
OPEN SPACE & ALIEN PLANT MANAGEMENT PLAN

1. PURPOSE

Invasive alien species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Plant Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Konkoosies II PV Facility. The broad objectives of the plan include the following:

- » Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment.
- » Develop and implement a monitoring and eradication programme for alien and invasive species.
- » Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

2. RELEVANT ASPECTS OF THE SITE

Prosopis glandulosa (Mesquite) a Category 3 invader species (refer below) was recorded on the site during both the EIA and walk-through surveys. This is a multi-stemmed acacia-like shrub or small tree up to 10m in height with paired, straight spines and reddish-brown branchlets (refer to Photograph 1 below).



Photograph 1: *Prosopis glandulosa* (Mesquite)

Prosopis trees are extravagant users of readily available groundwater and dense stands could seriously affect the hydrology of the ecosystems they invade. Dense stands compete with and replace indigenous woody and grassland species. Dense stands produce few pods and thus replace natural pasturage without providing pods in return. Dense stands are virtually impenetrable, restricting the movement of domestic and wild animals and causing injuries.

A guide to identification of other alien invader species which could be problematic at PV facilities in arid areas such as is the case for the Aggeneys PV Facility is included within Appendix A.

3. LEGISLATIVE CONTEXT

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

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

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

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

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

- » Category 1a: Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

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

Plants listed under the categories above are detailed within Notice 1 of the Alien and Invasive Species published in GNR599 of 01 August 2014. The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza, Pretoria.

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

4. ALIEN PLANT MANAGEMENT PRINCIPLES

4.1. Prevention and early eradication

A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas.

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

4.2. Containment and control

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

4.3. General Clearing & Guiding Principles

Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. The lighter infested areas should be cleared first to prevent the build-up of seed banks. Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently. Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses. All clearing actions should be monitored and documented to keep records of which areas are due for follow-up clearing.

i. Clearing Methods

Different species require different clearing methods such as manual, chemical or biological methods or a combination of both. Care should however be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.

Fire should not be used for alien control or vegetation management at the site. The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. <http://www.dwaf.gov.za/wfw/Control/>

» Mechanical control

This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical

treatment. Mechanical control is labour intensive and therefore expensive, and could cause severe soil disturbance and erosion.

» **Chemical Control**

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which resprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- * Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- * All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- * Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- * To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- * Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- * The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following Regulations and guidelines should be followed:

- * Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.
- * Pesticide Management Policy for South Africa published in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) – GNR 1120 of 2010.
- * South African Bureau of Standards, Standard SANS 10206 (2010)

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

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

» **Biological control**

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

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

4.4. General management practices

The following general management practices should be encouraged or strived for:

- » Establish an ongoing monitoring programme for construction phase to detect and quantify any alien species that may become established and identify the problem species.
- » Alien vegetation regrowth on areas disturbed by construction must be immediately controlled once recorded throughout the entire site during construction and operation.
- » Care must be taken to avoid the introduction of alien invasive plant species to the site. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.
- » Cleared areas that have become invaded by alien species can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.
- » The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control until late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.

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- » Alien management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
 - » Some alien species are best individually pulled by hand and in the case of *Opuntia* removed from the site.
 - » Regular vegetation control to reduce plant biomass within the site should be conducted. This should be timed so as to coincide with the critical growth phases of the most important alien species on site. This will significantly reduce the cost of alien management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.
 - » No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used
 - » During operation, surveys for alien species should be conducted regularly. It is recommended that this be undertaken every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared using appropriate means.

4.5. Monitoring

In order to monitor the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide an assessment of the magnitude of alien invasion on site as well as an assessment of the success of the management programme.

In general, the following principles apply for monitoring:

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

The following monitoring should be implemented to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Preconstruction & monthly thereafter
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

Operation Phase

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

**APPENDIX A:
GUIDE TO IDENTIFICATION OF ALIEN
INVADER SPECIES AT PV FACILITIES IN
ARID AREAS**

ALIEN & PROBLEM SPECIES IDENTIFICATION GUIDE .



***IDENTIFICATION GUIDE FOR PROBLEM SPECIES
ASSOCIATED WITH PV FACILITIES IN THE ARID PARTS OF
SOUTH AFRICA***

PRODUCED BY
SIMON TODD CONSULTING



Simon Todd Pr.Sci.Nat
C: 082 3326502
O: 021 782 0377
Simon.Todd@3foxes.co.za

60 Forrest Way
Glencairn
7975

Ecological Solutions for
People & the Environment

Simon.Todd@3foxes.co.za

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PROBLEM & LEGISLATIVE BACKGROUND

Alien plants require management because they may impact biodiversity as well as the provision of ecosystem services which contribute to human livelihoods and well-being. In recognition of these impacts, South Africa has legislation in place which requires landowners to clear or prevent the spread of certain declared weeds from their properties. Within the context of PV Plants, alien plant invasion can be problematic as they may shade the panels with direct economic consequences, increase the risk of fire within the plant, spread into the surrounding natural vegetation or be more costly or difficult to control than the indigenous vegetation.

In terms of the legislation, the Conservation of Agricultural Resources Act (CARA, Act 43 of 1983), as amended in 2001, requires that landusers clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties. Table 3 of CARA lists all declared weeds and invader plants that must be controlled. Alien plants are divided into 3 categories based on their risk and potential impact as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a landuser must obtain a water use licence as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species:

Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

RECOMMENDED MANAGEMENT PRACTICE & CLEARING METHODS

Alien species are adept at taking advantage of disturbance and many of their traits are linked to this ability. This usually includes the ability to produce large amounts of seed or being flexible in terms of their size, growth form or reproductive strategy. Alien plant control strategies

therefore need to focus on these key attributes while management practices need to ensure that they do not create circumstances under which alien species are encouraged or can thrive. Perhaps the most important aspects in this regard are minimising disturbance and ensuring the retention of indigenous vegetation as far as possible.

It is important to note that it is not possible or practical to prevent alien species from entering PV sites as seed during construction. There are many alien species usually already present in the immediate area along roadsides and other disturbed areas. The relatively large amount of disturbance created during construction will usually render a site vulnerable to invasion for some time and it is likely that many alien species from the local species pool will invade a site over time.

The following general principles and observations are likely to occur at most PV plants following construction:

- There is likely to be a progression of alien species presence and abundance at a site over time. Initially, alien species are likely to be a significant and persistent problem due to the high levels of disturbance following construction. Most alien species are poor competitors and the lack of indigenous vegetation cover will encourage the growth of alien species. Provided that alien species are controlled in a sensitive manner, a cover of perennial grasses is likely to become well established at most sites with a couple of years. This should discourage alien species which, with additional control, should become considerably less conspicuous within 5 years. Some more competitive alien species may become established at this time and alien control strategies may need to be adapted over time to address the new problem species.
- Alien species presence will vary from year to year in terms of abundance, density and the identity of species present. This can be ascribed largely to variation in rainfall timing and amount, which will favour a different suite of species each year. Therefore, occasional outbreaks of certain species is not likely to be cause for concern, whereas a persistent high or increasing abundance of a species is indicative of a species where control may be required.
- Management practices will impact indigenous as well as alien species. The dominant management practice at most PV sites is likely to be mowing to control vegetation height and fire risk within the facility. Regular mowing encourages the growth of low and creeping forms and discourages tall growth forms. This principle is well demonstrated by garden lawns or sports fields where most alien species or weeds in the lawn can be eradicated simply through regular mowing. Within the context of many PV facilities, the grass *Cynodon dactylon* is likely to be key as this species is able to tolerate

mowing or heavy grazing and is likely to increase under a regular mowing regime. It does however not occur under very arid conditions.

Without being too prescriptive as the exact methods and approaches that should be used, the following general management practices should be encouraged or strived for at PV plants:

- Mowing excess vegetation by hand, for example with a weedeater, generates the lowest level of associated disturbance and is identified as the preferred method for vegetation control. However, this is time consuming and more mechanical means such as using a tractor with mower is also usually acceptable and can
- There is a target height to which vegetation should be cut. If the vegetation is cut too low, then recovery of the grass layer will be slow and this may encourage erosion and an increase in alien invasion. On the other hand, if the vegetation is not cut low enough, then recovery will be rapid and frequent follow-up control may be required. It is recommended that the target height for vegetation after mowing should be about 10-15cm.
- The maintenance of a fire-break around many PV facilities is an important safety control and the service road around the perimeter of most facilities should be maintained free of vegetation. This is best achieved by manual clearing. Within the facility itself, some vegetation recovery along the internal roads should be considered acceptable.
- Where dense stands of alien species have established that cannot be controlled by manual means, some use of herbicides may be acceptable. However, the associated safety precautions should be taken with regards to the appropriate application methods as well as the use of personal safety equipment. The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. <http://www.dwaf.gov.za/wfw/Control/>
- The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control till late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.

- Alien management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- Some alien species such as *Opuntia* (Prickly Pear) and trees such as *Prosopis* (Mesquite) are best individually pulled by hand when young and in the case of *Opuntia* removed from the site as the leaves are able to root and grow again.

ALIEN SPECIES IDENTIFICATION GUIDE FOR PV PLANTS

What follows is a short and by no means comprehensive guide to the alien and problem species that are frequently associated with solar PV facilities. The list includes some weedy indigenous species as these can become a problem or are frequently mistaken for alien species. The guide includes the commonly used English and Afrikaans common names for the species as well as whether or not the species is a listed alien under CARA. Each species illustrated is rated and colour coded according to the likely risk it poses as an alien invasive and the level of control that should be exercised in order to prevent the species from becoming a dominant pest. It is important to note that the list and guide is not exhaustive as it is impossible to predict which alien species may invade a given site as this depends not only on the environment, but also on the levels of disturbance created during construction and the identity of the species already present in the area.

List of alien species which are commonly observed within solar PV facilities and which may become a problem if not adequately controlled.

Family	Species	English name	Afrikaans name	Category
<i>Amaranthaceae</i>	<i>Alternanthera pungens</i>	Paperthorn	Kakiebubbeltjie	Not Listed
<i>Amaranthaceae</i>	<i>Amaranthus hybridus</i>	Common Pigweed	Kaapse Misbredie	Not Listed
<i>Amaranthaceae</i>	<i>Amaranthus viridus</i>	Slender Amaranth	Skraal Misbredie	Not Listed
<i>Amaranthaceae</i>	<i>Gomphrena celosioides</i>	Globe Amaranth	Mierbossie	Not Listed
<i>Amaranthaceae</i>	<i>Guilleminea densa</i>	Carrot Weed		Not Listed
<i>Apiaceae</i>	<i>Ciclospermum leptophyllum</i>	Wild Celery	Wildeseldery	Not Listed
<i>Asclepiadaceae</i>	<i>Asclepias fruticosa</i>	Shrubby Milkweed	Melkbos	Not Listed
<i>Asteraceae</i>	<i>Bidens pilosa</i>	Blackjack	Knapsekerel	Not Listed

<i>Asteraceae</i>	<i>Cirsium vulgare</i>	Scotch Thistle	Speerdissel	1
<i>Asteraceae</i>	<i>Conyza bonariensis</i>	Fleabane	Skraalhans	Not Listed
<i>Asteraceae</i>	<i>Lactuca seriola</i>	Wild Lettuce	Wildeslaai	Not Listed
<i>Asteraceae</i>	<i>Schkurgia pinnata</i>	Dwarf Marigold	Klainkakiebos	Not Listed
<i>Asteraceae</i>	<i>Senecio consanguineus</i>	Stravation Senecio	Hongerbos	Not Listed
<i>Asteraceae</i>	<i>Sonchus oleraceus</i>	Sowthistle	Sydissel	Not Listed
<i>Asteraceae</i>	<i>Tagetes minuta</i>	Khakiweed	Kakiebos	Not Listed
<i>Asteraceae</i>	<i>Taraxacum officinale</i>	Common Dandelion	Perdeblom	Not Listed
<i>Asteraceae</i>	<i>Tragopogon porrifolius/dubius</i>	Goat's Beard	Bokbaard	Not Listed
<i>Asteraceae</i>	<i>Verbena bonariensis</i>	Purple Top	Blouwaterbossie	Not Listed
<i>Asteraceae</i>	<i>Xanthium spinosum</i>	Spiny Cocklebur	Boetebossie	1
<i>Brassicaceae</i>	<i>Lepidium africanum</i>	Pepperweed	Peperbossie	Not Listed
<i>Brassicaceae</i>	<i>Sisymbrium thellungi</i>	Wild Mustard	Wildemosterd	Not Listed
<i>Cactaceae</i>	<i>Opuntia ficus indica</i>	Prickly Pear	Turksvy	1
<i>Cannabaceae</i>	<i>Cannabis sativa</i>	Cannabis	Dagga	Not Listed
<i>Chenopodiaceae</i>	<i>Atriplex semibaccatta</i>	Australian Saltbush	Brakbossie	Not Listed
<i>Chenopodiaceae</i>	<i>Chenopium carinatum</i>	Green Goosefoot	Groenhondebossie	Not Listed
<i>Chenopodiaceae</i>	<i>Chenopodium album</i>	White Goosefoot	Withondebossie	Not Listed
<i>Chenopodiaceae</i>	<i>Salsola kali</i>	Russian Tumbleweed	Rolbossie	Not Listed
<i>Fabaceae</i>	<i>Medicago lanciniata</i>	Little Burweed	Klitsklawer	Not Listed
<i>Fabaceae</i>	<i>Prosopis glandulosa</i>	Honey Mesquite	Heuningprosopis	2
<i>Malvaceae</i>	<i>Malva parviflora</i>	Mallow	Kiesieblaar	Not Listed
<i>Onagraceae</i>	<i>Oenothera indecora/stricta</i>	Evening Primrose	Nagblom	Not Listed
<i>Papaveraceae</i>	<i>Argemone ochroleuca</i>	Mexican Poppy	Bloudissel	1
<i>Polygonaceae</i>	<i>Emex australis</i>	Spiny Emex	Kaapse Dubbeltjie	Not Listed
<i>Polygonaceae</i>	<i>Polygonum aviculare</i>	Prostrate Knotweed	Voelduisendknop	Not Listed
<i>Polygonaceae</i>	<i>Rumex crispus</i>	Curly Dock	Tongblaar	Not Listed
<i>Solanaceae</i>	<i>Datura ferox</i>	Large Thorn Apple	Groot Stinkblaar	1

<i>Solanaceae</i>	<i>Nicotiana glauca</i>	Wild Tobacco	Wildetabak	1
<i>Zygophyllaceae</i>	<i>Tribulis terrestris</i>		Dubbeltjie	Not Listed

AMARANTHACEAE – *Amaranthus viridis*



Amaranthus viridis

There are several species of *Amaranthus* which may become problematic at PV sites, they are however all very similar in appearance and impact to *A. viridis*. Most species do not grow very tall as they are weedy and sprawling. As a result, they are not generally a significant problem, but they can become quite abundant, especially in wetter situations and are also quite persistent.

Concern Rating:

The overall level of threat posed by this and similar species is considered to be moderate. Control should be exercised where this species becomes dominant, but occasional plants are not likely to be considered a significant concern.

Broadleaf herbicides are used to control this species in cropland situations.

AMARANTHACEAE - *Gomphrena celosioides*



Gomphrena celosioides

Gomphrena celosioides is a South American weed that has become naturalised on South Africa. It is not usually a significant problem as it is low-growing and does not usually out-compete other vegetation. It may become common in areas where there is additional disturbance and moisture present.

The overall level of threat posed by this species is considered to be low. Specific control is unlikely to be required. It can be controlled manually by pulling if required.

AMARANTHACEAE - *Alternanthera pungens*



Alternanthera pungens

Alternanthera pungens is another South American weed that has become naturalised on South Africa. It is more of an irritation than a significant problem as the seeds stick to shoes and are easily spread. It can become a problem on bare areas where it is difficult to eradicate. As it can grow quite dense it can suppress other species.

The overall level of threat posed by this species is considered to be generally low. Specific control may be required in bare or sparsely vegetated areas, but it is unlikely to be a problem where there is a good cover of grass. It can be controlled manually by pulling if required.

APIACEAE - Ciclospermum leptophyllum



Ciclospermum leptophyllum

Ciclospermum leptophyllum is of South American origin. It is not usually a significant problem in arid areas and most sites are not wet enough for this species to grow sufficiently well or large enough to pose a significant problem.

The overall level of threat posed by this species is considered to be low. Specific control is not likely to be required and a low abundance of this species at the sites can be tolerated.

ASCLEPIADACEAE - *Asclepias fruticosa*



Asclepias fruticosa

Asclepias fruticosa is an indigenous weed. It can commonly be seen along road sides across the country. It can become a problem in disturbed sites such as old lands and may become a problem at PV sites due to its large size.

The overall level of threat posed by this species is considered to be low. Due to its large size, it takes more than one season to reach maturity and can be relatively easily controlled manually.

ASTERAEAE - *Bidens pilosa*



Bidens pilosa - Fruit



Bidens pilosa - Flowers

Bidens pilosa is common weed of disturbed places and the seeds that cling to clothes or animals are well known. Under the right circumstances this species can form fairly dense stands and it is quite tolerant of grass as a competitor. Due to its height, which can exceed 1m, this species is a potential problem at PV sites and should be monitored.

The overall level of threat posed by this species is considered to be moderate. However, as it is quite tall, regular mowing will quickly eradicate this species if mowing is done often enough.

ASTERAEAE - *Cirsium vulgare*



Cirsium vulgare

Cirsium vulgare is common weed of disturbed places and old lands. It is however usually associated with relatively moist environments and it is only likely to be a potential problem where there are large amounts of run-on moisture available. It is large and regular mowing will prevent this species from becoming a significant problem. It can however also grow as a rosette flat on the ground and may persist in mowed areas in this manner and so manual clearing may be necessary.

The overall level of threat posed by this species is considered to be moderate to low. It can be controlled manually quite easily if required.

ASTERAEAE - *Conyza bonariensis*



Conyza bonariensis

Conyza bonariensis is common weed of disturbed places such as roadsides and old lands. It is ubiquitous and very difficult to totally eradicate. Due to its' height, which can exceed 1m, this species is a potentially problem at the sites that should be monitored. There are several similar *Conyza* species which are very similar in appearance and ecological characteristics.

The overall level of threat posed by this species is considered to be moderate. It is resistant to mowing as young plants form a rosette. In cultivated situations broadleaf herbicides are used to control *Conyza* spp.

ASTERAEAE - *Lactuca seriola*



Lactuca seriola

Lactuca seriola is a wild relative of lettuce and is a common weed of disturbed places. This species can form fairly dense stands and it is quite difficult to eradicate once established. Due to its height, which can exceed 1m, this species is a potentially problem at PV sites and should be monitored if observed.

The overall level of threat posed by this species is considered to be moderate. It is difficult to control. In cultivated situations herbicides are used to control this species.

ASTERAEAE - *Schkuria pinnata*



Schkuria pinnata

Schkuria pinnata is common weed of disturbed places such as roadsides and fields. It is however uncommon within intact vegetation and it is not likely to be a strong competitor. It does not usually grow very large and it is unlikely that this species will be a significant problem at PV sites.

The overall level of threat posed by this species is considered to be low. With regular mowing the abundance of this species is likely to be kept to a low level.

ASTERAEAE - *Senecio consanguineus*



Senecio consanguineus

Senecio consanguineus is an indigenous species common in disturbed veld. It is an indicator of disturbance or overgrazing and with proper management the abundance of this species should decline naturally over time as the grass layer recovers.

The overall level of threat posed by this species is considered to be low. The plants are not usually large and it is not alien.

ASTERAEAE - *Sonchus oleraceus*



Sonchus oleraceus

Sonchus oleraceus is common weed of disturbed places. It may be difficult to control, but manual clearing of plants before they have flowered may be most effective.

The overall level of threat posed by this species is considered to be moderate to low. A good cover of grass will suppress this species and with some control, it is likely to decline over time.

ASTERAEAE - *Tagetes minuta*



Tagetes minuta

Tagetes minuta is common weed of disturbed places and has a very distinctive and strong smell when crushed. Control of this species is likely to be difficult as it is plastic with regards to germination and growth. A good cover of grass is however likely to retard the germination of this species and it is likely to only become a problem where bare areas persist within a site.

The overall level of threat posed by this species is considered to be moderate. Controlling this species with normal vegetation control mowing may not be successful and it should be monitored in case additional control measures need to be implemented.

ASTERAEAE - Tragopogon porrifolius



Tragopogon porrifolius

Tragopogon porrifolius is common weed of disturbed places, but is not likely to become a significant problem at PV sites as it is relatively small and is not likely to outcompete indigenous vegetation.

Although this species has a thick taproot which makes it difficult to control manually or with herbicides, it is not likely to become a significant problem at PV sites and is considered a low risk species.

ASTERAEAE - *Verbena bonariensis*



Verbena bonariensis

Verbena bonariensis is common weed of disturbed places such as roadsides. It can sometimes form fairly dense stands and as it quite tall, it is likely to shade the panels.

The overall level of threat posed by this species is considered to be moderate. It also lives for more than 1 year but appears to reproduce relatively slowly and could probably be controlled manually if required.

ASTERAEAE - Xanthium spinosum



Xanthium spinosum

Xanthium spinosum was the first declared weed in South Africa and is a Category 1 invader. It has tough burrs that stick to clothes or animals. It should be controlled whenever this plant is observed as large populations can be difficult to eradicate.

The overall level of threat posed by this species is considered to be moderate to high. It is a Category 1 invader and requires intensive control to eradicate. It is considered a significant threat, but if disturbance levels are kept as low as possible then it likely that this species will not be a big problem.

BRASSICACEAE - *Sisymbrium thellungi*



Sisymbrium thellungi

Sisymbrium thellungi or wild mustard can grow to 1m which makes it a potential problem. Under the dry conditions at most PV sites, it however rarely reaches this size except in wetter places.

The overall level of threat posed by this species is considered to be moderate to low. Under the dry conditions prevalent at most sites, it does not appear to be a very strong competitor and it is likely that manual control of occasional large plants will be sufficient to control this plant.

CACTACEAE - *Opuntia ficus indica*



Opuntia ficus-indica



Opuntia humifusa



Cylindropuntia imbricata

Prickly pears are likely to be brought onto PV sites by birds and other animals which feed on the fruits. As these plants can reproduce from leaves as well, plants need to be poisoned or removed to be killed. All *Opuntia* species are Category 1 invaders and must be controlled.

Although it is likely that these species will occasionally need to be controlled, they are relatively slow-growing and can easily be manually within the context of the Plant.

CANNABACEAE - *Cannabis sativa*



Cannabis sativa

Cannabis does not normally grow under the arid conditions that characterise most PV sites but it has been observed that seed is brought onto PV sites during construction, and then germinates and grows in wetter sites. Even if some plants are present after construction, it is highly unlikely that the populations will persist.

The overall level of threat posed by this species is considered to be Low. Although plants can grow large, they will not do so in an arid environment and it is likely that any populations present will die out naturally.

CHENOPODIACEAE - *Atriplex semibaccata*



Atriplex semibaccata

Atriplex semibaccata is a naturalised Australian weed common in semi-arid areas. Although it occasionally forms dense patches, it is not considered a significant problem as grazing animals usually utilise it to some degree. Within the context of PV plants, it is not likely to be a significant problem due to its low stature.

The overall level of threat posed by this species is considered to be low. It is naturalised and does not usually invade disturbed areas to a large degree.

CHENOPODIACEAE - Chenopodium album



Chenopodium album



Chenopodium carinatum

Chenopodium album and *carinatum* are similar weedy species of annual or biennial forbs. They can grow over 1m tall under good conditions and as a result may pose a potentially problem at PV sites. They are not usually highly invasive and are not likely to invade areas with intact ground cover.

The overall level of threat posed by this species is considered to be low. Although these species can grow quite large, they are not usually highly invasive in less disturbed environments. Large plants can be controlled manually if necessary.

CHENOPODIACEAE - *Salsola kali*



Salsola kali

Salsola kali is a widespread weed of disturbed places. The shrubs come loose from the soil when dry and roll around, packing up against fences sometimes pushing them over with the force of the wind. This species is a potentially problem at most PV sites and should be specifically monitored and controlled.

The overall level of threat posed by this species is considered to be moderate to high. This species can be difficult to eradicate and it can also cause problems when it rolls around. It can be very persistent. It should be cleared manually while still green, before the seed has been set.

MALVACEAE - *Malva parviflora*



Malva parviflora

Malva parviflora can act as an annual or a perennial. Although it can grow quite large, it is unlikely to do so on a regular basis at most PV sites. However, it should be controlled when observed as established populations can be difficult to eradicate.

The overall level of threat posed by this species is considered to be moderate. It is flexible, adapting its growth form to be flat or upright depending on the conditions.

PAPAVERACEAE - *Argemone ochroleuca*



Argemone ochroleuca

Argemone ochroleuca is a Category 1 invader and should be controlled. This spiny plant can be a nuisance in disturbed areas and it is highly likely that this species will need to be controlled at many PV Sites.

The overall level of threat posed by this species is considered to be high. It can be difficult to eradicate. However if populations are controlled effectively immediately after construction, then it is unlikely to build up to problem proportions.

POLYGONACEAE - *Polygonum aviculare*



Polygonum aviculare

Polygonum aviculare usually grows on open disturbed places. It is usually sprawling or low-growing and it is not likely to become a significant problem at PV sites. It is not highly invasive and is likely to occur predominantly along the sides of the roads and other places with little other vegetation cover.

The overall level of threat posed by this species is considered to be low. It is not highly invasive and does not grow very large. Specific control is not likely to be required.

POLYGONACEAE - *Rumex crispus*



Rumex crispus

Rumex crispus usually occurs in moist places and will not be a problem in most parts of the Northern Cape, but can be common in the Free State. As it is associated with moist habitats, it is not likely to be a significant problem and any large plants can be cleared manually.

The overall level of threat posed by this species is considered to be low. It is associated with wetter environments and is therefore likely to be associated with places with receive runoff from other areas.

SOLANACEAE - Datura ferox



Datura ferox

Datura ferox is common in disturbed places such as fields, but also in natural vegetation around watering points and other disturbance. It is a Category 1 invader and should be cleared. Although it is annual, it can grow to more than a meter and has proven to be problematic within many PV facilities.

The overall level of threat posed by this species is considered to be high. It is a demonstrated problem in the country as well as within PV sites. It produces a lot of seed and can be hard to control, but mowing at the appropriate time of year should be effective. Encouraging the return of the grass layer will also discourage this species.

SOLANACEAE - *Nicotiana glauca*



Nicotiana glauca

Nicotiana glauca usually occurs in river beds and on floodplains, but will also grow in other situations where sufficient moisture gathers. Although it is a Category 1 invader, it is large and conspicuous and as such should be relatively easily controlled within PV Sites.

The overall level of threat posed by this species is considered to be moderate. Although it is a serious invader in some habitats, it is not likely to become a significant problem within PV Sites as it should be easy to control manually.

ZYGOPHYLLACEAE - *Tribulis terrestris*



Tribulis terrestris

Tribulis terrestris is an indigenous weed characteristic of disturbed ground. Although it is likely to increase at most PV sites, where it is likely to be considered a nuisance due to its thorny seeds, ecologically its presence is not highly significant.

The overall level of threat posed by this species is considered to be moderate to low. Although it may increase rapidly and colonise bare areas, it is not alien and does not pose an ecological threat. Plants can be cleared manually during flowering from bare ground where this species typically dominates

FABACEAE – *Prosopis glandulosa*



Prosopis glandulosa, pods and inflorescences

Prosopis glandulosa is present in most areas and is likely to become a potential problem in areas which receive runoff. This tree is a significant problem in large parts of the Northern Cape and once established, the dense stands that develop can be very difficult to eradicate. Category 2 invader.

The overall level of threat posed by this species is considered to be moderate. Although it is serious invader in some habitats, it would only be likely to become a problem in wetter areas, where it should be controlled regularly with manual clearing and the application of cut-stump arboricide treatment.

