WETLAND IMPACT ASSESSMENT REPORT

SATIVA
Travel and Environmental Consultants
Empowering sustainability through Innovation

A WETLAND IMPACT ASSESSMENT FOR THE PROPOSED UPGRADE AND EXTENSION OF THE LIBANON LANDFILL SITE IN THE RAND WEST CITY LOCAL MUNICIPALITY, GAUTENG PROVINCE.

REVISED 20 MAY 2026

RAND WEST CITY
LOCAL MUNICIPALITY
CITY OF CHOICE

Green Tree
Environmental Consulting

DOCUMENT INFORMATION

Item	Description
Proposed development and location	The proposed extension of the Libanon Landfill site in Rand West City Local Municipality, Gauteng Province.
Title	The proposed extension of LIbanon Landfill in Rand West City Local Municipality in Gauteng Province: Wetland Impact Assessment Report.
1:50 000 Topographic Map	2627 BC
Coordinates	S26° 19' 56.69" E027° 37' 48.75"
Municipalities	Rand West City Local Municipality.
Predominant land use of the surrounding area	Existing landfill site, Vacant, agricultural, mining, industrial, residential, road and transport
Applicant/Developer	Rand West City Local Municipality Corner Sutherland and Pollock Street, P.O Box 218, Randfontein 1760 Tel:011 278 3000
Heritage Consultant	Sativa Travel and Environmental Consultants (Pty) Ltd
Date of Report	20 May 2026
STEC Contact Person	Moses Kgopana (moses@sativatec.co.za)
EAP	Green Tree Environmental Consulting 7 Dublin Street, Rangeview Ext 2, Krugersdorp Gauteng Email: yonanda@gtec.net.za Cell: 082 409 0405
Author Identification	**Johannes Maree** (Aquatic Specialist).
REF	GAUT 002/25-26/I0003

EXECUTIVE SUMMARY

Background

The project is the licensing of the existing Libanon Landfill Site, the proposed expansion of the landfill, construction of a proper stormwater system, including the pollution control dam (PCD), and the establishment of a waste sorting and baling facility.

The Libanon Landfill Site is located outside Westonaria, Rand West City Local Municipality, Gauteng Province. The application will be submitted on behalf of the Rand West City Local Municipality.

Green Tree Environmental Consulting was appointed by Pro-Plan Consulting Engineers (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) Process for the project.

Sativa Travel and Environmental Consultants (Pty) Ltd was originally appointed as the independent specialist consultancy to conduct an ecological impact assessment in 2017.

Sativa has now been appointed and requested to update the 2017 studies.

Field investigations were initially undertaken in April 2017, with recent investigations for the project and update of studies undertaken on 29 April 2026.

Location of the Study Area

The Study Site is located within the boundaries of the Rand West City Local Municipality , Gauteng Province. The site is just north of the N12 (Maroka Bypass), bordering on Bridges Street, east of the R28, adjacent to and on the northern side of the Libanon Gold Mine's tailings dam.

Fatal Flaws

There are no fatal flaws.

Conclusions

- There are no watercourses present on the study site, including streams, drainage lines and wetlands;
- There are some unnatural ponds and manmade excavations where water has accumulated and pooled on site;
- The study site is not situated within any priority areas, including NFEPA rivers and wetlands.
- There are two badly degraded and disturbed valley bottom wetlands / wetland flats to the east to the study site. The study site is within the 500m wetland assessment area from these wetlands. However, they are far enough away for the project (landfill site) not to have any negative impact on them.
- The study site is not within or adjacent to any aquatic CBA and ESA areas. The site is within a terrestrial ESA 1.
- There are no 'fatal flaws', in terms of the water environment.

- However, the area is a dolomitic area, underlined by important dolomitic water-bearing compartments of significant importance, and any activities such as tailings facilities, sewage works, solid waste sites, and even industrial activities, the discharge of poor quality water and or even the transport of potable water supply (via pipes) and domestic wastewater (sewage) also via pipes has the potential to have a significant impact on the quality of the groundwater and the stability of the surface infrastructure (sink-hole formation);
- No Water Use Licence Application (WULA) procedures or General Authorisation (GA) procedures are required in terms of impacts on the water environment.
- However, a Licence in terms of the National Environmental Management: Waste, 2008 (Act 59 of 2008) as amended will be required.
- The formal dumping area with the boundaries of the site is fairly well managed but this is only a portion of the Site.
- The operation and management of a solid waste site do not need to expand beyond the current boundaries of the site, as there is enough "air-space" to expand the site within those boundaries and build the site upwards;
- People are living on the site this must be discouraged;
- Illegal mining activities are occurring on the site and this must be discouraged;
- Stormwater management plan including stormwater systems, such as pollution control dams must be properly constructed including and prevention of unnecessary pond or damming of water as is currently occurring on the site;
- Propose that if the site is established that a buffer zone be established a green zone of about 1 km around the site that no development is allowed such as residential areas, commercial properties, etc. that will be influenced by the odours from a Solid Waste Site; and
- The Site is more than likely on water bearing dolomite and a full geohydrological investigation needs to be done to determine if and what mitigation actions should be implemented including the management of stormwater and polluted run-off.

Substantiated Statement

The project is the expansion of the existing Libanon Landfill Site. The existing site area and the adjacent area earmarked for expansion are both transformed and badly degraded. The study site is within the historical distribution of Carletonville Dolomite Grassland, which is not an officially listed threatened veldtype (ecosystem), although some specialist view it as 'vulnerable'. The site is not within a critical biodiversity area (CBA), but is within an ecological support area (ESA 1), according to Gauteng C-Plan v4. There are no watercourses on the site, including wetlands. No floral or faunal SCC were observed during site investigations and none are expected to occur.

The study confirms (agrees with) the low sensitivity of the aquatic and plant themes, and the medium sensitivity of the animal theme, as assessed by the screening tool. However, the screening tool's terrestrial biodiversity theme's very high sensitivity is strongly disputed. The actual sensitivity is low.

Mitigating measure must be implemented. Of importance is the implementation of a surface stormwater plan, in which clean and polluted stormwater run-off must be kept separate.

From the investigations and studies conducted in 2017 and again in 2026, it is the opinion of the specialist that the proposed project and environmental impacts are acceptable.

It is the professional opinion of the specialist that the project should be approved and allowed to proceed, with the conditions of the mitigating measures.

Sensitivity map of the study area

REVIEW AND APPROVAL

Name	Title	Signature	Date
Johannes Maree	Ecology and Wetland Specialist (STEC)		**20 May 2026**
Moses Kgopana	Director (STEC)		**20 May 2026**
Yonanda Martins	Green Tree		

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department Water and Sanitation
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
EMF	Environmental Management Framework
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
SANBI	South African National Biodiversity Institute
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WUL	Water Use Licence
WULA	Water Use Licence Application

1 BACKGROUND

1.1 Project overview

The project is the licensing of the existing Libanon Landfill Site, the proposed expansion of the landfill, construction of a proper stormwater system, including the pollution control dam (PCD), and the establishment of a waste sorting and baling facility.
The Libanon Landfill Site is located outside Westonaria, Rand West City Local Municipality, Gauteng Province. The application will be submitted on behalf of the Rand West City Local Municipality.

Green Tree Environmental Consulting was appointed by Pro-Plan Consulting Engineers (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) Process for the project.

Sativa Travel and Environmental Consultants (Pty) Ltd was originally appointed as the independent specialist consultancy to conduct an ecological impact assessment in 2017.
Sativa has now been appointed and requested to update the 2017 studies.

Field investigations were initially undertaken in April 2017, with recent investigations for the project and update of studies undertaken on 29 March 2026.

1.2 Purpose of the study

The purpose of the study is to conduct an aquatic assessment to investigate the presence of watercourses and to delineate and assess them, if found to be present. Furthermore, the purpose of the study is to identify any potential fatal flaws, assess impacts, delineated buffer zones (if required), and to recommend mitigating measures aimed at reducing any potential negative impacts the project may have on the natural environment.

1.3 Quality and age of base data

The source and age of the data used included the following:

- Threatened ecosystems: SANBI (www.bgis.sanbi.org), NEMBA (G 34809, GoN 1002), 9 December 2011), Skowno, et. al. 2019. Terrestrial ecosystem threat status assessment 2018 - comparison with 2011 assessment for provincial agencies. SANBI.
- Protected areas: Protected Areas Register (PAR): DFFE – (https://portal.environment.gov.za).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012, 2018.
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Environmental Screening Tool – DFFE (www.environment.gov.za).
- National Freshwater Ecosystem Priority Areas (NFEPA) – DWS & SANBI databases.
- National Wetland Map 5 (2018) – CSIR, SANBI (www.bgis.sanbi.org).

- National Wetland Map 6 (2022) – Freshwater Biodiversity (https://freshwaterbiodiversity.org).
- Gauteng Province Conservation Plan (C-Plan) v.4

1.4 Assumptions and Limitations

The assumptions and limitations for the assessment are as follows:

- Information regarding the proposed project as provided by the Client is taken to be accurate.
- Site investigations were conducted on 29 March 2026, which is within the wet (summer) season for the region and which is the preferred season for field investigations in the region. Previously site investigations for the same site and study were conducted in May 2017.
- No additional investigations are required or recommended in terms of biodiversity, including a dry (winter) season assessment, because the area is well known to the Specialist, who has conducted several identical projects in the immediate area. The area is also a summer rainfall area and summer assessments, after some good rainfall is the best period for accurate assessments regarding flora and fauna.
- Precise buffer zones or exact GPS positions are accurate to within 2-3m.
- ArcGIS (v10.8); Google Earth Pro; and other computer-based programmes were used.
- No specific limitations were encountered, which could have a significant impact on the outcomes of the assessment and report findings.
- During site investigations all areas of the study site were easily accessed and evaluated.
- **NOTE**: Recommendations put forward in the report are based on actual biodiversity and specialist findings, but this does not mean that legal requirements do not still apply. In other words, recommendations do not negate legal requirements as set out in various acts such as NEMA (Act 107 of 1998) and NEMBA (Act 10 of 2004).
- **NOTE**: Recommendations and impact assessments are based on the project information and location as obtained from the Client and shown in this report. Any later changes in project layout, site location, etc. may negate the findings and recommendations of the study and report.

1.5 Duration, Season and Relevance to the Outcome of the Assessment

The site investigations were conducted on 29 March 2026, which is during the region's summer season. The study site is within a summer rainfall region and at the time of investigation all dormant plants would have emerged and flowered. The duration of the site investigation was only one day. However, the time was adequate in terms of easily assessing and traversing the study site (property). The season of the site investigations would be relevant to the outcome of the assessment if the study site were within good to moderate Highveld grassland habitat. However, the study site is mostly an existing landfill site and the entire study site is transformed and highly degraded, therefore, the season had no relevance or impact to the outcome of the assessment.

The specialist who conducted the site visit also has good knowledge and expertise of the area and ecosystems present, having conducted several similar studies in the area of Harbeespoort and the Hartebeesfontein Dam. Therefore, the duration of the investigation is considered adequate and no other studies, including a winter (dry) season study, is considered necessary.

2 METHODOLOGY

2.1 Desktop Assessment

A literature review was conducted regarding the main vegetation types, rivers, catchment areas and wetlands of the general region and of the specific study area. Various government departments such as the Department of Environment Affairs (DEA) and the Department of Water and Sanitation (DWS) were contacted and / or their databases utilised, to obtain background information on the relevant environment, as well as to obtain input relating to current legislation. For example, the National Water Act, Maps, Google Earth and other relevant data sets were used, specifically with regard to watercourses and wetlands in the study area.

Existing datasets from organisations such as South African National Biodiversity Institute (SANBI), Endangered Wildlife Trust (EWT), Birdlife SA, etc. were consulted and assessed to determine the presence or absence of priority areas within, or close to, the study area. Relevant Provincial conservation plans and sector plans were also consulted.

2.2 Field Surveys

Field surveys were conducted during which time cognisance was taken of the following environmental features and attributes:

- Biophysical environment
- Regional and site-specific vegetation
- Habitats ideal for potential red data faunal and floral species
- Watercourses and water bodies

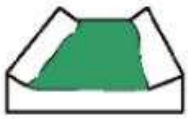
Digital photographs and GPS reference points of importance where recorded.

2.3 Definitions

2.3.1 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according to the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 1).

According to the DWS document and the National Water Act (NWA) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*."

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1]	
			Surface	Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/***
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans)		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/***	*/***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/*** Contribution may be small or important depending on the local circumstances

*/*** Contribution may be small or important depending on the local circumstances.

Wetland

Figure 1: Classification of wetlands

Furthermore, the guidelines stipulate that wetlands must have one or more of the following defining attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and

- A high-water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50cm of the soil.

During the site investigation, the following indicators were used to determine whether an area needed to be defined as a wetland or not, namely:

- Terrain unit indicator;
- Soil form indicator;
- Soil wetness indicator; and
- Vegetation indicator.

2.3.2 Riparian zones

Riparian vegetation is typically zonal vegetation closely associated with the course of a river or stream and found in the alluvial soils of the floodplain. According to the National Water Act (NWA) riparian habitat is defined as including "*The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.*"

It is important to note that the NWA states that the riparian zone has a floral composition distinct from those of adjacent areas. The NWA also defines riparian zones as areas that "c*ommonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments*."

2.4 Present Ecological State (PES)

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourse is found, prior to any further developments or impacts from the proposed project. The PES of watercourses found in the study area is just as important to determine, as are the potential impacts of the proposed development. The PES of a watercourse is assessed relative to the deviation from the Reference State (also known as the Reference Condition).

The reference state is the original, natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES Method (DWA, 2005) was used to establish the present state (integrity) of the unnamed drainage line in the study area. The methodology is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999).

Table 1 shows the criteria used for assessing the habitat integrity (PES) of wetlands and other watercourses, along with

Table 2 describing the allocation of scores to the various attributes. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a watercourse.

Table 1: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.

Rating Criteria	Relevance
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 2: Scoring guidelines for habitat assessments

Scoring guidelines per criteria	
Natural / unmodified	5
Mostly natural	4
Moderately modified	3
Largely modified	2
Seriously modified	1
Critically modified (totally transformed)	0

Table 3 provides guidelines for the determination of the Present Ecological Status Category (PESC), based on the mean score determined for the assessments. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the PESC (DWA, 2005).

Table 3: Wetland integrity categories

Category	Mean Score	Description
A	>4	Unmodified, natural condition.
B	>3 to 4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2,5 to 3	Moderately modified, but with some loss of natural habitats.
D	2 to 2,5	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
E	>0	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The integrity of watercourses with a category rating of F, E & D were deemed to be Low. Category rating of C was deemed to be Medium, while Category ratings of B & A were deemed to be High.

2.5 Ecological Importance and Sensitivity (EIS)

Ecological importance and sensitivity (EIS) looks at the importance of the wetland, watercourse or water ecosystem in terms of biodiversity and maintenance. The determination is not just based on the identified watercourse in isolation, but also its' importance in terms of supplying and maintaining services to the larger catchment and water systems up and downstream.

The ecological sensitivity (ES) part of the EIS looks at how sensitive the system is to changes in services and environmental conditions. The Recommended Environmental Management Class (REMC) is the recommended state to which the watercourse should be returned to or maintained at. The EIS categories and descriptions are outlined in the table below (Table 4).

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem / watercourse / wetland in terms of EIS, PES and function, and the desire to with realistic recommendations and mitigating actions to return the system to a certain level of functionality and original state.

Table 4: EIS Categories and Descriptions

EIS Categories	Median Range	Category
Wetlands that are considered ecologically important and sensitive on a **national or international** level. The biodiversity of these wetlands is usually very sensitive to flow & habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	Very high 3 - 4	A
Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	High 2 - 3	B
Wetland that are considered to be ecologically important and sensitive on a **provincial or local** scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	Moderate 1 - 2	C
Wetlands that are not ecologically important and sensitive on any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	Low 0 - 1	D

2.6 Impact Assessment

The impact assessment considers the nature, scale and duration of the effects on the natural environment and whether such effects are positive (beneficial) or negative (detrimental).

A rating/point system is applied to the potential impact on the affected environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue, the following criteria are used and points awarded as shown:

- Extent: National - 4; Regional – 3; Local – 2; Site – 1.
- Duration: Permanent – 4; Long term – 3; Medium term – 2; Short term – 1.
- Intensity: Very high – 4; High – 3; Moderate – 2; Low – 1.
- Probability of Occurrence: Definite – 4; Highly probable – 3; Possible – 2; Impossible – 1.

2.7 Criteria for the Classification of an Impact

Nature

A brief description of the environmental aspect being impacted upon by a particular action or activity is presented.

Extent (Scale)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

- Site: Within the construction site
- Local: Within a radius of 2 km of the construction site
- Regional: Provincial (and parts of neighboring provinces)
- National: The whole of South Africa

Duration

Indicates what the lifetime of the impact will be.

- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase.
- Medium-term: The impact will last for the period of the construction phase, where after it will be entirely negated.
- Long-term: The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity

Describes whether an impact is destructive or benign.

- Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
- Medium: Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.
- High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Very high: Natural, cultural and social functions and processes are altered to extent that they permanently cease.

Probability

Probability is the description of the likelihood of an impact actually occurring.

- Improbable: Likelihood of the impact materializing is very low.
- Possible: The impact may occur.
- Highly probable: Most likely that the impact will occur.
- Definite: Impact will certainly occur.

Significance

Significance is determined through a synthesis of impact characteristics. It is an indication of the importance of the impact in terms of both the physical extent and the time scale and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Using the scoring from the previous section, the significance of impacts is rated as follows:

- Low impact: 4-7 points. No permanent impact of significance. Mitigating measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
- Medium impact: 8-10 points. Mitigation is possible with additional design and construction inputs.
- High impact: 11-13 points. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
- Very high impact: 14-16 points. The design of the site may be affected. Intensive remediation as needed during construction and/or operational phases. Any activity, which results in a "very high impact", is likely to be a fatal flaw.

Status

Status gives an indication of the perceived effect of the impact on the area.

- Positive (+): Beneficial impact.
- Negative (-): Harmful or adverse impact.
- Neutral Impact (0): Neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo.* That is, should the project not proceed. Therefore, not all negative impacts are equally significant. The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented.

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study site (project site) is situated on Portion 41 of the farm Gemspost 288 IQ, Westonaria, Rand West city Local Municipality. The project site is approximately 40ha in extent and the entire site will be used for the disposal and recycling of waste.

The site is located approximately 3.5km south-west of the Westonaria Central Business District, but is located within 0.95km of the Westonaria residential neighbourhood.

Other residential neighbourhoods include Waterkop, Hillshaven and Glenharvie, located to the south of the N12. The Libanon Landfill Site has been in operation since the early 1980's, and general domestic waste from the municipal service area is disposed of at this site.

According to the GDARDE's Pollution Buffer Zone Guideline (2017), the recommended buffer zone of a general landfill is 400m. The proposed project site is approximately 900m from the closest residential neighbourhood of Westonaria.

- Libanon Landfill Site (Approx. centre): 26°19'42.53"S; 27°37'15.99"E.
- 1:50 000 map grid references – 2627BC.
- Quaternary Drainage Area: C23D.
- Gauteng EMF Zones: Normal Control Zone

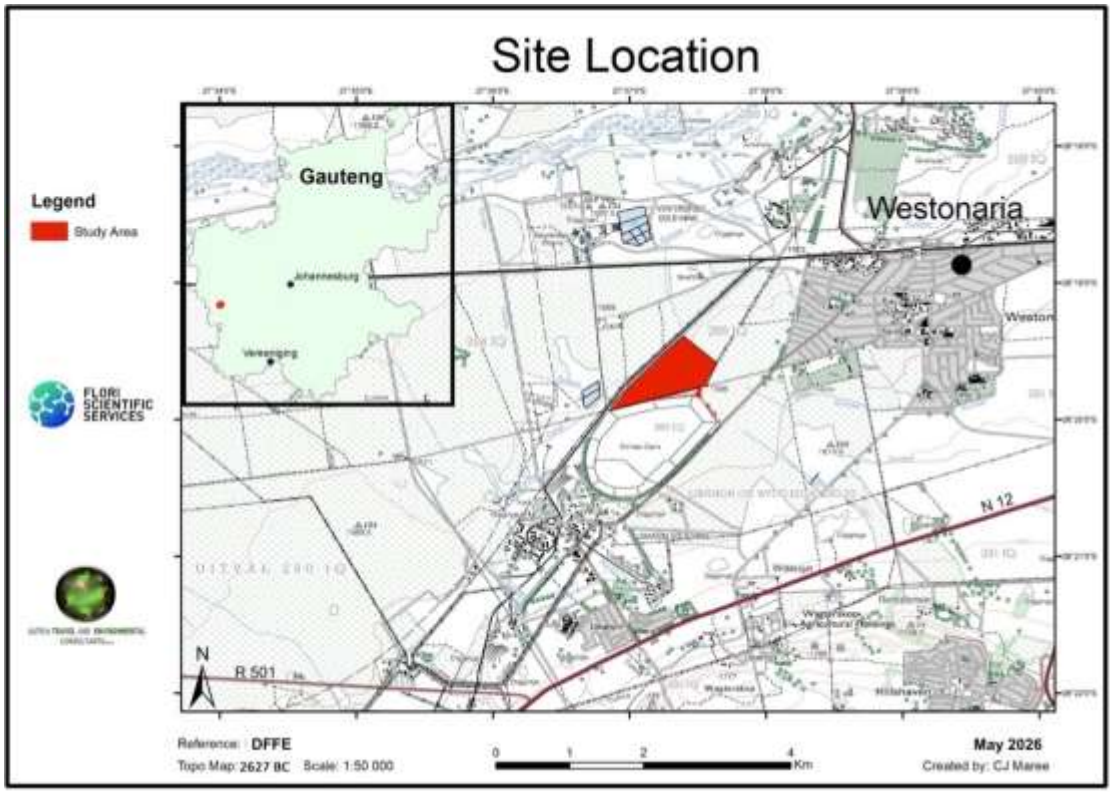


Figure 2: Site location

Figure 3: Site location (Google Earth)

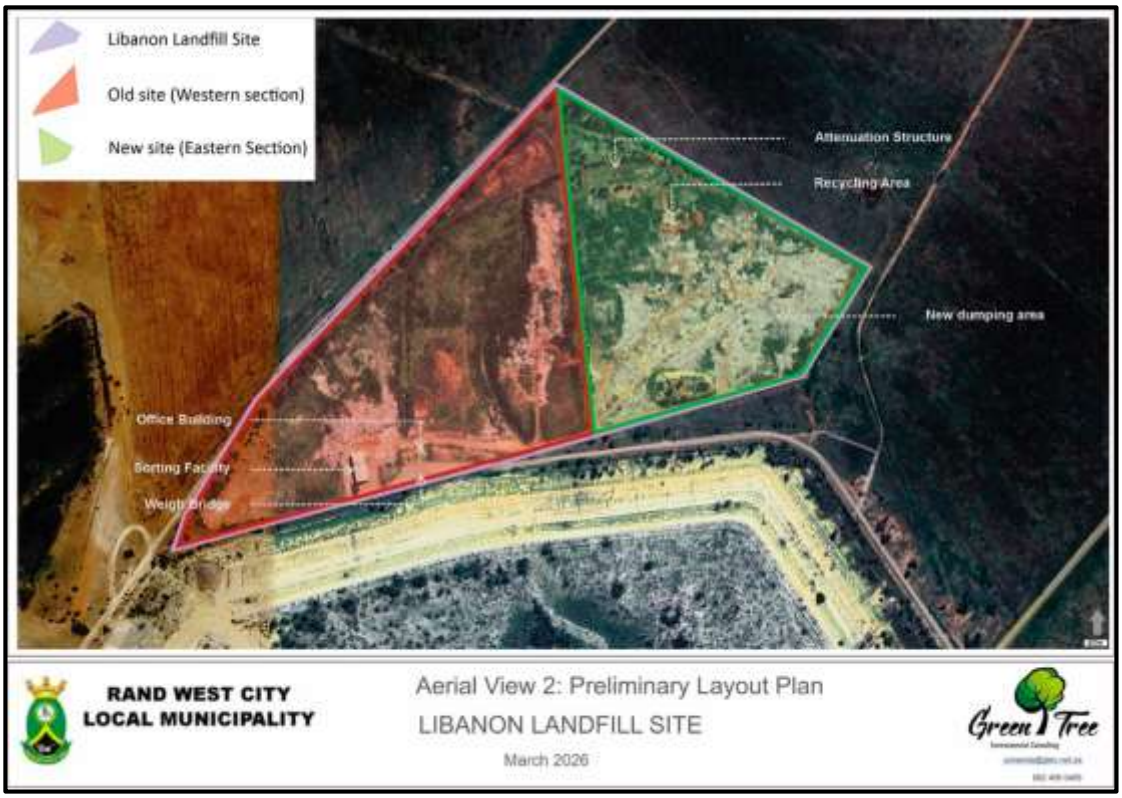


Figure 4: Project layout (Green Tree, 2026)

3.2 Description of the Site

The Site (Libanon) is an existing, operational solid waste site and the following activities, infrastructure and features were noted on site:

- The Site is approximately 41 ha;
- The Site is fenced in by a 2.5 m high concrete palisade fence (See Photo 1, below in Appendix 8.1);
- The Site's formal entrance is to the south of the site;
- The Site's access road is via a road that runs around the tailings dam on the western side and then follows around the tailings dam on the northern side between the solid waste site and the tailings facilities. The access road is a turn off from a road between Westonaria and the Mine Village running in an approximate north-east to south-west direction on the southern side of the tailings dump facility;
- There is another road, and track, running from Westonaria to the Mine Village, also in a north-east to south west direction (approximately). This road is used to access the cemetery. There is a gate, but uncontrolled entrance on the northern side of the Site;
- On the eastern side of the Site are trenches or excavations are filled with stormwater run-off (polluted) and will be having an impact on the dolomitic groundwater and are being used for the

processing of illegally mined ore or illegally mined tailings (See Photo 2 and Photo 3 below in Appendix 8.1). In the photographs, it can be seen stockpiles of ore, which has been brought onto site, obviously by truck or light delivery vehicles;

- Approximately only a third of the site (western side) is formal structured waste disposal taking place, where the waste is transported onto the site, compacted and covered;
- The middle part of the site, middle third is currently largely unused and open with some potentially cover material stock-piled;
- On the eastern side of the Site, one third of the site, is currently being used most by scavengers who are collecting the waste that can be recycled (See Photo 4 and Photo 5, below, in Appendix 8.1);
- The area outside of the Site, to the north, west and north-east is mainly open veld. The area is obviously being used for grazing. Parts of the veld is in fairly good condition, but most is burnt regularly, over-grazed and as a result in poor condition.

3.3 Rand West City Local Municipality

The Libanon Solid Waste Site is being developed to serve the Rand West City Local Municipality. Westonaria is situated amidst gold fields and forms the nucleus of five gold mines. The town is approximately 45 km from Johannesburg and is accessible by road and rail making it convenient for commuters to Johannesburg.

The greater Westonaria consists of several satellite towns, being, Westonaria, Hillshaven, Glenharvie, Venterspost, Libanon, Waterpan, Bekkersdal, Simunye. Westonaria was proclaimed in 1938 as a result of all the mining activities that took place in this area since 1910 when the first shaft – Pullinger Shaft was sunk.

Venterspost town was proclaimed in 1937; Hillshaven, Glenharvie, Waterpan and Libanon were mainly established as mining residential areas. Rand West City Local Municipality is providing services to these areas. Zuurbekom is mainly earmarked for agricultural purposes. Bekkersdal was established in 1945 and administered under Westonaria Town Council; Simunye Proper is situated next to the R28 and Simunye Extension 2 (Phases 1 – 4) was developed for the development of the Presidential RDP project.

South Africa's first national democratic election held in April 1994 heralded change to the old system of separate development and resulted in the amalgamation of the Bekkersdal Town Committee with the Westonaria Town Council forming a council serving the communities of the greater Westonaria.
The amalgamation was officially announced in the Government Gazette of 9 December 1994.

3.4 Topography

The topography of the study site and immediate surrounding area is that of flat to very flat plains with little relief or undulation. There are mountain ridges to the south running in an east west direction and the Wonderfonteinspruit to the north running in an east west direction. The average height above sea level across the study area is approximately 1580 amsl (See the red square of the position of the Site in Figure 5, below).

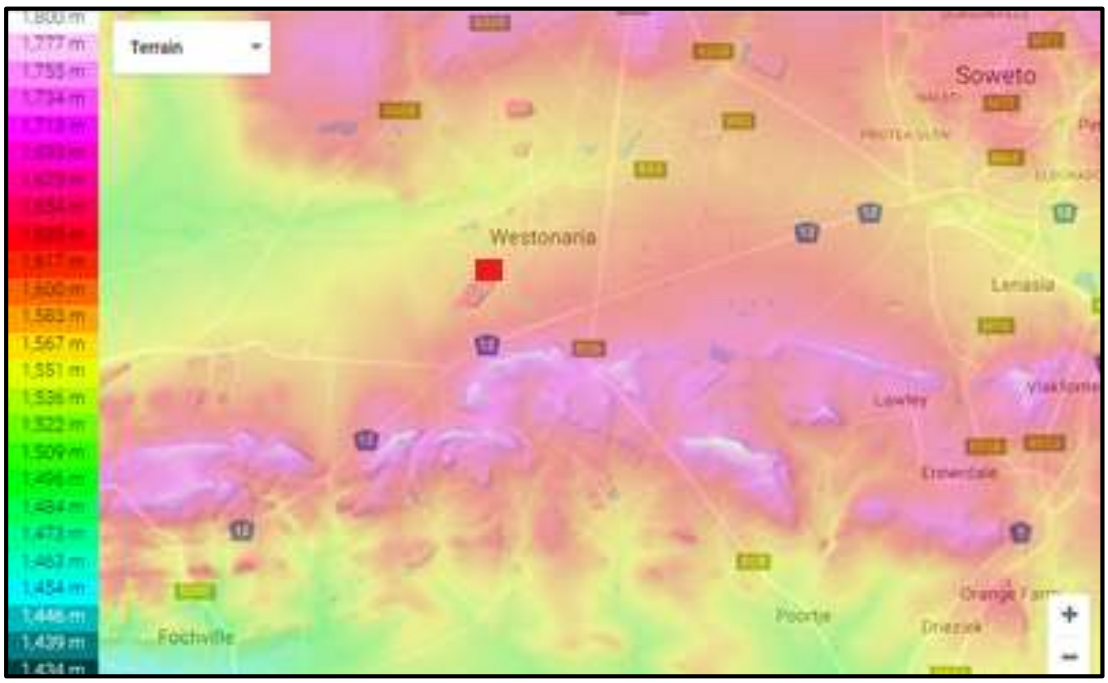


Figure 5: Topography (http://en-za.topographic-map.com)

3.5 Climate

The climate of Study Area, Westonaria (West Gauteng) normally receives about 604mm of rain per year, with most of the rainfall occurring during summer. The area receives the lowest rainfall (0mm) in July and the highest (113mm) in January. The study site is situated within the 600 mm – 800 mm high rainfall area of South Africa (Figure 6).

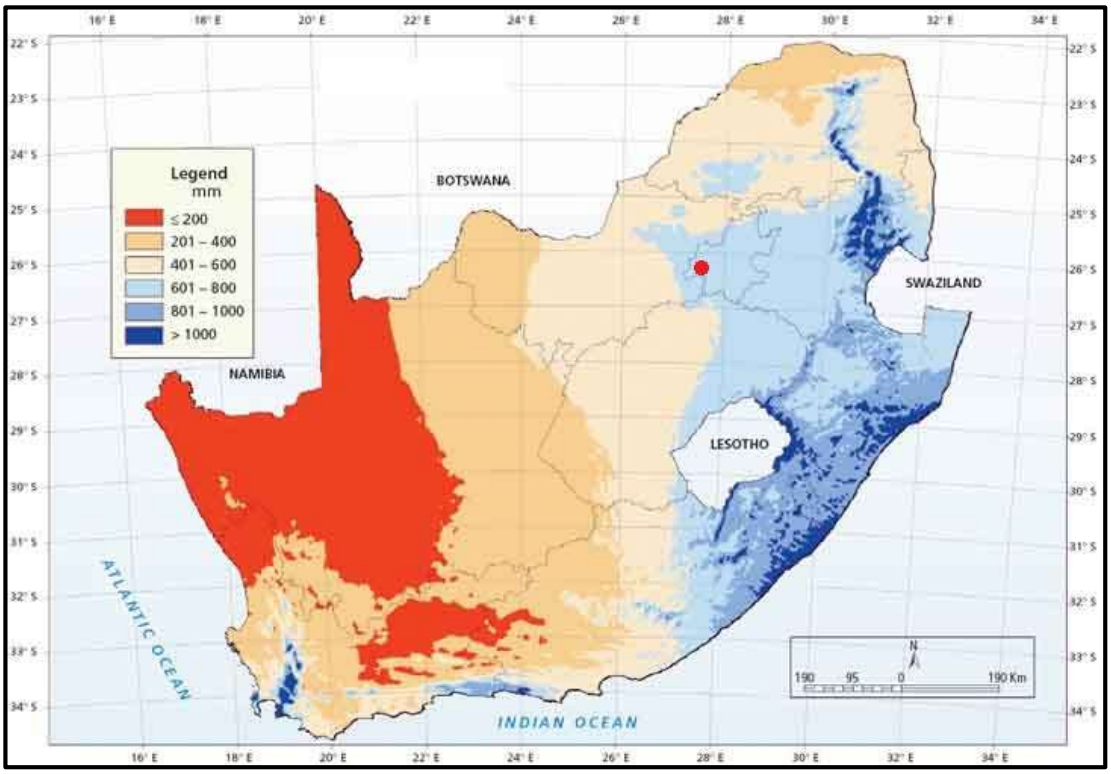


Figure 6: Rainfall averages for South Africa (FAO)

The monthly distribution of average daily maximum temperatures for the area is 16.6°C in June to 26.2°C in January for the midday temperatures. The area is the coldest during July when temperatures drop to 0.8°C on average during the night (www.saexplorer.com). The study site is within the Cold Interior climatic zone of South Africa (Figure 7, below).

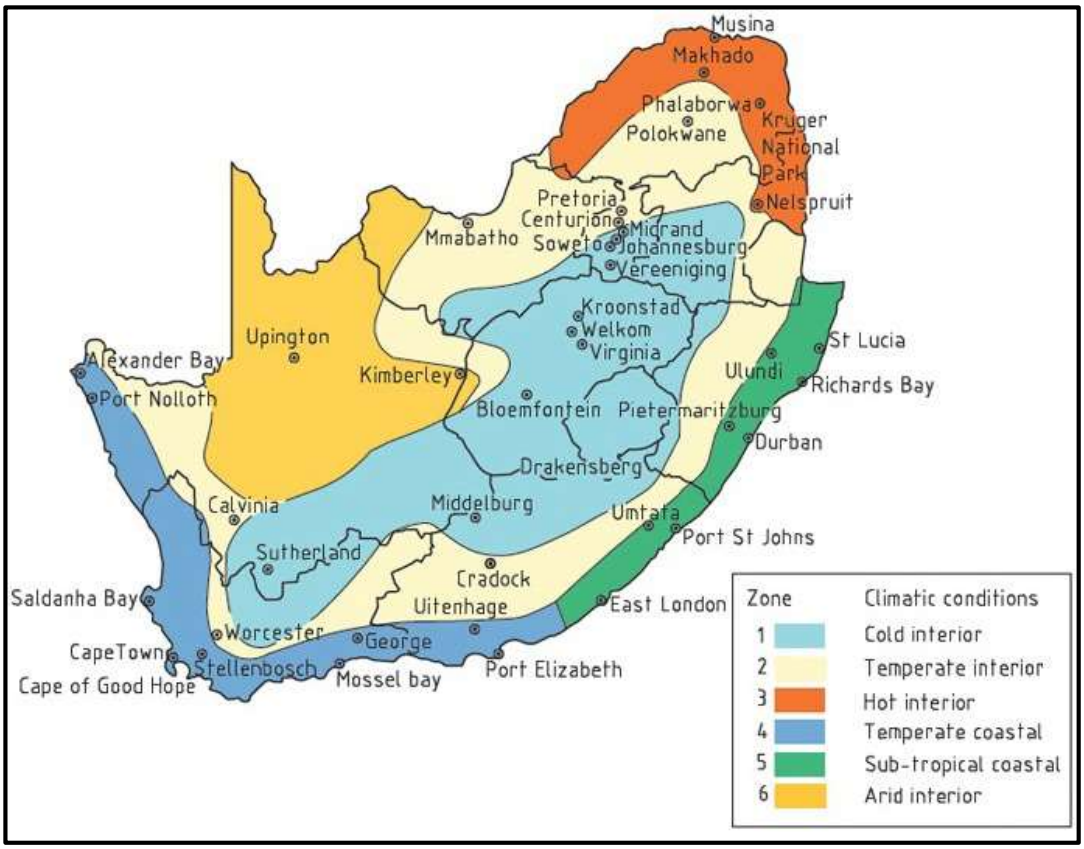


Figure 7: Climatic zones of South Africa

3.6 Landcover

The landcover or landuse of the area is predominantly cultivation and farmlands, with the dense, urban areas of Westonaria to the northeast and Libanon to the immediate southwest. Other landuses include mining activities, tailings dam and of course the Libanon Landfill Site. The study area consists of an existing and operational solid waste site (landfill site) and cultivated farmland.

The landuses have not change significantly between 2017 and 2026. A visible contrast is the increase in inactive cultivated land in the vicinity between the Libanon Landfill Site and the urban area of Westonaria. A comparison of the Environmental and Current Landuse Plans of 2017 and 2026 (during the same period of the month of May) are shown below (Figure 8, Figure 9).

Figure 8: Environmental & Current Landuse Map (2026)

Figure 9: Environmental and Previous Landuse Map (2017)

3.7 Vegetation

South Africa is divided up into nine major Biomes. The study area and the surrounding region fall within the Grassland Biome (Figure 10). The Grassland Biome can be naturally subdivided into dry and moist grassland regions. Grassland veldtypes with a rainfall of 600mm+ per annum tend to be dominated by sour, andropogonoid grasses. While in veldtypes with an average rainfall of below 600mm per annum, the sweet chloridoid grasses tend to be more common. Dry and moist grassland types are divided primarily on the basis of rainfall, with 500-700mm being the broad boundary. Historically, such as with the classification of veld types by JPH Acocks (1952) and AB Low & AG Rebelo (1998), these grasslands have been divided into sweet grasses (sweetveld) and sour grasses (sourveld) based primarily on agricultural or grazing criteria. In high rainfall areas (moist grasslands) sour grasses tend to dominate, while in low rainfall areas the sweet grasses (which are more palatable for livestock) tend to dominant. Grasslands (like any other vegetation type) are also influenced and shaped by numerous environmental factors such as temperature, soils and altitude.

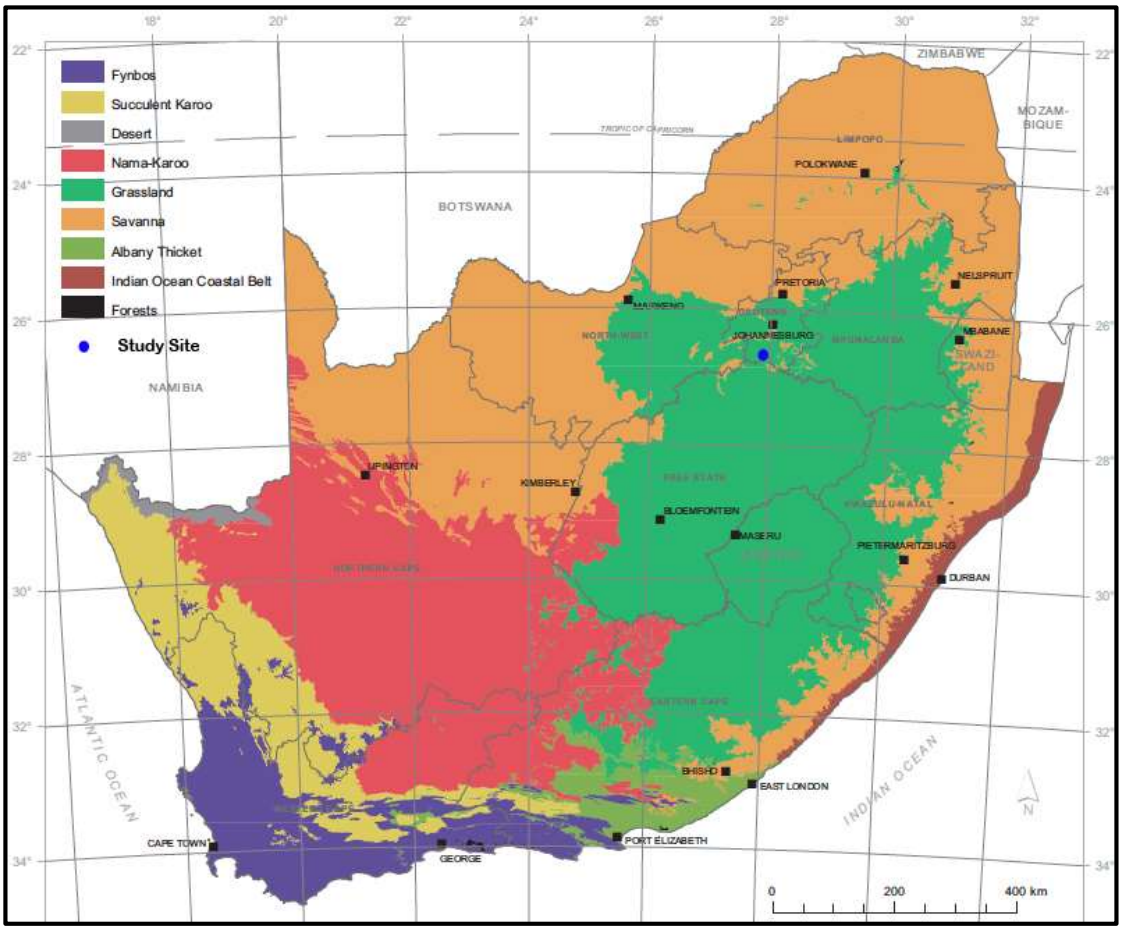


Figure 10: Biomes of South Africa

Mucina and Rutherford (eds) (2006) subdivided the Grassland Biome into four main bioregions. Namely, Dry Highveld Grasslands; Drakensberg Grasslands; Meisic Highveld Grasslands; and Sub-Escarpment Grasslands. These subdivisions of the Grassland Biome are based on gradients of altitude (height above sea-level) and moisture (rainfall). Altitude has a strong influence on climatic variables and an increase in altitude usually corresponds with an increase in rainfall and a decrease in temperature.

Grassland vegetation types are typically dominated by a single, lower-layer of grasses, with the occurrence of a middle layer of shrub and upper layer of trees being rare to absent, except in a few localised habitats such as koppies (rocky outcrops) and rocky ridges.

The study site is situated within the Dry Highveld Grassland Bioregion (Figure 11). The study site is situated entirely within Carletonville Dolomite Grassland (Figure 12). Carletonville Dolomite Grassland is also known as Bakenveld (Acocks, 1953) and Rocky Highveld Grassland (Low & Rebelo, 1996). Table 5 shows the hierarchy and classifications of the vegetation of the study area.

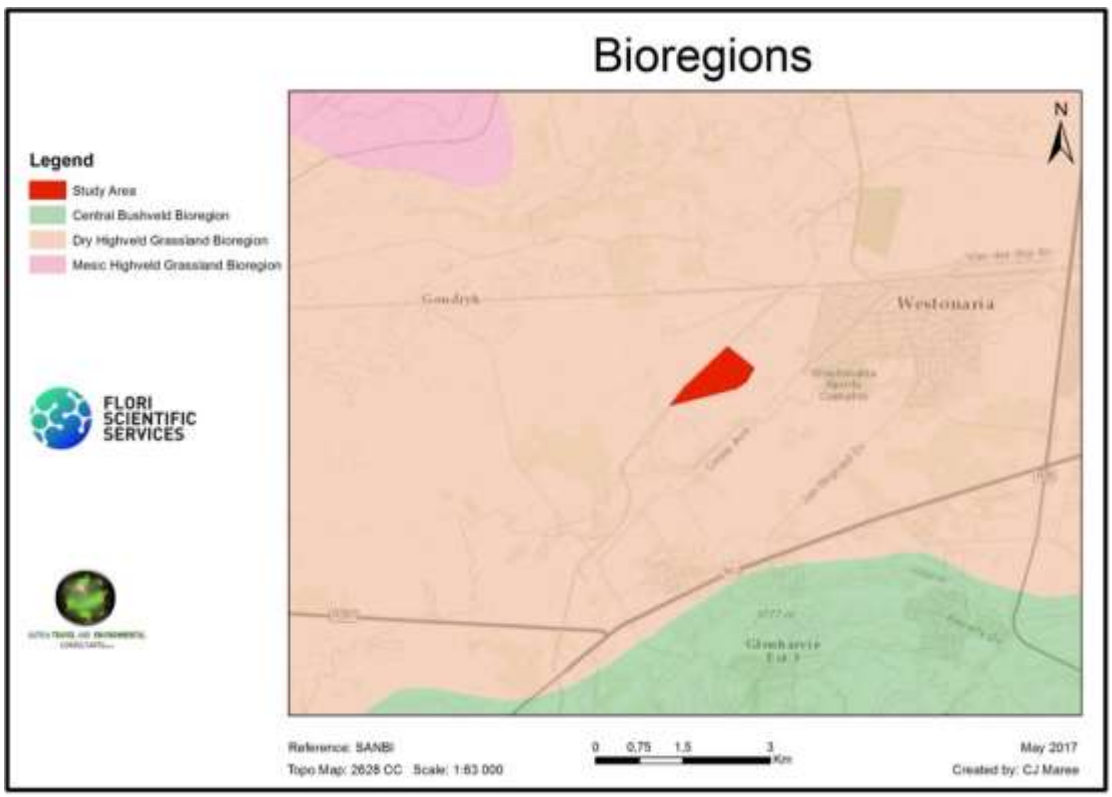


Figure 11: Bioregions

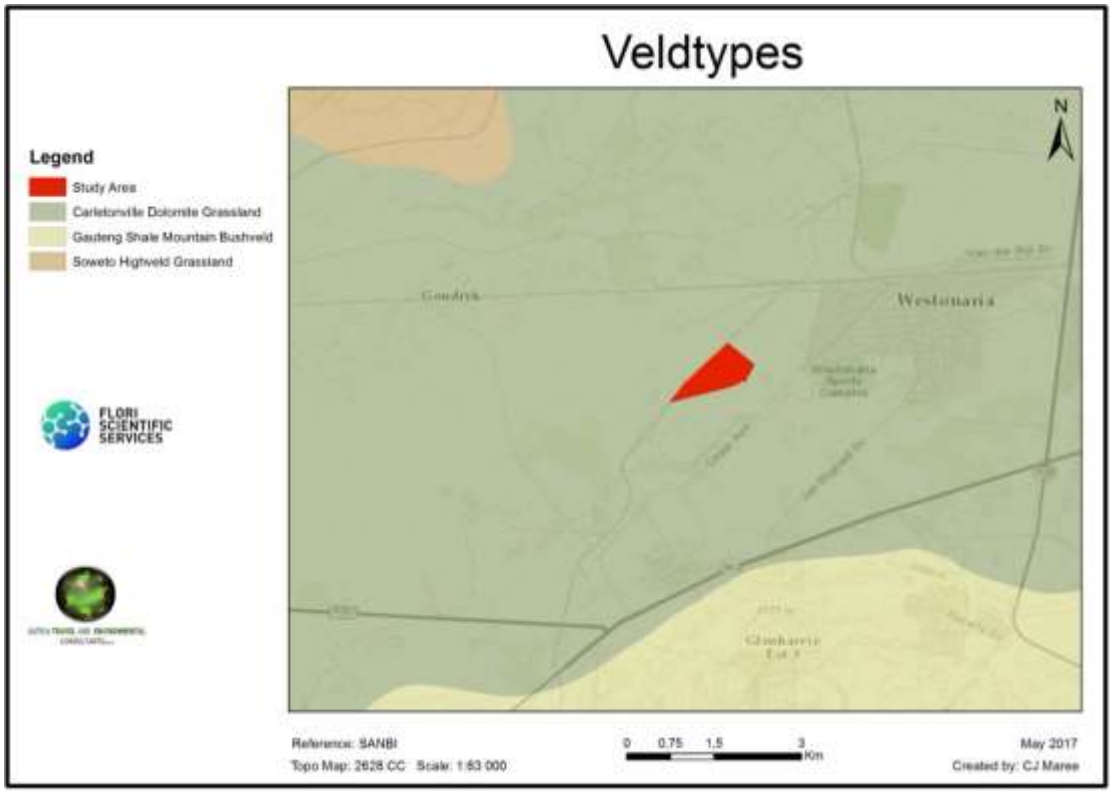


Figure 12: Veldtypes

Table 5: Vegetation classification of the study site

Category Description	Classification
Biome	Grassland
Bioregion	Dry Highveld Grassland
Vegetation Types	Carletonville Dolomite Grassland

Carletonville Dolomite Grassland is a veldtype that is characterised by lightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species (Mucina & Rutherford, 2006). The veldtype is dominated by a wide variety of grasses such as *Aristida* spp., *Digitaria* spp., *Eragrostis* spp., *Cynodon dactylon* (Couch grass) and *Heteropogon contortus* (spear grass).

The vegetation of the study site is not characteristic of Carletonville Dolomite Grassland. The vegetation of most of the study site (which is the existing Libanon Landfill Site) is totally transformed, with a mix of indigenous grasses and alien weeds, but no functional grassland ecosystem at all. The vegetation of the remainder or the study site (which is the proposed extension area) is old, cultivated land and grazing farmland. The hardy pioneer and establishing grasses recover and return within a short period of time if the land is left fallow, but the vegetation of the grassland areas of the proposed extension area is mostly modified and badly degraded.

3.8 Watercourses in the Study Area

There are no wetlands (including freshwater pans), rivers, streams, distinct drainage lines or dams in the study area. There are excavated areas on the site that have filled with stormwater run-off from the site. These disturbed areas impound rain water and stormwater run-off, resulting in small dams, but these are not natural features.

The closest river / stream to the Site is the Wonderfonteinspruit (See Figure 13, below), which is a major perennial river, and is approximately 3 km to the north of the site. The Wonderfonteinspruit flows in an east to west direction on the northern side of the site.

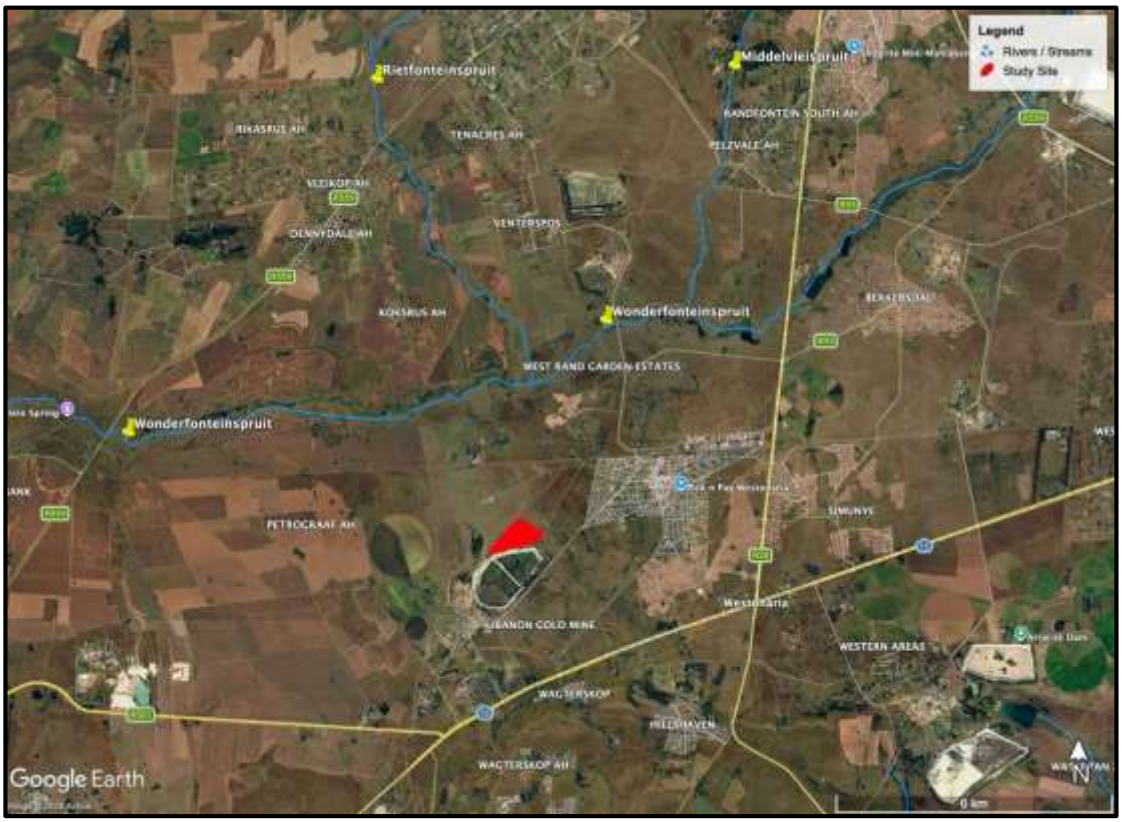


Figure 13: Wonderfonteinspruit

This piece of river is unique in that it is piped (transported) in a steel pipe, 1 m in diameter, for approximately 25 km from the Donaldson Dam (attenuation dams) in the north-east, to the town of Carletonville in the west, where the water is released back into the river.

This water is transported through the pipe because the integrity of the upper geological levels has been compromised and with the underlain de-watered dolomitic compartment (water has been pumped out by the mines) the water from the river filters directly into the dolomitic layers and into the mined areas and floods the mines. The water in the river only flows during the summer, rainfall season. It is possible that

farmlands in the region that are being irrigated take water directly from this pipeline or are supplied directly by the mines that are pumping the water from underground.
The Wonderfonteinspruit originates on the southern side of the ridge (Witwatersrand ridge) running through Krugersdorp approximately 5 km south of the Krugersdorp CBD. The Wonderfonteinspruit flows south through the Donaldson Dam, then in an east-west direction from the southern part of Randfontein, through Westonaria to Carletonville. The river flows on south and somewhere north-west of Potchefstroom confluences with the Mooi River, which is a tributary of the Vaal River.

There are two wetland systems to the east of the study site and within the 500m wetland assessment area. The wetlands are shallow valley bottom wetlands, that might in some cases be described as a wetland flat. These wetlands are highly degraded and disturbed by historical cultivation and ploughing through them. Other present negative impacts include regularly burning of the wetland vegetation, grazing of cattle, movement of people through the wetlands, etc.

The latest national wetland map shows the wetlands along the eastside of the study site. It does not highlight the artificial ponds / dams to the westside of the study site. The latest wetland map (Map 6, 2022) is over laid on a Google Earth map below (Figure 14).
Figure 14, below, also indicates the 500m wide wetland assessment area around the study site. This is an actually an indication of whether the project footprint is within 500m of delineated wetlands. If within this 500m zone then a risk assessment matrix and possible water authorisation process is required, depending on the assessed level of impact.

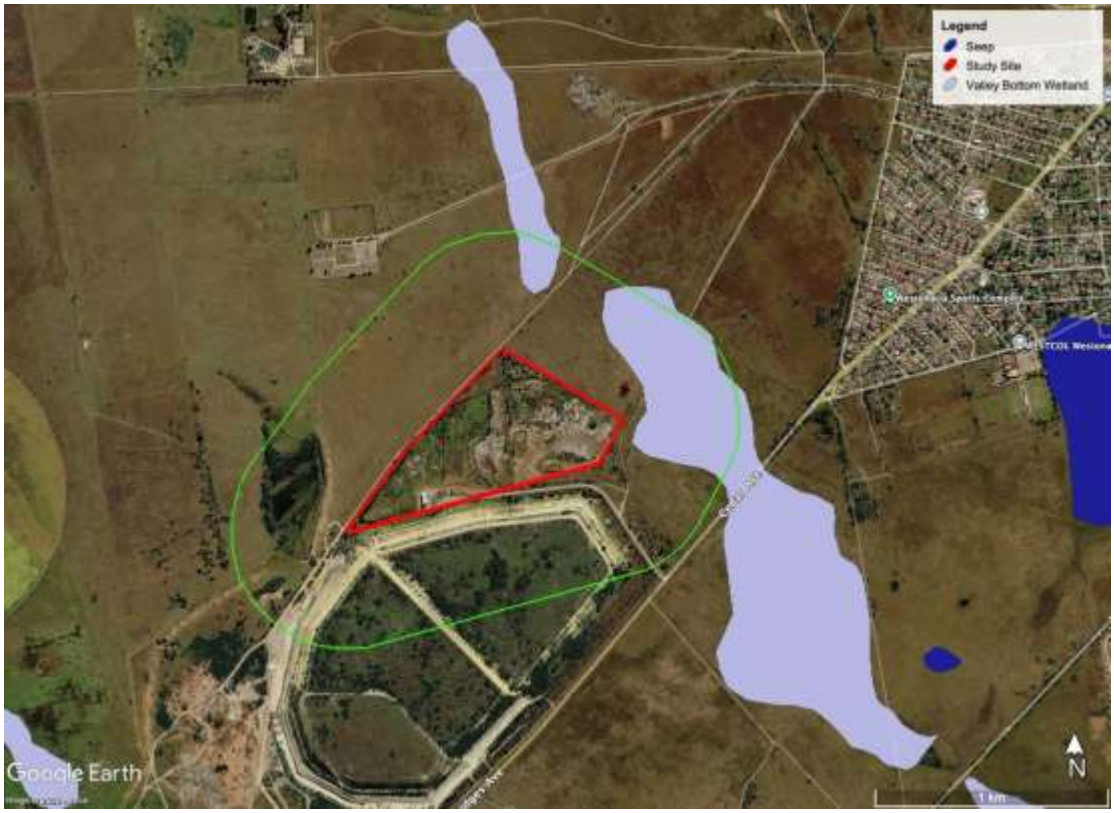


Figure 14: National Wetland Map (Map 6, 2022) and 500m wetland assessment area around site

3.9 Classification of Watercourses in the Study Area

Watercourses identified are classified along different hydrogeomorphic (HGM) units, typically up to Level 5, in terms of six levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013).

LEVEL 1 System	**LEVEL 2 Regional setting (Ecoregion)**	**LEVEL 3 Landscape Unit**	**LEVEL 4 HGM Unit**	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	• Valley floor • Slope • Plain • Bench	River	• Mountain headwater stream • Mountain stream • Transitional stream • Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channelled valley bottom wetland	
			Unchannelled valley bottom wetland	

			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected) • Without channel outflow (disconnected)
			Wetland flat	

LEVEL 5 Hydrological Regime	LEVEL 6 Ecosystem Characteristics
• Perenniality (Perennial & non-perennial) • Period & depth of inundation (Limnetic (>2m) and Littoral (<2m) maximum depth at the average annual low water level) • Period of saturation (Only of relevance to actual wetlands)	• Natural vs artificial • Salinity • pH • Substratum type • Vegetation cover type • Geology

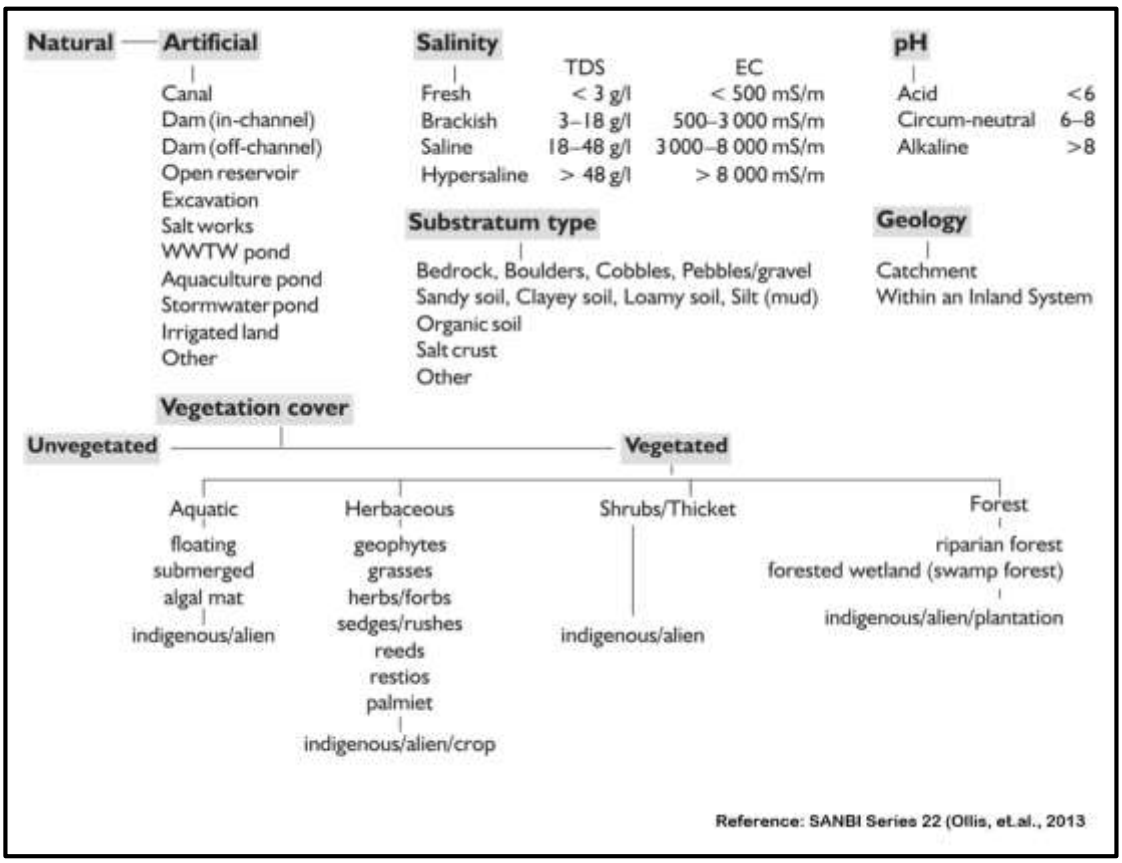


Figure 15: Schematic of Level 6 (Ecosystem Characteristics)

Identified watercourses were classified as shown below in Table 6.

Identified watercourses are classified along different hydrogeomorphic (HGM) types, up to Level 5, in terms of levels as refined for South Africa by Kleynhans, *et. al*. (2005) and as used in the Classification

System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013) (See appendices - Section **Error! Reference source not found.**).

Table 6: Classification of watercourses in the study area

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit	Level 5
Wetlands outside of study area	Inland	Dry Highveld Grassland	Plain	Unchannelled valley bottom wetland / wetland flat	- Non-perennial (Seasonal) - Littoral: <2m maximum depth at the average annual low water level

3.10 Drainage Regions

South Africa is naturally divided up into several geographically or topographically occurring Primary Drainage Areas (PDAs) (Figure 16). The PDAs can be naturally divided further into a number of Quaternary Drainage Areas (QDAs). The different areas are demarcated into Water Management Areas (WMAs) and Catchment Management Agencies (CMAs). Until recently, there were 19 WMAs and 9 CMAs. **Error! Reference source not found.** shows the extent of the old (or previous) Water Management Areas (WMAs). As of September 2016, these were revised and there are now officially only 9 WMAs, which correspond directly in demarcation and area to the 9 CMAs (Figure 17) (Government Gazette, 16 September 2016. No.1056, pg. 169-172).

The study area is situated in the Primary Drainage Area (PDA) of C and the Quaternary Drainage Area (QDA) of C23D (Figure 16 & Figure 18). The study area is within the Vaal Water Management Area (WMA 5) (previously under the Upper Vaal WMA) and now under the jurisdiction of the Vaal Catchment Management Agency (CMA 4) (Figure 17). The Catchment and water management information for the study site is summarised below (Table 7).

Table 7: Summary of Catchment Areas

Level	Category
Primary Drainage Area (PDA)	C
Quaternary Drainage Area (QDA)	C23D
Water Management Area (WMA) – Previous / Old	Upper Vaal
Water Management Area (WMA) – New (as of Sept. 2016)	Vaal (WMA 5)
Catchment Management Agency (CMA)	Vaal (CMA 5)

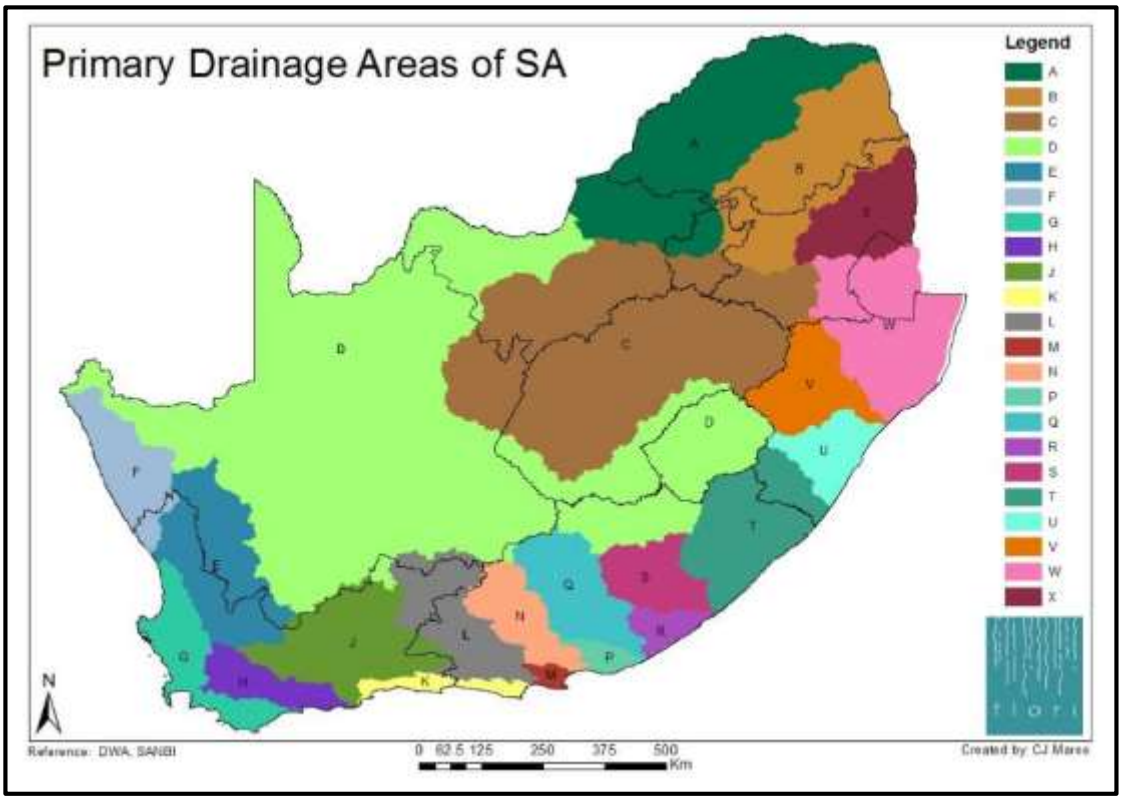


Figure 16: Primary Drainage Areas of South Africa

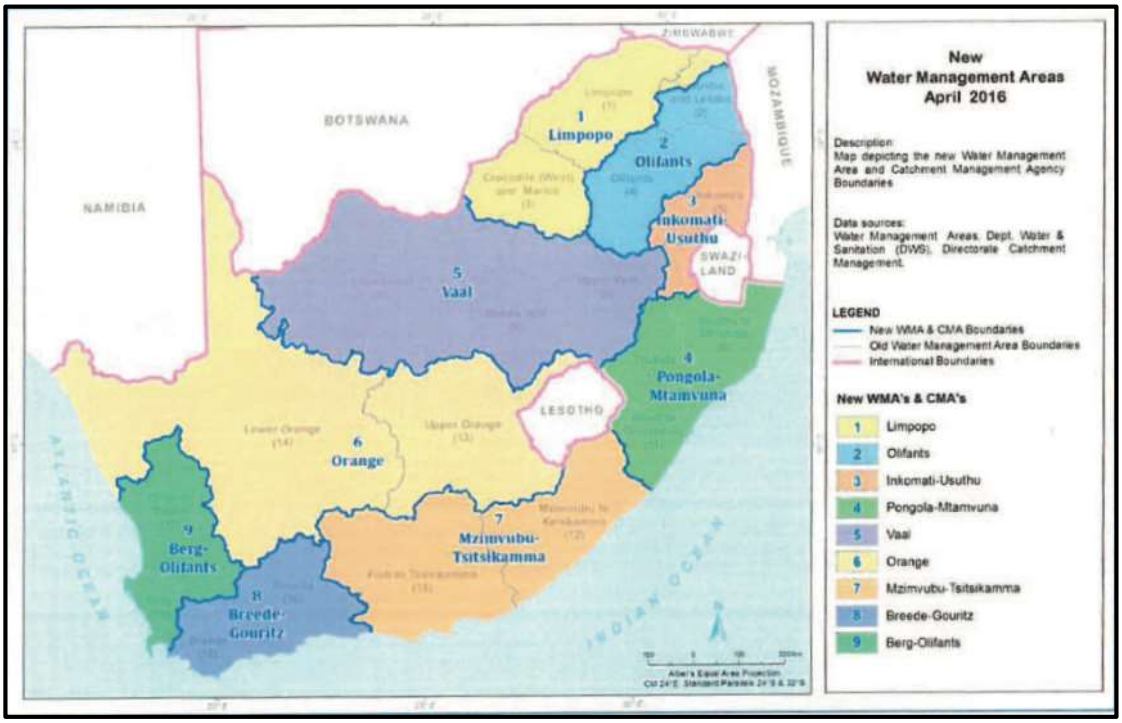


Figure 17: New WMAs & CMAs of South Africa

Figure 18: QDAs of the Study Area

3.11 Strategic Water Source Areas of South Africa (SWSA)

South Africa is a naturally dry country with limited water resources. For these and other reasons the main, important areas of stormwater run-off and volumes were investigated. From these investigations high water areas were identified. These Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff in relation to the size of the geographical region. These areas are important because they have the potential to contribute significantly to overall water quality and supply, supporting growth and development (SANBI). These areas make up 8% of the land area across South Africa, Lesotho and Swaziland, but provide 50% of the water resource in these countries. It is critical to consider these areas in terms of development, impact on water resources and / or use of water resources.

The study site is situated within the Far West Karst SWSA. The SWSA is a strategic groundwater source area. The nearby West Rand Belt SWSA is also a strategic groundwater source area (Figure 19).

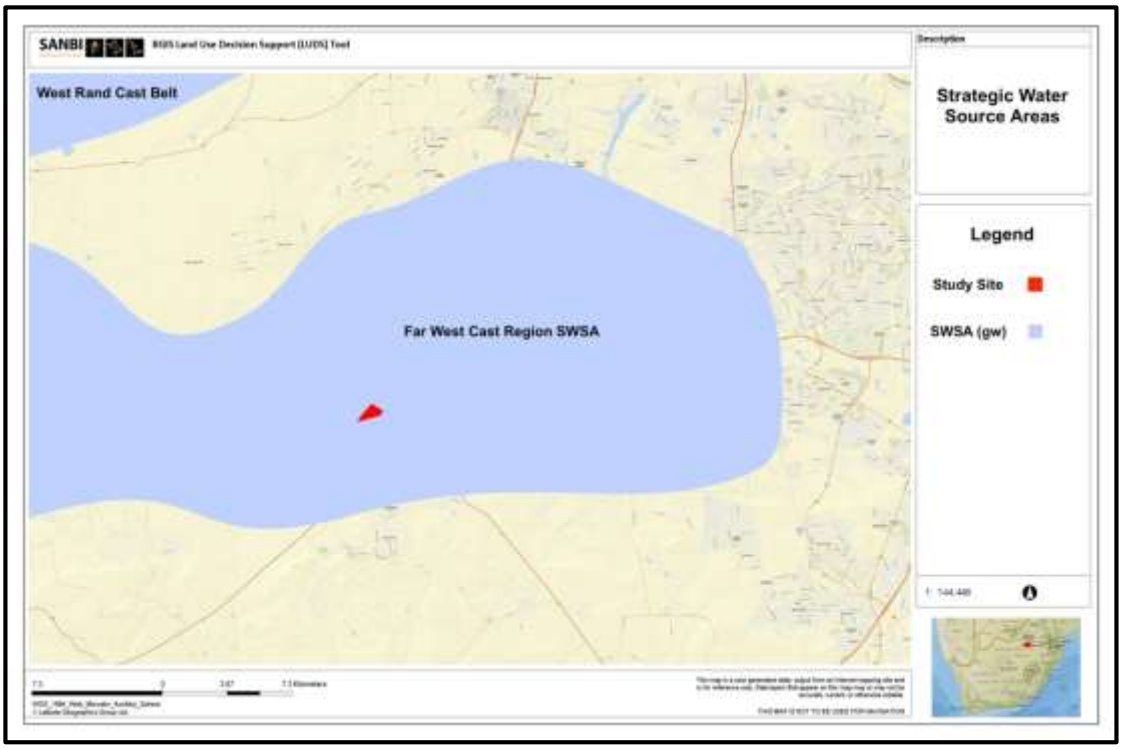


Figure 19: SWSA of South Africa

3.12 Priority Areas

3.12.1 National Priority Areas

Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; National fresh water ecosystem priority areas (NFEPA) (which include wetlands) and National protected areas expansion strategy (NPAES) focus areas. The study site is not within any priority areas, including NFEPA wetland areas.

During field investigations it was evident that there is no wetland in this area. The study site and surrounding areas have been transformed by mining, and residential development over a period of many years. Wetlands would not typically form in these areas because of the underlining dolomitic geology where the water filters away or forms sink-holes (unless there is a constant supply of water at a point) and is therefore not conducive to wetland formation. The wetland vegetation ecoregion, in which the study site is situated, is the Dry Highveld Grassland Group 5 ecoregion (Figure 20, below).

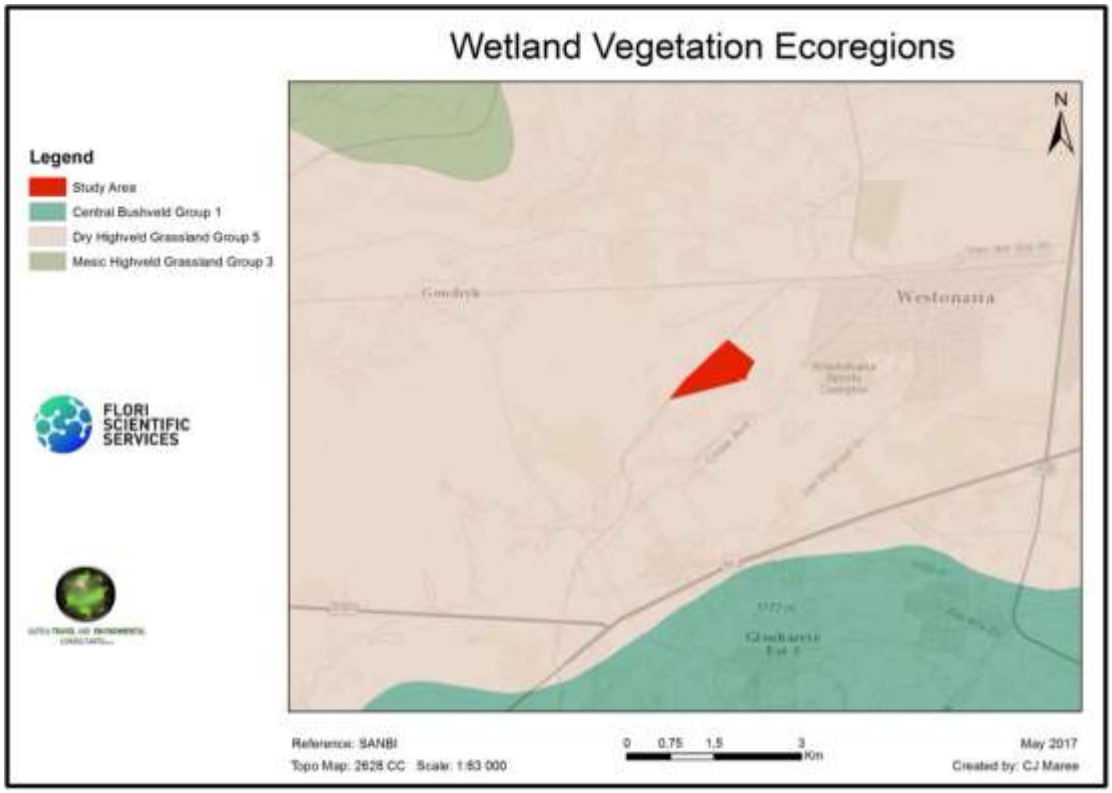


Figure 20: Wetland Vegetation

3.13 Delineation of Watercourses in the Study Area

There are no watercourses in the study area, or immediate surrounding areas. This includes wetlands, natural drainage lines and even manmade impoundments (farm dams). Therefore, no watercourses can be delineated.

3.14 Present Ecological State (PES) of Watercourses

During field investigations the Present Ecological State (PES) of watercourses within the study area, or those that might potentially be impacted upon, are calculated. The assessment criteria and structure are based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system. One of the reasons for a PES determination is that should there be impacts on the watercourse the extent of the impacts can be determined or calculated against the baseline / existing state of the watercourse and recommendations made to return the watercourse to the original state.

There are no watercourses present and therefore no PES determinations could be conducted.

3.15 Ecological Importance & Sensitivity (EIS) of Watercourses

The Environmental Importance and Sensitivity (EIS) is an important determination to conduct on watercourses within a study area. As in the case of the PES, the EIS of a watercourse can only be properly and accurately determined after field investigations. The EIS values of the watercourses are assessed during field investigations as per the methodology previously described.

However, as with the PES, there are no watercourses present so no EIS calculations can take place, or need to be conducted.

3.16 National Screening Tool Assessment

The National Screening Tool (www.screening.environment.gov.za) is a desktop assessment and guideline. The assessment of the aquatic biodiversity theme sensitivity for the study site 'Low' (Figure 21).

Figure 21: Screening tool assessment sensitivity map for the aquatic biodiversity theme

The screening tool and the gazetted protocols (GN R320 of 20 March 2020 and GN R 1150 of 30 October 2020) require a site sensitivity verification to be completed to either confirm or dispute the findings and sensitivity ratings of the screening tool.

During site investigations the screening tool assessments were assessed and ground truthed and the aquatic biodiversity theme sensitivity was found to be 'low'. That is, confirming the screening tool assessment for the study site. There are no watercourses on the study site.

Table 8: Comparison between Screening Tool and Site Assessment

Theme	Screening Tool	Site Investigations	Findings
Aquatic biodiversity Sensitivity	Low	Low	Confirmed (verified)

4 THE GO, NO-GO OPTION

4.1 Classification Criteria

The term '**fatal flaw**' is used in the pre-application planning and screening phases of a project to evaluate whether or not an impact would have a 'no-go' implication for the project. In the scoping and impact assessment stages, this term is not used. Rather impacts are described in terms of their potential significance.

A potential fatal flaw (or flaws) from a biodiversity perspective is seen as an impact that could have a "no-go" implication for the project. A 'no-go' situation could arise if residual negative impacts (i.e. those impacts that still remain after implementation of all practical migratory procedures/actions) associated with the proposed project were to:

a) Conflict with international conventions, treaties or protocols (e.g. irreversible impact on a World Heritage Site or Ramsar Site);

b) Conflict with relevant laws (e.g. clearly inconsistent with NEMA principles, or regulations in terms of the Biodiversity Act, etc.);

c) Make it impossible to meet national or regional biodiversity conservation objectives or targets in terms of the National Biodiversity Strategy and Action Plan or other relevant plans and strategies (e.g. transformation of a 'critically endangered' ecosystem);

d) Lead to loss of areas protected for biodiversity conservation;

e) Lead to the loss of fixed, or the sole option for flexible, national or regional corridors for persistence of ecological or evolutionary processes;

f) Result in loss of ecosystem services that would have a significant negative effect on lives (e.g. loss of a wetland on which local communities rely for water);

g) Exceed legislated standards (e.g. water quality), resulting in the necessary licences/approvals not being issued by the authorities (e.g. WULA);

h) Be considered by the majority of key stakeholders to be unacceptable in terms of biodiversity value or cultural ecosystem services.

4.2 Potential Fatal Flaws for the Project

From the available data and field investigations there are no obvious fatal flaws in terms of the water environment. However, it must be noted, that the area is a dolomitic area, underlined by important

dolomitic water-bearing compartments of significant importance, and any activities such as tailings facilities, sewage works, solid waste sites, and even industrial activities, the discharge of poor quality water and or even the transport of potable water supply (via pipes) and domestic wastewater (sewage) also via pipes has the potential to have a significant impact on the quality of the groundwater and the stability of the surface infrastructure (sink-hole formation). Therefore, typically rain water filtering through the waste on a solid waste site or pollution control dams that collect and contain polluted water from off the solid waste site will have a significant impact on the groundwater is not properly investigated and mitigating actions recommended.

5 IMPACT ASSESSMENT

The potential impacts of the activities related to the proposed project on the water environment are rated after field investigations. The methodology used as described above.

There are no watercourses or even unnatural open bodies of water in, or immediately adjacent to, the study area. Therefore, there will be no measurable impacts on natural surface watercourses and no measurable impacts on the closest, large perennial rivers in the region. However, some mitigating measures have been recommended in an effort to ensure that negative impacts on the natural environment are kept to a minimum.

The potential impacts of the activities related to the proposed project were rated after field investigations. Table 9 below is the rating assessments for the project showing the potential impacts before and after the implementation of mitigating measures.

Table 9: Impact assessments

GRASSLAND		
Impact Rating	**Mitigating Measures**	**Sensitivity**
Before Mitigation: Medium Extent: Local: 2 Duration: Medium-term: 2 Intensity: Moderate: 2 Probability: Highly probable: 3 Total: 9 After Mitigation: Low Extent: Site: 1 Duration: Short-term: 1 Intensity: Moderate: 2 Probability: Possible: 2 Total: 6	Any temporary storage or accommodation facilities to be setup in existing built-up areas or disturbed areas only. Ensure small footprint during construction phase. Dust suppression along gravel roads to be implemented. Erosion plan to be implemented and monitored (eventhough erosion is not at a high potential). All excess materials brought onto site for construction to be removed after construction. No open trenches or mounds of soils to be left. No open fires allowed for cooking, etc. because the site is within a grassland area. Rehabilitation plan for disturbed areas to be compiled and implemented.	LOW

	Re-seeding of bare areas with local indigenous grasses to be part of the rehabilitation plan. No exotic species to be used for rehabilitation. Any bulbous plants or aloes found to be lifted and replanted in a nearby, similar area as part of retaining biodiversity in the area. An ongoing maintenance and monitoring plan for the landfill site to be implemented as part of the operation phase of the landfill site.	
TRANSFORMED AREAS		
Impact Rating	**Mitigating Measures**	**Sensitivity**
Before Mitigation: Low Extent: Site: 1 Duration: Medium-term: 2 Intensity: Moderate: 2 Probability: Possible: 2 Total: 7 **After Mitigation: Low** Extent: Site: 1 Duration: Medium-term: 2 Intensity: Low: 1 Probability: Improbable: 1 Total: 5	Recommended mitigating measures to be implemented eventhough it is in a transformed environment. Construction vehicles and heavy vehicles to only use existing access roads. Access roads to be continually maintained during construction phase and then to be probably rehabilitated at end of construction but still as part of the construction phase. Erosion along roads and construction site to be continually monitored and repaired. Especially after heavy rain downpours. Dust suppression along gravel roads and construction site to be implemented. No temporarily storage facilities allowed outside of study area. If not possible then only within highly disturbed areas and then still proper rehabilitation to be done after construction phase. Erosion plan to be implemented and monitored. Stormwater plan to be compiled and implemented. An ongoing maintenance and monitoring plan for the landfill site to be implemented as part of the operation phase of the landfill site.	LOW

6 MITIGATION OF IMPACTS

The following general mitigating measures are recommended to reduce or avoid any potential negative impacts project-related activities might have on the natural environment.

6.1 Construction Phase

- No temporary accommodation or temporary storage facilities may be setup within 100m of the any river, stream, drainage line, wetland or farm dam. (It is understood that none occur, but the measure is still important to keep in mind).
- Temporary facilities (including portable toilets) should preferably be positioned or setup within existing disturbed areas where possible.
- Only existing roads to be used by vehicles during construction as far as possible.

- Disturbed surface areas arising during the construction phase to be rehabilitated. No open trenches to be left. No mounds of soils created during construction to be left.
- All construction material, equipment and any foreign objects brought into the area by contractors to be removed immediately after completion of the construction phase.
- Proper rubbish/waste bins to be provided. These to be emptied weekly and the waste to be removed to an official waste disposal site.
- Dust suppression to be used during the construction phase.
- Any erosion arising during the construction phase to be maintained during the construction phase and completely rehabilitated at the end of the construction phase.
- A stormwater management plan to be compiled and implemented.
- A rehabilitation plan to be compiled and implemented.

7 CONCLUSIONS & RECOMMENDATIONS

The following conclusions from the study are:

- There are no watercourses present on the study site, including streams, drainage lines and wetlands;
- There are some unnatural ponds and manmade excavations where water has accumulated and pooled on site;
- The study site is not situated within any priority areas, including NFEPA rivers and wetlands.
- There are two badly degraded and disturbed valley bottom wetlands / wetland flats to the east to the study site. The study site is within the 500m wetland assessment area from these wetlands. However, they are far enough away for the project (landfill site) not to have any negative impact on them.
- The study site is not within or adjacent to any aquatic CBA and ESA areas. The site is within a terrestrial ESA 1.
- There are no 'fatal flaws', in terms of the water environment.
- However, the area is a dolomitic area, underlined by important dolomitic water-bearing compartments of significant importance, and any activities such as tailings facilities, sewage works, solid waste sites, and even industrial activities, the discharge of poor quality water and or even the transport of potable water supply (via pipes) and domestic wastewater (sewage) also via pipes has the potential to have a significant impact on the quality of the groundwater and the stability of the surface infrastructure (sink-hole formation);

- No Water Use Licence Application (WULA) procedures or General Authorisation (GA) procedures are required in terms of impacts on the water environment.
- However, a Licence in terms of the National Environmental Management: Waste, 2008 (Act 59 of 2008) as amended will be required.
- The formal dumping area with the boundaries of the site is fairly well managed but this is only a portion of the Site.
- The operation and management of a solid waste site do not need to expand beyond the current boundaries of the site, as there is enough “air-space” to expand the site within those boundaries and build the site upwards;
- People are living on the site this must be discouraged;
- Illegal mining activities are occurring on the site and this must be discouraged;
- Stormwater management plan including stormwater systems, such as pollution control dams must be properly constructed including and prevention of unnecessary pond or damming of water as is currently occurring on the site;
- Propose that if the site is established that a buffer zone be established a green zone of about 1 km around the site that no development is allowed such as residential areas, commercial properties, etc. that will be influenced by the odours from a Solid Waste Site; and
- The Site is more than likely on water bearing dolomite and a full geohydrological investigation needs to be done to determine if and what mitigation actions should be implemented including the management of stormwater and polluted run-off.

8 Appendices

8.1 Photographs

Study Site

Study Site with cleared and levelled areas

General view of the existing landfill site

Accumulation (ponding) of surface stormwater run-off on the landfill site

Dump site with large mine dump (tailings dam) in the background

General view of the study area and landfill site

Below are some of the photographs taken during the May 2017 site investigations and shown in the initial specialist studies (Maree, JO. 2017).

Below are some of the photographs taken during the May 2017 site investigations and shown in the initial specialist studies (Maree, JO. 2017).

Photo 1: Palisade Fence on the Perimeter of the existing Libanon Landfill Site (2017)

Photo 2: Stormwater run-off into excavated holes on the Libanon Landfill Site (2017)

Photo 3: Illegal mining activities on the study site at the present Libanon Landfill Site (2017)

Photo 4: Recycling of waste at the study site by private individuals (2017)

Photo 5: Libanon Landfill Site (2017)

Photo 6: Carletonville Dolomite Grassland north of the study site (2017)

8.2 Definitions

8.2.1 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according to the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005).

According to the DWS document and the National Water Act (NWA) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*."

Furthermore, the guidelines stipulate that wetlands must have one or more of the following defining attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water-loving plants (hydrophytes); and
- A high-water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50 cm of the soil.

8.3 Regulated Zone versus Buffer Zone

A buffer zone implies a zone or area in which "nothing" should be done, or no activities are allowed to take place. A regulated zone (or area), has certain legal implications, under which certain or regulated activities may or may not take place.

The following areas / zones and regulations are relevant:

- The **32 m** in the NEMA listed activities. This is 32 m from the 1:1 year flood line or first flood bank of the active stream area. This is not 32 metres from the 1:100 year flood line or 32 metres from the 500 m zone of the delineated wetland as determined by DWS. Experts keep on using definitions in the NEMA to support or define things or issues in the NWA or vice versa. This should not be done.
- The 1:100 flood line, or the riparian area (whichever is the furthest) as defined by the GN509 in terms of the NWA; or
- The wetland area and 500 m from the wetland area as defined by GN509 in terms of the NWA

These areas are the "Extent" or "regulated area" of a watercourse. In other words areas in which the applicable legislation applies. Before any activity can take place as defined by the legislation the activity must be authorised in terms of that legislation. The term is "Regulated Area".

This means an activity may take place within a regulated area. Only if after the necessary environmental evaluation processes have been followed and it has been determined that the impacts are acceptable or the mitigating actions implemented will address any unacceptable impacts.

8.4 Legislation relating to buffer & regulated zones for watercourses

1. Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) EIA Regulations, 2014 (as amended) must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities;

2. In accordance with GN509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21(c) and 21(i) of the National Water Act, 1998 (Act 36 of 1998) is defined as:

- The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
- In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
- A 500 m radius from the delineated boundary (extent) of any wetland or pan

3. In terms of Regulation GN704 of the NWA, 1998 (Act no. 36 of 1998), a 100 m zone of regulation around the watercourses is required. If any mining activities are to take place within 100 metres or the 1: 100-year flood lines exemption in terms of this regulation, as well as General Notice No. 1199 of 2009, as it relates to the NWA, will also apply and therefore a Water Use License will be required

8.5 Vegetation indicators for Wetland zones

Below is a summary of vegetation indicators which could be expected in the three different wetness / wetland zones of a wetland (Table 10).

Table 10: Vegetation indicators for wetland zones

Vegetation	Temporary Zone	Seasonal Zone	Permanent Zone
Herbaceous	Predominantly grass species; mixture of species which occur extensively in non- wetland areas, and hydrophilic plant species which are restricted largely to wetland areas.	Hydrophilic sedge and grass species, which are restricted to wetland areas; *Phragmites australis.*	Dominated by: 1. emergent plants, including reeds (*Phragmites australis*), a mixture of sedges and bulrushes (*Typha capensis*), usually >1m tall; and/or 2. floating or submerged aquatic plants.
Woody	Mixture of woody species which occur extensively in non-wetland areas, and hydrophilic plant species that are restricted largely to wetland areas.	Hydrophilic woody species, which are restricted to wetland areas.	Hydrophilic woody species, which are restricted to wetland areas. Morphological adaptations to prolonged wetness (e.g. prop roots).

Reference: Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas. 2nd ed. Sept. 2008. DWS.

Below is a list of plant species typically found in freshwater wetlands on the Highveld:

Megagraminoid: *Cyperus congestus* (d). Graminoids: *Agrostis lachnantha* (d), *Carex acutiformis* (d), *Eleocharis palustris* (d), *Eragrostis plana* (d), *E. planiculmis* (d), *Fuirena pubescens* (d), *Helictotrichon turgidulum* (d), *Hemarthria altissima* (d), *Imperata cylindrica* (d), *Leersia hexandra* (d), *Paspalum dilatatum* (d), *P. urvillei* (d), *Pennisetum thunbergii* (d), *Schoenoplectus decipiens* (d), *Scleria dieterlenii* (d), *Setaria sphacelata* (d), *Andropogon appendiculatus*, *A. eucomus*, *Aristida aequiglumis*, *Ascolepis capensis, Carex austro-africana*, *C. schlechteri*, *Cyperus cyperoides*, *C. distans*, *C. longus*, *C. marginatus*, *Echinochloa holubii*, *Eragrostis micrantha*, *Ficinia acuminata*, *Fimbristylis complanata*, *F. ferruginea*, *Hyparrhenia dregeana*, *H. quarrei, Ischaemum fasciculatum*, *Kyllinga erecta*, *Panicum schinzii*, *Pennisetum sphacelatum*, *Pycreus macranthus*, *P. nitidus*, *Setaria pallide-fusca*, *Xyris gerrardii*. Herbs: *Centella asiatica* (d), *Ranunculus multifidus* (d), *Berkheya radula*, *B. speciosa*, *Berula erecta* subsp. *thunbergii*, *Centella coriacea*, *Chironia palustris*, *Equisetum ramosissimum*, *Falckia oblonga Haplocarpha lyrata, Helichrysum difficile, H. dregeanum, H. mundtii, Hydrocotyle sibthorpioides, H. verticillata, Lindernia conferta, Lobelia angolensis, L. flaccida, Mentha aquatica, Monopsis decipiens, Pulicaria scabra, Pycnostachys reticulata, Rorippa fluviatilis var. fluviatilis, Rumex lanceolatus, Senecio inornatus, S. microglossus, Sium repandum, Thelypteris confluens, Wahlenbergia banksiana. Geophytic Herbs: Cordylogyne globosa, Crinum bulbispermum, Gladiolus papilio, Kniphofia ensifolia, K. fluviatilis, K. linearifolia, Neobolusia tysonii, Nerine gibsonii (only in Eastern Cape), Satyrium hallackii subsp. hallackii.* ***Reed & sedge beds*** *Megagraminoids: Phragmites australis (d), Schoenoplectus corymbosus (d), Typha capensis (d), Cyperus immensus. Graminoid: Carex cernua.* ***Water bodies*** *Aquatic Herbs: Aponogeton junceus, Ceratophyllum demersum, Lagarosiphon major, L. muscoides, Marsilea capensis, Myriophyllum spicatum, Nymphaea lotus, N. nouchali var. caerulea, Nymphoides thunbergiana, Potamogeton thunbergii. Carnivorous Herb: Utricularia inflexa. Herb: Marsilea farinosa subsp. farinose* (Mucina & Rutherford, 2006).

(d) = Dominant.

9 REFERENCES

- Acocks, J.P.H. 1988. 3rd ed. Veld types of South Africa. Memoirs of the Botanical Survey of South Africa 57: 1-146.
- Bromilow, C. 2010. Problem plants and alien weeds of South Africa. Briza, Pretoria.
- Low, A.B. & G. Rebelo (eds). 1998. Vegetation of South Africa, Lesotho and Swaziland. Dept. Environmental Affairs and Tourism, Pretoria.
- Legislation on weeds and invasive plants in South Africa. Taken directly from Agricultural Research Council's (ARC) website. www.arc.agric.za.
- Manning, J. 2009. Field Guide to Wild Flowers of South Africa. Struik, Cape Town.
- Maree, JO. 2017. Ecological Impact Assessment for the extension of the existing Libanon Landfill Site.
- Maree, JO. 2017. Wetland Impact Assessment for the extension of the existing Libanon Landfill site.
- Mucina, L. & M.C. Rutherford (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. SANBI, Pretoria.
- Ollis, D.J, Snaddon, C.D, Job, N.M.& Mbona, M. 2013. Classification system for wetlands and other Aquatic ecosystems in South Africa. User Manual: Inland systems. SANBI. Biodiversity Series 22. Pretoria.
- Raimondo D., L. von Staden, W. Fonden, JE Victor, NA. Helme, RC. Turner, DA. Kamundi, PA. Manyama (eds). 2009. Red List of South African Plants. Strelitzia 25. SANBI. Pretoria.
- SANBI. South African National Biodiversity website. www.sanbi.org.
- South African National Biodiversity Institute (SANBI). Threatened ecosystems of South African Biomes. Draft 2009. www.sanbi.org or www.bgis.sanbi.org.
- Stuart, C. & T. Stuart. 2001. Field Guide to Mammals of Southern Africa. Struik, Cape Town.
- The Plants of Southern Africa (POSA) database. SANBI website. http://posa.sanbi.org or www.sanbi.org.
- National Environmental Management: Waste, 2008 (Act 59 of 2008) as amended.
- Food and Agriculture Organization of the United Nations (www.fao.org)
- Environmental Impact Report: Ecological study of the proposed Westgate Tarlton Kromdraai 132 kV Power Line and Substation Project for ESKOM in the Gauteng Province, Prepared by David Hoare (M.Sc., Pr.Sci.Nat.) David Hoare Consulting cc for ARCUS GIBB (Pty) Ltd
- SANBI. 2013. Grasslands Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and D. McCulloch. South African National Biodiversity Institute, Pretoria. 139 pages. ISBN: 978-1-919976-88-4

The following are references consulted but not quoted directly in the report:

- Carruthers, V. 2001. Frogs and Frogging in Southern Africa. Struik, Cape Town.
- Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmelt, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005. National Spatial Biodiversity Assessment 2004: Priorities for biodiversity conservation in South Africa. *Strelitzia 17*. South Africa. National Biodiversity Institute, Pretoria.
- Schmidt, E., M. Lötter & W. McCleland. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana, Johannesburg.
- Rouget, M., B. Reyers, Z. Jonas, P. Desmet, A. Driver, K. Maze, B. Egoh, R.M. Cowling, L. Mucina, M.C. Rutherford. 2004. South African National Spatial Biodiversity Assessment. Technical Report. Volume 1: Terrestrial Report. Dept. of Environment Affairs.