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PROPOSED ESTABLISHMENT OF THE  
KAROSHOEK PT FACILITY ON SITE 1.3,  
AS PART OF THE LARGER KAROSHOEK  
SOLAR VALLEY DEVELOPMENT  
NORTHERN CAPE PROVINCE

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DRAFT ENVIRONMENTAL MANAGEMENT  
PROGRAMME

Submitted as part of the Draft Environmental Impact  
Assessment Report  
June 2012

Prepared for  
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## PROJECT DETAILS

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## DEFINITIONS AND TERMINOLOGY

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**Alternatives:** Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

**Concentrating solar power:** Solar generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power facilities collect the incoming solar radiation and concentrate it (by focusing or combining it) onto a single point, thereby increasing the potential electricity generation capacity.

**Cumulative impacts:** The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

**Direct impacts:** Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

**'Do nothing' alternative:** The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

**Endangered species:** Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

**Endemic:** An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

**Environment:** the surroundings within which humans exist and that is made up of:

- i. The land, water and atmosphere of the earth;
- ii. Micro-organisms, plant and animal life;
- iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and

- iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

**Environmental impact:** An action or series of actions that have an effect on the environment.

**Environmental impact assessment:** Environmental Impact Assessment, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

**Environmental management:** Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

**Environmental management programme:** An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

**Indigenous:** All biological organisms that occurred naturally within the study area prior to 1800.

**Indirect impacts:** Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

**Interested and affected party:** Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

**Parabolic trough:** Consist of parabolic reflectors and cylindrical tubes (i.e. receivers) which run congruently. The reflectors are made of mirrored glass panels which are supported by a truss system that gives the solar collector assembly its structural strength. The support structure also allows the parabolic trough to track the sun thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver which is a highly efficient heat collection element which contains a heat transfer fluid (i.e. oil or water) which flows within a closed circuit to the power block of a solar facility.

**Rare species:** Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical

decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

**Red data species:** Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

**Significant impact:** An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

**Solar thermal power:** The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar thermal facilities, like conventional coal-fired power plants operate by heating water for the purpose of steam generation. This steam is used to turn a generator which is a rotating machine that converts mechanical energy into electrical energy by creating relative motion between a magnetic field and a conductor. Where conventional power stations burn fossil fuels (i.e. coal or gas) to generate steam, their solar counterparts extract this energy from the sun. Two types of solar thermal technologies make use of reflectors / mirrors to concentrate the incoming solar radiation onto a focal point. These are referred to as line and point concentrating solar power (CSP) technologies. The point focus technologies include the tower and dish technologies, the line focus technologies include the parabolic trough and linear Fresnel technologies. The parabolic trough is the proposed technology for site 1.3 of the broader Karoshoek Solar Valley Development.

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## PURPOSE AND OBJECTIVES OF THE EMP

## CHAPTER 1

An Environmental Management Programme (EMP) is defined as “an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced.”<sup>1</sup> The objective of this EMP is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMP is to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (i.e. site clearing and site establishment), during the construction activities themselves (i.e. erosion, noise, dust, and visual impacts), during site remediation (i.e. soil stabilisation, re-vegetation), during operation and decommissioning (i.e. similar to construction phase activities).

This EMP has been compiled in accordance with Section 33 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools).

This EMP has the following objectives:

- » Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction and rehabilitation, operation, and decommissioning phases of the project in order to manage and minimise the extent of potential environmental impacts associated with the facility
- » Ensure that all the phases of the project do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced

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<sup>1</sup> Provincial Government Northern Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

- » Identify entities responsible for the implementation of the measures and outline functions and responsibilities
- » Propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation
- » Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process

The management and mitigation measures identified within the Environmental Impact Assessment (EIA) process are systematically addressed in this EMP, and ensure the minimisation of adverse environmental impacts to an acceptable level.

FG Emvelo (Pty) Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMP and through its integration into the contract documentation. Since this EMP is part of the EIA process it is important that this document be read in conjunction with the final Scoping and EIA Reports. This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMP and the environmental authorisation, the stipulations in the environmental authorisation shall prevail over that of the EMP, unless otherwise agreed by the authorities in writing. Similarly, any provisions in current legislation overrule any provisions or interpretations within this EMP.

This EMP shall be binding on all the parties involved in the construction and operational phases and shall be enforceable at all levels of contract and operational management within the project.

## PROJECT DETAILS

## CHAPTER 2

**FG Emvelo (Pty) Ltd**, an independent developer of concentrating solar power plants (CSP), is in the process of investigating the possible establishment of a **CSP facility, using Parabolic Trough (PT) technology on site 1.3**, as part of the larger Karoshoek Solar Valley Development. The proposed development site is located approximately 30 km east of Upington within the Khara Hais Local Municipality, which falls under the Siyanda District Municipality in the Northern Cape. The facility is proposed on the farm **portion 0 of Zandemm 944** (refer to Figure 1.1).

The broader area proposed for the entire Karoshoek Solar Valley Development includes the following farm portions:

- » Portion 0 of Karos 959;
- » Portion 3 of Annashoek 41;
- » Portion 0 of Zandemm 944;
- » Portion 2 of Matjiesrivier 41; and
- » <sup>2</sup>Portion RE of Matjiesrivier 41

The proposed project will be referred to as “Karoshoek PT<sup>3</sup> on Site 1.3” which ultimately forms part of the future proposed Karoshoek Solar Valley Development. The proposed project includes the establishment of a CSP facility comprising parabolic troughs and associated infrastructure for the purposes of commercial electricity generation. The facility is proposed to have a maximum generating capacity of up to **100 MW**, while the larger Karoshoek facility is proposed to have a maximum generating capacity of 1 GW. This portion of land is located at 28° 30' 32.16" 21° 32' 25.01" (elevation: 890m) and covers an extent of 4.84 km<sup>2</sup>

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<sup>2</sup> No development is proposed on RE Portion of Matjiesrivier 41 at this stage, but the farm portion is included in the project scope as it is envisaged for future development

<sup>3</sup> PT stands for Parabolic Troughs

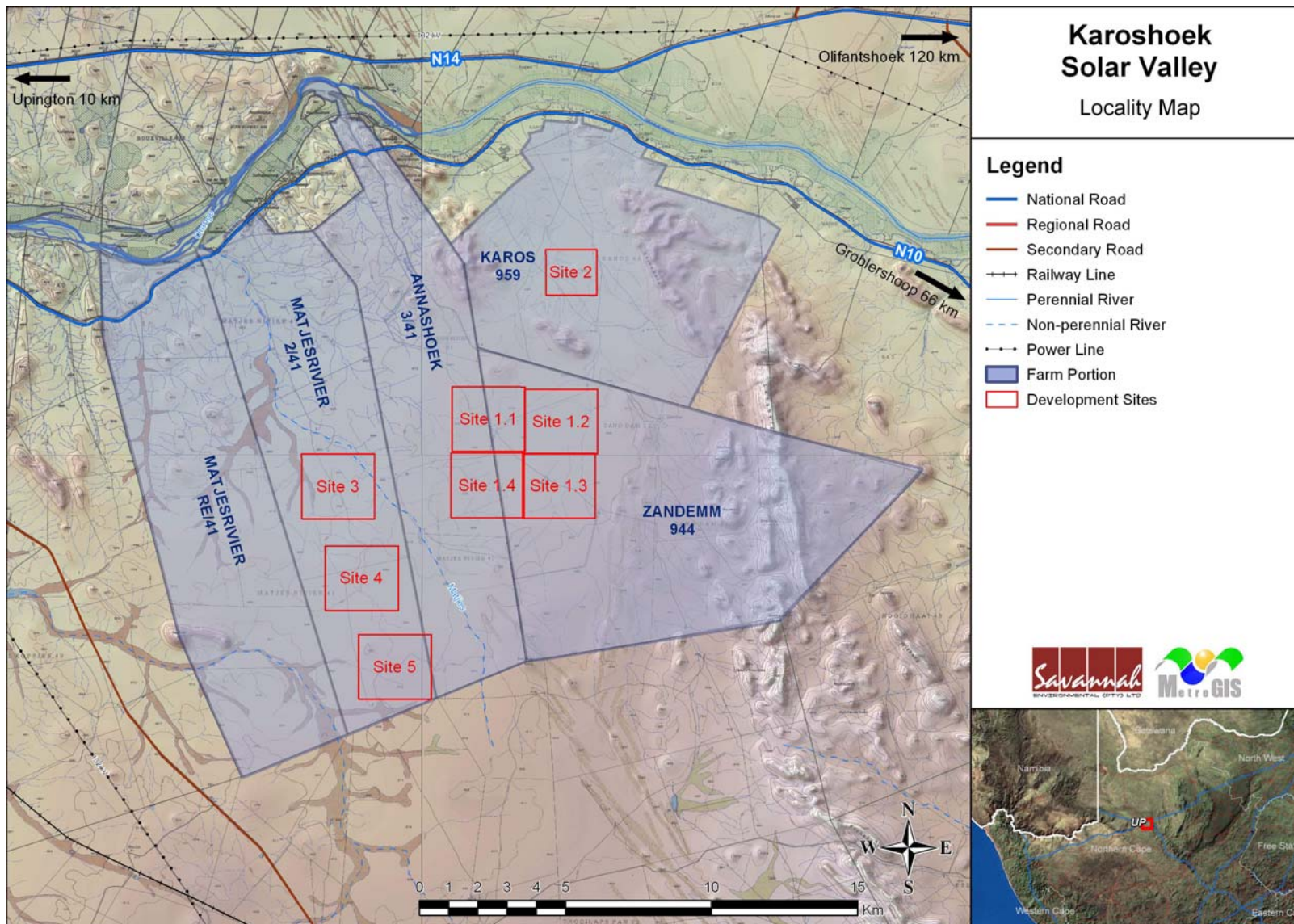


Figure 2.1: Locality map showing the broader Karoshok Solar Valley site east of Upington

## 2.1. Project Components Proposed As Part of the Karoshoek Solar Valley Development

Through a previous environmental process undertaken on the proposed broader Karoshoek development, a scoping study was undertaken and various technically feasible sites for development of future plants were identified. These sites are now being investigated for the establishment of various concentrating solar power plants as part of the Karoshoek Solar Valley Development. The following table provides an indication of what is being proposed at each of the sites:

**Table 2.1:** Description of entire Karoshoek Solar Valley Development:

Site reference (refer to Figure 2.1)	Project Name and Description	DEA Reference number
Site 2	Karoshoek CPVPD 1 (1 x 25 MW <b>Concentrating photovoltaic <u>or</u> parabolic dish</b> technology project)	14/12/16/3/3/2/292
	Karoshoek CPVPD 2 (1 x 25 MW <b>Concentrating photovoltaic <u>or</u> parabolic dish</b> technology project)	14/12/16/3/3/2/291
	Karoshoek CPVPD 3 (1 x 25 MW <b>Concentrating photovoltaic <u>or</u> parabolic dish</b> technology project)	14/12/16/3/3/2/290
	Karoshoek CPVPD 4 (1 x 25 MW <b>Concentrating photovoltaic <u>or</u> parabolic dish</b> technology project)	14/12/16/3/3/2/289
Site 1.1	Karoshoek LF 1 (1 x 100 MW <b>Linear Fresnel</b> )	14/12/16/3/3/2/293
Site 1.3	Karoshoek PT (1 x 100 MW <b>Parabolic Trough</b> )	14/12/16/3/3/2/294
Site 1.4	Karoshoek LFT 2 (1 x 100 MW <b>Linear Fresnel <u>or</u> Parabolic Trough</b> )	14/12/16/3/3/2/299
Site 3	Karoshoek Tower 1 (1 x 50MW <b>Tower</b> )	14/12/16/3/3/2/298
	Karoshoek Tower 2 (1 x 50MW <b>Tower</b> )	14/12/16/3/3/2/297
Site 4	Karoshoek LFTT 1 (1 X 100 MW <b>Linear Fresnel <u>or</u> Parabolic Trough <u>or</u> Tower</b> )	14/12/16/3/3/2/296
Site 5	Karoshoek LFTT 2 (1 X 100 MW <b>Linear Fresnel <u>or</u> Parabolic Trough <u>or</u> Tower</b> )	14/12/16/3/3/2/295
Grid connection	Electricity distribution line(s) which will connect to an on-site substation / switchyard	14/12/16/3/3/2/288

Note that Site 1.2 as indicated in Figure 1.1 was previously investigated for the establishment of a Parabolic Trough Plant with a capacity of up to 125MW, known as Project Ilanga (DEA Ref No: 12/12/20/2056). This facility and associated infrastructure has already been authorised.

Site 1.3 of the proposed Karoshoek Solar Valley Development, the subject of this report, will be comprised of the following primary elements (refer to Chapter 3 for more details):

- » The solar field - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the troughs and the steam cycle.
- » The power block - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
- » Water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056).** A pipeline would however be required to be constructed to each facility from the central water reservoir.
- » Cables linking the power block to the on-site substation.
- » Power line(s) which will connect to the future Eskom CSP MTS. The Eskom 400 kV power line to be located to the west of the site (planned to be constructed in 2016) (to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
- » Internal and external access roads.
- » Accommodation facilities and storerooms.
- » Temporary waste storage facilities may be required.

The area infrastructure (i.e. solar field, power block etc.) will be entirely contained within this identified site and will have a developmental footprint. The associated infrastructure will extend beyond this boundary across site 1.3 (i.e. the powerline will extend to its connection point).

In terms of the findings of the EIA Report, various planning, construction, and operation-related environmental impacts were identified, including:

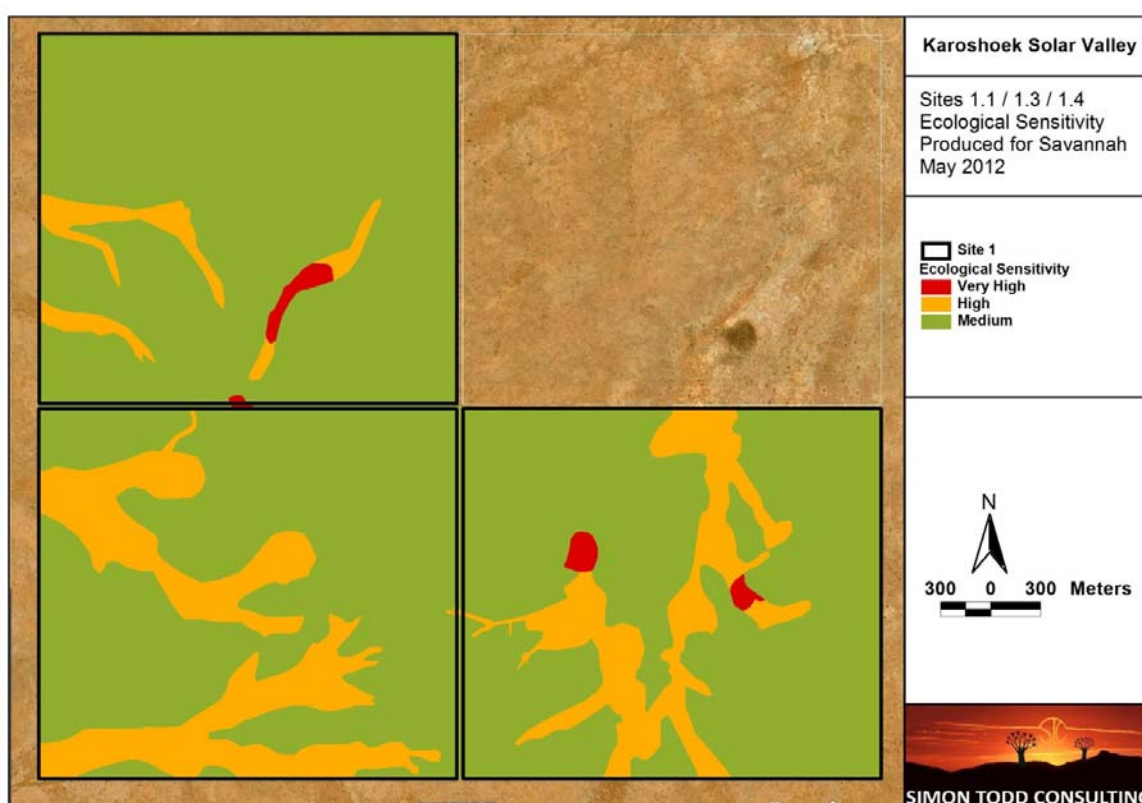
- » Disturbance of the ecological environment (i.e. flora and fauna)
- » Impacts on water resources (i.e. in terms of quantity and quality)
- » Impacts on the visual aesthetics and sensitive receptors
- » Impacts on the underlying geology (i.e. in terms soil disturbance and erosion)
- » Impacts on soils and agricultural potential
- » Impacts on heritage resources
- » Socio-economic impacts



The specialist studies undertaken in the EIA Phase did not identify any absolute no go areas for the proposed facility. However, the following potentially sensitive areas were identified (Refer to figure 2.2 and 2.3):

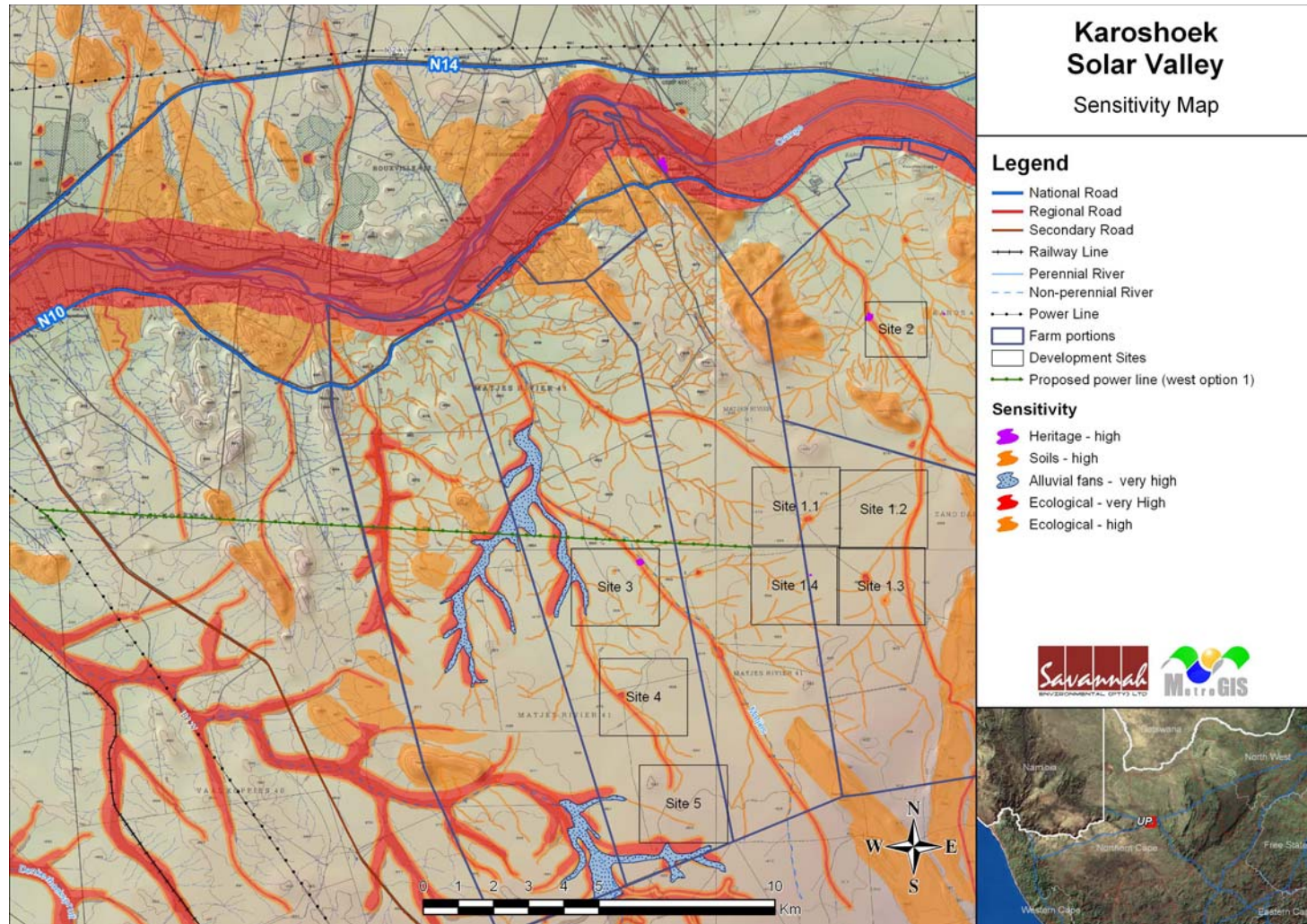
- » *Areas of high ecological sensitivity* –several non-perennial drainage lines and pans.
- » *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).

The preliminary design of the proposed facility and associated infrastructure has considered these identified sensitive areas within the broader site. Site-specific sensitivities have been identified through this EIA process. Areas of sensitivity within Site 1.3 relate to pans (very high sensitivity) and drainage lines (high sensitivity) on site (refer to Figure 2.2). No other areas of sensitivity were identified.



**Figure 2.2:** Ecological Sensitivity map of Sites 1.1 (top left), **1.3 (bottom right)** and 1.4 (bottom left)





**Figure 2.3:** Sensitivity map illustrating those sensitive areas across the broader site, in relation to the proposed layout for the PT facility on **site 1.3** as part of the larger Karoshoek Solar Valley Development

## 2.1 Activities and Components associated with the CSP Facility

The main activities/components associated with the proposed facility are detailed in the tables which follow.

**Table 2.1:** Activities to be undertaken during the pre-construction and construction phase

### **PRE-CONSTRUCTION AND CONSTRUCTION**

- » *Staff requirements* – on average an estimated labour force of 800 will be used on-site during the construction phase. However during peak construction periods approximately 800 – 1000 workers will be required on-site. These positions will be comprised of low skilled, semi-skilled, and skilled workers, the latter of which will most likely be sourced outside Upington (i.e. as these skills are unlikely to be available within the local community). The specialists / foreigners forming part of the construction team are likely to make use of the local establishments for accommodation facilities. A feasibility study being undertaken by the developer is considering the possibility of an on-site village that will have the appropriate facilities and amenities to accommodate approximately 800 people. It is expected that most of the construction (i.e. civil works) will be done by local South African companies. The use of local contractors such as Small, Medium, and Micro Enterprises (SMMEs) operating in the area will be considered by the EPC partner<sup>4</sup>, and will be driven largely by what skills and services could be sourced from local SMMEs (i.e. as part of a competitive tendering process). The EPC partner will determine the standards which all workers need to comply to and this will be in line with South African standards and laws applicable to the construction industry. The construction of the power line will be done by Eskom or its approved contractor. Eskom or its approved contractor will determine the size of the labour force that will be involved in the construction of the power lines. The actual planning and recruitment phase is expected to start approximately 6 months to one year after award of a REFIT bid and financial close.
- » *Construction materials and equipment requirements* - around 30 - 40% of the construction material and equipment may be sourced locally (i.e. within South Africa), depending on technical capabilities and prices of local industry. The materials and equipment will be transported to site by road, rail, and air if necessary.
- » *Housing of the labour force* – although the majority of the low and semi-skilled work force will be sourced from the local area and will be housed off-site, it is possible that approximately 800 people will be housed permanently on-site within the proposed location for a site village. The security team will operate on site in shifts over 24 hours.

<sup>4</sup> The EPC partner for this development is still to be finalised.

- » *Length of the construction phase* - commencement of the construction phase is dependent on the project being approved by DEA, a generating license being issued by NERSA, and a Power Purchase Agreement being secured with Eskom/Treasury or the designated buyer of renewable energy electricity and successfully reaching financial close. However, should all approvals be issued, it is expected that construction could start in mid-2013 (i.e. approximately 6 months after the expected receipt of the Environmental Authorisation). Thereafter, the construction phase is expected to take approximately 2-3 years to complete. The construction of the entire Karoshoek Solar Valley development is expected to take approximately 10-12 years.

<b>Activity</b>	<b>Detailed description</b>
Pre-construction surveys	<p>Prior to initiating construction, a number of detailed surveys will be required including, but not limited to:</p> <ul style="list-style-type: none"> <li>» <i>Geotechnical survey</i> – the geology and topography of the study area which was originally identified in the EIA Process will be confirmed. The geotechnical study will look at flood potential, foundation conditions, potential for excavations, and the availability of natural construction materials. This study will serve to inform the type of foundations required to be built (i.e. for the power block, and substation), and the extent of earthworks and compaction required in the establishment of the short internal access road to Site 1.3.</li> <li>» <i>Site survey</i> - in order to finalise the design layout of the solar field, the power block, and the other associated infrastructure. The finalisation will need to be confirmed in line with the Environmental Authorisation issued for the facility.</li> <li>» <i>Power line servitude survey</i> – once the placement of the power line towers has been finalised, a walk through survey will be undertaken for ecological, archaeology and heritage resources which may necessitate certain towers to be moved to avoid sensitivities (to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).</li> </ul>
Undertake site preparation	<ul style="list-style-type: none"> <li>» Site preparation activities will include:                             <ul style="list-style-type: none"> <li>* Clearance of vegetation at the footprint of the area infrastructure (i.e. parabolic troughs,</li> </ul> </li> </ul>

<b>Activity</b>	<b>Detailed description</b>
	<p>power block, and associated infrastructure).</p> <ul style="list-style-type: none"> <li>* Levelling of site (as necessary)</li> <li>* Clearance of vegetation at the footprint of the linear component (i.e. internal access road, water supply pipeline).</li> <li>* The development of stormwater control management systems which will include drainage channels which will collect all rain water and lead it to the natural stormwater drainage system after it has been settled/treated in a stormwater retention dam.</li> </ul> <p>» These activities will require the stripping of topsoil which will need to be backfilled as construction progresses and stockpiled for future rehabilitation.</p>
<p>Establishment of the access road and powerline servitudes</p>	<p>» The study site is accessible via the N10 from Upington to Groblershoop. Access off the N10 will be facilitated via an existing access road on the Farm Annashoek. A new road will branch off this existing road and lead to the area designated for the facility (i.e. a distance of approximately 1.2 km). The new road is required for construction purposes and is likely to remain in place for maintenance purposes during the operational phase.</p> <p>3 options are currently being investigated through different EIA processes for the Eskom grid integration as follows:</p> <ul style="list-style-type: none"> <li>» The power will be evacuated via a 400 kV power line of approximately 17 km which will have a loop-in/loop out<sup>5</sup> connection with the future Eskom CSP MTS/Niewenhoop 400 kV line (planned to be constructed by Eskom in 2016) located to the west of the site (DEA ref no. 14/12/16/3/3/2/288)</li> <li>» a new 132 kV power line running north from the north-western corner of Site 1.2 towards the existing 132 kV distribution line on the northern side of the Orange River. Here the</li> </ul>

<sup>5</sup> This type of connection requires the use of two powerlines such that the power can travel in a bidirectional manner between the on-site substation and the powerlines.

<b>Activity</b>	<b>Detailed description</b>
	<p>newly proposed line will encounter the existing Gordonia/Garona 132kV line, turn westwards, and run alongside the current power line servitude up to the Gordonia Sub Station. This line will be approximately 13km in length (DEA ref no. 14/12/16/3/3/1/554). This will necessitate crossing the Orange River.</p> <p>» A new 132kV power line will run directly west from the north-western corner of Site 1.2 until it connects up with the existing Gordonia/Kleinbegin 132 kV line and will then follow this line servitude (i.e. using the same servitude) up to the Gordonia Sub Station. This line will be around 17km long (DEA ref no. 14/12/16/3/3/1/554).</p> <p>NB: These were the options investigated through various studies but the first option has been determined to be the most preferred alternative from an environmental and technical perspective and is also preferred by Eskom.</p> <p>A servitude of approximately 35 m width for each power line will need to be established. Only the centre line may need to be cleared for stringing purposes. The remainder of the servitude will not be cleared, except where trees higher than 4m exist which could interfere with the operation of the power line. This work will be undertaken by an Eskom approved contractor.</p>
Transport of components to site	<p>» Depending on the local availability of equipment, the majority of the facility components and civil engineering construction equipment (i.e. excavators, trucks, graders, compaction equipment, cement trucks, etc.) will be sourced locally from Upington and will either be transported to site via provincial and local roads. The important equipment is likely to be imported to Saldanha Bay harbour and then transported to site via road or rail. This is still to be finalised through the Transportation Study.</p>

<b>Activity</b>	<b>Detailed description</b>
	<ul style="list-style-type: none"> <li>» Some of the power block components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)<sup>6</sup> by virtue of dimensional limitations (i.e. length and weight).</li> <li>» In some instances, the dimensional requirements of the loads to be transported (e.g. the boiler, the steam turbine, the main transformers, etc.) may require alterations to the existing road infrastructure (i.e. widening on corners), and protection of road-related structures (i.e. bridges, culverts, etc) due to those loads that are defined as abnormal.</li> </ul>
<p>Establishment of construction camps, storage facilities, laydown areas, and accommodation facilities</p>	<ul style="list-style-type: none"> <li>» Once the required equipment has been transported to site, dedicated construction camp(s), storage facilities, and laydown area/s will need to be established. These areas serve to confine activities to a designated area to limit potential site disturbance. The laydown area will be used for the assembly of the parabolic troughs, as a logistical area for the contractors and as a prefabrication area.</li> <li>» An area for accommodation will be established for the purpose of housing approximately 800 people during the construction phase, with the potential to construct more permanent structures in the future. An application will be made to the //Khara Hais Municipality for sanitation, water, electricity, and waste disposal services for this accommodation facility.</li> <li>» The fuel required for on-site construction vehicles and equipment will need to be secured in a temporary bunded facility within the construction camp to prevent leakages and soil contamination.</li> </ul>
<p>Establishment of electricity generation infrastructure</p>	<ul style="list-style-type: none"> <li>» Following the pre-construction surveys and clearing activities, the power block infrastructure (i.e. the steam turbine, generator, substation, and thermal storage units) will be constructed. Foundations will be established using concrete mixed at an off-site or on-site batching plant.</li> <li>» The parabolic troughs will be assembled in the parabola assembly building located in the</li> </ul>

<sup>6</sup> A permit will be required for the transportation of these abnormal loads on public roads.

<b>Activity</b>	<b>Detailed description</b>
	<p>solar field logistic area and transported around the site to the exact position where they will be erected and connected to its adjacent trough and the pipes conveying the heat transfer fluid (refer to Figure 2.5). Approximately one loop which consists of 48 collectors) will be constructed per day (i.e. one loop is approximately 300 metres in length).</p>
<p><sup>7</sup>Establishment of water supply infrastructure</p>	<ul style="list-style-type: none"> <li>» <i>Abstraction point</i> - the water required for the steam cycle is proposed to be abstracted from the Orange River via an existing abstraction point near Farm Annashoek. The water will be piped via a 200 mm (Ø) pipeline a distance of approximately 250 m to pass through a still basin, the main pump set, a sand filter, and a coffer dam<sup>8</sup>.</li> <li>» <i>Pipelines, reservoirs, etc</i> – the pipeline will continue from the sand filter in a south-westerly direction for approximately 200 m until it reaches the N10.                         <ul style="list-style-type: none"> <li>» At this point it will cross under the N10 (800 mm - 1000 mm cover at road crossing) and continue alongside it for approximately 1.3 km to meet with the existing gravel road that crosses the Farm Annashoek.</li> <li>» The pipeline will then follow the road for approximately 1.5 km to meet up with a 24 hour holding raw water reservoir (steel reservoir 12.2 m (L) x 12.2 m (W) x 4.88 m (H)), a water treatment works, and a 48 hour holding potable water steel reservoir (15.86 m (L) x 15.86 m (W) x 4.88 m (H)).</li> <li>» Thereafter the pipeline will continue for approximately 5 km to a 72 hour holding reservoir (steel reservoir 19.52 m (L) x 19.52 m (W) x 4.88 m (H)) for potable water<sup>9</sup>. Water will gravitate from this 72 hour reservoir to a 24 hour reservoir at Site 1.3 via a 250 mm Ø pipeline.</li> <li>» At Site 1.3 a 24 hour holding reservoir, a package treatment plant (i.e. for production</li> </ul> </li> </ul>

<sup>7</sup> This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056)

<sup>8</sup> The coffer dam will be used to store filter backwash for future use.

<sup>9</sup> At a point on this route (i.e. about 700 m from the water treatment plant), the pipeline will T-off to the west to deliver water to the proposed site for the accommodation areas for the construction crew.

<b>Activity</b>	<b>Detailed description</b>
	<p>of demineralised water that will be used in the water steam cycle and cleaning of the troughs), and a 48 hour holding reservoir for plant use will be located.</p> <ul style="list-style-type: none"> <li>» Any concrete that may be required for these facilities is proposed to be mixed at both an on and off-site batching plants.</li> </ul>
Undertake site rehabilitation	<ul style="list-style-type: none"> <li>» Areas requiring rehabilitation will include those areas disturbed during the construction phase and are not required for operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.</li> <li>» Where relevant disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.</li> <li>» All temporary facilities, temporary equipment, and waste materials must be removed from site.</li> <li>» Erosion control measures (i.e. drainage works and anti-erosion measures) should be used in sensitive areas (i.e. steep slopes, hills, and drainage lines), to minimise loss of topsoil and control erosion.</li> <li>» Any access points and/or access roads which are not required during the operational phase must be closed as part of the post-construction rehabilitation.</li> </ul>
Pipe cleaning	<ul style="list-style-type: none"> <li>» In order to get a clean piping, a pipe cleaning process will be undertaken. This consists mainly of blow-out, acid pickling, and cleaning. The final acid pickling agent to be used is not defined yet, but most probably hydrofluoric acid will be used. Waste from acid pickling will be collected, adequately treated, and carefully disposed according to the applicable regulation.</li> </ul>



**Table 2.2:** Activities to be undertaken during the operational phase

<b>OPERATION</b>	
»	<i>Staff requirements</i> – approximately 60 staff members are expected to be required on-site during the operational phase of the project.
»	<i>Length of the operation phase</i> – the facility is expected to be commissioned in March 2016 and is expected to be operational for 30 - 40 years, where after it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.

<b>Activity</b>	<b>Detailed description</b>
Sourcing, treatment and use of water	<ul style="list-style-type: none"> <li>» Approximately 224 110 m<sup>3</sup> of water will need to be abstracted annually from the Orange River to meet the proposed development requirements (i.e. 100 MW CSP facility). The water will be pumped to the de-gritting and filtration reservoir. The water will flow by gravity through the pipeline (as described above) to the storage reservoir at the power block area, where it will be treated according to the needs of the project.</li> <li>» Through a series of heat exchangers the water will be converted into steam for driving the turbine. The water cycle will be cooled through a process of dry cooling (i.e. air cooled condensers will be used instead of cooling towers). The HTF will be cooled in the boiler of the water steam cycle (i.e. main heat exchanger). No additional cooling of the HTF is foreseen, apart from minor fan coolers for certain equipment in the HTF system.</li> <li>» Once the water leaves the steam cycle, it will be released into the evaporation pond.</li> </ul>
Treatment and disposal of waste water	<ul style="list-style-type: none"> <li>» Water from the condensate polishing plant will be collected in a neutralisation basin and then will be forwarded to the collecting pond while wastewater from the demineralisation plant will go directly to the collecting pond. All surface water, storm water, and drains, etc. will pass through an oil separator station and all chemical wastewater will be pH adjusted before entering the collecting pond. The water from the collecting pond is finally forwarded</li> </ul>

<b>Activity</b>	<b>Detailed description</b>
	to the evaporation pond. Any water from ablution facilities will be collected in a septic tank.
Chemical dosing for the water-steam cycle	» In order to maintain the required condensate quality of the water-steam cycle, ammonia is dosed in small quantities.
Inhibitor dosing for the closed cooling system	» To minimize oxidation of the system a corrosion inhibitor (carbohydrazide) is dosed to the closed system.
Operation of the solar field	<ul style="list-style-type: none"> <li>» The solar radiation will be concentrated by the mirrors onto the receiver which contains the heat transfer fluid. The heat transfer fluid is heated and circulated through the solar field back to the power block area where heat exchangers will transfer the collected solar thermal energy from the heat transfer system to the water steam cycle where superheated steam is generated.</li> <li>» The thermal energy in form of superheated steam is routed to the steam turbine generator in which the thermal energy is converted into electric power.</li> <li>» The solar collectors will track the sun during the progression of the day in order to maximise the solar energy yield.</li> </ul>
Antifreeze heating	» Thermal oil in the HTF-system freezes at ambient conditions. Hence, the oil always has to be kept at a certain operation temperature, even if the plant is not in operation. For this purpose, antifreeze heaters will be installed, running on LPG or biofuel. The installed boilers will comply with the relevant emission standards and regulation.
Operation of the electrical infrastructure	» The steam turbine generator will generate electricity at a voltage of approx 16 kV and will be alternating current (AC). The electricity will be stepped up to a voltage of 132 kV and evacuated into the overhead distribution line and into the electricity grid.
Site operation and maintenance	<ul style="list-style-type: none"> <li>» It is anticipated that a full-time security, maintenance, and control room staff will be required on site.</li> <li>» The facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions, or routine maintenance activities.</li> </ul>

**Table 2.3: Activities to be undertaken during the decommissioning phase**

<b>DECOMMISSIONING</b>	
<ul style="list-style-type: none"> <li>» <i>Length of the decommissioning phase</i> – following the operational phase it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.</li> <li>» <i>Activities during the decommissioning phase</i> - it is most likely that decommissioning would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time.</li> </ul>	
<b>Activity</b>	<b>Detailed description</b>
Site preparation	<ul style="list-style-type: none"> <li>» Site preparation activities similar to those undertaken in the construction phase will be required during the decommissioning phase. This will include confirming the integrity of site access to the site in order to accommodate the required equipment (e.g. lay down areas and decommissioning camp) and the mobilisation of decommissioning equipment.</li> </ul>
Disassemble and replace existing components	<ul style="list-style-type: none"> <li>» The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.</li> </ul>

## STRUCTURE OF THIS EMP

## CHAPTER 3

The first two chapters provide background to the EMP and the proposed project, while the chapters which follow consider the following:

- » Key legislation applicable to the development
- » Planning and design activities
- » Construction activities
- » Operation activities
- » Decommissioning activities

These chapters set out the procedures necessary for FG Emvelo, as the project developer, to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation for the solar energy facility project, an overarching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management programme has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMP table has been established for each environmental objective. The information provided within the EMP table for each objective is illustrated below:

**OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the EIA specialist studies**

<b>Project Component/s</b>	» List of project components affecting the objective.
<b>Potential Impact</b>	» Description of potential environmental impact if objective is not met.
<b>Activity/Risk Source</b>	» Description of activities which could affect achieving objective.
<b>Mitigation: Target/Objective</b>	» Description of the target and/or desired outcomes of mitigation.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
List specific action(s) required to meet the mitigation target/objective described above	Who is responsible for the measures	Time periods for implementation of measures

<b>Performance Indicator</b>	Description of key indicator(s) that track progress/indicate the effectiveness of the management programme.
<b>Monitoring</b>	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods, and reporting.

The objectives and EMP tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

- » Planned activities change (i.e. in terms of the components and/or layout of the facility)
- » Modification to or addition to environmental objectives and targets
- » Relevant legal or other requirements are changed or introduced
- » Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc

### 3.1. Project Team

This draft EMP was compiled by:

	<b>Name</b>	<b>Company</b>
<b>EMP Compilers:</b>	Alicia Govender – Environmental Assessment Practitioner (EAP) Jo Anne Thomas – EAP (Project Manager)	Savannah Environmental
<b>Specialists:</b>	Simon Todd – fauna, flora and ecology	Simon Todd Consulting
	Iain Paton – geology, soils and erosion potential	Outeniqua Geotechnical Services
	Stephan Gaigher – heritage resources	G&A Heritage
	Lourens du Plessis – visual aesthetics	MetroGIS
	Patsy Scherman – water resources	Scherman, Colloty and Associates
	Ingrid Snyman - social	Batho Earth

The Savannah Environmental team have extensive knowledge and experience in EIA and environmental management, having been involved in EIA processes over the past ten years. They have managed and drafted EMPs for other power generation projects throughout South Africa, including numerous wind and solar energy facilities. Specific experience of the project team includes:

- » *Jo-Anne Thomas* who will be the project manager responsible for planning, programming, and overseeing of the EIA process. Jo-Anne has considerable experience (more than 14 years) in conducting EIAs and in EIA project management.
- » *Alicia Govender* who will be the EAP responsible for preparation of the EIA reports and assessment of environmental aspects. Alicia has 4 years experience in the environmental field and has been involved with the EIA Process for multiple solar energy facilities, particularly in the Northern Cape.

## KEY LEGISLATION APPLICABLE TO THE DEVELOPMENT

## CHAPTER 4

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The following legislation and guidelines have informed the scope and content of this EMP Report:

- » National Environmental Management Act (Act No 107 of 1998)
- » EIA Regulations, published under Chapter 5 of the NEMA (GNR R545, GNR 546 in Government Gazette 33306 of 18 June 2010)
- » Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - \* Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  - \* Public Participation in the EIA Process (DEA, 2010)

Several other acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table that follows.

**Table 4.1:** Relevant legislative and permitting requirements applicable to the establishment of the proposed Project

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Management Act (Act No 107 of 1998)	<p>EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations.</p> <p>In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation.</p> <p>In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project</p>	<p>National Department of Environmental Affairs – lead authority.</p> <p>Provincial Environmental Department - commenting authority.</p>	The EIA process undertaken for the proposed project is in line with NEMA.
National Environmental Management Act (Act No 107 of 1998)	<p>In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.</p> <p>In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.</p>	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.



Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992).	National Department of Environmental Affairs  Provincial Environmental Department - commenting authority.  Local authorities  Local Municipality	There is no requirement for a noise permit in terms of the legislation.  There are noise level limits which must be adhered to, as detailed in SANS 10103. It provides the maximum average background ambient sound levels, $L_{Req,d}$ and $L_{Req,n}$ during the day and night respectively to which different types of developments may be exposed.
National Water Act (Act No 36 of 1998)	Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999.	Department of Water Affairs	A water use licence has been applied by the developer.
National Water Act (Act No 36 of 1998)	In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs (as regulator of NWA)	A water use licence has been applied by the developer. This section will find application during the life cycle of the project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act.  Requirements for Environmental Management Programmes and	Department of Minerals and Energy	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Environmental Management Plans are set out in Section 39 of the Act.		
National Environmental Management: Air Quality Act (Act No 39 of 2004)	<p>Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as “priority areas”</p> <p>Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.</p>	National Department of Environmental Affairs	<p>While no permitting or licensing requirements arise from this legislation, this Act will find application during the operational phase of the project.</p> <p>The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.</p>
National Heritage Resources Act (Act No 25 of 1999)	<p>Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including</p> <ul style="list-style-type: none"> <li>» the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;</li> <li>» any development or other activity which will change the character of a site exceeding 5 000 m<sup>2</sup> in extent.</li> </ul> <p>The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5</p>	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains.	Although no heritage sites have been identified on the site, a permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the construction activities.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>000 m<sup>2</sup>; or the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.</p> <p>Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.</p>		
<p>Nature Conservation Ordinance (Act 19 of 1974)</p>	<p>Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, gathering, uprooting, damaging or destroying). Schedule 3 lists endangered flora and Schedule 4 lists protected flora.</p> <p>Articles 26 to 47 regulates the use of wild animals.</p>	<p>National Department of Environmental Affairs</p>	<p>A TOPS permit is required for any activities involving any TOPS listed species. This section will find application throughout the life cycle of the project.</p>
<p>National Environmental Management: Biodiversity Act (Act No 10 of 2004)</p>	<p>In terms of S57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came</p>	<p>Department of Environmental Affairs</p>	<p>As the applicant must apply for the relevant permits as there are three threatened tree species likely to be impacted by the proposed development.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>into effect on 1 June 2007.</p> <p>In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA Phase.</p> <p>The Act provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems</p>		

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011).		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	<p>Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:</p> <ul style="list-style-type: none"> <li>» Category 1 plants: are prohibited and must be controlled.</li> <li>» Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.</li> <li>» Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.</li> </ul> <p>These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.</p>	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Veld and Forest	In terms of Section 21 the applicant would	Department of Water Affairs	While no permitting or licensing

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Fire Act (Act 101 of 1998)	<p>be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land.</p> <p>In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material.</p> <p>In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.</p>		<p>requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency.</p>
National Forests Act (Act No 84 of 1998)	<p>Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.</p> <p>Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.</p>	Department of Water Affairs	<p>A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. As none such species occur on the site, no permits in this regard are required.</p>
Aviation Act (Act No 74 of 1962) 13 <sup>th</sup> amendment of	Any structure exceeding 45m above ground level or structures where the top of the	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation,

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
<p>the Civil Aviation Regulations (CARS) 1997</p>	<p>structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure.</p> <p>Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified.</p> <p>Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft.</p> <p>Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.</p>		<p>this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.</p>
<p>Hazardous Substances Act (Act No 15 of 1973)</p>	<p>This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the</p>	<p>Department of Health</p>	<p>It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.</p> <p>Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance;</p> <p>Group IV: any electronic product;</p> <p>Group V: any radioactive material.</p> <p>The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>		
<p>National Road Traffic Act (Act No 93 of 1996)</p>	<p>The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.</p> <p>Legal axle load limits and the restrictions</p>	<p>Provincial Department of Transport (provincial roads)</p> <p>South African National Roads Agency Limited (national roads)</p>	<p>An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include:</p> <ul style="list-style-type: none"> <li>» Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.</li> <li>» Transport vehicles exceeding the dimensional limitations (length) of 22m.</li> </ul>



Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.</p> <p>The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.</p>		<p>» Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).</p>
<p>Development Facilitation Act (Act No 67 of 1995)</p>	<p>Provides for the overall framework and administrative structures for planning throughout the Republic.</p> <p>Sections 2- 4 provide general principles for land development and conflict resolution.</p>	<p>Provincial Environmental Department - commenting authority.</p> <p>Local Municipality, District Municipality</p>	<p>The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.</p>
<p>Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land.</p>	<p>Provincial Environmental Department - commenting authority.</p> <p>Local Municipality, District Municipality</p>	<p>Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO.</p> <p>Subdivision is required to be undertaken following the</p>	<p>A consent use application has been filed with the local Municipality and the approval is due shortly.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
		issuing of an environmental authorization for the proposed project.	
National Environmental Management: Waste Act (Act No 59) of 2008	<ul style="list-style-type: none"> <li>» The Minister may by notice in the <i>Gazette</i> publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.</li> <li>» The Minister may amend the list by—                             <ul style="list-style-type: none"> <li>(a) adding other waste management activities to the list;</li> <li>(b) removing waste management activities from the list; or</li> <li>(c) making other changes to the particulars on the list.</li> </ul> </li> </ul>	National Department of Environmental Affairs (DEA)	The volumes of waste generated during construction and operation of the facility will not be large enough to require a waste license.
Promotion of Access to Information Act (Act No 2 of 2000)	<ul style="list-style-type: none"> <li>» All requests for access to information held by state or private body are provided for in the Act under S11.</li> </ul>	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act may find application during through the project life cycle.
Promotion of Administrative Justice Act (Act No 3 of 2000)	<ul style="list-style-type: none"> <li>» In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions</li> <li>» Interested &amp; affected parties have right to be heard</li> </ul>	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act will find application during through the project life cycle.

## MANAGEMENT PROGRAMME: PLANNING AND DESIGN

## CHAPTER 5

**Overall Goal:** undertake the planning and design phase in a way that:

- » Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
- » Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
- » Ensures that the best environmental options are selected for the linear components, including the pipe line, access road and powerline alignment.
- » Enables the solar energy facility construction activities to be undertaken without significant disruption to other land uses and activities in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

### 5.1 Objectives

**OBJECTIVE: Ensure the facility design responds to identified environmental constraints and opportunities**

No absolute 'no go' areas were identified by the specialists during the EIA Phase. However, a number of potentially sensitive areas were identified to be associated with the proposed project, which included:

- » *Areas of high ecological sensitivity* – several non-perennial drainage lines and pans.
- » *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).
- » *Areas of high agricultural potential.*
- » *Areas with sensitive noise receptors* – several rural settlements located near the Orange River and the N10 and any receptor located within 2 km of the facility.

In order to minimise impacts associated with the construction and operation of the facility, the following surveys are required to be undertaken during the final design phase.

- » Geotechnical survey – this will investigate flood potential, foundation conditions, potential for excavations, and the availability of natural construction materials. This study will serve to inform the type of foundations required to be constructed (i.e. for

the power block, and solar field), and the extent of earthworks and compaction required in the establishment of the internal access roads.

- » A storm-water management plan – this will detail how storm-water runoff (i.e. over engineered hard surfaces) can be managed to reduce velocities and volumes of water that could lead to erosion and potential sedimentation of drainage systems.. Stormwater drains should be correctly located and designed with appropriate erosion-control features to ensure local stormwater run-off over the flood embankments and natural riverbanks do not cause erosion and subsequent bank slumping.
- » Water usage design - optimise the design or technology to reduce consumptive water requirements as far as possible.
- » Heritage survey – a survey of the linear infrastructure will be surveyed prior to construction (i.e. the pipeline, access road, and the tower positions of the power line). If a heritage object is found, appropriate specialists must be brought in to assess the site, notify the administering authority of the item/site, and undertake due/required processes.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Solar field and associated infrastructure</li> <li>» Power generation components and associated infrastructure</li> <li>» Water related infrastructure (i.e. pipeline, associated reservoirs, and abstraction point).</li> <li>» Access roads.</li> <li>» Power lines.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impact on identified sensitive areas.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Positioning of all the facilities components (i.e. including the infrastructure within Site 1.3 and across the broader site to include the access road, pipeline, reservoirs and treatment facilities, and the powerline towers).</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» The design of the facility responds to the identified environmental constraints and opportunities.</li> <li>» Site sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Undertake a heritage pre-construction survey.	Heritage specialist	Design
Undertake a geotechnical pre-construction survey.	Geotechnical specialist	Design
Obtain any additional environmental permits required (e.g. water use license).	FG Emvelo	Project planning
Consider and incorporate design level mitigation measures recommended by the specialists as detailed within the EIA Report and relevant appendices.	Engineering design consultant, solar component supplier, and FG Emvelo	Design review
External access point and internal access road to be	FG Emvelo	Design

Mitigation: Action/Control	Responsibility	Timeframe
carefully planned to maximise road user safety.		
Compile a comprehensive surface runoff storm water management plan for hard surfaces as part of the final design of the project. This must include appropriate means for the handling of stormwater within the site, e.g. separate clean and dirty water streams around the plant, install stilling basins to capture large volumes of run-off, trapping sediments, and reduce flow velocities (i.e. water used when washing the mirrors).	FG Emvelo	Design
In designing the facility, use should be made of existing road infrastructure as far as possible. Where no road infrastructure exists, new roads should be placed within areas areas of lower sensitivity or management measures must be implemented to ensure minimum damage is caused to natural habitats.	FG Emvelo / Design engineer	Design phase
Roads must be designed so that changes to surface water runoff are avoided and erosion is not initiated.	FG Emvelo / Design engineer	Design phase

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The design meets the objectives and does not degrade the environment.</li> <li>» Design and layouts respond to the mitigation measures and recommendations in the EIA Report.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Review of the design by the Project Manager and the Environmental Control Officer (ECO) prior to the commencement of construction.</li> </ul>

**OBJECTIVE: Ensure the selection of the best environmental option for the alignment of the powerlines, pipeline, and associated access roads**

- » **Road** - Access off the N10 will be via Farm Annashoek and will use the existing gravel road on the Farm Annashoek which will also lead to Site 1.3. Furthermore, this new alignment allows for the consolidation of linear infrastructure (i.e. the road and water pipeline). In addition SANRAL has approved the plan to realign the N10 entrance to Annashoek, this will be an added benefit to the public as it will reduce the number of accidents that used to take place around this section of the N10.
- » **Power lines** - The power will be evacuated via power lines which will connect to the future Eskom 400kV CSP MTS (planned to be constructed by Eskom in 2016) and will be located to the west of the site (DEA ref no. 14/12/16/3/3/2/288). Or will be

evacuated as follows: A servitude of approximately 55 m in width for each power line will need to be established. Only the centre line may need to be cleared for stringing purposes. The remainder of the servitude will not be cleared, except where trees higher than 4 m exist which could interfere with the operation of the powerline. This work will be undertaken by an Eskom approved contractor.

- » **Water Supply Pipeline** - the pipeline will originate at the abstraction point on the Orange River, and continue in a south-westerly direction between farmland plots to an earth stilling steel pond, through a main pump system and high pressure sand filter (i.e. to get rid of the sediments). Thereafter the pipeline will cross under the N10 and traverse alongside it to the point of the existing access road to the Farm Annashoek. The pipeline will then follow the road within its reserve for approximately 1.5 km to meet up with a proposed water treatment works, and a 24-hour holding raw water steel reservoir and a 48-hour holding potable water steel reservoir. Thereafter the pipeline will continue for approximately 5 km to a 72-hour holding reservoir for potable water. At a point on this pipeline route, about 700 m from the water treatment plant, a pipeline will T-off from the main pipe line to deliver water to the proposed site for the residential area in a 48-hour closed steel reservoir. Water will gravitate from the 72-hour reservoir to the 24-hour reservoir at the site. A third holding reservoir with a 48, 24-hour capacity and a package treatment plant for production of demineralised water that will be used in the water steam cycle and cleaning of the troughs will be located near Site 1.3..

In order to minimise environmental impacts, it is proposed that the powerlines, access road, and water supply pipeline follow the same route. . Selection of the proposed route along the existing access road to Annashoek has largely minimised impacts associated with this proposed infrastructure. However, where new routes are required (i.e. from the existing access road to Site 1.2), mitigation measures are required to be implemented to ensure impacts are minimised. The most sensitive landscape features for planning purposes in the study area will be the presence of drainage lines, and areas with indigenous natural vegetation.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power lines.</li> <li>» Water supply pipeline.</li> <li>» Access roads.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Route that degrades the environment unnecessarily, particularly with respect to visual aesthetics, loss of indigenous flora, and erosion.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Alignment of powerline within corridor.</li> <li>» Alignment of access roads.</li> <li>» Alignment of water supply pipeline.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure selection of best environmental option for alignment for the linear infrastructure.</li> <li>» Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Select an alignment that curtails environmental impacts and enhances environmental benefits.	FG Emvelo	Prior to submission of the final construction layout plan
Locate water supply pipeline, and access roads within the same route corridor.	FG Emvelo	Prior to submission of the final construction layout plan
Consider design level mitigation measures recommended by the specialists as detailed within the EIA report and relevant appendices.	FG Emvelo	Design
Plan new access roads according to contour lines to minimise cutting and filling operations.	FG Emvelo	Design
Use bird-friendly powerline tower and conductor designs.	FG Emvelo	Design
Install bird diverters/flappers on powerline sections across active agricultural land and the Orange River.	FG Emvelo	Design
As far as possible, cross river at right angle with powerlines.	FG Emvelo	Design

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Powerlines, pipeline, and road alignments meet environmental objectives.</li> <li>» Selected linear alignments that minimise any negative environmental impacts and maximise any benefits.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Ensure that the design implemented meets the objectives and mitigation measures in the EIA Report through review of the design by the Project Manager, and the ECO prior to the commencement of construction.</li> </ul>

**OBJECTIVE: To ensure effective communication mechanisms**

On-going communication with affected and surrounding landowners is important to maintain during the construction and operational phases of the solarenergy facility. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

<b>Project component/s</b>	List of project components affecting the objective <ul style="list-style-type: none"> <li>» CSP facility</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impacts on affected and surrounding landowners and land uses</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Activities associated with solarenergy facility construction</li> <li>» Activities associated with solar energy facility operation</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Effective communication with affected and surrounding landowners</li> <li>» Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible</li> </ul>

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Compile and implement a grievance mechanism procedure for the public (as outlined in Appendix D) to be implemented during both the construction and operational phases of the facility. This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues.	FG Emvelo	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel (as outlined in Appendix D). This procedure should be in line with the South	FG Emvelo Contractor	Pre-construction (construction procedure) Pre-operation (operation procedure)



Mitigation: Action/control	Responsibility	Timeframe
African Labour Law.		
Liaison with landowners is to be undertaken prior to the commencement of construction in order to provide sufficient time for them to plan agricultural activities.	FG Emvelo Contractor	Pre-construction

<b>Performance Indicator</b>	» Effective communication procedures in place.
<b>Monitoring</b>	» An incident reporting system should be used to record non-conformances to the EMP.

### OBJECTIVE: Minimise visual impacts

<b>Project Component/s</b>	» Night lighting on power block and substation.
<b>Potential Impact</b>	» Visual impacts on those receptors in close proximity to the facility.
<b>Activities/Risk Sources</b>	» Visual impact of the above mentioned by observers on or near the site as well as within the region.
<b>Mitigation: Target/Objective</b>	» Optimal planning of infrastructure to minimise visual impact.

Mitigation: Action/Control	Responsibility	Timeframe
Consult a lighting engineer in the planning and placement of light fixtures for the plant and the ancillary infrastructure.	Project proponent, or design consultant	Planning.

<b>Performance Indicator</b>	» Lighting impact is minimal and no complaints received from settlements or homesteads.
<b>Monitoring</b>	» Not applicable.

### OBJECTIVE: Minimise impact on riparian environment

<b>Project Component/s</b>	» Site selection minimising the overall impact on the functioning of the riparian environment.
<b>Potential Impact</b>	» Loss of important habitat and fragmentation of the riverine systems.

<b>Activities/Risk Sources</b>	» Site selection and incorrect placement of the development footprint.
<b>Mitigation: Target/Objective</b>	» Minimise the loss of and impact on riparian systems through ill placement of facility components.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Minimise the loss of riparian habitat – physical removal and replacement by hard surfaces.	FG Emvelo	Planning and design
The placement of pump inlets and the supporting infrastructure must be planned to prevent the potential for scour / erosion and downstream sedimentation of the Orange River.	FG Emvelo	Design

<b>Performance Indicator</b>	» Minimal impact on the riparian environment (i.e. in terms of vegetation removal around drainage lines).
<b>Monitoring</b>	» N/A

**OBJECTIVE: Minimise stormwater runoff and subsequent alteration of the local hydrological regime**

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Stormwater management components</li> <li>» Reservoirs</li> <li>» Abstraction point.</li> <li>» Any hard engineered surfaces (i.e. pipeline, access roads).</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Poor stormwater management and alteration of the hydrological regime.</li> <li>» Risk of river system erosion and downstream sedimentation.</li> <li>» There is a high risk of elevated sediment input into the Orange River during the establishment of the water abstraction facilities on the banks and floodplains of the Orange River.</li> <li>» Backwash water discharged from the sand filters could result in sediment laden water reaching the Orange River.</li> <li>» Poor planning and design of new abstraction infrastructure and new flood protection measures on the floodplain, resulting in bank erosion or slumping to occur during river flooding events.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Construction of the facility (i.e. placement of hard engineered surfaces).</li> <li>» Construction of water abstraction infrastructure.</li> </ul>
<b>Mitigation: Target/Objective</b>	» Appropriate management of stormwater to minimise impacts on the environment.

Mitigation: Action/Control	Responsibility	Timeframe
Reduce the potential increase in surface flow velocities and the resultant impact on the localised drainage system through increased sedimentation.	FG Emvelo	Planning and design
Adjacent riparian habitats outside the "footprint" of the new infrastructure should be declared sensitive habitats and out of bounds. Storage dams should be lined in a suitable manner to prevent any groundwater contamination.	FG Emvelo	Planning and design
Careful rehabilitation using natural riparian vegetation to stabilise the riverbanks and all disturbed areas in the riparian zone.	FG Emvelo	Post construction
Appropriately plan hard-engineered bank erosion protection structures.	FG Emvelo	Planning and design
Position the pump inlets and supporting infrastructure in such a way as to prevent the potential for scour / erosion and downstream sedimentation of the Orange River. The current placement is within an area of dense reed growth ( <i>Phragmites australis</i> ), and would not be considered a severe impact.	FG Emvelo	Planning and design
Suitable handling of stormwater within the site (i.e. clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities).	FG Emvelo	Construction and operation

<b>Performance Indicator</b>	» Sound water quality and quantity management (i.e. as per the Water Use Licence Conditions).
<b>Monitoring</b>	» Surface water quality monitoring plan.

## MANAGEMENT PROGRAMME: CONSTRUCTION

## CHAPTER 6

**Overall Goal:** Undertake the construction phase in a way that:

- » Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- » Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
- » Minimises the impact on the indigenous natural vegetation, protected tree species, and habitats of ecological value (i.e. drainage lines).
- » Minimises impacts on fauna using the site.
- » Minimises the impact on heritage site should they be uncovered.
- » Establishes an environmental baseline during construction activities on the site, where possible.

### 6.1 Institutional Arrangements: Roles and Responsibilities for the Construction Phase

As the proponent, FG Emvelomust ensure that the implementation of the facility complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation. FG Emvelo will retain various key roles and responsibilities during the construction of the facility.

**OBJECTIVE:** Establish clear reporting, communication, and responsibilities in relation to overall implementation of environmental management plant

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environment Representative; Environmental Control Officer (ECO) and Contractor for the construction phase of this project are as detailed below.

**Project Manager** will:

- » Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these
- » Ensure that FG Emvelo and its Contractor(s) are made aware of all stipulations within the EMP

- » Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes
- » Be fully conversant with the EIA for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation

**Site Manager** (FG Emvelo's on-site Representative) will:

- » Be fully knowledgeable with the contents of the EIA and risk management
- » Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued)
- » Be fully knowledgeable with the contents of the EMP
- » Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these
- » Have overall responsibility of the EMP and its implementation
- » Conduct audits to ensure compliance to the EMP
- » Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on matters concerning the environment.
- » Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site
- » Confine activities to the demarcated construction site

An independent **Environmental Control Officer** (ECO) must be appointed by FG Emvelo prior to the commencement of any authorised activities. The ECO will be responsible for monitoring, reviewing, and verifying compliance by the Contractor with the environmental specification specifications of the EMP and the conditions of the Environmental Authorisation and accordingly will:

- » Be fully knowledgeable with the contents with the EIA.
- » Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
- » Be fully knowledgeable with the contents with the EMP.
- » Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- » Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- » Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
- » Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address this.
- » Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.

- » Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- » Ensure that activities on site comply with all relevant environmental legislation.
- » Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMP.
- » Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
- » Ensure that there is communication with the Site Manager regarding the monitoring of the site.
- » Ensure that any non-compliance or remedial measures that need to be applied are reported
- » Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.

As a general mitigation strategy, the Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter weekly site compliance inspections would probably be sufficient. However, in the absence of the ECO there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

**Contractors and Service Providers:** It is important that contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The contractor's obligations in this regard include the following:

- » Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » A copy of the EMP must be easily accessible to all on-site staff members.
- » Employees must be familiar with the requirements of this EMP and the environmental specifications as they apply to the construction of the proposed facility.
- » Prior to commencing any site works, all employees and sub-contractors must have attended an environmental awareness training course which must provide staff with

an appreciation of the project's environmental requirements, and how they are to be implemented.

- » Staff will be informed of environmental issues as deemed necessary by the ECO.

All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

- » Ensuring adherence to the environmental management specifications
- » Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken
- » Any lack of adherence to the above will be considered as non-compliance to the specifications of the EMP
- » Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to
- » Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting
- » Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO
- » Ensuring that a register of all public complaints is maintained
- » Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations)

## 6.2 Objectives

In order to meet the overall goal for construction, the following objectives, actions, and monitoring requirements have been identified.

### **OBJECTIVE: Minimise impacts related to inappropriate site establishment**

The contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans and any other relevant local languages, all to the approval of the Site Manager.

All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape). Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Area infrastructure (i.e. troughs, power block, etc).</li> <li>» Linear infrastructure (i.e. powerline, pipeline, access road).</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Hazards to landowners and public.</li> <li>» Damage to indigenous natural vegetation, due largely to ignorance of where such areas are located.</li> <li>» Loss of threatened plant species and protected tree species.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Open excavations (foundations and cable trenches).</li> <li>» Movement of construction vehicles in the area and on-site.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To secure the site against unauthorised entry.</li> <li>» To protect members of the public/landowners/residents.</li> <li>» No loss of or damage to sensitive vegetation in areas outside the immediate development footprint.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Secure site, working areas and excavations in an appropriate manner, as agreed with the ECO.	Contractor	Site establishment, and duration of construction
Where necessary control access, fence, and secure area.	Contractor	Site establishment, and duration of construction
Fence and secure contractor's equipment camp.	Contractor	Site establishment
The construction camp must be located in a disturbed area or in a low sensitivity area, and must be screened off as far as practical during the entire construction phase.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Establish appropriately bunded areas for storage of hazardous materials.	Contractor	Site establishment
All development footprints for the road, pipeline, power lines and reservoirs should be appropriately fenced off and clearly demarcate	Contractor	Site establishment, and duration of construction
Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Site establishment, and duration of construction
Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands.	Contractor	Site establishment, and duration of



Mitigation: Action/Control	Responsibility	Timeframe
		construction
Supply adequate waste collection bins at site where construction is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling.	Contractor	Site establishment, and duration of construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Site is secure and there is no unauthorised entry.</li> <li>» No members of the public/ landowners injured.</li> <li>» Appropriate and adequate waste management and sanitation facilities provided at construction site.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> <li>» ECO to monitor all construction areas on a continuous basis until all construction is completed. Non-conformances will be immediately reported to the site manager.</li> </ul>

**OBJECTIVE: Appropriate management of the construction site and construction workers**

A maximum of 100 construction workers may be accommodated on site, while the rest (i.e. those who will not commute from their residences) are expected to be accommodated at existing accommodation facilities in the study area. Construction equipment will need to be stored at appropriate locations on site.

In order to minimise impacts on the surrounding environment, contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report, and this EMP, as well as the requirements of all relevant environmental legislation.

<b>Project Component/s</b>	» Area and linear infrastructure.
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Damage to indigenous natural vegetation and sensitive areas.</li> <li>» Damage to and/or loss of topsoil (i.e. pollution, compaction etc).</li> <li>» Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities.</li> <li>» Pollution/contamination of the environment.</li> </ul>
<b>Activities/Risk</b>	» Vegetation clearing and levelling of equipment storage area/s.

<b>Sources</b>	<ul style="list-style-type: none"> <li>» Access to and from the equipment storage area/s.</li> <li>» Ablution facilities.</li> <li>» Accommodation facilities.</li> <li>» Contractors not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Limit equipment storage within demarcated designated areas.</li> <li>» Ensure adequate sanitation facilities and waste management practices.</li> <li>» Ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
The siting of the construction equipment camp/s will take cognisance of any sensitive areas identified by the EIA studies. The location of this construction equipment camp/s shall be approved by the project ECO.	Contractor	Pre-construction
As far as possible, minimise vegetation clearing and levelling for equipment storage areas.	Contractor	Site establishment, and during construction
Rehabilitate all disturbed areas at the construction equipment camp as soon as construction is complete within an area.	Contractor	Duration of Contract
Ensure ablution facilities are maintained.	Contractor	Site establishment, and duration of construction
Ensure waste removal facilities are maintained and emptied as and when required.	Contractor	Site establishment, and duration of construction
The terms of this EMP and the Environmental Authorisation (once issued) must be included in all tender documentation and Contractors contracts	FG Emvelo	Tender process
Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through the provision of appropriate environmental awareness training to all personnel. Records of all training undertaken must be kept.	Contractor	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no ablution activities will be permitted outside the designated	Contractor and sub-contractor/s	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
areas. These facilities must be regularly serviced by appropriate contractors. A minimum of one toilet shall be provided per 15 persons at each working area such as the Contractor's camp		
Cooking/meals must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor and sub-contractor/s	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor and sub-contractor/s	Duration of contract
No one other than the ECO or personnel authorised by the ECO may disturb flora or fauna outside of the demarcated construction area/s.	Contractor and sub-contractor/s	Duration of contract
Fire fighting equipment and training provided before the construction phase commences.	Contractor and sub-contractor/s	Duration of contract
Contractors appointed by FG Emvelo must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor and sub-contractor/s	Construction
Provide opportunities for workers to go home over weekends where required and practically possible.	Contractor and sub-contractor/s	Construction
On completion of the construction phase, all construction workers must leave the site within one week of their contract ending.	Contractor and sub-contractor/s	Construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The construction camps have avoided sensitive areas, as approved by the ECO.</li> <li>» Ablution and Waste removal facilities are in a good working order and do not pollute the environment due to mismanagement.</li> <li>» All areas are rehabilitated promptly after construction in an area is complete.</li> <li>» Excess vegetation clearing and levelling is not reported by the ECO.</li> <li>» No complaints regarding contractor behaviour or habits.</li> <li>» Appropriate training of all staff is undertaken prior to them commencing work on the construction site.</li> <li>» Code of Conduct drafted before commencement of construction phase.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Regular audits of the construction camps and areas of construction on site by the ECO.</li> <li>» Proof of disposal of sewage at an appropriate waste water treatment works.</li> <li>» An incident reporting system should be used to record non-conformances to the EMP.</li> </ul>

	<ul style="list-style-type: none"> <li>» Observation and supervision of Contractor practices throughout construction phase by the ECO.</li> <li>» Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>
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**OBJECTIVE: Maximise local employment and business opportunities associated with the construction phase**

Although limited, employment opportunities could be created during the construction phase, specifically for semi-skilled and unskilled workers. The unemployment rate in the study area is quite high and there are therefore various individuals in the area in search of employment. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs.

<b>Project Component/s</b>	» Construction activities associated with the establishment of the facility, including the associated infrastructure.
<b>Potential Impact</b>	» The opportunities and benefits associated with the creation of local employment and business.
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Contractors who make use of their own labour for unskilled tasks, thereby reducing the employment and business opportunities for locals.</li> <li>» The inflow of various specialists from outside the study area and even abroad.</li> <li>» Sourcing of individuals with skills similar to the local labour pool outside the municipal area.</li> </ul>
<b>Mitigation: Target/Objective</b>	» Employment of a maximum number of low-skilled to semi-skilled workers for the project from the local area where possible.

Mitigation: Action/Control	Responsibility	Timeframe
Employment of local community members (i.e. source labour from within the municipal area focused on the communities in closest proximity to the site e.g. Karos, Leerkrans, and Ntsikelelo) should be undertaken where possible.	FG Emvelo, Local Municipality, and contractor	Duration of construction
A broad-based approach should be followed to identify and involve relevant organisations which could assist the main contractor and developer in identifying people whose skills may correspond with	FG Emvelo, Local Municipality, and contractor	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
the required job specifications.		
An equitable process should be promoted whereby locals and previously disadvantaged individuals (including women) are considered for employment opportunities.	FG Emvelo, Local Municipality, and contractor	Duration of construction
Create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.	FG Emvelo, Local Municipality, and contractor	Pre-construction
Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses, and SMMEs from the local sector.	FG Emvelo, Local Municipality, and contractor	Pre-construction
A local labour desk should be set-up (if not already established) in the beneficiary communities to co-ordinate the process of involving local labour.	FG Emvelo, Local Municipality, and contractor	Pre-construction
Skills training and capacity building should be embarked upon from the onset of the construction phase and even prior to the construction phase if possible.	FG Emvelo, Local Municipality, and contractor	Pre-construction and construction
Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.	FG Emvelo	Pre-construction and construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Job opportunities, especially of low to semi-skilled positions, are primarily awarded to members of local communities as appropriate.</li> <li>» Locals and previously disadvantaged individuals (including women) are considered during the hiring process.</li> <li>» SMMEs are awarded contracts, where possible, during the construction phase.</li> <li>» Labour, entrepreneurs, businesses, and SMMEs from the local sector are awarded jobs, where possible, based on requirements in the tender documentation.</li> <li>» The involvement of local labour is promoted.</li> <li>» Reports are not made from members of the local communities regarding unrealistic employment opportunities or that only outsiders were employed.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.</li> </ul>

**OBJECTIVE: Maximise capacity building and skills training, and address economic inequities within the study area**

The education levels among the population of the //Khara Hais Municipality are low. Furthermore, the majority of the people within the study area (local communities) are employed within the agricultural sector.

As the construction phase would involve unskilled, semi-skilled, and skilled workers it is likely that locals could be sourced for the unskilled and semi-skilled positions, thereby there should be sufficient numbers of individuals to choose from. Due to the high unemployed figures, it is also clear that there would be various unemployed persons in search of employment, even if they can only secure temporary positions. For the lower level skilled positions, outsiders would thus definitely not have to be externally sourced. Even though all that would be employed might not have the necessary applicable skills, this issue could be addressed through proper focussed skills training and capacity building initiatives after locals have been sourced, but prior to construction activities starting.

<b>Project Component/s</b>	» Availability of required skills in the local communities.
<b>Potential Impact</b>	» The opportunities and benefits associated with the creation of local employment and business could be maximised.
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Unavailability of locals with the required skills resulting in locals not being employed and labour being sourced from outside the municipal area.</li> <li>» Locals are unavailable to assist farmers during pruning and harvesting seasons.</li> <li>» Higher skilled positions might be sourced internationally.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Employment of a maximum number of the low-skilled and/or semi-skilled workers from the local area where possible.</li> <li>» Appropriate skills training and capacity building</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The developer, in discussions with the Local Municipality, should aim to employ a maximum number of the low-skilled and/or semi-skilled workers from the local area where possible.	FG Emvelo, and Local Municipality	Duration of construction
A broad-based approach should be followed to identify and involve relevant organisations in identifying people whose skills may correspond with the job specifications.	FG Emvelo, and Local Municipality	Pre-construction
In cases for the semi-skilled jobs, where the relevant	FG Emvelo, and	Duration of

Mitigation: Action/Control	Responsibility	Timeframe
skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	Local Municipality	construction
A proactive consultative skills-audit should be undertaken in the local communities where job creation is currently a significant need.	FG Emvelo, and Local Municipality	Pre-construction, and construction
Appropriate training should be provided as per a skills development plan to narrow the gap between skills and demand. It is preferable that training be of such a nature that the skills thereby acquired are transferable and of real benefit in other employment contexts.	FG Emvelo, and Local Municipality	Pre-construction, and construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» A skills development plan is developed.</li> <li>» Job opportunities, especially of lower skilled positions, are primarily awarded to members of local communities.</li> <li>» Skills training and capacity building initiatives are developed and implemented.</li> <li>» Local SMMEs and/or entrepreneurs awarded the opportunity to become involved in the tender process.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.</li> </ul>

**OBJECTIVE: Minimise the impact of the inflow of an outside workforce and job seekers into the study area**

Approximately 1 000 construction workers would be involved with the project over the course of the construction period. The timeframe for the proposed facility would be between 24 to 30 months. It is anticipated that one hundred construction workers could be housed in a formal on-site accommodation facility. Should this not be properly managed it could result in negative social impacts such as possible social conflict between the outsiders and the local community members.

Even though the inflow of jobseekers is likely to occur, the probability of this issue becoming problematic and resulting in severe negative social impacts is seen to be improbable.

Other possible negative impacts due to the workforce's presence in the area and especially when jobseekers come to the area would include misconduct of workers, trespassing of workers on privately owned farms, the possible increase in crime, littering, increase in traffic, increase in noise, the development of informal vending stations, and poaching of livestock.

<b>Project Component/s</b>	» Inflow of an outside workforce and jobseekers.
<b>Potential Impact</b>	» The inflow of outsiders and jobseekers could result in negative impacts on the surrounding property owners and local communities, and could even lead to conflict between the locals and these outsiders.
<b>Activities/Risk Sources</b>	<p>» Outside workforce and jobseekers come into conflict with locals, their presence leads to environmental pollution and possibility of them remaining in the area (without proper housing facilities) after construction has ceased. This would put additional pressure on the existing infrastructure and services.</p> <p>» Locals are not employed, which would increase the probability of the impacts occurring.</p>
<b>Mitigation: Target/Objective</b>	<p>» A limited number of outsiders employed.</p> <p>» Pro-active measures in place to deal with possible jobseekers.</p> <p>»</p>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Implement a transparent approach and open consultation with adjacent property owners, prior and throughout the construction period in order to provide a platform where grievances or requests can be addressed before issues become contentious.	Contractor	Pre-construction and construction
Construction workers falling within the semi-skilled to unskilled category should be sourced from the local population where possible.	Contractor	Construction
Local labourers should remain at their existing residences.	Contractor	Construction
Before construction commences, representatives from the local municipality, community leaders, community-based organisations and the surrounding property owners (of the larger area), should be informed of the details of the contractors, size of the workforce and construction schedules.	FG Emvelo	Pre-construction and construction
On-site security should be active prior to the construction phase.	FG Emvelo	Pre- construction
Construction workers should be easily identifiable by wearing uniforms and even identity tags.	ECO	Construction
Sufficient water and sanitation facilities should be provided for the workers on site during the construction phase.	Contractor	Construction
The construction site and accommodation facility should be properly managed to avoid any environmental pollution (due to inadequate water, sanitation and waste infrastructure and services) and littering.	ECO and Contractor	Construction



Mitigation: Action/Control	Responsibility	Timeframe
The construction site should be appropriately fenced.	Contractors	Pre-construction
The applicant, local leaders, and the //Khara Hais Municipality should jointly develop a strategy to minimise the influx of jobseekers to the area.	FG Emvelo, local leaders and Local Municipality	Pre-construction Construction
Informal vending stations should not be allowed on or near the construction site. Construction workers should preferably receive daily meals and beverages to avoid the need for a vending station.	Contractors	Construction
Information distributed as part of the existing HIV/Aids awareness campaigns should again be focused on and communicated to the local workforce.	FG Emvelo and Contractors	Construction
Develop a transparent communication and recruitment process to minimise the influx of jobseekers to the area.	FG Emvelo, local leaders and Local Municipality	Pre-construction
The recruitment process and the use of contractors should be clearly communicated to the local communities.	FG Emvelo	Pre-construction
The communication strategy should ensure that unrealistic employment expectations are not created.	FG Emvelo	Pre-construction and Construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Locals are employed where possible.</li> <li>» Reports are not made from members of the local communities regarding unrealistic employment opportunities and/or negative intrusions or even possible increase in crime.</li> <li>» Sound environmental management of the construction site.</li> <li>» No conflict between outsiders, jobseekers, and local community members.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» FG Emvelo and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.</li> </ul>

**OBJECTIVE: Minimise impacts related to traffic management and transportation of equipment and materials to site**

This would include heavy and light vehicles transporting goods and building materials (i.e. from Upington). At this stage it is not clear how many vehicles would make use of this road on a daily basis but it is expected that it would increase the traffic volume on the meandering N10 national road. An increased risk of accidents is a concern, especially if vehicles overtake on the sections of the road where passing is not allowed. Additional pressure on the capacity and road surface of the N10 is also foreseen.

<b>Project Component/s</b>	» Delivery of any component required within the construction phase.
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals.</li> <li>» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted</li> <li>» Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Construction vehicle movement.</li> <li>» Speeding on local roads.</li> <li>» Degradation of local road conditions.</li> <li>» Site preparation and earthworks.</li> <li>» Foundations or plant equipment installation.</li> <li>» Transportation of ready-mix cement from off-site batching plant to the site.</li> <li>» Mobile construction equipment movement on-site.</li> <li>» Powerline and substation construction activities.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Minimise impact of traffic associated with the construction of the facility on local traffic volume, existing infrastructure, property owners, animals, and road users.</li> <li>» To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction</li> <li>» To ensure all vehicles are roadworthy and all materials/equipment are transported appropriately and within any imposed permit/licence conditions</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The contractor's plans, procedures and schedules, as well as the anticipated intrusion impacts should be clarified with affected parties prior to the commencement of construction activities on site.	FG Emvelo and ECO	Pre-construction
Gravel roads should be sprayed with water to limit dust creation if economically feasible and reasonable from an environmental perspective (water scarce area), or an appropriate dust suppressant should be used.	FG Emvelo and ECO	Construction
Access roads and entrances to the site should be carefully planned to limit any intrusion on the neighbouring property owners and road users.	FG Emvelo and ECO	Planning and design
Construction vehicles and those transporting materials and goods should be inspected by the contractor or a sub-contractor to ensure that these are in good working order and not overloaded.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	FG Emvelo and ECO	Construction
All relevant permits for abnormal loads must be applied for from the relevant authority.	Contractor (or appointed)	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
	transportation contractor)	
A designated access to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved transportation routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards).	Contractor	Duration of contract
Signs must be placed along construction roads to identify speed limits, travel restrictions and other standard traffic control information.	Contractor	Duration of contract
Appropriate maintenance of all vehicles of the contractor must be ensured.	Contractor	Duration of contract
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract
Develop and implement a Traffic and Transportation Management Plan (refer to generic plan contained in Appendix F of this EMP).	Contractors	Duration of construction

**Performance Indicator**

- » Vehicles keeping to the speed limits.
- » Vehicles are in good working order and safety standards are implemented.
- » Local residents and road users are aware of vehicle movements and schedules.
- » No construction traffic related accidents are experienced.
- » Local road conditions and road surfaces are up to standard.
- » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).

**Monitoring**

- » Developer and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.

**OBJECTIVE: Minimise the potential impact on health, safety and security**

An inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to “outsiders” being in the area to undertake their criminal activities. The actual safety of construction workers is also of concern. Further health and safety issues associated with the actual construction site include unauthorised entry to the site and construction areas, the usage of large equipment on site, the risks associated with the storage of equipment and material on site, as well as the increased risk of accidents due to the increased movement of construction vehicles on the local roads.

Other concerns relate to littering, unwanted behaviour of construction workers, transmission of Sexually Transmitted Diseases (STDs), environmental pollution, an increase risk in fires and so forth. Although such perceptions cannot be substantiated or be changed it should be sensitively dealt with. It is thus clear that even though the construction phase when these impacts could occur is only of a short duration, the effects of the impacts could remain in the medium term.

<b>Project Component/s</b>	» Inflow of workers could result in increased safety and security risks.
<b>Potential Impact</b>	» Outside workers are involved in criminal activities and/or fires occur.
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Safety of individuals and animals are at risk.</li> <li>» Theft of livestock.</li> <li>» Theft of construction material.</li> <li>» On-site accidents.</li> <li>» Spread of sexually transmitted diseases.</li> <li>» Littering and environmental pollution.</li> </ul>
<b>Mitigation: Target/Objective</b>	» Employment of local labour should be maximised and strict security measures should be implemented at the construction site.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the presence of an outside workforce.	Contractor	Pre-construction
Screening of applicants could lessen perceived negative perceptions about the outside workforce.	Contractor	Pre- construction
Construction workers should be easily identifiable by	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
wearing uniforms and even identity tags.		
Local community members and property owners should be informed of the presence of the outside workforce, the construction schedule, and movement of workers.	Developer	Construction
Care should be taken to avoid conflict between the local communities and the "outside" workforce	FG Emvelo and Contractor	Pre- construction and construction
Property owners, their workers, as well as local communities should be motivated to be involved in crime prevention and by reporting crimes.	FG Emvelo and Local communities	All phases of project
The construction site should be fenced and access to the area controlled.	FG Emvelo and Contractor	All phases of project
Security personnel should be aware of the possibility of animal theft and poaching and should be able to identify possible criminal elements and/or criminal activities in this regard.	FG Emvelo and Contractor	Construction
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners and the Local Municipality	FG Emvelo, Local Municipality, and local communities	Pre- construction and when required
Contact details of emergency services should be prominently displayed on site.	FG Emvelo and Contractor	Construction
Appropriate fire-fighting equipment must be present on site and members of the workforce should be appropriately trained in using this equipment in the fighting of veld fires	FG Emvelo and Contractor	Construction
Develop and implement an appropriate health and safety plan	FG Emvelo Contractor	Construction

<b>Performance Indicator</b>	» No criminal activities and theft of livestock are reported. » No fires or on-site accidents occur.
<b>Monitoring</b>	» FG Emvelo,, and appointed ECO must monitor indicators listed above to ensure that they have been implemented.

**OBJECTIVE: Minimise the potential impact on the daily living and movement patterns and farming activities**

The main property affected by the proposed development is currently used for farming (i.e. mainly cattle) and leisure activities. Smaller farming units north of the N10 are mainly used for the cultivation of grapes and raisins by means of irrigation farming. Farmland could be lost to the development footprint should the project be implemented,

although it was indicated that farming activities between the Orange River and the N10 would be retained, and other types of farming activities on the property are being investigated.

An important issue to note concerning the impact on farming activities is the possible “loss” of seasonal workers for the local grape and raisin farming community to the construction site, and the creation of contesting remuneration packages.

Some intrusion impacts due to the construction activities and vehicular movements (noise and dust) on the surrounding property owners could be experienced. Again, due to dwellings being far removed from the construction site, the impact is anticipated to be low and would respond to mitigation.

<b>Project Component/s</b>	» Construction activities associated with the area and linear infrastructure.
<b>Potential Impact</b>	» Loss of agricultural land. » Possible increase in dust, noise, and general intrusion.
<b>Activities/Risk Sources</b>	» Increased risk of accidents due to increase in vehicle movement » Possible degradation of local roads.
<b>Mitigation: Target/Objective</b>	» Limit any negative impacts on the farming activities and on the surrounding property owners’ daily living and movement patterns.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Additional access roads should be kept to a minimum. Access roads and entrances to the site should be carefully planned to limit any intrusion on the neighbouring property owners and road users and to limit any accident risks.	Contractor	Pre-construction and construction
Source general construction material and goods locally where available to limit transportation over long distances.	FG Emvelo and Contractor	Pre-construction and construction
Local labourers should be used during the construction phase to limit the inflow of outsiders to the area.	FG Emvelo and Contractor	Pre-construction and construction
Remuneration packages should be market related and should take note of the sensitivities at hand.	FG Emvelo and Contractor	Pre-construction and construction
Construction activities should not interfere with the farming activities on surrounding properties.	FG Emvelo , Contractor and affected property owner	Pre-construction

<b>Performance Indicator</b>	» Minimal loss of agricultural land. » Limited noise and dust pollution. » Limited intrusions on surrounding property owners. » No reports from property owners regarding problems with
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	<ul style="list-style-type: none"> <li>» construction activities and workforce.</li> <li>» Limited degradation of local roads.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer, and appointed ECO must monitor indicators listed above to ensure that they have been implemented.</li> </ul>

## OBJECTIVE: Management of dust and air emissions

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the main and internal access roads.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Construction activities associated with the area and linear infrastructure.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility.</li> <li>» Release of minor amounts of air pollutants (for example NO<sub>2</sub>, CO and SO<sub>2</sub>) from vehicles and construction equipment</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Clearing of vegetation and topsoil.</li> <li>» Excavation, grading, scraping, levelling, digging, drilling.</li> <li>» Transport of materials, equipment, and components on internal access roads.</li> <li>» Re-entrainment of deposited dust by vehicle movements.</li> <li>» Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces.</li> <li>» Fuel burning vehicle and construction engines.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure emissions from all vehicles and construction engines are minimised, where possible, for the duration of the construction phase</li> <li>» To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Roads must be maintained to a manner that will ensure that nuisance to the community from dust emissions from road or vehicle sources is not visibly excessive Ensure that any damage to roads because of construction activities is repaired before completion of the construction phase.	Contractor	Site establishment and construction

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins if required by the wind conditions.	Contractor	Duration of contract
Speed of construction vehicles must be restricted, as defined by the ECO.	Contractor	Duration of contract
Dust-generating activities or earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased during periods of high winds if visible dust is blowing toward nearby residences outside the site.	Contractor	Duration of contract
Strictly control vibration pollution from compaction plant or excavation plant.	Contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable once construction in an area is completed.	Contractor	Completion of construction
Vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints from affected residents or community regarding dust or vehicle emissions.</li> <li>» Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase commences.</li> <li>» Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed.</li> <li>» All heavy vehicles equipped with speed monitors before they are used in the construction phase in accordance with South African vehicle legislation.</li> <li>» Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.</li> </ul>
<b>Monitoring</b>	<p>Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods:</p> <ul style="list-style-type: none"> <li>» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager.</li> <li>» A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon.</li> <li>» An incident reporting system must be used to record non-conformances to the EMP.</li> </ul>



## OBJECTIVE: Minimisation of development footprint and disturbance to topsoil

In order to minimise impacts on flora, fauna, and ecological processes, the development footprint should be limited.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power block.</li> <li>» Power lines.</li> <li>» Water pipeline and water storage/treatment reservoirs.</li> <li>» Offices and workshops.</li> <li>» Access roads.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impacts on natural vegetation.</li> <li>» Impacts on soil.</li> <li>» Loss of topsoil.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks.</li> <li>» Trenching activities for water supply pipeline.</li> <li>» Excavation of foundations.</li> <li>» Construction of site access road.</li> <li>» Site preparation (e.g. compaction).</li> <li>» Foundations or plant equipment installation.</li> <li>» Powerline and pipeline construction activities.</li> <li>» Stockpiling of topsoil, subsoil and spoil material.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To retain natural vegetation, where possible.</li> <li>» To minimise footprints of disturbance of vegetation/habitats on-site</li> <li>» Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas.</li> <li>» Minimise spoil material.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on flora and fauna is restricted.	Contractor	Site establishment & duration of contract
Construction activities must be restricted to demarcated areas so that impact on flora and fauna is restricted.	Contractor	Site establishment & duration of contract
All fill material must be sourced from a commercial off-site suitable/permitted source, quarry or borrow pit. Where possible, material from foundation excavations must be used as fill on-site.	Contractor	Duration of contract
Excavated topsoil must be stockpiled in designated	Contractor	Site

Mitigation: Action/Control	Responsibility	Timeframe
areas separate from base material and covered until replaced during rehabilitation. As far as possible, topsoil must not be stored for longer than 3 months.		establishment & duration of contract
Topsoil must not be stripped or stockpiled when it is raining or when the soil is wet as compaction will occur.	Contractor	Site establishment Maintenance: for duration of contract
The maximum topsoil stockpile height must not exceed 2m in order to preserve micro-organisms within the topsoil, which can be lost due to compaction and lack of oxygen.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas.</li> <li>» Minimise clearing of existing vegetation.</li> <li>» Topsoil appropriately stored.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation clearing and soil management activities by ECO throughout construction phase.</li> <li>» Supervision of all clearing and earthworks.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>

**OBJECTIVE: Minimise the impacts on and loss of indigenous vegetation**

<b>Project Component/s</b>	» Any infrastructure or activity that will result in disturbance to natural areas.
<b>Potential Impact</b>	» Loss of indigenous natural vegetation due to construction activities, or poor behaviour on the part of the construction team.
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Vegetation clearing.</li> <li>» Construction of access roads.</li> <li>» Placement of powerline towers.</li> <li>» Construction/placement of water pipeline, storage/treatment reservoirs, and water abstraction infrastructure</li> <li>» Chemical contamination of the soil by vehicles and machinery.</li> <li>» Operation of construction camps.</li> <li>» Storage of materials required for construction.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Retain natural vegetation in the highly sensitive areas of the site.</li> <li>» Minimise footprints of disturbance of vegetation/habitats on-site.</li> <li>» Minimise loss of indigenous vegetation.</li> <li>» Minimise loss of species of conservation concern.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Areas to be cleared must be clearly marked in the field to eliminate unnecessary clearing.	Contractor	Construction
Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld, use access roads only.	Contractor	Construction
Search and Rescue to be completed in all areas of natural vegetation prior to any construction related activities in these areas. General items that can be considered for rescue are all bulbs and tuberous species (including <i>Haemanthus</i> , <i>Brunsvigia</i> , <i>Babiana</i> , <i>Trachyandra</i> , <i>Albuca</i> , <i>Veltheimia</i> , <i>Arctopus</i> , etc.), plus selected specimens of succulents such as <i>Ruschia</i> and <i>Lampranthus</i> species. Material is to be bagged up or stored in suitable conditions; to be replanted in areas requiring rehabilitation following cessation of all construction related disturbance in particular area.	FG Emvelo and ECO	Pre-construction
All rescued species should be bagged (and cuttings taken where appropriate) and kept in an on-site nursery (if water can be provided; otherwise off-site) and should be returned to site once construction activities are completed and rehabilitation of a disturbed area is required.	Contractor	Construction
Limit impacts on riparian vegetation at the water	Contractor	Duration of

Mitigation: Action/Control	Responsibility	Timeframe
abstraction point and powerline crossing point of the river.		contract
A site rehabilitation programme must be implemented (refer Chapter 6).	Contractor in consultation with Specialist	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas.</li> <li>» Minimised clearing of existing/natural vegetation.</li> <li>» Limited impacts on areas of identified and demarcated sensitive habitats/vegetation.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation clearing activities by ECO throughout construction phase.</li> <li>» Monitoring of vegetation clearing activities in terms of permit conditions.</li> <li>» Supervision of all clearing and earthworks.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>

**OBJECTIVE: Minimise the establishment and spread of alien invasive plants**

<b>Project Component/s</b>	» Any infrastructure or activity that will result in disturbance to natural areas.
<b>Potential Impact</b>	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species.
<b>Activities/Risk Sources</b>	» Construction, environmental management.
<b>Mitigation: Target/Objective</b>	» There is a target of no alien plants within project control area during the construction and operation phases.

Mitigation: Action/Control	Responsibility	Timeframe
Avoid creating conditions in which alien plants may become established: <ul style="list-style-type: none"> <li>» Keep disturbance of indigenous vegetation to a minimum.</li> <li>» Rehabilitate disturbed areas as soon as possible after construction is complete in an area.</li> <li>» Do not import soil from areas with alien plants.</li> </ul>	Contractor	Construction and operation
Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per	Contractor	Construction and operation

Mitigation: Action/Control	Responsibility	Timeframe
Conservation of Agricultural Resources Act and Biodiversity Act).		
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction
Develop and implement alien control management plan (refer to Appendix A for generic plan)	Contractor	Construction

<b>Performance Indicator</b>	» For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings.
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Ongoing monitoring of area by ECO during construction.</li> <li>» Ongoing monitoring of area by environmental manager during operation.</li> <li>» Annual audit of project area and immediate surroundings by qualified botanist.</li> <li>» If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants.</li> <li>» The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.</li> <li>» The environmental manager should be responsible for driving this process.</li> <li>» Reporting frequency depends on legal compliance framework.</li> </ul>

## OBJECTIVE: Minimise the impacts on fauna

<b>Project Component/s</b>	» Any infrastructure or activity that will result in disturbance to natural areas.
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Vegetation clearance and associated impacts on faunal habitats.</li> <li>» Traffic to and from site.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks.</li> <li>» Construction-related traffic.</li> <li>» Foundations or plant equipment installation.</li> <li>» Mobile construction equipment.</li> <li>» Powerline and pipeline construction activities.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To minimise footprints of habitat destruction</li> <li>» To minimise disturbance to (and death of) resident and visitor faunal and avifaunal species</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
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Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared must be clearly marked in the field to eliminate unnecessary clearing/disturbance.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Site establishment & duration of contract
Animals that cannot flee from the affected areas by themselves (e.g. tortoises, amphibians, small mammals) must be removed from the affected areas before the start of site clearing/construction and relocated to safe areas.	Specialist	Pre-construction
A site rehabilitation programme should be implemented.	Contractor in consultation with Specialist	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas</li> <li>» Minimised clearing of existing/natural vegetation and habitats for fauna</li> <li>» Limited impacts on faunal species (i.e. noted/recorded fatalities)</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation clearing activities by ECO throughout construction phase</li> <li>» Supervision of all clearing and earthworks</li> <li>» Recording faunal fatalities to monitor success of relocation efforts</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>

## OBJECTIVE: Minimise impacts on water resources

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Construction activities, particularly near the abstraction point on the Orange River.</li> <li>» Storage of chemicals and hazardous materials.</li> <li>» Ablution facilities.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Pollutants such as lime-containing (high pH) construction materials such as concrete, cement, grouts, etc could be harmful to aquatic biota, particularly during low flows when dilution is reduced.</li> <li>» Health risk to locals using the river water for domestic purposes.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Fuelling, usage and maintenance of construction vehicles.</li> <li>» Cement batching and usage.</li> <li>» Labourer using abluion facilities.</li> <li>» Use of any chemicals or hazardous materials during construction.</li> </ul>

<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» No incidents related to spills of chemicals and hazardous materials.</li> <li>» No release of contaminated water, which includes any 'backwash" or process water that could be released back into the Orange River.</li> <li>» No misbehaviour of construction workers (i.e. ablution activities, washing).</li> </ul>
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Mitigation: Action/Control	Responsibility	Timeframe
Strict use and management of all hazardous materials used on site.	Contractor	Construction
Strict management of potential sources of pollution (hydrocarbons from vehicles and machinery, cement during construction, etc.).	Contractor	Construction
Containment of all contaminated water, which includes any 'backwash" or process water that could be released back into the Orange River.	Contractor	Construction
Strict control over the behaviour of construction workers.	Contractor	Construction
Any current erosion or destabilisation of the river banks due to existing structures near the abstraction sites should be repaired and stabilised as part of the present project.	Contractor	Construction
Ensure hard-engineered erosion-control structures are maintained and rehabilitated using appropriate indigenous vegetation.	Contractor	Construction

<b>Performance Indicator</b>	» Compliance with the terms and conditions of the water use license in terms of quality control.
<b>Monitoring</b>	» Surface water monitoring plan - elevated turbidity in the irrigation canals and Orange River.

### OBJECTIVE: Minimising alteration of the hydrological regime

<b>Project Component/s</b>	» Alteration of sandy substrata into hard surfaces impacting on the local hydrological regime
<b>Potential Impact</b>	» Poor stormwater management and the alteration hydrological regime
<b>Activities/Risk Sources</b>	» Placement of hard engineered surfaces
<b>Mitigation: Target/Objective</b>	» Reduce the potential increase in surface flow velocities and the impact on dry riverbeds and the localised drainage systems

Mitigation: Action/Control	Responsibility	Timeframe
» The most significant form of mitigation would be to	Developer /	Planning, design

Mitigation: Action/Control	Responsibility	Timeframe
select a development area that contained no drainage lines. » Any stormwater within the site will be handled in a suitable manner, i.e. clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities.	Operator	and operation

<b>Performance Indicator</b>	» Water quality and quantity management - "Water Use Licence Conditions"
<b>Monitoring</b>	» Surface water monitoring plan

## OBJECTIVE: Minimise soil degradation and erosion

The soil on site may be impacted in terms of:

- » Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern across the entire site which is underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion).
- » Uncontrolled run-off relating to construction activity (excessive wetting, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation of the river.
- » Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems. Degradation of parent rock is considered low as there are no deep excavations envisaged.

<b>Project Component/s</b>	» Power block. » Powerline. » Water pipeline, water storage/treatment reservoirs, and water abstraction facilities. » Offices and workshops. » Access roads.
<b>Potential Impact</b>	» Soil and rock degradation. » Soil erosion. » Increased deposition of soil into drainage systems. » Increased run-off over the site.
<b>Activities/Risk Sources</b>	» Removal of vegetation, excavation, stockpiling, compaction, and pollution of soil.



	<ul style="list-style-type: none"> <li>» Rainfall - water erosion of disturbed areas.</li> <li>» Wind erosion of disturbed areas.</li> <li>» Concentrated discharge of water from construction activity.</li> <li>» Establishment or extension of the water abstraction facilities etc on the banks and floodplains of the Orange River.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Minimise extent of disturbance areas.</li> <li>» Minimise activity within disturbance areas.</li> <li>» Minimise soil degradation (mixing, wetting, compaction, etc).</li> <li>» Minimise soil erosion.</li> <li>» Minimise deposition of soil into drainage lines.</li> <li>» Minimise instability of embankments/excavations.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Identify disturbance areas and restrict construction activity to these areas.	Contractor	Before and during construction
Rehabilitate disturbance areas as soon as practicable when construction in an area is complete.	Contractor	During and after construction
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer/ECO/ Contractor	Design and construction
Where access roads cross natural drainage lines, culverts must be designed to allow free flow and regular maintenance must be carried out.	Engineer/ECO/ Contractor	Design, before and during construction
Dust control on construction site: wetting of denuded areas.	Contractor	Construction
Minimise removal of vegetation which adds stability to soil.	ECO/Contractor	Construction
If any clearing is done near the abstraction point, this area is to be monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place.	Contractor	Planning, design, construction and operation
Soil conservation: Stockpile topsoil for re-use in rehabilitation phase, protect stockpile from erosion	Contractor	Before and during construction
Erosion control measures: Run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, shade nets, or temporary mulching over denuded area as required.	Contractor/ECO	Erection: Before construction Maintenance: Duration of contract
Control depth of excavations and stability of cut faces/sidewalls.	Engineer/ECO/ Contractor	Before construction and Maintenance Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
The placement of pump inlets and their supporting infrastructure so to prevent the potential for scour / erosion and downstream sedimentation of the Orange River.	Contractor	Planning, design, and construction
<u>Anti-erosion measures (such as silt fences or other appropriate mechanisms) must be installed in areas disturbed through construction activities.</u>	<u>Contractor</u>	<u>Construction</u>

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No activity outside demarcated disturbance areas.</li> <li>» Acceptable level of activity within disturbance areas, as determined by the ECO.</li> <li>» Acceptable level of soil erosion around site, as determined by the ECO.</li> <li>» Acceptable level of increased siltation in drainage lines, as determined by the ECO.</li> <li>» Acceptable state of excavations, as determined by the ECO.</li> <li>» No activity in restricted areas.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Monthly inspections of the site by the ECO.</li> <li>» Monthly inspections of sediment control devices.</li> <li>» Monthly inspections of surroundings, including drainage lines.</li> <li>» Immediate reporting of ineffective sediment control systems.</li> <li>» An incident reporting system will record non-conformances.</li> </ul>

## OBJECTIVE: Protection of heritage resources

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large-scale excavations for foundations will damage archaeological sites, as will road construction activities.

Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility.

Several sites of were identified (i.e. include tool, flakes and cores, a house, and a single roomed structure), of differing significance on a local level.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power block.</li> <li>» Powerline.</li> <li>» Water pipeline and water storage/treatment reservoirs.</li> <li>» Offices and workshops.</li> <li>» Access roads.</li> </ul>
<b>Potential Impact</b>	» Heritage objects or artefacts found on site are inappropriately managed or destroyed
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Foundations or plant equipment installation</li> <li>» Mobile construction equipment movement on site</li> <li>» Powerline and pipeline construction activitiespipeline</li> </ul>
<b>Mitigation: Target/Objective</b>	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Areas required to be cleared during construction must be clearly marked in the field to avoid unnecessary disturbance of adjacent areas (which will not be surveyed in detail by a heritage specialist).	Contractor in consultation with Specialist	Pre-construction
Familiarise all staff and contractors with procedures for dealing with heritage objects/sites.	ECO/specialist	Pre-construction
Project employees and any contract staff will maintain, at all times, a high level of awareness of the possibility of discovering heritage sites.	FG Emvelo/ Contractor	Duration of contract
If a heritage object is found, work in that area will be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	FG Emvelo/ Contractor in consultation with Specialist	Duration of contract
Apply for sampling permits from SAHRA for work on any archaeological sites identified as needing intervention.	FG Emvelo in consultation with Specialist	Pre-construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero disturbance outside of designated work areas</li> <li>» All heritage items located are dealt with as per the legislative guidelines</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of excavation activities by ECO throughout construction phase</li> <li>» Supervision of all clearing and earthworks</li> <li>» Due care taken during earthworks and disturbance of land by all staff and any heritage objects found reported.</li> </ul>

- » Appropriate permits obtained from SAHRA prior to the disturbance or destruction of heritage sites
- » An incident reporting system will be used to record non-conformances to the EMP.

## **OBJECTIVE: Minimisation of visual impacts associated with construction**

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a visual nuisance to landowners and residents in the area as well as road users. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility. Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

The primary visual impact of the facility and ancillary infrastructure, including the power line, is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts. Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

- » Reduce the construction period through careful planning and productive implementation of resources.
- » Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.
- » Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- » Ensure that rubble, litter, and disused construction materials are managed and removed regularly.
- » Ensure that all infrastructure and the site and general surrounds are maintained in a neat manner.
- » Reduce and control construction dust using approved dust suppression techniques.
- » Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- » Rehabilitate all disturbed areas, construction areas, roads, and servitudes to acceptable visual standards.

Secondary impacts anticipated as a result of the proposed facility (i.e. visual character, sense of place and tourism potential) are not possible to mitigate.

<b>Project Component/s</b>	» Construction site and construction accommodation.
<b>Potential Impact</b>	» Visual impact of general construction activities and construction accommodation, and the potential scarring of the landscape due to vegetation clearing.
<b>Activity/Risk Source</b>	» The viewing of the above mentioned by observers on or near the site.
<b>Mitigation: Target/Objective</b>	» Minimal visual intrusion by construction activities and construction accommodation and intact vegetation cover outside of immediate works areas.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Reduce the construction period through careful planning and productive implementation of resources.	FG Emvelo or contractor	Planning
Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.	FG Emvelo or contractor	Planning
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	FG Emvelo or Contractor	Construction
Ensure that rubble, litter, and disused construction materials are managed and removed regularly.	FG Emvelo or Contractor	Construction
Ensure that all infrastructure and the site and general surrounds are maintained in a neat a manner.	FG Emvelo or Contractor	Construction
Reduce and control construction dust using approved dust suppression techniques.	Contractor	Construction
As far as possible, restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Contractor	Construction
Rehabilitate all disturbed areas, construction areas, roads, and servitudes to acceptable visual standards.	Contractor	Construction

<b>Performance Indicator</b>	» Vegetation cover on and near the site is intact with no evidence of degradation or erosion. » Construction site is kept in a neat and tidy state.
<b>Monitoring</b>	» Monitoring of vegetation clearing during construction. » Monitoring of rehabilitated areas post construction.

**OBJECTIVE: Appropriate handling and management of waste**

The construction of the solar energy facility will involve the generation of various wastes. In order to manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented (Refer to Appendix E). The main wastes expected to be generated by the construction of the solar energy facility will include:

- » general solid waste
- » hazardous waste
- » liquid waste (including grey water and sewage)

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power block.</li> <li>» Powerline.</li> <li>» Water pipeline and water storage/treatment reservoirs.</li> <li>» Offices and workshops.</li> <li>» Access roads.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Inefficient use of resources resulting in excessive waste generation</li> <li>» Litter or contamination of the site or water through poor waste management practices</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Packaging</li> <li>» Other construction wastes</li> <li>» Hydrocarbon use and storage</li> <li>» Spoil material from excavation, earthworks and site preparation</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To comply with waste management legislation</li> <li>» To minimise production of waste</li> <li>» To ensure appropriate waste storage and disposal</li> <li>» To avoid environmental harm from waste disposal.</li> <li>» A waste manifests should be developed for the ablutions showing proof of disposal of sewage at appropriate water treatment works.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste as required. Location	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.		
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Uncontaminated waste will be removed at least weekly for disposal; other wastes will be removed for recycling/disposal at an appropriate frequency.	Contractor	Duration of contract
Disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Regularly serviced chemical toilets facilities will be used to ensure appropriate control of sewage.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction
Dispose of all solid waste collected at an appropriately registered waste disposal site. Waste disposal shall be in accordance with all relevant legislation and under no circumstances may waste be burnt on site.	Contractor	Duration of construction
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.	Contractor	Duration of construction

**Performance Indicator**

- » No complaints received regarding waste on site or indiscriminate dumping.
- » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately.
- » Provision of all appropriate waste manifests for all waste streams.

<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of waste management practices throughout construction phase.</li> <li>» Waste collection will be monitored on a regular basis.</li> <li>» Waste documentation completed.</li> <li>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>
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**OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances**

The construction phase will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. Chemical storage is likely to occur within the power block site (Refer to appendix E of this EMP).

<b>Project Component/s</b>	» Storage and handling of chemicals, hazardous substances.
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Release of contaminated water from contact with spilled chemicals</li> <li>» Generation of contaminated wastes from used chemical containers</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Vehicles associated with site preparation and earthworks.</li> <li>» Construction activities of area and linear infrastructure.</li> <li>» Hydrocarbon use and storage.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons.</li> <li>» To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
Implement an emergency preparedness plan (refer to Appendix I) during the construction phase.	Contractor	Duration of Contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants,	Contractor	Duration of



Mitigation: Action/Control	Responsibility	Timeframe
the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.		contract
Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not to take place on-site (except for emergencies). If repairs of vehicles must take place, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
All stored fuels to be maintained within a bund and on a sealed surface. <u>The bunded area must be provided with a tap-off system through which spillages and leakages that might occur will be removed without any spillage outside the bunded area.</u>	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations	Contractor	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction

**Performance Indicator**

- » No chemical spills outside of designated storage areas.
- » No unattended water or soil contamination by spills.
- » No complaints received regarding waste on site or indiscriminate dumping.

	»
<b>Monitoring</b>	<ul style="list-style-type: none"><li>» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase.</li><li>» A complaints register must be maintained, in which any complaints from the community will be logged.</li><li>» An incident reporting system will be used to record non-conformances to the EMP.</li></ul>

### 6.3 Detailing Method Statements

**OBJECTIVE: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk**

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

A Method Statement is defined as “a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor’s proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications”. The Method Statement must cover applicable details with regard to:

- » Construction procedures
- » Materials and equipment to be used
- » Getting the equipment to and from site
- » How the equipment/material will be moved while on-site
- » How and where material will be stored
- » The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
- » Timing and location of activities
- » Compliance/non-compliance with the Specifications, and
- » Any other information deemed necessary by the Site Manager.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Construction Manager (or may be delegated to the OE) Project Manager, except in the case of emergency activities and then only with the consent of

the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

The ECO should monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

#### 6.4 Awareness and Competence: Construction Phase of the Solar Energy Facility

**OBJECTIVE: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm**

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

- » Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document.
- » Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.
- » Employees must undergo training for the operation and maintenance activities associated with a Concentrating Solar Power (CSP) Plant and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
- » The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- » Awareness of any other environmental matters, which are deemed necessary by the ECO.

- » Ensuring that employee information posters, outlining the environmental “do’s” and “don’ts” (as per the environmental awareness training course) are erected at prominent locations throughout the site.
- » Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
- » Records must be kept of those that have completed the relevant training.
- » Training should be done either in a written or verbal format but must be appropriate for the receiving audience.
- » Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMP. This training and awareness will be achieved in the following ways:

#### **6.4.1 Environmental Awareness Training**

Environmental Awareness Training must take the form of an on-site talk and demonstration by the ECO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the ECO on site.

#### **6.4.2 Induction Training**

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor’s or Engineer’s staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should include discussing the developer’s environmental policy and values, the function of the EMP and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do’s and don’ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE Officer on site.

#### **6.4.3 Toolbox Talks**

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

## 6.5 Monitoring Programme: Construction Phase of the Solar Energy Facility

**OBJECTIVE: To monitor the performance of the control strategies employed against environmental objectives and standards.**

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, FG Emvelo will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

- » Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
- » Ensure adequate and appropriate interventions to address non-compliance
- » Ensure adequate and appropriate interventions to address environmental degradation
- » Provide a mechanism for the lodging and resolution of public complaints
- » Ensure appropriate and adequate record keeping related to environmental compliance
- » Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site
- » Aid communication and feedback to authorities and stakeholders

The ECO will ensure compliance with the EMP, and to conduct monitoring activities. The ECO must have the appropriate experience and qualifications to undertake the necessary tasks. The ECO must report any non-compliance or where corrective action is necessary

to the Site Manager and/or any other monitoring body stipulated by the regulating authorities. The following reports will be applicable:

#### **6.5.1 Non-Conformance Reports**

All supervisory staff including Foremen, Resident Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

#### **6.5.2 Monitoring Reports**

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out.

#### **6.5.3 Final Audit Report**

A final environmental audit report must be submitted to DEA upon completion of the construction and rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMP.

**OBJECTIVE: Ensure disciplined conduct of on-site contractors and workers**

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report and this EMP, as well as the requirements of all relevant environmental legislation.

<b>Project component/s</b>	» Construction workers on site and residing in surrounding areas
<b>Potential Impact</b>	» Pollution/contamination of the environment » Disturbance to the environment
<b>Activity/risk source</b>	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
<b>Mitigation: Target/Objective</b>	» To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The terms of this EMP and the Environmental Authorisation (once issued) will be included in all tender documentation and Contractor's contracts.	FG Emvelo	Tender process
Conduct environmental awareness training with construction workers before the commencement of construction.	FG Emvelo / Contractor	Prior to commencement of construction
An ECO must be permanently on site throughout the road construction, cable laying, and turbine foundation excavation periods, and at other times should visit the site at least once a week.	FG Emvelo	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no ablutions will be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract
Cooking/meals must take place in a designated area; no firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the ECO or personnel authorised by the ECO must disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract
Contractors appointed by BioTherm Energy must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor (and sub-contractor/s)	Construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne	Contractor (and sub-contractor/s)	Construction

Mitigation: Action/control	Responsibility	Timeframe
by the contractor		
<u>Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.</u>	FG Emvelo Contractor	<u>Pre-construction</u>

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Compliance with specified conditions of Environmental Authorisation, EIA report and EMP.</li> <li>» No complaints regarding contractor behaviour or habits.</li> <li>» Code of Conduct drafted before commencement of construction phase.</li> <li>» Briefing session with construction workers held at outset of construction phase regarding environmental requirements and Code of Conduct.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of Contractor practices throughout construction phase.</li> <li>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>



## MANAGEMENT PROGRAMME: REHABILITATION

## CHAPTER 7

**Overall Goal:** Undertake the rehabilitation measures in a way that:

- » Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

### 7.1. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

**OBJECTIVE:** Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

<b>Project Component/s</b>	» Area and linear infrastructure.
<b>Potential Impact</b>	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion and increased runoff, and the requirement for on-going management intervention.
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Temporary construction areas.</li> <li>» Temporary access roads/tracks.</li> <li>» Pipeline and powerline servitude</li> <li>» Other disturbed areas/footprints.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Ensure and encourage site rehabilitation of disturbed areas.</li> <li>» Ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
Develop and implement a habitat rehabilitation plan	Contractor	Pre-construction
All temporary facilities, equipment, and waste materials must be removed from site.	Contractor	Following execution of the works

Mitigation: Action/Control	Responsibility	Timeframe
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up.	Contractor	Following completion of construction activities in an area
All hardened surfaces within the construction camp area should be ripped, all imported materials removed, and the area shall be top soiled and re-vegetated.	Contractor	Following completion of construction activities in an area
Temporary roads must be closed and access across these blocked	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
A rehabilitation plan should be drawn up that specifies the rehabilitation process and should be approved by the ECO.	Contractor, FG Emvelo and ECO	Pre-construction
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use of native/indigenous plant species removed from disturbance areas in the rehabilitation phase to be determined by a botanist as applicable.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	FG Emvelo in consultation with rehabilitation specialist	Post-rehabilitation
Erosion control measures should be used in sensitive areas such as steep slopes, hills, and drainage lines is necessary.	FG Emvelo in consultation with rehabilitation specialist	Post-rehabilitation
On-going alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	FG Emvelo in consultation with rehabilitation specialist	Post-rehabilitation

**Performance**

» All portions of site, including construction equipment camp and

<b>Indicator</b>	working areas, cleared of equipment and temporary facilities. <ul style="list-style-type: none"><li>» Topsoil replaced on all areas and stabilised where practicable or required after construction and temporally utilised areas.</li><li>» Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites.</li><li>» Completed site free of erosion and alien invasive plants.</li></ul>
<b>Monitoring</b>	<ul style="list-style-type: none"><li>» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented during the operational lifespan of the facility.</li><li>» On-going alien plant monitoring and removal should be undertaken on an annual basis.</li></ul>

**MANAGEMENT PROGRAMME: OPERATION**

**CHAPTER 8**

**Overall Goal:** To ensure that the operation of the solar energy facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the solar energy facility in a way that:

- » Ensures that operation activities are properly managed in respect of environmental aspects and impacts
- » Enables the solar energy facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents
- » Minimises impacts on fauna using the site
- » Establishes an environmental baseline for solar energy facility sites in South Africa

An environmental manager must be appointed during operation whose duty it will be to ensure the implementation of the operational EMP.

**8.1. Objectives**

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

**OBJECTIVE: Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation**

Indirect impacts on vegetation and terrestrial fauna during operation could result from maintenance activities and the movement of people and vehicles on site. In order to ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

<b>Project component/s</b>	<ul style="list-style-type: none"> <li>» Areas requiring regular maintenance.</li> <li>» Route of the security team.</li> <li>» Areas disturbed during the construction phase and subsequently rehabilitation at its completion</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Disturbance to or loss of vegetation and/or habitat.</li> <li>» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.</li> </ul>

<b>Activity/Risk Source</b>	» Movement of employee vehicles within and around site.
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Maintain minimised footprints of disturbance of vegetation/habitats on-site.</li> <li>» Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Vehicle movements must be restricted to designated roadways.	FG Emvelo	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	FG Emvelo	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	FG Emvelo	Operation
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis.	FG Emvelo or Specialist	Annual monitoring until successful re-establishment of vegetation in an area

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No further disturbance to vegetation or terrestrial faunal habitats.</li> <li>» Continued improvement of rehabilitation efforts.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of vegetation on-site by CSP facility Manager and environmental manager.</li> <li>» Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas.</li> </ul>

## OBJECTIVE: Protection of avifauna

During the operation of the facility, the threat of collision with the powerline is the biggest potential threat to avifauna, particularly sensitive, collision prone species that may occur in the study area. This is of particular concern where the powerline crosses active agricultural land and the Orange River. The threat of electrocution while perching on the powerline and associated infrastructure serves as a threat to certain sensitive species.

Interaction of avifauna with the parabola is possible, however unlikely. Drowning events have been known to occur in dry environments in water storage reservoirs.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Powerline.</li> <li>» Reservoirs.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Collision and electrocution events with the overhead powerline.</li> <li>» Drowning in the reservoirs.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Operation of the powerline and water reservoirs without mitigation measures.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Maintain a low number of collision, electrocution, and drowning events.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Fit the earth wire with bird marking/deterrent devices in defined problem areas (i.e. spans across active agricultural land and the Orange river) which have proved to be extremely effective in preventing bird collisions by making the line more visible.	FG Emvelo	Construction
Ensure bird-friendly tower designs are implemented to minimize the risk of electrocutions	FG Emvelo	Construction
Ensure storage water reservoirs are covered, or bird deterrent measures are used.	FG Emvelo	Construction
Notes of electrocution, collision, and drowning events must be sent to a qualified Ornithologist for the recommendation of further mitigation measures.	ECO and avifauna specialist	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Zero collision, drowning, or electrocution events</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation of electrocution or collision events with the powerline</li> <li>» Monitor powerline servitude and reservoirs for mortalities.</li> </ul>

## OBJECTIVE: Minimisation of visual impacts

The primary visual impact of the facility and its ancillary infrastructure, including the power line, is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power block.</li> <li>» Power line.</li> <li>» Water pipeline and water storage/treatment reservoirs.</li> <li>» Offices and workshops.</li> <li>» Access roads.</li> </ul>
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<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Visual impact of facility degradation and vegetation rehabilitation failure.</li> <li>» Lighting influences from the facility on surrounding areas.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» The proposed facility.</li> <li>» Power lines.</li> <li>» Reservoirs.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To minimise potential for visual impact.</li> <li>» To ensure a well maintained and neat facility.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Maintain the general appearance of the facility in an aesthetically pleasing way.	FG Emvelo	Operation.
Monitor rehabilitated areas, and implement remedial action as and when required.	FG Emvelo	Operation.
Use of light fixtures and the fitment of covers and shields will be designed to contain rather than spread light.	FG Emvelo	Operation and maintenance

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Well maintained and neat facility with intact vegetation on and near the facility.</li> <li>» Lighting impact and visual intrusion is minimal and no complaints received from settlements or homesteads.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Monitoring of rehabilitated areas.</li> </ul>

## OBJECTIVE: Minimise soil degradation and erosion

The soil on site may be impacted in terms of:

- » Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern across the entire site which is underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion).
- » Uncontrolled run-off relating to construction activity (excessive wetting, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation of drainage systems or the river (in the case of the abstraction point).
- » Degradation of the natural soil profile due to pollution.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power block.</li> <li>» Power lines.</li> <li>» Water pipeline, water storage/treatment reservoirs, and water abstraction facilities.</li> </ul>
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	<ul style="list-style-type: none"> <li>» Offices and workshops.</li> <li>» Access roads.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Soil degradation.</li> <li>» Soil erosion.</li> <li>» Increased deposition of soil into drainage systems.</li> <li>» Increased run-off over the site.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Poor rehabilitation of cleared areas.</li> <li>» Rainfall - water erosion of disturbed areas.</li> <li>» Wind erosion of disturbed areas.</li> <li>» Concentrated discharge of water from construction activity.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Ensure rehabilitation of disturbed areas is maintained.</li> <li>» Minimise soil degradation (i.e. wetting).</li> <li>» Minimise soil erosion and deposition of soil into drainage lines.</li> <li>» Ensure continued stability of embankments/excavations.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Rehabilitate disturbance areas should the previous attempt be unsuccessful.	FG Emvelo	Operation
Ensure dust control on site: wetting of denuded areas or the use of an appropriate dust suppression measure.	FG Emvelo	Operation
Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, and shade nets).	FG Emvelo	Operation
Control depth of excavations and stability of cut faces/sidewalls.	FG Emvelo	Operation
Maintain pump inlets and their supporting infrastructure so to prevent the potential for scour / erosion and downstream sedimentation of the Orange River.	FG Emvelo	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Acceptable level of soil erosion around site, as determined by the site manager.</li> <li>» Acceptable level of increased siltation in drainage lines, as determined by the site manager.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Inspections of site on a bi-annual basis.</li> <li>» Water management plan</li> </ul>

### OBJECTIVE: Minimise dust and air emissions

During the operational phase, limited gaseous or particulate emissions are anticipated from exhaust emissions (i.e. from operational vehicles), and from the augmentation



plant. According to National Environmental Management: Air Quality Act, an air emissions license is not required for power generation facilities with a capacity of less than 50 MW. Out of a maximum generating capacity of 100 MW, the expected air emissions for site 1.3 within the broader Karoshoek Solar Valley Development will be approximately 18 MW (i.e. 15% of the maximum) and therefore no license will be required, if supplementary firing is used.

Windy conditions and the movement of vehicles on site may lead to dust creation.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Hard engineered surfaces</li> <li>» On-site vehicles</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Dust and particulates from vehicle movement to and on-site.</li> <li>» Release of minor amounts of air pollutants (for example NO<sub>2</sub>, CO and SO<sub>2</sub>) from vehicles and the augmentation plant.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Re-entrainment of deposited dust by vehicle movements.</li> <li>» Wind erosion from unsealed roads and surfaces.</li> <li>» Fuel burning vehicle and construction engines.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure emissions from all vehicles are minimised, where possible.</li> <li>» To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Roads must be maintained to a manner that will ensure that nuisance to the community from dust is not visibly excessive.	FG Emvelo	Site establishment and construction
Appropriate dust suppressant must be applied to the roads as required to minimise/control airborne dust.	FG Emvelo	Duration of contract
Speed of vehicles must be restricted, as defined by the ECO.	FG Emvelo	Duration of contract
Vehicles and equipment must be maintained in a road-worthy condition at all times.	FG Emvelo	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints from affected residents or community regarding dust or vehicle emissions.</li> <li>» Dust suppression measures implemented for where required.</li> <li>» Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager.</li> <li>» A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon.</li> <li>» An incident reporting system must be used to record non-conformances to the EMP.</li> </ul>



**OBJECTIVE: Ensure the implementation of an appropriate fire management plan during the operation phase**

The vegetation in the study area may be at risk of fire, particularly the parabolic troughs which are situated closer to the ground. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

<b>Project Component/s</b>	» Operation and maintenance of the solar energy facility and associated infrastructure.
<b>Potential Impact</b>	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a risk to the solar energy facility infrastructure.
<b>Activities/Risk Sources</b>	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.
<b>Mitigation: Target/Objective</b>	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Provide adequate fire fighting equipment on site.	FG Emvelo	Operation
Provide fire-fighting training to selected operation and maintenance staff.	FG Emvelo	
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	FG Emvelo	Operation
Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.).	FG Emvelo	Operation
Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.	FG Emvelo	Operation
Contact details of emergency services should be prominently displayed on site.	FG Emvelo	Operation

<b>Performance Indicator</b>	» Fire fighting equipment and training provided before the construction phase commences. » Appropriate fire breaks in place.
<b>Monitoring</b>	» FG Emvelo must monitor indicators listed above to ensure that they have been met.

**OBJECTIVE: Maximise local employment and business opportunities**

The proposed facility is expected to require approximately 100 permanent employees including security personnel who would be on site on a permanent basis.

Therefore, long-term direct job opportunities for locals could exist, although limited. However, in an area with such high unemployment figures, these limited opportunities should still be seen as a positive impact on the quality of life of those benefiting from the employment.

Some local procurement of goods, materials and services could occur which would result in positive economic spin-offs. These opportunities for local service providers to render services to the proposed facility could include maintenance of the guardhouse, gardening at the guardhouse, cleaning services, security services and maintenance or replacement of general equipment

<b>Project Component/s</b>	» Operation and maintenance of the facility.
<b>Potential Impact</b>	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
<b>Activities/Risk Sources</b>	» Locals are not employed where the skills exist. » Local procurement is not undertaken if possible. » Local businesses are not supported.
<b>Mitigation: Target/Objective</b>	» Maximise the appointment of local employees.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
A skills development plan should be developed which should concentrate on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere.	FG Emvelo	Operation
The developer should capacitate locals where practical.	FG Emvelo	Operation
The developer should consider training and capacity building programmes to lessen the skills disparity.	FG Emvelo	Operation
The skill requirements should be communicated to the local community leaders and community based organisations.	FG Emvelo	Operation
Make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers.	FG Emvelo	Operation

Mitigation: Action/Control	Responsibility	Timeframe
An equitable process whereby minorities and previously disadvantaged individuals (including women) are taken into account should be implemented.	FG Emvelo	Operation
Local sourcing of materials, general services to assist in providing economic, and employment opportunities for the local people.	FG Emvelo	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» An employee list drawn up indicating the percentage of locals employed.</li> <li>» Local procurement is undertaken.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» FG Emvelo should be able to demonstrate that the above indicators are implemented.</li> </ul>

**OBJECTIVE: Assist with social development and enhance capacity building and skills development within the local communities**

An important positive role that FG Emvelo could fulfil as part of their social responsibility towards the local communities is to assist in addressing community development needs during the operational phase.

The project applicant is therefore accountable to optimise the productive potential of those employed at the proposed facility's operation through capacity building and skills training, whether these individuals are temporary or permanent employees.

One of the aims of the project could be to revitalise the area in terms of job creation and infrastructure development, in other words it would focus on broad based empowerment.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Capacity building and skills training undertaken during the operational phase.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Positive contribution to the capacity of individuals involved with the project, and equipping them with transferable skills.</li> <li>» Contribution towards local development initiatives.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» No social responsibility from developer.</li> <li>» No contribution towards local development initiatives.</li> <li>» Inefficient training or lack of capacity building and skills training.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Capacity building and skills training continuously undertaken during the operational phase of the project.</li> <li>» Positive social responsibility initiatives.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
Involvement in upliftment programmes could be done according to the needs identified as part of the IDP of the //Khara Hais Municipality.	FG Emvelo	Operation
Capacity building and skills training should form part of the social development support provided to local communities.	FG Emvelo	Operation
In cases for the middle to lower skilled jobs, where the relevant skills do not exist, training should be provided to willing local community members to enable them to fill the positions.	FG Emvelo	Operation
The project applicant should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the operational phase for rendering ancillary services to the proposed facility.	FG Emvelo	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The skills development plan concentrates on the transfer of skills to employees to increase their capacity and to equip them with alternative skills should they wish to be employed elsewhere.</li> <li>» Local development initiatives should be supported</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer should be able to demonstrate that the above indicators are implemented.</li> </ul>

**OBJECTIVE: Minimise the potential impact on farming activities and on the surrounding landowners**

Once operational, the impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (i.e. the increase in traffic to and from site, possible dust creation of vehicle movement on gravel roads on site and possible increase in criminal activities). The number of workers on site on a daily basis is anticipated to have minimal negative social impacts in this regard.

Individuals leaving their existing full time employment positions at farms in the area to obtain work at the facility could result in possible negative impacts on the farming community. Employing outsiders on the other hand and accommodating them at the planned accommodation facility on site could also affect the community's social dealings with each other as well as the traditional character of the area. In worst cases it could result in social conflict between the various groupings. The recruitment and employment process would thus have to be sensitively dealt with to limit any possible

negative impacts on the daily living patterns of the existing farming community and other community members.

The operations at the facility, however is not anticipated to have severe negative impacts on the neighbouring farmers' living and movement patterns, apart from a limited increase in the movement of people to and from the site, as well as the presence of these employees on-site on a permanent basis. Concerns about rental agreements should be considered.

Vehicle movement to and from the site (e.g. transportation of workers and goods) could influence road users' daily movement patterns, although it is anticipated that this impact would only materialise intermittently.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners.</li> <li>» Impact on farming activities on site.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Possible limited intrusion impact on surrounding land owners.</li> <li>» Possible phasing out of cattle farming.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Effective management of the facility.</li> <li>» Mitigation of intrusion impacts on property owners.</li> <li>» Mitigation of impact on farming activities.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Effective management of the facility and accommodation facility to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services.	FG Emvelo	Operation
Vehicle movement to and from the site should be minimised as far as possible.	FG Emvelo	Operation
Limit the development of new access roads on site as far as possible.	FG Emvelo	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No environmental pollution occurs (i.e. waste, water, and sanitation).</li> <li>» No intrusion on private properties and on the activities undertaken on the surrounding properties.</li> <li>» Continuation of farming activities.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met.</li> </ul>

**OBJECTIVE: Appropriate handling and management of hazardous substances and waste**

The operation of the solar energy facility will involve the storage of chemicals and hazardous substances, as well as the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and liquid waste.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Parabolic troughs (i.e. heat transfer fluid).</li> <li>» Substation.</li> <li>» Fuel for 15% augmentation if required as a back will come from LPG or biofuel plant.</li> <li>» Water treatment works.</li> <li>» Operation and maintenance staff.</li> <li>» Workshop.</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Inefficient use of resources resulting in excessive waste generation.</li> <li>» Litter or contamination of the site or water through poor waste management practices.</li> <li>» Contamination of water or soil because of poor materials management.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Transformers and switchgear – substation.</li> <li>» Parabolic troughs.</li> <li>» Water storage and treatment reservoirs.</li> <li>» Fuel, oil, HTF, and LNG storage.</li> <li>» Maintenance building.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Comply with waste management legislation.</li> <li>» Minimise production of waste.</li> <li>» Ensure appropriate waste disposal.</li> <li>» Avoid environmental harm from waste disposal.</li> <li>» Ensure appropriate storage of chemicals and hazardous substances.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Hazardous substances (such as used/new transformer oils, HTF, etc) must be stored in sealed containers within a clearly demarcated designated area.	FG Emvelo	Operation
Storage areas for hazardous substances must be appropriately sealed and banded.	FG Emvelo	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	FG Emvelo	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should	FG Emvelo	Operation and maintenance



Mitigation: Action/Control	Responsibility	Timeframe
take place within an appropriately sealed and banded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.		
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	FG Emvelo	Operation and maintenance
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	FG Emvelo / waste management contractor	Operation
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	FG Emvelo / waste management contractor	Operation
Used oils and chemicals: » Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority » Waste must be stored and handled according to the relevant legislation and regulations	FG Emvelo	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	FG Emvelo	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	FG Emvelo	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	FG Emvelo	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints received regarding waste on site or indiscriminate dumping.</li> <li>» Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately.</li> <li>» Provision of all appropriate waste manifests.</li> <li>» No contamination of soil or water.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Waste collection must be monitored on a regular basis.</li> <li>» Waste documentation must be completed and available for inspection</li> <li>» An incidents/complaints register must be maintained, in which any complaints from the community must be logged.</li> <li>» Complaints must be investigated and, if appropriate, acted upon.</li> <li>» Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the ECO.</li> <li>» All appropriate waste disposal certificates with the monthly reports.</li> </ul>

## MANAGEMENT PROGRAMME: DECOMMISSIONING

## CHAPTER 9

The solar infrastructure which will be utilised for the proposed solar energy facility is expected to have a lifespan of 40 years and eventual extensions (i.e. with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the solar infrastructure with more appropriate technology/infrastructure available at that time.

Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered at any relevant and competent authority at that time.

*The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section.*

### 9.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required equipment, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

### 9.2 Disassemble and Replace Infrastructure

Disassembled components will be reused, recycled, or disposed of in accordance with regulatory requirements.

**OBJECTIVE: To avoid and or minimise the potential impacts associated with the decommissioning phase**

<b>Project Component/s</b>	» Decommissioning phase of the solar energy facility.
<b>Potential Impact</b>	» Decommissioning will result in job losses, which in turn can result in a number of social impacts, such as reduced quality of life. » Decommissioning is similar to the construction phase in that it will also create temporary employment opportunities.
<b>Activity/Risk Source</b>	» Decommissioning of the solar energy facility.
<b>Mitigation:</b>	» To avoid and or minimise the potential social impacts associated with

<b>Target/Objective</b>	decommissioning phase of the solar energy facility.
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Mitigation: Action/control	Responsibility	Timeframe
Retrenchments should comply with current South African Labour Legislation.	FG Emvelo	At decommissioning

<b>Performance Indicator</b>	Relevant South African Labour Legislation.
<b>Monitoring</b>	No occurrences of dismissals not in-line with South African Labour Legislation.

## **FINALISATION OF THE EMP**

## **CHAPTER 10**

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The EMP is a dynamic document, which must be updated to include any additional specifications as and when required. It is considered critical that this draft EMP be updated to include site-specific information and specifications following the final walk-through survey by specialists of the powerline, water supply pipeline and development site. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features.

## **Appendix A:**

Karoshhoek Alien Invasive Management Plan

## KAROSHOEK ALIEN INVASIVE MANAGEMENT PLAN & CLEARING GUIDELINES

### OVERALL OBJECTIVE

Manage alien and invasive species, through the implementation of an alien invasive species control programme within the Karoshoek Solar Valley.

### PROBLEM OUTLINE

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (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. A list of declared weeds and invader plants is attached.

### SPECIFIC MANAGEMENT OBJECTIVES:

- Ensure alien plants do not become dominant in parts or the whole landscape
- Initiate and implement a monitoring and eradication programme for alien and invasive species
- Control alien and invasive species dispersal & encroachment
- Promote the planting of indigenous species

### 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 plan should include a map showing the alien density & indicating dominant alien species in each area.
- The lighter infested areas should be cleared first (with young/ immature, less dense trees) to prevent the build up of seed banks.. In the case of alien species confined to rivers, it is ideal to start in the headwaters and then move downstream, thereby removing the source of re-infestation.
- 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 at the moment.
- Collective management and planning with neighbours may be required as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

### CLEARING METHODS

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- 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

### IDENTIFICATION OF ALIEN SPECIES

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk 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.

### USE OF HERBICIDES FOR ALIEN 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 guidelines should be followed:

*Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.*

### ALIEN PLANT MANAGEMENT PLAN

#### CONSTRUCTION PHASE ACTIVITIES

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

<b>Action</b>	<b>Frequency</b>
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation must be undertaken as the work front progresses – mass clearing is not allowed unless the entire cleared area is to be rehabilitated immediately.	Weekly
Should revegetation not be possible immediately, the cleared areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded 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.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. Arid soils are usually very low in organic matter and the use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 20m of any wetland, 80m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand).	Weekly
Alien vegetation regrowth must be controlled throughout the entire site during the construction period.	Monthly



The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website, as well as the attached herbicide guidelines.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	Monthly
Wetlands (existing), forest edges, riverine fringe vegetation and potentially unstable areas must remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities – workers entering these zones for any reason other than rehabilitation work must be disciplined.	Daily

### MONITORING – CONSTRUCTION PHASE

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Preconstruction
Document alien plant distribution	Alien plant distribution map	Monthly
Document & record alien control measures implemented	Record of clearing activities	Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Bi-annually

### OPERATIONAL PHASE ACTIVITIES

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Action	Frequency
Surveys for alien species should be conducted regularly. Every 3 months for the first two years after construction and biannually thereafter. All aliens identified should be cleared.	Every 3 months for 2 years and biannually thereafter
Revegetation with indigenous, locally occurring species should take place in areas where natural vegetation is slow to recover or where repeated invasion has taken place.	Biannually, but revegetation should take place at the

	start of the rainy season.
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

### MONITORING – OPERATIONAL PHASE

The following monitoring and evaluation actions should take place during the operational phase of the development.

<b>Monitoring Action</b>	<b>Indicator</b>	<b>Timeframe</b>
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	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

**Appendix B:**  
Draft NEMBA Regulations

# Working for Water Nurseries Partnership Programme

## National Environmental Management: Biodiversity Act (2004)

### DRAFT NEMBA REGULATIONS

**Gazetted: 3 April, 2009**

On 3rd April 2009, Minister of Environmental Affairs and Tourism, Mr Marthinus van Schalkwyk, published (Gazette No. 32090) the following documents (see [www.deat.gov.za](http://www.deat.gov.za)) for 30 days of public comment:

- The 2nd draft of the Alien and Invasive Species Regulations of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004);
- Draft lists of categories of species exempted (section 66), prohibited alien species (section 67) and invasive species (section 70).

Should the regulations become law, any species designated under section 70 can not be propagated, grown, bought or sold by the industry without a permit. Below is a brief explanation of the three categories and the proposed list of invasive plants species (section 70 only).

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

**Category 1b:** Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

**Category 2:** Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for 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			
No	Scientific Name	Common Name	Category
1	<i>Acacia baileyana</i> F.Muell.	Bailey – se – wattel / Bailey's wattle	3
2	<i>Acacia cyclops</i> A.Cunn. ex G.Don	Rooikrans / Red eye	2
3	<i>Acacia dealbata</i> Link	Silverwattel / Silver wattle	1b
4	<i>Acacia decurrens</i> Willd.	Groenwattel /	2 in KwaZulu Natal,

Plants			
No	Scientific Name	Common Name	Category
		Green wattle	Mpumalanga and Eastern Cape; 1b in the rest of South Africa
5	<i>Acacia elata</i> A.Cunn. ex Benth. ( <i>Acacia terminalis</i> misapplied in South Africa)	Peperboomwattel / Pepper tree wattle	1b
6	<i>Acacia implexa</i> Benth.	Screw pod wattle	1a
7	<i>Acacia longifolia</i> (Andrews) Willd.	Langblaarwattel / Long – leaved wattle	1b
8	<i>Acacia mearnsii</i> De Wild.	Swartwattel / Black wattle	2
9	<i>Acacia melanoxylon</i> R.Br.	Australiese swarthout / Australian blackwood	2 in Western and Eastern Cape; 1b in the rest of South Africa
10	<i>Acacia paradoxa</i> DC. (= <i>A. Armata</i> R.Br.)	Kangaroo wattle	1a
11	<i>Acacia pendula</i> A.Cunn. ex G.Don	Weeping myall	3
12	<i>Acacia podalyrifolia</i> A.Cunn. ex G.Don	Vaal mimosa / Pearl acacia	1b
13	<i>Acacia pycnantha</i> Benth.	Gouewattel / Golden wattle	1b
14	<i>Acacia saligna</i> (Labill.) H.L.Wendl.	Port Jackson / Port Jackson willow	1b
15	<i>Acacia stricta</i> (Andrews) Willd.	Hop wattle	1a
16	<i>Acer buergerianum</i> Miq.	Chinese ahorn / Chinese maple	3
17	<i>Acer negundo</i> L.	Essenblaarahorn, Kaliforniese esdoring / Ash – leaved maple, Box elder	3
18	<i>Agave americana</i> L. var. <i>expansa</i> ( <i>Jacobi</i> ) Gentry	Garingboom / Spreading century – plant	1b in Western Cape
19	<i>Agave sisalana</i> Perrine	Garingboom / Sisal hemp, Sisal	2
20	<i>Ageratina adenophora</i> (Spreng.) R.M.King & H.Rob. (= <i>Eupatorium adenophorum</i> Spreng.)	Crofton weed	1b
21	<i>Ageratina riparia</i> (Regel) R.M.King & H.Rob. (= <i>Eupatorium riparium</i> Regel)	Misblom / Mistflower	1b
22	<i>Ageratum conyzoides</i> L.	Indringer – ageratum / Invading ageratum	1b
23	<i>Ageratum houstonianum</i> Mill. Excluding cultivars under investigation	Mexikaanse ageratum / Mexican ageratum	1b
24	<i>Agrimonia procera</i> Wallr. (= <i>A. odorata</i> Mill.)	Akkermonie, Geelklits / Scented agrimony	1b
25	<i>Agrostis castellana</i> Boiss. & Reut.	Bent grass	1a Prince Edward Island; 1b Marion Island
26	<i>Agrostis gigantea</i> Roth	Black bent grass, redtop	1a Prince Edward and

Plants			
No	Scientific Name	Common Name	Category
			Marion Islands
27	<i>Agrostis stolonifera</i> L.	Creeping bent grass	1a Prince Edward Island; 1b Marion Island
28	<i>Ailanthus altissima</i> (Mill.) Swingle	Hemelboom / Tree – of – heaven	1b
29	<i>Albizia lebeck</i> (L.) Benth.	Lebeckboom / Lebeck tree	1b
30	<i>Albizia procera</i> (Roxb.) Benth.	Basterlebeck / False lebeck	1b
31	<i>Alhagi maurorum</i> Medik. (= <i>A. camelorum</i> Fisch.)	Kameeldoringbos / Camel thorn bush	1b
32	<i>Alisma plantago – aquatica</i> L.	Wateralisa, Padda lepel / Mud plantain, Water alisa	1b
33	<i>Alnus glutinosa</i> (L.) Gaertn.	Swartels / Black alder	3
34	<i>Alopecurus geniculatus</i> L. (= <i>A. australis</i> Nees)	Marsh foxtail, Water foxtail	1a Prince Edward and Marion Islands
35	<i>Alpinia zerumbet</i> (Pers.) B.L.Burt & R.M.Sm. (= <i>A. speciosa</i> (J.C.Wendl.) Schum.)	Skulpgemmer, Pienkporseleinlelie / Shell ginger, Pink porcelain lily	3
36	<i>Ammophila arenaria</i> (L.) Link	Marram grass	2
37	<i>Anredera cordifolia</i> (Ten.) Steenis ( <i>A. baselloides</i> misapplied in South Africa)	Madeira ranker / Madeira vine, Bridal wreath	1b
38	<i>Antigonon leptopus</i> Hook. & Arn.	Koraalklimop / Coral creeper	1b
39	<i>Araujia sericifera</i> Brot.	Motvanger / Moth catcher	1b
40	<i>Ardisia crenata</i> Sims ( <i>Ardisia crispa</i> misapplied in South Africa)	Koraalbessieboom / Coralberry tree, Coral Bush	1b
41	<i>Ardisia elliptica</i> Thunb. (= <i>A. humilis</i> Vahl)	Shoebuttan ardisia	1b
42	<i>Argemone mexicana</i> L.	Geelblom – bloudissel / Yellow – flowered Mexican poppy	1b
43	<i>Argemone ochroleuca</i> Sweet subsp. <i>ochroleuca</i> (= <i>A. subfusiformis</i> G.B.Ownbey)	Witblom – bloudissel / White – flowered Mexican poppy	1b
44	<i>Aristolochia elegans</i> Mast.	Sisblom / Dutchman's pipe	1b
45	<i>Arundo donax</i> L.	Spaanse riet / Giant reed	1b
46	<i>Atriplex inflata</i> F.Muell. (= <i>A. lindleyi</i> Moq. subsp. <i>inflata</i> (F. Muell.) Paul G.Wilson)	Blasiesoutbos / Sponge – fruit saltbush	1b
47	<i>Atriplex nummularia</i> Lindl. Subsp. <i>Nummularia</i>	Oumansoutbos / Old man saltbush	2

Plants			
No	Scientific Name	Common Name	Category
48	<i>Azolla filiculoides</i> Lam.	Rooiwatervaring / Azolla, Red water fern	1b
49	<i>Azolla pinnata</i> R.Br. subsp. <i>asiatica</i> R.M.K.Saunders & K.Fowler (= <i>A. imbricata</i> (Roxb. ex Griff.) Nakai	Mosquito fern	1b
50	<i>Bartlettina sordida</i> (Less.) R.M. King & H.Rob. (= <i>Eupatorium atrorubens</i> (Lem.) G.Nicholson, <i>E. sordidum</i> Less.)	Bartlettina	1b
51	<i>Bauhinia purpurea</i> L.	Skoenlapperorgideëboom / Butterfly orchid tree	1b in Kwa Zulu – Natal, Limpopo, Mpumalanga and Eastern Cape; 3 in the rest of South Africa
52	<i>Bauhinia variegata</i> L.	Orgideëboom / Orchid tree	1b in Kwa Zulu – Natal, Limpopo, Mpumalanga and Eastern Cape; 3 in the rest of South Africa
53	<i>Berberis thunbergii</i> DC. Excluding cultivars under investigation	Japanse berberis / Japanese barberry	3
54	<i>Billardiera heterophylla</i> (Lindl.) L.W.Cayzer & Crisp (= <i>Sollya heterophylla</i> Lindl.)	Bluebell creeper	1a
55	<i>Bryophyllum delagoense</i> (Eckl. & Zeyh.) Schinz (= <i>B. tubiflorum</i> Harv., <i>Kalanchoe tubiflora</i> (Harv.) Raym.- Hamet, <i>K. delagoensis</i> Eckl. & Zeyh.)	Kandelaarplant / Chandelier plant	1b
56	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Cathedral bells	1b
57	<i>Bryophyllum proliferum</i> Bowie (= <i>Kalanchoe prolifera</i> (Bowie) Raym.- Haymet)	Green mother of millions	1b
58	<i>Buddleja davidii</i> Franch.	Chinese saliehout / Chinese sagewood, Summer lilac	3
59	<i>Buddleja madagascariensis</i> Lam.	Madagaskarsaliehout / Madagascar sagewood	3
60	<i>Cabomba caroliniana</i> A.Gray	Cabomba, Carolina fanwort	1a
61	<i>Caesalpinia decapetala</i> (Roth) Alston (= <i>C. sepiaria</i> Roxb.)	Kraaldoring / Mauritius thorn	1b
62	<i>Caesalpinia gilliesii</i> (Hook.) D.Dietr.	Paradysvoëlblom / Bird – of – paradise flower	1b
63	<i>Callisia repens</i> (Jacq.) L.	Creeping inch plant	1b
64	<i>Callistemon citrinus</i> (Curtis) Skeels	Lemoenperdestert / Lemon bottlebrush	3
65	<i>Callistemon rigidus</i> R.Br.	Perdestert / Stiff – leaved bottlebrush	1b in Western and Eastern Cape; 3 in the rest of South Africa

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
66	<i>Callistemon viminalis</i> (Sol. ex Gaertn.) G. Don Excluding cultivars under investigation	Treurperdestert / Weeping bottlebrush	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape; 3 in the rest of South Africa
67	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Calotropis, Giant – milkweed	1b
68	<i>Campuloclinium macrocephalum</i> (Less.) DC. (= <i>Eupatorium macrocephalum</i> Less.)	Pom – pom bossie / Pom pom weed	1b in Gauteng, North West, Limpopo and Mpumalanga; 1a in the rest of South Africa
69	<i>Canna indica</i> L. Excluding hybrid cultivars	Indiese kanna / Indian shot	1b
70	<i>Cardiospermum grandiflorum</i> Sw.	Blaasklimop / Balloon vine	1b
71	<i>Cardiospermum halicacabum</i> L.	Blaasklimop / Lesser balloon vine	3
7	<i>Casuarina cunninghamiana</i> Miq.	Kasuarisboom / Beefwood	2 within 100m of any natural ecosystem or untransformed land
73	<i>Casuarina equisetifolia</i> L.	Perdestertboom / Horsetail tree	2
74	<i>Catharanthus roseus</i> (L.) G. Don Excluding hybrids	Begraafplaasblom / Madagascar periwinkle	3
75	<i>Celtis australis</i> L.	Netelboom / Nettle tree, European hackberry	3
76	<i>Celtis occidentalis</i> L.	Vals witstinkhout / Common hackberry	3
77	<i>Cerastium fontanum</i> Baumg.	Common mouse – ear chickweed	1b Prince Edward and Marion Islands
78	<i>Cereus jamacaru</i> DC. ( <i>C. peruvianus</i> misapplied in South Africa)	Nagblom / Queen of the night	1b
79	<i>Cestrum</i> spp	Sestrum spp. / Cestrum spp.	1b
80	<i>Chondrilla juncea</i> L.	Skeleton weed	1a
81	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob. (= <i>Eupatorium odoratum</i> L.)	Paraffienbos / Triffid weed, Chromolaena	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape; 1a in the rest of South Africa
82	<i>Cichorium intybus</i> L.	Sigorei / Chicory	2
83	<i>Cinnamomum camphora</i> (L.) J. Presl	Kanferboom / Camphor tree	1b in KwaZulu – Natal, Mpumalanga, Eastern Cape, Southern Cape
84	<i>Cirsium japonicum</i> Fisch. ex DC.	Japanese thistle	1b
85	<i>Cirsium vulgare</i> (Savi) Ten. (= <i>C. lanceolatum</i> (L.) Scop.)	Speerdissel, Skotse dissel / Spear thistle, Scotch	1b



<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
		thistle	
86	<i>Coffea arabica</i> L. Excluding cultivars	Koffieboom / Coffee tree	3
87	<i>Convolvulus arvensis</i> L.	Akkerwinde, Klimop / Field bindweed, Wild morning – glory	1b
88	<i>Coreopsis lanceolata</i> L. Excluding hybrids	Coreopsis / Tickseed	3
89	<i>Cortaderia jubata</i> (Lemoine ex Carrière) Stapf	Pampasgras / Pampas grass	1b in Gauteng; 1a in the rest of South Africa
90	<i>Cortaderia selloana</i> (Schult.) Asch. & Graebn. Excluding cultivars under investigation	Pampasgras, Silwergras / Pampas grass	1b in Western and Eastern Cape, KwaZulu – Natal and Gauteng; 1a in the rest of South Africa
91	<i>Cotoneaster franchetii</i> Bois	Oranje cotoneaster / Cotoneaster	1b
92	<i>Cotoneaster glaucophyllus</i> Franch.	Bloudwergmispel / Late cotoneaster	1b
93	<i>Cotoneaster pannosus</i> Franch.	Silwerdwergmispel / Silver leaf cotoneaster	1b
94	<i>Cotoneaster salicifolius</i> Franch.	Willow – leaved showberry	1b
95	<i>Cotoneaster simonsii</i> Baker	Himalayan cotoneaster, Simon's cotoneaster	1b
96	<i>Crotolaria agatiflora</i> Schweinf.	Voeltjebos / Canarybird bush, bird flower	1a
97	<i>Cryptostegia grandiflora</i> R.Br.	Rubberklimop / Rubber vine	1a
98	<i>Cryptostegia madagascariensis</i> Bojer ex Decne.	Madagascar rubber vine	1a
99	<i>Cuscuta campestris</i> Yunck.	Gewone dodder / Common dodder	1b
100	<i>Cuscuta suaveolens</i> Ser.	Luserndodder / Lucerne dodder	1b
101	<i>Cytisus scoparius</i> (L.) Link (= <i>Genista scoparia</i> (L.) Lam.)	Skotse brem / Scotch broom	1a
102	<i>Datura ferox</i> L.	Grootstinkblaar / Large thorn apple	1b
103	<i>Datura innoxia</i> Mill.	Harige stinkblaar / Downy thorn apple	1b
104	<i>Datura stramonium</i> L.	Gewone stinkblaar / Common thorn apple	1b
105	<i>Diplocyclos palmatus</i> (L.) C.Jeffrey	Lollipop – climber	1a
106	<i>Duchesnea indica</i> (Andrews) Focke	Wilde – aarbei / Wild strawberry	1b
107	<i>Duranta erecta</i> L. (= <i>D. repens</i> L., <i>D. plumieri</i> Jacq.) Excluding cultivars under investigation	Vergeet – my – nie – boom / Forget – me – not – tree,	3

Plants			
No	Scientific Name	Common Name	Category
		Pigeon berry	
108	<i>Echinodorus cordifolius</i> (L.) Griseb.	Creeping burhead	1b
109	<i>Echinodorus tenellus</i> (Mart. ex Schult.f.) Buchenau	Amazon sword plant	1b
110	<i>Echinopsis spachiana</i> (Lem.) Friedrich & G.D.Rowley (= <i>Trichocereus spachianus</i> (Lem.) Riccob.)	Orrelkactus / Torch cactus	1b
111	<i>Echium plantagineum</i> L. (= <i>E. lycopsis</i> L.)	Pers echium / Patterson's curse	1b
112	<i>Echium vulgare</i> L.	Blou – echium / Blue echium	1b
113	<i>Egeria densa</i> Planch. (= <i>Elodea densa</i> (Planch.) Casp.)	Waterpes / Dense water weed	1b
114	<i>Eichhornia crassipes</i> (Mart.) Solms	Waterhiasint / Water hyacinth	1b
115	<i>Elodea canadensis</i> Michx.	Kanadese waterpes / Canadian water weed	1b
116	<i>Elytrigia repens</i> (L.) Desv. ex Nevski (= <i>Agropyron repens</i> (L.) P. Beauv., <i>Elymus repens</i> (L.) Gould)	Bloukweek / Couch grass	1a Prince Edward and Marion Islands
117	<i>Equisetum hyemale</i> L.	Rough horsetail, Common scouring – rush	1a
118	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Lukwart / Loquat	3
119	<i>Eucalyptus camaldulensis</i> Dehnh. And hybrids with <i>E. tereticornis</i> Sm.	Rooibloekom / River red gum	2 where more than 50 stems within 5,000 square metres (half of one hectare). (The demarcation can be for areas broader than individual properties within urban boundaries.) 1b within riparian areas, wetlands, declared mountain catchment areas, designated high fire – risk areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)
120	<i>Eucalyptus cladocalyx</i> F.Muell.	Suikerbloekom / Sugar gum	2 within, or within 50 metres from, fire –

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
			<p>prone vegetation in the fynbos, grassland and savannah biomes. (The demarcation can be for areas broader than individual properties within urban boundaries.)</p> <p>1b within riparian areas, wetlands, declared mountain catchment areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)</p>
121	<i>Eucalyptus conferruminata</i> D.J.Carr & S.G.M.Carr ( <i>E. lehmannii</i> misapplied in South Africa)	Spinnekopbloekom / Spider gum	<p>2 within, or within 50 metres from, fire – prone vegetation in the fynbos, grassland and savannah biomes. (The demarcation can be for areas broader than individual properties within urban boundaries.)</p> <p>1b within riparian areas, wetlands, declared mountain catchment areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)</p>
122	<i>Eucalyptus diversicolor</i> F.Muell.	Karie / Karri	2 where more than 50 stems within 5,000 square metres (half of

Plants			
No	Scientific Name	Common Name	Category
			one hectare). (The demarcation can be for areas broader than individual properties within urban boundaries.) 1b within riparian areas, wetlands, declared mountain catchment areas, designated high fire – risk areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)
123	<i>Eucalyptus grandis</i> W.Hill ex Maiden ( <i>E. saligna</i> Sm. in part) and hybrids	Salignabloekom / Saligna gum, Rose gum	2 where more than 50 stems within 5,000 square metres (half of one hectare). (The demarcation can be for areas broader than individual properties within urban boundaries.) 1b within riparian areas, wetlands, declared mountain catchment areas, designated high fire – risk areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)
124	<i>Eucalyptus tereticornis</i> Sm. and hybrids with <i>E. camaldulensis</i> Dehnh.	Bosrooibloekom / Forest red gum	2 where more than 50 stems within 5,000 square metres (half of one hectare). (The

Plants			
No	Scientific Name	Common Name	Category
			demarcation can be for areas broader than individual properties within urban boundaries.) 1b within riparian areas, wetlands, declared mountain catchment areas, designated high fire – risk areas, or within a protected area declared in terms of NEM: PAA (Act 57 of 2003), or within a listed ecosystem or where it may be required in terms of a bioregional plan or biodiversity management plans published under NEM:BA (Act 10 of 2004)
125	<i>Eugenia uniflora</i> L.	Pitanga / Pitanga, Surinam cherry	1
126	<i>Euphorbia esula</i> L. (= <i>E. xpseudovirgata</i> (Schur) Soó, <i>E. tommasiniana</i> Bertol., <i>E. virgata</i> Waldst. & Kit.)	Leafy spurge	1a
127	<i>Euphorbia leucocephala</i> Lotsy	White poinsettia	1b
128	<i>Fallopia sachalinensis</i> (F.Schmidt) Ronse Decr. (= <i>Polygonum sachalinense</i> F.Schmidt, <i>Reynoutria sachalinensis</i> (F.Schmidt) Nakai)	Giant knotweed	1a
129	<i>Festuca rubra</i> L.	Creeping red fescue	1a Prince Edward and Marion Islands
130	<i>Flaveria bidentis</i> (L.) Kuntze	Smeltersbossie / Smelter's – bush	1b
131	<i>Foeniculum vulgare</i> Mill. Excluding cultivars under investigation	Vinkel / Fennel	2 in Western Cape
132	<i>Fraxinus americana</i> L.	Amerikaanse esseboom / American ash	3
133	<i>Fraxinus angustifolia</i> Vahl	Algeriese esseboom / Algerian ash	3
134	<i>Galium tricornutum</i> Dandy (= <i>G. tricornis</i> Stokes, pro parte)	Three – horned bedstraw, Corn – cleavers	1b
135	<i>Gaura coccinea</i> Pursh (= <i>G. odorata</i> Sessé ex Lag.)	Scarlet gaura	3
136	<i>Genista monspessulana</i> (L.) L.A.S.Johnson (= <i>Cytisus monspessulanus</i> L., <i>C. candicans</i> (L.) DC.)	Montpellierbrem / Montpellier broom	1a
137	<i>Gleditsia triacanthos</i> L.	Amerikaanse driedoring /	1b

Plants			
No	Scientific Name	Common Name	Category
	Excluding cultivars under investigation	Honey locust	
138	<i>Glyceria maxima</i> (Hartm.) Holmb. (= <i>Poa aquatica</i> L., <i>Glyceria aquatica</i> (L.) Wahlb.)	Reed meadow grass, Reed sweet grass	2
139	<i>Grevillea banksii</i> R.Br.	Australiese rooi – eik / Australian crimson oak, Red flowering silky oak	1b
140	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Australiese silwereik / Australian silky oak	1b
141	<i>Grevillea rosmarinifolia</i> A.Cunn.	Rosemary grevillea	3
142	<i>Hakea drupacea</i> (C.F.Gaertn.) Roem. & Schult. (= <i>H. suaveolens</i> R.Br.)	Soethakea / Sweet hakea	1a
143	<i>Hakea gibbosa</i> (Sm.) Cav.	Harige hakea / Rock hakea	1b
144	<i>Hakea sericea</i> Schrad. & J.C.Wendl.	Syerige hakea / Silky hakea	1b
145	<i>Harrisia martinii</i> (Labour.) Britton & Rose (= <i>Eriocereus martinii</i> (Labour.) Riccob.)	Toukaktus, <i>Harrisia</i> kaktus / Moon cactus, <i>Harrisia</i> cactus	1b
146	<i>Hedera helix</i> L. subsp. <i>canariensis</i> (Willd.) Cout. Excluding cultivars under investigation	Madeiraklimop / Canary ivy, Madeira ivy, Algerian ivy	3
147	<i>Hedera helix</i> L. subsp. <i>helix</i> Excluding cultivars under investigation	Engelse hedera / English ivy	3
148	<i>Hedychium coccineum</i> Buch.-Ham. Ex Sm.	Rooigemmerlelie / Red ginger lily	1b
149	<i>Hedychium coronarium</i> J.König	Witgemmerlelie / White ginger lily	1b
150	<i>Hedychium flavescens</i> Carey ex Roscoe	Geelgemmerlelie / Yellow ginger lily	1b
151	<i>Hedychium gardnerianum</i> Sheppard ex Ker Gawl.	Kahiligemmerlelie / Kahili ginger lily	1b
152	<i>Homalanthus populifolius</i> Graham	Gebrokehartjieboom / Bleeding – heart tree	1b
153	<i>Houttuynia cordata</i> Thunb.	Chameleon plant	3
154	<i>Hydrilla verticillata</i> (L.f.) Royle	Hydrilla	1a
155	<i>Hydrocleys nymphoides</i> (Humb. & Bonpl. ex Willd.) Buchenau	Water poppy	1a
156	<i>Hylocereus undatus</i> (Haw.) Britton & Rose	Night – blooming cereus	1b
157	<i>Hypericum androsaemum</i> L.	Tutsan	1b
158	<i>Hypericum perforatum</i> L.	Johanneskruid / St. John's wort, Tipton weed	2
159	<i>Ipomoea alba</i> L.	Maanblom / Moonflower	1b
160	<i>Ipomoea carnea</i> Jacq. subsp. <i>fistulosa</i> (Mart. ex Choisy) D.F.Austin (= <i>I. fistulosa</i> Mart. ex Choisy)	Morning – glory bush	1b
161	<i>Ipomoea indica</i> (Burm.) Merr.	Purperwinde /	1b

Plants			
No	Scientific Name	Common Name	Category
	(= <i>I. congesta</i> R.Br.)	Morning glory	
162	<i>Ipomoea purpurea</i> (L.) Roth	Purperwinde / Morning glory	1b
163	<i>Iris pseudacorus</i> L.	Geel iris / Yellow flag	1a
164	<i>Jacaranda mimosifolia</i> D.Don	Jakaranda / Jacaranda	1b in KwaZulu – Natal, Mpumalanga, Limpopo and North West 2 in Gauteng (can be demarcated in areas broader than individual properties) 3 in the rest of South Africa
165	<i>Jatropha curcas</i> L.	Purgeerboontjie / Physic nut	2
166	<i>Jatropha gossypifolia</i> L.	Cotton – leaf physic nut	1b
167	<i>Juniperus virginiana</i> L.	Rooiseder / Red cedar	3 in Free State and Eastern Cape
168	All seed producing species or seed producing hybrids of <i>Lantana</i> that are non – Indigenous to Africa	Lantana / Lantana, Tickberry, Cherry pie	1b
169	<i>Kunzea ericoides</i> (A.Rich.) Joy Thomps. (= <i>Leptospermum ericoides</i> A. Rich.)	Burgan, White teatree	1a
170	<i>Lepidium draba</i> L. (= <i>Cardaria draba</i> (L.) Desv.)	Peperbos / Hoary cardaria	1b
171	<i>Leptospermum laevigatum</i> (Gaertn.) F.Muell.	Australiese mirt / Australian myrtle	1b
172	<i>Leucaena leucocephala</i> (Lam.) de Wit (= <i>L. glauca</i> Benth.)	Reuse wattel / Leucaena	1a in Western Cape; 2 in the rest of South Africa
173	<i>Ligustrum japonicum</i> Thunb.	Japanse liguster / Japanese wax – leaved privet	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape, Gauteng and North West; 3 in Free State and Northern Cape
174	<i>Ligustrum lucidum</i> W.T.Aiton	Chinese blinkliguster / Chinese wax – leaved privet	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape, Gauteng and North West; 3 in Free State and Northern Cape
175	<i>Ligustrum ovalifolium</i> Hassk. Excluding cultivars under investigation	Kaliforniese liguster / Californian privet	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape, Gauteng and North West; 3 in Free State and Northern Cape;

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
176	<i>Ligustrum sinense</i> Lour.	Chinese liguster / Chinese privet	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape, Gauteng and North West; 3 in Free State and Northern Cape
177	<i>Ligustrum vulgare</i> L.	Gewone liguster / Common privet	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape, Gauteng and North West; 3 in Free State and Northern Cape
178	<i>Lilium formosanum</i> Wallace (= <i>L. longiflorum</i> Thunb. var. <i>formosanum</i> Baker)	Formosa lelie / Formosa lily	1b
179	<i>Limonium sinuatum</i> (L.) Mill.	Papierblom / Statice, Sea lavender	1b Western and Northern Cape
180	<i>Linaria dalmatica</i> (L.) Mill. (= <i>Antirrhinum dalmaticum</i> L., <i>Linaria</i> <i>genistifolia</i> subsp. <i>dalmatica</i> (L.) Maire & Petitm.	Dalmatian toadflax, Broadleaf toadflax	1b
181	<i>Linaria vulgaris</i> Mill.	Common toadflax, Butter – and – eggs	1b
182	<i>Litsea glutinosa</i> (Lour.) C.B.Rob. (= <i>Litsea sebifera</i> Pers.)	Indiese lourier / Indian laurel	1b
183	<i>Lonicera japonica</i> Thunb. 'Halliana'	Japane kanferfoelie / Japanese or Hall's honeysuckle	3
184	<i>Ludwigia peruviana</i> (L.) H. Hara	Water – primrose, Peruvian primrosebush	1a
185	<i>Luzula</i> sp.	Woodrush	1a Prince Edward and Marion Islands
186	<i>Lythrum hyssopifolia</i> L.	Hyssop loosestrife	1b
187	<i>Lythrum salicaria</i> L.	Purple loosestrife	1a
188	<i>Macfadyena unguis – cati</i> (L.) A.H.Gentry	Katteklouranker / Cat's claw creeper	1b
189	<i>Malva dendromorpha</i> M.F.Ray (= <i>Lavatera arborea</i> L.)	Mak kiesieblaar / Tree mallow	1b
190	<i>Malva verticillata</i> L.	Kiesieblaar / Mallow	1b
191	<i>Malvastrum coromandelianum</i> (L.) Garcke	Prickly malvastrum	1b
192	<i>Melaleuca hypericifolia</i> Sm.	Red – flowering tea tree	1a
193	<i>Melia azedarach</i> L.	Seringboom / Seringa	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern Cape, North West and Gauteng 3 in the rest of South Africa
194	<i>Metrosideros excelsa</i> Sol. ex Gaertn. (= <i>M. tomentosa</i> A.Rich.)	Nieu – Seelandse perdestert /	1a in Overstrand District



Plants			
No	Scientific Name	Common Name	Category
		New Zealand Christmas tree	
195	<i>Mimosa pigra</i> L.	Raak – my – nie / Giant sensitive plant	1b
196	<i>Mirabilis jalapa</i> L.	Vieruurtjie / Four – o'clock, Marve – of – Peru	1b
197	<i>Montanoa hibiscifolia</i> Benth.	Montanoa / Tree daisy	1b
198	<i>Morus alba</i> L.	Witmoerbe, Gewone moerbe / White mulberry, Common mulberry	2
199	<i>Murraya paniculata</i> (L.) Jack. (= <i>M. exotica</i> L.)	Oranjejasmyn / Orange Jessamine	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
200	<i>Myoporum insulare</i> R.Br.	Manatoka / Manatoka, Boobyalla	3
201	<i>Myoporum laetum</i> G.Forst.	Nieu – Seelandse manatoka / New Zealand manatoka	3
202	<i>Myoporum tenuifolium</i> G.Forst. subsp. <i>montanum</i> (R.Br.) Chinnock (= <i>M. montanum</i> R.Br.), ( <i>M. acuminatum</i> misapplied in South Africa)	Manatoka	1b
203	<i>Myriophyllum aquaticum</i> (Vell.) Verdc.	Waterduisendblaar / Parrot's feather	1b
204	<i>Myriophyllum spicatum</i> L.	Spiked water – milfoil	1b
205	<i>Nassella tenuissima</i> (Trin.) Barkworth (= <i>Stipa tenuissima</i> Trin.)	Witpolgras / White tussock	1b
206	<i>Nassella trichotoma</i> (Nees) Hack. ex Arechav. (= <i>Stipa trichotoma</i> Nees)	Nassella polgras / Nassella tussock	1b
207	<i>Nasturtium officinale</i> R.Br. (= <i>Rorippa nasturtium – aquaticum</i> (L.) Hayek)	Bronkors / Watercress	2
208	<i>Nephrolepis cordifolia</i> (L.) C.Presl (= <i>Polypodium cordifolium</i> L.) Excluding cultivars under investigation	Erect sword fern, Ladder sword fern	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape; 3 in the rest of South Africa
209	<i>Nephrolepis exaltata</i> (L.) Schott (= <i>Polypodium exaltatum</i> L.) Excluding cultivars under investigation	Swaardvaring / Sword fern, Boston sword fern	1b in KwaZulu – Natal, Mpumalanga, Limpopo, Eastern and Western Cape; 3 in the rest of South Africa
210	<i>Nerium oleander</i> L. Excluding cultivars under investigation	Selonsroos / Oleander	1b
211	<i>Nicandra physalodes</i> (L.) Gaertn.	Basterappelliefie / Apple – of – Peru	1b

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
212	<i>Nicotiana glauca</i> Graham	Wildetabak / Wild tobacco	1b
213	<i>Nymphaea mexicana</i> Zucc. and hybrids	Geel waterlelies / Yellow water lilies	1b
214	<i>Nymphoides peltata</i> (S.G.Gmel.) Kuntze (= <i>Limnanthemum peltatum</i> S.G.Gmel.)	Gringed waterlily, Yellow floating – heart	1a
215	<i>Opuntia aurantiaca</i> Lindl.	Litjieskaktus / Jointed cactus	1b
216	<i>Opuntia engelmannii</i> Salm-Dyck ex Engelm. (= <i>O. lindheimeri</i> Engelm.)	Klein rondeblaarturksvy / Small round – leaved prickly pear	1b
217	<i>Opuntia exaltata</i> A.Berger (= <i>Austrocylindropuntia exaltata</i> (A.Berger) Backeb.)	Langdoringkaktus / Long spine cactus	1b
218	<i>Opuntia ficus – indica</i> (L.) Mill. (= <i>O. megacantha</i> Salm-Dyck) Excluding all spineless cactus pear cultivars and selections	Boereturksvy, Grootdoringturksvy / Mission prickly pear, Sweet prickly pear	1b
219	<i>Opuntia fulgida</i> Engelm. ( <i>O. rosea</i> misapplied in South Africa)	Roseakaktus / Rosea cactus, Chain – fruit cholla	1b
220	<i>Opuntia humifusa</i> (Raf.) Raf. ( <i>O. compressa</i> misapplied in South Africa)	Large flowered prickly pear, Creeping prickly pear	1b
221	<i>Opuntia imbricata</i> (Haw.) DC. (= <i>Cylindropuntia imbricata</i> (Haw.) F.M.Knuth)	Imbrikkaktus, Kabelturksvy / Imbricate cactus, Imbricate prickly pear	1b
222	<i>Opuntia microdasys</i> (Lehm.) Pfeiff.	Yellow bunny – ears, Teddy – bear cactus	1b
223	<i>Opuntia monacantha</i> Haw. ( <i>O. vulgaris</i> misapplied in South Africa)	Suurturksvy, Luisiesturksvy / Cochineal prickly pear, Drooping prickly pear	1b
224	<i>Opuntia robusta</i> H.L.Wendl. ex Pfeiff.	Robusta turksvy / Blue – leaf cactus	2
225	<i>Opuntia spinulifera</i> Salm-Dyck	Blouturksvy, Groot rondeblaar turksvy / Saucepan cactus, Large roundleaved prickly pear	1b
226	<i>Opuntia stricta</i> (Haw.) Haw. (= <i>O. dillennii</i> (Ker Gawl.) Haw.)	Suurturksvy / Pest pear of Australia	1b
227	<i>Orobanche minor</i> Sm.	Klawerbesemraap, Bremraap / Lesser broomrape, Clover broomrape	1b
228	<i>Orobanche ramosa</i> L.	Blouduiwel / Blue broomrape, Branched broomrape	1b
229	<i>Paraserianthes lophantha</i> (Willd.) I.C.Nielsen (= <i>Albizia lophantha</i> (Willd.) Benth.)	Australiese albizia, Stinkboon / Australian albizia, Stink bean	1b

Plants			
No	Scientific Name	Common Name	Category
230	<i>Parkinsonia aculeata</i> L.	Mexikaanse groenhaarboom / Jerusalem thorn	1b
231	<i>Parthenium hysterophorus</i> L.	Parthenium	1b
232	<i>Paspalum quadrifarium</i> Lam.	Tussock paspalum	1a
233	<i>Passiflora caerulea</i> L.	Siergrenadella / Blue passion flower	1b
234	<i>Passiflora edulis</i> Sims	Grenadella / Purple granadilla, Passion fruit	2 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
235	<i>Passiflora tripartita</i> (Juss.) Poir. var. <i>mollissima</i> (Kunth) Holm-Niels. & P.Jorg. (= <i>P. mollissima</i> (Kunth) L.H.Bailey)	Piesangdilla / Banana poka, Bananadilla	1b
236	<i>Passiflora suberosa</i> L.	Devil's pumpkin, Indigo berry	1b
237	<i>Passiflora subpeltata</i> Ortega	Granadina	1b
238	<i>Paulownia tomentosa</i> (Thunb.) Steud. (= <i>Paulownia imperialis</i> Siebold & Zucc.)	Keiserinboom, Prinsesboom / Empress tree, Princess tree, Royal Paulownia	1a
239	<i>Pennisetum purpureum</i> Schumach.	Olifantsgras / Elephant grass, Napier grass	1b
240	<i>Pennisetum setaceum</i> (Forssk.) Chiov. Excluding sterile cultivar 'Rubrum'	Pronkgras / Fountain grass	1b
241	<i>Pennisetum villosum</i> R.Br. ex Fresen.	Veergras / Feathertop	1b
242	<i>Pereskia aculeata</i> Mill.	Pereskia / Pereskia, Barbados gooseberry	1b
243	<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don) H.Gross (= <i>Polygonum capitatum</i> Buch.-Ham. ex D.Don)	Knoopkruid / Knotweed	1b
244	<i>Phytolacca americana</i> L. (= <i>P. decandra</i> L.)	Inkbos, Karmosynbos / American pokeweed	1b
245	<i>Phytolacca dioica</i> L.	Bobbejaandruifboom, Belhambra / Belhambra	3
246	<i>Phytolacca icosandra</i> L. (= <i>P. octandra</i> L.)	Bobbejaandruif, Inkbessie / Forest inkberry	1b
247	<i>Pinus canariensis</i> C.Sm.	Kanariese den / Canary pine	3
248	<i>Pinus elliotti</i> Engelm.	Basden / Slash pine	2
249	<i>Pinus halepensis</i> Mill.	Aleppoden / Aleppo pine	2
250	<i>Pinus patula</i> Schiede ex Schltdl. & Cham.	Treurden / Patula pine	2
251	<i>Pinus pinaster</i> Aiton	Trosden / Cluster pine	2

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
252	<i>Pinus pinea</i> L.	Sambreelden / Umbrella or Stone pine	3
253	<i>Pinus radiata</i> D.Don	Radiataden / Radiata pine, Monterey pine	2
254	<i>Pinus roxburghii</i> Sarg. (= <i>P. longifolia</i> Roxb. ex Lamb.)	Tjirden / Chir pine, Longifolia pine	2
255	<i>Pinus taeda</i> L.	Loblollyden / Loblolly pine	2
256	<i>Pistia stratiotes</i> L.	Waterslaai / Water lettuce	1b
257	<i>Pittosporum crassifolium</i> Banks & Sol. ex A.Cunn.	Karo, Stywerblaarkasuur / Karo, Stiff – leaved cheesewood	3
258	<i>Pittosporum undulatum</i> Vent.	Australiese kasuur, Soet pittosporum / Australian cheesewood, Sweet pittosporum	1b
259	<i>Plectranthus comosus</i> Sims (= <i>Coleus grandis</i> Cramer) ( <i>Plectranthus barbatus</i> misapplied in South Africa)	'Abessiniese' coleus / 'Abyssinian' coleus, Woolly plectranthus	1b
260	<i>Poa pratensis</i> L.	Kentucky bluegrass	1a Prince Edward Island; 1b Marion Island
261	<i>Polypodium aureum</i> (L.) J.Sm.	Haaspoetvaring / Rabbits – foot fern	3 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
262	<i>Pontederia cordata</i> L.	Jongsnoekkruid / Pickerel weed	1b
263	<i>Populus alba</i> L.	Witpopulier / White poplar	2
264	<i>Populus ×canescens</i> (Aiton) Sm.	Vaalpopulier / Grey poplar, Matchwood poplar	2
265	<i>Prosopis glandulosa</i> Torr. var. <i>torreyana</i> (Benson) Johnst. and hybrids	Heuningprosopis / Honey mesquite	1b in North West, Free State, Eastern and Western Cape 2 in Northern Cape
266	<i>Prosopis velutina</i> Wooton and hybrids	Fluweelprosopis / Velvet mesquite	1b in North West, Free State, Eastern and Western Cape 2 in Northern Cape
267	<i>Prunus serotina</i> Ehrh.	Swartkersie / Black cherry	1b
268	<i>Psidium cattleianum</i> Sabine (= <i>P. littorale</i> Raddi var. <i>longipes</i> (O.Berg.) Fosberg)	Aarbei koejawel / Strawberry guava	1b
269	<i>Psidium guajava</i> L.	Koejawel / Guava	2 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
270	<i>Psidium guineense</i> Sw.	Brasiliaanse koejawel /	1b

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
		Brazilian guava	
271	<i>Psidium ×durbanensis</i> Baijnath ined.	Durbanse koejawel / Durban guava	1b
272	<i>Pueraria montana</i> (Lour.) Merr. var. <i>lobata</i> (Willd.) Maesen & S.M.Almeida (= <i>P. lobata</i> (Willd.) Ohwi)	Kudzuranker / Kudzu vine	1a
273	<i>Pyracantha angustifolia</i> (Franch.) C.K.Schneid. Excluding cultivars under investigation	Geelbranddoring / Yellow firethorn	1b
274	<i>Pyracantha coccinea</i> M.Roem. Excluding cultivars under investigation	Rooibranddoring / Red firethorn	1b
275	<i>Pyracantha crenatoserrata</i> (Hance) Rehder (= <i>P. fortuneana</i> misapplied) Excluding cultivars under investigation	Chinese firethorn, Broad leaf firethorn	1b
276	<i>Pyracantha crenulata</i> (D.Don) M.Roem. Excluding cultivars under investigation	Rooivuurddoring / Himalayan firethorn	1b
277	<i>Pyracantha koidzumii</i> (Hayata) Rehder Excluding cultivars under investigation	Formosa firethorn	1b
278	<i>Pyracantha rogersiana</i> (A.B.Jacks.) Chitt. Excluding cultivars under investigation	Firethorn	1b
279	<i>Rhus glabra</i> L.	Gladde sumak / Scarlet sumach, Vinegar bush	3
280	<i>Ricinus communis</i> L.	Kasterolieboom / Castor – oil plant	1b
281	<i>Rivina humilis</i> L.	Bloedbessie / Rivina, Bloodberry	1a
282	<i>Robinia pseudoacacia</i> L.	Witakasia / Black locust	1b
283	<i>Rosa rubiginosa</i> L. (= <i>R. eglanteria</i> L.)	Wilderoos / Eglantine, Sweetbriar	1b
284	<i>Rubus cuneifolius</i> Pursh and hybrid <i>R. ×</i> <i>proteus</i> C.H.Stirt.	Amerikaanse braam / American bramble	1b
285	<i>Rubus flagellaris</i> Willd.	Braam / Bramble	1b
286	<i>Rubus fruticosus</i> L. agg.	Braam / European blackberry	2
287	<i>Rubus niveus</i> Thunb.	Ceylon raspberry, Mysore raspberry	1b
288	<i>Rumex acetosella</i> L.	Sheep sorrel, Red sorrel	1a Prince Edward and Marion Islands
289	<i>Rumex usambarensis</i> (Dammer) Dammer (= <i>R. nervosus</i> Vahl var. <i>usambarensis</i> Dammer)	Oos-Afrikaanse tongblaar / East African dock	1b
290	<i>Salsola kali</i> L.	Rolbossie / Tumbleweed	1b
291	<i>Salsola tragus</i> L. (= <i>S. australis</i> R.Br.)	Russiese rolbossie / Russian tumbleweed	1b
292	<i>Salvia tiliifolia</i> Vahl	Lindenleaf sage	1b
293	<i>Salvinia molesta</i> D.S.Mitch. and other species of the Family Salviniaceae	Watervaring / Kariba weed, Salvinia	1b

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
294	<i>Sambucus canadensis</i> L. (= <i>S. nigra</i> L. subsp. <i>canadensis</i> (L.) Bolli)	Kanadese vlier / Canadian elder	1b
295	<i>Sambucus nigra</i> L.	Europese vlier / European elder	1b
296	<i>Sasa ramosa</i> (Makino) Makino & Shibata (= <i>Arundinaria vagans</i> Gamble)	Dwerggeelstreepbamboes / Dwarf yellow – striped bamboo	3
297	<i>Schefflera actinophylla</i> (Endl.) Harms	Australiese kiepersol / Australian cabbage tree, Queensland umbrella tree	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
298	<i>Schefflera arboricola</i> (Hayata) Merr.	Hawaiiese dwerg / Dwarf umbrella tree	3 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
299	<i>Schefflera elegantissima</i> (hort. Veitch ex Mast.) Lowry & Frodin (= <i>Dizygotheca elegantissima</i> (hort. Veitch ex Mast.) R.Vig. & Guillaumin)	Vals – aralia / False aralia	3 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
300	<i>Schinus terebinthifolius</i> Raddi	Brasiliaanse peperboom / Brazilian pepper tree	1b KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape; 3 in rest of South Africa
301	<i>Senna bicapsularis</i> (L.) Roxb. (= <i>Cassia bicapsularis</i> L.)	Rambling cassia	1b
302	<i>Senna didymobotrya</i> (Fresen.) H.S.Irwin & Barneby (= <i>Cassia didymobotrya</i> Fresen.)	Grondboontjieberkassia / Peanut butter cassia	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape; 3 in the rest of South Africa
303	<i>Senna hirsuta</i> (L.) H.S.Irwin & Barneby (= <i>Cassia hirsuta</i> L.)		1b
304	<i>Senna occidentalis</i> (L.) Link (= <i>Cassia occidentalis</i> L.)	Stinking weed, Wild coffee	1b
305	<i>Senna pendula</i> (Willd.) H.S.Irwin & Barneby var. <i>glabrata</i> (Vogel) H.S.Irwin & Barneby (= <i>Cassia coluteoides</i> Collad.)		1b
306	<i>Senna septemtrionalis</i> (Viv.) H.S.Irwin & Barneby (= <i>Cassia floribunda</i> sensu Brenan non Cav., <i>C. laevigata</i> Willd.)	Arsenic bush, Smooth senna	1b
307	<i>Sesbania punicea</i> (Cav.) Benth.	Rooi sesbania / Red sesbania	1b
308	<i>Solanum betaceum</i> Cav. (= <i>Cyphomandra betacea</i> (Cav.) Sendtn.)	Boomtamatie / Tree tomato	3 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
309	<i>Solanum chrysotrichum</i> Schldl. ( <i>S. hispidum</i> misapplied in South Africa)	Giant devil's fig	1b
310	<i>Solanum elaeagnifolium</i> Cav.	Satansbos / Silver – leaf bitter apple	1b
311	<i>Solanum mauritianum</i> Scop.	Luisboom / Bugweed	1b

Plants			
No	Scientific Name	Common Name	Category
312	<i>Solanum pseudocapsicum</i> L.	Jerusalemkersie / Jerusalem cherry	1b
313	<i>Solanum seafortianum</i> Andrews	Aartappelranker / Potato creeper	1b
314	<i>Solanum sisymbriifolium</i> Lam.	Wildetamatie, Doringtamatie / Wild tomato, Dense – thorned bitter apple	1b
315	<i>Sorghum halepense</i> (L.) Pers.	Johnsongras / Johnson grass, Aleppo grass	2
316	<i>Spartium junceum</i> L.	Spaanse besem / Spanish broom	1b in Western Cape; 3 in the rest of South Africa
317	<i>Spathodea campanulata</i> P.Beauv.	Afrikaanse vlamboom / African flame tree	3 in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
318	<i>Sphagneticola trilobata</i> (L.) Pruski (= <i>Thelechitonia trilobata</i> (L.) H.Rob. & Cuatrec., <i>Wedelia trilobata</i> (L.) Hitchc.)	Singapoer – madeliefie / Singapore daisy	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape; 3 in rest of South Africa
319	<i>Stachytarpheta</i> spp.	Snakeweeds	3
320	<i>Stellaria media</i> (L.) Vill.	Sterremuur / Common chickweed	1a Prince Edward Island; 1b Marion Island
321	<i>Syngonium</i> spp.	Gansvoete / Goose foot plants, Arrow – head vines	1b in KwaZulu – Natal, Mpumalanga, Limpopo and Eastern Cape
322	<i>Syzygium cumini</i> (L.) Skeels	Jambolan	1b in KwaZulu – Natal, Mpumalanga, Limpopo; 1a in the rest of South Africa
323	<i>Syzygium jambos</i> (L.) Alston	Jamboes / Rose apple	3
324	<i>Tamarix aphylla</i> (L.) H.Karst. Not to be confused with indigenous <i>Tamarix usneoides</i> E.Mey. ex Bunge	Woestyntamarisk / Athel tree, Desert tamarisk	1b
325	<i>Tamarix chinensis</i> Lour. Not to be confused with indigenous <i>Tamarix usneoides</i> E.Mey. ex Bunge	Chinese tamarisk / Chinese tamarisk	1b
326	<i>Tamarix gallica</i> L. Not to be confused with indigenous <i>Tamarix usneoides</i> E.Mey. ex Bunge	Franse tamarisk / French tamarisk	1b
327	<i>Tamarix ramosissima</i> Ledeb. Not to be confused with indigenous <i>Tamarix usneoides</i> E.Mey. ex Bunge	Perstamarisk / Pink tamarisk	1b
328	<i>Tecoma stans</i> (L.) Juss. ex Kunth	Geelklokkies / Yellow bells	1b
329	<i>Tephrocactus articulatus</i> (Pfeiff.) Backeb. (= <i>Opuntia articulata</i> (Pfeiff.) D.R.Hunt	Pine cone cactus, Paper – spine cholla	1a
330	<i>Thevetia peruviana</i> (Pers.) K.Schum. (= <i>T. nerifolia</i> Juss. ex Steud.)	Geel – oleander / Yellow oleander	1b

<b>Plants</b>			
<b>No</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Category</b>
331	<i>Tipuana tipu</i> (Benth.) Kuntze (= <i>T. speciosa</i> Benth.)	Tipoeboom / Tipu tree	3
332	<i>Tithonia diversifolia</i> (Hemsl.) A.Gray	Mexikaanse sonneblom / Mexican sunflower	1b
333	<i>Tithonia rotundifolia</i> (Mill.) S.F.Blake	Rooisonneblom / Red sunflower	1b
334	<i>Toona ciliata</i> M.Roem. (= <i>Cedrela toona</i> Roxb. ex Willd.)	Toonboom / Toon tree	1b
335	<i>Toxicodendron succedaneum</i> (L.) Kuntze (= <i>Rhus succedanea</i> L.)	Wasboom / Wax tree	1b
336	<i>Tradescantia fluminensis</i> Vell.	Wandelende Jood / Wandering Jew	1b
337	<i>Tradescantia zebrina</i> hort. ex Bosse (= <i>Zebrina pendula</i> Schnizl.)	Wandelende Jood / Wandering Jew	1b
338	<i>Triplaris americana</i> L.	Triplaris / Triplaris, Ant tree	1b
339	<i>Tropaeolum speciosum</i> Poepp. & Endl.	Chilean flame creeper, Flame nasturtium	3
340	<i>Ulex europaeus</i> L.	Gaspeldoring / European gorse	1b
341	<i>Verbena bonariensis</i> L.	Blouwaterbossie / Wild verbena, Tall verbena, Purple top	1b
342	<i>Verbena brasiliensis</i> Vell.	Brazilian verbena	1b
343	<i>Vinca major</i> L. Excluding cultivars under investigation	Gewone – opklim / Greater periwinkle	1b
344	<i>Vinca minor</i> L. Excluding cultivars under investigation	Lesser periwinkle	1b
345	<i>Vitex trifolia</i> L.	Indian three – leaf vitex	1b
346	<i>Wigandia urens</i> (Ruiz & Pav.) Kunth var. <i>caracasana</i> (Kunth) D.N.Gibson (= <i>W. caracasana</i> Kunth)	Wigandia	3
347	<i>Xanthium spinosum</i> L.	Boetebos / Spiny cocklebur	1b
348	<i>Xanthium strumarium</i> L.	Kankerroos / Large cocklebur	1b



## **Appendix C:**

Policy on the Use of Herbicides for the Control of Alien  
Vegetation

WORKING FOR WATER

POLICY ON THE USE OF  
HERBICIDES FOR THE CONTROL OF ALIEN VEGETATION.

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GUIDE TO CONTROL METHODS AND  
HERBICIDE SELECTION FOR SELECTED ALIEN  
VEGETATION.

ANNEXURE A.

## WORKING FOR WATER HERBICIDE POLICY

### 1. OBJECTIVE FOR THE USE OF HERBICIDES FOR ALIEN VEGETATION CONTROL

- 1.1 To implement a long-term strategy for the initial and long term eradication of alien vegetation.
- 1.2 To ensure the safety of operators involved in the control operations and public in the operational area.
- 1.3 To ensure that there is minimal environmental impact in the short-term and that there are no long-term adverse effects on the environment resulting from the application of herbicides.
- 1.4 To ensure that the application takes place in the most cost effective way within objectives 1.2 and 1.3.
- 1.5 To attain these objectives Working for Water management shall be responsible for:
  - 1.5.1 Determining areas and species to be controlled and setting priorities.
  - 1.5.2 Deciding upon appropriate methods of chemical control.
  - 1.5.3 Drawing up short and long-term control programmes.
  - 1.5.4 Selection of suitable herbicides.
  - 1.5.5 Establishing training requirements for Working for Water personnel and contractors and ensuring that the training takes place
  - 1.5.6 Costing control programmes.
  - 1.5.7 Sourcing suitable herbicide and equipment suppliers and obtaining product and equipment at the best prices.
  - 1.5.8 Ensuring that herbicide applications take place within all relevant legislation.

## 2. METHODS OF CONTROL

2.1 Selection of appropriate methods of control shall be based on the following criteria:

- Species to be controlled
- Size of target plants
- Density of stand
- Accessibility of terrain
- Environmental safety
- Disposal of dead vegetation
- Cost of application

### 2.1.1 Species to be controlled

2.1.1.1 Herbicides selected for control shall be registered for use on that species under the conditions specified.

2.1.1.2 Selection should be based on “A Guide to the Use of Herbicides” issued by the Directorate: Agricultural Production Inputs and labels and information brochures issued by suppliers.

### 2.1.2 Size of plants

The following methods of control are appropriate for age or size target plants:

#### 2.1.2.1 Seedlings

2.1.2.1.1 Hand pulling or hoeing. Hand pulling should be carried out in sparse stands under conditions where seedlings are easily removed from the soil. Operators should be supplied with suitable gloves or other hand protection. Hoeing is also most suited to sparse stands. Seedlings should be severed below the soil surface or removed from the soil. Soil disturbance should be minimised to reduce re-germination.

2.1.2.1.2 Foliar applications of herbicides can be carried out in dense stands or open stands. For dense stands suitable fan nozzles for overall application should be fitted. Sprayers should be fitted with pressure or flow regulators. In stands where individual plants are

treated solid cone nozzles should be fitted.

#### 2.1.2.2 Saplings

2.1.2.2.1 Hand pulling or hoeing. Where appropriate hand pulling or hoeing should be carried out as recommended for seedlings.

2.1.2.2.2 Foliar sprays. Overall application or individual plant spraying can be carried out, depending on the density of the stand. Fan nozzles should be fitted for overall spraying and solid cone nozzles for individual plant treatment. Pressure or flow regulators should be fitted to sprayers for overall application. Spraying should be restricted to plants waist height or lower, but ensure there is sufficient foliage to carry the applied herbicide to the root system.

2.1.2.2.3 Basal stem treatments. Application of suitable herbicides in diesel can be carried out to the bottom 250 mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle.

2.1.2.2.4 Cut stump treatments. Stems should be cut as low as practical as stipulated on the label. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label

2.1.2.3 Mature trees. These should be regarded as trees above shoulder height or robust bushes 12-18 months or older.

2.1.2.3.1 Ring barking. Bark must be removed from the bottom of the stem to a height of 0,75-1,0 m. All bark must be removed to below ground level for good results.

Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.

Bush knives (machettes) or hatchets should be used for de-barking.

2.1.2.3.2 Frilling or partial frilling. Cuts should be made through the bark into the sapwood by means of a bush knife or light axe and a suitable herbicide applied into the cuts.

2.1.2.3.3 Basal stem treatments. Suitable herbicides should be applied in diesel to the base of the stem and to any exposed roots. Stems with a diameter up to 50 mm should be treated to a height of 250 mm and stems above 50m diameter to a height of 500 mm. This method is only suitable for stems up to 100 mm in diameter. Application is by means of a low pressure coarse droplet spray from a narrow angle, solid cone nozzle.

2.1.2.3.4 Cut stump treatments. Stumps should be cut as low as practical as stipulated on the label. Herbicide is applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

2.1.2.3.5 Stem injection. Herbicide solutions are applied directly into pre-made holes in the stem and claydodes of certain cactus species.

2.1.2.3.6 Ecoplugs. These are placed directly in the stem of standing trees. They should be used in inaccessible mountainous areas where the use of implements such as chain saws is difficult or hazardous.

### 2.1.3 Density of stands.

2.1.3.1 Overall applications can be made to dense stands of seedlings or saplings. Where other desirable vegetation is present (e.g. grass cover), selective herbicides or mixes that will not damage the grass or other desirable vegetation cover should be applied. Fan nozzles and pressure regulators should be fitted to sprayers.

2.1.3.2 Where dense stands of big trees, resulting in a large bio-mass, treatment of standing trees may be appropriate to obviate the problem of disposing of felled trees. Where there is a danger of dead trees falling into water courses they should be cut down and removed and the stumps treated with a suitable herbicide.

#### 2.1.4 Accessibility of terrain.

2.1.4.1 In inaccessible areas such as mountainous areas or where no access roads exist, methods of control where a minimum amount of transportation of equipment and chemical is involved should be given preference.

#### 2.1.5 Environmental considerations.

2.1.5.1 Protection of the environment is of prime importance. Riparian areas, where most alien vegetation infestations occur, require a particularly careful approach. Only herbicides that are approved for use in riparian areas should be used. Washing of equipment or disposal of waste spray mixture or washings is prohibited in or near water courses where contamination of water can occur.

#### 2.1.6 Desirable vegetation.

2.1.6.1 Where desirable vegetation is present, e.g. grass cover in pastures or the margins of forests, methods of control must be selected that will cause minimum damage to the desirable vegetation. Alternative methods to foliar spraying should be adopted where there is a danger of damage to adjacent desirable plants occurring.

#### 2.1.7 Disposal of vegetation.

2.1.7.1 Where possible utilizable wood should be removed after felling.

2.1.7.2 Brushwood is often burned on purpose or accidentally. If burning is planned, brushwood should be spread rather than stacked to limit soil damage as intense fires result in stacked brushwood destroying soil structure and preventing grass establishment for many years.

2.1.7.3 If there is a danger of damaging fires, unusable trees should be left standing as this will result in a less intense fire.

2.1.7.4 Felled trees or trees in danger of falling in water courses should be removed so that they do not cause blockages with resulting problems of flooding and damage to infrastructure such as roads and fences.

### 3. LONG TERM CONTROL PROGRAMMES



3.1 In areas where after initial control of alien vegetation has taken place and regrowth of the species and/or other undesirable vegetation will occur, the programme should be so structured that a minimum of regrowth will occur and a follow-up programme will be actioned. The following must be taken into consideration:

3.1.1 Species coppicing. Many species coppice from cut stumps and/or roots. Cut stumps must be thoroughly treated within 15 minutes of cutting according to label recommendations to minimise regrowth. Root coppice from species such as grey poplar (*Populus canescens*) and silver wattle (*Acacia dealbata*) occurs rapidly and control measures must be undertaken before plants become too large to be controlled with foliar sprays. Coppicing stumps should be treated before coppice reaches head height.

3.1.2 Seedling control. Germination of acacia species takes place rapidly after a fire and control measures must be put in place as soon as possible to minimise the quantity of herbicide used and the cost of application. Selective herbicides should be used where there is a danger of damage to grass present.

3.1.3 Burning. Burning should be considered part of the control programme to get rid of unwanted brushwood or to stimulate even growth of seedlings so that follow-up control measures are easier.

3.1.4 Rehabilitation. Where the danger of erosion exists or where the re-establishment of pastures is desired after clearing, rehabilitation of the area with grasses or other suitable plants should be carried out. The advice of pasture experts should be sought in planning this operation. Other erosion control measures such as the building of weirs should be undertaken where necessary.

#### 4. SELECTION OF HERBICIDES

4.1 The selection of herbicides should be based on the following criteria and any deviation from this point must be approved by the management committee. (MANCO). Consult the Working for Water Technical Advisor.

4.1.1 Overall policy. Only the following herbicides are approved for use:

- 4.1.1.2 Garlon 4 (triclopyr (butoxy ethyl ester) 480g/l )
- Viroaxe (triclopyr (butoxy ethyl ester) 480g/l )
- Timbrel 3A (triclopyr (amino salt) 360 g/l )
- Mamba 360 SL (glyphosate 360 g/l )
- Chopper (imazapyr 100 g/l )
- MSMA (MSMA 720 g/l )

Starane 200 (fluroxypyr 200 g/l ) (blackwood control)  
 Tumbleweed (glyphosate 240 g/l ) (Tsitsikamma and Kouga only )  
 Access (picloram (K-salt) 240 g/l ) **(on approval of MANCO)**  
 Ecoplug (glyphosate 0.49) (High altitude teams if registered on particular spp).  
 Molopo SC (tebuthiuron 500g/ l) **(Prosopis control only on approval of MANCO).**

4.2 Efficacy. Where alternative products are available for the same purpose, advice should be sought on the efficacy of these products under the prevailing application conditions.

4.3 Cost. Where different methods of application exist the cost of application and retreatment, in addition to the cost of the product shall be taken into consideration in deciding on which herbicide to apply.

4.4 Operator safety.

4.4.1 All measures must be taken to ensure the safety of the operators and where choices exist preference should be given to the safest product. Check the label colour band.

4.4.2 The following table gives the toxicity rating according to the label colour band:

GREEN	ACUTE HAZARD UNLIKELY IN NORMAL USE
BLUE	SLIGHTLY HAZARDOUS - CAUTION
YELLOW	MODERATELY HAZARDOUS - HARMFULL
RED	TOXIC TO VERY TOXIC

4.4.3 Label recommendations regarding safety must be strictly observed.

4.5 Environmental safety.

4.5.1 Herbicides that have the least impact on the environment shall be used.

4.5.2 Every precaution shall be taken to ensure that these products are safely stored, handled and applied.

4.6 Availability. Products should be readily available from suppliers in the areas of use to limit quantities stored.

## 5. TRAINING

All contractors (or one of their employees) who apply herbicide for gain in the Working for Water Programme must attend and pass the approved WfW Limited Pest Control Certified Herbicide Course or it's equivalent.

All Project Managers, in order to effectively manage the herbicide operations in their projects, must attend and pass the approved WfW Limited Pest Control Certified Herbicide Course or it's equivalent.

Operating teams shall be trained in the following aspects of herbicide use. Teams must receive training before commencing operations. Training shall be appropriate for the situations where teams will operate and specialised training or teams operating under specialised conditions, e.g. indigenous forests or soil applied herbicides, may be necessary.

5.1 Supervisors. Team supervisors shall receive training in the following:

5.1.1 Herbicide awareness. Basic training on the mode of action of herbicides.

5.1.2 Operator safety. Handling of concentrates and spray mixtures, personal hygiene and protective clothing.

5.1.3 Safe storage of product at depots and operational sites and spray mixtures at operational sites.

5.1.4 Mixing. Handling of concentrates and mixing techniques.

5.1.5 Safety procedures to be observed during transportation of product, spray mixtures, equipment and personnel.

5.1.6 Care and maintenance of application equipment, saws etc.

5.1.7 Record keeping in respect of quantities of product/spray mixtures used, area treated, person hours per area/operation, stock control.

5.1.8 Planning. Advanced planning for follow-up operations, transportation, equipment and spares requirements, product procurement and availability. Team management.

5.1.9 First aid. Actions to be taken in case of accidental contamination, suspected and actual poisoning, chronic poisoning, eye contamination and other physical injuries.

5.1.10 Health of operators. Persons unsuitable for use as application operators, e.g. chronically ill, disabled, pregnant women. Allergic reactions. Wearing of protective apparel. Hygiene.

5.1.11 Disposal of waste and spillage.

5.1.12 Managing major and minor spills, accident sites.

5.1.13 Calibrating application equipment.

5.1.14 Environmental safety.

5.1.15 Application techniques. Correct application to obtain most cost effective results.

5.1.16 Suitable and unsuitable application conditions.

5.2 Operators. Operators should receive training in the following:

5.2.1 Basic herbicide awareness - the purpose and functioning of herbicides and the need for correct application.

5.2.2 Safe handling of concentrates and spray mixtures, toxicity of herbicides, protective clothing, safe application, personal hygiene and disposal of waste.

5.2.3 Application techniques. Correct, thorough application. Preventing waste.

5.2.4 Care of equipment. Cleaning and disposal of washings.

## 6. COSTING OPERATIONS OR PROGRAMMES

6.1 Prior to the commencement of any control operations or programmes an assessment shall be made on the cost, based on the following:

6.1.1 Cost of herbicides and adjuvants.

6.1.2 Quantity, to be based on:

6.1.2.1 Method of application

6.1.2.2 Size and density of target plants.

6.1.2.3 Dilution rates

6.1.3 Adjuvants required.

6.1.4 Personnel costs. Number of person hours per area/operation.

6.1.5 Cost of equipment, spares and maintenance.

6.1.6 Cost of transportation, storage and other incidental costs.

6.2 Follow-up treatments such as seedling and/or coppice control must be similarly costed and built into the total cost of the control operation.

## 7. PROVISION OF EQUIPMENT

7.1 Application equipment shall be standardised and obtained from approved suppliers.

7.2 Use of the following brand of knapsacks has been approved. CP 3, CP 15, Matabi, Solo, Agrimex A18.

7.2.1 Where appropriate sprayers must be fitted with pressure regulators or flow regulators.

7.2.2 Spares must be readily available and spares such as nozzles, plumbers tape, nuts, screws, hose and washers must be carried with teams. Suppliers must be consulted on spares requirements.

7.2.3 The following nozzles or their equivalents shall be used as standard TG-1, FL-5VS and TF-VS2 or their equivalents.

7.3 The teams should have the necessary tools, e.g. spanners, screwdrivers, pliers, to carry out necessary maintenance and repairs in the field.

7.4 Malfunctioning nozzles should be replaced in the field and no attempt should be made to clean them. Cleaning should be done at the workshop/store using preferably compressed air and water.

7.5 Small hand held sprayers should be standardised on to Polyspray or

equivalent and Hack-pack applicators.

7.6 Suitable plastic measuring cylinders, beakers and mixing containers must be available and only used for herbicide mixing.

7.7 Containers must always be provided for clean water for personal use.

## 8. STORAGE, HANDLING AND TRANSPORTATION

### 8.1 Storage.

All storage facilities shall comply with the requirements of AVCASA. These can be summarised as follows:

#### 8.1.1 Isolation.

Where possible, a store should preferably be a separate building and should not be sited near a dwelling house, livestock buildings or where fodder, fuel or other flammable materials are stored. A minimum of five meters between the store and the other buildings is recommended. If part of a complex, the store must be totally sealed off from the rest of the complex, i.e. no free movement of air between the storage area and the rest of the complex.

8.1.1.1 The location of the store must take into account the possible pollution risk from spilt chemicals. The store should be away from rivers, dams, boreholes and areas likely to be flooded.

8.1.1.2 The store should be situated where it can be supervised.

#### 8.1.2 Accessibility.

When planning a store bear in mind the ease of access for delivery or despatch. Also consider the possibility of a fire and the need to be able to approach the building from all sides.

#### 8.1.3 Construction.

##### 8.1.3.1 Floor.

Earth, timber, bitumen, PVC or linoleum, coarse unscreened or disintegrating concrete is not acceptable. Smooth screeded concrete is ideal, however sealed, steel container floors are acceptable. The doorway should be bunded to a minimum height of 200 mm and this, as well as all wall to floor joints, should be made watertight. The purpose of the bund is to contain spills or fire water which could cause damage to the environment and prevent water (e.g. flood run-off) entering the store.

#### 8.1.3.2 Walls.

Walls should preferably be brick or concrete block with airbricks or vents 200 mm from the floor and near or at roof level. Containers are acceptable if there is adequate ventilation 200 mm from floor level and near roof level. The container should where possible be placed in a shaded area. If this is not possible ensure good permanent ventilation.

#### 8.1.3.3 Roof.

The roof should be leak-free and have some form of insulation to maintain temperatures at a reasonable level. Vent in the roof will allow for the escape of hot air during the summer months.

#### 8.1.3.4 Doors.

Steel doors with an effective locking system are preferred. A wooden door should have a security gate to reduce the risk of forced entry. Containers with fitted security gates can be left open to cool the contents during the heat of the day. Only authorised personnel should have access to keys and be allowed in the store.

#### 8.1.3.5 Windows.

Windows should be adequate to allow enough light into the store to be able to read product labels. All windows should be weather proof, burglar barred and preferably be at/or above head height (“out of sight out of mind”) for security reasons.

#### 8.1.3.6 Lighting.

There should be sufficient lighting to allow for reading of product labels. If electric lighting is required it must be secure in order to reduce fire risk. The mains control should be outside the store itself.

#### 8.1.3.7 Sanitation.

Staff should have immediate access to washing facilities with running water, soap and towels. They should be encouraged to use it frequently. An eye wash bottle or similar object must

be available at all times for the flushing of contamination from the eyes should it occur. A shower facility is recommended.

#### 8.1.4 Equipment.

8.1.4.1 Equip the room with a table of suitable strength and height to facilitate reading of labels, decanting and measuring out of herbicides.

8.1.4.2 Measuring jugs, funnels, pumps and buckets must be kept on hand and kept specifically for the purpose of measuring out herbicides. Do not use household items for this purpose.

8.1.4.3 For the sake of good housekeeping, have on hand a broom, spade and a supply of dry fine soil as absorbent material to contain and absorb spills.

#### 8.2 Handling.

The handling of herbicide concentrates requires strict precautions and personnel handling product concentrates must be fully aware of precautions to be observed.

8.2.1 Suitable protective clothing must be available and use thereof is compulsory.

8.2.1.1 Chemical resistant plastic aprons, gloves and eye protection must be worn when handling concentrates.

8.2.2 Adequate hygiene aids such as plentiful water, soap, towels and eye wash must be readily available.

8.2.3 Suitable absorbent material such as fine dry soil and cleaning equipment must be available to handle accidental spillage.

8.2.4 In the case of spillage, the spill must be contained immediately and cleaned up with absorbent material such as fine dry soil. The contaminated material should then be disposed of by burying in a safe place.

8.2.5 Concentrates should if possible be decanted in a safe, suitable place and not in the field. Such a handling and mixing area should have a hard impermeable floor, be bunded and have an adequate sump to accommodate run-off from washing, flooding or fire containment. A 1m<sup>3</sup> sump /10m<sup>2</sup> floor space is recommended.



- 8.2.6 Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.
- 8.2.7 All containers into which herbicides or adjuvants are decanted must be clearly marked and a copy of the original label secured to the container.
- 8.2.8 Suitable equipment must be available to prepare spray mixtures. These include plastic measuring cylinders and beakers, mixing containers (buckets) and funnels.

### 8.3 In the field the following must be observed:

- 8.3.1 If concentrates must be handled in the field, observe the precautions listed under 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.2.6, 8.2.7, and 8.2.8.
- 8.3.2. Spray mixtures must be kept in leak-proof, non-spill containers. The containers should be kept away from personal belongings, foodstuff, drinking water and eating and living areas.
- 8.3.3. Containers should stand on suitable absorbent material, EG a large piece of thick hesian sack, that will absorb minor drips, out of direct sunlight in a cool place.
- 8.3.4. Containers must be kept at least 20m away from water bodies.
- 8.3.5. Filling sites should be selected to prevent damage to desirable vegetation and to enable spillage to be cleaned up and disposed of.
- 8.3.6. Spray mixture containers must be clearly labelled and only reused for the specific herbicide.
- 8.3.7. Application equipment and containers should not be cleaned on site but at a suitable designated area at the store.
- 8.3.8. Suitable protective clothing, overalls, rubber boots, gloves and if necessary eye protection must be worn by operators when handling and applying herbicides.

### 8.4 Transportation.

- 8.4.1 Herbicides and application equipment must be carried on a separate vehicle or in a part of the vehicle isolated from people, food and clothing.

8.4.2 Vehicles should carry absorbent material to absorb any spillage.

8.4.3 Herbicides and equipment must be secured to prevent spillage and damage.

8.4.4 Product, spray mixtures and equipment must not be left unattended where there is a danger of theft or abuse.

8.4.5 Product should not be left uncovered in the sun.

## 8.5 Disposal.

8.5.1 A designated officer should be responsible to ensure that herbicide containers are correctly and safely disposed of, according to AVCASA guidelines.

8.5.2 Empty containers must be destroyed after use and not be used for any other purpose. Under no circumstances may containers be taken home for personal use.

8.5.3 Empty containers should be returned to the store for safe keeping and disposal.

8.5.4 Where arrangements have been made containers should be returned to the supplier.

8.5.5 Containers that have to be destroyed should be triple rinsed, punctured, flattened and, if suitable, burned. See attached pamphlet for details of triple rinsing.

8.5.6 Only sufficient spray mixture that can be used in a day should be prepared. Left-over material should be returned to the depot for safe storage and re-use. Spray mixture should only be disposed of in a suitable site.

8.5.7 Certain spray mixtures should not be left standing overnight and should be safely disposed of. Consult the product label. If mixtures can be left overnight with no adverse effects, they should be kept to reduce costs and pollution from herbicide and wash water.

## 9. PUBLIC SAFETY

9.1 Due regard must be paid at all times to the health and safety of the public.

9.2 Public should be kept out of operational areas where any hazard's exist. Warning notices should be displayed to this effect where necessary.

- 9.3 Herbicides must only be applied strictly according to label recommendations.
- 9.4 Product and spray mixtures should be stored so that they are inaccessible to the public.
- 9.5 Treatment of areas within 50 m of habitations and public areas (e.g. parks) should be avoided or only carried out in consultation with the parties effected.
- 9.6 Public should be informed of control operations in their area by means of verbal communication, notices, pamphlets, the press etc.

## 10. ENVIRONMENTAL SAFETY.

Most alien vegetation control operations are carried out in riparian situations which are regarded as environmentally sensitive. In order to minimise the impact of the operation on the natural environment the following must be observed.

- 10.1 Area contamination must be minimised by careful accurate application with a minimum amount of herbicide to achieve good control.
- 10.2 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.
- 10.3 Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- 10.4 To avoid damage to indigenous or other desirable vegetation product should be selected that will have the least effect on non-target vegetation.
  - 10.4.1 Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation, e.g. TG-1 or equivalent.

## 11. APPLICATION

- 11.1 Equipment.
  - Only application equipment and accessories specified (see 7. PROVISION OF EQUIPMENT). shall be used by operating teams.
  - 11.1.1 Equipment shall be inspected regularly between and during applications and necessary repairs carried out.

- 11.1.2 Leaking sprayers or sprayer not applying correctly should be withdrawn until repairs have been carried out. Spare applicators and parts should always be available so as not to impede operations.
- 11.1.3 Ensure that correct nozzles are fitted and pressure settings are checked regularly.
- 11.1.4 Where possible use low water volumes to keep turn around (refilling) time down to a minimum. Caution must be observed to limit drift when using minimum output nozzles.
- 11.1.5 Always ensure that knapsacks are filled to the maximum.
- 11.1.6 Equipment must be emptied and cleaned thoroughly after spraying ceases. Spray mixture must not be left in the apparatus overnight.
- 11.1.7 Apparatus should be stored under lock and key when not in use.

## 11.2 Rates of Application.

- 11.2.1 Products shall be mixed and applied at rates recommended on the label. This shall not be deviated from without consultation with Working for Water Technical Advisor and suppliers.
- 11.2.2 Applications should be checked regularly to ensure that they comply with recommendations.

## 11.3 Precautions.

- 11.3.1 Appropriate protective clothing must be changed and washed regularly and should be removed immediately if grossly contaminated.
- 11.3.2 Spillage must be attended to immediately and appropriately disposed of.
- 11.3.3 Application teams must be trained to avoid damage to non-target species.
- 11.3.4 Contamination of all water bodies must be strictly avoided.
- 11.3.5 Hygiene aids - clean water, soap, towels and eye wash must always be available to spray operators.

## 11.4 Adjuvants

- 11.4.1 Where recommended wetting and spreading agents should be added to spray mixtures. Wetters should always be mixed in accordance with label recommendations.
- 11.4.2 Dye must be added to all applications where the product has no built in dye to ensure that no target species are missed and plants are correctly treated.
- 11.4.3 In areas where alkaline water is used for spraying the use of a buffering agent may be necessary. Consult the product label. Buffers should always be added to the water before the herbicide.
- 11.4.5 In sensitive areas where drift must be controlled, the use of drift control agents may be necessary. Seek expert advice on the use of these agents.

## **11.5 Water Sources.**

- 11.5.1 Only clean water may be used for spray mixtures.
- 11.5.2 Where particulate matter occurs in water, e.g. water drawn from rivers, the water must be filtered to avoid nozzle blockages.
  - 11.5.2.1 Funnels with filters should be used for filling or filters should be fitted in the application equipment.
- 11.5.3 Where large volumes of water are transported, tankers or tanks should be fitted with buffer plates particularly where operating in rough terrain.
- 11.5.4 The product label should be consulted regarding the quality of water suitable for the specific herbicide.

## **12. WEATHER CONDITIONS.**

- 12.1 Applications should not be carried out under unfavourable weather conditions that could effect the control obtained or endanger nearby desirable vegetation, water bodies or personnel.
- 12.2 Label recommendations regarding suitable application conditions must be followed.
- 12.3 The following conditions must be taken into consideration, depending on the method of application.

- 12.3.1 Application to wet plants.
- 12.3.2 Threatening rain.
- 12.3.3 Wind conditions.
- 12.3.4 Hot, dry conditions
- 12.4 Conditions of target plants.
  - 12.4.1 Poor results may result if target plants are not in a suitable condition for treatment. The following conditions may result in poor control.
    - 12.4.1.1 Water stressed plants.
    - 12.4.1.2 Water logged plants.

### **13. MIXING HERBICIDES**

- 13.1 Mixing must take place according to label instructions.
- 13.2 Suitable protective clothing must be worn when handling concentrates.
- 13.3 Liquid concentrates should be added to the half full tank which is then topped up.
- 13.4 Adjuvants should be added to the tank as per the label instruction prior to the addition of the herbicide when buffering and afterwards for wetters and dyes.
- 13.5 Do not mix concentrates together before adding them to the tank.. Consult product labels.
- 13.6 Proper mixing in knapsacks and hand held applicators is difficult and spray mixtures should be mixed in bulk containers or if necessary (e.g. wettable powders) buckets before pouring into the knapsacks or hand held applicators.
- 13.7 Spray mixtures should be agitated continuously if recommended. This is essential after they have been standing for a while.

## 14. CALIBRATION

14.1 Application equipment must be correctly calibrated to obtain optimum results and prevent wastage through over-application.

14.2 Calibration should be carried out in the area to be treated.

14.3 Calibration should be checked frequently during application. The following should be checked:

14.3.1 Correct spray pressure.

14.3.2 Correct nozzle size and spray pattern.

14.3.3 Correct nozzle output.

14.3.4 Volume of application over a specific area.

## ESTIMATED VOLUMES OF PRODUCT PER HECTARE ARE FOR A

DENSE / CLOSED STAND OF THE SPECIFIC SPECIES. FOR LOWER INFESTATIONS VOLUMES SHOULD BE REDUCED ACCORDINGLY.

MEDIUM	=	75% OF DENSE/ CLOSED
SPARSE	=	50% OF DENSE / CLOSED
SCATTERED	=	25% OF DENSE / CLOSED
VERY SCATTERED	=	10 % OF DENSE / CLOSED
OCCASIONAL	=	1 % OF DENSE / CLOSED

- **FOR WATER BASED APPLICATIONS, ACTIPRON SUPER WETTER SHOULD BE ADDED WHERE RECOMMENDED ON THE LABEL. RATE PER HECTARE FOR DENSE / CLOSED STAND – 1.75 l / ha**
- FOR ALL WATER BASED TREATMENTS A SUITABLE DYE SHOULD BE ADDED WHEN NECESSARY TO ENSURE THAT ALL TARGET PLANTS ARE TREATED.  
RATE PER HECTARE FOR DENSE / CLOSED STAND - 350ml / ha
- **FOR DIESEL BASED APPLICATIONS, SUDAN RED DYE SHOULD BE ADDED.  
RATE PER HECTARE FOR DENSE / CLOSED STAND 300 ml / ha.**



**ANNEXURE A.**

**GUIDE TO CONTROL METHOD AND HERBICIDE SELECTION FOR ALIEN VEGETATION.**

**AMERICAN BRAMBLE (*RUBUS CUNEIFOLUS.*)**

TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
ALL PLANTS	FOLIAR SPRAYS	MAMBA (GLYPHOSATE 360g/l)	300ml /10l WATER (6l / Ha)	SEE NOTE	6l / ha
MATURE PLANTS	SLASH AND SPRAY REGROWTH	TOUCH DOWN GLYPHOSATE TRIMESIUM 480g/l)	6l / ha	SEE NOTE	6l / ha
		GARLON 4/VIROAXE (TRICLOPYR ESTER 480gm / l)	50ml / 10l WATER	SEE NOTE	1.5 l / ha

**NOTE:**  
 SPRAY ON ACTIVELY GROWING PLANTS.  
 SLASH OLD GROWTH IN WINTER, AND SPRAY  
 SPRING GROWTH WHEN ABOVE 0.5 m TALL.

**INKBERRY (*CESTRUM LAEVIGATUM*.)**

TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
SEEDLINGS	HAND PULL				
LARGE TREES	SINGLE STEMMED	BASAL STEM	GARLON 4 VIROAXE (TRICLOPYR 480g/l)	100ml / 10 l DIESEL	2 l / ha
	ALL	CUT STUMP	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360 g /l)	300ml / 10 l WATER	2 l / ha
			CHOPPER (IMAZAPYR 100g / l)	200ml / 10 l WATER	1.5 l / ha

- CONSULT THE WFW TECHNICAL ADVISOR.

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**AUSTRALIAN MYRTLE (*LEPTOSPERMUM LAEVIGATUM.*)**

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**TARGET PLANTS**

**METHOD**

**PRODUCT**

**RATE**

**COMMENTS**

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**BIG TREES**

**CUT DOWN**

CUT DOWN AT  
GROUND LEVEL  
DO NOT APPLY  
HERBICIDE

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**BARBADOS GOOSEBERRY (*PERESKIA ACULEATA*.)**

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<b>TARGET PLANTS</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENTS</b>	<b>ESTIMATED PRODUCT / HECTARE.</b>
<b>VINES</b>	CUT DOWN TO 2m AND SPRAY	GARLON 4 VIROAXE (TRICLOPYR ESTER 480g/l)	50ml/10 l WATER	BURN REMAINING PLANT MATERIAL.  FOLLOW UP SPRAYS MAY BE NECESSARY.	1.5 l

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**BEEFWOOD (*CASUARINA EQUISETIFOLIA*)**

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TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENT	ESTIMATED PRODUCT / HECTARE
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ALL TREES

FRILL

CHOPPER  
IMAZAPYR  
100g / l)

1000ml / 10 l  
WATER

5L/Ha

## BLACK WATTLE (*ACACIA MEARNsii*)

TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTMATED PRODUCT/ HECTARE
	HAND PULL OR HOE			OPEN STANDS	
SEEDLINGS AND SAPLINGS	FOLIAR SPRAY UP TO 1 m TALL	MAMBA (GLYPHOSATE 360g/l)	150ml/ 10L WATER	AVOID WATER COURSE CONTAMINATION	3 l
	FOLIAR SPRAY UP TO 2m TALL	TOUCHDOWN (GLYPHOSATE TRIMESIUM 480g/l)	3l/ ha		3 l
	FOLIAR SPRAY UP TO 1.5m TALL	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	25 – 75ml/ 10L WATER	LOW RATE ON SEEDLINGS SEE NOTE BELOW	0.5 – 1.5 l
YOUNG TREES	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	75ml/ 10L WATER		3 l
BIG TREES	CUT STUMP	TIMBREL 3 A * (TRICLOPHYR AMINE SALT 360g / l)	3l / 100l WATER		1.5 l / ha
	FRILL	TIMBREL 3 A * (TRICLOPHYR AMINE SALT 360g / l)	300ml / 10l WATER		1.5 l / ha
INACCESSABLE TREES	STEM TREATMENT	ECO – PLUG *		INACCESSABLE OR DANGEROUS AREAS	

\* CONSULT THE WFW TECHNICAL ADVISOR.

**NOTE:** USE GARLON 4 / VIROAXE IF GRASS SPECIES ARE PRESENT.

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**BLUEGUMS** (*EUCALYPTUS SPP.*)

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TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT/ HECTARE
SEEDLINGS	HAND PULL				
COPPICE	FOLIAR SPRAY	BRUSH OFF * (METSULPHFURON METHYL 500g / kg) PLUS MAMBA * (GLYPHOSATE 360 g /l)	200g / ha + 3 l / ha	APPLY TO COPPICE 1.5 – 1.8 m TALL	200 g / ha 3 l / ha
FELLED TREES	CUT STUMP	CHOPPER (IMAZAPYR 100 g/l)	1250 ml / 10 l WATER	IF SPECIES KNOWN CHECK RATE ON LABEL	6 l / ha
	FRILL	CHOPPER (IMAZAPYR 100g/l)	1250ml / 10 l WATER	IF SPECIES KNOWN CHECK RATE ON LABAEL	6 l / ha

**\* CONSULT THE  
WFW TECHNICAL  
ADVISOR.**

**SPOT SPRAY COPPICE:  
16 LITRES WATER  
16 GMS BRUSH OFF  
1% MAMBA  
0.5% ACTIPRON**

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**BRAZILIAN PEPPER TREE (*SCHINUS TEREBRINTHIFOLIUS*.)**

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<b>TARGET TREES</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENTS</b>	<b>ESTIMATED PRODUCT / HECTARE</b>
<b>ALL TREES</b>	<b>— BASAL STEM</b>	<b>- GARLON 4 /VIROAXE (TRICLOPYR ESTER 480g/l)</b>	<b>— 200ml / 10L DIESEL</b>	<b>- WET UP TO 0.5m STEM AND ROOTS</b>	<b>— 1.5 l / ha</b>



**BUGWEED (*SOLANUM MAURITIANUM.*)**

**1.**

TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
SEEDLINGS & SAPLINGS	HAND PULL				
		STARANE 200 (FLUROXYPYR 200g/l)	12.5ml / 10L WATER	UP TO 1m TALL	0.5l / ha
		MAMBA (GLYPHOSATE 360g/l)	50ml / 10L WATER		2l / ha
	FOLIAR SPRAY				
		TOUCH DOWN (GLYPHOSATE TRIMESIUM 480g/l)	2l / ha	SPRAY WHEN 500mm TALL	2l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER		1.5 / ha

## BUGWEED

2.

TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
<b>BIG TREES</b>	CUT DOWN & SPRAY COPPICE	STARANE 200 (FLUROXYPYR 200g/l)	12.5ml / 10L WATER	SPRAY WHEN 500mm TALL	0.51 / ha
		MAMBA (GLYPHOSATE 360g/l)	150ml / 10L WATER		31 / ha
		TOUCH DOWN (GLYPHOSATE TRIMESIUM 480g/l)	2l / ha	SPRAY WHEN 500mm TALL	21 / ha
	CUT STUMP	CHOPPER (IMAZAPYR 100g/l)	200ml/10l WATER	CUT SURFACE ONLY	1 l / ha
		TIMBREL 3 A (TRICLOPYR AMINE SALT 360g/l)	300ml / 10L WATER	CUT SURFACE ONLY	2.25l / ha
	FRILL	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360 g/l)	300ml / 10L WATER		1.5 l / ha
		CHOPPER (IMAZAPYR 100g/l)	200ml / 10 l WATER		1 l / ha
* CONSULT THE WFW TECHNICAL ADVISOR.					

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**C A C T I**


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<b>SPECIES</b>	<b>TARGET PLANTS</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENTS</b>	<b>ESTIMATE PRODUCT/ HECTARE</b>
<b>HARRISIA CACTUS</b> <i>(HARRISIA MARTINI.)</i>	STANDING PLANTS	SPRAY APPLICATION	MSMA (MSMA 720g/l)	1 l / 20 l WATER		10 l / ha
			GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	100ml / 10L WATER	TREES UP TO 1.5 m TALL	2 l / ha
		STEM INJECTION	MSMA (MSMA 720g/l)	1 l / 2 l WATER		2 l / ha
<b>JOINTED CACTUS</b> <i>(OPUNTIA AURANTIACA.)</i>	PLANTS AND LOOSE CLADODES	SPRAY APPLICATION	MSMA (MSMA 720g/l)	1 l / 2 l WATER		5 l / ha

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**C A C T I**


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SPECIES	TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
IMBRICATE CACTUS ( <i>OPUNTIA IMBRICATA.</i> )	STANDING PLANTS	SPRAY APPLICATION	WHOLE PLANT	MSMA (MSMA 720g/l)	1 l / 22 l WATER	10 l / ha
			CUT STUMP	MSMA (MSMA 720g/l)	1 l / 22 l WATER	CUT PLANTS DOWN TO 100 – 150 mm. AND SPRAY CUT STUMP
ROSEA CACTUS ( <i>OPUNTIA ROSEA.</i> )						

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**C A C T I**


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SPECIES	TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE.
<b>PRICKLY PEAR</b> <i>(OPUNTIA FICUS-INDICA)</i>	STANDING PLANTS	STEM INJECTION	MSMA (MSMA 720g/l)	1l / 1l WATER	2 ml DOSES	12 l / ha
			MAMBA (GLYPHOSATE 360g/l)	1l/2l WATER	2 ml DOSES	16 l / ha
			TOUCHDOWN (GLYPHOSATE TRIMESIUM 480g/l)	330ml / 10L WATER	2 ml DOSES	8 l / ha

**NOTE:** INJECT INTO 4  
- 12 PREMADE HOLES  
PER PLANT

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**C A C T I.**


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SPECIES	TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
SOUR PRICKLEY PEAR ( <i>OPUNTIA STRICTA</i> )	LARGE PLANTS	STEM INJECTION	MSMA (MSMA 720g/l)	1l/1l WATER	2 ml DOSES SEE NOTE BELOW	8 l / ha
	SMALL PLANTS	SPRAY APPLICATION	MSMA (MSMA 720g/l)	1l / 30l WATER		10 l / ha

**NOTE:** APPLY DOSES INTO 1 – 8 PRE-MADE HOLES IN PLANTS.

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**CAMEL THORN BUSH (*ALHAGI CAMELORUM*)**

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<b>TARGET PLANTS</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENT</b>	<b>ESTIMATED PRODUCT/ HECTARE</b>
<b>STANDS OF PLANTS</b>	<b>GRANULAR APPLICATION</b>	<b>MOLOPO GG (TEBUTHIURON 200 g / kg)</b>	<b>2 – 4 g / m<sup>2</sup></b>	<b>RATE DEPENDS ON CLAY CONTENT</b>	<b>20 – 40 Kg / ha</b>

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**NOTE:** OBTAIN ASSISTANCE FROM SUPPLIER ON APPLICATION TECHNIQUES BEFORE APPLYING.

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**CLUSTER PINES** (*PINUS PINASTER.*)

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<b>TARGET PLANTS</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENTS</b>
<b>ALL TREES</b>	CUT DOWN CLOSE TO GROUND			DO NOT APPLY HERBICIDE TO STUMPS
<b>IN DIFFICULT TERRAIN</b>	STEM	ECOPLUG *		ONLY ON SMALL TREES 10CM OR LESS. NOT EFFECTIVE ON LARGER TREES

\* CONSULT THE WFW TECHNICAL ADVISOR.



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**GOLDEN WATTLE (*ACACIA PYCNANTHA*.)**

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TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS
SEEDLINGS AND SAPLINGS	HAND PULL OR HOE			
BIG TREES	CUT STUMP	STUMP OUT ( <i>CYLINDROBASIDIUM</i> <i>LAEVE</i> ) 2X10 SPORES PER SACHET	1 SACHET/ 400ml SUNFLOWER OIL	APPLY 1 – 2 DROPS PER STUMP

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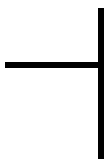
**GREEN WATTLE ( *ACACIA DECURRENS* )**

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TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT/ HECTARE
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SEEDLING AND — HAND PULL  
SAPLINGS — OR HOE

TREES		CUT STUMP	— TIMBREL* (TRICLOPYR AMINE SALT 360g / l)	— 300ml / 10L WATER —	1.5l / ha
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\* CONSULT THE WFW TECHNICAL ADVISOR

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**GUAVA (*PSIDIUM GUAJAVA.*)**

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TARGET TREE	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
ALL TREES	CUT STUMP	CHOPPER (IMAZAPYR 100g/l)	1250ml / 10l WATER	TREAT CUT SURFACE	6l / ha

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**HONEY MESQUITE (*PROSOPIS SPP.*)**

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TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
ALL TREES	CUT STUMP	GARLON 4 VIROAXE (TRICLOPYR ESTER 480g/l)	400ml / 10L DIESEL		31/ha
	SOIL APPLICATION	MOLOPO S.C. * (TEBUTHIURON 500 g / l)	1.5L / 8.5 L WATER	LIGHT SOILS ONLY IN RESTRICTED AREAS	21/ha

\* CONSULT THE  
WFW TECHNICAL  
ADVISOR.

**TRIFFID WEED (CROMOLAENIA ODORATA.)**

TARGET PLANTS	METHOD	PRODUCT	RATE	ESTIMATED PRODUCT / HECTARE
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SEEDLINGS	HAND PULL			
	FOLIAR SPRAY	MAMBA (GLYPHOSATE 360g/l)	100ml / 10L WATER	4 l / ha
		TOUCHDOWN (GLYPHOSATE TRIMESIUM 480g/l)	100ml / 10L WATER	4 l / ha
		GARON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	37.5ml / 10L WATER	1.5 l / ha

**TRIFFID WEED ( *CROMOLAENIA ODORATA.* )**

TARGET PLANTS	METHOD	PRODUCT	RATE	ESTIMATED PRODUCT/ HECTARE.
ESTABLISHED PLALNTS	SLASH AND SPRAY REGROWTH WHEN 500 mm TALL	MAMBA (GLYPHOSATE 360g/l)	100ml / 10L WATER	4 l / ha
		TOUCHDOWN (GLYPHOSATE TRIMESIUM 480g/l)	100ml / 10L WATER	4 l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480 g/l)	37.5ml / 10L WATER	1.5 l / ha
	CUT STUMP	CHOPPER (IMAZAPYR 100 g/l)	200 ml / 10 l WATER	1.5 l / ha

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**KUDZU (*PUERARIA LOBATA.*)**

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<b>TARGET TREES</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENTS</b>	<b>ESTIMATED PRODUCT / HECTARE</b>
<b>ACTIVELY GROWING PLANTS</b>	<b>SPRAY</b>	<b>GARLON 4 VIROAXE (TRICLOPYR ESTER 480g/l)</b>	<b>50ml/10L WATER</b>	<b>WET THOROUGHLY</b>	<b>3 l / ha</b>

**LONG - LEAVED WATTLE ( ACACIA LONGIFOLIA )**

TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT/ HECTARE
SEEDLINGS AND SAPLINGS UP TO 2m TALL	HAND PULL OR HOE			OPEN STANDS	
	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	60ml/10L WATER		2 l / ha
TREES	CUT DOWN AND TREAT COPPICE	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	60ml/10L WATER	CUT LOW DOWN TO REDUCE COPPICE	2 l / ha
	CUT STUMP	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360g / l)	300ml / 10L WATER	SEE NOTE BELOW	1.5 l / ha
	FRILL	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360g / l)	300ml / 10L WATER		1.5 l / ha

NOTE: TREES CUT CLEANLY LOW DOWN, DO NOT NORMALLY COPPICE

\* CONSULT THE WFW TECHNICAL ADVISOR.



**PORT JACKSON WILLOW (*ACACIA SALIGNA.*)**

TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
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SEEDLINGS	HAND PULL OR HOE			OPEN STANDS	
	FOLIAR SPRAY	MAMBA (GLYPHOSATE 360g/l)	2 – 4l / ha	SPOT SPRAY 1.5% SOLUTION	2-4 l / ha
		TOUCHDOWN (GLYPHOSATE TRI- MESIUM 480g/l)	2 – 4 l / ha		2-4 l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml/10L WATER	SEE NOTE BELOW	1.5 l / ha

**NOTE:** USE GARLON 4 or VIROAXE,  
IF OTHER PIONEER GRASS  
SEEDLINGS PRESENT.

**PORT JACKSON WILLOW (*ACACIA SALIGNA*).**

TARGET TREES	METHOD	PRODUCT	RATE	COMMENT	ESTIMATED PRODUCT/ HECTARE
SAPLINGS AND YOUNG TREES	HAND PULL OR HOE				
		TOUCH DOWN (GLYPHOSATE)	4 l/ha	PLANTS UP TO 600mm HIGH	4 l/ ha
	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER	PLANTS UP TO 2m HIGH	3 l/ ha
BIG TREES	CUT STUMP	TIMBREL 3A (TRICLOPHYR AMINE SALT 360 g/l)	300ml / 10L WATER		1.5 l / ha
	FRILL	TIMBREL 3A (TRICLOPHYR AMINE SALT 360 g/l)	300ml / 10L WATER		1.5 l/ ha

**MAURITIOUS THORN ( CAESALPINIA DECAPETALIA.)**

TARGET PLANTS	METHOD	PRODUCT	RATE	ESTIMATED PRODUCT/ HECTARE
SEEDLINGS	FOLIAR SPRAY	TOUCH DOWN (GLYPHOSATE TRI- MESIUM 480g/l)	3 l / ha	3 l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g / l)	50ml / 10l WATER	1.5 l / ha
		MAMBA (GLYPHOSATE 360g/l)	150ml/10L WATER	3 l / ha
PLANTS UP TO 1m TALL	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml/10L WATER	1.5 l / ha
		MAMBA (GLYPHOSATE 360g/l)	3l / Ha	3 l / ha
YOUNG PLANTS AND REGROWTH UP TO 500mm AFTER SLASHING	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER	2 l / ha
TREES	CUT STUMP	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360g / l)	300ml / 10L WATER	1.5 l / ha

\* CONSULT THE WFW  
TECHNICAL ADVISOR

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QUEEN OF THE NIGHT (*CEREUS JAMACARU.*)

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TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
LARGE PLANTS	STEM INJECTION	MSMA (MSMA 720g/l)	1l / 2l WATER 2ml / INJECTION	OCTOBER TREATMENT. 1 INJECTION PER 2.5m STEM LENGTH	
SMALL PLANTS	SPRAY APPLICATION	MSMA (MSMA 720g /l)	1l / 20l WATER	OCTOBER TREATMENT	10 l / ha

## RED EYE (*ACACIA CYCLOPS*)

TARGET TREE	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT/ HECTARE
SEEDLINGS & SAPLINGS	HAND PULL OR HOE			OPEN STAND	
	SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml/10L WATER	DENSE STAND	2l / ha
TREES UP TO 2m TALL	CUT LOW DOWN				
	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml/10L WATER		4l / ha
LARGE TREES	CUT LOW DOWN			DO NOT APPLY HERBICIDE	
	FRILL	TIMBREL 3 A * (TRICLOPYR AMINE SALT 360g / l)	300ml /10L WATER		1.5 l / ha

NOTE: CUT DOWN LOW, TO PREVENT COPPICING.

\* CONSULT THE WFW TECHNICAL ADVISOR.

**RED SESBANIA (SESBANIA PUNICEA.)**

TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE.
SEEDLINGS	FOLIAR SPRAY	MAMBA (GLYPHOSATE 360g/l)	150ml / 10L WATER		4 l / ha
		TOUCH DOWN (GLYPHOSATE TRIMESIUM 480g/l)	4 l / ha		4 l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER		2 l / ha
TREES	SLASH AND SPRAY COPPICE	MAMBA (GLYPHOSATE 360g/l)	150ml / 10L WATER	SPRAY WHEN 1m TALL	4 l / ha
		TOUCH DOWN (GLYPHOSATE TRIMESIUM 480g/l)	4 l / ha		4 l / ha
		GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER	SPRAY UP TO 2m TALL	2 l / ha

**NOTE:** DO NOT SPRAY TREES UNDER BIO – CONTROL.

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**RED SESBANIA**


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TARGET	METHOD	PRODUCT	RATE	COMMENT	ESTIMATED	PRODUCT/ HECTARE
		CHOPPER (IMAZAPYR 100g/l)	200ml / 10 l WATER	<i><b>DO NOT APPLY IN RIPERIAN SITUATIONS WHERE WATER CONTAMINATION CAN TAKE PLACE.</b></i>		1.5 l / ha
TREES	CUT STUMP	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	50ml / 10L WATER	WHOLE STUMP		1.5 l / ha
			100ml / 10L WATER	CUT SURFACE ONLY <i><b>DO NOT APPLY IN RIPERIAN SITUATIONS WHERE WATER CONTAMINATION CAN TAKE PLACE.</b></i>		1.5 l / ha
		TIMBREL 3A * (TRICLOPYR AMINE SALT 360g/l)	300ml / 10L WATER	CUT SURFACE ONLY <i><b>DO NOT APPLY IN RIPERIAN SITUATIONS WHERE WATER CONTAMINATION CAN TAKE PLACE.</b></i>		2 l / ha

\* CONSULT THE WFW TECHNICAL ADVISOR.

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**ROCK HACKEA (*HACKEA GIBBOSA.*) & SILKY HACKEA (*HACKEA SERICIA.*)**

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**TARGET TREES**

**METHOD**

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**ALL PLANTS** ————— SLASH AND BURN, THEN  
HAND PULL SEEDLINGS.



**SILVER WATTLE (*ACACIA DEALBATA*)**

TARGET TREES	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE.
SEEDLINGS AND YOUNG SAPLINGS	HAND PULL OR HOE			OPEN STANDS	
	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480g/l)	25 – 50 ml/ 10L WATER	LOW RATE ON SEEDLINGS	0.5 – 2l / ha
TREES UP TO 1.5M TALL AND COPPICE	FOLIAR SPRAY	GARLON 4 / VIROAXE (TRICLOPYR ESTER 480c/l)	75ml/10L WATER		3l / ha
LARGE TREES	CUT STUMP	MAMBA (GLYPHOSATE 360g/l)	200ml/10L WATER	TREAT CUT SURFACE	6l / ha
		TIMBREL 3 A (TRICLOPYR AMINE SALT 360g/l)	300ml/10L WATER	TREAT CUT SURFACE	1.5l / ha
	FRILL	MAMBA (GLYPHOSATE 360g/l)	2L/10L WATER	APPLY WITHIN 30 MINUTES	6l / ha

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**SISAL** (*AGAVE SISALANA*)

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<b>TARGET PLANTS</b>	<b>METHOD</b>	<b>PRODUCT</b>	<b>RATE</b>	<b>COMMENT</b>	<b>ESTIMATED PRODUCT/ REQUIRED</b>
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<b>ALL SISAL</b>	<b>INJECTION</b>	<b>MSMA</b> (MSMA 720 g/l)	<b>2ml PER PLANT</b>	<b>INTO BOLE</b>	<b>2 l / 1000 PLANTS</b>
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**SYRINGA (MELIA AZEDRACH.)**

TARGET PLANTS	METHOD	PRODUCT	RATE	COMMENTS	ESTIMATED PRODUCT / HECTARE
ALL TREES	CUT STUMP FRILL	CHOPPER (IMAZAPYR 100g/l)	300ml/10l WATER	TREAT CUT SURFACE	2 l / ha
		TIMBREL 3A * (TRICLOPYR AMINE SALT 360 g / l)	300ml / 10L WATER		2 l / ha
SEEDLINGS	REMOVE BY HAND				

\* CONSULT THE WFW TECHNICAL ADVISOR.

LANTANA (*LANTANA CAMARA*)

TARGET PLANTS	METHOD	PRODUCT	RATE	ESTIMATED PRODUCT / HECTARE.
SEEDLINGS	HAND PULL OR HOE			
	FOLIAR SPRAY	MAMBA (GLYPHOSATE 360g/l)	300ml / 10L WATER	6 l / ha
		TOUCH DOWN (GLYPHOSATE TRIMESIUM 480g/l)	6l / ha	6 l / ha
		ACCESS * (PICLORAM K - SALT 240g / l)	100ml / 10L WATER	2l / ha

*SELECTED AREAS ONLY*

**LANTANA (*LANTANA CAMARA*)**  
*Cont.*

<b>LARGE PLANTS</b>	FOLIAR SPRAY	TOUCHDOWN (GLYPHOSATE TRIMESIUM 480g/l)	6l / ha	6 l / ha
		ACCESS *	100ml / 10L WATER	2 l / ha
		(PICLORAM K – SALT 240g / l)	<b>SELECTED AREAS ONLY</b>	
<b>CUT STUMP</b>	CHOPPER	(IMAZAPYR 100g/l)	200 ml / 10 l WATER	1.5 l / ha
		ACCESS *	100ml / 10L WATER	2 l / ha
		(PICLORAM K – SALT 240g / l)	<b>SELECTED AREAS ONLY</b>	

\* CONSULT THE WFW  
TECHNICAL ADVISOR.

**GREY POPLAR (*POPULUS SPP.*)**

<i>TARGET TREES PRODUCT /</i>	<i>METHOD</i>	<i>PRODUCT</i>	<i>RATE</i>	<i>COMMENTS</i>	<b>ESTIMATED HECTARE</b>
<b><u>SEEDLINGS</u></b>	FOLIAR SPRAY	GARLON* VIROAXE (TRICLOPYR ESTER 480g/l)	150ml/10L WATER		2l / ha
	CUT STUMP	CHOPPER (IMAZAPYR 100g / l)	500ml / 10L WATER		1.5 l / ha
<b>LARGE TREES</b> — ALL	CUT STUMP FRILL	CHOPPER (IMAZAPYR 100g / l)	500ml / 10 L WATER		1.5 l / ha

\* CONSULT THE WFW TECHNICAL ADVISOR.

**BLACKWOOD (*ACACIA MELANOXYLON.*)**

<i>TARGET TREES PRODUCT /</i>	<i>METHOD</i>	<i>PRODUCT</i>	<i>RATE</i>	<i>COMMENTS</i>	<b>ESTIMATED HECTARE</b>
<b>SEEDLINGS</b>	FOLIAR SPRAY	STARANE*	12.5ml/10L WATER		0.5L/Ha
	FRILL/STEM APPLICATION	GARLON VIROAXE (TRICLOPYR ESTER 480g/l)	200ml / 10 L DIESEL		1.5 l / ha
<b>LARGE TREES</b> — ALL	FRILL/STEM APPLICATION	GARLON VIROAXE (TRICLOPYR ESTER 480g/l)	200ml / 10 L DIESEL		1.5 l / ha

\* CONSULT THE WFW TECHNICAL ADVISOR.

**JACARANDA (JACARANDA MIMOSIFOLIA.)**

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<i>TARGET TREES PRODUCT /</i>	<i>METHOD</i>	<i>PRODUCT</i>	<i>RATE</i>	<i>COMMENTS</i>	<b>ESTIMATED HECTARE</b>
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<b>ALL TREES AND SEEDLINGS</b>	<b>FRILL/CUT STUMP</b>	<b>CHOPPER (IMAZAPYR 100g / l)</b>	<b>1000ml / 10 L WATER</b>		<b>5L/Ha</b>
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**PEANUT BUTTER TREE (*SENNA SPP.*)**

<i>TARGET TREES PRODUCT /</i>	<i>METHOD</i>	<i>PRODUCT</i>	<i>RATE</i>	<i>COMMENTS</i>	<b>ESTIMATED HECTARE</b>
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<b>ALL TREES AND SEEDLINGS</b>	<b>CUT STUMP</b>	<b>CHOPPER (IMAZAPYR 100g / l)</b>	<b>500ml / 10 L WATER</b>		<b>3L/Ha</b>
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## **Appendix D:**

Grievance Mechanism for Public Complaints and Issues

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## **GRIEVANCE MECHANISM / PROCESS**

### **AIM**

The aim of the grievance mechanism is to ensure that grievances / concerns raised by local landowners and or communities are addressed in a manner that is:

- Fair and equitable;
- Open and transparent;
- Accountable and efficient.

It should be noted that the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. However, the aim should be to address grievances in a manner that does not require a potentially costly and time consuming legal process.

### **Proposed generic grievance process**

- Local landowners, communities and authorities will be informed in writing by the proponent (the renewable energy company) of the grievance mechanism and the process by which grievances can be brought to the attention of the proponent.
- A company representative will be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person will be provided to local landowners, communities and authorities.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
- The grievance will be registered with the contact person who, within 2 working days of receipt of the grievance, will contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting. Unless otherwise agreed, the meeting will be held within 2 weeks of receipt of the grievance.
- The contact person will draft a letter to be sent to the Complainant acknowledging receipt of the grievance, the name and contact details of Complainant, the nature of the grievance, the date that the grievance was raised, and the date and venue for the meeting.
- Prior to the meeting being held the contact person will contact the Complainant to discuss and agree on who should attend the meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the grievance mechanism process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

- The meeting will be chaired by the company representative appointed to address grievances. The proponent will provide a person to take minutes of and record the meeting/s. The costs associated with hiring venues will be covered by the proponent. The proponent will also cover travel costs incurred by the Complainant, specifically in the case of local, resource poor communities.
- Draft copies of the minutes will be made available to the Complainant and the proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome will be recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of a dispute between the Complainant and the proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s will note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned;
- In the event that the parties agree to appoint a mediator, the proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the proponent, will identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator will be borne by the proponent. The proponent will provide a person to take minutes of and record the meeting/s.
- In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome will be recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of the dispute not being resolved, the mediator will prepare a draft report that summarizes the nature of the grievance and the dispute. The report should include a recommendation by the mediator on the proposed way forward with regard to the addressing the grievance.
- The draft report will be made available to the Complainant and the proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days.

The way forward will be informed by the recommendations of the mediator and the nature of the grievance. As indicated above, the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the proponent, either party may be of the opinion that legal action may be the most appropriate option.

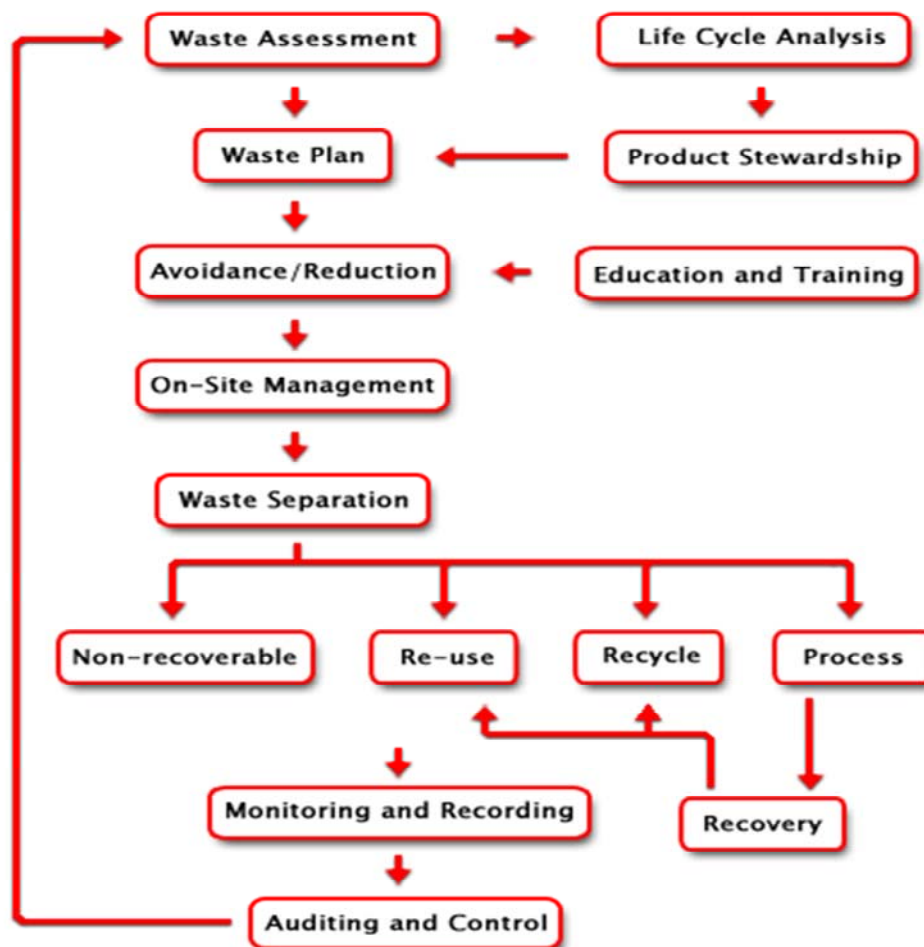
Tony Barbour  
May 2012

**Appendix E:**  
Guideline for Integrated Management of Construction  
Waste

## GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

Waste is broadly defined by the Department of Water Affairs in 1994 as: 'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity'. An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.

**The Integrated Waste Management Approach to Waste**



Source: <http://www.enviroserv.co.za/pages/content.asp?SectionId=496>

## 1. Waste Assessment

A detailed waste assessment is necessary to understand the waste types and volumes being produced. In order to achieve this, construction practices must be measured and analysed.

## 2. Waste Plan

A waste plan must be developed to provide appropriate solutions for managing the entire waste stream on site. The objective of the plan should be to reduce the volumes of waste to disposal and thereby to reduce the cost of management of the waste stream without compromising environmental standards. The plan should include recovery, re-use and recycle recommendations.

Construction Waste Management is the practice of reducing the actual waste that goes to the landfill site. Waste reduction is best met by recycling, and construction wastes offer several opportunities in this regard. In fact, 80% of the wastes found in construction waste piles are recyclable in some form or another. Wood, concrete, bricks, metals, glass and even paint offer several options for recycling.

There are three basic steps for construction waste management, i.e. Reduce, Reuse, and Recycle. **Reduce** is the prevention of the waste from arising and optimising material usage. Waste avoidance and waste reduction can be achieved through improved education and training - by improving efficiencies and by making staff environmentally aware.

**Reuse** is using existing materials instead of throwing these away. Reusing does not mean that it needs to be reused on the same construction site. Selling or donating waste materials to a third party is one option of construction waste management.

**Recycle** is somewhat limited since it only allows for those items that can be used on-site. The most important step for recycling of construction waste is on-site separation. Initially, this will take additional effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

## 3. What to Recycle

Before recycling construction waste, identify who will accept it. This is important in designating type of waste to separate, and in making arrangements for drop-off or delivery of materials. Materials that can be recycled include:

- » Cardboard and Paper
- » Wood

- » Metals
- » Plastics
- » Glass
- » Paints, Stains, Solvents and Sealants
- » Oil

#### **4. Materials Separation**

Successful recycling requires good clean uniform collections of single waste types. This is most effectively achieved by separating the waste streams close to source rather than at the landfill site. Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

Some materials will require bins or storage that protect these from rain. Other bins may be locked to prevent tampering.

#### **5. Recycling and Waste Minimisation Guidelines**

- » *Wood*
  - \* Optimise building dimensions to correspond to standard wood dimensions in order to reduce the need for cutting.
  - \* Store wood on level blocking under cover to minimize warping, twisting and waste.
- » *Metals*
  - \* During construction, separate metals for recycling, including copper piping, wire, aluminium, iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.
- » *Cardboard and Paper*
  - \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  - \* As far as possible, use recyclable packaging.
  - \* Separate cardboard waste, bundle, and store in a dry place.
  - \* Minimise the number of blueprints and reproductions necessary during the design and construction process.
- » *Plastic*
  - \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  - \* As far as possible, use recyclable packaging.



Since more than 60 different types of plastic resins exist, the Plastics Federation of South Africa has adopted a voluntary number coding system for each category of plastics to aid in their sorting by material type for recycling (Bruyns et al, 2002). The most common resin types are itemised in Table 1.

**Table 1:** Identification System for Plastic

<b>Id Number</b>	<b>Plastic Resin Type</b>
1	PET (polyethylene terephthalate)
2	HDPE (high-density polyethylene)
3	PVC (polyvinyl chloride ) or V (vinyl)
4	LDPE (low-density polyethylene)
5	PP (polypropylene)
6	PS (polystyrene)
7	Other (laminates, etc.)

» *Paints, Stains, Solvents and Sealants*

\* Unused materials should be taken to a hazardous waste collection facility.

## **6. On-site Management**

Good supervision of the waste management programme on site is critical to success. Management of the entire on-site program is critical to ensure smooth operations.

## **7. Auditing and Control**

The success of the waste plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Finally, good record keeping and control, becomes a continuous waste assessment process, allowing the waste plan to be improved and adjusted as required.

## **8. Useful contacts:**

<http://www.transpaco.co.za/page5.htm>

Transpaco, a manufacturing and distribution company operating extensively in the plastics and packaging industries, conducts plastic reclamation and recycling.

<http://www.jclenterprises.co.za/>

JCL Enterprises for plastic sales of quality recycled plastic materials as well as the recycling of plastic.

<http://www.rosefoundation.org.za/>

The Rose Foundation specialises in the collection and recycling of used motor (engine) oil.

**Information Sources:**

<http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines>

<http://www.enviroserv.co.za/pages/Content.asp?SectionID=587>

<http://www.enviroserv.co.za/pages/content.asp?SectionId=496>

Programme for the Implementation of the National Waste Management Strategy. DEAT,  
May 2000

Residential Construction Waste Management Demonstration and Evaluation. Prepared  
for U.S. Environmental Protection Agency by NAHB Research Center, May 2, 1995

**Appendix F:**  
Traffic and Transportation Management Plan

## Karoshoek Solar Valley – Traffic Management Plan

### Introduction

A traffic management plan for the site access roads into the Karoshoek Solar Valley has been developed to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted during and after the construction of the solar power plants and associated infrastructure. Worley Parsons, Upington was approached to conduct investigations into possible access routes from the N10 to the Karoshoek Solar Valley

### Methodology

Three possible access routes were identified at the N10 where safe access intersections that would allow for traffic to flow and not result in any hazards were identified. These access routes identified were; Option 1, Option 2 and Option 3 as shown in figure 1 below.

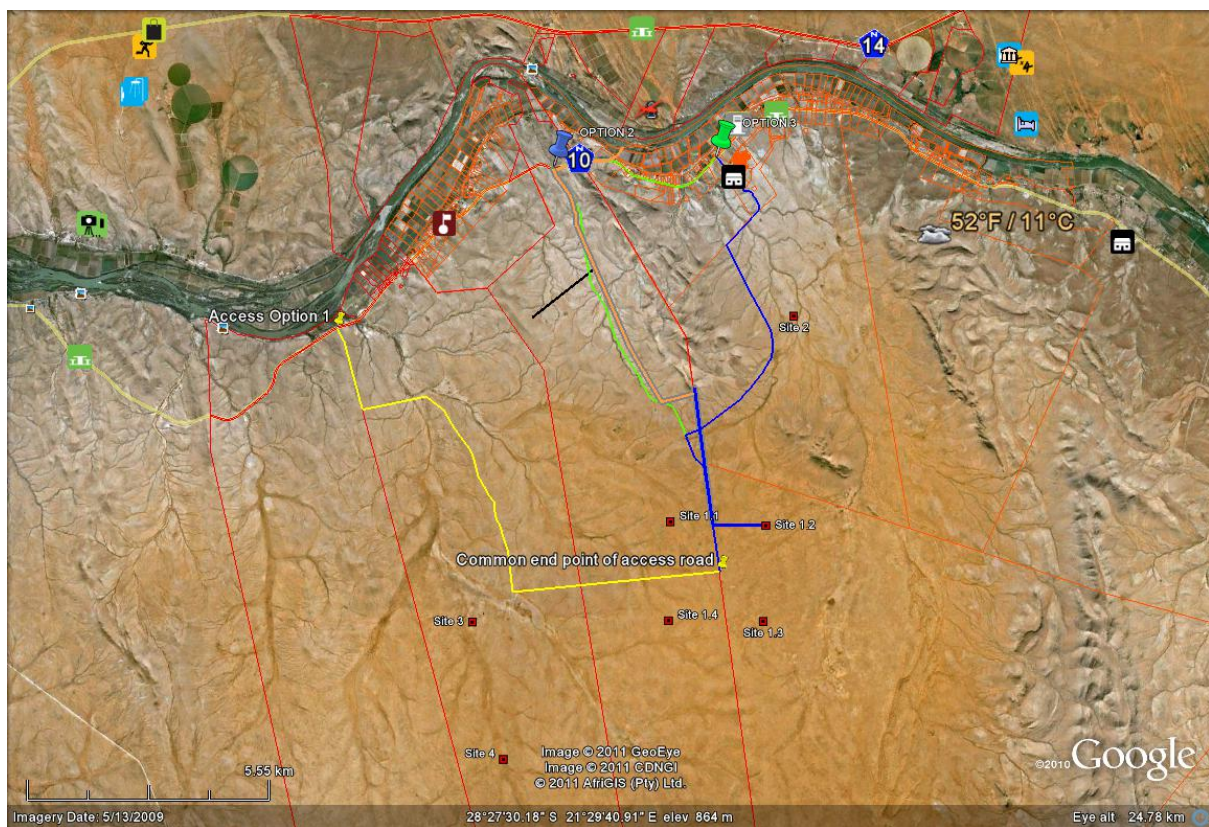


Figure 1: N10 access options for the Karoshoek Solar Valley Site

A site visit inspection with three representatives from SANRAL was organised by Worley Parsons as part of study that included a cost benefit analysis, road traffic flow improvement that benefits road users, the nearby communities and reduces the number of accidents and traffic hazards in the area. Option 2 despite being the most expensive option was selected as the option that will ensure there will be no hazards as a result of increased trucks and it will prevent as well as reduce the number of accidents at section 11 at kilometre chainage 87.2 as shown in figure 2 below.



Figure 2: N10, kilometre chainage 87.2

### **Road Traffic Plan**

SANRAL advised that the Option 2 intersection would only be approved if the re-alignment of the N10 at km chainage 87.2 will adhere to a design speed of 100km/hour as this will allow for traffic to flow without resulting in congestion at the chosen intersection. The current speed limit at the proposed intersection is 60km/hour, because of the fact that the road is not aligned as indicated in figure 2.

To meet the requirements of SANRAL, a detailed survey and design was conducted by Worley Parsons. The design makes provision for traffic from the N10 to enter the Karoshoek Solar Valley site without causing any congestion as extra lanes will be developed to accommodate the traffic at the N10 and from the Karoshoek Solar Valley site.

The traffic crossing the N10 from the north to the south will be accommodated by a proposed sub – level bridge and no crossing with the N10 will be done. This has been designed so for traffic safety reasons. The intersection will be used to transport staff on a daily basis to and from the site as well as material and people during construction. Traffic within the Karoshoek Solar Valley will be accommodated by internal access routes that will be designed according to the normal safe horizontal and vertical specifications for the South African Standards and storm water structures will be designed to accommodate effluent crossing the roads.

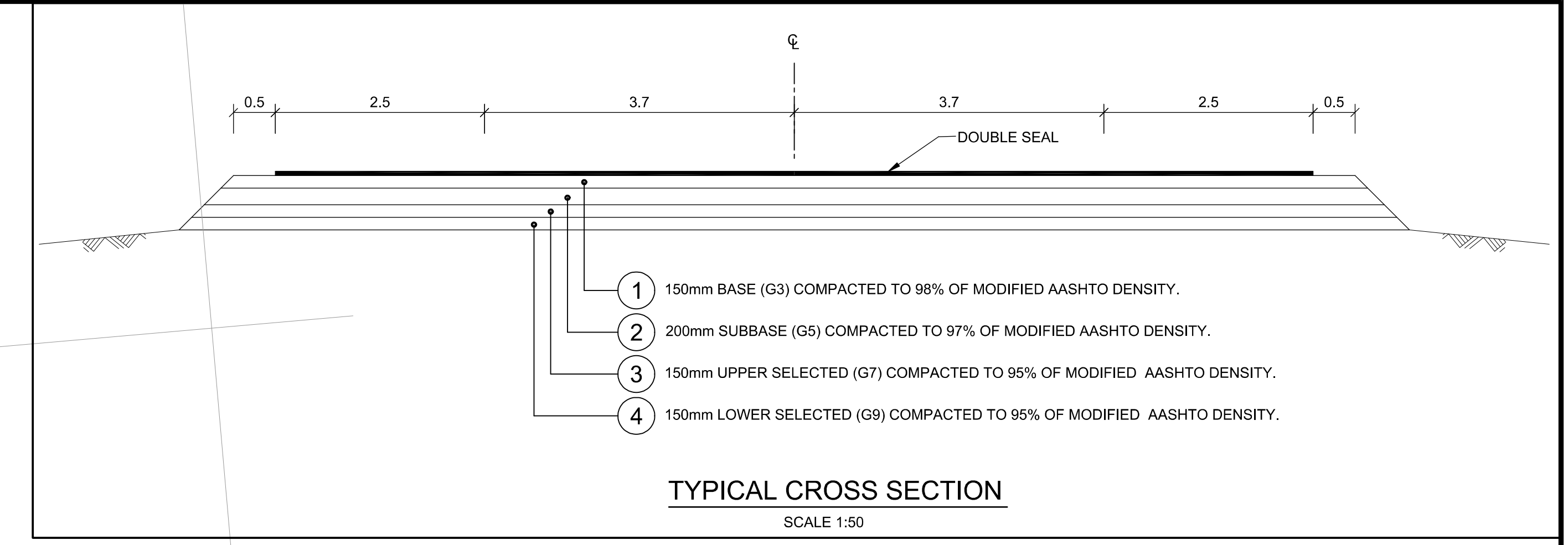
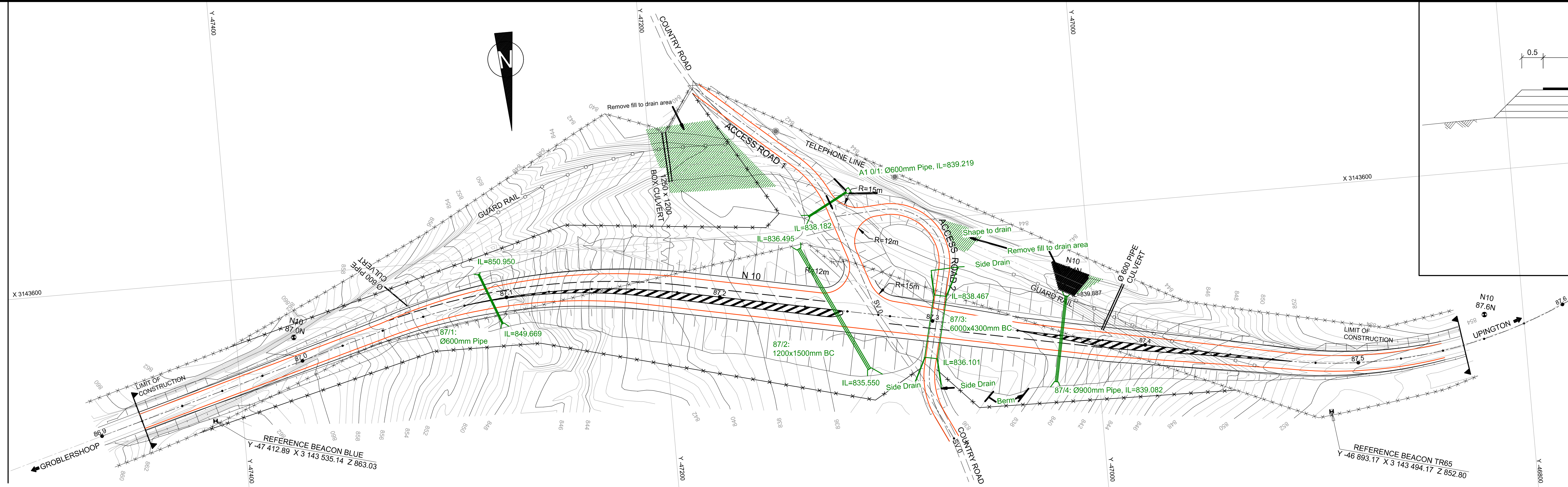
### **SANRAL Approval**

SANRAL has approved the road design for the intersection at km chainage 87.2, Drawing No's 26537KPO/LS/1 and 26537KPO/LS/2 showing the detailed design was approved by SANRAL as shown in the 8 June correspondence letter NC11/2/3-10/11-9 from SANRAL.

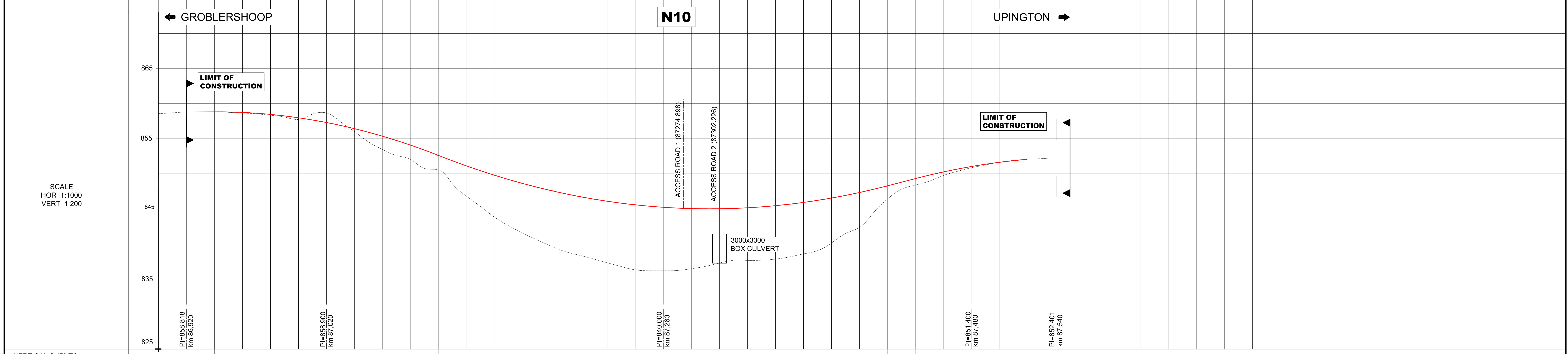


# PROFILE

SCALE  
HOR 1:1000



DRAINAGE	NUMBER AND SIZE	Ø 600 PC	1500x1200 BC	6000x4300 BC	Ø 900 PC
	NUMBER				
GUARDRAILS	LEFT				
	RIGHT				
KERBS	LEFT				
	RIGHT				
BARRIER LINES	LEFT				
	RIGHT				
SUBSURFACE DRAIN	LEFT				
	RIGHT				
SIDE DRAIN TYPE	LEFT				
	RIGHT				



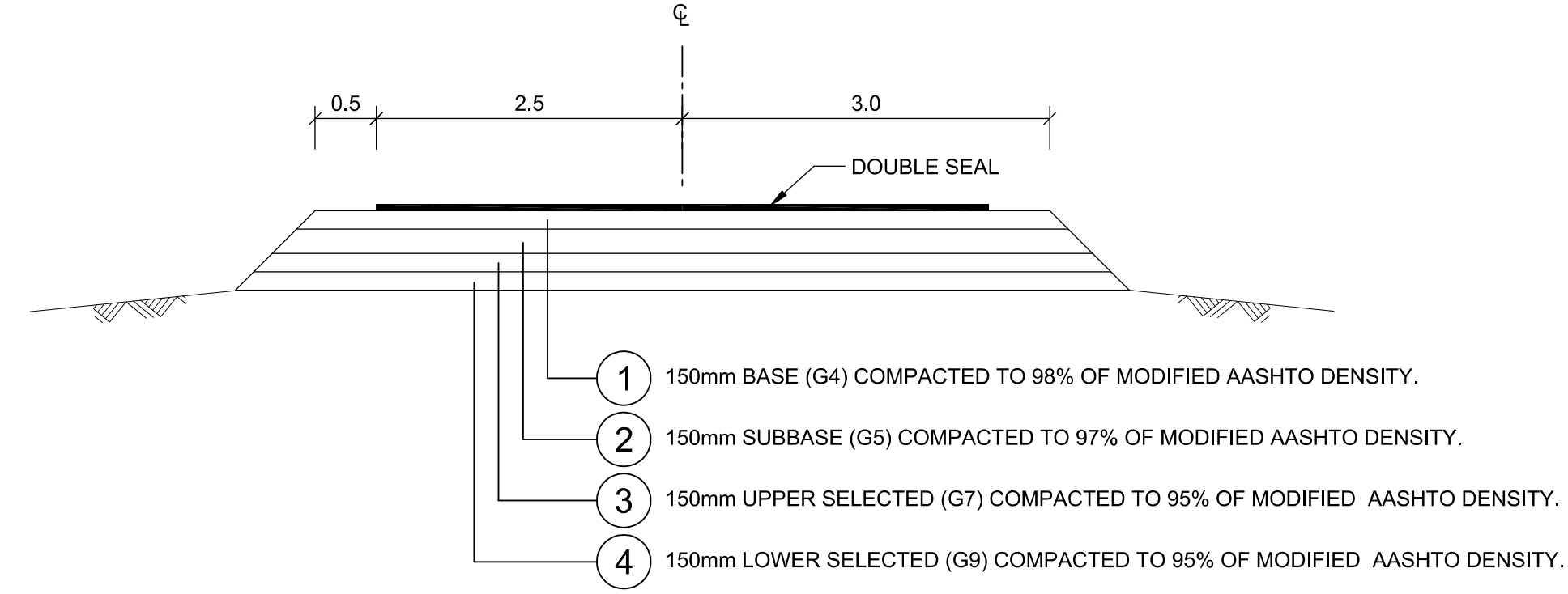
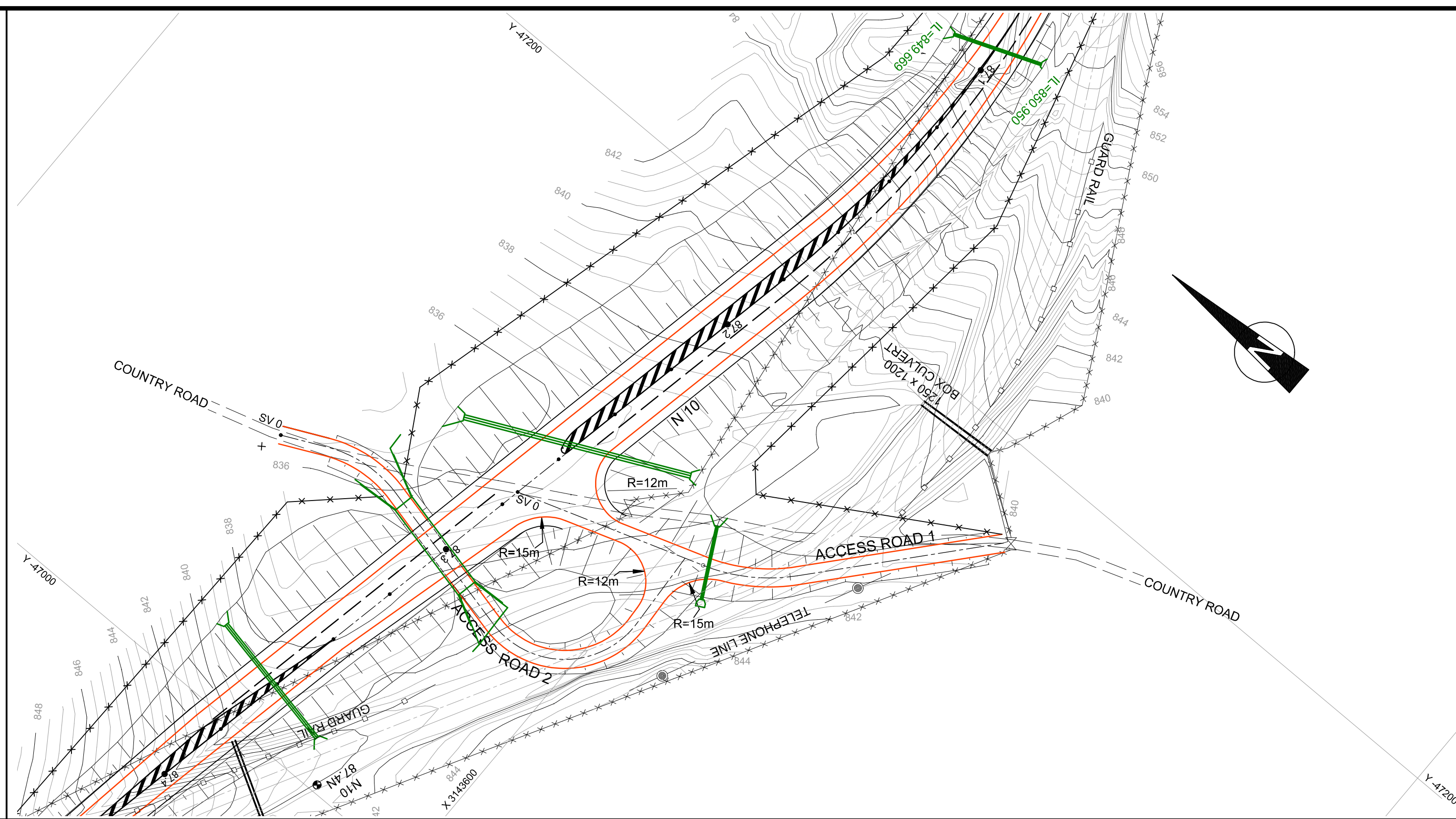
VERTICAL CURVES	L=160,0	K=20	L=320,0	K=25	L=80,0	K=23
GRADES %	+ 0,08 %		- 7,88 %		+ 5,18 %	
FINAL LEVELS	6.2m LEFT	58.694	58.694	58.694	58.694	58.694
	ON CENTRE LINE	58.694	58.694	58.694	58.694	58.694
	6.2m RIGHT	58.694	58.694	58.694	58.694	58.694
GROUND LEVELS ON CENTRE LINE	58.576	58.694	58.818	58.942	59.066	59.190
KILOMETRE DISTANCE	86.980	86.920	86.860	86.800	86.740	86.680
HORIZONTAL ALIGNMENT	CURVE 2 RIGHT L=141,3 m T=72,0 m R=300,0 m Ø=026-58-54 e=8 %		CURVE 3 LEFT L=154,9 m T=80,8 m R=220,0 m Ø=040-20-01 e=8 %			

<b>AMENDMENT</b> NO. DATE CHECKED DONE BY DESCRIPTION						DESIGNED: GJS DRAWN: EL CHECKED: GJS		CLIENT: ILANGALETHU SOLAR POWER (Pty) LTD Postnet Suite 306 Private Bag X9 BENMORE SANDTON 2010 TEL: 011 775 6317 E-MAIL: pancho@emvelo.co.za		PROJECT: N10/11 ACCESS ROAD AT km 87,200		DRAWING DESCRIPTION: LONGITUDINAL SECTION AND LAYOUT OF N10		SCALE: AS SHOWN ORIGINAL DWG SIZE: A0 DATE: SEPTEMBER 2011 DRAWING NUMBER: 26537KP0/LS/1 REV NO: 00	
----------------------------------------------------------	--	--	--	--	--	--------------------------------------------	--	-----------------------------------------------------------------------------------------------------------------------------------------------------	--	------------------------------------------	--	-------------------------------------------------------------	--	-----------------------------------------------------------------------------------------------------------------	--



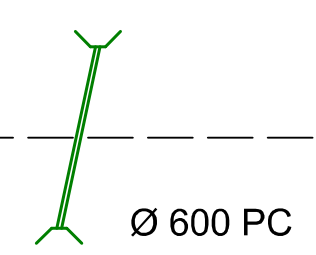
**PROFILE**

SCALE  
HOR 1:1000



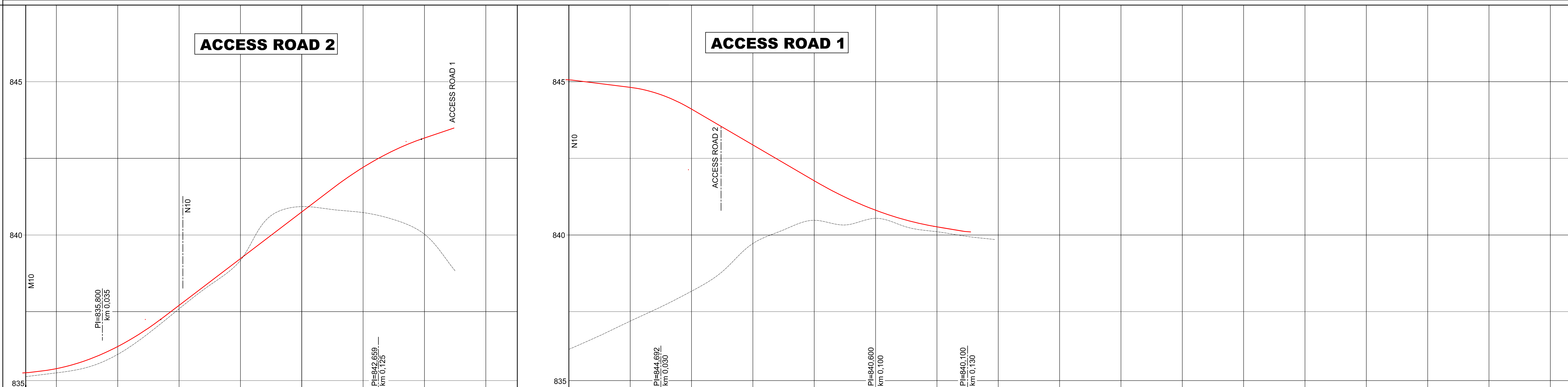
**TYPICAL CROSS SECTION**  
SCALE 1:50

DRAINAGE	NUMBER AND SIZE	
	NUMBER	
GUARDRAILS	LEFT	
	RIGHT	
KERBS	LEFT	
	RIGHT	
BARRIER LINES	LEFT	
	RIGHT	
SUBSURFACE DRAIN	LEFT	
	RIGHT	
SIDE DRAIN TYPE	LEFT	
	RIGHT	



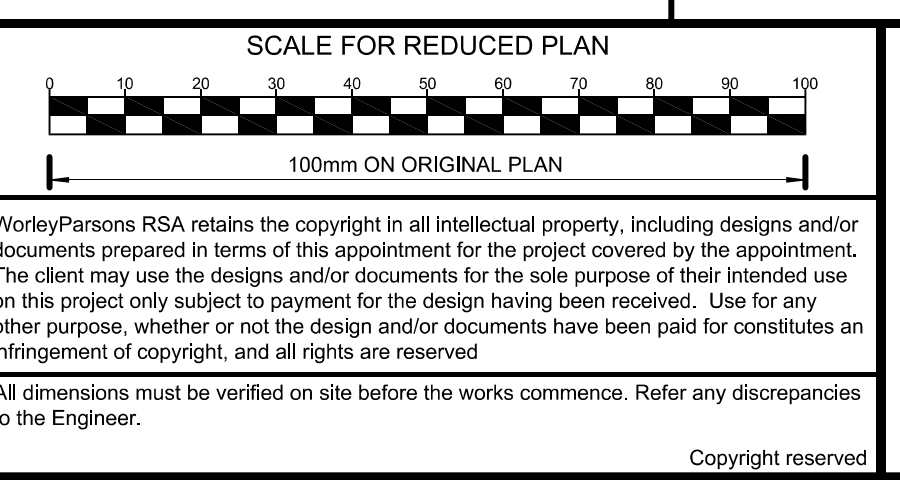
**PROFILE**

SCALE  
HOR 1:500  
VERT 1:50



VERTICAL CURVES	L=40 K=6	L=30 K=7	L=40 K=10
GRADES %	+ 1,20 %	+ 7,62 %	- 1,25 %
FINAL LEVELS	2.5m LEFT		
	ON CENTRE LINE		
	2.5m RIGHT		
GROUND LEVELS ON CENTRE LINE			
KILOMETRE DISTANCE			
HORIZONTAL ALIGNMENT	CURVE 2 RIGHT L=23,8 m T=12,4 m R=35,0 m $\Theta=038-53-03$	CURVE 3 LEFT L=46,6 m T=33,6 m R=25,0 m $\Theta=106-45-34$	CURVE 2 LEFT L=26,6 m T=13,6 m R=50,0 m $\Theta=030-31-47$

AMENDMENT				
NO.	DATE	CHECKED	DONE BY	DESCRIPTION



**WorleyParsons**  
resources & energy  
Incorporating KVA ENGINEERS  
POSTNET SUITE 222  
PRIVATE BAG 5879  
UPINGTON 8800  
TEL: (054) 332 4943  
FAX: (054) 332 2748  
E-MAIL: upington@wv3.co.za

DESIGNED	GJS	CONSULTING ENGINEER
DRAWN	EL	DATE
CHECKED	GJS	CLIENT
		DATE

CLIENT  
**ILANGALETHU SOLAR POWER (Pty) LTD**  
Postnet Suite 306  
Private Bag X9  
BENMOORE  
SANDTON  
2010  
TEL: 011 775 6317  
E-MAIL: pancho@emvelo.co.za

PROJECT  
**N10/11  
ACCESS ROAD AT km 87,200**

DRAWING DESCRIPTION  
**LONGITUDINAL SECTION AND  
LAYOUT OF ACCESS ROADS 1 & 2**

SCALE	AS SHOWN
ORIGINAL DWG SIZE A0	
DATE	SEPTEMBER 2011
DRAWING NUMBER	26537KP0/LS/2
REV NO	00