



REHABILITATION MANAGEMENT PLAN



ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

THE PROPOSED DEVELOPMENT OF A VILLAGE ESTATE FOR ABANDONED AND ORPHANED CHILDREN, DE DEUR, GAUTENG

REHABILITATION MANAGEMENT PLAN

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LIST OF ABBREVIATIONS

ECD	Early Childhood Development
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographical Information System
NEMBA	National Environmental Management: Biodiversity Act
SA	South Africa
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TOPS	Threatened and Protected Species



1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE REHABILITATION MANAGEMENT PLAN

An application for Environmental Authorisation was submitted on 20/05/2019 (Gaut: 002/19-20/E0263), however it was noted that some development had already occurred. This included the construction of three housing units, a short dirt road and a 10kl sewerage package plant.

The applicant received local planning approvals and was under the impression that they could start construction. However, the applicant has realised that they have made a mistake and would like to rectify this. All further construction has been stopped and an S24G application submitted for the construction and operation of three housing units, a short dirt road and a 10kl sewerage package plant. A directive (Reference: S24G/03/20-21/0515) has been issued by Gauteng Department of Agriculture and Rural Development (GDARD) and one of the instructions is to provide *“A Rehabilitation Plan to mitigate against current and potential ecological and biodiversity impacts that have and may further result from development activities on the site.”*

The objective of the Rehabilitation Management Plan is to re-establish, manage and maintain indigenous vegetation units and plant communities within the development footprint, by rehabilitating degraded areas or areas impacted on during construction that are not needed during the Operational Phase.

1.2 OBJECTIVES

The objectives of this Rehabilitation Management Plan are as follows:

- Identify areas that must be rehabilitated to their natural state and areas that can be rehabilitated to a functional state (e.g. lawns and gardens).
- Provide a description of the procedures that should be followed for soil stabilisation and planting.
- Provide a framework for monitoring and reporting on the success of the rehabilitation plan.
- Define roles and responsibilities for the implementation of this plan.

1.3 PROJECT DESCRIPTION

The proposed development will be constructed on 12.1 ha of the property (25 ha in extent) and will consist of the following infrastructure:

- 59 three-bedroom residential units (approximately 170 m² each, including patios);
- 10 two-bedroom residential units (approximately 124 m² including patios);
- Administrative Offices;
- A school to cater for a maximum of 375 - 400 children.
- A baby house to cater for the care of 50-60 babies at any one time.



- An Early Childhood Development (ECD) Centre to cater for a maximum of 100 - 125 children.
- Sports facilities including two grassed large fields, six hard courts and two fenced swimming pools. Certain recreational areas will be lit at night, preferably using solar flood lights and only when used.
- Two recreational centers;
- A library;
- A Dining hall;
- A Medical Centre;
- Therapy Offices;
- Storage facilities.;
- Outdoor gym and / or indoor gym (within the recreation center or school precinct) only for staff and residents;
- A multipurpose hall / church/ recreational facility;
- Maintenance workshops and storerooms;
- Green spaces (subsistence farming gardens, orchards and food forests);
- Upgrading of existing roads to provide access;
- Water Tank;
- Sewerage Treatment Plant; and
- Stormwater Infrastructure.



2 ROLES AND RESPONSIBILITIES

POSITION TITLE	ROLE	DESCRIPTION OF TASK
Contractor	Implementation, Monitoring and Review	<ul style="list-style-type: none"> • Responsible for implementing the rehabilitation plan for all new infrastructure that will be built. • Responsible for ensuring that the construction team complies with the requirements of this management plan; • Review and interpretation of monitoring data; • Keeping records of all activities/incidents on site in the Site Diary concerning the environment (including rehabilitation) and reporting these to the ECO and the Door of Hope Children’s Mission; • Reporting back on the environmental issues (including rehabilitation) at regular site meetings and other meetings that may be called regarding environmental matters; • Inspecting the site and surrounding areas regularly (at least once per week) to ensure compliance with the EMPr as well as this Management Plan, and reporting these findings at least monthly throughout the construction phase to the ECO and the applicant; and • Ensuring that all new contractor personnel coming onto site attend the environmental awareness training courses conducted by the Contractor or other responsible personnel.
Environmental Control Officer (ECO)	Implementation and Monitoring	<ul style="list-style-type: none"> • Inspecting the site and surrounding areas regularly with regard to compliance with the EMPr as well as this Rehabilitation Management Plan, and reporting these findings at least quarterly throughout the construction phase to the relevant environmental authorities and the applicant; • Completing start-up, monthly and site closure compliance checklists; • Keeping records of all environmental incidents on site in the Site Diary and reporting these to the applicant; • Keeping a photographic record of progress on rehabilitation progress and other actions affecting the environment of the site; • Reviewing and approving construction method statements related to rehabilitation of the site; • Recommending and/or developing corrective actions in the event of significant non-compliance; and • Implement appropriate actions in the case of non-compliance with this plan.
Door of Hope Children’s Mission	Implementation, Monitoring and Review	<ul style="list-style-type: none"> • Ensure that all necessary environmental authorisations and permits (including plant permits for the destruction or removal of species of conservation concern) have been obtained; • Ensure that activities on site comply with other relevant environmental legislation;



POSITION TITLE	ROLE	DESCRIPTION OF TASK
		<ul style="list-style-type: none"> • Ongoing liaison with National and Provincial Government agencies and regulatory authorities; • Continuously reviewing the effectiveness of the actions described in the rehabilitation plan as informed by regular review of ECO monitoring reports; and • Ongoing liaison with appropriate project personnel regarding the rehabilitation of the site. • Rehabilitate areas on the ridge that were affected by the unauthorised clearing of vegetation for the infrastructure that forms part of the S24G process. • Ensure that the rehabilitation measures are implemented by the ECO and Contractor for areas that do not form part of the S24G process. • Respond to any third-party complaints related to inadequate rehabilitation measures including dust and erosion.



3 REHABILITATION PLAN

Rehabilitation of disturbed and heavily impacted environments is closely linked to ecological successional theory (Andel *et. al.*, 2012). Succession can be described as a change of species, or patterns of species abundance, over time. Directional, continuous and sequential patterns of colonisation by various species are indicators of successional stages of an environment.

The first sequence of succession (after a disturbance) is the initial colonisation of an area by fast-growing, aggressive pioneering species, which are often short-lived, perennial species and grasses. These plant species are responsible for changing soil properties and creating micro-niches for further colonisation.

The initial sequence of pioneer species is followed by early and late successional species migrating into the area, resulting in a climax community.

The “4 R” Approach should be employed for the rehabilitation of the disturbed environment. This includes:

- Restoration;
- Rehabilitation;
- Replacement/re-vegetation; and
- Reservation/conservation.

The success of rehabilitating the community/population within a designated area is dependent on the satisfactory establishment of the chosen plant species. To ensure that the process is optimised, the correct plant species in the correct densities and combinations should be utilised. Monitoring of the rehabilitation process is imperative to ensure that aggressive plant species and herbivores are controlled, and slopes/banks remain stable.

The general aim of a rehabilitation programme is to recreate a natural ecosystem. The rehabilitation will therefore be outlined in three (3) phases, which are required, namely:

- Take measures to stabilise the soil and remedy the soil, when required, through the monitoring and management of the soil composition, pH levels, nutrients, etc.;
- Re-vegetate disturbed areas using appropriate natural successional species;
- Monitor and manage the success of the rehabilitation by controlling aggressive indigenous plants, removing alien invasive plant species as soon as they are observed, and maintaining the re-vegetated areas to ensure the successful establishment of these re-vegetated areas.

The Rehabilitation Plan is applicable to the following areas:

- Areas on the ridge that have not been developed;
- Road verges after road construction is completed;



- Wetlands;
- Stormwater soak away features and landscaped areas; and
- Areas where large patches of Invasive Alien Plant species have been removed.

The transformed portions of the ridges that are not developed must be rehabilitated by planting indigenous plant species occurring in the area (Figure 3-1 and 3-2). These areas must be returned to their natural state and be representative of ridge vegetation. Only plants on the approved list (Appendix A) may be used for landscaping purposes in this area.

The transformed portions of the grassland and stand of alien trees must be rehabilitated back to a functional state (Figure 3-1 and 3-2). A functional state is one where the soil has been stabilised to prevent erosion and reduce runoff. In this instance, these can include landscaped gardens or natural vegetation.

Wetland areas must be rehabilitated back to their natural state using only indigenous species (Figure 3-2).

Rehabilitation starts at the beginning of the project i.e. when clearing for construction begins and is not applied retrospectively. The steps outlined in the sections below must therefore be applied during the construction phase.

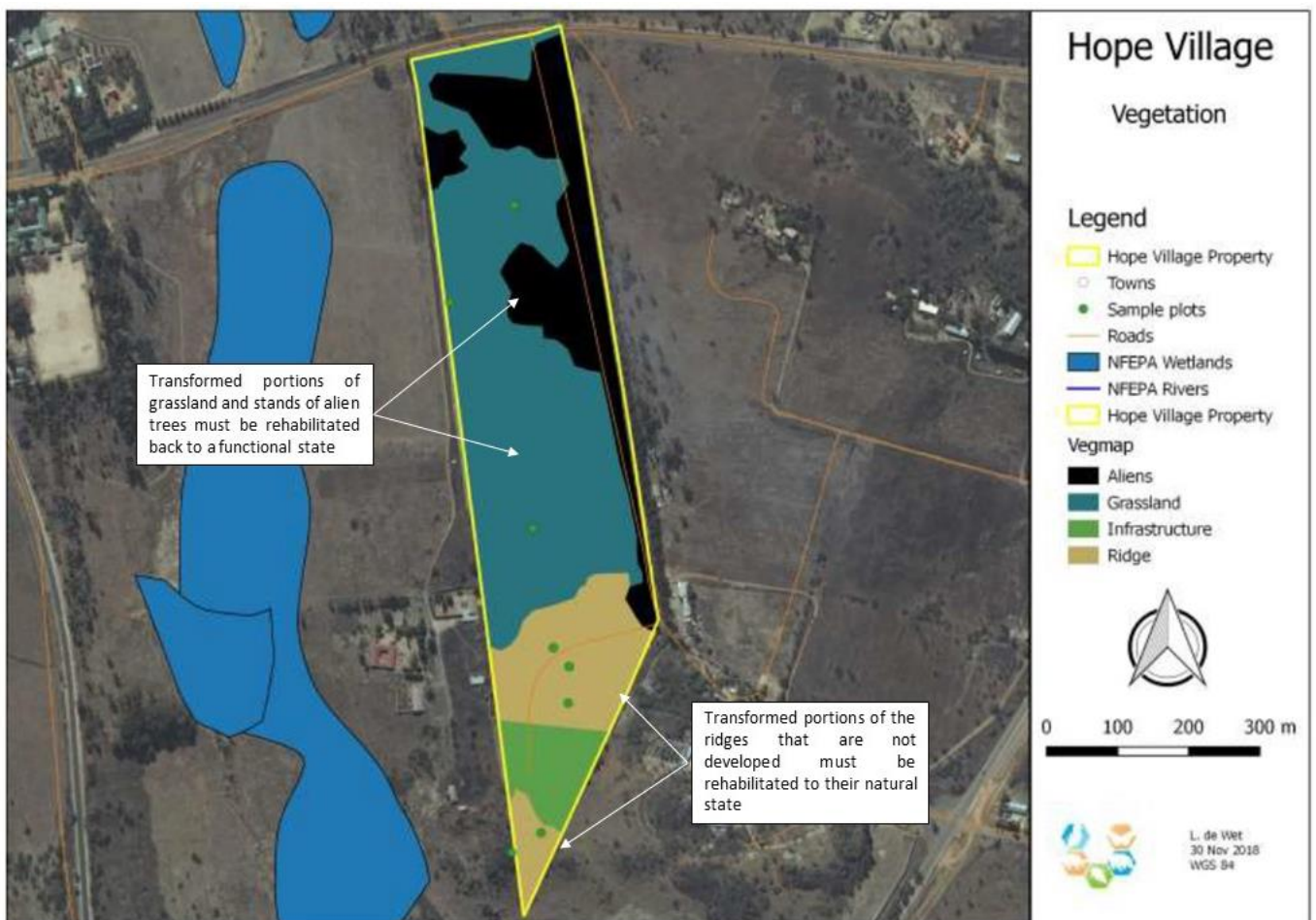


Figure 3-1: Vegetation map showing the location of the different vegetation types recorded on site.

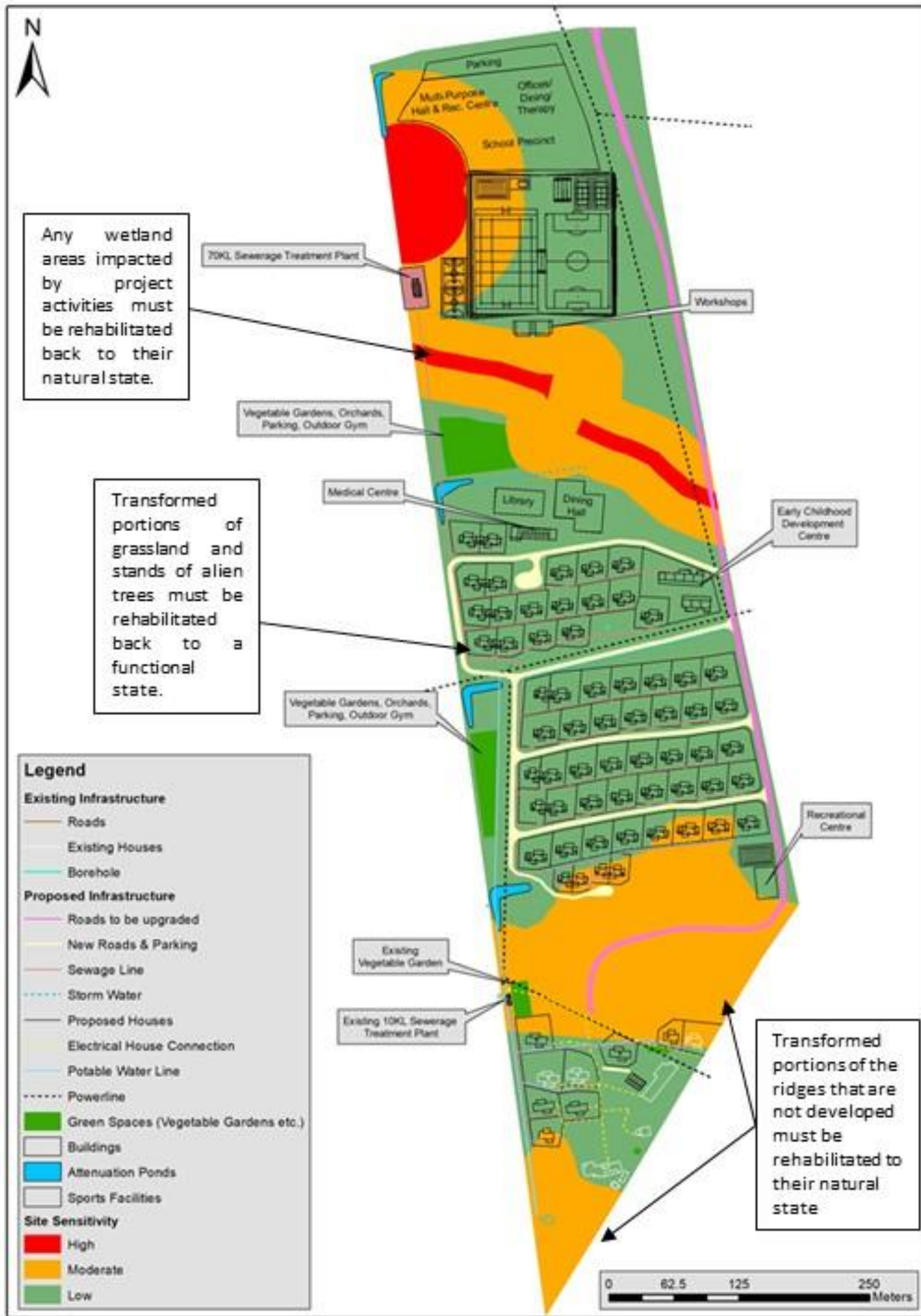


Figure 3-2: Sensitivity map indicating the areas that need to be rehabilitated to their natural state and the areas that can be rehabilitated to a functional state.



3.1 PHASE 1: SOIL STABILISATION AND REMEDIATION

Topsoil, which is removed during construction, must be utilised in the nursery and stored on site for rehabilitation and re-vegetation. Once construction is complete, the topsoil must be spread over the disturbed site and covered with mulch. Where necessary, the soil must be stabilised using suitable materials, such as netting or geotextiles. The plant material (grasses and herbs), which have been removed from the site, should be mixed into the topsoil to supplement the organic nutrient content of the soil. No further soil conditioning in terms of fertilising is deemed necessary at this stage.

3.2 PHASE 2: RE-VEGETATION PROCEDURE

The selection of species to be used for re-vegetation should be based on the ability of the species to successfully grow from the indigenous seeds, sods and/or slips which have been collected from the site.

The table below outlines the steps which should be followed during out-planting for the re-vegetation procedure.

Table 3.1: Revegetation procedure

<p><u>Plot preparation</u></p>	<p>The plots should be prepared as follows:</p> <ul style="list-style-type: none"> • Prior to rehabilitation of the site, all remnants of foreign debris should be removed from the site. • Compacted soil should be ripped to a depth of more than 250 mm. • The final prepared surface should not be smooth but furrowed to follow the natural contours of the land. • All plots must be covered with topsoil. Topsoil should be manually spread evenly over the surface. Topsoil must be spread to the original depth and deeper where sufficient topsoil is available. • Sites where concrete slabs are to be thrown must first have 20cm of the topsoil removed for later use in the rehabilitation programme. • All the plots should be mulched. The vegetation stripped and stockpiled during site preparation must be spread in a single layer across the plots as mulch. • All plots should be treated with nitrogen-fixing bacteria which is important for legumes, <i>Trichoderma sp.</i> and mycorrhizal products as a natural form of soil remediation.
<p><u>Plant Preparation</u></p>	<p>Plants should undergo a period of 'hardening-off' during which they have been exposed to full, direct sunlight and been under a reduced watering regime. The individual plants destined for each plot should be grouped into plot-specific, marked baskets or containers, before they leave the nursery. Each plant should be labelled with an aluminium label, giving species code, and a specific numeral identifying the plot. Before out-planting commences, the equipment necessary for the proper handling and placing of all required materials must be on hand, in good condition and to acceptable approved standards.</p> <p><u>Shrubs and trees</u></p>



	<ul style="list-style-type: none"> • Planting should preferably be done during the rainy season (summer). • Unless otherwise specified by the ECO, excavate square holes of approximately 800 mm x 800 mm x 800 mm for trees and approximately 500 mm x 500 mm x 500 mm for shrubs. • Backfill planting holes with excavated material/approved topsoil, thoroughly mixed with weed-free manure or compost (per volume, approximately one quarter of the plant hole), one cup of 2:3:2 fertiliser and an approved ant and termite poison (if required). • As much of the soil from container plants as possible must be retained around the roots of the plant during planting. • The soil must cover all the roots and be gently pressed down to a level equal to that of the surrounding <i>in situ</i> material. • After planting, each plant must be well watered and additional soil should be added once the soil has settled, if necessary. • Mulch must be added to the surface area of the bermed basin in order to sustain soil moisture. • Stake all trees using at least three (3) weather resistant wooden or steel stakes anchored firmly into the ground. Two (2) of the three (3) stakes should be located on the windward side of the plant. Galvanised wire binding, 3 mm thick, covered with a 20 mm diameter plastic hosepipe must be tied tightly to the stakes, half- to two thirds the height of the tree above the ground and looped around the trunk of the tree. • Place stakes at least 500 mm apart and away from the stem and roots of the tree, so as not to damage the tree or its roots. • Thoroughly water plants as required until the plants are able to survive independently, i.e. until they are able to survive when receiving water from rainfall only. • A raised circular 200 mm high subsoil berm placed 500 mm (shrubs) to 750 mm (trees) from the plant stem must be provided for the watering. Do not simply leave the excavated plant hole partially backfilled for this purpose, the berm must be raised above the natural soil level. • Water aloes and bulbs once directly after transplanting to settle the soil. • Remove stakes and wire binds over time as required, as plants become established.
<p>Grassing using sods</p>	<ul style="list-style-type: none"> • “Sodding” is defined as the laying of grass sods. • Sodding may be done at any time of the year. • The soil should be uniformly wet to a depth of at least 150 mm before grass sods are planted. • Protect sods against drying out by keeping them moist from the time of harvesting until final placement. • Rake or spike the plot area to create a loose surface to a depth of approximately 100 mm. • Lay two (2) rows of sods in a straight line or following a contour, starting at the bottom of a slope, where possible. • Place the next two (2) rows of sods in the same direction, 5 m away, until the full area is covered with rows of sods. • Tightly push sods together, taking care not to stretch or overlap sods. • Where a good fit cannot be obtained, the intervening spaces should be filled with parts of sods or topsoil. • After planting, water sods to prevent drying out. • Irrigate as required until the grass is able to survive independently, i.e. until it is able to survive when receiving water from rainfall only.
<p>Grassing using runners</p>	<ul style="list-style-type: none"> • Plant grass runners evenly by hand or by mechanical means at a rate of at least 400 runners per hectare (i.e. at 250 mm centres). • Only use fresh runners, avoiding grass runners which have dried out.



	<ul style="list-style-type: none"> • Rake or spike the area to create a loose surface to a depth of approximately 100 mm. • The soil should be uniformly wet to a depth of at least 150 mm before planting of grass runners. • After planting, the runners must be given copious amounts of water and, when sufficiently dry, must be rolled with a light agricultural roller and re-watered. • Irrigate as required until the grass is able to survive independently, i.e. until it is able to survive when receiving water from rainfall only.
<p>Grassing using seeds</p>	<ul style="list-style-type: none"> • All seed should be collected from the site during vegetation clearing or from the neighbouring veld. • Seeding must be done during the summer months, when the germination rate is better. • Seeds must be sown at the rate of 0,5kg per 100m² (50kg per hectare). • The soil should be loose and uniformly wet to a depth specified by the ECO, before any seeding commences. • Halve the seed and fertiliser mixture as specified and apply evenly in two (2) successive applications perpendicular to each other. • The seeded area must be raked over after seed application and well-watered. • Irrigate as required until the grass is able to survive independently, i.e. until it is able to survive when receiving water from rainfall only.
<p>Maintenance</p>	<ul style="list-style-type: none"> • Cordon-off areas which are under rehabilitation as temporary no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced-off to prevent vehicular, pedestrian and livestock access. • Re-vegetation of the ridges must be the same as the vegetation type which previously existed. • Water all transplanted, planted and grassed areas as specified. • Watering must commence and continue immediately after the seeds have germinated and growth begins. • Mow lawns regularly to a height of 50 mm above ground level. This promotes adequate coverage. • Mowing of veld grass is to take place once a year after the grass has shed its seed and not before the grass has fully grown - fire breaks are important. • Check all plants for pests and diseases on a regular basis and treat the plants, when required, using approved methods and products as per the manufacturers' specifications. • Control weeds by means of extraction, cutting or other approved methods. • In planted areas which have failed to establish, replace plants with the same species as originally specified. The same species must be used unless otherwise specified by the ECO. • A minimum grass cover of approximately 80% is required. Individual plants must be strong and healthy growers by the end of the maintenance period. • Acceptable cover, in the case of sodding, is attaining 100% cover by the specified vegetation.

3.3 PHASE 3: REHABILITATION MONITORING



Door of Hope Children's Mission will implement and maintain a rehabilitation monitoring plan from the commencement date of rehabilitation activities, which should be recorded in the Environmental File. Monitoring of rehabilitation efforts must continue for a period of twelve (12) months after the rehabilitation procedure has been completed. Should any issues arise, which are not resolved through the implementation of the recommended measures, a suitably qualified horticulturist or botanist should be contacted to provide further rehabilitation/remedial measures.

The ECO should monitor the rehabilitation process and record the progress in the regular audit reports using photographic evidence. This should include monitoring the establishment success (presence, percentage cover or absence) of plant cover and species composition per plot.

Monitoring must be undertaken quarterly during the construction phase and annually thereafter until rehabilitation has been deemed successful. Rehabilitation will be deemed successful once primary grass cover has been established, and there is no further requirement for frequent monitoring and management of the growth of alien species.

3.4 ALIEN VEGETATION REMOVAL

An invasive alien plant (IAP) species is defined as being a non-native, or exotic, species that occurs outside of its natural distribution range and may cause damage to the ecosystem, environment and/or economy and often results in the displacement of indigenous species.

IAP species are characterised by their rapid reproduction and spread in new environments due to their (i) highly competitive growth rates that allow them to outcompete local indigenous species, (ii) their resistance to local diseases and (iii) their lack of natural enemies in new environments.



IAP's must not be confused with exotic/introduced species and weeds. These definitions are outlined in Box 1 below.

Box 1: Definitions explaining the difference between an exotic/introduced species, weeds and emerging weeds	
Term	Definition
<i>Alien Invasive Plant Species</i>	Alien invasive plant species are non-native, or exotic, species that occurs outside of its natural distribution range and may cause damage to the ecosystem, environment and/or economy and often results in the displacement of indigenous species.
<i>Exotic or Introduced species</i>	<i>Exotic species</i> , which are also known as introduced, <i>alien</i> or <i>non-indigenous species</i> , are <i>species of plants</i> that occur outside of their native distribution range but are not necessarily invasive. These species have been intentionally or accidentally moved by humans to areas outside of their native ranges. For example, ornamental species such as roses are considered to be exotic.
<i>Weed</i>	A weed species is considered an undesirable species in a particular place and can be either indigenous or exotic, invasive or not.

Invasive alien plant species within the project site need to be controlled for the following reasons:

- **They present a fire risk.** The large available biomass provides a large fuel load that will easily ignite if lit. This not only poses a threat to nearby homesteads but could also result in unwanted erosion, especially in areas with steep slopes.
- **They threaten water security.** Studies in South Africa have shown how alien invasive species notably reduce the country's water resources which has far reaching ecological, economic and social implications. For example, it is estimated that one large Eucalyptus tree uses between 100-1000 litres of water per day.
- **They threaten biodiversity.** AIP's threaten to displace indigenous vegetation and could result in local extinctions if not controlled.

Three types of control methods are used to control IAP species:

- **Mechanical Control:** This is the physical removal or destruction of plants and includes techniques such as hand-pulling, felling, uprooting, ringbarking, cutting/slashing, strip-barking or mowing. The type of mechanical control used will depend on the species, the level of infestation and the steepness of the slopes and accessibility on which the species occur. Controlled burns can be used in conjunction with the mechanical removal of a species.
- **Chemical Control:** This method uses herbicides (plant poison) to kill targeted plant species. It is important that the appropriate herbicide is selected for the species and purpose required as these poisons can often do more harm than good, especially when working near wetlands and water courses.
- **Biological Control:** This is the use of a species' natural enemies (biological control agents) to remove a plant's competitive advantage and thereby reduce population vigour. This method is usually only effective in the long term.



An integrated approach to control IAP species is often used and employs at least two of these primary elements of control.

3.1.1. Manual and Mechanical Control methods

- **Hand pulling:** The removal of the entire plant and roots by hand. This method is recommended for seedlings/juvenile plants where the plants are small enough to be pulled out successfully with the roots intact. This method is recommended for sparsely invaded areas when the soil is damp or soft.
- **Ring Barking:** The removal of the trees bark and cambium, in a horizontal 30 cm band (about 50 cm from the ground). This method is used to kill large trees. If herbicide is used it must be applied immediately after ring barking on the cut area.
- **Cut Stumping:** The cutting of trees as low to the ground as possible with a saw, chainsaw or cane knife. If herbicide is used it must be applied to the cut surface immediately.
- **Slashing:** The control of annuals by slashing seed stalks and/or branches with a cane knife, machete, slasher or brush cutter before seeds mature. This is generally a low cost method of reducing the presence of viable seeds that will germinate in the new season.
- **Strip barking:** The stripping of bark from waist height to the base of the trunk using an axe or cane knife. If herbicide is used it must be applied immediately to the stripped surface area.
- **Frilling:** The cutting of an angled groove into the bark and cambium around the entire tree trunk. Herbicide is then applied into the groove which kills the tree as it seeps into the cambium. This method is effective for small trees as it is quicker and more cost effective than ring barking or strip barking.

3.1.2. Chemical Control methods

- **Foliar Spraying:** The spraying of leaves, on plants below 1 m, to the point of run-off using a knapsack sprayer. This method is more cost effective than stump treatment as fewer people are required to treat large areas. However, it does require large amounts of clean water in which the herbicides are mixed. All team members using this method must be trained and certified before using this technique.
- **Handheld spraying:** The application of herbicide after cut stumping, ring barking, frilling and strip-barking using a handheld sprayer with an adjustable nozzle to achieve the correct spray width. This method is cheap and the application of herbicide is accurate. As with the foliar spray, all team members must receive training on how to use this sprayer effectively.
- **Injection:** The application of herbicide directly into the plant by drilling or punching downward slanting holes into the tree around the circumference of the stem/trunk and then injecting the chemical into these holes.



3.1.3. *Specific Control per species*

Working for Water (2007) have developed management guides for IAP that are species specific. These guides inform the user of the best method to remove each species based on its size class and where herbicides are required, provides the recommended herbicide type and dosage as well as the estimated amount of product required per hectare of land treated. IAP species recorded at the project site have been included in Appendix B.

3.1.4. *Disposal of Plant Material*

Plant material without seeds can be used beneficially where possible. Large timber can be sold as firewood to offset some of the clearing costs associated with this plan. Other material can be chipped and used as mulch or compost, provided there are no seeds present.

Material that cannot be used because of the presence of seeds must be disposed of at a registered and approved waste disposal site.



4 MONITORING AND EVALUATION

The Applicant will ensure that this Rehabilitation Plan is reviewed for efficacy, and any necessary changes thereto will be reflected in the periodic revisions of this document. A summary of all rehabilitation monitoring activities and outcomes will need to be included in the annual performance monitoring report.

5 REFERENCES

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APPENDIX A: INDIGENOUS SPECIES EXPECTED TO OCCUR ON SITE AND WHICH CAN BE USED FOR REHABILITATION

Family	Species	Recorded	POSA
Acanthaceae	<i>Barleria macrostegia</i>		x
	<i>Barleria obtusa</i>		x
	<i>Blepharis stainbankiae</i>		x
	<i>Crabbea acaulis</i>		x
Agapanthaceae	<i>Agapanthus campanulatus</i>		x
Agavaceae	<i>Chlorophytum bowkeri</i>		x
	<i>Chlorophytum fasciculatum</i>		x
Aizoaceae	<i>Delosperma sp.</i>		x
	<i>Hereroa sp.</i>		x
	<i>Khadia acutipetala</i>		x
	<i>Lithops lesliei</i>		x
	<i>Mossia intervallaris</i>		x
Alismataceae	<i>Alisma plantago-aquatica</i>		x
Alliaceae	<i>Tulbaghia leucantha</i>		x
Amaranthaceae	<i>Achyranthes aspera</i>		x
	<i>Amaranthus muricatus</i>		x
	<i>Chenopodium album</i>		x
	<i>Chenopodium schraderianum</i>		x
	<i>Chenopodium sp.</i>		x
	<i>Chenopodium stellulatum</i>		x
Amaryllidaceae	<i>Boophone disticha</i>	x	
	<i>Crinum bulbispermum</i>		x
	<i>Crinum graminicola</i>		x
	<i>Haemanthus humilis</i>		x
	<i>Scadoxys punicens</i>	x	
Anacardiaceae	<i>Searsia discolor</i>		x
	<i>Searsia lancea</i>	x	



Family	Species	Recorded	POSA
	<i>Searsia leptodictya</i>		X
	<i>Searsia magalismontana</i>		X
	<i>Searsia rigida</i>	X	X
Apiaceae	<i>Afroscidium magalismontanum</i>		X
	<i>Alepidea peduncularis</i>		X
	<i>Bupleurum mundii</i>		X
	<i>Heteromorpha arborescens</i>		X
Apocynaceae	<i>Ancylobotrys capensis</i>		X
	<i>Asclepias adscendens</i>		X
	<i>Asclepias aurea</i>		X
	<i>Asclepias eminens</i>		X
	<i>Asclepias fallax</i>		X
	<i>Asclepias fulva</i>		X
	<i>Asclepias gibba</i>		X
	<i>Aspidoglossum biflorum</i>		X
	<i>Aspidoglossum lamellatum</i>		X
	<i>Cordylogyne globosa</i>		X
	<i>Gomphocarpus sp.</i>	X	
	<i>Pachycarpus schinzianus</i>		X
	<i>Parapodium costatum</i>		X
	<i>Pentarrhinum insipidum</i>	X	
	<i>Raphionacme hirsuta</i>		X
	<i>Raphionacme velutina</i>		X
	<i>Schizoglossum periglossoides</i>		X
	<i>Stenostelma umbelliferum</i>		X
<i>Xysmalobium undulatum</i>		X	
Aquifoliaceae	<i>Ilex mitis</i>		X
Asparagaceae	<i>Agave americana</i>	X	
	<i>Agave sisalana</i>	X	
	<i>Asparagus cooperi</i>	X	X
	<i>Asparagus laricinus</i>	X	X
	<i>Asparagus setaceus</i>		X



Family	Species	Recorded	POSA
	<i>Asparagus suaveolens</i>		X
Asphodelaceae	<i>Aloe jeppeae</i>		X
	<i>Aloe marlothii</i>		X
	<i>Aloe sp.</i>		X
	<i>Aloe verecunda</i>		X
	<i>Aloe zebrina</i>	X	
	<i>Bulbine narcissifolia</i>		X
	<i>Kniphofia ensifolia</i>		X
	<i>Trachyandra erythrorrhiza</i>		X
	<i>Trachyandra laxa</i>		X
	<i>Trachyandra saltii</i>		X
	Asteraceae	<i>Afroaster peglerae</i>	
<i>Afroaster serrulatus</i>			X
<i>Athrixia angustissima</i>			X
<i>Athrixia elata</i>			X
<i>Athrixia phyllicoides</i>			X
<i>Barkheya zeyheri</i>		X	
<i>Berkheya seminivea</i>			X
<i>Berkheya zeyheri</i>			X
<i>Brachylaena sp.</i>			X
<i>Cineraria aspera</i>			X
<i>Cineraria longipes</i>			X
<i>Cineraria lyratiformis</i>			X
<i>Conyza podocephala</i>			X
<i>Cotula coronopifolia</i>			X
<i>Cotula microglossa</i>			X
<i>Cotula nigellifolia</i>			X
<i>Crepis hypochaeridea</i>			X
<i>Denekia capensis</i>			X
<i>Dimorphotheca spectabilis</i>			X
<i>Felicia filifolia</i>		X	X
<i>Garuleum woodii</i>		X	



Family	Species	Recorded	POSA
	<i>Gazania sp.</i>	x	
	<i>Gerbera viridifolia</i>	x	
	<i>Haplocarpha scaposa</i>	x	
	<i>Helichrysum aureum</i>		x
	<i>Helichrysum caespititium</i>		x
	<i>Helichrysum cephaloideum</i>		x
	<i>Helichrysum chionosphaerum</i>		x
	<i>Helichrysum harveyanum</i>		x
	<i>Helichrysum kraussii</i>		x
	<i>Helichrysum lepidissimum</i>		x
	<i>Helichrysum mundtii</i>		x
	<i>Helichrysum nudifolium</i>		x
	<i>Helichrysum rugulosum</i>		x
	<i>Helichrysum setosum</i>		x
	<i>Hilliaraella oligocephala</i>	x	
	<i>Hilliardiella aristata</i>		x
	<i>Hilliardiella elaeagnoides</i>		x
	<i>Hilliardiella hirsuta</i>		x
	<i>Hilliardiella sutherlandii</i>		x
	<i>Lopholaena coriifolia</i>		x
	<i>Nidorella anomala</i>		x
	<i>Osteospermum scariosum</i>		x
	<i>Phymaspermum athanasioides</i>		x
	<i>Pseudopegoletia tenella</i>		x
	<i>Schistostephium crataegifolium</i>		x
	<i>Schkuhria pinnata</i>		x
	<i>Senecio asperulus</i>		x
	<i>Senecio coronatus</i>		x
	<i>Senecio harveianus</i>		x
	<i>Senecio hieracioides</i>		x
	<i>Senecio lydenburgensis</i>		x
	<i>Senecio sp.</i>		x



Family	Species	Recorded	POSA
	<i>Tagetes minuta</i>		x
	<i>Tarchonanthus camphoratus</i>		x
	<i>Ursinia nana</i>		x
Bignoniaceae	<i>Jacaranda mimosifolia</i>	x	
	<i>Tecomaria capensis</i>	x	
Boraginaceae	<i>Cynoglossum hispidum</i>		x
	<i>Erhetia ridiga</i>	x	
Brassicaceae	<i>Lepidium mossii</i>		x
	<i>Nasturtium officinale</i>		x
	<i>Rorippa nudiuscula</i>		x
Cactaceae	<i>Cereus jamacara</i>	x	
	<i>Opuntia ficus-indica</i>	x	
Cannabaceae	<i>Celtis africana</i>	x	
Caryophyllaceae	<i>Dianthus mooiensis</i>		x
	<i>Pollichia campestris</i>		x
Celastraceae	<i>Gymnosporia polyacantha</i>	x	
	<i>Maytenus c.f. tenuispina</i>	x	
	<i>Pterocelastrus echinatus</i>		x
Cleomaceae	<i>Cleome conrathii</i>		x
	<i>Cleome maculata</i>		x
	<i>Cleome monophylla</i>		x
Colchicaceae	<i>Gloriosa superba</i>	x	
Combretaceae	<i>Combretum erythrophyllum</i>		x
Commelinaceae	<i>Cyanotis speciosa</i>		x
Convolvulaceae	<i>Cuscuta campestris</i>		x
	<i>Falkia oblonga</i>		x
	<i>Ipomoea bathycolpor</i>	x	
	<i>Ipomoea crassipes</i>		x
	<i>Ipomoea oblongata</i>		x
Crassulaceae	<i>Cotyledon orbiculata</i>	x	
	<i>Crassula alba</i>		x
	<i>Crassula arborescens</i>		x



Family	Species	Recorded	POSA
	<i>Crassula capitella</i>		x
	<i>Crassula setulosa</i>		x
Cucurbitaceae	<i>Coccinia adoensis</i>		x
	<i>Cucumis hirsutus</i>		x
	<i>Cucumis zeyheri</i>		x
	<i>Kedrostis africana</i>		x
Cyperaceae	<i>Abildgaardia ovata</i>		x
	<i>Bulbostylis burchellii</i>		x
	<i>Cyperus congestus</i>		x
	<i>Cyperus denudatus</i>		x
	<i>Cyperus longus</i>		x
	<i>Cyperus obtusiflorus</i>	x	x
	<i>Fimbristylis complanata</i>		x
	<i>Fuirena coerulescens</i>		x
	<i>Fuirena pubescens</i>		x
	<i>Isolepis cernua</i>		x
	<i>Isolepis costata</i>		x
	<i>Isolepis fluitans</i>		x
	<i>Kyllinga pulchella</i>		x
	<i>Schoenoplectus muriculatus</i>		x
<i>Scirpoides burkei</i>		x	
Droseraceae	<i>Drosera burkeana</i>		x
Ebenaceae	<i>Diospyros austro-africana</i>		x
	<i>Diospyros lycioides</i>		x
	<i>Euclea crispa</i>	x	x
Ericaceae	<i>Erica drakensbergensis</i>		x
	<i>Erica woodii</i>		x
Euphorbiaceae	<i>Acalypha angustata</i>		x
	<i>Ricinus communis</i>		x
	<i>Spirostachys africana</i>		x
Fabaceae	<i>Abrus laevigatus</i>		x
	<i>Acacia caffra</i>	x	



Family	Species	Recorded	POSA
	<i>Acacia dealbata</i>		X
	<i>Acacia mearnsii</i>	X	
	<i>Argyrolobium rupestre</i>		X
	<i>Argyrolobium tuberosum</i>		X
	<i>Crotalaria distans</i>		X
	<i>Dichilus lebeckioides</i>		X
	<i>Dichilus strictus</i>		X
	<i>Elephantorrhiza elephantina</i>		X
	<i>Eriosema burkei</i>		X
	<i>Erythrina zeyheri</i>		X
	<i>Indigastrium burkeanum</i>		X
	<i>Indigastrium fastigiatum</i>		X
	<i>Indigofera dimidiata</i>		X
	<i>Indigofera hedyantha</i>		X
	<i>Indigofera hilaris</i>		X
	<i>Indigofera obscura</i>		X
	<i>Indigofera oxytropis</i>		X
	<i>Indigofera zeyheri</i>		X
	<i>Lablab purpureus</i>		X
	<i>Leobordea foliosa</i>		X
	<i>Lessertia mossii</i>		X
	<i>Lotononis macrosepala</i>		X
	<i>Macrotyloma axillare</i>		X
	<i>Melolobium wilmsii</i>		X
	<i>Mundulea sericea</i>		X
	<i>Pearsonia cajanifolia</i>		X
	<i>Rhynchosia adenodes</i>		X
	<i>Rhynchosia nervosa</i>		X
	<i>Rhynchosia pedunculata</i>		X
	<i>Rhynchosia reptabunda</i>		X
	<i>Rhynchosia sordida</i>		X
	<i>Rhynchosia totta</i>		X



Family	Species	Recorded	POSA
	<i>Senegalia caffra</i>		X
	<i>Senegalia hereroensis</i>		X
	<i>Tephrosia longipes</i>		X
	<i>Tephrosia semiglabra</i>		X
	<i>Trifolium africanum</i>		X
	<i>Vicia sativa</i>		X
	<i>Vigna vexillata</i>		X
	<i>Zornia linearis</i>		X
Geraniaceae	<i>Geranium multisectum</i>		X
	<i>Monsonia angustifolia</i>		X
	<i>Pelargonium sidoides</i>		X
Gunneraceae	<i>Gunnera perpensa</i>		X
Hyacinthaceae	<i>Drimia angustifolia</i>		X
	<i>Eucomis sp.</i>		X
	<i>Ledebouria cooperi</i>		X
	<i>Ledebouria inquinata</i>		X
	<i>Ledebouria marginata</i>	X	
Hypericaceae	<i>Hypericum aethiopicum</i>		X
Hypoxidaceae	<i>Hypoxis acuminata</i>		X
	<i>Hypoxis hemerocallidea</i>	X	
	<i>Hypoxis multiceps</i>	X	X
	<i>Pauridia canaliculata</i>		X
Iridaceae	<i>Babiana bainesii</i>		X
	<i>Gladiolus crassifolius</i>		X
	<i>Gladiolus papilio</i>		X
	<i>Gladiolus permeabilis</i>		X
	<i>Gladiolus sericeovillosus</i>		X
	<i>Gladiolus sericeovillosus</i>		X
	<i>Moraea pallida</i>		X
	<i>Moraea simulans</i>		X
	<i>Tritonia nelsonii</i>		X
Juncaceae	<i>Juncus exsertus</i>		X



Family	Species	Recorded	POSA
	<i>Juncus oxycarpus</i>		X
Lamiaceae	<i>Ajuga ophrydis</i>		X
	<i>Leonotis schinzii</i>	X	X
	<i>Mentha aquatica</i>		X
	<i>Ocimum obovatum</i>	X	
	<i>Salvia runcinata</i>		X
	<i>Syncolostemon pretoriae</i>		X
	<i>Teucrium trifidum</i>		X
Lobeliaceae	<i>Cyphia assimilis</i>		X
	<i>Lobelia erinus</i>		X
	<i>Lobelia flaccida</i>		X
	<i>Monopsis decipiens</i>		X
Lythraceae	<i>Nesaea sagittifolia</i>		X
	<i>Nesaea schinzii</i>		X
Malvaceae	<i>Dombeya rotundifolia</i>	X	
	<i>Hermannia coccocarpa</i>		X
	<i>Hermannia cordata</i>		X
	<i>Hermannia depressa</i>	X	X
	<i>Hermannia geniculata</i>		X
	<i>Hermannia grandistipula</i>		X
	<i>Hermannia lancifolia</i>		X
	<i>Hermannia sp.</i>		X
	<i>Hibiscus microcarpus</i>	X	
	<i>Melhania prostrata</i>		X
	<i>Sida chrysantha</i>		X
<i>Sida rhombifolia</i>		X	
Meliaceae	<i>Melia azedarach</i>	X	
Menispermaceae	<i>Antizoma angustifolia</i>		X
Molluginaceae	<i>Psammotropha myriantha</i>		X
Moraceae	<i>Ficus sp.</i>	X	
Myrsinaceae	<i>Myrsine africana</i>		X
Oleaceae	<i>Menodora africana</i>	X	



Family	Species	Recorded	POSA
Onagraceae	<i>Oenothera tetraptera</i>		X
Orchidaceae	<i>Eulophia hians</i>		X
	<i>Habenaria bicolor</i>		X
	<i>Habenaria epipactidea</i>		X
	<i>Satyrium hallackii</i>		X
Orobanchaceae	<i>Harveya huttonii</i>		X
	<i>Harveya speciosa</i>		X
	<i>Striga bilabiata</i>		X
Phytolaccaceae	<i>Phytolacca dioica</i>	X	
	<i>Phytolacca octandra</i>		X
Pinaceae	<i>Pinus sp.</i>	X	
Plantaginaceae	<i>Plantago lanceolata</i>		X
	<i>Veronica anagallis-aquatica</i>		X
Poaceae	<i>Agrostis eriantha</i>		X
	<i>Alloteropsis semialata</i>		X
	<i>Andropogon appendiculatus</i>		X
	<i>Andropogon schirensis</i>		X
	<i>Aristida bipartita</i>		X
	<i>Aristida canescens</i>		X
	<i>Aristida diffusa</i>		X
	<i>Aristida sp.</i>		X
	<i>Arundinella nepalensis</i>		X
	<i>Brachiaria serrata</i>		X
	<i>Chloris virgata</i>	X	X
	<i>Cymbopogon caesius</i>		X
	<i>Cynodon transvaalensis</i>		X
	<i>Digitaria diagonalis</i>		X
	<i>Digitaria monodactyla</i>		X
	<i>Digitaria ternata</i>		X
<i>Digitaria tricholaenoides</i>		X	
<i>Diheteropogon amplexans</i>		X	
<i>Echinochloa jubata</i>		X	



Family	Species	Recorded	POSA
	<i>Elionurus muticus</i>		X
	<i>Eragrostis capensis</i>		X
	<i>Eragrostis curvula</i>		X
	<i>Eragrostis nindensis</i>		X
	<i>Eragrostis sclerantha</i>		X
	<i>Eragrostis sp.</i>		X
	<i>Eragrostis stapfii</i>		X
	<i>Eragrostis tef</i>		X
	<i>Eustachys paspaloides</i>		X
	<i>Harpochloa falx</i>		X
	<i>Helictotrichon sp.</i>		X
	<i>Heteropogon contortus</i>		X
	<i>Hyparrhenia dregeana</i>		X
	<i>Hyparrhenia hirta</i>		X
	<i>Imperata cylindrica</i>		X
	<i>Koeleria capensis</i>		X
	<i>Leersia hexandra</i>		X
	<i>Leptochloa fusca</i>		X
	<i>Lolium multiflorum</i>		X
	<i>Lolium perenne</i>		X
	<i>Miscanthus junceus</i>		X
	<i>Panicum coloratum</i>		X
	<i>Panicum maximum</i>		X
	<i>Panicum repens</i>		X
	<i>Panicum schinzii</i>		X
	<i>Panicum sp.</i>	X	
	<i>Paspalum dilatatum</i>		X
	<i>Paspalum distichum</i>		X
	<i>Pennisetum sphacelatum</i>		X
	<i>Phragmites australis</i>		X
	<i>Poa annua</i>		X
	<i>Setaria nigrirostris</i>		X



Family	Species	Recorded	POSA
	<i>Setaria sp.</i>	x	
	<i>Setaria sphacelata</i>		x
	<i>Sporobolus natalensis</i>		x
	<i>Sporobolus pectinatus</i>		x
	<i>Sporobolus sp.</i>		x
	<i>Themeda triandra</i>	x	
	<i>Trachypogon spicatus</i>		x
	<i>Trichoneura grandiglumis</i>		x
	<i>Tristachya leucothrix</i>	x	x
	<i>Urelytrum agropyroides</i>		x
	<i>Urochloa panicoides</i>		x
Polygalaceae	<i>Muraltia empetroides</i>		x
	<i>Polygala houtboshiana</i>		x
	<i>Polygala illepada</i>		x
Polygonaceae	<i>Persicaria decipiens</i>		x
	<i>Persicaria madagascariensis</i>		x
	<i>Rumex conglomeratus</i>		x
Polypodiaceae	<i>Pleopeltis macrocarpa</i>		x
Potamogetonaceae	<i>Potamogeton pectinatus</i>		x
Proteaceae	<i>Leucospermum cuneiforme</i>		x
	<i>Protea caffra</i>		x
Pteridaceae	<i>Adiantum raddianum</i>		x
	<i>Cheilanthes quadripinnata</i>		x
Ranunculaceae	<i>Ranunculus dregei</i>		x
	<i>Ranunculus multifidus</i>		x
Rhamnaceae	<i>Ziziphus zeyheriana</i>	x	x
Rosaceae	<i>Cliffortia nitidula</i>		x
	<i>Erobotrya japonica</i>	x	
	<i>Rubus rigidus</i>		x
Rubiaceae	<i>Afrocanthium gilfillanii</i>		x
	<i>Anthospermum hispidulum</i>		x
	<i>Galium capense</i>		x



Family	Species	Recorded	POSA
	<i>Galium spurium-aparine</i>		x
	<i>Kohautia amatymbica</i>	x	
	<i>Pentanisia angustifolia</i>	x	x
	<i>Vangueria infausta</i>		x
Santalaceae	<i>Osyris lanceolata</i>	x	x
	<i>Thesium costatum</i>		x
	<i>Thesium deceptum</i>		x
	<i>Thesium exile</i>		x
	<i>Thesium rasum</i>		x
	<i>Thesium sp.</i>		x
	<i>Thesium transvaalense</i>		x
	<i>Thesium utile</i>		x
	<i>Thesium zeyheri</i>		x
Sapindaceae	<i>Pappea capensis</i>		x
Sapotaceae	<i>Mimusops zeyheri</i>		x
Scrophulariaceae	<i>Buddleja saligna</i>		x
	<i>Diclis rotundifolia</i>		x
	<i>Jamesbrittenia burkeana</i>		x
	<i>Selago capitellata</i>		x
Solanaceae	<i>Datura stramonium</i>		x
	<i>Physalis angulata</i>		x
	<i>Solanum campylacanthum</i>		x
	<i>Solanum humile</i>		x
	<i>Solanum mauritianum</i>	x	
	<i>Solanum retroflexum</i>		x
	<i>Solanum sisymbriifolium</i>	x	x
	<i>Solanum sp.</i>	x	
<i>Withania somnifera</i>		x	
Thymelaeaceae	<i>Gnidia caffra</i>	x	
	<i>Lasiosiphon caffer</i>		x
	<i>Lasiosiphon capitatus</i>		x
	<i>Lasiosiphon kraussianus</i>		x



Family	Species	Recorded	POSA
	<i>Passerina falcifolia</i>		x
Verbenaceae	<i>Lippia wilmsii</i>		x
	<i>Verbena aristigera</i>	x	
	<i>Verbena bonariensis</i>	x	
Vitaceae	<i>Rhoicissus tridentata</i>	x	x



6 APPENDIX B: LIST OF INVASIVE ALIEN PLANT SPECIES RECORDED ON SITE

Species	Common name	Expected	Present	CARA	NEMA
<i>Acacia dealbata</i>	Silver wattle	x		2	2
<i>Acacia mearnsii</i>	Black wattle		x	2	2
<i>Achyranthes aspera</i>	Burweed	x		1	
<i>Agave sisalana</i>	Sisal		x	2	2
<i>Alisma plantago-aquatica</i>	Mud plantain	x			1b
<i>Cereus jamacaru</i>	Queen of the night		x	1	1b
<i>Cuscuta campestris</i>	Common dodder	x		1	1b
<i>Datura stramonium</i>	Common thorn apple	x		1	1b
<i>Eucalyptus grandis</i>	Saligna gum		x	2	1b
<i>Jacaranda mimosifolia</i>	Jacaranda		x	3	1b
<i>Melia azedarach</i>	Seringa		x	3	1b
<i>Nasturtium officinale</i>	Watercress	x			2
<i>Opuntia ficus-indica</i>	Prickly-pear		x	1	1b
<i>Phytolacca dioica</i>	Belhambra		x	3	3
<i>Phytolacca octandra</i>	Forest inkberry	x			1b
<i>Pinus sp.</i>	Pine		x	2	
<i>Ricinus communis</i>	Castor-oil plant	x		2	2
<i>Solanum mauritianum</i>	Bugweed		x	1	1b
<i>Solanum sisymbriifolium</i>	Wild tomato	x	x	2	1b
<i>Solanum sp.</i>			x		1b
<i>Verbena bonariensis</i>	Purple top		x		1b