Adult or near-adult life-stage able to produce seed, potentially high seed bank already present. Area prone to further infestation. High potential to cause further infestation into neighbouring areas.	URGENT, This currently results in legal non-compliance
Medium	Moderate abundance of Category 2 species (low abundance of Category 1), early emergence life stage with lower seed production potential. Current seed bank likely to be low. Area is partially resilient to further significant infestation. Potential to act as a source of further invasion in future if uncontrolled.	Control measures need to be put in place to avoid further infestation and avoid non-compliance.
Low	No Category 1 species present, area is relatively resilient to infestation if not disturbed.	No action required, annual monitoring to detect any potential infestations.

These criteria will be used as the basis to determine the priority areas. In order to make the priority areas more practical, the following criteria should also be considered (Nature Conservation IAP's BPG, 2006):

1. The area immediately around buildings, if there is a risk of fire.
 - Due to the proximity of these plants to buildings and their ability to produce high volumes of dry litter which acts as fuel for fire. These areas include the shafts, plant areas and administration buildings.
2. The tops of slopes, watercourses, and steep, long bare slopes.
 - This is to inhibit the spread of seeds downhill or downstream, where they will infest new areas.
3. Low-density infestations, to curb the spread of IAP's into surrounding areas.
 - These are isolated areas within the lease area that are showing signs of spreading to other areas.
4. Sites where control work has been completed and regrowth is present to prevent densification and further infestation.
 - Follow up inspection and maintenance is very important to successfully control the spread of invasive alien species. If IAPs re-emerge, immediate action should be taken to remove all re-emerging plants.
5. Disturbed sites, to prevent new infestations from mass germination of alien seeds in the soil.
 - Disturbed soil that has not been rehabilitated is generally ideal environments for IAPs to establish as there is no competition from indigenous plants.

3 LEGISLATIVE FRAMEWORKS

The legislative frameworks that guides the assessment of Alien Invasive Plants and the composition of an Alien Invasive Management Plan in the South African context is discussed in the following sections.

3.1.1 CARA

The intention of this Act (No 43 of 1983) is to control the over-utilization of South Africa's natural agricultural resources, and to promote the conservation of soil and water resources and natural vegetation. CARA has categorised a large number of invasive plants together with associated obligations of the land owner, including the requirement to remove categorised invasive plants and taking measures to prevent their further spread. Although the act stipulates the protection of agricultural resources, the provision of the Act relating to weeds, as classified in section 2 of the Act, shall also apply to other land-use types.

Under section 5.1 of the Act, the prohibition of the spreading of weeds, states that:

- (a) - "no person shall sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, exchange for anything or dispose of to any person in any manner for consideration, any weed;"
- (b) - "no person shall in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any place in the Republic;"

As this act stipulates that landowners/users are responsible for the control of "weeds", as defined by section 2 in the Act, non-conformance to this may be seen as an offense and actions can be taken against the landowner/user by the appointed Executive Officer or Minister.

3.1.2 NEMBA

The National Environmental Management of Biodiversity Act (NEMBA) Act 10 of 2004 was specifically designed to provide a management and conservation outline for biological diversity, drafted under the National Environmental Management Act (NEMA), 1998. This Act deals with the management and conservation of biodiversity, with its relevant components, which includes the use of indigenous biological resources in a sustainable manner, the fair and equitable sharing of benefits arising from bio-prospecting, cooperative governance in biodiversity management and conservation within the structures of NEMA. The Act, in protecting biodiversity, deals with the protection of threatened ecosystems and species (Chapter 4 of the Act), the control of alien invasive species (Chapter 5 of the Act), genetically modified organisms (Chapter 5 of the Act) and regulates bio-prospecting (Chapter 6 of the Act). As with NEMA, NEMBA incorporates and gives effect to international agreements relating to biodiversity. The invasive alien plant listings as published in Government Gazette No. 40166, Notice 864 of 29 July 2016 were used to categorise the invasive alien plants identified at Lonmin's shafts operations. The invasive alien plants were categorised according to Notice 3, list 1 of Regulation 864. All identified invasive alien species on site were compared to the prohibited species list in Notice 4, list 1 of Regulation 864 to determine if any of the identified plants are listed prohibited species.

The Alien and invasive Species regulations as published in Government Gazette No. 40166, Notice 864 of 29 July 2016 specifically addressed the restricted activities defined in terms of section 1 of the Act. Chapter 5 and 6 of this regulation addresses the issue of applying for permits if restricted activities

that are done on the applicant’s land and the necessity for an environmental assessment practitioner to do risk assessments.

Regulation 864 of the Act gives notice to which restricted activities are prohibited in terms of section 71A (1); exempted in terms of section 71(3); require a Permit in terms of section 71 (1). No restricted activity was found at Harmony.

In order for the NEMBA to better the management and conservation of biodiversity the standards, norms and indicators are continuously reviewed with amendments or additions published by the Minister in the Government Gazette. These publications should always be referred to when planning on undertaking a listed activity, in order to ensure that the minimum standards are considered and guidelines followed.

3.1.3 Categories of listed invasive species

In order to manage invasive species in accordance to their degree of potential to threaten agricultural resources (CARA, Table 3-1) and biodiversity (NEMBA, Table 3-2), a categorization system was established. Each listed species is given a category, which determines the legal management requirements/actions needed for the associated species. The categories and their associated species are frequently reviewed and therefore it is the landowner’s responsibility to remain aware of the category of any listed species on his/her land.

Table 3-1: CARA categorisation of IAPs

Category	Description
1	These species are prohibited and must be controlled or eradicated (except in Biocontrol reserves that are designated for the breeding of their biocontrol agents). These plants serve no economic purpose and possess characteristics that are harmful to humans, animals or the environment. E.g. Yellow bells
2	These species are mainly used for commercial purposes or for woodlots, animal fodder, soil stabilization etc. These plants are allowed to grow in demarcated areas under controlled conditions and in biocontrol reserves. E.g. Castor-oil plant
3	These species were mainly introduced as ornamental plants but have escaped and are proven invaders. No further planting allowed (except with special written permission), nor trade in propagative material. Existing plants may remain (except those within the flood line of watercourses or wetlands or as directed by the executive officer) but must be prevented from spreading. E.g. Syringa

Table 3-2: NEMBA Categorization of AIP`s

Category	Description
1a	May not be owned, imported, grown, moved, sold, given as a gift or dumped in a waterway. These species need to be controlled and officials of DEA must be allowed access to monitor or assists with control. E.g. Rubber vine
1b	May not be owned, imported, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders that may need government assistance to remove. All category 1b species must be contained, and in many cases, they already fall under a government sponsored management programme. E.g. Jacaranda tree
2	These are invasive species that can remain in your garden, but only with a permit, which is granted under very few circumstances. E.g. Grey poplar tree
3	These are invasive species that can remain in your garden. However, you cannot propagate or sell these species and must control them in your garden. In riparian zones or wetlands all category 3 plants become category 1b plants. E.g. Tipu tree

It is important to note that the presence of a species listed both under CARA and under NEMBA is regarded as non-compliance under both Acts and therefore may result in two separate fines/legal actions to be taken.

3.1.4 Fertilizers, Farm feeds, Agricultural Stock Remedies Act

The use of chemicals to control invasive alien plants are govern by the Fertilizers, Farm feeds, Agricultural Stock Remedies Act 1947 (Act No. 36 of 1947). Section 7 of this Act emphasises that no person shall sell any fertilizer, farm feed, agricultural remedy or stock remedy unless it is registered. Agricultural remedies that are banned or prohibited under this Act includes Chlordane, Lindane, Dieldrin, Aldrin, Endrin, Heptachlor, Camphechlor (Toxaphene), Dichlor-diphenyl-trichloroethane (DDT), Hexachlorobenzene ad Polychlorinated Biphenyls. Agricultural remedies that are only registered for use by certain entities include Temik® and methyl bromide. DDT is registered only to be use by state agencies. Chlordane and Lindane are still used by certain pest control operators although the use of them is prohibited (Verdoorn, 2011). Formalin (formaldehyde solution) is not registered and the use of it is illegal in South Africa.

4 CONTROL METHODS

Eradication of alien invasive species is essential in order to achieve the long-term plant community composition and structure required at a site. Control measures need to be implemented as soon as possible in order to fast track the pathway to final desired state, delays may result in further infestation and increased eradication costs. The eradication of these invasive species is difficult as a result of their significant ability to spread and multiply. Areas already invaded are likely to have significant seed banks and will require numerous follow-up operations to permanently remove these species from the system. Reducing these existing stands of alien species will also reduce the potential of these species further invading neighbouring areas.

An alien vegetation control programme usually has three phases:

Phase	Description
Initial Control	Significant reduction of the existing population(s)
Follow-up Control	Control of seedlings, root suckers and coppice re-growth
Maintenance Control	Sustaining low plant numbers with low annual control costs. It is important to monitor these areas two to three times a year (seasonally) to prevent alien plant re-infestation (Campbell, 2002).

The DEA in the National Strategy for dealing with Biological Invasions (2014) describes three approaches that can be considered to manage invasive alien plants at any given stage of invasion. The approach to managing invasive alien plants can either be species-, area-, or pathway-based, or a combination of all or any of these. The document continues to state that it is important to consider an appropriate mix of approaches, rather than a single approach, to ensure that key actions are not overlooked. For the purpose of this study, we will only discuss and consider the species- and area-based approaches.

Approach	Description
Species-based approach	Focusses on preventing the introduction of, eradicating, containing or controlling particular species. This approach aims to manage only a particular species in an area and not a suite of species. This approach can be considered where sparse infestations occur of a single species or even multiple species that can be managed with the same control method.
Area-based approach	Focusses on managing invasive plant infestations on an ecosystem level. This approach is the preferred option where dense stands of invasive plants occur as the management of only one species would not make sense. This is because the remaining species would only replace those whose density and impact have been reduced. This approach is appropriate for highly disturbed areas such as the waste rock dumps, tailings dams and protected areas.

Different control methods exist to control and eradicate the spread of these species. Planning and preparation is essential in invasive alien plant control, as the risk associated with it can be deleterious to the environment, as well as to the people carrying out the task. These preparations include

procuring the required equipment and materials, having staff undergo the required training, and ensuring that the relevant land-owners and neighbours are notified of the clearing activities before they are undertaken– if they are to be impacted by this in any way (**Text Box 1**).

Planning for invasive alien plant control include appointing a suitably qualified/ experienced person to survey the areas that are to be cleared and creating a clearing plan (targeting priority areas- areas close to infrastructure when fire is used as control method, riparian areas, wetlands, etc.)

Text box 1: Factors to considered for the selection of control method

- The species to be controlled;
- The size (life-stage) of the target plants:
 - Seedlings are best controlled by hand pulling, hoeing or foliar (leaf) application of herbicides to dense or open stands;
 - Saplings are best controlled by hand pulling or hoeing, foliar (leaf) sprays, basal stem treatments and cut stump treatments;
 - Mature trees are best controlled by ring barking, frilling or partial frilling, basal stem treatments, cut stump treatments and stem injections.
- The density of the stand of plants:
 - Where other desirable vegetation is present (e.g. indigenous grass cover), selective herbicides or mixes that will not damage the desirable vegetation cover should be applied.
 - With respect to dense stands of large trees, herbicide treatment of standing trees may be appropriate to prevent the problem of disposing of felled trees.
- The accessibility of the terrain:
 - In inaccessible areas (i.e. areas where there is difficult or no access), methods of control where a minimum amount of transportation of equipment and chemicals is required, are preferable.
- Environmental safety:
 - Chemical control used in the vicinity of riparian areas must be executed with caution so as to avoid pollution of water resources. Only herbicides that are approved for use in riparian areas should be used. The washing of equipment or disposal of waste spray mixture is prohibited.
- The disposal of dead vegetation:
 - Wood that can be used should be removed after felling;
 - If brushwood is to be burned then it should be spread rather than stacked to prevent soil damage upon burning;
 - Felled trees or trees in danger of falling should be removed so as not to cause damage to infrastructure.
- Financial implications;
- Rehabilitation potential post-clearing;
- Management history of the land; and
- The threat to surrounding agricultural land and biodiversity.
- Time of eradication:
 - The time of eradication is an important factor to consider in ensuring species is effectively eradicated. Some species can be controlled throughout the year whilst other can only be controlled during certain periods of the year (e.g. Oct.-May). Eradication efforts must be planned as per the proposed schedule in the eradication plan.
 - The time of day and the climatic conditions (e.g. rainfall) herbicides are applied can also impact on the success of eradication.

The techniques selected must be appropriate to the individual species of concern, whilst taking into account that many desirable species exist around, above and underneath the undesirables. An integrated and phased approach is, therefore, unavoidable and will lead to the best results. The species of concern are also representative of a wide range of plant growth forms, from large woody species, grasses, evergreen shrubs, tuberous climbers and annual forbs. Each has different potential control methods, different registered herbicides, potential for biological control and of course has different preferred combination treatments at different densities. Different control methods are briefly discussed below:

- a. **Biological Control Mechanisms** - this is a generally poorly researched field in South Africa and few of the species of concern have bio-control programmes approved by the Plant Protection Research Institute. The greatest negative aspect of biological control is that it is very slow and can be highly cyclical. Bio-control may be best undertaken in conjunction with other control mechanisms, as it is usually species-specific;
- b. **Fire Control** - this is only suitable for large, mono-stands of undesirable species and where sufficient fuel loads exist. In most cases, it will not be a feasible option for alien and invasive plant control close to infrastructure and operations;
- c. **Mechanical Control** - this is suitable for large, mono stands of undesirable species or where invasive plant densities (particularly woody species) are excessive. There are different intensities that can be applied, ranging from (i) clearing areas with heavy plant (dozers/ graders), (ii) chains/cables, (iii) manual/mechanical cutting, chopping or slashing, and (iv) ringbarking or girdling. Higher intensity mechanical control methods (i&ii) leads to very high disturbance levels and will require immediate restorative efforts. Low intensity mechanical control (iii&iv) requires less intensive restoration efforts and can often be applied in conjunction with chemical control mechanisms on a species or growth-form specific basis;
- d. **Chemical Control Mechanisms** - this is a sophisticated and highly regulated field that, if applied correctly by qualified persons, does have perhaps the highest degree of selectivity and the greatest versatility of the different control mechanisms. Chemicals have been developed for the control of most plant-types and most of the categorised alien and invasive species have specifically registered active ingredients that are available for their control. Chemicals are either applied directly to soils, to foliage, to notched or cut stumps, deep into plant material or over wide areas with aerial applications. The combination of selective mechanical control, followed up by selective chemical applications remains one of the best methods for integrated plant control, particularly where desirable species are not to be affected;
- e. **Integrated approach** -The above-mentioned control methods used in isolation are generally unsustainable in the long term, because of plant characteristics such as rapid re-growth, re-infestation via vegetative shoots, and prolific quantities of wind-dispersed seeds. The invaders tend to grow at a rate that exceeds the capabilities of mechanical or chemical control alone. An integrated control strategy uses a combination of the most suitable control methods for a species in a particular situation. Therefore, an integrated approach of mechanical and chemical is usually recommended. Such an integrated approach may comprise of:
 - Trees being felled and the cut stumps treated with a chemical herbicide.
 - Trees being felled and burnt and the resulting seedlings then sprayed with herbicide.
 - The cleared area being burnt if the soil seedbank is persistent and the resulting seedlings treated with herbicides.

As alluded to earlier in the document, the management of IAPs can generally be achieved by following a species-based or area-based approach. The ***species-based approach*** is the preferred method when controlling smaller areas or sparse infestations as this approach focus on a single species at a particular stage of invasion. However, in larger areas (ecosystem level) where dense stands of IAPs occur, the ***area-based approach*** is the preferred option.

5 GENERAL INVASIVE ALIEN PLANTS DIVERSITY, DISTRIBUTION AND DENSITIES

In this chapter the findings of the assessments are presented. Each farming unit is discussed separately as per the project scope. Two tables are presented per farming unit, the first shows the location number of mapped species and/or species clusters with the species names, CARA and NEMBA classification, species density at the location point where applicable, diameter at breast height (DBH) for woody plants and average stand height for woody plants. The second table gives an indication of the relative densities of each species over the farming unit area, based on the criteria of Table 2-1. A map of the farming unit, containing the location points of plant clusters is also presented. It is important to note that these points represent clusters of species and not necessarily single plants. Each point illustrates a cluster of species within a minimum radius of 20 m and a maximum radius of 50 m.

5.1 Mispah 274

5.1.1 General description of invasive alien plant diversity and distribution for Mispah 274

The distribution and diversity of IAPs at Mispah 274 was moderate to high with isolated clusters and individual plants occurring over the farming portion (Table 5-1 and Figure 5-1). A total of 15 species were recorded on the farming portion as indicated in Table 5-2. Four plantations, consisting of listed and non-listed Eucalyptus species (mainly *E. grandis*, *E. camaldulensis* and *E. sideroxylon*) and listed Pinus species were located on this farming portion. These plantations are indicated in Figure 5-1 but are not included in the species lists as existing plantations of these species are exempted under NEMBA. Although existing plantations of these species are exempted, the spread of these plants, outside of the existing plantation, is not acceptable and plants growing outside of the indicated boundaries of the plantations will have to be controlled. The main invader species found on Mispah 274 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Melia azedarach* and *Robinia psuedoacacia*. Of the 15 species recorded, 14 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining specie, *Tipuana tipu*, is declared a Category 3 species under both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

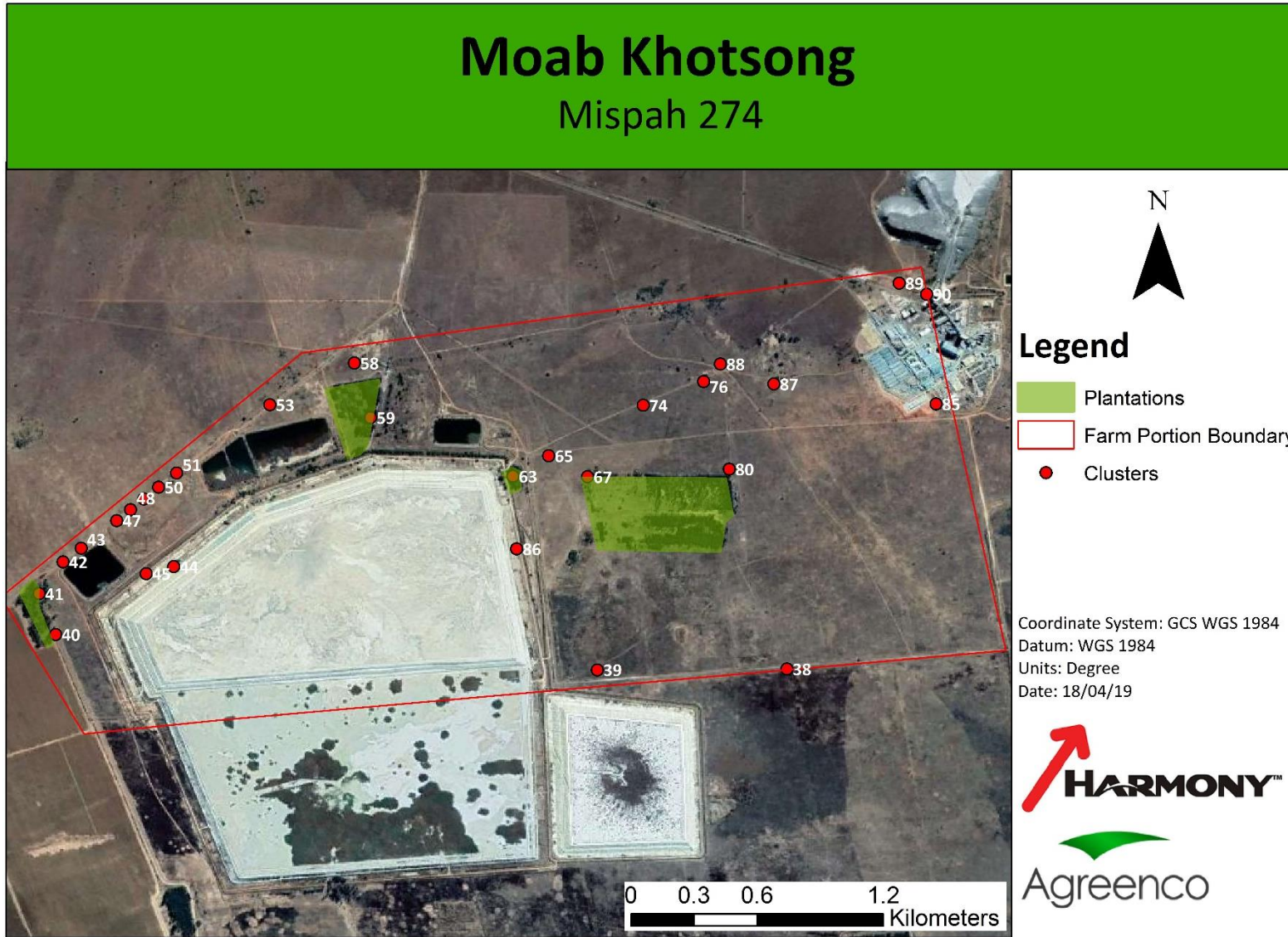


Figure 5-1: Area distribution of AIP's for Misphah 274

Table 5-1: IAP cluster points and locations recorded on the Mispah 274 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
38	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and sedges	26°47'39.80"E	27° 0'2.96"S
39	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and sedges	26°47'10.64"E	27° 0'3.10"S
40	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°45'47.32"E	26°59'57.66"S
41	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	5	2m	15m	Tree	26°45'44.79"E	26°59'51.38"S
42	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°45'48.45"E	26°59'46.49"S
43	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°45'51.24"E	26°59'44.38"S
44	<i>Tipuana tipu</i>	Tipu Tree	3	3		3m	10m	Tree	26°46'1.24"E	26°59'48.30"S
45	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'5.48"E	26°59'47.21"S
47	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°45'56.70"E	26°59'40.15"S
48	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°45'58.83"E	26°59'38.46"S
	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°45'58.83"E	26°59'38.46"S
49	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'0.88"E	26°59'36.81"S
50	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'3.15"E	26°59'34.99"S
51	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'5.92"E	26°59'32.81"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
53	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°46'20.27"E	26°59'22.31"S
58	<i>Melia azedarach</i>	Syringa	3	1b	-	-	5m	Tree	26°46'33.27"E	26°59'15.89"S
59	<i>Casuarina cunninghamiana</i>	Beefwood	2	2	-	-	-	Tree	26°46'35.76"E	26°59'24.29"S
63	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	-	3m	30m	Tree	26°46'57.65"E	26°59'33.30"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'57.65"E	26°59'33.30"S
65	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'3.17"E	26°59'30.17"S
67	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	5	1.5m	10m	Tree	26°47'9.13"E	26°59'33.39"S
74	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'17.71"E	26°59'22.38"S
76	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°47'26.98"E	26°59'18.73"S
80	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	0.2m	5m		Tree	26°47'30.94"E	26°59'32.21"S
85	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Tree	26°48'2.75"E	26°59'22.18"S
86	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Herb	26°46'58.24"E	26°59'44.48"S
87	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	1m	25m		Tree	26°47'37.80"E	26°59'19.11"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Robinia pseudoacacia</i>	Black locust	2	1b	1.5m	3m		Tree	26°47'37.80"E	26°59'19.11"S
	<i>Melia azedarach</i>	Syringa	3	1b	0.2m	5m		Tree	26°47'37.80"E	26°59'19.11"S
88	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Herb	26°47'29.56"E	26°59'16.03"S
89	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'57.08"E	26°59'3.59"S
90	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°48'1.31"E	26°59'5.30"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°48'1.31"E	26°59'5.30"S
	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°48'1.31"E	26°59'5.30"S

Table 5-2: Species list of all the declared IAPs recorded on the Mispah 274 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended Control Method
1	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1	1b	Manual, Chemical
2	<i>Cortaderia selloana</i>	Pampas grass	1	1	1b	Chemical
3	<i>Datura ferox</i>	Large thorn-apple	1	1	1b	Manual, Chemical
4	<i>Datura stramonium</i>	Common thorn-apple	1	1	1b	Manual, Chemical
5	<i>Eucalyptus grandis</i>	Saligna gum	3	1b	5	Mechanical, Chemical
6	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical
7	<i>Melia azedarach</i>	Syringa	3	3	1b	Mechanical, Chemical
8	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical
9	<i>Pennisetum setaceum</i>	Fountain grass	1	1	1b	Manual
10	<i>Robinia psuedoacacia</i>	Black Locust	3	2	1b	Mechanical, Chemical

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended Control Method
11	<i>Salsola kali</i>	Glasswort	1	-	1b	Chemical
12	<i>Tamarix ramosissima</i>	Pink tamarisk	1	3	1b	Mechanical, Chemical
13	<i>Tipuana tipu</i>	Tipu tree	1	3	3	Mechanical, Chemical
14	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical
15	<i>Xanthium strumarium</i>	Large cocklebur	1	1	1b	Manual, Chemical

5.2 Moab 279

5.2.1 General description of invasive alien plant diversity and distribution for Moab 279

The distribution and diversity of IAPs at Moab 279 was moderate to high with clusters and individual plants occurring over the farming portion (Table 5-3 and Figure 5-2). A total of six species were recorded on the farming portion as indicated in Table 5-4. Three plantations, consisting of listed and non-listed Eucalyptus species (mainly *E. grandis*, *E. camaldulensis* and *E. sideroxylon*) were located on this farming portion. These plantations are indicated in Figure 5-2 but are not included in the species lists as existing plantations of these species are exempted under NEMBA. Although existing plantations of these species are exempted, the spread of these plants, outside of the existing plantation, is not acceptable and plants growing outside of the indicated boundaries of the plantations will have to be controlled. The main invader species found on Moab 279 were *Eucalyptus camaldulensis* and *Tamarix ramosissima*. *Eucalyptus camaldulensis* occur in disturbed areas along roads and in the toe paddocks of the tailings facilities as individual plants with clusters occurring close to plantations. *Tamarix ramosissima* is limited in its spread to the TSF side slopes and toe paddocks. Of the six species recorded, all six are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The recorded species include herbs, grasses, shrubs, creepers and trees.

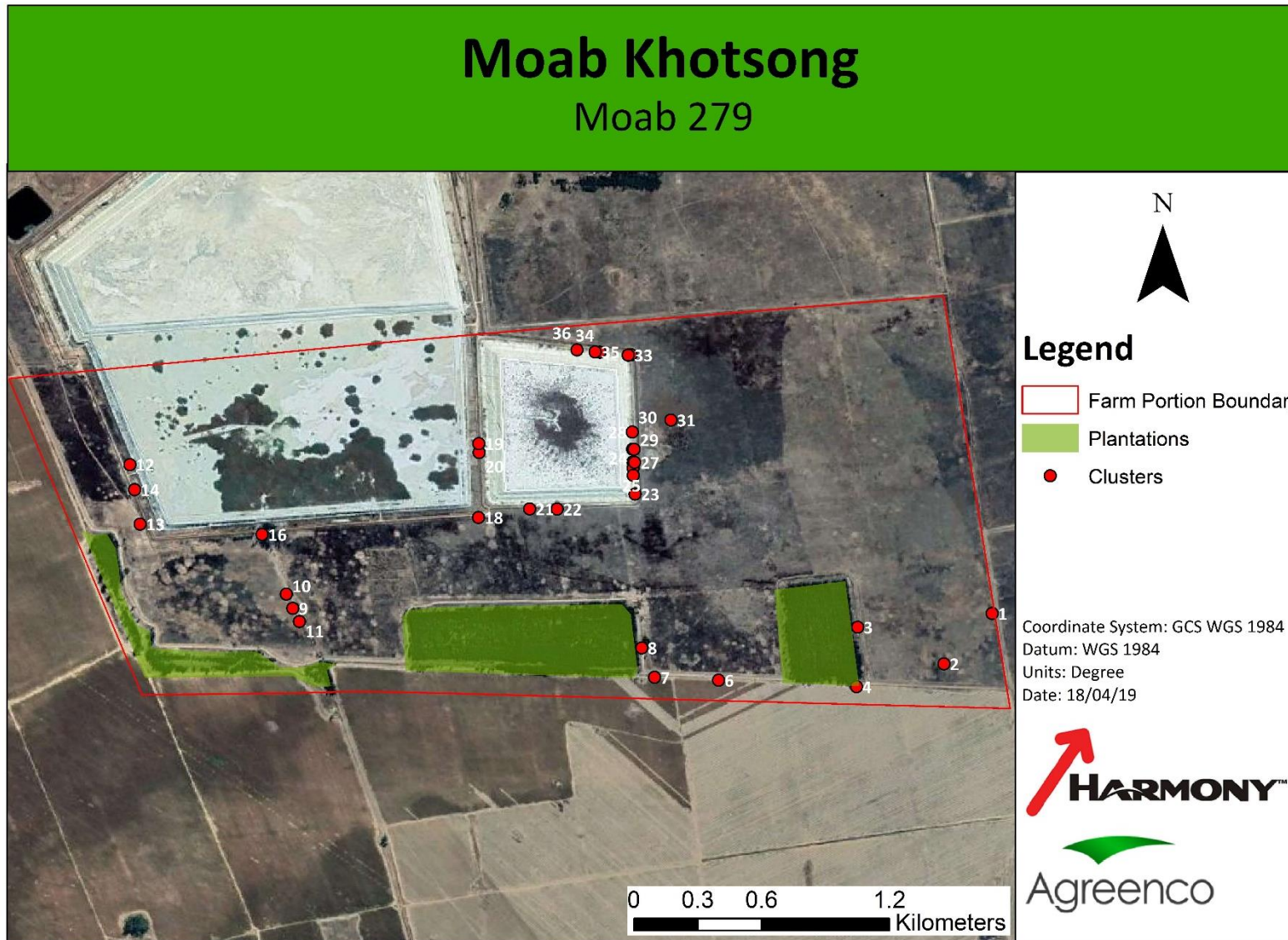


Figure 5-2: Area distribution of AIP's for Moab 279

Table 5-3: IAP cluster points and locations recorded on the Moab 279 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
1	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°48'20.6 6"E	27° 0'48.62"S
2	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and Sedges	26°48'13.3 5"E	27° 0'56.26"S
3	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°48'0.25" E	27° 0'50.69"S
4	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°48'0.08" E	27° 0'59.71"S
6	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	0.5m	20m	Herb	26°47'39.1 4"E	27° 0'58.74"S
7	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and Sedges	26°47'29.4 3"E	27° 0'58.29"S
8	<i>Eucalyptus grandis</i>	Saligna gum	3	1b	3	-	-	Tree	26°47'27.4 7"E	27° 0'53.84"S
9	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1m	15m	Tree	26°46'34.5 0"E	27° 0'47.83"S
10	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1m	15m	Tree	26°46'33.5 1"E	27° 0'45.66"S
11	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1m	15m	Tree	26°46'35.5 0"E	27° 0'49.83"S
12	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°46'9.75" E	27° 0'26.00"S
13	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	20m	Tree	26°46'11.3 1"E	27° 0'35.05"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
14	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	10m	Tree	26°46'11.7 3"E	27° 0'35.29"S
16	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	5	1m	10m	Tree	26°46'29.8 3"E	27° 0'36.61"S
18	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'2.69" E	27° 0'34.04"S
19	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'2.73" E	27° 0'22.82"S
20	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'2.79" E	27° 0'24.18"S
21	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'10.4 5"E	27° 0'32.73"S
22	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'14.6 3"E	27° 0'32.75"S
23	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'26.4 4"E	27° 0'30.48"S
24	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'26.1 9"E	27° 0'27.64"S
25	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and Sedges	26°47'26.1 5"E	27° 0'26.53"S
26	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'26.1 3"E	27° 0'25.59"S
27	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'26.3 8"E	27° 0'25.66"S
28	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'26.0 9"E	27° 0'23.67"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
29	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and Sedges	26°47'26.3 0"E	27° 0'23.68"S
30	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'26.0 4"E	27° 0'21.06"S
31	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and Sedges	26°47'31.9 0"E	27° 0'19.25"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'31.9 0"E	27° 0'19.25"S
32	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	2m	Tree	26°47'25.8 6"E	27° 0'9.32"S
33	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-		Tree	26°47'25.4 1"E	27° 0'9.37"S
34	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	2m	Tree	26°47'21.1 3"E	27° 0'8.94"S
35	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-		Tree	26°47'20.4 0"E	27° 0'8.88"S
36	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	2m	Tree	26°47'17.6 4"E	27° 0'8.60"S

Table 5-4: Species list of all the declared IAPs recorded on the Moab 279 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Eucalyptus camaldulensis</i>	Red river gum	5	2	1b	Mechanical, Chemical
2	<i>Cortaderia selloana</i>	Pampas grass	1	1	1b	Manual, Chemical
3	<i>Salsola kali</i>	Glasswort	5	-	1b	Manual, Chemical
4	<i>Tamarix ramosissima</i>	Pink tamarisk	2	3	1b	Mechanical, Chemical

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
5	<i>Verbena bonariensis</i>	Wild verbena	2	-	1b	Manual, Chemical
6	<i>Eucalyptus grandis</i>	Saligna gum	3	3	1b	Mechanical, Chemical

5.3 Zaaiplaats 190

5.3.1 General description of invasive alien plant diversity and distribution for Zaaiplaats 190

The distribution and diversity of IAPs at Zaaiplaats 190 was low with very few individual plants occurring over the farming portion (Figure 5-3 and Table 5-5). A total of 4 species were recorded on the farming portion as indicated in Table 5-6. These species are annual weeds and only 6 individual plants were recorded on the farming unit.

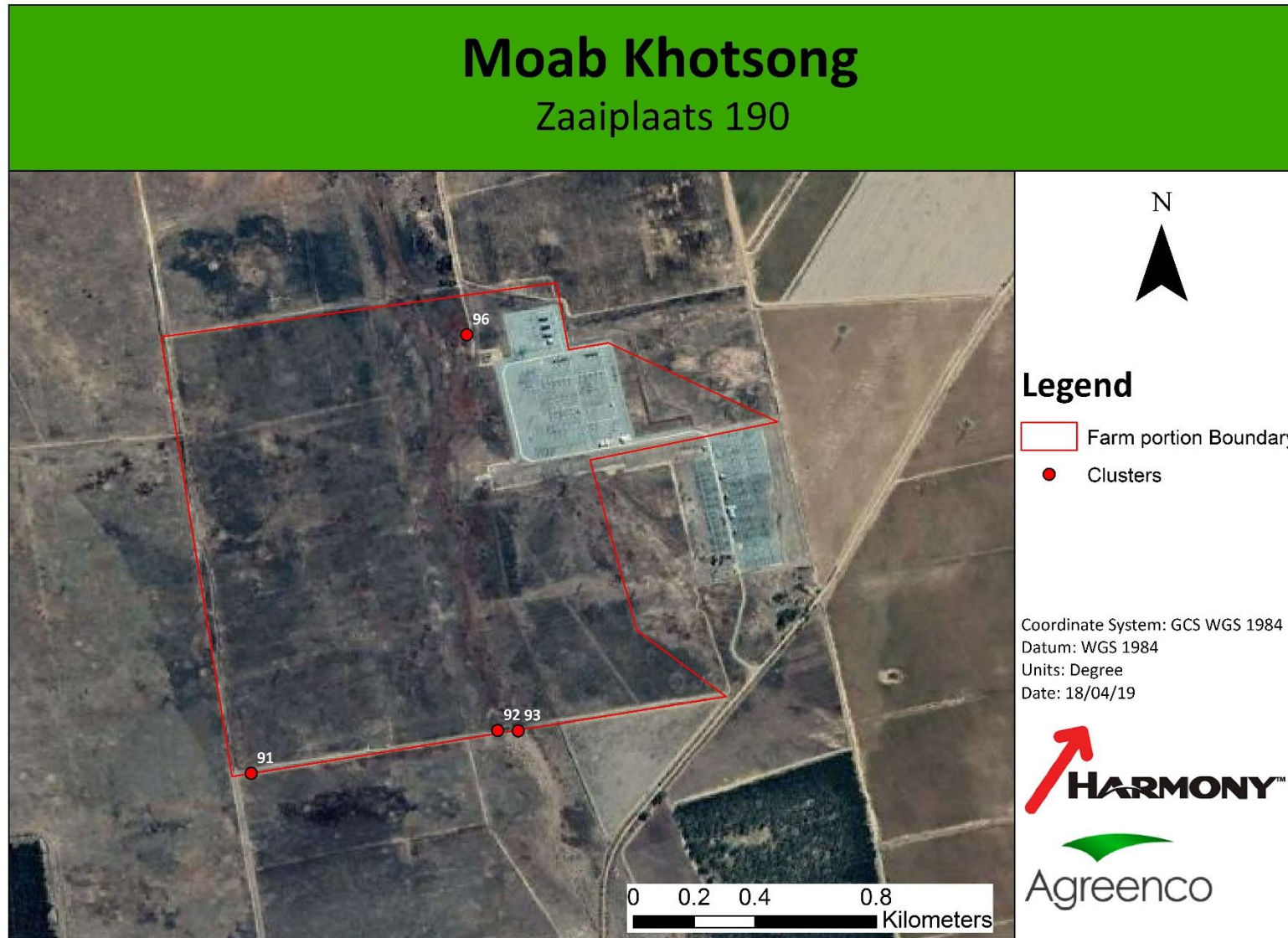


Figure 5-3: Area distribution of AIP's for Zaaiplaats 190

Table 5-5: IAP cluster points and locations recorded on the Zaaiplaats 190 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
91	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°48'21.16"E	27° 0'36.13"S
92	<i>Cirsium vulgare</i>	Spear thistle	1	1b	-	-	-	Herb	26°48'47.47"E	27° 0'31.54"S
93	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and sedges	26°48'49.66"E	27° 0'31.58"S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°48'49.66"E	27° 0'31.58"S
	<i>Cirsium vulgare</i>	Spear thistle	1	1b	-	-	-	Herb	26°48'49.66"E	27° 0'31.58"S
96	<i>Verbena bonariensis</i>	Wild verbena	-	1b	3	-	-	Herb	26°48'44.16"E	26°59'49.28"S

Table 5-6: Species list of all the declared IAPs recorded on the Zaaiplaats 190 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical
2	<i>Cirsium vulgare</i>	Spear thistle	1	1	1b	Manual, Chemical
3	<i>Cortaderia selloana</i>	Pampas grass	1	1	1b	Manual, Chemical
4	<i>Salsola kali</i>	Glasswort	1	-	1b	Manual, Chemical

5.4 Hoekplaats 598

5.4.1 General description of invasive alien plant diversity and distribution for Hoekplaats 598

The distribution and diversity of IAPs at Hoekplaats 598 was low to moderate with plant clusters localised to the shaft boundary and South western portion of the farming unit (Table 5-7 and Figure 5-4). A total of 9 species were recorded on the farming portion as indicated in Table 5-6. The main invader species found on Hoekplaats 598 were *Melia azedarach* and *Robinia psuedoacacia*. Most of these plants were located in clusters on the South western side of the farming portion. Of the 9 species recorded, 8 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining specie, *Populus alba* is declared Category 2 under both CARA and NEMBA. The recorded species include herbs, grasses, shrubs and trees.

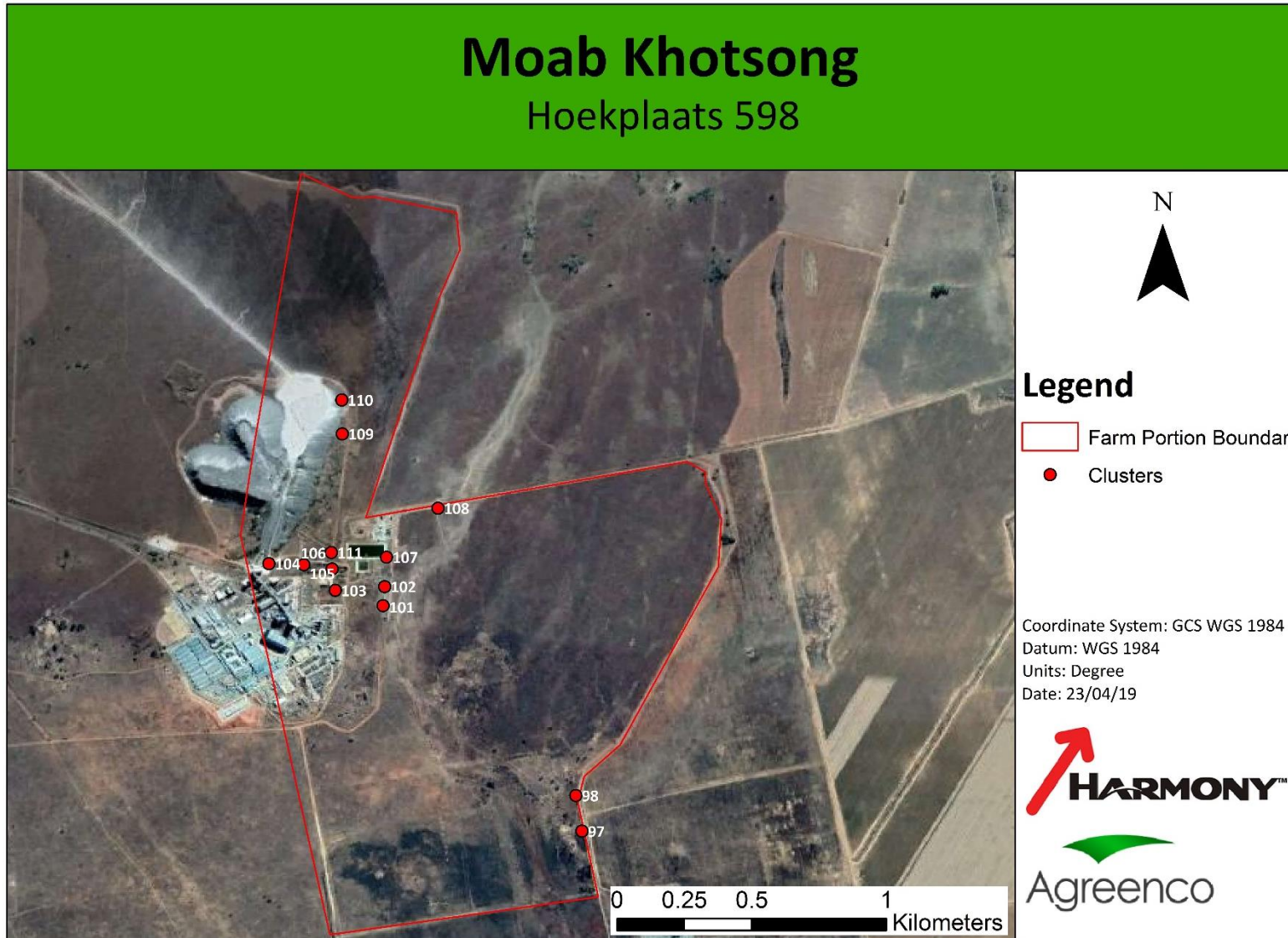


Figure 5-4: Area distribution of AIP's for Hoekplaats 598

Table 5-7: IAP cluster points and locations recorded on the Hoekplaats 598 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
97	<i>Melia azedarach</i>	Syringa	3	1b	1	-	4m	Tree	26°48'41.48"E	26°59'36.71"S
	<i>Populus alba</i>	white poplar	2	2	-	-	4m	Tree	26°48'41.48"E	26°59'36.71"S
	<i>Robinia pseudoacacia</i>	Black locust	2	1b	5	-	4m	Tree	26°48'41.48"E	26°59'36.71"S
98	<i>Salsola kali</i>	glasswort	-	1b	-	-	-	Herb	26°48'40.75"E	26°59'32.43"S
101	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'17.61"E	26°59'9.61"S
102	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'17.79"E	26°59'7.32"S
103	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°48'11.87"E	26°59'7.78"S
	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'11.87"E	26°59'7.78"S
104	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°48'3.90"E	26°59'4.57"S
105	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°48'8.08"E	26°59'4.71"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°48'8.08"E	26°59'4.71"S
106	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'11.48"E	26°59'5.21"S
107	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'18.01"E	26°59'3.79"S
108	<i>Salsola kali</i>	glasswort	-	1b	-	-	-	Herb	26°48'24.19"E	26°58'57.90"S
109	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'12.71"E	26°58'48.97"S
110	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and Sedges	26°48'12.64"E	26°58'44.89"S
111	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°48'11.39"E	26°59'3.24"S
	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	-	-	-	Herb	26°48'11.39"E	26°59'3.24"S

Table 5-8: Species list of all the declared IAPs recorded on the Hoekplaats 598 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical
2	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical
3	<i>Pennisetum setaceum</i>	Fountain grass	1	1	1b	Manual
5	<i>Populus alba</i>	White poplar	4	2	2	Mechanical, Chemical
6	<i>Robinia pseudoacacia</i>	Black locust	5	2	1b	Mechanical, Chemical
7	<i>Salsola kali</i>	glasswort	1	-	1b	Manual, Chemical
8	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical
9	<i>Xanthium strumarium</i>	Large cocklebur	1	1	1b	Manual, Chemical

5.5 Anglo 593

5.5.1 General description of invasive alien plant diversity and distribution for Anglo 593

The distribution and diversity of IAPs at Anglo 593 was very low with only 3 individual plants located on the farming portion (Figure 5-5 and Table 5-9). A total of 2 species were recorded on the farming portion as indicated in Table 5-10. All three of the plants were found close to the shaft in the south western corner of the farming unit as indicated in Figure 5-5. Both species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively.

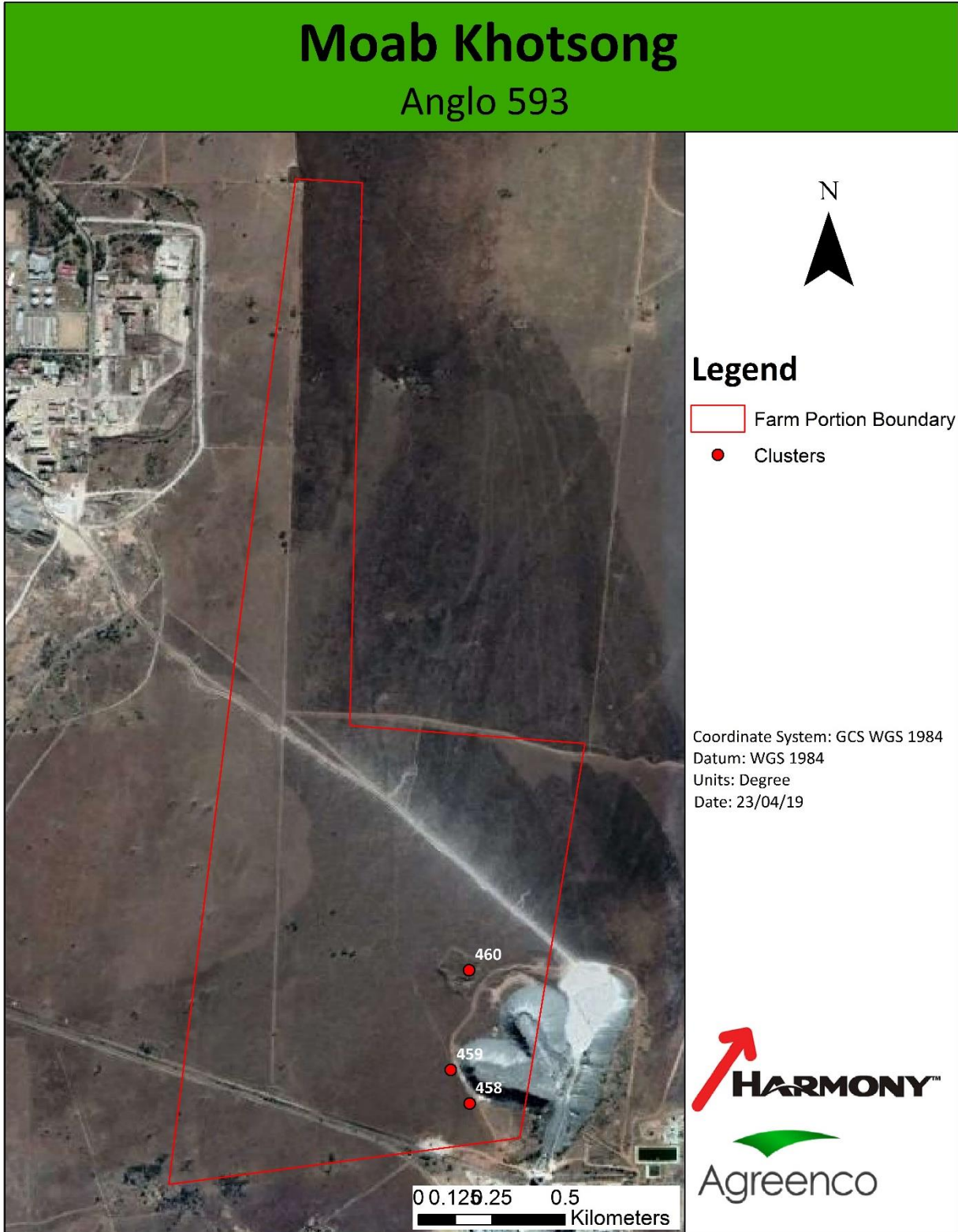


Figure 5-5: Area distribution of AIP's for Anglo 593

Table 5-9: IAP cluster points and locations recorded on the Anglo 593 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
458	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'54.86"E	26°58'57.41"S
459	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'52.76"E	26°58'53.69"S
460	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'54.80"E	26°58'42.67"S

Table 5-10: Species list of all the declared IAPs recorded on the Anglo 593 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical
2	<i>Melia azedarach</i>	Syringa	1	3	1b	Mechanical, Chemical

5.6 Doornkop West 446

5.6.1 General description of invasive alien plant diversity and distribution for Doornkop West 446.

The distribution and diversity of IAPs at Doornkop West 446 was high with clusters and individual plants occurring regularly over the central and northern parts of the farming portion and isolated clusters located to the south of the farming portion (Table 5-11 and Figure 5-6). A total of 19 species were recorded on the farming portion as indicated in Table 5-12. The main invader species found on Doornkop West 446 were *Eucalyptus camaldulensis* and *Melia azedarach*, both abundant in the riverine areas to the north of the farming portion and *Populus alba* clusters located around the sewage plant. Of the 19 species recorded, 5 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

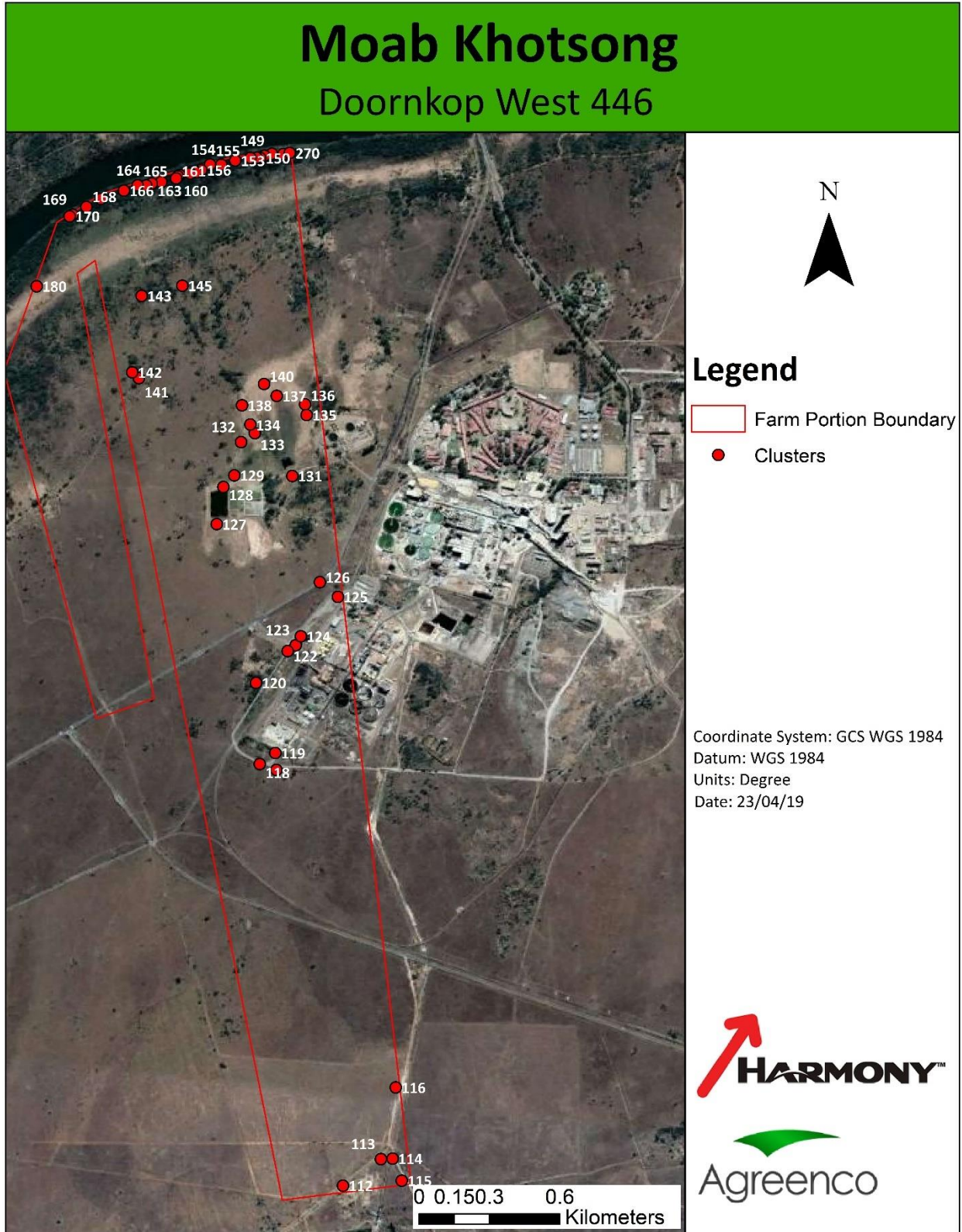


Figure 5-6: Area distribution of AIP's for Doornkop West 446

Table 5-11: IAP cluster points and locations recorded on the Doornkop West 446 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
112	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'33.55"E	26°59'12.25" S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'33.55"E	26°59'12.25" S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'33.55"E	26°59'12.25" S
113	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°46'38.79"E	26°59'8.57"S
114	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'40.39"E	26°59'8.51"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'40.39"E	26°59'8.51"S
115	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'41.66"E	26°59'11.54" S
116	<i>Tecoma stans</i>	Yellow bells	1	1b	-	-	-	Shrubs	26°46'40.83"E	26°58'58.68" S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'40.83"E	26°58'58.68" S
117	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'24.36"E	26°58'14.83" S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'24.36"E	26°58'14.83" S
118	<i>Tecoma stans</i>	Yellow bells	1	1b	-	-	-	Shrubs	26°46'22.06"E	26°58'14.02" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'22.06"E	26°58'14.02" S
119	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'24.20"E	26°58'12.50" S
120	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'21.55"E	26°58'2.81"S
122	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	-	Tree	26°46'25.92"E	26°57'58.44" S
123	<i>Melia azedarach</i>	Syringa	3	1b	-	-	3m	Tree	26°46'27.02"E	26°57'57.62" S
	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	3m	Tree	26°46'27.02"E	26°57'57.62" S
124	<i>Tipuana tipu</i>	Tipu tree	3	3	-	10m	5m	Tree	26°46'27.74"E	26°57'56.39" S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°46'27.74"E	26°57'56.39" S
125	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°46'32.85"E	26°57'50.95" S
126	<i>Melia azedarach</i>	Syringa	3	1b	-	-		Tree	26°46'30.37"E	26°57'48.92" S
127	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	2	-	-	Herb	26°46'16.11"E	26°57'40.90" S
	<i>Salsola kali</i>	Glasswort	-	1b	2	-	-	Herb	26°46'16.11"E	26°57'40.90" S
128	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	2	-	-	Herb	26°46'17.03"E	26°57'35.76" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Datura ferox</i>	Large thorn-apple	1	1b	2	-	-	Herb	26°46'17.03"E	26°57'35.76" S
	<i>Salsola kali</i>	Glasswort	-	1b	2	-	-	Herb	26°46'17.03"E	26°57'35.76" S
129	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	1	-	-	Herb	26°46'18.56"E	26°57'34.16" S
130	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'24.01"E	26°57'37.88" S
131	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'26.55"E	26°57'34.25" S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'26.55"E	26°57'34.25" S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Herb	26°46'26.55"E	26°57'34.25" S
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	4	-	4m	Tree	26°46'26.55"E	26°57'34.25" S
	<i>Arundo donax</i>	Giant reed	1	1b	-	-	-	Grasses and Sedges	26°46'26.55"E	26°57'34.25" S
132	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	2	2m	2m	Tree	26°46'18.56"E	26°57'34.16" S
133	<i>Melia azedarach</i>	Syringa	3	1b		4m	3m	Tree	26°46'21.37"E	26°57'28.34" S
134	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'20.76"E	26°57'27.14" S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'20.76"E	26°57'27.14" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
135	<i>Populus alba</i>	White poplar	2	2	5	0.5m	10m	Tree	26°46'28.54"E	26°57'25.83" S
136	<i>Pinus patula</i>	Patula pine	2	2		1m	30m	Tree	26°46'28.31"E	26°57'24.36" S
137	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'24.39"E	26°57'23.19" S
138	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'19.61"E	26°57'24.50" S
	<i>Solanum elaeagnifolium</i>	Silver leaf	1	1b	-	-	-	Herb	26°46'19.61"E	26°57'24.50" S
140	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'22.65"E	26°57'21.56" S
141	<i>Datura stramonium</i>	Common thorn-apple	1	1b	1			Herb	26°46'5.37"E	26°57'20.74" S
142	<i>Morus alba</i>	White mulberry	3	3		3m	2m	Tree	26°46'4.45"E	26°57'19.94" S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'4.45"E	26°57'19.94" S
143	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°46'5.76"E	26°57'9.38"S
145	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	3m	30m	Tree	26°46'11.38"E	26°57'7.97"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'11.38"E	26°57'7.97"S
147	<i>Morus alba</i>	White mulberry	3	3	-	0.75 m	2m	Tree	26°46'25.32"E	26°56'49.81" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'25.32"E	26°56'49.81" S
148	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1.5m	20m	Tree	26°46'23.73"E	26°56'49.76" S
149	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	5m	Tree	26°46'22.70"E	26°56'50.04" S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'22.70"E	26°56'50.04" S
150	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'22.12"E	26°56'50.33" S
151	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.5m	3m	Tree	26°46'21.62"E	26°56'50.31" S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'21.62"E	26°56'50.31" S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°46'21.62"E	26°56'50.31" S
152	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	10m	Tree	26°46'20.79"E	26°56'50.33" S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'20.79"E	26°56'50.33" S
153	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1m	20m	Tree	26°46'18.67"E	26°56'50.70" S
154	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°46'16.75"E	26°56'51.27" S
155	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.3m	10m	Tree	26°46'15.21"E	26°56'51.24" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'15.21"E	26°56'51.24" S
156	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'13.99"E	26°56'52.01" S
157	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'13.31"E	26°56'52.32" S
158	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'12.46"E	26°56'52.48" S
159	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	2m	Tree	26°46'11.05"E	26°56'52.71" S
160	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'10.77"E	26°56'52.86" S
161	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'10.52"E	26°56'53.17" S
162	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'8.48"E	26°56'53.65" S
163	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulents	26°46'7.16"E	26°56'53.87" S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'7.16"E	26°56'53.87" S
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°46'7.16"E	26°56'53.87" S
164	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	3m	5m	Tree	26°46'6.39"E	26°56'54.14" S
165	<i>Opuntia ficus-indica</i>	sweet prickly pear	-	1b	-	-	-	Succulents	26°46'5.21"E	26°56'54.12" S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	6m	Tree	26°46'5.21"E	26°56'54.12" S
166	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	1.5m	Tree	26°46'3.32"E	26°56'54.85" S
167	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	3m	Tree	26°46'0.15"E	26°56'55.99" S
168	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	10m	Tree	26°45'58.14"E	26°56'57.11" S
169	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	2m	Tree	26°45'56.22"E	26°56'58.16" S
170	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°45'55.82"E	26°56'58.39" S
180	<i>Verbena bonariensis</i>	Wild verbena	-	1b	1	-	-	Herb	26°45'51.26"E	26°57'8.06" S
270	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1.5m	10m	Tree	26°46'26.19"E	26°56'49.66" S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'26.19"E	26°56'49.66" S

Table 5-12: Species list of all the declared IAPs recorded on the Doornkop West 446 farming portion:

Nr	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Arundo donax</i>	Giant reed	1	1	1b	Chemical
2	<i>Datura ferox</i>	Large thorn-apple	1	1b	2	Manual, Chemical
3	<i>Datura stramonium</i>	Common thorn-apple	1	1	1b	Manual, Chemical

Nr	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
4	<i>Eucalyptus camaldulensis</i>	Red river gum	5	2	1b	Mechanical, Chemical
5	<i>Flaveria bidentis</i>	Smelter's bush	2	-	1b	Manual, Chemical
6	<i>Gleditsia triacanthos</i>	Honey locust	2	2	1b	Mechanical, Chemical
7	<i>Ipomoea purpurea</i>	Morning glory	2	3	1b	Manual, Chemical
8	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical
9	<i>Morus alba</i>	White mulberry	1	3	3	Mechanical, Chemical
10	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical
11	<i>Pinus panister</i>	Cluster pine	1			Mechanical, Chemical
12	<i>Pinus patula</i>	Patula pine	1	2	2	Mechanical, Chemical
13	<i>Populus alba</i>	White poplar	5	2	2	Mechanical, Chemical
14	<i>Salsola kali</i>	Glasswort	1	-	1b	Manual, Chemical
15	<i>Solanum elaeagnifolium</i>	Silver leaf	1	1	1b	Manual, Chemical
16	<i>Tamarix ramosissima</i>	Pink tamarisk	2	3	1b	Mechanical, Chemical
17	<i>Tecoma stans</i>	Yellow bells	1	1	1b	Mechanical, Chemical
18	<i>Tipuana tipu</i>	Tipu tree	1	3	3	Mechanical, Chemical

Nr	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
19	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Mechanical, Chemical

5.7 Chrystalkop 69

5.7.1 General description of invasive alien plant diversity and distribution for Chrystalkop 69

The distribution and diversity of IAPs at Chrystalkop 69 was high with clusters and individual plants occurring regularly over the central and northern parts of the farming portion (Table 5-13 and Figure 5-7). A total of 20 species were recorded on the farming portion as indicated in Table 5-14. The main invader species found on Chrystalkop 69 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Morus alba* and *Melia azedarach*, all abundant in the riverine areas to the north and around the operational areas to the centre of the farming portion. Of the 20 species recorded, 15 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

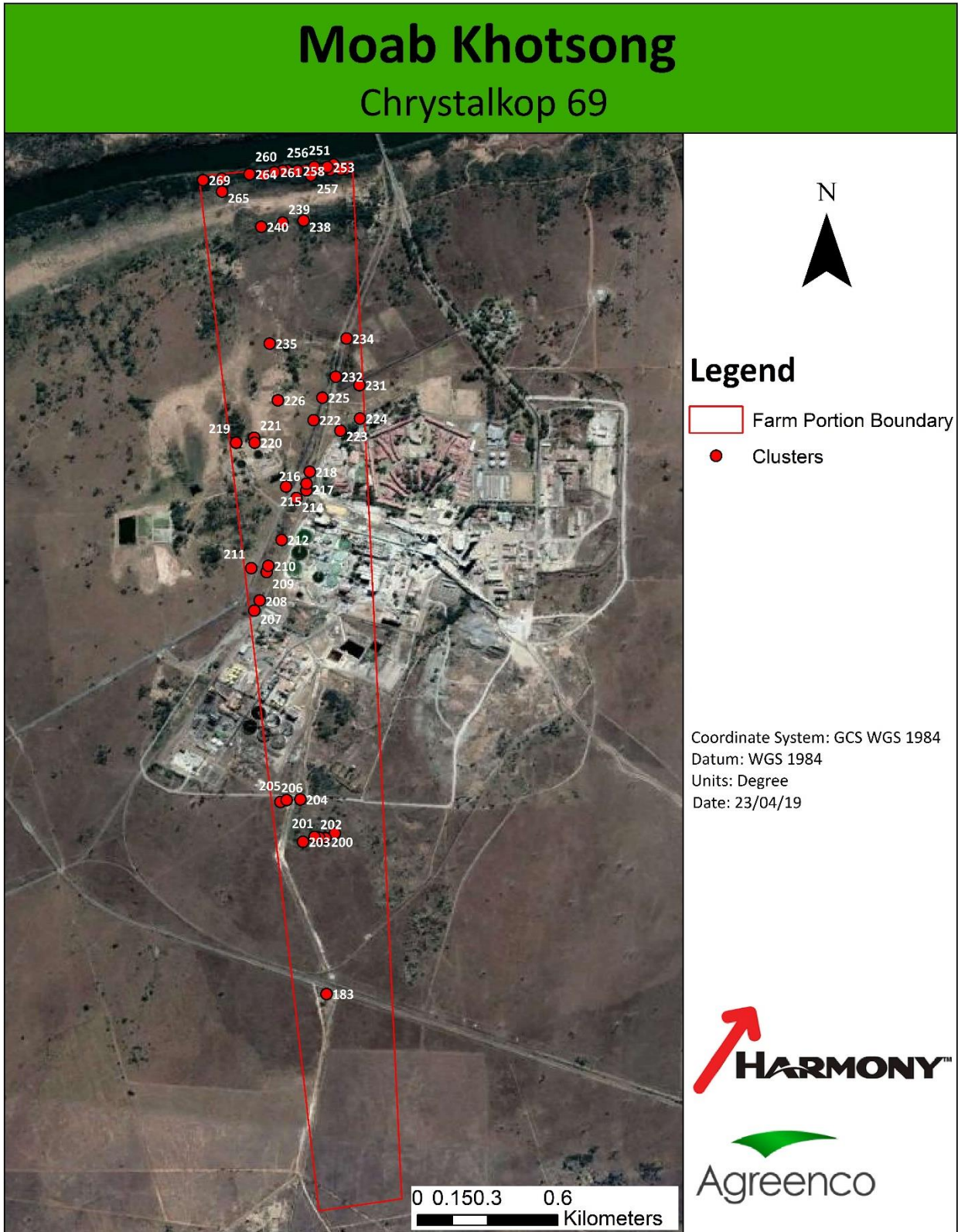


Figure 5-7: Area distribution of AIP's for Chrystalkop 69

Table 5-13: IAP cluster points and locations recorded on the Chrystalkop 69 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
183	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'43.97"E	26°58'42.00"S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'43.97"E	26°58'42.00"S
	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°46'43.97"E	26°58'42.00"S
198	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'45.12"E	26°58'19.84"S
200	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°46'43.82"E	26°58'20.50"S
201	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	1m	5m	Tree	26°46'42.97"E	26°58'20.42"S
202	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°46'42.31"E	26°58'20.33"S
203	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'40.72"E	26°58'21.01"S
204	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'40.34"E	26°58'15.16"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'40.34"E	26°58'15.16"S
205	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'38.45"E	26°58'15.23"S
206	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'37.61"E	26°58'15.49"S
207	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'33.99"E	26°57'49.07"S
208	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'34.74"E	26°57'47.69"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'34.74"E	26°57'47.69"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°46'34.74"E	26°57'47.69"S
209	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'35.70"E	26°57'43.75"S
210	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°46'35.93"E	26°57'42.92"S
211	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'33.56"E	26°57'43.24"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b		0.5m	10m	Tree	26°46'33.56"E	26°57'43.24"S
	<i>Melia azedarach</i>	Syringa	3	1b	4	-	2m	Tree	26°46'33.56"E	26°57'43.24"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°46'33.56"E	26°57'43.24"S
212	<i>Eucalyptus grandis</i>	Saligna gum	2	1b		0.5m	10m		26°46'37.76"E	26°57'39.33"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	5m	3m	Tree	26°46'37.76"E	26°57'39.33"S
214	<i>Melia azedarach</i>	Syringa	3	1b	3	-	4m	Tree	26°46'39.79"E	26°57'33.55"S
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	3	-	4m	Tree	26°46'39.79"E	26°57'33.55"S
215	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°46'38.36"E	26°57'31.98"S
	<i>Pinus patula</i>	Patula pine	2	2	-	0.5m	15m	Tree	26°46'38.36"E	26°57'31.98"S
	<i>Populus alba</i>	white poplar	2	2	2	-	3m	Tree	26°46'38.36"E	26°57'31.98"S
216	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'41.17"E	26°57'32.49"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'41.17"E	26°57'32.49"S
217	<i>Eucalyptus grandis</i>	Saligna gum	2	2	-	-	1m	Tree	26°46'41.21"E	26°57'31.56"S
218	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	2m	Tree	26°46'41.66"E	26°57'29.94"S
219	<i>Pinus patula</i>	Patula pine	2	2	-	1m	30m	Tree	26°46'31.47"E	26°57'25.91"S
220	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'34.04"E	26°57'25.90"S
221	<i>Populus alba</i>	white poplar	2	2	-	3m	4m	Tree	26°46'33.96"E	26°57'25.23"S
222	<i>Morus alba</i>	White mulberry	3	3		0.2m	3m	Tree	26°46'42.19"E	26°57'22.79"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'42.19"E	26°57'22.79"S
223	<i>Tecoma stans</i>	Yellow bells	1	1b	-	0.5m	3m	Tree	26°46'45.88"E	26°57'24.24"S
224	<i>Morus alba</i>	White mulberry	3	3	-	1.5m	3m	Tree	26°46'48.59"E	26°57'22.56"S
225	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'43.38"E	26°57'19.68"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°46'43.38"E	26°57'19.68"S
226	<i>Xanthium strumarium</i>	Large cocklebur	1	1b	2	-	-	Herb	26°46'37.25"E	26°57'20.06"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	3m	Tree	26°46'37.25"E	26°57'20.06"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'37.25"E	26°57'20.06"S
	<i>Morus alba</i>	White mulberry	3	3	-	3m	5m	Tree	26°46'37.25"E	26°57'20.06"S
231	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'48.51"E	26°57'17.97"S
234	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°46'46.73"E	26°57'11.53"S
232	<i>Tecoma stans</i>	Yellow bells	1	1b	-	-	1m	Tree	26°46'45.24"E	26°57'16.79"S
235	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulent	26°46'36.12"E	26°57'12.21"S
238	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°46'40.79"E	26°56'55.24"S
239	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'37.90"E	26°56'55.53"S
240	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°46'34.94"E	26°56'56.10"S
249	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'46.59"E	26°56'48.16"S
250	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'45.95"E	26°56'48.20"S
251	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.5m	15m	Tree	26°46'44.95"E	26°56'47.50"S
252	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'44.45"E	26°56'48.27"S
253	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°46'44.08"E	26°56'47.87"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
254	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°46'43.60"E	26°56'48.08"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b					26°46'43.60"E	26°56'48.08"S
255	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'42.95"E	26°56'48.20"S
256	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.5m	10m	Tree	26°46'42.27"E	26°56'47.82"S
	<i>Eucalyptus grandis</i>	Saligna gum	2	1b	-	0.5m	10m	Tree	26°46'42.27"E	26°56'47.82"S
257	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'41.82"E	26°56'49.00"S
258	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.5m	10m		26°46'39.94"E	26°56'48.38"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'39.94"E	26°56'48.38"S
259	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.5m	10m	Tree	26°46'39.94"E	26°56'48.38"S
	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	1.5m	10m	Tree	26°46'38.52"E	26°56'48.33"S
260	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'37.89"E	26°56'48.37"S
261	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'36.79"E	26°56'48.57"S
263	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'35.28"E	26°56'48.96"S
264	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-		3m	Tree	26°46'33.34"E	26°56'48.84"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
265	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'29.52"E	26°56'51.25"S
266	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1.5m	25m	Creepers and climbers	26°46'29.48"E	26°56'49.45"S
269	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1.5m	25m	Tree	26°46'26.90"E	26°56'49.67"S

Table 5-14: Species list of all the declared IAPs recorded on the Chrystalkop 69 farming portion:

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy		1	1b	Manual, Chemical
2	<i>Datura ferox</i>	large thorn-apple		1	1b	Manual, Chemical
3	<i>Datura stramonium</i>	Common thorn-apple		1	1b	Manual, Chemical
4	<i>Eucalyptus camaldulensis</i>	Red river gum		2	1b	Mechanical, Chemical
5	<i>Eucalyptus grandis</i>	Saligna gum		2	2	Mechanical, Chemical
6	<i>Flaveria bidentis</i>	Smelter's bush		-	1b	Manual, Chemical
7	<i>Gleditsia triacanthos</i>	Honey locust		2	1b	Mechanical, Chemical
8	<i>Ipomoea purpurea</i>	Morning glory		3	1b	Manual, Chemical
9	<i>Melia azedarach</i>	Syringa		3	1b	Mechanical, Chemical
10	<i>Morus alba</i>	White mulberry		3	3	Mechanical, Chemical
11	<i>Nicotiana glauca</i>	Wild tobacco		1	1b	Mechanical, Chemical
12	<i>Opuntia ficus-indica</i>	Sweet prickly pear		-	1b	Chemical
13	<i>Pennisetum setaceum</i>	Fountain grass		1	1b	manual

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
14	<i>Pinus patula</i>	Patula pine		2	2	Mechanical, Chemical
15	<i>Populus alba</i>	White poplar		2	2	Mechanical, Chemical
16	<i>Salsola kali</i>	Glasswort		-	1b	Manual, Chemical
17	<i>Tamarix ramosissima</i>	Pink tamarisk		3	1b	Mechanical, Chemical
18	<i>Tipuana tipu</i>	Tipu tree		3	3	Mechanical, Chemical
19	<i>Verbena bonariensis</i>	Wild verbena		-	1b	Manual, Chemical
20	<i>Xanthium strumarium</i>	Large cocklebur		1	1b	Manual, Chemical

5.8 Zuiping 394

5.8.1 General description of invasive alien plant diversity and distribution for Zuiping 394

The distribution and diversity of IAPs at Zuiping 394 was high with clusters and individual plants located over large parts of the farming portion (Table 5-15 and Figure 5-8). A total of 23 species were recorded on the farming portion as indicated in Table 5-16. One plantation and one windrow, consisting of listed and non-listed *Eucalyptus* species (mainly *E. grandis*, *E. camaldulensis*, *Eucalyptus cinerea* and *E. sideroxylon*) and listed *Pinus* species were located on this farming portion. This plantation and wind row are indicated in Figure 5-8 but are not included in the species lists as existing plantations and wind rows of these species are exempted under NEMBA. Although existing plantations and wind rows of these species are exempted, the spread of these plants, outside of the existing exempted areas, is not acceptable and plants growing outside of the indicated boundaries of the exempted areas will have to be controlled. The main invader species found on Zuiping 394 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Melia azedarach*. Of the 23 species recorded, 20 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining three species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

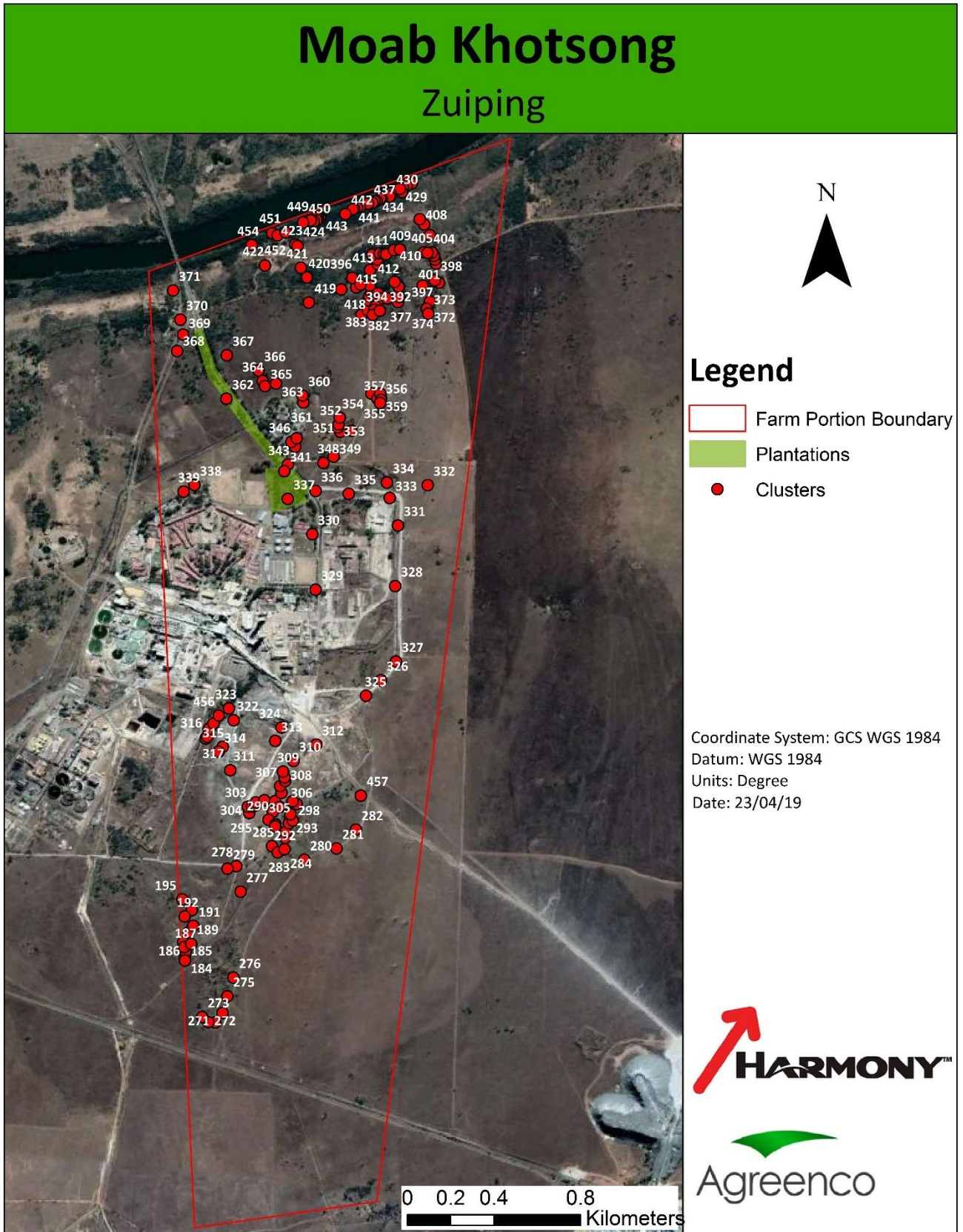


Figure 5-8: Area distribution of AIP's for Zuiping 394

Table 5-15: IAP cluster points and locations recorded on the Zuiping 394 farming portion

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
184	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'52.03"E	26°58'30.29"S
185	<i>Melia azedarach</i>	Syringa	3	1b		0.2m	3m	Tree	26°46'52.90"E	26°58'30.33"S
186	<i>Melia azedarach</i>	Syringa	3	1b	3	1m	10m	Tree	26°46'51.75"E	26°58'29.64"S
187	<i>Datura ferox</i>	Large thorn-apple	1	1b	1	-	-	Herb	26°46'51.91"E	26°58'28.71"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	1	-	-	Herb	26°46'51.91"E	26°58'28.71"S
188	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	5	-	-	Herb	26°46'52.63"E	26°58'27.61"S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	5	-	-	Herb	26°46'52.63"E	26°58'27.61"S
189	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'53.84"E	26°58'27.84"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'53.84"E	26°58'27.84"S
190	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	5m	Tree	26°46'53.44"E	26°58'26.13"S
	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°46'53.44"E	26°58'26.13"S
	<i>Solanum elaeagnifolium</i>	Silverleaf bitter apple	1	1b	-	-	-	Herb	26°46'53.44"E	26°58'26.13"S
191	<i>Melia azedarach</i>	Syringa	3	1b	-	2m	5m	Tree	26°46'54.13"E	26°58'25.15"S
192	<i>Melia azedarach</i>	Syringa	3	1b	-	3m	5m	Herb	26°46'52.87"E	26°58'23.74"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
193	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'53.93"E	26°58'22.80"S
195	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°46'52.49"E	26°58'21.18"S
	<i>Tipuana tipu</i>	Tipu tree	3	3	-	-	-	Tree	26°46'52.49"E	26°58'21.18"S
236	<i>Melia azedarach</i>	Syringa	3	3	-	-	-	Tree	26°46'51.40"E	26°57'11.89"S
242	<i>Eucalyptus camaldulensis</i>	Red river gum	2	2	-	-	-	Tree	26°46'51.05"E	26°56'46.50"S
244	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'50.17"E	26°56'47.39"S
245	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'49.73"E	26°56'47.35"S
246	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	1m	6m	Tree	26°46'49.35"E	26°56'47.25"S
247	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°46'48.39"E	26°56'47.76"S
248	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	2m	15m	Tree	26°46'48.00"E	26°56'47.67"S
275	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'59.25"E	26°58'35.68"S
276	<i>Melia azedarach</i>	Syringa	3	1b	2	-	3m	Tree	26°47'0.15"E	26°58'32.88"S
	<i>Tipuana tipu</i>	Tipu tree	3	3	-	2m	4m	Tree	26°47'0.15"E	26°58'32.88"S
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	0.2m	5m	Tree	26°47'0.15"E	26°58'32.88"S
277	<i>Melia azedarach</i>	Syringa	3	1b	-	-	1.5m	Tree	26°47'1.24"E	26°58'20.01"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
278	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	0.5m	5m	Tree	26°47'0.60"E	26°58'16.22"S
279	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'59.29"E	26°58'16.60"S
280	<i>Melia azedarach</i>	Syringa	3	1b	2	-	3m	Tree	26°47'10.79"E	26°58'15.25"S
281	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'15.61"E	26°58'13.56"S
282	<i>Melia azedarach</i>	Syringa	3	1b	1	-	3m	Tree	26°47'18.50"E	26°58'10.75"S
	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	1	-	3m	Tree	26°47'18.50"E	26°58'10.75"S
283	<i>Verbena bonariensis</i>	Wild verbena	-	1b	1	-	-	Herb	26°47'6.81"E	26°58'14.15"S
284	<i>Melia azedarach</i>	Syringa	3	1b	-	-	3m	Tree	26°47'7.82"E	26°58'13.68"S
285	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'5.94"E	26°58'13.23"S
286	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'7.94"E	26°58'11.97"S
287	<i>Melia azedarach</i>	Syringa	-	1b	4	-	-	Tree	26°47'7.98"E	26°58'11.06"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'7.98"E	26°58'11.06"S
288	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'6.43"E	26°58'10.28"S
289	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'6.46"E	26°58'9.96"S
290	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'5.41"E	26°58'9.29"S
291	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'8.46"E	26°58'9.80"S
292	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'9.05"E	26°58'9.40"S
293	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'8.71"E	26°58'8.45"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
294	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'6.05"E	26°58'8.07"S
295	<i>Acacia baileyana</i>	Bailey's wattle	3	3	4	-	-	Tree	26°47'2.54"E	26°58'8.27"S
296	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'7.07"E	26°58'7.35"S
297	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'9.63"E	26°58'6.93"S
298	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'9.02"E	26°58'6.52"S
299	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'6.39"E	26°58'6.48"S
	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'6.39"E	26°58'6.48"S
300	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'4.78"E	26°58'6.34"S
301	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	3	-	-	Grasses and sedges	26°47'3.51"E	26°58'6.67"S
	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'3.51"E	26°58'6.67"S
302	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'3.49"E	26°58'7.11"S
303	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'2.95"E	26°58'7.29"S
304	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'2.32"E	26°58'7.31"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	3	-	-	Tree	26°47'2.32"E	26°58'7.31"S
305	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'7.36"E	26°58'5.24"S
306	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'7.91"E	26°58'3.46"S
307	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'7.17"E	26°58'4.23"S
308	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'7.82"E	26°58'2.93"S
309	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'7.58"E	26°58'2.06"S
	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'7.58"E	26°58'2.06"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'7.58"E	26°58'2.06"S
310	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'9.16"E	26°58'0.47"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'9.16"E	26°58'0.47"S
	<i>Salsola kali</i>	Glasswort	-	1b	2	-	-	Herb	26°47'9.16"E	26°58'0.47"S
311	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	5	-	-	Tree	26°46'59.70"E	26°58'1.85"S
312	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'12.58"E	26°57'58.03"S
	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'12.58"E	26°57'58.03"S
	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°47'12.58"E	26°57'58.03"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
313	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and sedges	26°47'6.43"E	26°57'57.47"S
314	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'57.95"E	26°57'59.09"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'57.95"E	26°57'59.09"S
316	<i>Melia azedarach</i>	Syringa	3	1b	-	1.5m	4m	Tree	26°46'56.23"E	26°57'56.85"S
317	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'56.01"E	26°57'57.13"S
319	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'56.47"E	26°57'55.68"S
320	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'57.17"E	26°57'54.86"S
322	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°47'0.20"E	26°57'54.37"S
323	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	-	-	-	Grasses and sedges	26°46'59.48"E	26°57'52.60"S
324	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'7.38"E	26°57'55.47"S
	<i>Pennisetum setaceum</i>	Fountain grass	1	1b	4	-	-	Grasses and sedges	26°47'7.38"E	26°57'55.47"S
	<i>Salsola kali</i>	Glasswort	-	1b	4	-	-	Herb	26°47'7.38"E	26°57'55.47"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	4	-	-	Tree	26°47'7.38"E	26°57'55.47"S
325	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'20.01"E	26°57'50.72"S
326	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'22.25"E	26°57'48.39"S
	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'22.25"E	26°57'48.39"S
327	<i>Nicotiana glauca</i>	Wild tobacco	1	1b	-	-	-	Tree	26°47'24.51"E	26°57'45.59"S
328	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'24.40"E	26°57'34.29"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Tipuana tipu</i>	Tipu tree	3	3	-	-	-	Tree	26°47'24.40"E	26°57'34.29"S
330	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'11.97"E	26°57'26.54"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'11.97"E	26°57'26.54"S
331	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'24.81"E	26°57'25.23"S
332	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulents	26°47'29.26"E	26°57'19.20"S
333	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'23.56"E	26°57'21.12"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'23.56"E	26°57'21.12"S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°47'23.56"E	26°57'21.12"S
334	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulents	26°47'23.14"E	26°57'18.79"S
335	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'17.43"E	26°57'20.48"S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'17.43"E	26°57'20.48"S
	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°47'17.43"E	26°57'20.48"S
336	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'12.46"E	26°57'20.07"S
347	<i>Melia azedarach</i>	Syringa	3	1b	-	1.5m	3m	Tree	26°47'8.29"E	26°57'21.24"S
348	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'13.65"E	26°57'15.84"S
	<i>Tecoma stans</i>	Yellow bells	1	1b	-	-	2m	Tree	26°47'13.65"E	26°57'15.84"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	2m	Tree	26°47'13.65"E	26°57'15.84"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'13.65"E	26°57'15.84"S
349	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°47'15.18"E	26°57'14.93"S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'15.18"E	26°57'14.93"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'15.18"E	26°57'14.93"S
	<i>Tecoma stans</i>	Yellow bells	1	1b	-	-	3m	Tree	26°47'15.18"E	26°57'14.93"S
	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	3m	Tree	26°47'15.18"E	26°57'14.93"S
350	<i>Melia azedarach</i>	Syringa	3	1b	-	-	1.5m	Tree	26°47'17.81"E	26°57'11.05"S
351	<i>Melia azedarach</i>	Syringa	3	1b	-	-	1.5m	Tree	26°47'16.16"E	26°57'11.21"S
352	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	1m	Tree	26°47'15.93"E	26°57'10.12"S
353	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	1m	Tree	26°47'15.80"E	26°57'10.57"S
354	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	1m	Tree	26°47'16.08"E	26°57'9.10"S
355	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°47'21.71"E	26°57'6.26"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'21.71"E	26°57'6.26"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
356	<i>Morus alba</i>	White mulberry	3	3		2m	4m	Tree	26°47'22.12"E	26°57'6.87"S
357	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Tree	26°47'22.27"E	26°57'6.42"S
358	<i>Melia azedarach</i>	Syringa	3	1b	-	-	0.5m	Tree	26°47'20.82"E	26°57'5.50"S
359	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b	-	-	-	Herb	26°47'22.13"E	26°57'5.51"S
	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'22.13"E	26°57'5.51"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°47'22.13"E	26°57'5.51"S
360	<i>Opuntia humifusa</i>	Large flower prickly pear	1	1b	-	-	-	Succulents	26°47'10.51"E	26°57'5.79"S
361	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	2m	Tree	26°47'10.64"E	26°57'6.81"S
	<i>Opuntia humifusa</i>	Large flower prickly pear	1	1b	-	-	-	Succulent	26°47'10.64"E	26°57'6.81"S
362	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	5		10m	Tree	26°46'59.13"E	26°57'6.26"S
	<i>Pinus patula</i>	Patula pine	2	2	5		10m	Tree	26°46'59.13"E	26°57'6.26"S
363	<i>Melia azedarach</i>	Syringa	3	1b		1m	3m	Tree	26°47'6.54"E	26°57'4.00"S
364	<i>Morus alba</i>	White mulberry	3	3	-	-	2m	Tree	26°47'4.57"E	26°57'3.60"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'4.57"E	26°57'3.60"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
365	<i>Verbena bonariensis</i>	Wild verbena	-	1b	1		-	Herb	26°47'4.88"E	26°57'4.38"S
366	<i>Melia azedarach</i>	Syringa	3	1b	1	-	1m	Tree	26°47'3.90"E	26°57'2.04"S
	<i>Acacia baileyana</i>	Bailey's wattle	3	3	-	-	-	Tree	26°47'3.90"E	26°57'2.04"S
368	<i>Cortaderia selloana</i>	Pampas grass	1	1b	3	-	-	Grasses and sedges	26°46'51.74"E	26°56'59.14"S
369	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'52.63"E	26°56'56.66"S
370	<i>Cortaderia selloana</i>	Pampas grass	1	1b	-	-	-	Grasses and sedges	26°46'52.23"E	26°56'54.44"S
371	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°46'51.14"E	26°56'50.07"S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°46'51.14"E	26°56'50.07"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°46'51.14"E	26°56'50.07"S
372	<i>Melia azedarach</i>	Syringa	3	1b	-	0.2m	10m	Tree	26°47'29.33"E	26°56'53.48"S
373	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Herb	26°47'29.31"E	26°56'53.53"S
374	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulent	26°47'29.09"E	26°56'52.79"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	0.2m	10m	Tree	26°47'29.09"E	26°56'52.79"S
375	<i>Melia azedarach</i>	Syringa	3	1b	-	0.2m	10m	Tree	26°47'29.59"E	26°56'51.73"S
376	<i>Melia azedarach</i>	Syringa	3	1b	-	2m	10m	Tree	26°47'25.00"E	26°56'51.06"S
377	<i>Melia azedarach</i>	Syringa	3	1b	-	-	3m	Tree	26°47'24.80"E	26°56'51.80"S
378	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	15m	Tree	26°47'23.18"E	26°56'51.25"S
379	<i>Melia azedarach</i>	Syringa	3	1b	-	3m	10m	Tree	26°47'22.28"E	26°56'51.27"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'22.28"E	26°56'51.27"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
380	<i>Melia azedarach</i>	Syringa	3	1b	-	1.5m	15m	Tree	26°47'21.44"E	26°56'51.27"S
381	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'21.29"E	26°56'52.95"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'21.29"E	26°56'52.95"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	2m	5m	Tree	26°47'21.29"E	26°56'52.95"S
382	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'22.08"E	26°56'53.09"S
383	<i>Melia azedarach</i>	Syringa	3	1b	-	-	2m	Tree	26°47'21.02"E	26°56'53.70"S
384	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.25"E	26°56'53.00"S
	<i>Melia azedarach</i>	Syringa		1b	-	3m	10m	Tree	26°47'20.25"E	26°56'53.00"S
385	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'19.37"E	26°56'53.68"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	2m	4m	Tree	26°47'19.37"E	26°56'53.68"S
386	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.39"E	26°56'51.54"S
	<i>Melia azedarach</i>	Syringa		1b	-	-	-	Tree	26°47'20.39"E	26°56'51.54"S
387	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.51"E	26°56'50.90"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.51"E	26°56'50.90"S
388	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.80"E	26°56'50.36"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	1m	Tree	26°47'20.80"E	26°56'50.36"S
	<i>Morus alba</i>	White mulberry	3	3	-	-	3m	Tree	26°47'20.80"E	26°56'50.36"S
389	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'21.22"E	26°56'50.61"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	10m	Tree	26°47'21.22"E	26°56'50.61"S
390	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'21.83"E	26°56'50.50"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'21.83"E	26°56'50.50"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	0.5m	10m	Tree	26°47'21.83"E	26°56'50.50"S
391	<i>Ipomoea purpurea</i>	Morning glory		1b	-	-	-	Creepers and climbers	26°47'24.92"E	26°56'49.50"S
392	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'24.29"E	26°56'48.78"S
393	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.59"E	26°56'49.32"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.59"E	26°56'49.32"S
394	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'19.17"E	26°56'49.20"S
395	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'18.56"E	26°56'49.61"S
396	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'17.95"E	26°56'48.18"S
397	<i>Melia azedarach</i>	Syringa		1b	-	-	1m	Tree	26°47'30.94"E	26°56'48.88"S
398	<i>Melia azedarach</i>	Syringa	3	1b	-	-		Tree	26°47'30.31"E	26°56'48.54"S
399	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b	-	-	-	Succulent	26°47'28.50"E	26°56'49.33"S
400	<i>Solanum elaeagnifolium</i>	Silver leaf	1	1b	-	-	-	Herb	26°47'30.50"E	26°56'46.07"S
401	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'30.34"E	26°56'45.45"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
402	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'30.20"E	26°56'44.88"S
403	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'29.90"E	26°56'44.37"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'29.90"E	26°56'44.37"S
404	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'29.23"E	26°56'44.42"S
405	<i>Melia azedarach</i>	Syringa	3	1b	-	-	3m	Tree	26°47'28.69"E	26°56'44.32"S
406	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'29.54"E	26°56'41.79"S
407	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'28.72"E	26°56'40.19"S
409	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'25.11"E	26°56'43.94"S
410	<i>Melia azedarach</i>	Syringa	3	1b	-	-	5m	Tree	26°47'24.20"E	26°56'44.02"S
411	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'23.03"E	26°56'44.66"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'23.03"E	26°56'44.66"S
412	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'22.68"E	26°56'44.60"S
413	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'22.07"E	26°56'44.52"S
414	<i>Morus alba</i>	White mulberry	3	1b	-	-	-	Tree	26°47'21.70"E	26°56'45.44"S
415	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	-	Tree	26°47'21.80"E	26°56'46.15"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'21.80"E	26°56'46.15"S
416	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.93"E	26°56'44.73"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°47'20.93"E	26°56'44.73"S
417	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.63"E	26°56'46.98"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
418	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'16.31"E	26°56'49.92"S
419	<i>Solanum elaeagnifolium</i>	Silver leaf	1	1b	2	-	-	-	26°47'13.46"E	26°56'49.79"S
420	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'11.18"E	26°56'48.12"S
421	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'10.26"E	26°56'46.65"S
422	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
	<i>Cirsium vulgare</i>	Spear thistle	1	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'4.88"E	26°56'46.33"S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
	<i>Datura ferox</i>	Large thorn-apple	1	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
423	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'4.88"E	26°56'46.33"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'9.40"E	26°56'43.18"S
424	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'9.40"E	26°56'43.18"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'9.75"E	26°56'43.40"S
425	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	-	-	-	Herb	26°47'9.75"E	26°56'43.40"S
	<i>Salsola kali</i>	Glasswort	-	1b	-	-	-	Herb	26°47'26.85"E	26°56'34.05"S
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'26.85"E	26°56'34.05"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
426	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'26.12"E	26°56'34.34"S
427	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'25.57"E	26°56'34.76"S
428	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'25.41"E	26°56'35.33"S
429	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'25.08"E	26°56'34.86"S
430	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'23.70"E	26°56'35.55"S
	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'23.70"E	26°56'35.55"S
431	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'23.55"E	26°56'35.99"S
	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'23.55"E	26°56'35.99"S
432	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'22.38"E	26°56'36.31"S
433	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'22.18"E	26°56'36.30"S
	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'22.18"E	26°56'36.30"S
434	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'21.59"E	26°56'36.66"S
435	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'21.29"E	26°56'36.66"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'21.29"E	26°56'36.66"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
436	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.97"E	26°56'36.92"S
437	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'20.33"E	26°56'37.06"S
	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'20.33"E	26°56'37.06"S
438	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'19.09"E	26°56'37.60"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'19.09"E	26°56'37.60"S
439	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'18.66"E	26°56'37.61"S
440	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'18.20"E	26°56'37.76"S
441	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'18.05"E	26°56'37.89"S
442	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'16.92"E	26°56'38.63"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'16.92"E	26°56'38.63"S
443	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'13.14"E	26°56'39.07"S
444	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'12.62"E	26°56'39.14"S
445	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'12.84"E	26°56'39.02"S
447	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'12.63"E	26°56'39.57"S
448	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'12.19"E	26°56'39.75"S
449	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'11.75"E	26°56'39.58"S
450	<i>Morus alba</i>	White mulberry	3	3	-	-	-	Tree	26°47'10.61"E	26°56'39.87"S

Cluster number	Scientific name	Common name	CARA	NEMBA	Density	DBH	Height	Growth form	Longitude	Latitude
	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'10.61"E	26°56'39.87"S
451	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'7.97"E	26°56'41.38"S
452	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'6.77"E	26°56'41.81"S
	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°47'6.77"E	26°56'41.81"S
453	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b	-	-	-	Tree	26°47'5.96"E	26°56'41.49"S
454	<i>Ipomoea purpurea</i>	Morning glory	3	1b	-	-	-	Creepers and climbers	26°47'2.90"E	26°56'43.25"S
456	<i>Verbena bonariensis</i>	Wild verbena	-	1b	-	-	-	Tree	26°46'57.96"E	26°57'53.68"S
	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b	-	-	-	Tree	26°46'57.96"E	26°57'53.68"S
457	<i>Gleditsia triacanthos</i>	Honey locust	2	1b	-	-	-	Tree	26°47'19.24"E	26°58'5.65"S
	<i>Datura stramonium</i>	Common thorn-apple	1	1b	-	-	-	Herb	26°47'19.24"E	26°58'5.65"S
236	<i>Melia azedarach</i>	Syringa	3	1b	-	-	-	Tree	26°46'51.40"E	26°57'11.89"S
458	<i>Nerium oleander</i>	Oleander	1	1b	-	-	-	Shurb	26°47'9.26"E	26°57'12.44"S

Table 5-16: Species list of all the declared IAPs recorded on the Zuiping 394 farming portion:

Nr	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
1	<i>Acacia baileyana</i>	Bailey's wattle	3	3	3	Mechanical, Chemical
2	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1	1b	Manual, Chemical

Nr	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method
3	<i>Cirsium vulgare</i>	Spear thistle	1	1	1b	Manual, Chemical
3	<i>Cortaderia selloana</i>	Pampas grass	1	1	1b	Manual, Chemical
4	<i>Datura ferox</i>	Large thorn-apple	2	1	1b	Manual, Chemical
5	<i>Datura stramonium</i>	Common thorn-apple	2	1	1b	Manual, Chemical
6	<i>Eucalyptus camaldulensis</i>	Red river gum	2	2	1b	Mechanical, Chemical
7	<i>Eucalyptus grandis</i>	Saligna gum	4	2	1b	Mechanical, Chemical
8	<i>Flaveria bidentis</i>	Smelter's bush	2	-	1b	Manual, Chemical
9	<i>Gleditsia triacanthos</i>	Honey locust	3	2	1b	Mechanical, Chemical
10	<i>Ipomoea purpurea</i>	Morning glory	2	3	1b	Manual, Chemical
11	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical
12	<i>Morus alba</i>	White mulberry	5	3	3	Mechanical, Chemical
13	<i>Nerium oleander</i>	Oleander	1	1b		Mechanical, Chemical
14	<i>Nicotiana glauca</i>	Wild tobacco	2	1	1b	Mechanical, Chemical
15	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical
16	<i>Opuntia humifusa</i>	Large flower prickly pear	1	1	1b	Chemical
17	<i>Pennisetum setaceum</i>	Fountain grass	4	1	1b	Manual
18	<i>Pinus patula</i>	Patula pine	1	2	2	Mechanical, Chemical
19	<i>Salsola kali</i>	Glasswort	3	-	1b	Manual, Chemical
20	<i>Solanum elaeagnifolium</i>	Silver leaf	2	1	1b	Manual, Chemical
21	<i>Tamarix ramosissima</i>	Pink tamarisk	4	3	1b	Mechanical, Chemical
22	<i>Tecoma stans</i>	Yellow bells	1	1	1b	Mechanical, Chemical
23	<i>Tipuana tipu</i>	Tipu tree	2	3	3	Mechanical, Chemical
24	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical

6 MANAGEMENT PLAN

This section aims to give detail on the implementation of eradication programmes for the AIP's assessed on the Moab Khotsong operational area. The eradication plan will follow a species-specific based approach to control invasive plants as indicated in Section 4 of this report. Species tables are presented for each of the farming portions listing the species name, categorisation, recommended control method and listed herbicide for that species where applicable. A summary table for all species encountered on the Moab Khotsong footprint, is also presented. Control methodologies for each vegetation type, is discussed for all the recorded vegetation types identified during the assessment. The management area is divided into management units based on the recorded prioritisation and recommendation are made on the scheduling of eradication and subsequent monitoring of the eradication effectiveness for the next three years.

6.1 Species based control recommendations for each of the farming portions

6.1.1 Mispah 274

The main invader species found on Mispah 274 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Melia azedarach* and *Robinia psuedoacacia*. Of the 15 species recorded, 14 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining specie, *Tipuana tipu*, is declared a Category 3 species under both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

Table 6-1: Species list with recommended control methods for Mispah 274

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1	1b	Manual, Chemical	Sept-March	Picloram or Glyphosate
2	<i>Cortaderoa selloana</i>	Pampas grass	1	1	1b	Manual, Chemical	Sept-April	Glyphosate
3	<i>Datura ferox</i>	Large thorn-apple	1	1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
4	<i>Datura stramonium</i>	Common thorn-apple	1	1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
5	<i>Eucalyptus grandis</i>	Saligna gum	3	1	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
6	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical	Sept-May	Picloram or Glyphosate
7	<i>Melia azedarach</i>	Syringa	3	3	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr, Triclopyr mixed with diesel
8	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical	Sept-April	MSMA (Monosodium methane arsenate)
9	<i>Pennisetum setaceum</i>	Fountain grass	1	1	1b	Manual	Sept-May	No registered Herbicide
10	<i>Robinia psuedoacacia</i>	Black Locust	3	2	1b	Mechanical, Chemical		Clopyralid/Triclopyr
11	<i>Salsola kali</i>	Glasswort	1	-	1b	Chemical	Sept-May	Tebuthiuron/Bromacil
12	<i>Tamarix ramosissima</i>	Pink tamarisk	1	3	1b	Mechanical, Chemical	Sept-May	Imazapyr
13	<i>Tipuana tipu</i>	Tipu tree	1	3	3	Mechanical, Chemical	Sept-April	Triclopyr/Imazapyr
14	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical	Sept-Dec	Glyphosate/ 2-4-D
15	<i>Xanthium strumarium</i>	Large cocklebur	1	1	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D

6.1.2 Moab 279

The main invader species found on Moab 279 were *Eucalyptus camaldulensis* and *Tamarix ramosissima*. *Eucalyptus camaldulensis* occur in disturbed areas along roads and in the toe paddocks of the tailings facilities as individual plants with clusters occurring close to plantations. *Tamarix ramosissima* is limited in its spread to the TSF side slopes and toe paddocks. Of the six species recorded, all six are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The recorded species include herbs, grasses, shrubs, creepers and trees.

Table 6-2: Species list with recommended control methods for Maob 279

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Eucalyptus camaldulensis</i>	Red river gum	5	2	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
2	<i>Eucalyptus grandis</i>	Saligna gum	3	3	1b	Mechanical, Chemical	Sept-April	picloram/Fluroxypyr
3	<i>Cortaderoa selloana</i>	Pampas grass	1	1	1b	Manual, Chemical	Sept-April	Glyphosate
4	<i>Salsola kali</i>	Glasswort	5	-	1b	Manual, Chemical	Sept-March	Tebuthiuron/Bromacil
5	<i>Tamarix ramosissima</i>	Pink tamarisk	2	3	1b	Mechanical, Chemical	Sept-May	Imazapyr
6	<i>Verbena bonariensis</i>	Wild verbena	2	-	1b	Manual, Chemical	Sept-Dec	Glyphosate/ 2-4-D

6.1.3 Zaiplaats 190

Only six individual alien invasive plants were recorded on Zaiplaats. These consisted of three annual herbs and one perennial grass specie, all categorised as category 1b under NEMBA.

Table 6-3: Species list with recommended control methods for Zaaipiaats 190

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Cirsium vulgare</i>	Spear thistle	1	-	1b	Manual, Chemical	Oct-March	Picloram and Glyphosate
2	<i>Cortaderoa selloana</i>	Pampas grass	1	1	1b	Manual, Chemical	Sept-April	Glyphosate
3	<i>Salsola kali</i>	Glasswort	1	1	1b	Manual, Chemical	Sept-May	Tebuthiuron/Bromacil
4	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical	Sept-Dec	Glyphosate/ 2-4-D

6.1.4 Hoekplaats 598

The main invader species found on Hoekplaats 598 were *Melia azedarach* and *Robinia psuedoacacia*. Most of these plants were located in clusters on the South western side of the farming portion. Of the 9 species recorded, 8 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining specie, *Populus alba* is declared Category 2 under both CARA and NEMBA. The recorded species include herbs, grasses, shrubs and trees.

Table 6-4: Species list with recommended control methods for Hoekplaats 598

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical	Sept-May	Picloram or glyphosate
2	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr, Triclopyr mixed with diesel
3	<i>Pennisetum setaceum</i>	Fountain grass	1	1	1b	Manual	Sept-April	No registered Herbicide
5	<i>Populus alba</i>	White poplar	4	2	2	Mechanical, Chemical	Sept-March	Imazapyr/Picloram/Triclopyr
6	<i>Robinia pseudoacacia</i>	Black locust	5	2	1b	Mechanical, Chemical	Sept-March	Clopyralid/Triclopyr
7	<i>Salsola kali</i>	Glasswort	1	-	1b	Manual, Chemical	Sept-May	Tebuthiuron/Bromacil
8	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D
9	<i>Xanthium strumarium</i>	Large cocklebur	1	1	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D

6.1.5 Anglo 593

Only three individual plants were recorded at Anglo 593. These consisted of two species, the annual weed *Flaveria bidentis* and the deciduous tree *Melia azedarach*. Both these species are categorised as category 1b invasive plants under NEMBA.

Table 6-5: Species list with recommended control methods for Anglo 593

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Flaveria bidentis</i>	Smelter's bush	1	-	1b	Manual, Chemical	Sept-May	Picloram or glyphosate
2	<i>Melia azedarach</i>	Syringa	1	3	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr, Triclopyr mixed with diesel

6.1.6 Doornkop West 446

The main invader species found on Doornkop West 446 were *Eucalyptus camaldulensis* and *Melia azedarach*, both abundant in the riverine areas to the north of the farming portion and *Populus alba* clusters located around the sewage plant. Of the 19 species recorded, 5 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

Table 6-6: Species list with recommended control methods for Doornkop West 446

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Arundo donax</i>	Giant reed	1	1	1b	Manual, Chemical	Feb-March	Glyphosate
2	<i>Datura ferox</i>	Large thorn-apple	1	1b	2	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
3	<i>Datura stramonium</i>	Common thorn-apple	1	1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
4	<i>Eucalyptus camaldulensis</i>	Red river gum	5	2	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
5	<i>Flaveria bidentis</i>	Smelter's bush	2	-	1b	Manual, Chemical	Sept-May	Picloram or glyphosate
6	<i>Gleditsia triacanthos</i>	Honey locust	2	2	1b	Chemical	Sept-Feb	Picloram/Triclopyr
7	<i>Ipomoea purpurea</i>	Morning glory	2	3	1b	Manual, Chemical	Oct-Feb	Triclopyr
8	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
9	<i>Morus alba</i>	White mulberry	1	3	3	Mechanical, Chemical	Sept-May	Picloram
10	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical	Sept-April	MSMA (Monosodium methane arsenate)
11	<i>Pinus pinaster</i>	Cluster pine	1	2	1b	Chemical	Sept-April	Glyphosate
12	<i>Pinus patula</i>	Patula pine	1	2	2	Chemical	Sept-April	Glyphosate
13	<i>Populus alba</i>	White poplar	5	2	2	Mechanical, Chemical		Imazapyr/Picloram/Triclopyr

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
14	<i>Salsola kali</i>	Glasswort	1	-	1b	Manual, Chemical	Sept-May	Tebuthiuron/Bromacil
15	<i>Solanum elaeagnifolium</i>	Silver leaf	1	1	1b	Manual, Chemical	Sept-Dec	Triclopyr
16	<i>Tamarix ramosissima</i>	Pink tamarisk	2	3	1b	Mechanical, Chemical	Sept-May	Imazapyr
17	<i>Tecoma stans</i>	Yellow bells	1	1	1b	Mechanical, Chemical	Sept-Dec	Triclopyr
18	<i>Tipuana tipu</i>	Tipu tree	1	3	3	Mechanical, Chemical	Sept-April	Triclopyr/Imazapyr
19	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical	Sept-Dec	Glyphosate/ 2-4-D

6.1.7 Chrystalkop 69

The main invader species found on Chrystalkop 69 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Morus alba* and *Melia azedarach*, all abundant in the riverine areas to the north and around the operational areas to the centre of the farming portion. Of the 20 species recorded, 15 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, a succulent, shrubs, creepers and trees.

Table 6-7: Species list with recommended control methods for Chrystalkop 69

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy		1	1b	Manual, Chemical	Sept-May	Picloram or Glyphosate
2	<i>Datura ferox</i>	Large thorn-apple		1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
3	<i>Datura stramonium</i>	Common thorn-apple		1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
4	<i>Eucalyptus camaldulensis</i>	Red river gum		2	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
5	<i>Eucalyptus grandis</i>	Saligna gum		2	2	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
6	<i>Flaveria bidentis</i>	Smelter's bush		-	1b	Manual, Chemical	Sept-May	Picloram or glyphosate
7	<i>Gleditsia triacanthos</i>	Honey locust		2	1b	Chemical	Sept-Feb	Picloram/Triclopyr
8	<i>Ipomoea purpurea</i>	Morning glory		3	1b	Manual, Chemical	Oct-Feb	Triclopyr
9	<i>Melia azedarach</i>	Syringa		3	1b	Mechanical, Chemical	Sept-April	Picloram/ Fluroxypyr, Triclopyr with mixed diesel
10	<i>Morus alba</i>	White mulberry		3	3	Mechanical, Chemical	Sept-May	Picloram
11	<i>Nicotiana glauca</i>	Wild tobacco		1	1b	Mechanical, Chemical	Sept-April	Triclopyr
12	<i>Opuntia ficus-indica</i>	Sweet prickly pear		-	1b	Chemical	Sept-April	MSMA (Monosodium methane arsenate)
13	<i>Pennisetum setaceum</i>	Fountain grass		1	1b	manual	Sept-April	No registered Herbicide

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
14	<i>Pinus patula</i>	Patula pine		2	2	Chemical	Sept-April	Glyphosate
15	<i>Populus alba</i>	White poplar		2	2	Mechanical, Chemical	Sept-April	Imazapyr/Picloram/Triclopyr
16	<i>Salsola kali</i>	Glasswort		-	1b	Manual, Chemical	Sept-May	Picloram and Glyphosate
17	<i>Tamarix ramosissima</i>	Pink tamarisk		3	1b	Mechanical, Chemical	Sept-May	Imazapyr
18	<i>Tipuana tipu</i>	Tipu tree		3	3	Mechanical, Chemical	Sept-April	Triclopyr/Imazapyr
19	<i>Verbena bonariensis</i>	Wild verbena		-	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D
20	<i>Xanthium strumarium</i>	Large cocklebur		1	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D

6.1.8 Zuiping 394

The main invader species found on Zuiping 394 were *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Melia azedarach*. Of the 23 species recorded, 20 species are declared Category 1 and/or Category 1b species under CARA and NEMBA, respectively. The remaining three species are declared Category 2 and 3 species under either or both CARA and NEMBA. The recorded species include herbs, grasses, succulents, shrubs, creepers and trees.

Table 6-8: Species list with recommended control methods for Zuiping 394

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
1	<i>Acacia baileyana</i>	Bailey's wattle	3	3	3	Mechanical, Chemical	Sept - May	Picloram
2	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1	1b	Manual, Chemical	Sept-May	Picloram or Glyphosate
3	<i>Cirsium vulgare</i>	Spear thistle	1	1	1b	Manual, Chemical	Oct-March	Picloram and Glyphosate
3	<i>Cortaderoa selloana</i>	Pampas grass	1	1	1b	Manual, Chemical	Sept-April	Glyphosate
4	<i>Datura ferox</i>	Large thorn-apple	2	1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
5	<i>Datura stramonium</i>	Common thorn-apple	2	1	1b	Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
6	<i>Eucalyptus camaldulensis</i>	Red river gum	2	2	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
7	<i>Eucalyptus grandis</i>	Saligna gum	4	2	1b	Mechanical, Chemical	Sept-April	picloram/Fluroxypyr
8	<i>Flaveria bidentis</i>	Smelter's bush	2	-	1b	Manual, Chemical	Sept-May	Picloram or glyphosate
9	<i>Gleditsia triacanthos</i>	Honey locust	3	2	1b	Chemical	Sept-Feb	Picloram/Triclopyr
10	<i>Ipomoea purpurea</i>	Morning glory	2	3	1b	Manual, Chemical	Oct-Feb	Triclopyr
11	<i>Melia azedarach</i>	Syringa	5	3	1b	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr, Triclopyr mixed with diesel
12	<i>Morus alba</i>	White mulberry	5	3	3	Mechanical, Chemical	Sept-May	Picloram
13	<i>Nerium oleander</i>	Oleander	1	1b		Mechanical, Chemical	Sept-April	Imazapyr
14	<i>Nicotiana glauca</i>	Wild tobacco	2	1	1b	Mechanical, Chemical	Sept-April	Triclopyr

NR	Scientific name	Common name	Density score	CARA	NEMBA	Recommended control method	Eradication schedule	Active ingredient
15	<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	-	1b	Chemical	Sept-April	MSMA (Monosodium methane arsenate)
16	<i>Opuntia humifusa</i>	Large flower prickly pear	1	1	1b	Chemical	Sept-April	MSMA (Monosodium methane arsenate)
17	<i>Pennisetum setaceum</i>	Fountain grass	4	1	1b	Manual	Sept-April	No registered Herbicide
18	<i>Pinus patula</i>	Patula pine	1	2	2	Chemical	Sept-April	Glyphosate
19	<i>Salsola kali</i>	Glasswort	3	-	1b	Manual, Chemical	Sept-May	Picloram and Glyphosate
20	<i>Solanum elaeagnifolium</i>	Silver leaf	2	1	1b	Manual, Chemical	Sept-Dec	Triclopyr
21	<i>Tamarix ramosissima</i>	Pink tamarisk	4	3	1b	Mechanical, Chemical	Sept-May	Imazapyr
22	<i>Tecoma stans</i>	Yellow bells	1	1	1b	Mechanical, Chemical	Sept-May	Triclopyr and Clopyralid
23	<i>Tipuana tipu</i>	Tipu tree	2	3	3	Mechanical, Chemical	Sept-April	Triclopyr/Imazapyr
24	<i>Verbena bonariensis</i>	Wild verbena	1	-	1b	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D

6.2 Eradication Methodology

6.2.1 Eradication timing

Table 6-9 gives a list of all the species recorded at Moab Khotsong. These species consist of annual and perennial herbs, sedges and grasses, succulents and deciduous and semi-deciduous or evergreen trees. The eradication schedule given in the table, shows an indication of the optimum timing for the treatment of these species. Climatic conditions have a significant influence on the success of chemical treatment as most systematic herbicides target specific mechanisms during the plant lifecycle. Conditions, therefore, need to be optimal for the herbicide to be taken up by the plant. Plants need to be actively growing when treated to enhance herbicide uptake. This requires the availability of sufficient water, and temperatures between 5 and 29°C depending on the plant type and herbicide action. Other timing factors include the growth stage of the plant. *Arundo donax*, for example, shows reduced die-off when treated during spring and mid-summer due to the reduced movement of nutrients from the leaves to the plant rhizomes during this time of year. From February to March, the success of treatment increases substantially as nutrient transport from the leaves to the rhizomes increases and herbicide transportation through the plant is enhanced. High temperatures and water stress cause reduced transpiration rates as plant stomata close to reduce plant water use. Most foliar absorbed herbicides enter the plant through the stomata and absorption rates are therefore greatly reduced.

For the effective control of AIP's the eradication needs to be scheduled before plant seeds ripen. Although individual plants can still be controlled after seed has been produced, the ripened seed will only add to the existing seed bank and therefore, it is advisable to treat adult plants before viable seeds are produced. All control methods listed in this document are aimed at controlling growing plants and seed reserves are not controlled. It is therefore, essential that eradications are scheduled to coincide with germination events and multiple eradications may be undertaken during one season.

The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947), requires that herbicide application be overseen by a registered Pest Control Operator (PCO). A PCO registration can only be obtained once the department has been provided with proof that the applicant has received the required training and is competent in the identification of invasive plants and the registered herbicides to control these plants.

For the Moab Khotsong mine, the following recommendations are made with regards to the treatment methodology for the assessed plants.

6.2.2 Vegetation Type

6.2.2.1 Trees

All the trees recorded during the assessment are registered for control through chemical means with various products registered for the control of these plants. When controlling invasive trees, cut stump treatment is the preferred method. This consists of felling the tree as close as practically possible to the natural ground level and treating the remaining stump with a registered herbicide. Alternatively, where felling the tree will pose a safety risk to employees or property, ring barking is advised. Ring

barking entails the removal of a circular section of the outer bark of the targeted tree. This section should be continuous around the tree perimeter and between 15 and 25 cm wide. The exposed area should then be treated with a registered herbicide as per the specific herbicide application rate. Saplings in their first year of growth may be treated by foliar application of registered herbicides only if these trees cannot be uprooted. Trees should ideally be treated during the growing season from September to March but some trees may be treated throughout the year.

6.2.2.2 Herbs

Herbs are can be easily removed by manually uprooting juvenile plants where site conditions allow. Uprooting plants is by far the most economical and least environmentally harmful why of controlling these plants where individual or small clusters of plant occur in isolation. Larger infestations will need to be chemically controlled and where site conditions do not allow for successful uprooting of the plants, chemicals will be more effective. Care should be taken to only treat targeted plants when applying chemicals and the chemicals should only be applied as indicated on the specific product label for the specific targeted plant. All of the herbs recorded on Moab Khotsong are annual weeds and it is advised that these be targeted early in the growing season after the first rainfall. Annual herbs can germinate at any time during the growing season and it is therefore advised that follow-up treatments be conducted once or twice during the season to ensure adequate control and to prevent these plants from producing viable seed. Follow up treatments should ideally be timed to take place two to three weeks after good rains.

6.2.2.3 Succulents

Two succulent species were recorded on the Moab Khotsong footprint during the assessment. Succulents are drought tolerant plants that are commonly found in areas with low rainfall. Succulents spread easily through vegetative means when parts of the plants are broken off and carried away by animals or people. Common control methods for succulents include collection and pulping of the plant material or chemical control methods through direct injection or foliar application. Pulping is an expensive process and is not advised for the control of succulents on small scale. Plants should be treated with a registered herbicide through direct injection of the herbicide into the plant sells. Every third succulent leaf should be treated with a follow up treatment scheduled during the next year to treat any remaining parts of the succulent plant. Succulents may be treated throughout the year.

6.2.2.4 Creepers and Climbers

The main creeper recorded on Moab Khotsong was *Ipomoea purpurea*. These plants were mainly located within the riverine area to the north of the operations. *I. purpurea* is an annual weed in areas where frost occur. Small plants should be uprooted and left to die off. Larger plants should be cut and the remaining stump should be treated. Various herbicides are registered for foliar application but due to the plant's climbing nature, treating it without contaminating the plant it is climbing on, is difficult. Due to the climatic conditions at Moab Khotsong it is advised that *I. purpurea* be treated early in the growing season after the first rains. Larger plants may be treated throughout the growing season but ideally before seeds ripen.

6.2.2.5 Grasses

The main invasive grass species recorded at Moab Khotsong was *Pennisetum setaceum* or Fountain grass. There is currently no herbicide registered for the control of fountain grass and individual plants should be manually uprooted. Certain glyphosate-based herbicides are registered for industrial/non-crop use and may be applied as a foliar application to control dense stands of unwanted vegetation, including grasses. These areas should be rehabilitated and seeded with indigenous seed after the grasses have died off. Any unwanted plants that re-emerge within these areas will have to be controlled during follow-up eradications. Grasses should be treated early in the growing season before seeds ripen, this should be before the end of February dependent on when the first rains occur.

Table 6-9: Species list and recommended eradication methods for all species recorded at Moab Khotsong

NR	Scientific name	Common name	CARA	NEMBA	Farm Portion								Recommended control method	Eradication schedule	Active ingredient
					1	2	3	4	5	6	7	8			
1	<i>Acacia baileyana</i>	Bailey's wattle	3	3		*							Mechanical, Chemical	Sept - May	Picloram
2	<i>Argemone ochroleuca</i>	White-flowered Mexican poppy	1	1b		*	*			*			Manual, Chemical	Sept-May	Picloram or Glyphosate
3	<i>Arundo donax</i>	Giant reed	1	1b							*		Manual, Chemical	Feb-March	Glyphosate
4	<i>Cirsium vulgare</i>	Spear thistle	1	1b		*		*					Manual, Chemical	Oct-March	Picloram and Glyphosate
5	<i>Cortaderoa selloana</i>	Pampas grass	1	1b		*		*	*	*			Manual, Chemical	Sept-April	Glyphosate
6	<i>Datura ferox</i>	Large thorn-apple	1	1b		*	*			*	*		Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
7	<i>Datura stramonium</i>	Common thorn-apple	1	1b		*	*			*	*		Manual, Chemical	Nov-Feb	Glyphosate/ 2-4-D
8	<i>Eucalyptus camaldulensis</i>	Red river gum	2	1b		*	*		*		*		Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr
9	<i>Eucalyptus grandis</i>	Saligna gum	2	2		*	*		*	*			Mechanical, Chemical	Sept-April	picloram/Fluroxypyr

NR	Scientific name	Common name	CARA	NEMBA	Farm Portion								Recommended control method	Eradication schedule	Active ingredient
10	<i>Flaveria bidentis</i>	Smelter's bush	-	1b	*	*	*			*	*	*	Manual, Chemical	Sept-May	Picloram/glyphosate
11	<i>Gleditsia triacanthos</i>	Honey locust	2	1b		*	*				*		Chemical	Sept-Feb	Picloram/Triclopyr
12	<i>Ipomoea purpurea</i>	Morning glory	3	1b		*	*				*		Manual, Chemical	Oct-Feb	Triclopyr
13	<i>Melia azedarach</i>	Syringa	3	1b	*	*	*			*	*	*	Mechanical, Chemical	Sept-April	Picloram/Fluroxypyr, Triclopyr mixed with diesel
14	<i>Morus alba</i>	White mulberry	3	3		*	*				*		Mechanical, Chemical	Sept-May	Picloram
15	<i>Nerium oleander</i>	Oleander	1b	-		*							Mechanical, Chemical	Sept-April	Imazapyr
16	<i>Nicotiana glauca</i>	Wild tobacco	1	1b		*	*						Mechanical, Chemical	Sept-April	Triclopyr
17	<i>Opuntia ficus-indica</i>	Sweet prickly pear	-	1b		*	*			*	*		Chemical	Sept-April	MSMA (Monosodium methane arsenate)
18	<i>Opuntia humifusa</i>	Large flower prickly pear	1	1b		*							Chemical	Sept-April	MSMA (Monosodium methane arsenate)
19	<i>Pennisetum setaceum</i>	Fountain grass	1	1b		*	*			*		*	Manual	Sept-April	No registered Herbicide
20	<i>Pinus panister</i>	Cluster pine	2	1b							*		Chemical	Sept-April	Glyphosate

NR	Scientific name	Common name	CARA	NEMBA	Farm Portion								Recommended control method	Eradication schedule	Active ingredient
21	<i>Pinus patula</i>	Patula pine	2	2		*	*				*		Chemical	Sept-April	Glyphosate
22	<i>Populus alba</i>	White poplar	2	2			*				*	*	Mechanical, Chemical	Sept-March	Imazapyr/Picloram/Triclopyr
23	<i>Robinia psuedoacacia</i>	Black Locust	2	1b						*		*	Mechanical, Chemical	Sept-Feb	Clopyralid/Triclopyr
24	<i>Salsola kali</i>	Glasswort	-	1b		*	*	*	*	*	*	*	Manual, Chemical	Sept-May	Tebuthiuron/Bromacil
25	<i>Solanum elaeagnifolium</i>	Silver leaf bitter apple	1	1b		*					*		Manual, Chemical	Sept-Dec	Triclopyr
26	<i>Tamarix ramosissima</i>	Pink tamarisk	3	1b		*	*		*	*	*		Mechanical, Chemical	Sept-May	Imazapyr
27	<i>Tecoma stans</i>	Yellow bells	1	1b		*					*		Mechanical, Chemical	Sept-Dec	Triclopyr
28	<i>Tipuana tipu</i>	Tipu tree	3	3		*	*			*	*		Mechanical, Chemical	Sept-April	Triclopyr/Imazapyr
29	<i>Verbena bonariensis</i>	Wild verbena	-	1b		*	*	*	*	*	*	*	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D
30	<i>Xanthium strumarium</i>	Large cocklebur	1	1b			*			*		*	Manual, Chemical	Sept-Feb	Glyphosate/ 2-4-D

6.3 Implementation Plan

Figure 6-1 show a map of the priority areas identified during the assessment conducted at Moab Khotsong. Based on the diversity and densities of AIP's in the area (Table 5-1 to Table 5-16 and Table 6-9), it is advised that eradications be scheduled in various phases. Phase 1 and 2 should be completed during the first season of eradication and phase 3 and 4 during the second and third season respectively.

6.3.1 Phase 1

The first phase of eradication should be aimed at controlling existing trees within the high priority areas located to the north and around the Great Nologwa plant. This phase should be undertaken at the beginning of September in the first year of eradication and should be completed at the end of October of the same year. All listed category 1 trees should be controlled during this time.

6.3.2 Phase 2

Phase 2 should be conducted from October of the first year after the first rains and should be aimed at controlling all category 1 plants located within the Moab Khotsong footprint. Care should be taken to treat all actively growing plants during this phase. To reduce the initial cost of eradication, it would be possible to schedule phase 2 a year after phase 1 but it is then advised that three eradications be conducted during the growing season as described for phase 3 below.

6.3.3 Phase 3

The third phase of eradication should be conducted in September of the second year after completion of the initial eradication programme in the previous year. Three eradications should be conducted during the growing season. These should be aimed at controlling any regrowth of woody plants treated during the previous season and controlling annual weeds just after germination during the growing season. Eradications should be timed to take place two to three weeks after good rains to ensure that all annual plants are treated when they are actively growing but before seed is produced.

6.3.4 Phase 4

Phase 4 will consist of two eradications during the growing season following the completion of phase 3. Eradications should be timed to coincide with rain events as recommended for phase 3. After completion of the final eradication the area should be re-assessed by a suitably qualified individual and the management plan should be updated to accurately address the remaining invasive plants within the target area.

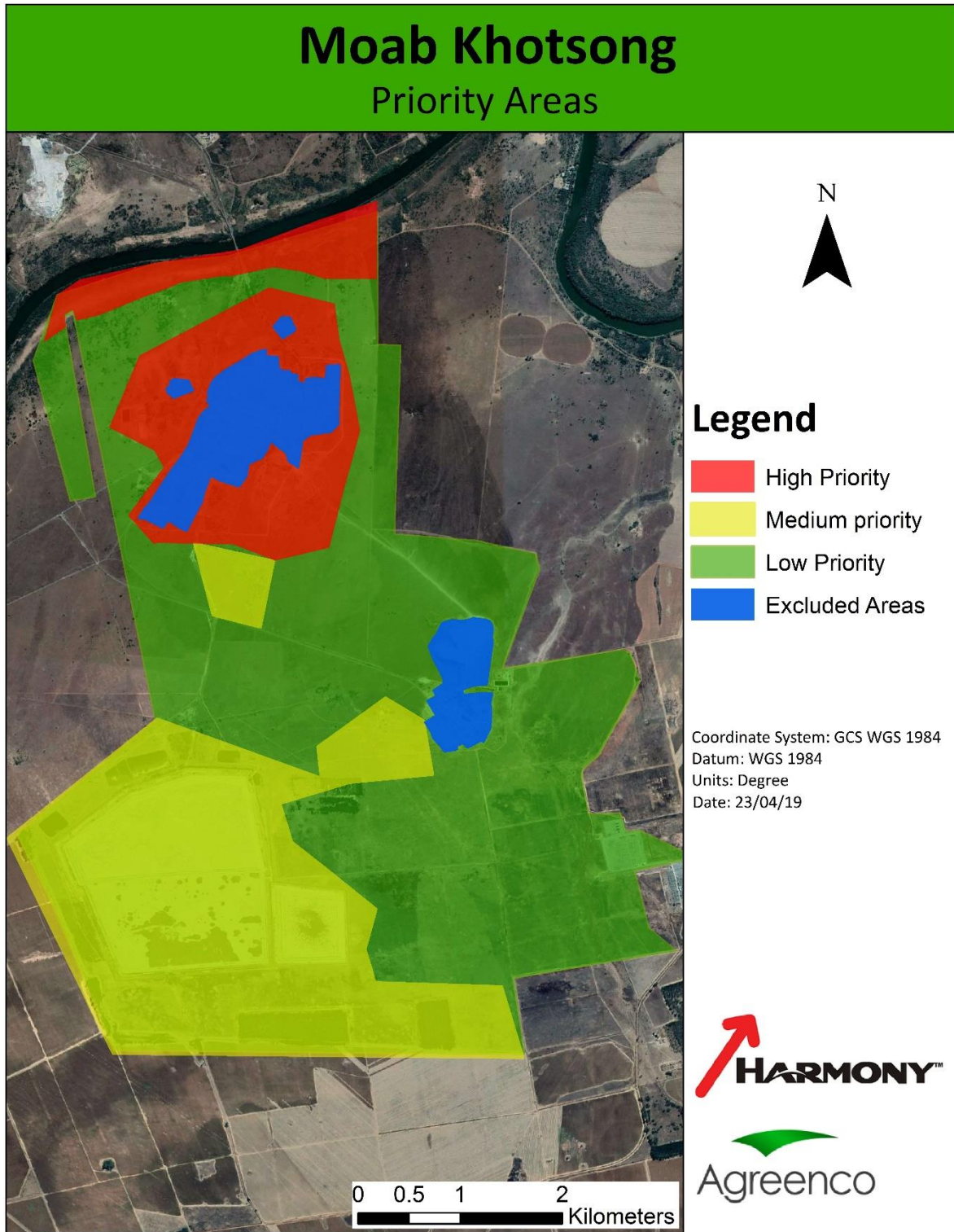


Figure 6-1: Priority areas for the treatment of Alien invasive weeds at Moab Khotsong

7 SUMMARY

Over all the distribution and density of Alien Invasive plants over the footprint of the Moab Khotsong operations was moderate to High. High densities of category 1 species, dominated by *Melia azedarach* and *Eucalyptus camaldulensis*, were observed in the riverine area to the north of the footprint where the operations meet the Vaal River. This area will be of high importance and it is recommended that eradication be targeted at controlling category 1 trees during the first phase of the eradication programme. The second phase should include the control of all listed category 1 plants within the area and within the same season as phase 1.

High to moderate densities and distribution occurred around the Great Nologwa plant. This area shows signs of disturbances in the recent past with invasive species invading the disturbed areas. This area will also be of high importance and should be included in phase 1 and 2 of the eradication programme. Moderate densities and distribution of AIP's occur to the south of the footprint area, around the tailings complex. This area will be of moderate importance and may be targeted during phase 2 and onwards when the eradication programme is implemented.

Table 7-1 gives a summary of the findings for each of the farming portions detailing the total number of species, the number of category 1 species and the management priority of the farming portions. Management priority is based on the density and distribution of AIP's as indicated in Table 2-3.

Table 7-1: Summary of findings

Farm Portion Name	Total number of species	Total Number of Category 1 species	Management Priority
Mispah 274	15	14	Medium
Moab 279	6	6	Low
Zaaiplaats 190	4	4	Low
Hoekplaats 598	9	8	Low
Anglo 593	2	2	Low
Doornkop West 446	19	5	Medium
Chrystalkop	20	15	High
Zuiping 394	23	20	High

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