WETLAND REHABILITATION AND MANAGEMENT PLAN
FOR THE WETLAND RESOURCE WITHIN THE
CARLSWALD VALLEY RESIDENTIAL DEVELOPMENT,
KYALAMI, GAUTENG PROVINCE

Prepared for

Century Property Development

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GLOSSARY OF TERMS

**Alien vegetation/plant species**
Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally.

**Endangered**
Organisms in danger of extinction if causal factors continue to operate.

**Endemic species**
Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.

**Biodiversity**
The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.

**Habitat**
In relation to a specific species, a place or type of site where such species naturally occurs.

**Indigenous vegetation**
Vegetation occurring naturally within a defined area. In relation to a specific area, a species that occurs, or has historically occurred, naturally in a free state in nature within that specific area, but excludes a species introduced in that area as a result of human activity.

**Open Space**
“Any undeveloped vegetated land within and beyond the urban edge, belonging to any of the following six open space categories: ecological, social, institutional, heritage, agricultural and prospective (degraded land).” (JMOSS, 2002)

**Red Data Listed species**
Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.

**Species of Conservation Concern**
The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.
**Watercourse**

As defined by the National Water Act, 1998 (Act 36 of 1998): “A river or spring; A natural channel in which water flows regularly or intermittently; A wetland, lake or dam into which, or from which, water flows; and Any collection of water which the Minister may by notice in the Government Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.”

**LIST OF ABBREVIATIONS**

**CoJ**
City of Johannesburg

**DEAT**
Department of Environmental Affairs and Tourism

**ECO**
Environmental Control Officer

**EIS**
Ecological Importance and Sensitivity

**GPS**
Global Positioning System

**JMOSS**
Joburg Metropolitan Open Space System

**NEMBA**
National Environmental Management: Biodiversity Act (Act 10 of 2004)

**PES**
Present Ecological State

**RDL**
Red Data Listed

**REC**
Recommended Ecological Class

**SAS**
Scientific Aquatic Services

**SCC**
Species of Conservation Concern

**WRMP**
Wetland Rehabilitation and Management Plan
1 INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to develop a Wetland Rehabilitation Management Plan for the Open Space and Wetland Area associated with the Carlswald Valley Residential Development within the City of Johannesburg (CoJ), Gauteng Province. The Carlswald Valley Estate is located approximately 0.6 km west of the R55 roadway, and is bordered by Tamboti road in the south, and Acacia Rd (a gravel road) in the west. The Montecello Country Estate is located approximately 0.4 km to the east, and the Summerset Estate approximately 0.35 km to the North. The Northern Section of the Carlswald Valley Estate comprises a wetland feature, which is the focus area for this Wetland Rehabilitation report and will henceforth be referred to as the study area. (Figure 1). The aim of this report is to not only guide responsible parties to restore the wetland feature to an improved ecological state, but to also create an open space area that will add value to the development as a whole, and which can be enjoyed by prospective residents.

For the purpose of this document, ‘Open Space’ refers to all areas designated as having increased ecological sensitivity. The Open Space area therefore includes the Wetland resource and the Wetland Buffer Zone, the latter which includes all areas located within the 15m buffer wetland zone as delineated by WET CS (2006). These areas are indicated in Figure 2.

The Wetland Rehabilitation and Management Plan (WRMP) acts as a management tool for the study area, which has been developed to address and manage all perceived and potential environmental impacts which may occur during the remainder of the construction phase and subsequent operational phase of the Carlswald Valley development.

The WRMP advocates the use of several environmental management tools and mitigatory measures that are appropriate for the specific development. The management and rehabilitation plan is a system that seeks to achieve a required end state and describes how activities that have, or could have, a negative impact on the open space environment will be controlled and monitored and also identifies the responsible parties and relevant timeframes (where applicable) which will be tasked with implementing these measures.
Figure 1: Map of the study area in relation to the Carlswald Valley Development and the surrounding areas presented on a digital satellite image.
Figure 2: Map indicating the location of the Wetland and the Wetland Buffer zone as determined by Wetland Consulting Services.
1.1 **Context of the Wetland Rehabilitation and Management Plan**

The WRMP fits into the overall planning process of the development activities and should be implemented by the proponent as soon as it has been approved by the relevant authorities and as soon as construction on the residential development has reached a stage where rehabilitation activities become viable. This document serves as an open space management and rehabilitation plan to manage the ecological characteristics of the study area during the construction and operational phases of the development.

2 **METHOD OF ASSESSMENT**

In order to develop suitable mitigation, rehabilitation and management measures for the open space of the study area, a field assessment was undertaken during August 2015 as a general site walk-through, whereby the various aspects of the ecology of the wetland and associated buffer zone, were observed. During the site walk-through, notes were made of impacting activities (both current and historical) which affect the study area, as well as impacts which may potentially affect the study area as a result of construction and operation of the development. Special attention was paid to the removal of construction material and rubble from within the wetland and buffer zone, re-profiling of disturbed soils as well as the removal of alien vegetation in order to improve environmental functions and services within this area and with the aim of restoring some functionality and habitat integrity of the Open Space associated with the wetland system while still allowing the use of the open space by prospective residents and thereby improving the socio-cultural service provision of the system.

3 **RECEIVING ENVIRONMENT**

3.1 **Description of Current State**

The temporary and seasonal zones of the wetland, as well as areas falling within the 15m wetland buffer zone are severely degraded with a high incidence of bare soils observed and high levels of alien vegetation encroachment present. The wetland permanent zone, does however support an increased abundance of indigenous vegetation, lower levels of alien vegetation encroachment and improved habitat, which contributes to the permanent zone being in a moderate ecological condition, compared to the outer wetland zones that are in a poor ecological condition, with limited ecological functioning. The table below indicates the
dominant alien and invasive floral species encountered within the Open Space area, including the country of origin of such species and their current NEMBA invasive status.

### Table 1: List of dominant alien plants within the Open Space area, including the origin of the species and the NEMBA category.

<table>
<thead>
<tr>
<th>Species</th>
<th>English name</th>
<th>Origin</th>
<th>NEMBA Category*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHRUBS AND GROUNDCOVERS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Tagetes minuta</em></td>
<td>Tall khakiweed</td>
<td>South America</td>
<td>N/A</td>
</tr>
<tr>
<td><em>Verbena aristigera</em></td>
<td>Fine-leaved verbena</td>
<td>South America</td>
<td>N/A</td>
</tr>
<tr>
<td><em>Verbena bonariensis</em></td>
<td>Wild verbena, Tall verbena, Purple top</td>
<td>South America</td>
<td>1b</td>
</tr>
</tbody>
</table>

*National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R598 of 2014*

**Category 1a** – Invasive species that require compulsory control.

**Category 1b** – Invasive species that require control by means of an invasive species management programme.

**Category 2** – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

**Category 3** – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

During the site visit, a number of current impacts and issues have been identified which threaten the ecological integrity of the Open Space area. These impacts are listed below:

- The construction associated with the Carlswald Valley development has resulted in severe degradation of one section of the wetland feature located next to the gravel road west of the study area. The following environmental aspects and activities were present in this area (Figure 3):
  - Driving of construction vehicles through this section of the wetland, has resulted in severe loss of vegetation, and therefore exposure of bare soils;
  - significant alteration of soil profiles and runoff patterns has taken place due to the disposal of topsoil and other earthworks in the area;
  - Construction rubble such as bricks, and wire as well as litter has been dumped in this area of the wetland; and
  - Excavated soil heaps have also been left in this area of the wetland; and
  - It is deemed likely that the area was regularly burned in the past which would have impacted on vegetation structure in the area.

- The section of the wetland feature located in the southwestern corner of the study area has also been severely degraded due to historical activities with a high percentage of...
bare ground being exposed in this area. The vegetation in this section is also dominated by alien species; and

➢ The remainder of the wetland resource is in a moderate condition, with alien encroachment and soil exposure mainly being associated with the temporary zone of the wetland edge and associated buffer zone.

The figures below serve to illustrate the current condition of the designated wetland feature.

Figure 3: Present ecological condition of the wetland area associated with the gravel road to the west of the study area.
FIGURE 4: Current ecological condition of the wetland area located in the south western corner of the study area

FIGURE 5: Current ecological condition of the remainder of the wetland feature.

4 OPEN SPACE MANAGEMENT CRITERIA

4.1 Open Space as defined by the Joburg Metropolitan Open Space System (JMOSS)

According to the JMOSS (2002), open space can be defined as “any undeveloped vegetated land within and beyond the urban edge, belonging to any of the following six open space categories: ecological, social, institutional, heritage, agricultural and prospective (degraded land).” This definition is based on green open space and therefore does not include hard surface open space areas, such as roads, malls, pavements etc.

4.2 Purpose of Open Space

According to the Department of Environmental Affairs and Tourism (DEAT, 1995), the purpose of open space is to:

- **Provide recreational opportunities** for the city’s population. Outdoor experiences are a means to provide important social values, and are an important and inexpensive form of relaxation.
- **Conserve natural resources.** Open space is not only a means of conserving indigenous fauna and flora, but also play a part in maintaining the ecological balance within the city.
Be ecologically productive. Open space areas help to improve the microclimate, air and water quality, recharge of the groundwater regime, prevent flooding, reduce the impact of stormwater run-off, and increase the biological diversity of an area.

Provide opportunity for environmental education. Open space areas allow for educational opportunities to educate people of all ages about the environment and history (JMOSS, 2002).

Be a viable economic entity. If an open space area is carefully planned and managed, the open space system can improve the image of a town as a tourist destination, as well as attract and retain businesses (JMOSS, 2002).

Enhance the city's appearance. Open space areas, help break the monotony of the built environment, by blending with natural elements. These elements also have an effect in stabilising property values by providing a better quality of life to citizens.

Ecological open spaces associated with wetland areas deliver a variety of ecosystem services, such as the temporary storage of floodwaters and attenuation of flood peaks; improvement of water quality, maintenance of baseflow downstream of large wetlands; erosion control through sediment trapping and storage, support biodiversity, supply fishing, grazing and land for subsistence agriculture; as well as reed and medicinal plant harvesting. (DWAF, 2008)

Wetlands have the ability to regulate water supply, by holding back water during flood periods, and releasing water during low flow periods, improving water quality, trapping sediment, as well as preventing erosion of rivers and siltation of dams. These are all important characteristics, especially in a water scarce country such as South Africa, where it is estimated that the country will reach the economically exploitable water supply level by the year 2030. Without water, the country cannot grow enough crops or support the growth of the industry. Wetlands therefore play an integral part in the well-being of humans, the environment and the economy (DWAF, 2008).

The majority of remaining wetlands in urbanised areas are degraded or under threat of degradation. The continuous destruction of wetlands will result in less fresh water, less reliable water supplies, increased flooding and erosion, more endangered species, and lower agricultural productivity (DWAF, 2008). Conservation and rehabilitation of our remaining wetland sources are therefore of utmost importance. Utilising wetlands as part of open space areas are therefore a means of not only conserving our wetlands, but also creating areas of value that can be enjoyed by residents within an urban setting.
The measures as set out in this report should contribute to remediating existing impacts of the open space area and improve the overall ecological and aesthetic functioning thereof leading to an overall betterment of the environment and enhanced socio-cultural service provision by the system to the prospective residents.

4.3 **Qualities of Sustainable Open Space**

The provision and management of open space is considered to be essential as urban density increases and the need for quality open space, which in turn enhances quality of life, increases. According to the Community Open Space Policy (2000), quality open spaces should be:

- Accessible, inviting and meet local needs;
- Safe and free from criminal activity;
- Diverse and supportive of a variety of uses for diverse user groups;
- Connected with other open space areas in order to enhance ecological diversity and functions and provide greater opportunities;
- Ecological and provide environmental benefits at multiple scales;
- Engaging, with a positive impact on citizens;
- Cared for through devoting time and resources to the management of the open space; and
- Funded, as the long-term success of open space also requires long-term commitment and maintenance to protect the quality of the environment and visitor enjoyment.

The measures as set out in this report are deemed sufficient to manage and improve the ecological resources of the system to a point where the resource can be sustainably utilised, and funds must be set aside to cover the costs of these management and rehabilitation interventions.

4.4 **Creating Value for Open Space**

Open spaces in urban settings which have not had any financial value attributed to them are prone to degradation through various illegal activities such as refuse dumping and squatting. With the above in mind the design of the proposed development and the design of the open space, consideration was given to the concept that conservation and open space areas need to provide economic value to an area in order to ensure that they will be managed in a sustainable manner in the future as open space areas within an urban setting. In order to
harness the value of the wetland open space area within the study area two main concepts were employed in the open space design and rehabilitation plan.

Firstly, it is proposed that the open space area within the proposed development be managed as private open space with controlled access thereby creating a valuable area of open space for tenants of the proposed development. By having private open space in a secure environment, residential owners will be afforded the privilege of utilising the open space. The availability of open space to tenants will enhance the value of the property, which will allow increased levies to be charged. Some of the money from levies can then be made available by the relevant governing body in order to manage and maintain the open space area for on-going use by the development tenants.

The second mechanism of harnessing the value of the open space areas is to ensure that the open space area is utilised sustainably. Recreational use is one of the services which can be provided by wetlands, and this option was investigated. It is proposed that the option of an open space recreational area be considered, where owners of the proposed development can utilise this area for leisure purposes and to a lesser degree education purposes. Figure 6 (Section 5.3) provides a layout of areas where various higher and lower impact infrastructure and activities can take place within the open space area. Higher impact infrastructure includes structures such as a children’s play area with swings, slides etc., outdoor gym equipment and ponds for attenuation and aesthetics Only bird hides and boardwalks can be constructed within the lower impact infrastructure areas. Care must be taken to limit the impact on the sensitive wetland areas (No-Go area) to the absolute minimum and environmentally sensitive construction methods must be used. In order to improve socio-cultural service provision and further create value for the open space the construction of the footpath already approved by GDARD through the No-Go area is therefore considered acceptable.

4.5 Sensitive Habitats and Landscapes

The majority of the wetland and associated 15m buffer zone are considered to be of increased ecological sensitivity, and if effective management and rehabilitation takes place, its ecological service provision capability and sensitivity will increase.

The most pertinent threats which are currently posed to the open space system, over which the proponent for this development has control are alien invasion, topographic alteration, control of dumping of solid waste within the Open Space area, prevention of water pollution
as a result of the development, control of potential erosion and incision of the wetland and prevention of downstream sedimentation of water resources through management and rehabilitation of the wetland and associated buffer zone. Should these factors be actively mitigated and effective rehabilitation measures be implemented, the wetland will regain, to a large extent, its ecological service provision capability.

4.6 Open Space Linkage beyond the Study area

Neighbouring land uses need to be compatible with the open space system to ensure the on-going survival of various faunal and floral species. When future developments on surrounding properties takes place, consultation between the relevant parties needs to be encouraged during the planning phases to ensure connectivity of natural systems. In the design of the WRMP, consideration was given to providing open space linkages to open space within the broader area. Open space systems and migration corridors allow the free movement of faunal species that may use the system for migratory or foraging purposes, while some species will also make use of the system for permanent habitation. These corridors will also contribute to the exchange of genetic material between floral communities along the system. The CoJ encourages and advocates the establishment and management of interconnected open space systems and migratory corridors (JMOSS, 2002).

4.7 Consideration of Edge Effects

During the design of the WRMP, consideration was given to the effects of the proximity of the development to the wetland and buffer zone, roadways, as well as other infrastructure and developments close to the open space area. The development will generate edge effects during its construction and operational phases through soil disturbance, vegetation removal, generation of waste, generation of increased amounts of stormwater and the possible occurrence of fires. The management plan aims to address these issues in terms of waste management, clean-up operations, fire management, alien vegetation control and erosion control. These effects are deemed to be suitably mitigated if the measures in the WRMP are adhered to.
5 WETLAND REHABILITATION AND MANAGEMENT PLAN

This WRMP is designed to manage, maintain and improve the current ecological condition of the wetland zone and associated buffer zone within the study area, with particular emphasis on the impacts that the development of a residential development associated with the study area may have on the Open Space and Wetland area.

5.1 Principles of the Wetland Rehabilitation and Management Plan

To assist in achieving the objectives of the WRMP, a set of principles was applied, which contributed to the formulating of action plans and specific management measures. The principles of the WRMP are:

- Avoiding impacts by not performing environmentally detrimental actions;
- Minimising impacts by limiting aspects of an action;
- Rectifying impacts through rehabilitation, restoration, etc. of the affected environment;
- Transparency and open communication channels through which affected parties can raise their concerns and follow-up on issues raised;
- Minimising impacts by optimising processes, structural elements and other design features;
- Provide ongoing monitoring and management of environmental impacts of a development and documenting of any digressions /good performances; and
- The WRMP, once approved for implementation by the relevant authorities, is a legally binding document that all parties involved in the project must be informed about the importance of the WRMP.

5.2 Objectives of the Wetland Rehabilitation and Management Plan

The WRMP aims to address anticipated impacts that the development is likely to have on the study area. Therefore, certain objectives were developed which guided the development of the WRMP. The objectives of the WRMP are too:

- Meet the requirements of relevant local and regional authorities;
- Ensure the sufficient use of the open space area does not lead to unexpected harm of the receiving environment;
Prevent the degradation of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the Wetland feature;

Ensure that the wetland feature are rehabilitated appropriately in order to meet the Recommended Ecological Class (REC) of the wetland;

Maximise the service provision and hydrology of the open space area (including the wetland zone and wetland buffer zone);

Prevent contamination of the open space area;

Identify measures that could optimise beneficial impacts in order to improve the ecological value of the wetland area and associated buffer zone, such as:

- Assisting in the promotion of sustainable management and ongoing functioning of open space areas;
- Encouraging open space connectivity and preventing habitat fragmentation;
- Removal of alien and invasive plant species from the wetland and buffer zone and replacing these species with indigenous vegetation; and
- To ensure adequate vegetation cover within the wetland and the wetland buffer zone and allowing for indigenous floral and faunal species to be re-established within the open space area;

Ensure that the construction and operational phases of the project continues within the principles of Integrated Environmental Management;

Identify a range of mitigation measures which could reduce and mitigate the potential impacts on the receiving environment to minimal or acceptable levels;

Detail specific actions deemed necessary to assist in mitigating the potential environmental impact on open space areas;

Ensure that the development does not negatively impact on the social environment and that clear communication channels are present through which concerns can be raised and addressed;

Ensure as far as is practicable that the measures contained in the report are implemented;

Propose mechanisms for monitoring compliance with the WRMP and reporting thereon; and

5.3 Key Design Criteria

In addition to the active rehabilitation and management of the wetland feature, the intention of the WRMP is to also guide the development of an open space area that can be enjoyed and utilised by future residents of the new development in a sustainable, environmentally
appropriate manner. Figure 6 indicates areas identified during the site assessment that can be utilised for the placement of infrastructure with varying degrees of intensity:

- Areas where lower impact infrastructure such as boardwalks and bird hides can be constructed, and
- Areas where infrastructure with increased utilisation intensity, such as a play area for children, outdoor gym equipment or ponds for stormwater attenuation or aesthetics can be developed.

The following specific design criteria should be taken into account during the construction of the above-mentioned infrastructure:

- Boardwalks and bird hides should be raised, this will not only allow a better view over the open space and wetland areas, but will also allow for continuity of the open space area; prevent habitat loss and fragmentation as well as reduced erosion and sedimentation and allow for a smaller development footprint;
- This infrastructure should be constructed as far as possible using natural biodegradable materials such as timber or recycled material such as recycled plastic (plastic timber).
- Hard surface areas within the play areas should be minimised, and as much vegetation growth as possible should be promoted;
- Attenuation ponds should be constructed in line with engineering requirements and stormwater runoff volumes, but attenuation ponds should be shallow, with more ponds constructed, rather than fewer, deep ponds. As a minimum, attenuation ponds should be vegetated with *Cynodon dactylon*, but planting with aquatic and marginal wetland floral species as stipulated in the Carlswald Valley Landscape Master Plan is recommended depending on the final depths of the ponds and if enough permanent surface water will be available to sustain such vegetation; and
- Continuation of the open space with the surrounding areas beyond the study area is essential. This can be accomplished by removing small sections from the bottom of the fence, to allow small animals to pass to and from the enclosed wetland feature.

During construction of the above, the following should also be considered:

- Removal of vegetation during the construction of these features should be limited to what is absolutely essential:
  - Vegetation should only be cut to ground level instead of being completely removed in order to stabilise the soil in clearing areas and to prevent erosion. Alien species should however be removed completely; and
• Clearing of vegetation should only be done immediately prior to the construction of each specific infrastructure component to prevent soils being left bare for an extended period of time, which can lead to erosion and incision.

➢ Foundation footprint areas of the infrastructure should be kept as small as possible;
➢ Bare soils that might arise due to the construction of infrastructure or removal of alien vegetation within the open space area should be properly rehabilitated and revegetated as set out in Section 9 of this WRMP; and
➢ Boardwalks and bird hides should be monitored and maintained regularly to prevent impacts of these infrastructure components on the surface water of the wetland or existing wetland habitat.
Figure 6: Areas identified within the study area where high and low impact infrastructure can be placed.
5.4 Monitoring of Management and Rehabilitation Measures

During the construction phase, the monitoring of the open space management measures and rehabilitation works will be part of the activities and duties of the Environmental Control Officer (ECO).

6 LAYOUT OF THE WETLAND REHABILITATION AND MANAGEMENT PLAN

The WRMP is separated into sections addressing two phases of the project, namely the construction phase, which is currently in progress and the subsequent operational phase as each phase have specific issues unique to the specific development phase. The impact is identified and given a brief description.

The tables in Section 9 of this report first present the anticipated risk or impact, then provide an objective or action which addresses this risk. Following this, control measures are provided which aim to manage and mitigate the risk, after which a responsible person/party is identified through all phases of the development.

7 ROLES & RESPONSIBILITIES

7.1 Proponent

- The Proponent will be responsible for the appointing of a suitably qualified Environmental Practitioner as an independent ECO for the construction phase of the project;
- A management body must be appointed to ensure compliance with the WRMP during the operational phase;
- The Proponent will be responsible for ensuring all relevant contractors receive a copy of the rehabilitation plan and understand its contents; and
- Should ownership of the property change, the role and responsibility for compliance with the WRMP must also be transferred.
7.2 **Environmental Control Officer (ECO)**

The ECO is the person responsible for the monitoring of the implementation of the WRMP during the remainder of the construction phase and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of the construction phase and is mandated to do the following:

- Ensure that all contractors/subcontractors/employees are fully aware of their environmental responsibilities. This should take the form of an initial environmental awareness-training program in which requirements of the rehabilitation plan will be explained;
- Monitor site activities on a regular basis to ensure that there is minimal environmental impact due to construction activities;
- Ensure that a ‘hotline’ exists for reporting incidents and resolving any problems rapidly;
- Ensure that there is a mechanism available for Interested and Affected Parties to raise concerns and a mechanism to ensure that all such concerns are addressed;
- The ECO has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the construction operations;
- Upgrade or amend the WRMP as necessary, and inform the relevant parties of the changes; and
- Conduct a final environmental audit and a review of management and rehabilitation measures.

7.3 **Contractors**

- The contractor/s in this case refers to any contractor/s on site, including the building contractor/s and sub-contractors on each individual unit or item of infrastructure being erected as well as the landscaping contractors responsible for greening of the development;
- Such contractor/s will take full responsibility for each of his/her employees and any penalties imposed; and
- It is the responsibility of the contractor/s to ensure that they adhere to the WRMP.
8 TRAINING AND AWARENESS

8.1 Training of Construction Workers

Construction workers must receive basic training in environmental awareness, including minimisation of disturbance to the open space wetland area of increased ecological sensitivity, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution.

8.2 Contractor Performance

The Contractor must ensure that the conditions of the WRMP are adhered to. Should the Contractor require clarity on any aspect of the WRMP the Contractor must contact the Environmental Control Officer (ECO) for advice.

The ECO must regularly audit the operation and establish whether the measures in the WRMP are applied, where after the ECO reports to the lead project manager. The lead project manager must ensure that the WRMP is implemented and that suitable penalties are in place for non-conformance to the WRMP by contractors. The ECO should be the designated authority to issue a stop work order if severe non-compliance is taking place by the contractor.

9 WETLAND REHABILITATION AND MANAGEMENT PLAN

The tables below serve to present the rehabilitation and management plans for the wetland area and associated buffer zones which will be managed as open space.
### 9.1 Construction Phase

**Table 2: Construction Phase wetland rehabilitation and management plan**

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<th>Environmental risk or issue</th>
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<th>Control measure</th>
<th>Responsibility</th>
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| General                     | To prevent environmental degradation through educating the construction team | • Management Objective: to educate and instil a sense of environmental awareness in the construction team.  
• Management Criteria:  
  o It is important that prior to commencement of work within the wetland resource or its 15m buffer area, that this wetland rehabilitation management plan (WRMP) be approved by the relevant authorities.  
  o The WRMP document must be made available to all relevant contractors and subcontractors and all members of the construction team must be informed of the contents and importance of the WRMP.  
  o An environmental incident management reporting procedure for incidents relating to the open space areas (which includes the wetland resource as well as the 15m wetland buffer zone area) must be implemented.  
  o Every effort should be made to avoid potential impacts on the open space area for the remainder of the construction phase in order to prevent or limit impacts on the wetland. No contamination of wetland resources may occur.  
  o The boundaries of the designated open space must be clearly communicated to the employees and construction workers, indicated on site through fencing and be treated as a No-Go Zone for general construction workers (except when carrying out a task as set out in this plan). Construction or construction-related activities may only take place within the open space area in those areas stipulated in this report.  
  o All areas earmarked for development must be fenced off from the open space system and construction related activities must be contained within the fenced-off development areas.  
  o To ensure that it reaches most people signs must be written in the languages of the area (NOT just English), informing people that the wetland area is a strictly no-go area. This ensures that non-English speakers can understand and will hopefully cooperate in reducing pollution of the wetland area by the measures indicated on the sign. | Proponent, Main Contractor and ECO | Generally this should be done prior to the start of the construction phase. Since construction has already started, this should be done immediately once the WRMP has been approved by the relevant authorities |
| Faunal and floral biodiversity within the Open Space area | To retain the indigenous floral and faunal assets within the Open Space area | • Management Objective: Prevent unnecessary damage to indigenous faunal and floral assets within the Open Space area.  
• Management Criteria:  
  o Trapping, capture or hunting of fauna by construction personnel or others is not allowed.  
  o No collection of floral species must be allowed for medicinal, charcoal or firewood purposes.  
  o No fires may be permitted on site and especially the wetland area and associated | Proponent, Main Contractor and ECO | The removal of sections from the fence should be implemented as soon as the WRMP has been approved by the relevant authorities. The |
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| To control the further invasion of alien plant species within the Open Space area | Management Objective: Eradicate existing invasive alien plants within and bordering the development footprint. Management Criteria:  
- All invasive alien species present within the study area must be eradicated during the remainder of the construction phase, with specific emphasis on the site boundaries where alien species are likely to occur as a result of disturbance from development activities.  
- During the construction phase, the perimeter of the construction area, bordering the open space area, must be regularly monitored and an assessment made of the recruitment of alien vegetation. All alien species must be manually removed prior to the flowering season of the relevant species and alien vegetation must be controlled for the duration of the construction phase.  
- No alien plants may be introduced to the wetland area and associated buffer and surrounding areas during the construction phase of the project and particular attention must be paid to ensure that any imported material, such as topsoil, is certified weed-free. | Proponent, Main Contractor and ECO | Alien species should be eradicated as soon as the WRPM has been approved. The re-establishment of invasive species should be controlled and monitored for the duration of the construction phase and throughout the operational phase of the development |
| Storm water design | Management Objective: to ensure that no harm to the receiving environment and wetland resource occurs due to erosion, siltation and groundwater pollution. Management Criteria:  
- The most efficient approach to control sedimentation and erosion is to minimise the area of land disturbed as well as the duration for which it is exposed and therefore exposed soils within the development must be minimised.  
- Surface runoff must be reduced as far as possible for the duration of the construction phase, and should be dispersed and slowed down outside the Open Space area, to limit erosion of the wetland resource and associated buffer area.  
- Surface storm water generated as a result of the development should not be directed directly into the Wetland, and stormwater/attenuation ponds should be constructed to accumulate the majority of stormwater runoff. These ponds can be constructed within the areas assigned in this report as High impact infrastructure areas (Figure 6), or within the development footprint in the area where existing small earth dams already exist.  
- These ponds should be constructed in such a fashion to maintain the natural flow of water into the wetland resource, and to allow for natural groundwater recharge. This can be achieved by: | Proponent, Main Contractor and ECO | Attenuation ponds should be constructed as soon as possible. Erosion and sedimentation should be controlled for the remainder of the construction phase |
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<td>▪ Planting of additional wetland plants, around attenuation ponds, may be</td>
<td>Proponent, Main Contractor and ECO</td>
<td>Soil compaction should be controlled and monitored for the duration of the construction phase</td>
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<td>considered, as it not only aesthetic appeal of these ponds, but will also serve as an effective means of reducing the velocity of the runoff, increasing infiltration, reducing sedimentation and erosion and increasing nutrient and toxin uptake; and ▪ More shallower ponds should be constructed rather than fewer deeper ponds; o A storm water management plan must be implemented. Storm water on the site must be managed so as to reduce the silt loads and runoff peaks in the wetland system. o Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of erosion. o The retention of the runoff outside the Open Space should be clearly indicated, as well as how the natural release of the water will be simulated to prevent an impact on the natural hydrology of the watercourse. o Special care should be taken to prevent sediment rich storm water from directly entering the wetland, smothering the wetland vegetation with soil and lowering the water quality.</td>
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<td>Soils</td>
<td>Compaction of soils</td>
<td>• Management Objective: To prevent the compaction, damage and or removal of valuable soils due to construction traffic and equipment. • Management Criteria: o The designated Open Space areas are to be off-limit and must remain off-limit to construction vehicles. o Any areas compacted as a result of current construction activities outside of the construction area and/ or within the Open Space areas, where applicable, shall be ripped to a depth of approximately 150mm, using hand-held equipment, prior to being rehabilitated with topsoil and reseeded. o When excavated areas are backfilled the surface must be level with the surrounding land surface, to minimise soil erosion from the areas when the excavation is complete.</td>
<td>Project Engineer, Proponent, Main Contractor and ECO</td>
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<td>Loss of topsoil through erosion and other means</td>
<td>• Management Objective: To prevent the unnecessary loss of soil through ineffective management. • Management Criteria: o The most efficient approach to control erosion is to minimise the area of land disturbed as well as the duration for which it is exposed. o Where required, erosion berms should be installed below access roads, in order to prevent siltation and gully formation within the Wetland. The following points should serve to guide the placement of erosion berms (Figure 7): ▪ Where the track has a slope of less than 2%, berms every 50m should be installed. ▪ Where the track slopes between 2% and 10%, berms every 25m should be installed. ▪ Where the track slopes between 10%-15%, berms every 20m should be installed.</td>
<td>Project Engineer, Proponent, Main Contractor and ECO</td>
<td>Management and monitoring of soil erosion should be continued for the remainder of the construction phase</td>
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### Environmental risk or issue | Objective or requirement | Control measure | Responsibility | Target Date
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- Sedimentation of watercourse | | Where the track has a slope greater than 15%, berms every 10m should be installed. | Project Engineer, Proponent, Main Contractor and ECO | Throughout the duration of the construction phase

**Figure 7: Example of erosion berms.**

- In this regard, it should be noted that the construction of a cut-off berm on the development boundary between the wetland and the construction site should be sufficient, and the above should be implemented only if deemed necessary.
- A second berm should be constructed outside the fence of the subject property, where the channel associated with the wetland traverses the informal gravel road, to attenuate flow, prevent erosion and incision from occurring.
- All/any erosion control mechanisms need to be regularly maintained for the duration of the construction phase.
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| **Lighting**               | Control of light pollution within Open Space areas | • Management Objective: Minimise light and visual pollution into the surrounding areas.  
• Management Criteria:  
  o The generation of light by security lighting and other lighting must be effectively designed so as not to spill unnecessary light into the wetland open space area where wildlife may reside. Safety lighting must be designed keeping this in mind and low wattage lighting must be used. | Proponent, Main Contractor and ECO | As soon as the WRMP is approved by the relevant authorities |
| **Ecological functioning of Open Space area** | To ensure that the development poses no harm to the ecologically sensitive Open Space area | • Management Objective: to ensure that no loss of ecological function of the Open Space area occurs and that ecological functioning of the Open Space area is improved.  
• Management Criteria:  
  o Existing waste, in the form of litter, such as plastic bottles etc., is to be cleared, and disposed of at a registered landfill site (Figure 8).  
  o All construction-related rubble, specifically referring to material such as wire and bricks, must be removed from the wetland (Figure 9).  
  o During rubble removal activities, no additional impacts, such as the unnecessary site clearing or scraping is to occur and the footprint area should be limited to only the area necessary for carrying out the specified works. The unnecessary disturbance of open space habitat should be avoided. | Proponent, Main Contractor and ECO | As soon as the WRMP is approved, management and monitoring should be continued throughout the remainder of the construction phase |

Figure 8: Litter within the wetland to be cleaned up
Figure 9: Construction related rubble to be removed from the wetland

Wetland and Buffer Zone within the study area
- Historic construction-related rubble, such as concrete ponds associated with the south western section of the study area, must be broken up and removed from the wetland. (Figure 10) For this purpose, due to the volume and weight of such material, limited vehicle access may be allowed. However, the following should be adhered to in this regard:
  - Vehicles are to enter this portion of the wetland area from the southern side of the development.
  - As far as possible, only a single access road should be allowed for this purpose, the number of vehicles should be limited to the minimum number required and the footprint of disturbance should be kept as small as possible.
  - Vehicles may not be allowed to drive indiscriminately within the Wetland Buffer zone and vehicles are not allowed to access the Wetland Zone at all.
  - Once construction rubble has been cleared, all vehicle tracks should be ripped to a depth of 150mm, levelled, topsoiled and reseeded with an indigenous veldgrass mixture as recommended in this report.
- Storm water runoff from stockpile sites, material yards, the construction camp and other related areas must be directed into the storm water system and may not run freely into the wetland area;
- The construction of a cut-off berm along the periphery of the development is recommended.
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| Rehabilitation             | Removal of alien and invasive species | - Management Objective: To improve the current state of the wetland and buffer zone areas through removal of alien plant species.  
- Management Criteria:  
  o If any impacts from edge effects are observed in the open space areas (Wetland and associated 15m buffer zone), measures to rehabilitate these areas must be immediately implemented as outlined below.  
  o Areas where construction activities have encroached on the Open Space area must be rehabilitated after clearing of construction material from these areas have taken place.  
  o Rehabilitation, in the context of the WRMP, is the process of returning damaged land (e.g. from construction or agricultural activities) to some degree of its former state. Rehabilitation should be done throughout the duration of an operation and not just at the end in order to save time, money and energy as well as reduce the environmental impact of the activity.  
- Alien Species control within the open space area  
  o Care should be taken that all alien/ weed vegetation is removed prior to seed production. This typically take place early spring.  
  o The focus of alien vegetation clearing within the open space area is to be on all species indicated in Table 1 as falling within the NEMBA Invasive Categories 1b, 2 and 3 as well as all species mentioned within the wetland and floral assessment reports.  
  o It is also important to note, that the possibility exists that other listed invasive species may be present within the open space area, which have not been noted during the site | Proponent, Main Contractor and ECO | Impacted areas, should be rehabilitated as soon as the WRMP is accepted by the relevant authorities, and monitoring and management should be continued for the remainder of the construction phase |

Figure 10: Historic concrete pond to be removed from the wetland
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<td>visit. The appointed ECO should therefore advise on plant identification and invasive categories should there be any queries on species during the alien vegetation control process. Manual removal of alien vegetation is preferred. o Footprint areas should be kept as small as possible when removing alien vegetation within the open space area and no vehicles should be allowed within the designated open space area during eradication of alien and weed species. o In the removal of smaller alien shrubs and groundcovers, Category 1b, 2 and 3 alien species, including are to be prioritised in eradication. Non-listed alien species may also be hand-pulled. It is important that the guidelines as outlined in Annexure A of this document be followed in terms of eradication methods. In all instances physical/manual eradication techniques must be preferred over chemical treatment. o Where chemicals are however used the following guidelines and precautions apply: • Do not transport chemicals in bulk as this gives the potential for serious accidents to occur. • Apply chemicals in cool, dry and non-windy weather to prevent drift from reaching water bodies. • Contaminated equipment should not be cleaned in field. • Many chemicals (e.g. pesticides/herbicides) are harmful to human and environmental health, and should therefore only be applied by properly trained and equipped workers that are registered according to the statutory requirements. • Herbicides and pesticides have the same toxic effect on aquatic plants and organisms as they do on the terrestrial plants and organisms to which they were applied. Therefore when applying pesticides, landowners should strictly adhere to best practice guidelines (as indicated in the label instructions) to minimise spray drift or wash-off into water resources or adjacent non alien plants. These include application under suitable weather conditions (i.e. sufficiently dry and calm), seeking professional advice on the type and quantity of pesticides that should be applied and considering the environmental conditions and hazards at the site. • Over application must NOT take place and spray plans should also be continuously updated to prevent over application and contamination of water resources. • Herbicide should not be used if weed cover is low. The best way to keep weeds at bay is to maintain healthy, dense vegetation that shades the ground surface, preventing weed seedlings from taking root. Mulching can also be used to prevent weeds. However, if weeds do take hold, they should be dug or pulled out. • Herbicides should be used to spot-treat weeds only and not applied universally. o All removed alien plant species must be disposed of at a registered garden refuse site and may not be burned on site. o None of the removed alien species may be chipped and used as mulch as there may</td>
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<td>be seeds present within the mulch that will spread to areas beyond the present alien floral communities.</td>
<td>Project Engineer, Contractor and ECO Developer and resident’s association</td>
<td>Impacted areas, should once again be rehabilitated as soon as the WRMP is accepted by the relevant authorities, and monitoring and management should be continued for the remainder of the construction phase</td>
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<td>Removal of alien and invasive species must continue throughout the operational phase of the development and a monthly eradication exercise must be performed to remove alien and invasive species. This must form part of the responsibilities of the maintenance staff for a period of at least two years and continue annually thereafter for the life of the development.</td>
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<td>Erosion control and rehabilitation</td>
<td>Management Objective: To improve the current state of the open space area through erosion control</td>
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<td>Management Criteria:</td>
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<td>o Soil erosion as a result of runoff from areas where alien vegetation has been cleared must be prevented/ mitigated through the application of biodegradable hessian material where required.</td>
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<td>o Any disturbed and exposed areas must be further stabilised through re-vegetation with indigenous grasses and flora (also making use of floral species rescued from the development footprints, if applicable) as soon as possible to prevent erosion. Although the primary goal is erosion control, the vegetation can also provide nesting cover for birds and small faunal species.</td>
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<td>o Gullies and other areas of active erosion, if noted, should be stabilised through infilling with topsoil, cover with biodegradable hessian material/ geotextile such as GeoJute, and revegetated to minimise sediment entering the wetland resource from these sources</td>
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<td>o A mulch cover may be required to stabilise the soil during the winter months when grass does not grow or grows poorly.</td>
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<td>Wetland feature and channel associated with the gravel road west of the study area</td>
<td>The first step in the rehabilitation of this area will be the removal of current and historical construction material in the form of wire and bricks, as well as other waste material, from within this area as outlined under the section above – ‘Ecological functioning of the Open Space area’.</td>
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<td>The wetland profile should be rectified, this includes the breakdown of large soil clusters adjacent to the informal road, as well as the levelling of the soil surface.</td>
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<td>Excavated soil heaps present within this area can be used for the levelling of the wetland soil surface. The excess soil should be removed and dumped at a registered dumping site.</td>
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<td>In is not necessary to reseed this area, however regular monitoring should be done, to ensure no erosion or incision is taking place, until the wetland has been able to re-establish itself.</td>
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<td>It is recommended that the existing informal wetland crossing is formalised by</td>
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<td>the construction of a culvert and bridge. The design of the culvert / bridge should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained. In this regard, special mention is made of:</td>
<td>Project Engineer, Contractor and ECO Developer and property owner</td>
<td>Areas with bare soils, or where alien vegetation were removed, should be reseeded, as soon as the WRMP is accepted by the relevant authorities, and monitoring and management of affected areas should be continued for the remainder of the construction phase</td>
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<td>• The design of such a culvert and bridge should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface.</td>
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<td>• The design of such a culvert and bridge must ensure that the seasonal wetland zone should have waterlogged soils within 300mm of the soil surface at all times.</td>
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<td>• Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer season.</td>
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<td>o Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the culverts.</td>
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<td>o It must be ensured that flow connectivity along the wetland features is maintained.</td>
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<td>To ensure that the wetland and buffer zone are revegetated with indigenous plant species</td>
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<td>• Management Objective: To improve the current state of the wetland and wetland buffer zone area and to rehabilitate any impacts arising from construction activities</td>
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<td>• Management Criteria:</td>
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<td>o Bare soils and areas where alien vegetation has been cleared within the open space area, must be reseeded with an indigenous grass species mixture, in order to re-establish a grassed filtration area between the development and the permanent wetland zone, indigenous wetland vegetation and bulbs may also be introduced within this area.</td>
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<td>o As far as possible, a gradual transition from wet grassland to grassland should be established as part of the rehabilitation work.</td>
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<td>o Any compacted and disturbed areas must be ripped to a depth of at least 150mm using manual techniques and treated with a 150mm layer of topsoil.</td>
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<td>o Seed mixtures must be certified weed-free.</td>
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<td>o Any mulches, topsoil or compost mixtures used in open space rehabilitation works must be certified weed-free and only good quality topsoil may be used in rehabilitation works.</td>
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<td>o Due to loss of alien vegetation within the open space area, soils will be exposed and replanting/ reseeding should therefore take place immediately to prevent soil loss.</td>
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<td>o Areas with bare soils, or where alien vegetation were removed, should be reseeded, as soon as the WRMP is accepted by the relevant authorities, and monitoring and management of affected areas should be continued for the remainder of the construction phase.</td>
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<td>o Where alien plant species have therefore been removed within the open space area, as well as within other bare areas, these areas are to be topsoiled and reseeded with the indigenous veld grass mixture, such as Mayford’s Biomosone Grassland Reclamation Mixture, at a density of 24kg/ha to prevent erosion and ensure adequate vegetation cover. This is an eco-matched veld seed mix, for the manufacturers contact details, see Annexure B.</td>
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<td>o The following should be considered when utilising this product:</td>
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<td>• The product may be irritating to the eyes. Eye protection is advisable when handling the seed.</td>
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<td>• Thoroughly mix the contents of each bag immediately before planting, as components are packed separately and settle at different rates during handling and transport.</td>
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<td>• Seed of most veld harvested species is characterised by the presence of straw. As this hinders the flow of seed in the planting process, a spreading agent is advantageous. The seed should be blended with the spreading agent to achieve a uniform mix of seed in the material.</td>
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<td>• Commonly used spreading agents are river sand, bran, finely sifted kraal manure or a mixture in equal quantity of agricultural lime and granular fertilizer. The latter has the added advantage of visibility of areas seeded. The quantity of spreading agent should be sufficient for smooth flow using the planting method selected. Typically, the volume of spreading agent should be equal to the volume of seed being mixed. Only as much should be mixed as will be required on the day of seeding in order not to damage seed in storage.</td>
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<td>• The seeds are packed in bags 5 kg maximum. Before each planting, mix the contents of the bag thoroughly before taking whatever quantity is required. If more than one bag is required for a planting, separate batches per bag of seeds should be blended into spreading agent to maintain the integrity of the composition of species. In larger quantities, the components will shift too much due to differences in shape, texture, size and specific gravity of the seed.</td>
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<td>o As an alternative to using the abovementioned product, the veldgrass seed mixture to be used is to comprise the following species which occur naturally within the Egoli granite grassland vegetation type and is to be seeded at 24kg/ha:</td>
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<td></td>
<td></td>
<td>• <em>Cynodon dactylon</em> (Couch grass)</td>
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<tr>
<td>Environmental risk or issue</td>
<td>Objective or requirement</td>
<td>Control measure</td>
<td>Responsibility</td>
<td>Target Date</td>
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<td></td>
<td></td>
<td>• <em>Eragrostis curvula</em> (Weeping love grass)</td>
<td>Proponent, Contractor and ECO</td>
<td>After completion of the construction phase</td>
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<td></td>
<td></td>
<td>• <em>Brachiaria serrata</em> (Velvet signal grass)</td>
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<td></td>
<td></td>
<td>• <em>Eragrostis gummiillua</em> (Gum grass)</td>
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<td>• <em>Eragrostis chloromelas</em> (Curly leaf grass)</td>
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<td>• <em>Chloris Guyana</em> (Rhodes grass)</td>
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<td></td>
<td>o Hand seeding is recommended in order to avoid further impacts from machinery; and</td>
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<td></td>
<td>o The seed mixture used for re-vegetation must be certified weed-free</td>
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<td>o Once established, it may be necessary to cut grasses back (as would have happened in the veld with grazing) to strengthen the plants. Long grass can be cut in late autumn, but clumps should be left as a refuge for birds, insects and small mammals.</td>
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<td>o In general it may however be beneficial to keep grass height as tall as possible as this enables it to effectively out-compete weeds and tolerate greater disease/pest pressure so reducing the amount of herbicides needed. Taller grass also uses water more efficiently than shorter grass and protects the soil from moisture loss and erosion.</td>
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<td>o Should any floral Species of Conservation Concern (SCC) be observed within the Open Space area, these species should be fenced for the remainder of the rehabilitation works and may not be disturbed.</td>
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<td>General landscaping of the development</td>
<td>To prevent encroachment of alien plant species into the Open Space area.</td>
<td>• Management Objective: To guide the landscaping of the development.</td>
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<td>• Management criteria:</td>
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<td>o Ensure that greening and landscaping of the development is done using indigenous/endemic species only.</td>
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<td>o The use of indigenous <em>Cynodon dactylon</em> lawns as opposed to <em>Pennisetum clandestinum</em> (Kikuyu) lawns within the development, if applicable is recommended.</td>
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<td>o The escape of ornamental plant species into the designated open space area is to be prevented through regular monitoring of the development boundaries.</td>
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<td>o Should bird hides or boardwalks be constructed within the open space area, they should be limited to areas indicated in this report (Figure 6) as low impact infrastructure areas and the following principles should apply:</td>
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<td>• All boardwalks and bird hides should be raised;</td>
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<td>• The material used for the construction of these features should be biodegradable;</td>
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<td>• The construction footprint of these features should be kept as small as possible;</td>
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<td>• Bare areas as a result of the construction of these features should be rehabilitated and reseeded.</td>
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</table>
### 9.2 Operational Phase

Table 3: Operational Phase Open Space and Rehabilitation EMP

<table>
<thead>
<tr>
<th>Environmental risk or issue</th>
<th>Objective or requirement</th>
<th>Control measure</th>
<th>Responsibility</th>
<th>Target Date</th>
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</thead>
</table>
| General                     | To educate residents of the development about the importance of the surrounding natural environment | • Management Objective: Ensure that all managing bodies associated with the development are aware of the importance of an ecologically functional open space environment and that the WRMP principles are implemented on an on-going basis.  
• Management criteria:  
  o The managing agency/body will be responsible for executing ongoing environmental measures such as alien floral control, litter collection, recycling and the expansion/improvement of the WRMP.  
  o Ensure that consultation and stakeholder engagement takes place if any future developments take place on surrounding properties.  
  o Ensure that surrounding landowners are aware of habitat requirements of the open space system, especially connectivity requirements.  
  o Develop and implement proper environmental management and auditing systems to ensure that pollution prevention and impact minimisation plans and measures are implemented.  
  o Ensuring the maintenance of grassed areas and pruning of trees to enable improved sight lines onto the Open Space area from the development. | Managing agency/property owner | During the onset of the operational phase, and should be continued for the life of the development |
| Faunal and Floral biodiversity and Ecological functioning | To continually manage impacts on the faunal and floral environment arising from the development | • Management Objective: Ensure that no activities arising from the operational phase of the development impact on the surrounding fauna and flora.  
• Management criteria:  
  o It must be ensured that no additional impacts such as vegetation clearing are allowed to occur in the designated Open Space area.  
  o Edge effects of activities in the Open Space area, including erosion and alien/weed control, need to be strictly managed and continued throughout the operational phase of the development for the lifetime of the development.  
  o Control of activities occurring within the open space area must be implemented and no active recreational activities may take place, except for those areas specifically designated for such activities.  
  o No dumping of waste or litter must be allowed in the Open Space area. Any waste noted must be cleared immediately.  
  o No indiscriminate burning within the Open Space area must be allowed.  
  o No trapping, hunting or collection of faunal species must be allowed.  
  o As much vegetation growth as possible must be promoted within the development area in order to protect soils and to reduce the percentage of the surface area which is paved.  
  o If any erosion is observed the affected areas should immediately be rehabilitated | Managing agency/property owner | Should be monitored and maintained throughout the life of the development |
<table>
<thead>
<tr>
<th>Environmental risk or issue</th>
<th>Objective or requirement</th>
<th>Control measure</th>
<th>Responsibility</th>
<th>Target Date</th>
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<td></td>
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<td>through leveling of the area, reprofiling of soils and revegetating the area as per guidelines for the construction phase.</td>
<td>Managing agency/property owner</td>
<td>Should be monitored and maintained throughout the life of the development</td>
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<td>o Escape of ornamental species into the open space area is to be prevented and monitored. Garden escapees must be eradicated manually as soon as they are noted and prior to the onset of seeding (which usually occurs in early summer).</td>
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<td>o All vehicles must remain on designated roads with no indiscriminate driving through the Open Space area to be allowed.</td>
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<td>o The effectiveness of re-vegetation and erosion control must be monitored periodically after construction. Should any bare or eroded areas be noted, remedial measures are to be implemented immediately. This may include importing additional topsoil, reseeding and mulching, depending on the reasons for the failure of the prior re-vegetation methods</td>
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<td>o Regular monthly site investigations must be undertaken to assess the following:</td>
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<td></td>
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<td>▪ Recurrence of erosion</td>
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<td>▪ Germination of new invasive plants</td>
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<td>▪ Status of the vegetative cover within the open space area</td>
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<td>Visual Aspects</td>
<td>Light pollution</td>
<td>Management Objective: Minimise Light Pollution within the Open Space area</td>
<td>Managing agency/property owner</td>
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<td></td>
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<td>Management criteria:</td>
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<td>o The generation of light must be effectively designed and controlled so as not to spill unnecessarily into the surrounding environment and disturb the faunal life inhabiting the open space area.</td>
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<td>o Low wattage light bulbs must be used where possible.</td>
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<td>o Location of lights, purpose and intensity required must be considered.</td>
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<td>Services and Waste management</td>
<td>Avoid, reuse or recycle material where possible and correctly dispose of unusable wastes</td>
<td>Management Objective: All waste must be removed to a recommended waste disposal site at suitable intervals to prevent the build-up of waste in the area.</td>
<td>Managing agency/property owner</td>
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<td></td>
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<td>Management criteria:</td>
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<td>o Implement a monthly cleanup program, at least every two months where staff performs a cleanup of the Open Space area.</td>
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<td>o Bins should be placed at regular intervals along boardwalks, as well as in bird hides. Bins should be emptied regularly, at least twice weekly.</td>
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10 MONITORING PLAN

The water resource monitoring plan comprises the following monitoring programs:

- **Erosion**
  - Monitoring should take place after every rainstorm or flood that takes place and has an influence on the water flow into the wetland.

- **Alien Vegetation**
  - Regrowth of alien vegetation should be monitored monthly and be removed and rehabilitated as described in the management plan.

These programs are described in the following section.

10.1 Monitoring philosophy and requirements

Prudent monitoring of the wetland feature within the study area is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage water resource related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Fixed point monitoring should be applied as the preferred method of monitoring.
- All data gathered should be measurable (qualitative and quantitative).
- Monitoring reports should be repeatable.
- Data should be auditable.
- General habitat unit overviews should also be undertaken.

10.2 Wetland Data Capturing Protocols

10.2.1 Monitoring/Sampling Frequency

A walk down must be done after heavy rain or a flood have surpassed to monitor for any new erosion and damage to infrastructure, in order to ensure that temporal comparisons can be made. Alien vegetation should be monitored on a monthly basis.

10.2.2 Monitoring/Sampling Technique

- Photos and GPS point locations must be taken of existing erosion in the wetland zone that falls within the study area; and
- After a heavy rainstorm or a flood a walk down must be done of, the wetland zone and any new erosion falling within the study area must be noted and rehabilitated.
Alien vegetation must be monitored on a monthly basis, and a species list of invasive species should be compiled, which should guide the removal of the specific species.

10.2.3 Monitoring/Sampling Equipment

- Camera
- Field sheets.
- GPS.

10.2.4 Information Generation Protocols

10.2.4.1 Reporting Frequency

A monthly monitoring report should be compiled by the appointed ECO during the construction phase of the development. During the operational phase of the development, monitoring of alien vegetation should take place annually in late spring in order to ensure that species can be eradicated before producing seed in late summer.

10.2.4.2 Report Field Data Content

All documented erosion in the wetland zone, which is recorded by means of a GPS point, must be photographed and a small description of the erosion must be added. Areas associated with new alien vegetation growth should be recorded by means of a GPS point, and photographed.

10.2.5 Data Base Entry and Backup

All data should be captured and stored electronically by the ecologist undertaking the monitoring. Hard copies of all field score sheets should also be kept.

10.2.6 Report Content

Reports should contain maps indicating areas where alien vegetation and erosion are present, a brief indication of the assessment methods used, any assumptions and limitations to the study and the results of the application of each index. The report must include any mitigatory measures deemed necessary to minimise the impact on the environment.
11 WETLAND REHABILITATION AND MANAGEMENT PLAN REVIEW

- The Environmental Consultants are authorised to change and re-issue the WRMP;
- The provincial authority, the local authority, site supervisor, project manager and Environmental Site Officer is to be informed of any changes made by the Environmental Consultants;
- The site supervisor or contractor is responsible for ensuring construction personnel are complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes before starting any works; and
- If the contractor cannot comply with any of the activities as described above, they should inform the ECO with reasons within 7 working days.
12 REFERENCES


National Environmental Management: Biodiversity Act (Act 10 of 2004) and the associated Alien and Invasive Species Regulations (GN R598 of 2014)


Working for Water Species Herbicide List v3.1
ANNEXURE A – ALIEN FLORAL SPECIES CONTROL

The dominant alien floral species identified within the study area are illustrated and described below. Also indicated are alien species falling within an alien invasive category as per the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983, amended 2001) and National Environmental Management: Biodiversity Act (Act 10 of 2004) Alien and Invasive Species Regulations, GN R598 of 2014. Eradication of alien species falling within Category 1b should receive priority.

The various alien and invasive floral species categories may be summarised as follows:

- **Category 1a – Invasive species that require compulsory control.**
  Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. These species need to be controlled on your property and officials from the Department of Environmental Affairs must be allowed access to monitor or assist with control.

- **Category 1b – Invasive species that require control by means of an invasive species management programme.**
  Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders that may need government assistance to remove. All Category 1b species must be contained, and in many cases, they already fall under a government sponsored management programme.

- **Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.**
  Category 2 species are invasive species that can remain in your garden, but only with a permit, which is granted under very few circumstances.

- **Category 3 – Ornamentally used plants that may no longer be planted.**
  These are invasive species that can remain in your garden. However, you cannot propagate or sell these species and must control them in your garden. In riparian zones (within 32 metres of the edge of a river, lake, dam, wetland or estuary, or within the 1:100 year floodline, whichever is the greater) or wetlands all Category 3 plants become Category 1b plants.
Verbena bonariensis

Common name: Tall verbena, Purple top
Dispersal: The seeds are dispersed by animals, wind and water.
Ecological impact or threat: It is poisonous to livestock and invades roadsides, disturbed places, moist areas and grasslands.
Habitat invaded: It is a weed of gardens, roadsides, waste places and fallow lands. Its presence on a site indicates a suitable habitat for the very dangerous pompom weed (*Campuloclimium macrocephalum*).
Eradication and control: When young, this species can easily be controlled by cultivation and with the usual broadleaf weed herbicides. The mature plant, however, is tough. Wiry and more tolerant to herbicides.
Working for Water Species Herbicide List v3.1: Springbok/ Brushoff as a foliar spray.
**Tagetes minuta**

www.kerneliv.dk

**Common name:** Tall khaki weed, Stinking Roger, Mexican Marigold

**Dispersal:** The seeds are dispersed by animals, wind, water, or by simply falling to the ground.

**Ecological impact or threat:** *T. minuta* is a significant crop seed contaminant in East Africa (especially of wheat and some pasture grass seeds) and contaminates wool in South Africa.

**Habitat invaded:** It invades roadsides, disturbed places, and cultivated fields.

**Eradication and control:** *T. miuta* can easily be removed by hand, this should however be done, prior to seed formation, to prevent the return of viable seed to the soil. This weed requires sunlight for germination, which means that germination occurs close to the soil surface, making the weed susceptible to most pre-emergence herbicides. The best way to prevent the return of tall khaki weed is to ensure sufficient growth of natural vegetation, thereby shadowing the soil surface, and preventing germination of *T. miuta*
ANNEXURE B

Contact detail for Mayford’s Biomosome Grassland Reclamation Mixture.

Mayford is a division of Sakata

http://mayford.co.za/
http://sakata.co.za/contact/