

WALKERVILLE LANDFILL SITE VEGETATION ASSESSMENT

SEF Reference No. 503719

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July 2010

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I, **Antoinette Eyssell**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member;
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement; and
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered.

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EXECUTIVE SUMMARY

Strategic Environmental Focus as independent environmental consultants and impact assessors, were appointed by SCIP Engineering to undertake an ecological study of the Walkerville Landfill Site. The Walkerville Landfill Site is currently operating without a permit and in order to apply for a permit, biodiversity studies regarding the study site were needed. This report represents the vegetation report and should be read in conjunction with the other specialist reports pertaining to the site. The field survey was conducted on the 30 June 2010.

Although vegetation studies should be undertaken during the growing season from October to April the vegetation study was carried out in the winter months when most bulbs are dormant and grasses lacked flowers or were burnt. Although a large part of the study site was already impacted upon by the landfill site, recognizable sensitive features were assessed to determine the vegetation sensitivity on the site. The seasonality hampered positive identification of plant species and consequently no formal sampling was undertaken e.g. Braun Blanquet sampling methodology. However, this study should suffice to indicate sensitive vegetation communities as well as the occurrence or possible occurrence of threatened and protected plants.

The Walkerville Landfill Site falls within the jurisdiction of the Sedibeng District Municipality, within the Midvaal Municipality, Gauteng. The site is situated east of the R82 road between Vereniging and Johannesburg with coordinates 27°56'42.12"E and 26°28'45.35"S. The study site is situated within the Grassland Biome and in specific the regional Soweto Highveld Grassland which is classified as an endangered vegetation as only a few remaining patches are statutorily conserved. The Soweto Highveld Grassland is under pressure from urban development and remaining primary portions should thus be conserved. The site vegetation was assessed to determine whether any primary Soweto Highveld Grassland exist on the site and to describe the vegetation communities present.

The study area comprised very little natural vegetation as the majority of the site was transformed by the landfill site activities. However, a small patch of remaining natural Rocky Bushveld vegetation was identified in the south-western corner. The landfill site was bordered by a strip of mowed grass with some natural vegetation in the south west corner of the site. The Walkerville Landfill Site was bordered by *Eucalyptus* stands to the north-west, rocky Bushveld vegetation to the south-west and grassland to the east and north.

The Rocky Bushveld vegetation that occurs on the south western portion of the study site may have some intermediate levels of species diversity, although no plants of conservation concern were present. In addition, this area is fenced from the adjacent natural vegetation, and being small and isolated has little ecological function. This portion is thus classified as being of medium to low sensitivity.

The transformed vegetation had little to no conservation potential and was of a low ecological function. These areas are ecologically degraded and of low sensitivity.

At least two plants of conservation concern (previously termed Red Data plants) could potentially occur on the site: *Lithops lesliei* subsp *lesliei* and *Trachyandra erythrorhiza*. Although suitable habitat for *Lithops lesliei* subsp *lesliei* occurs within the Rocky Bushveld on the south-western portion of the site, the plants was not identified during the site visit. The Walkerville Landfill Site did not provide suitable habitat for *Trachyandra erythrorhiza* and it is unlikely to occur here.

The study site directly borders land that are classified by the provincial conservation plan as Important to reach the conservation targets of the province. Although the Walkerville Landfill Site does not comprise vegetation of conservation concern, the surrounding landscape includes primary grassland, suitable habitat for plants of conservation concern as well as a non-perennial river and a possible wetland system to the east of the landfill site. In order to preserve the natural vegetation in proximity to the landfill site, this report recommends mitigation measures to prevent the landfill site from negatively impacting on the surrounding landscape.

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1. INTRODUCTION

1.1 Project Description

Strategic Environmental Focus as independent environmental consultants and impact assessors, were appointed by SCIP Engineering to undertake an ecological study of the Walkerville Landfill Site. The Walkerville Landfill Site is currently operating without a permit and in order to apply for a permit, biodiversity studies regarding the study site were needed. This report represents the vegetation report and should be read in conjunction with the other specialist reports pertaining to the site.

1.2 Terms of Reference

The terms of reference for this assessment were as follows:

- To provide a vegetation survey of the study site;
- To conduct a survey to assess the occurrence or potential occurrence of conservation important plant species on the proposed study site; and
- To provide an indication of the relative vegetation sensitivity (conservation importance and ecological function) of the study site and incorporate the findings into a sensitivity map.

This report presents the findings obtained following an assessment of the study area. The field survey was conducted on the 30 June 2010.

1.3 Assumptions and Limitations

In order to obtain a comprehensive understanding of the dynamics of the biota on the site, including species of conservation concern, on a specific site, studies should include the following:

- Investigations through the different seasons of the year;
- Investigations over a number of years; and
- Extensive sampling of the area.

In addition, vegetation studies should be undertaken during the growing season from October to April (GDACE, 2009). However, due to project time constraints, seasonal and long-term studies were not undertaken. The vegetation study was carried out in the winter months when most bulbs are dormant and grasses lacked flowers or were burnt. This hampered positive identification and consequently no formal sampling was undertaken e.g. Braun Blanquet sampling methodology. Therefore, the plants identified is the minimum plants that occur on the site, as many plant species could have been dormant or not recognisable due to a lack of flowers. However, this study should suffice to indicate sensitive vegetation communities as well as the occurrence or possible occurrence of threatened and protected plants.

1.4 Methodology

Satellite images (Google-Earth, 2010) indicated that most of the study site is already transformed by landfill activities. Transects were walked within the remaining natural vegetation as well as the natural vegetation surrounding the study site, concentrating on moving through environmental gradients encountered within the habitat type in order to identify species and communities. This was continued until few to no new species were encountered. Any additional information on any other feature thought to have ecological significance within the site, such as fauna or evidence of fauna, soil type, altitude, erosion, rocky cover, alien/exotic/invasive plants as well as species of conservation concern and/or their habitat was also recorded.

Plant names follow Van Oudtshoorn (2002), Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Coates Palgrave (1992) and Henderson (2001).

1.5 List of Abbreviations

Table 1 Abbreviations used in the report

Abbreviation	Description
EMP	Environmental Management Plan
GDACE	Gauteng Department of Agriculture, Conservation and Environment <i>now called GDARD</i>
GDACEL	Gauteng Department of Agriculture, Conservation, Environment and Landcare <i>(pre-GDACE)</i>
GDARD	Gauteng Department of Agriculture and Rural Development
NEMBA	National Environmental Management Biodiversity Act
QDS	Quarter Degree Square

2. Description of the Environment

2.1 Locality

The Walkerville Landfill Site falls within the jurisdiction of the Sedibeng District Municipality, within the Midvaal Municipality, Gauteng. The site is situated east of the R82 road between Vereninging and Johannesburg with coordinates 27°56'42.12"E and 26°28'45.35"S (Figure 1).

2.2 Biophysical description

2.2.1 Climate

The site is situated within the Highveld which experiences frost in winter and rainfall during the summer months. The average temperature in summer ranges between 26°C and 16°C, and in winters. The average temperature is 4°C.

2.2.2 Regional Vegetation

The study site is located within the Grassland Biome (Rutherford & Westfall, 1994). High summer rainfall characteristic of the Grassland Biome combined with dry winters with night frost and marked diurnal temperature variations are unfavourable to tree growth. The Grassland Biome therefore comprises mainly of grasses and plants with perennial underground storage organs, for example bulbs and tubers and less trees.

The Grassland Biome consists of various different grassland types. The site is situated within the Soweto Highveld Grassland (Mucina & Rutherford, 2006) (Figure 2). Soweto Highveld Grassland is classified as an endangered vegetation as only a few remaining patches are statutorily conserved. The Soweto Highveld Grassland is under pressure from urban development and remaining primary portions should thus be conserved. In its natural state, Soweto Highveld Grassland is dominated by *Themeda triandra* (Red Grass) accompanied by grasses such as *Elionorus muticus* (Wire Grass), *Eragrostis racemosa* (Narrow Heart Love Grass), *Heteropogon contortus* (Spear Grass) and *Tristachya leucothrix* (Hairy Trident Grass) (Mucina & Rutherford, 2006). Undisturbed Soweto Highveld Grassland could contain wetlands, narrow stream alluvial and ridges or rocky outcrops (Mucina & Rutherford, 2006).

The grassland biome is under severe threat from urbanisation, industrialisation, mining and agriculture, especially in Gauteng. Very few reserves have been proclaimed or set aside to protect this vegetation type within the Gauteng province and only a mere 1.38 % is conserved, while approximately 65 % is already transformed (Bredenkamp & Van Rooyen 1996). The grassland biome contains the greatest concentration of urban areas in southern Africa and has therefore suffered severely from the destruction of areas for the cultivation of crops and from the development of extensive urban areas (van Wyk and Malan, 1997). It is important to conserve areas where grassland is still in its natural state. This vegetation

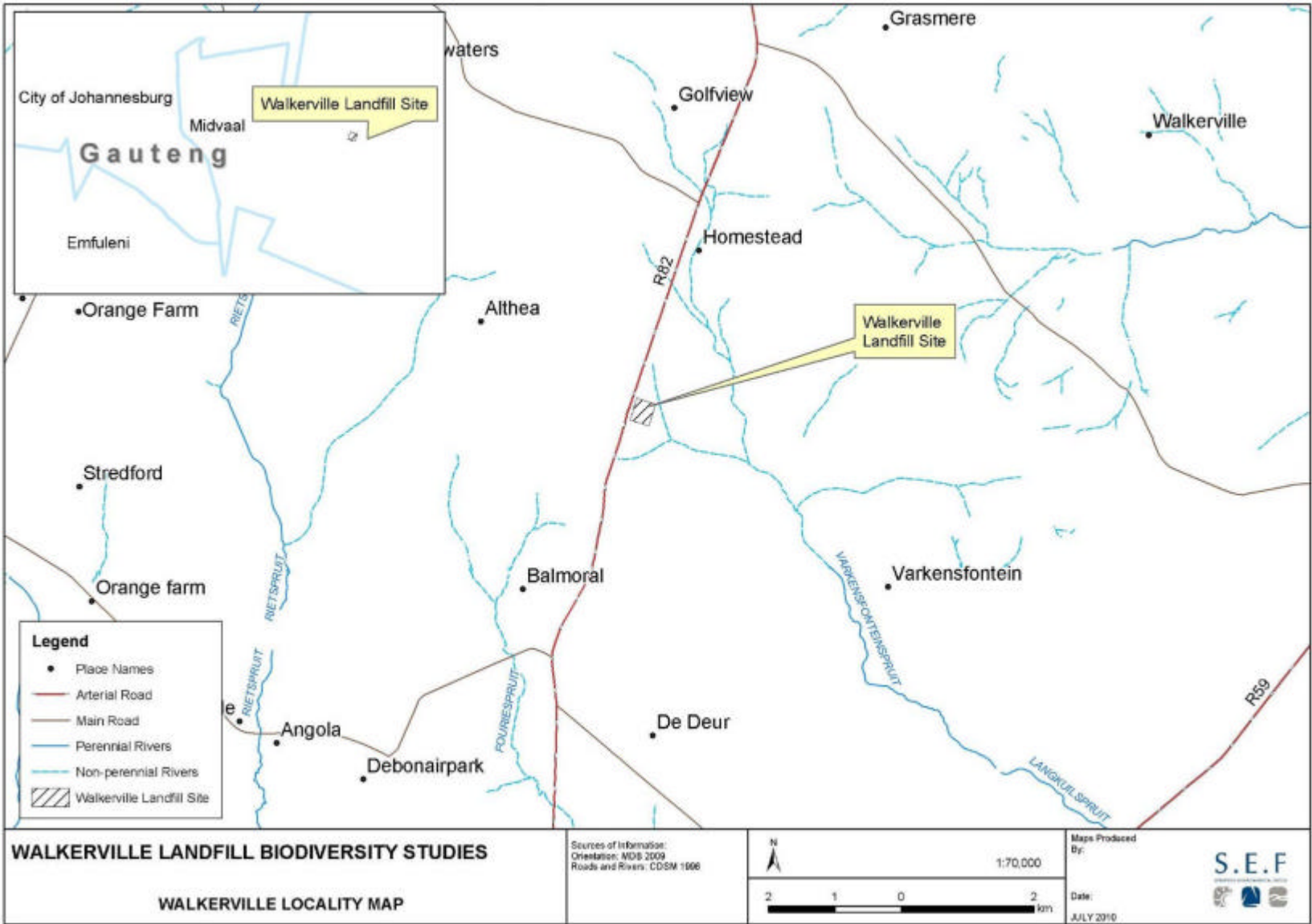


Figure 1: Locality of the Study Area

assessment thus aimed to determine the state of the grassland vegetation on the study site and advise accordingly.

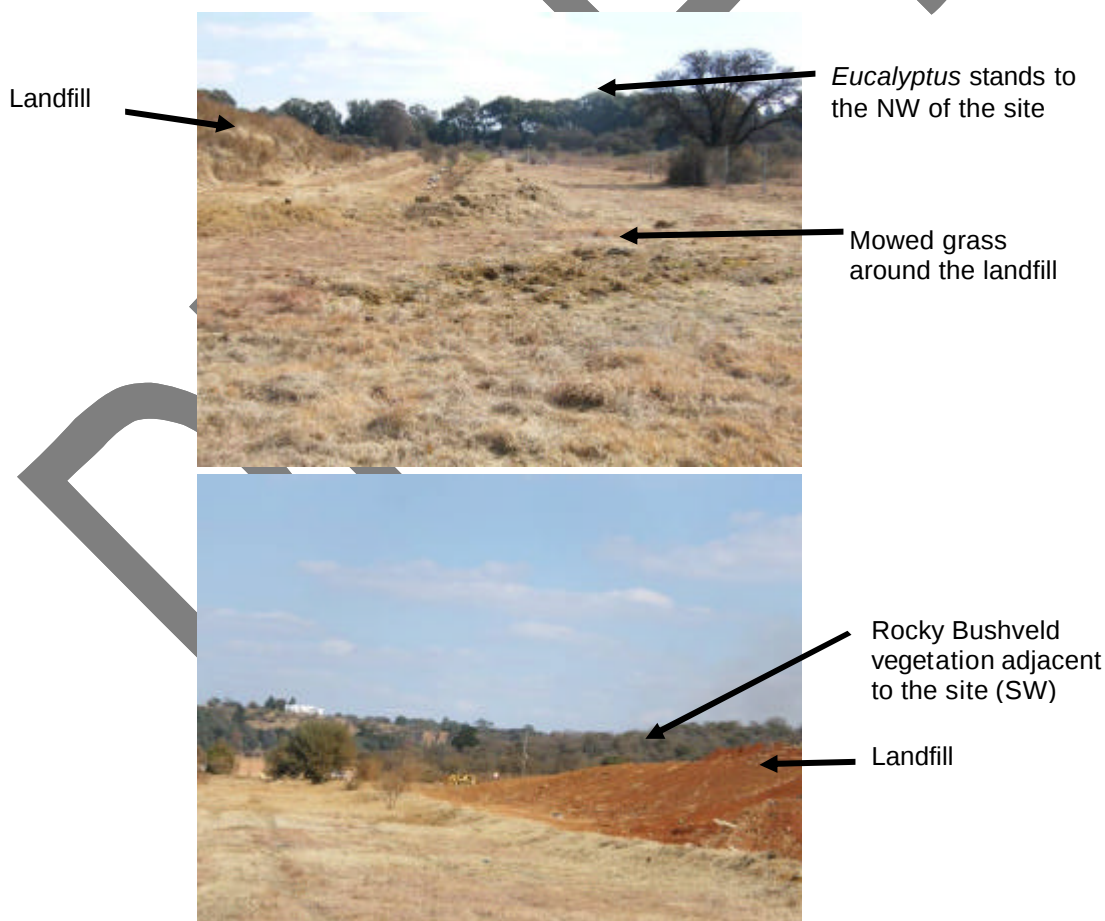
2.2.3 Associated Water Courses and Land Cover

A non-perennial river flows east of the site (Chief Directorate: Surveys & Mapping, 1996) According to the Land Cover data, the site contains unimproved (natural) grassland (Satellite Application Centre, 2000).

3. RESULTS

3.1 Land Use

The study area comprised very little natural vegetation as the majority of the site was transformed by the landfill site activities. The landfill site was bordered by a strip of mowed grass (Photograph 1) with some natural vegetation in the south west corner of the site. The Walkerville Landfill Site was bordered by *Eucalyptus* stands to the north-west, rocky Bushveld vegetation to the south-west and grassland to the east and north.



Photograph 1: Landfill site and surrounds

3.2 Vegetation on site

The majority of the vegetation on the site comprised the mowed grasses around the landfill and pioneer weedy plants where soil disturbances occurred. These were classified as transformed vegetation. The only natural vegetation that remained on the site was some rocky bushveld vegetation in the south-western corner of the Walkerville Landfill Site (Photograph 2).

The site vegetation was classified as (Figure 2):

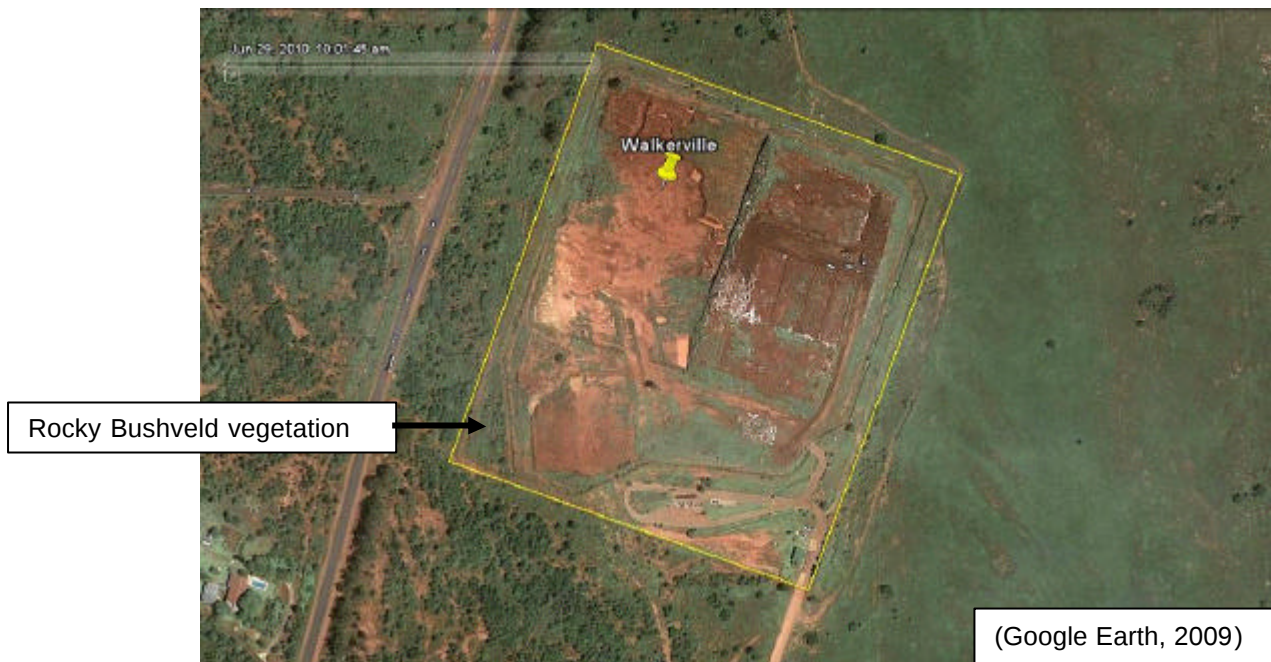
1. Transformed vegetation; and
2. Rocky Bushveld vegetation

3.2.1 Transformed vegetation

The mowed grasses were identified as mostly *Hyparrhenia hirta* (Thatch Grass), *Themeda triandra* (Red Grass) and a *Cynodon* species (Couch Grass) and included limited herbaceous plants. The regular mowing of these grasses as well as the area being used for vehicle access restricts the possibility of any conservation important plants persisting in these grass areas. The herbaceous layer included *Helichrysum rugulosum*, *Asparagus larcinus* and weedy plants such as *Conyza albida* (Tall Fleabane), *Opuntia* species (Prickly pear) and *Tagetes minuta* (Khaki Weed). *Acacia karroo* (Sweet Thorn) occurred along the perimeter of the site as well as the invasive *Melia azedarach* (Seringa). Although the study was undertaken in the winter months, it is unlikely that a significant amount of additional herbaceous plants, as well as plants of conservation concern, would be identified during a summer study. This vegetation community is thus described as being species poor (much of the plants identified here were exotic, weedy plants) and of little conservation importance.

3.2.2 Rocky Bushveld vegetation

The south western corner of the Walkerville Landfill Site contained vegetation associated with rocky outcrops and ridges (Photograph 2). Numerous trees and shrubs grew here including *Acacia karroo* (Sweet Thorn), *Searsia lancea* (Karee), *Asparagus suaveolens* and *A. larcinus*. The grasses included *Themeda triandra* (Red Grass), *Cymbopogon pospischillii* (Narrow-leaved Turpentine Grass) and *Setaria sphacelata* (Common Bristle Grass). The herbaceous plants identified included *Felicea muricata*, *Hermannia depressa*, *Aloe greatheadii* and *Acalypha punctata* (Copper Leaf). This small patch of remaining natural vegetation is subjected to edge effects from the landfill site activities and numerous weedy plants are also present. No plants of conservation concern were identified during this winter study and it is unlikely that these plants will persist here.



Photograph 2: Aerial image indicating the site and surrounding vegetation

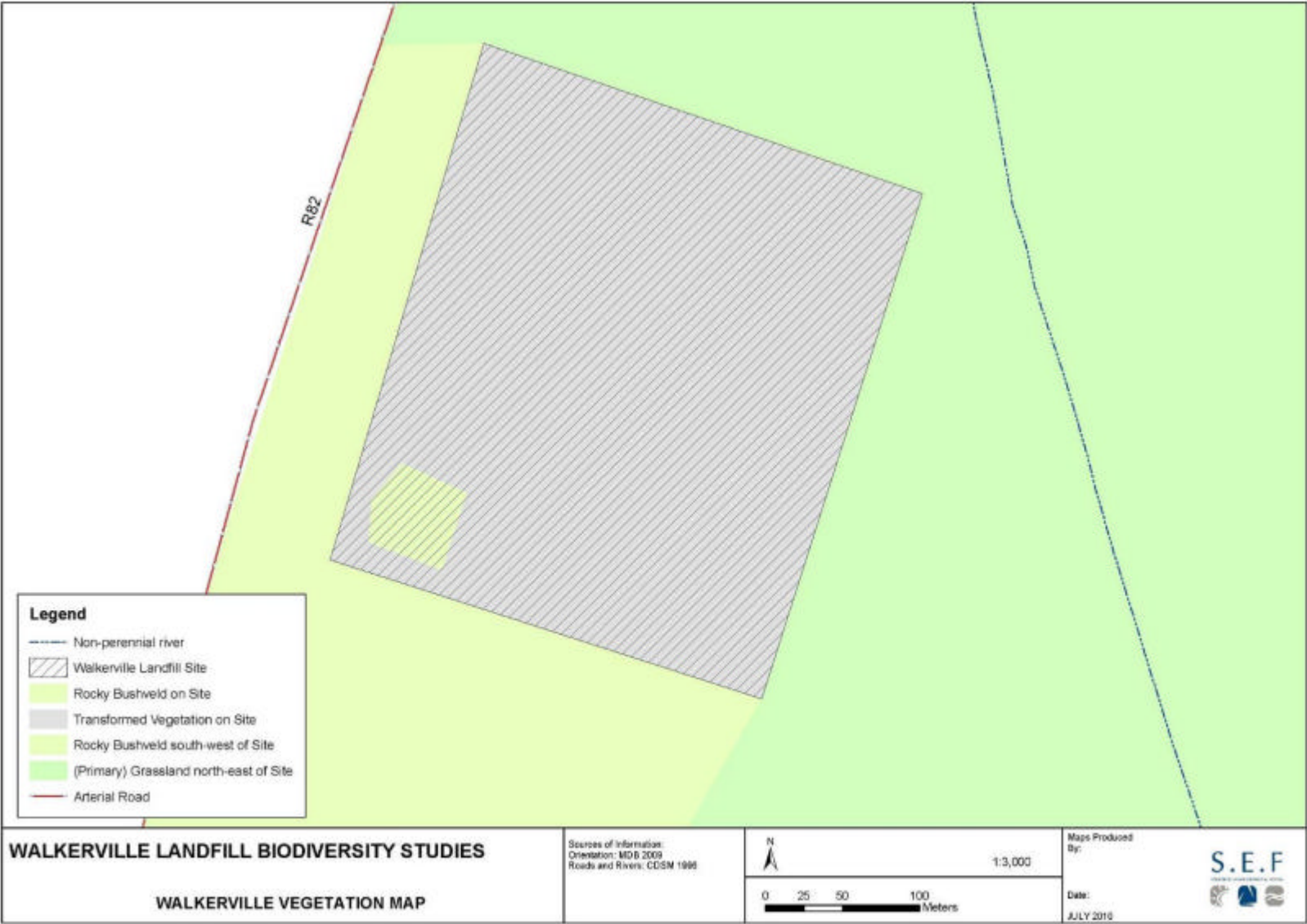


Figure 2: Vegetation communities on the site

3.3 Plants of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near threatened, Critically rare, Rare and Declining. These plants are *nationally* protected by the National Environmental Management: Biodiversity Act No 10 of 2004 (NEMBA). Rare and threatened plant species in grasslands are mostly small, very localised and visible for only a few weeks in the year when they flower (Ferrar & Lötter, 2007). As these plants might not have been visible at the time of the field survey, the probabilities of occurrence for these plants were based on distribution data, present state of the vegetation and evidence found during the field survey.

According to GDARD (2010), at least two plants of conservation concern (previously termed Red Data plants) could potentially occur on the site: *Lithops lesliei* subsp *lesliei* and *Thrachyandra erythrorrhiza*. Although suitable habitat for *Lithops lesliei* subsp *lesliei* occurs within the Rocky Bushveld on the south-western portion of the site, the plants was not identified during the site visit. The Walkerville Landfill Site did not provide suitable habitat for *Trachyandra erythorriza* and it is unlikely to occur here.

As per the minimum requirement for biodiversity studies in Gauteng (GDACE 2009), the surrounding area was also checked for suitable habitat. The vegetation outside of the Walkerville Landfill site is in good condition and could provide suitable habitat to these and other plants of conservation concern (Appendix B). The land adjacent to the south-west of the study site also comprised Rocky Bushveld vegetation that is suitable habitat for *Lithops lesliei* subsp *lesliei*. In addition, the grassland north and east of the study site provide suitable habitat for *Thrachyandra erythrorrhiza*. Transects were also walked through this grassland and although *Thrachyandra erythrorrhiza* was not identified within these transects, another plant of conservation concern, *Hypoxis hemerocallidea*, were observed. *Hypoxis hemerocallidea* is nationally classified as a Declining plant specie (Raimondo, *et al*, 2009). Typically, Declining plants are used for their medicinal purposes which place further strain on the populations already restricted by development in Gauteng. Although not threatened yet, their numbers are declining.

3.4 Gauteng Conservation Plan and surrounding sensitivities

The study site directly borders land that are classified by GDARD as Important to reach the conservation targets of the province (C-plan, GDACE, 2005). The Importance classification was based on the occurrence of primary vegetation as well as groundwater processes (Figure 3). Although the vegetation on the Walkerville Landfill Site was significantly degraded, the vegetation to the north and east of the site contains primary vegetation (Soweto Highveld Grassland) as well as a non-perennial river and should thus not be impacted upon by the landfill activities.

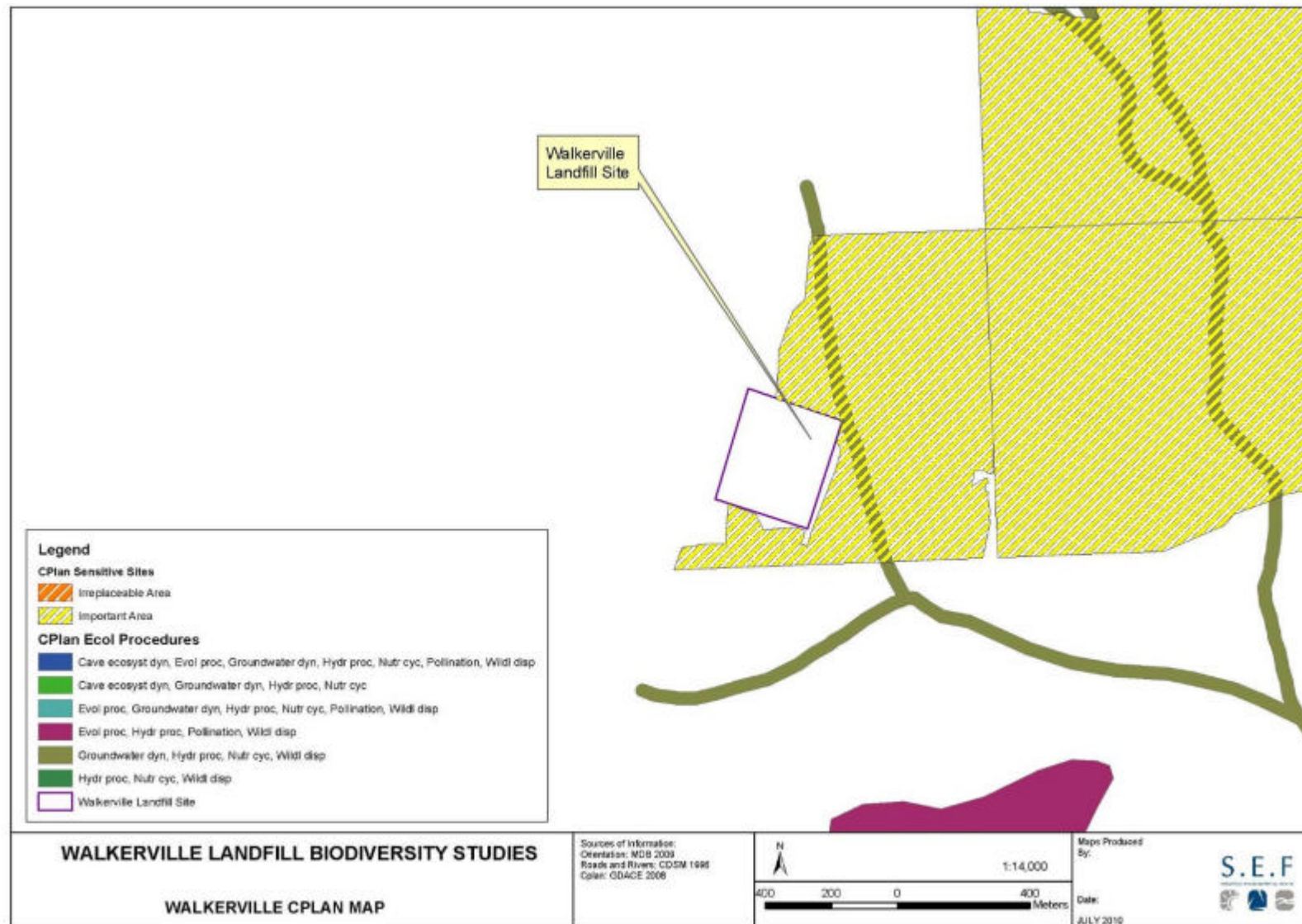


Figure 3: Gauteng Conservation Plan and in relation to the study site

3.5 Alien and Invasive Plants

Declared weeds and invaders have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. The Vaal Marina Landfill site harbours numerous exotic species which could invade the surrounding natural areas. Furthermore, garden refuse dumped in the landfill site, may include plant material and seeds from invasive plants that could grow on the landfill site and spread into disturbed soils and natural areas. Therefore, it is important that all these transformers (as defined above) be controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

The amended Regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) identified three categories of problem plants. However, a new Draft Alien and Invasive Species Regulations of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) contain a list of proposed invader species and their invasive categories. 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 are brief explanations of the new proposed three categories.

- 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 Category 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 Category 3 plants to exist in riparian zones.

Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be removed and eradicated (Henderson, 2001). Weed species that occur on the site is listed in plant list in Appendix A.

3.6 Ecological Importance and Sensitivity

The sensitivity classification of the study site and surrounds are represented in Figure 4 and discussed below. Based on the findings of the study and the following criteria, sensitive habitat or areas of conservation importance were classified based on:

Ecological Function: The ecological function describes the intactness of the structure and function of an ecosystem in terms of the relationship between plant and animal assemblages and the surrounding abiotic environment. It also refers to the degree of ecological connectivity between systems within a landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

High – Sensitive ecosystems with either low inherent resistance or resilience towards disturbance factors or highly dynamic systems that are considered important for the maintenance of ecosystem integrity. Most of these systems represent late succession ecosystems with high connectivity with other important ecological systems.

Medium – These systems occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

Low – Degraded and highly disturbed systems with little ecological function.

Conservation Importance: The conservation importance of the site gives an indication of the necessity to conserve areas based on factors such as the importance of the site on a national and/or provincial scale and on the ecological state of the area (degraded or pristine). This is determined by the presence of a high diversity, rare or endemic species and areas that are protected by legislation. The criteria are defined as follows:

High – Ecosystems with high species diversity and usually provide suitable habitat for a number of threatened species. These areas should be protected.

Medium – Ecosystems with intermediate levels of species diversity without any threatened species.

Low – Areas with little or no conservation potential and usually species poor (most species are usually exotic).

3.6.1 Identified areas of High Sensitivity

The study site did not include vegetation of high ecological sensitivity. The vegetation surrounding the site is indicated as Important in the Gauteng Conservation plan (GDACE, 2005) and although the study was undertaken in winter, it was evident that the grassland north and north-east of the study was in a primary condition. In

addition, this area includes a non-perennial river. According to GDACE (2009), a 100m buffer is applicable from the edge of the riparian zone of this river (Figure 4).

3.6.2 Identification of areas of Medium to Low Sensitivity

The Rocky Bushveld vegetation that occurs on the south western portion of the study site may have some intermediate levels of species diversity, although no plants of conservation concern were present. In addition, this area is fenced from the adjacent natural vegetation, and being small and isolated has little ecological function. This portion is thus classified as being of medium to low sensitivity.

3.6.3 Identification of areas of Medium to Low Sensitivity

The transformed vegetation had little to no conservation potential and was of a low ecological function. These areas are ecologically degraded and of low sensitivity.

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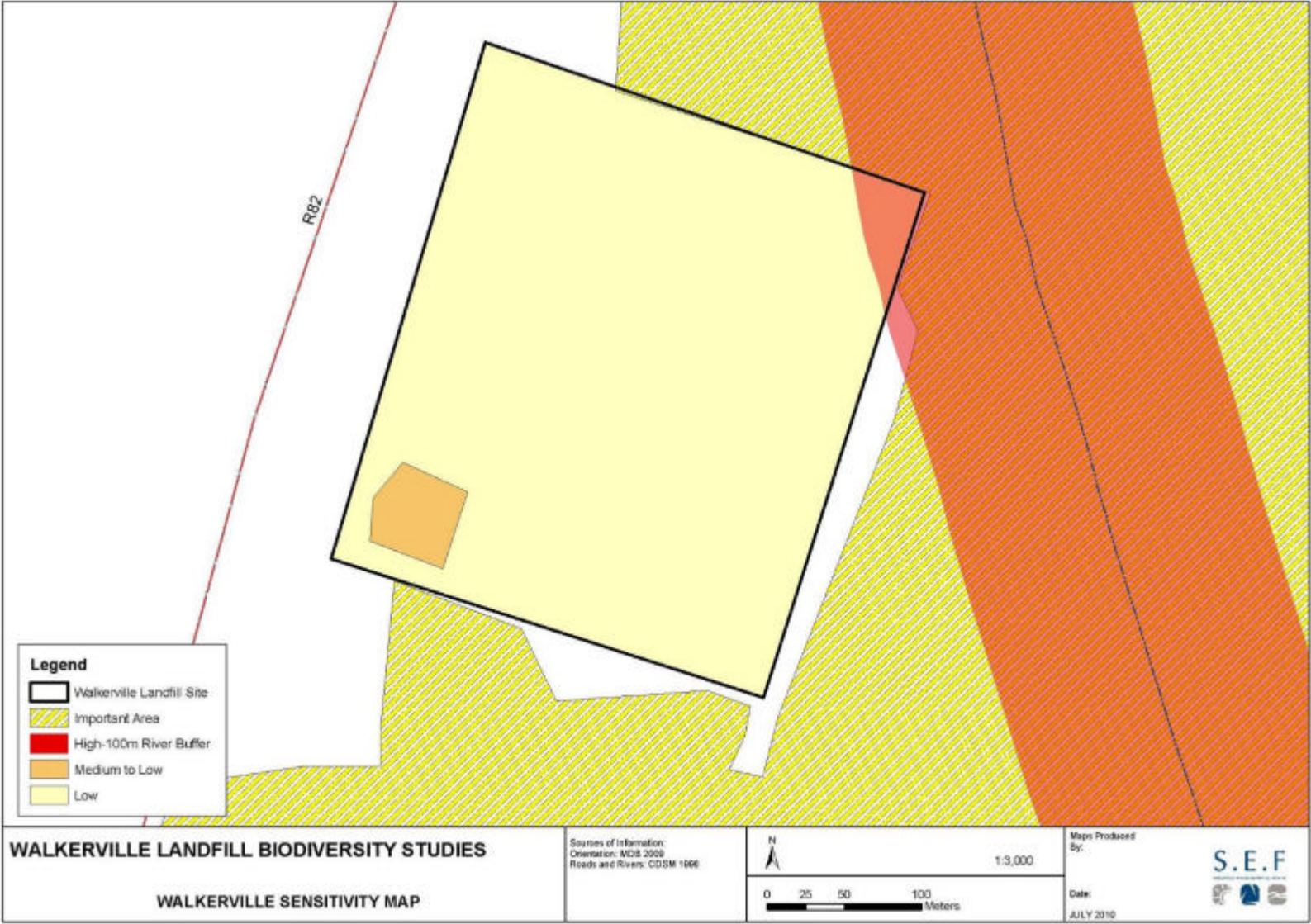


Figure 4: Site vegetation sensitivity

4. IMPACT ASSESSMENT AND MITIGATION

Any development in a natural system will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was therefore to identify and assess the significance of the ecological impacts likely to arise during the operational phase of the landfill in order to recommend suitable mitigation measures that address the conservation of natural resources on and around the site. Possible impacts associated with the Walkerville Landfill Site are provided in Table 3.

4.1 Assessment Criteria

The environmental impacts are assessed with mitigation measures (WMM) and without mitigation measures (WOMM) and the results presented in impact tables which summarise the assessment. Mitigation and management actions are also recommended with the aim of enhancing positive impacts and minimising negative impacts. The criteria against which these activities were assessed are discussed below.

4.1.1 Nature of the Impact

This is an appraisal of the type of effect the project would have on the environment. This description includes what would be affected and how and whether the impact is expected to be positive or negative.

4.1.2 Extent of the Impact

A description of whether the impact will be local (extending only as far as the servitude), limited to the study area and its immediate surroundings, regional, or on a national scale.

4.1.3 Duration of the Impact

This provides an indication of whether the lifespan of the impact would be short term (0-5 years), medium term (6-10 years), long term (>10 years) or permanent.

4.1.4 Intensity

This indicates the degree to which the impact would change the conditions or quality of the environment. This was qualified as low, medium or high.

4.1.5 Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

4.1.6 Degree of Confidence

This describes the degree of confidence for the predicted impact based on the available information and level of knowledge and expertise. It has been divided into low, medium or high.

4.2 Impact Assessment

The possible impacts of the current landfill site as well as a summary of the possible risks that could occur are listed in Table 3.

Table 2: Potential Impacts and Risks associated with the Walkerville Landfill Site

Possible Risks	Source of the Risk	Site to be affected
Destruction of natural habitat	Earth moving equipment, and vehicles	Adjacent primary grassland (Important C Plan site)
Possible pollution of groundwater	Contaminated water draining from the landfill site	Groundwater and in specific the non-perennial water course north-east of the site
Possible littering in the natural vegetation from windswept rubbish	Rubbish from the landfill site swept up by wind	Surrounding natural vegetation
Possible increase in exotic and invasive vegetation	Garden refuse that contain seeds /vegetative plant material of invasive and exotic plants	Surrounding natural vegetation

4.2.1 Possible Risk during operation and possible expansion

4.2.1a Destruction of Natural Habitat

Impact	Site	Extent	Duration	Intensity	Probability of occurrence	Significance		Confidence
						WOMM	WMM	
Destruction of natural habitat	Surrounding Primary vegetation	Local	Permanent	High	Highly probable	High	Medium	Medium

Description of Impact

Due to the nature of the landfill activities throughout the site, most of the natural habitat was destroyed. The surrounding vegetation is still intact and activities such as the turning of heavy earthmoving vehicles and trucks outside of the current landfill site, may impact on the surrounding natural vegetation.

Mitigation Measures:

- The natural vegetation surrounding the site should not be destroyed to make way for an expanding land fill site; and
- Restrict the landfill activities to the currently transformed areas and prevent any destruction to the natural vegetation surrounding the Walkerville Landfill Site.

4.2.1b Possible pollution of groundwater

Impact	Site	Extent	Duration	Intensity	Probability of occurrence	Significance		Confidence
						WOMM	WMM	
Possible pollution of groundwater	Non-perennial river and surrounds	Regional	Medium to long term	High	Probable	High	Medium-Low	Medium

Description of Impact

Contaminated water draining from the landfill site could pollute groundwater and in specific the non-perennial water course and possible wetlands north-east of the site.

Mitigation Measures

- If not in existence and implemented yet, a water management plan that include regular monitoring of groundwater and suitable mitigation measures must be implemented for the full lifespan of the landfill site or as long as this risk persists.
- *4.2.1c Possible littering in the natural vegetation from windswept rubbish*

Impact	Site	Extent	Duration	Intensity	Probability of occurrence	Significance		Confidence
						WOMM	WMM	
Possible littering in the natural vegetation from windswept rubbish	Surrounding natural vegetation	Site and surrounds	Medium term	Medium	Probable	Medium	Low	Medium

Description of Impact

Rubbish from the landfill site could be blown by the wind to the natural vegetation surrounding the site. This could be detrimental to fauna and flora that inhabit the natural vegetation.

Mitigation Measure

- Maintain suitable fencing around the landfill site; and
- Clean up any litter that may occur due to windy conditions as soon as possible and include this task into the Environmental Management Plan (EMP) of the Walkerville Landfill Site.

4.2.1d Possible increase in exotic vegetation

Impact	Site	Extent	Duration	Intensity	Probability of occurrence	Significance		Confidence
						WOMM	WMM	
Possible increase in exotic vegetation	Site and surrounding natural vegetation	Site and surrounding environment	Medium to long term	Medium	Probable	High	Low	High

Description of Impact

Alien invasive species can spread into disturbed soils on the landfill site, especially from the *Eucalyptus*-stands north-east of the site. Furthermore, garden refuse dumped in the Walkerville Landfill Site could include seeds and vegetative plant material of exotic and invasive plant species which could lead to the spread of these invasive species to the natural vegetation surrounding the Walkerville Landfill Site.

Mitigation Measure

- If not yet implemented, compile and implement an alien invasive plant species monitoring plan to prevent the colonisation and spread of alien invasive plant species; and
- Once the landfill site reached capacity, rehabilitate the site with indigenous vegetation that naturally occur within the area;
- Regularly monitor the success of rehabilitation as well as possible incidences of alien plants spreading into the area and mitigate where needed.

5. CONCLUSION AND RECOMMENDATIONS

The Walkerville Landfill Site does not contain any vegetation of high sensitivity. The landfill site comprised transformed vegetation with a small patch of natural vegetation remaining within the south-western portion of the study site. Although this patch of natural vegetation may have some intermediate levels of species diversity, no plants of conservation concern were identified there during the field survey. In addition, this area is fenced from the adjacent natural vegetation, and being small and isolated has little ecological function. This portion is thus classified as being of medium to low sensitivity, while the remainder of the site is of low ecological sensitivity.

Although the Walkerville Landfill Site does not comprise vegetation of conservation concern, the surrounding landscape includes primary grassland, suitable habitat for plants of conservation concern as well as a non-perennial river and a possible wetland system to the east of the landfill site. In order to preserve the natural vegetation in proximity to the landfill site, this report recommends mitigation measures to prevent the landfill site from negatively impacting on the surrounding landscape.

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7. GLOSSARY OF TERMS

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Climax community	The presumed end point of successional sequence; a community that has reached a steady state, the most mature and fully developed vegetation that an ecosystem can achieve under the prevailing conditions. It is reached after a sequence of changes in the ecosystem, known as succession. Once climax vegetation develops, the changes are at a minimum and the vegetation is in dynamic equilibrium with its environment. Very few places show a true climax because physical environments are constantly changing so that ecosystems are always seeking to adjust to the new conditions through the process of succession.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity. Critically Endangered A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future
Conservation concern (Plants of..)	South Africa's conservation decision making processes and include all plants that are Threatened (see), Extinct in the wild, Data deficient, Near threatened , Critically rare, Rare and Declining . These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading
Conservation status	An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the

	population over time, breeding success rates, known threats, and so on.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo <i>et al</i> , 2009).
Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future (Raimondo <i>et al</i> , 2009)
Endemic	Naturally only found in a particular and usually restricted geographic area or region
Exotic species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Flora	The plant life of a region.
Forb	A herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Least Concern	A taxon is Least Concern when it has been evaluated against five IUCN criteria and does not qualify for the Threatened or Near

threatened Categories (Raimondo *et al*, 2009)

Mitigation	The implementation of practical measures to reduce adverse Impacts
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo <i>et al</i> , 2009).
Protected Plant	According to Provincial Nature Conservation Ordinances, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo <i>et al</i> , 2009)
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat
Succession	Progressive change in the composition of a community of plants, e.g. from the initial colonisation of a bare area, or of an already established community towards a largely stable climax. The complete process of succession may take hundreds or thousands of years and entails a number of intermediate communities - each called a seral community. The replacement of one seral community by another in most cases leads to the eventual formation of a climax community, a relatively stable community of plants and animals.
Vegetation Unit	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels, and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future (Raimondo <i>et al</i> , 2009)

8. APPENDICES

Appendix A: Plants identified on the site and important plants off the site

Appendix B: Plants of conservation concern that could potentially occur on the site and surrounding vegetation

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APPENDIX A: PLANTS IDENTIFIED ON THE SITE AND IMPORTANT PLANTS OFF THE SITEPlant in **RED** = Declining (not on site)

Specie name	Common Name	Relevant Notes	Rocky Bushveld	Transformed	Off Site
Herbaceous plants					
<i>Acalypha punctata</i>	Sticky Brooms and Brushes	Grassland	X		
<i>Aloe greatheadii</i>		Grassland and bushveld. Often forming dense stands in overgrazed areas.	X		
<i>Artemissia affra</i>	Wilde Als	Grassland	X		
<i>Asparagus laricinus</i>	Cluster-leaved Asparagus	Thicket or disturbed areas.	X	X	
<i>Asparagus suaveolens</i>		Shady places in between trees.	X		
<i>Felicia muricata</i>		Grassland, proliferating in overgrazed/disturbed places	X	X	
<i>Helichrysum rugulosum</i>		Grassland, summit of ridges	X		
<i>Hermannia depressa</i>	Creeping Hermannia	Grassland, in trampled areas	X		
<i>Lipkea scaberrima</i>		Grassland	X		
<i>Verbena bonariensis</i> *	Wild Verbena	Exotic weed invading moist areas (Naturalized).	X	X	
Hypoxis hemerocallidea	Star Flower	Grassland			In grassland east of site
<i>Vernonia oligocephala</i>	Bitterbossie	Bushveld, often weed in disurbed places	X		
Total number of herbaceous species identified = 13			11	3	

GRASSES					
<i>Aristida adscensionis</i>	Annual Three-awn	Disturbed land	X		
<i>Aristida bipartita</i>	Rolling Grass	Moist places or overgrazed veld and road reserves.		X	
<i>Cymbopogon excavatus</i>	Broad-leaved Turpetine Grass	Adapted to various growing conditions	X		
<i>Cynodon dactylon</i>	Couch grass	Most soils, usually in disturbed areas	X	X	
<i>Diheteropogon amplexans</i>	Broad-leaved Bluestem	Open grassland as well as open areas within bushveld. Mostly in poor rocky slopes.	X		
<i>Eragrostis chloromelas</i>	Curly leaf	Rocky slopes, mostly in open grassland	X	X	
<i>Hyparrhenia hirta</i>	Common Thatching Grass	Well drained, rocky soil in open grassland and disturbed areas	X	X	
<i>Melinis nerviglumis</i>	Bristle-leaved Red Top	Undisturbed grassland, rocky slopes and soils.	X		
<i>Melinis repens</i>	Natal Red Top	Disturbed grassland	X		
<i>Setaria incrassata</i>	Vlei bristle grass	Moist areas and sometimes on rocky slopes	X		
<i>Themedia triandra</i>	Red Grass	Undisturbed or disturbed open grassland	X		
Total number of grasses identified = 11			10	4	
TREES					
<i>Acacia caffra</i>	Common Hook-thorn		X		
<i>Acacia karroo</i>	Sweet Thorn	Widespread, often proliferate in overgrazed areas	X	X	
<i>Searsia (Rhus) lancea</i>	Karee	Grassland and bushveld	X		
Total number of indigenous trees identified = 3			3	1	

INVADERS					
<i>Amaranthus hybridus</i>	Common Pigweed	Disturbed areas		X	
<i>Araujia sericifera</i>	Moth catcher	Declared Weed		X	
<i>Conyza albida</i>	Tall Fleabane	Annual weed in fallow land		X	
<i>Eucalyptus specie</i>	Blue Gum	Invader			North-west of site
<i>Impomoea purpurea</i>	Morning Glory	Declared Weed and invader		X	
<i>Lantana camara</i>		Lantana	X	X	
<i>Melia azedarach</i>	Syringa	Invader		X	
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Transformer	X		
<i>Rincus communis</i>	Castor Oil	Invade moist areas, roadsides and waste lands (category 2)		X	
<i>Tagetes minuta</i>	Khaki Weed	Weed in disturbed places	X	X	
<i>Datura stramonium</i>	Thorn-apple			X	
Total number of weeds identified = 11			3	9	
Total species per vegetation community:			27	17	

APPENDIX B: PLANTS OF CONSERVATION CONCERN THAT OCCUR OR COULD POTENTIALLY OCCUR ON THE SITE AND SURROUNDING VEGETATION

Name	Status	Suitable Habitat	Occurrence on	
			Site	Surrounding vegetation
<i>Hypoxis hemerocallidea</i>	Declining	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	Not identified on site, probability of occurrence is low	Yes, was identified in the grassland north and east of the site
<i>Boophane disticha</i>	Declining	Dry grassland and rocky areas	Not identified on site, probability of occurrence is low	Not identified, however suitable habitat does exist in the surrounding natural vegetation
<i>Cineraria longipes</i>	Vulnerable	Grassland, on koppies, amongst rocks and along seepage lines, exclusively on basalt on south-facing slopes.	No suitable habitat	Suitable habitat occurs in the rocky Bushveld vegetation south west of the site
<i>Dioscorea sylvatica</i>	Vulnerable	Wooded places with fair to reasonably good rainfall, such as the moister bushveld areas, coastal bush and wooded mountain kloofs	No suitable habitat	No suitable habitat
<i>Habenaria mossii</i>	Endangered	Open grassland on dolomite or in black sandy soil.	No suitable habitat	Possible habitat in the natural grassland east of the site
<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Near Threatened	Primary habitat appears to be the arid grasslands in the interior of South Africa where it usually occurs in rocky places, growing under the protection of surrounding forbs and grasses.	No suitable habitat	Possible habitat south west of the site

Name	Status	Suitable Habitat	Occurrence on	
			Site	Surrounding vegetation
<i>Trachyandra erythrorrhiza</i>	Near Threatened	Marshy areas, grassland, usually in black turf marshes	No suitable habitat	Suitable habitat in the grassland east of the site

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