Watercourse Investigation for the Skhemelele Landfill Site (LFS), KwaZulu-Natal Province

Specialist Report

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Approach and Disclaimer

This report provides a brief description of watercourses, as defined by the National Water Act (NWA), Act No. 36 of 1998, that are present within the study area, including wetlands present within a 500m radius of the study area. The latter is undertaken at a secondary level of detail through a mainly desktop approach with limited site surveying. The study area is known as the Skhemelele landfill site (LFS), an operational LFS located approximately 1 km east of Tembe Elephant Park in the Umhlabuyalingana Local Municipality, in Maputaland, in northern KwaZulu-Natal. The investigation furthermore provides a description of selected aspects of the study area and identifies potential project related impacts, recommended mitigation measures and an impact assessment table.

This study does not provide detailed descriptions of the local geology, agricultural potential, climatic conditions, hydrology of the aquatic environments(including volumes and flow patterns), surface and ground water quality, aquatic and terrestrial flora and fauna, or a detailed review of the legal constraints associated with potential project related impacts on the environment. It has been assumed for the purposes of this report that these aspects have been the subject of separate specialist studies should they be required as part of the environmental authorisation process. The following refers to general limitations that affect the accuracy of information represented within this report:

- A soil specific wetland delineation approach had to be adopted as hydrophyte indicators were not readily available, due to the survey period (early October 2015), overlapping with the non-growing season when plant identification to the species level is constrained by the general absence of reproductive structures. In addition, plant identification was further hindered by excavation and stockpile disturbances associated with the operation of a landfill site within the study areas, while a high grazing pressure was present in the surrounding 500m study area buffer.
- Hydrophyte wetland indicators were therefore of limited use during the field surveys and a soil specific wetland delineation approach had to be adopted. Soil indicators were, however, also partially obscured within the study area by stockpiles located in between excavated areas.

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1. Introduction

1.1. Background and Terms of Reference

SE Solutions appointed Imperata Consulting to conduct a watercourse specialist investigationforthe existing and operational Skhemelele landfill Site (LFS), located in the Umhlabuyalingana Local Municipality in the KwaZulu-Natal Province. This specialist study supports the Waste Management License (WML) application for the closure of the Skhemelele LFS. The study was undertaken by Mr. L.E.R Grobler from Imperata Consulting who compiled the report on the findings of the commissionedwatercourse assessment, which included a desktop component as well as a fieldwork survey component. Mrs. L. Van Rooyen (nee Pretorius), a PhD student at the University of the Free State, was also present during the site survey. Mrs. Van Rooyen is currently undertaking a PhD study that evaluates soil organic matter and other features as possible indicators of wetland conditions on the Maputaland Coastal Plain. The terms of reference for the specialist study include the following:

- The delineation and assessment of wetlands and other watercourses present within the study area, including the delineation of wetlands within a 500m radius around the property (henceforth referred to as the 500m study area buffer or 500m buffer). The delineation of wetlands within the 500m buffer will be undertaken at a secondary level of detail through a mainly desktop approach with limited site surveying.
- Watercourses identification will be based on definitions specified in the National Water Act (Act No. 36 of 1998) (NWA). Watercourse definitions used as part of the investigation include the following:
    - A river or spring.
    - A natural channel in which water flows regularly or intermittently.
    - A wetland, lake or dam into which, or from which, water flows.
- The description and classification of delineated wetlands into corresponding hydro-geomorphic (HGM) units according to Ollis *et al.* (2013).
- Present Ecological State (PES) assessment of identified wetlands within the LFS study area. PES assessments for wetlands and other watercourses located outside of the study area, but inside the 500m buffer, are excluded from this study.
- Ecological Importance and Sensitivity (EIS) assessment of identified wetlands present within the study area. EIS assessments for wetlands and other watercourses located outside of the study area, but inside the 500m buffer, are excluded from this study.
- The identification of potential project-related impactsalong with an impact assessment and the recommendation of appropriate mitigation measures.

1.2. Experience of the author

Mr. Grobler has undergraduate majors in Botany (UP) and Soil Science (UP), an honours degree in Botany from the University of Pretoria (cum laude), and a MSc (cum laude) from the Department of Plant Sciences (UP) with a focus on peatland wetland systems. He is a registered Pr. Sci. Nat professional natural scientist in the fields of Botanical Science and Ecological Science (Reg. no. 400097/09). He has been working as a consultant based in Pretoria, with work experience in Gauteng, Mpumalanga, North-West, Eastern Cape, Northern Cape, Free State, Limpopo and KwaZulu-Natal Provinces over the last eight years. Areas of specialisation include wetland, riparian and headwater drainage line assessments, with a special interest in peat wetlands.

1.4. General assumptions

- This study assumes that the project proponents will always strive to *avoid, mitigate* or *offset* potentially negative project related impacts on the environment, with impact avoidance being considered the most successful approach, followed by mitigation and offset. It further assumes that the project proponents will seek to enhance potential positive impacts on the environment.
- Spatial GIS shapefiles received from the client were used to demarcate the landfill site boundaries are deemed accurate.
- The project proponents will commission an additional study to assess the impact(s) if there is a change in the size and/or extent of the study area or proposed infrastructure that is likely to have a potentially significant and/ or unavoidable impact on watercourses (e.g. wetlands).

1.5. Overview of wetlands and riparian habitat

1.5.1. What are wetlands?

In terms of the Ramsar Convention on Wetlands (Iran 1971), to which South Africa is a contracting party, "… wetlands include a wide variety of habitats such as marshes, peatlands, floodplains, rivers and lakes, and coastal areas such as salt marshes, mangroves, and sea grass beds, but also coral reefs and other marine areas no deeper than six meters at low tide, as well as human-made wetlands such as waste-water treatment ponds and reservoirs" (Ramsar Convention Secretariat 2007).

In South Africa, wetlands are defined as "…land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the 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" (National Water Act, 1998 (Act No. 36 of 1998)). Wetlands are also included in the definition of a watercourse within the NWA, which implies that whatever legislation refers to the aforementioned will also be applicable to wetlands.

In addition, the NWA stipulates that "…reference to a watercourse includes, where relevant, its bed and banks…". This has important implications for the management of watercourses and encroachment on their boundaries, as discussed further on in this document.

The NWA defines riparian areas as "…the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized 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…" Note that this does not imply that the plant species within a riparian zone must be aquatic, only that the species composition of plant assemblages must be different within the riparian area and adjacent uplands.

In terms of the wetland delineation document available from the Department of Water Affairs and Forestry (DWAF), now known as the Department of Water and Sanitation (DWS), "wetlands must have one or more of the following attributes" (DWAF 2005):

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

It follows that the level of confidence associated with a specific area being considered as a wetland is proportionate to the number of confirmed indicators that positively correlate with wetland habitat. Not all indicators are always present within a specific biophysical and land use setting, while not all indicators are always reliable and/or useful under all conditions. The use of additional wetness indicators from different disciplines that are internationally applied therefore adds value and confidence in the identification and delineation of wetland habitats, especially in challenging environments. These types of environments include urban settings where disturbances to the natural soil and vegetation are common.

2. Methods

2.1.General

The following methods and approaches were applied as part of the wetland investigation:

- Existing spatial datasets that indicate potential watercourses an ecologically important areas were used as part of an initial desktop approach:
    - The 1:50 000 river and drainage line data of the study area and its surroundings was used, as illustrated on the relevant topographic map (2732ABSihangwane).
    - The recently completed National Freshwater Ecosystem Priority Areas (NFEPA) spatial database was used to identify potential wetland areas within the study area and its immediate surroundings. This wetland layer has been formed by combing information from the National Land Cover 2000 data set (NLC 2000), 1:50 000 topographic maps and sub national data (Van Deventer *et al.,* 2010).
    - The National Spatial Biodiversity Assessment (NSBA) spatial dataset, which is based on the DWA 1:500 000 rivers GIS layer (Driver et al. 2004). The GIS layer was obtained via the BGIS website hosted by the South African National Biodiversity Institute (SANBI).
    - The KZN Freshwater Systematic Conservation Plan 2007 and the KZN Terrestrial Systematic Conservation Plan 2010.
- A Topographic Wetness Index model was performed with SAGA GIS software to help indicate the potential occurrence of wetlands and other watercourses within the study area and its surrounding 500m buffer. Sample points were targeted in areas with expected increased wetness, as indicated on the modeled map, which were regarded as more likely to contain wetlands.
- Awetland site surveywas undertaken on 26 October 2015 by Mr. LER Grobler & Mrs. L Van Rooyen.
- Watercourses were identified and delineated through the procedure described by the Department of Water and Sanitation (DWS; previously also known as DWAF and DWA) in their document entitled: “A Practical field procedure for the identification and delineation of wetlands and riparian areas” (DWAF 2005).
- Available wetland indicators that were investigated included hydromorphic (wetland soil) features, the presence of wetland plant species (e.g. hydrophytes), riparian species and vegetation features, alluvial soil features, and terrain unitindicators.
- A strong emphasis was placed on the identification of hydromorphic features to identify and delineated wetland areas. Investigated hydromorphic features typically included the

presence of mottling, gleying, localised iron depletion, low chroma matrix colours, and organic enrichment in the A horizon (DWAF, 2005 & Nobel *et al*., 2005).

- Sample points were generally arranged along transects perpendicular and parallel to areas with convergent contour lines where drainage lines or flow paths were expected, in order to record gradients of change between terrestrial and watercourse habitats.
- The field surveys primarily focussed on the delineation of watercourses within the study area, while selected areas were investigated within a 500 m radius of the site. Any wetland habitat located within the 500m buffer area was mainly delineated and classified through a desktop approach with limited site surveying.
- Identified wetland areas and other watercourseswere delineated into GIS polygonshapefiles, which were used for map creation.
- All natural wetlands identified within the study area were classified according to the recently completed 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' up to the hydrogeomorphic (HGM) unit level (Ollis *et al*., 2013).
- The HGM classification system is based on three key parameters pertaining to the wetland: the geomorphic setting of the wetland, the source of water inputs into the wetland, and its hydrodynamics (how does water move through the wetland), (Brinson 1993; Kotze *et al.,* 2008).
- The Present Ecological State (PES) of any wetland that may occur within the study area was to be assessed according to the method developed by Kleynhans (DWAF 1999) or the Wetland IHI method developed by DWA (2007).
- The PES method compares the current condition of a wetland, or other watercourse type, to its perceived reference condition, in order to determine the extent to which the watercourse had been modified from its pristine (reference) condition.
- Results from the PES assessments are rated into one of six categories ranging from unmodified/ pristine wetlands (Class A) to critically/ totally modified HGM wetland units (Class F).
- An Ecological Importance and Sensitivity (EIS) assessment of any identifiedwetlands that may occur within the study area were undertakento provide an indication of the conservation value and sensitivity of these watercourses. The applied EIS wetland assessment was based on the following criteria derivedfrom the method proposed by Rountree& Malan (2010):
    - Habitat uniqueness
    - Species of conservation concern
    - Habitat fragmentation with regards to ecological corridors

- Prominent ecosystem services

2.2.Limitations

The following refers to general limitations that affect the applicability of information represented within this report (also refer to the Approach and Disclaimer section):

- Wetland assessments are based on a selection of available techniques that have been developed through the Department of Water and Sanitation (DWS), as well as the Water Research Council (WRC) based on site conditions and applicability. These techniques are, however, largely qualitative in nature with associated limitations due to the range of interdisciplinary aspects that have to be taken into consideration.
- Wetland areas within transformed landscapes, such as urban, agricultural settings,or other areas with existing disturbances, such as landfill sites, are often affected by disturbances that restrict the use of available wetland indicators, such as hydrophytic vegetation or soil indicators (e.g. as a result of the dominance of alien vegetation, cultivation, hard surfaces, and dumping and infilling). Hence, a wide range of available indicators are considered, to help determine wetland boundaries more accurately.
- A soil specific wetland delineation approach had to be adopted as hydrophyte indicators were not readily available due to the survey period overlapping with the non-growing season (dry season)when plant identification is constrained by the general absence of reproductive structures. In addition, plant identification was further hindered by excavation and stockpiling activities within the site.
- Plant-associated wetland indicators were therefore of limited use during the field surveys and a soil specific wetland delineation approach had to be adopted.

3. Study Area Description

3.1. Location and existing land use

- The Skhemelele landfill site (LFS), henceforth referred as the study area or site, is located within the uMhlabuyalingana Local Municipality in KwaZulu-Natal Province. The site is located approximately 20 km south of Mozambique Border and about 38 km east of Swaziland Border, with the nearest towns being Ingwavumato the west-southwest(±38.5 km) and Manguzi to the east-northeast (±37 km).
- The study area is located approximately 1 km west of the Tembe Elephant Park (Provincial Reserve) and is therefore located within a 3 km buffer zone around the nature reserve (Figure 1).
- Other prominent features include the tar road between Ingwavuma and the Kosi Bay - Ponta do Ouro Border Post, which forms the southern boundary of the study area.
- Apart from the landfill site, the study area is specified as vacant/unused based on the KZN Land Cover (2008) dataset.
- The study area and its surroundings are located on plain terrain morphology. Several footpaths, vehicle tracks and rural homesteads are present within the 500m study area buffer(Figure 1).
- Surrounding rural dwellings include Sihangwane, KwaShokoda, KwaNdaba and Nhlohleri.

3.3. Study Area catchment and surface hydrology

- The study area is located within the Usuthuto Mhlathuze Water Management Area (WMA) and falls within Quaternary Catchment W45B.
- Quaternary catchment W45B has a Very High conservation status and a Moderately Modified condition (Class C) Present Ecological State (PES) as indicated by Middleton & Bailey (2008).
- A drainage line transects the study area from northwest to southwest (Figure 1), and forms part of a drainage network that flows into the non-perennial Nhlole River, as indicated on the 1:50000 topographical map (2732AB). The latter flows into the Pongola Floodplain Wetland.

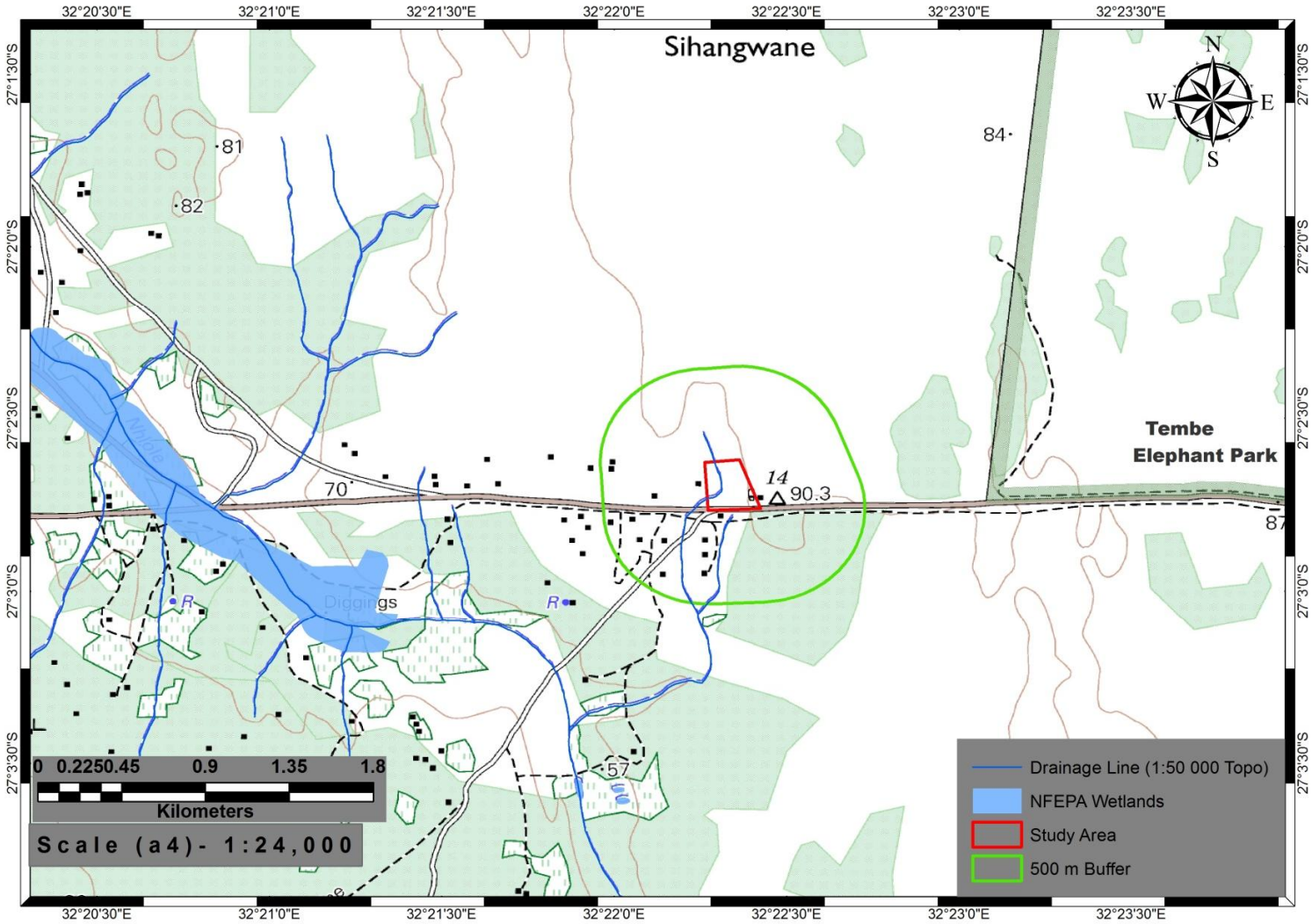

Figure 1: Locality mapof the study area illustrating the study area boundary, wetland indicated on the NFEPA dataset, and drainage lines from the 1:50 000 topographical map (2732AB).

3.4. Local climate, regional vegetation and soils

- Mean annual precipitation ranges between 550 to 800 mm and falls mainly during summer months, while the mean annual temperature is 21.6°C with no incidences of frost (Mucina& Rutherford, 2006).
- The latest vegetation map for South Africa, Lesotho and Swaziland, also known as VEGMAP (Mucina& Rutherford, 2006; Scott-Shaw & Escott 2011), indicate that the entire study area is located in the Savanna Biome and includes one bioregion (subgroup), while portions of land in the 500 m buffer are mapped as fragments from the Forest Biome. The entire study area and majority of land in the 500m buffer forms part of the Tembe Sandveld Bushveld vegetation unit (Lowveld Bioregion), while remaining forest fragments in the 500 m buffer form part of the Sand Forest vegetation unit (Mucina& Rutherford, 2006 & 2012). Sand forest areas in Maputaland are also referred to as Licuati Sand Forests (Gaugris & Van Rooyen, 2008).
- The Tembe Sandveld Bushveld vegetation unit is classified as Least Threatened due to statutorily conservation of the vegetation almost all in Tembe Elephant Park and as such it is moderately protected. The Sand Forest vegetation unit is classified as Critically Endangered as a result of its vulnerability to economic pressure, but it is well protected due to its close proximity to conservation areas (Mucina& Rutherford, 2006).
- The study area does not overlap with any listed Threatened Ecosystem areas according to the 2011 Schedule (Government Gazette of December 2011) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA).
- The area is characterised by grey regic to reddish redistributed sand dunes of marine origin that are poor in nutrients and well leached (Mucina& Rutherford, 2006).

3.5. Information from the KwaZulu-Natal Systematic Conservation Plan (KZNSCP)

The KwaZulu-Natal Systematic Conservation Plan(KZNSCP) provided information about terrestrial and freshwater ecosystems throughput the province.

- According to EKZNW (2007) Freshwater Systematic Conservation Plan the study area and its 500m buffer are confined to the Available Planning Unit.
- According to EKZNW (2010) Terrestrial Systematic Conservation Plan the entire study area overlaps with a Critical Biodiversity Area (CBA) 1 Mandatory. CBA 1 Mandatory planning unit. These planning units represent the only localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved i.e. there are no alternative sites available (EKZN 2010).

4. Watercourse Delineation and Assessment

4.1. Delineated and classified watercourses

- The study area nor its 500m buffer overlaps with wetland habitat indicated on the NFEPA wetland spatialdataset (Figure 1).
- Two drainage lines are indicated on the 1:50000 topographical map 2732AB within the study area (Figure 1).
- A Topographical Wetness Index model was created to illustrate potential areas with increased soil moisture conditions within the site and its surroundings (Figure 2). This map was used to help target transect and other surveys during the site visit. Areas with expected increased wetness and therefore possible wetland conditions do overlap with the study area and are closely associated with one of the drainage lines on the topographical map (Figure 2).
- The site survey confirmed the absence of wetland habitat within the study area, as well as the surrounding 500 m study area buffer. Hydromorphic features, including signs of organic enrichment, were distinctly absent within the study area, including the area with an increased moisture that overlaps with the drainage line from the 1:50000 topographical map (Figure 3).
- No other type of watercourse, such as a natural channel with regular or intermittent flow, was recorded within the study area during the site survey. The area that overlaps with the drainage line on the 1:50000 topographical map is regarded as an interdunal swale or depression that lacks flow features and channel development.This swale appears to be isolated and therefore not clearly connected to the drainage network, as no channel features were recorded at the road crossing, while no pipe or culvert is present along the road at the vicinity of the drainage line crossing, as indicated on topographical map 2732AB (Figure 1).
- Surface flow within the swale is highly unlikely due to the low gradient of the catchment and study area, as well as the high porosity of the deep sandy soils present within the swale and its catchment.
- The Namib soil form is present within the swale and consists of an indistinct orthic A horizon that overlies regic sand.

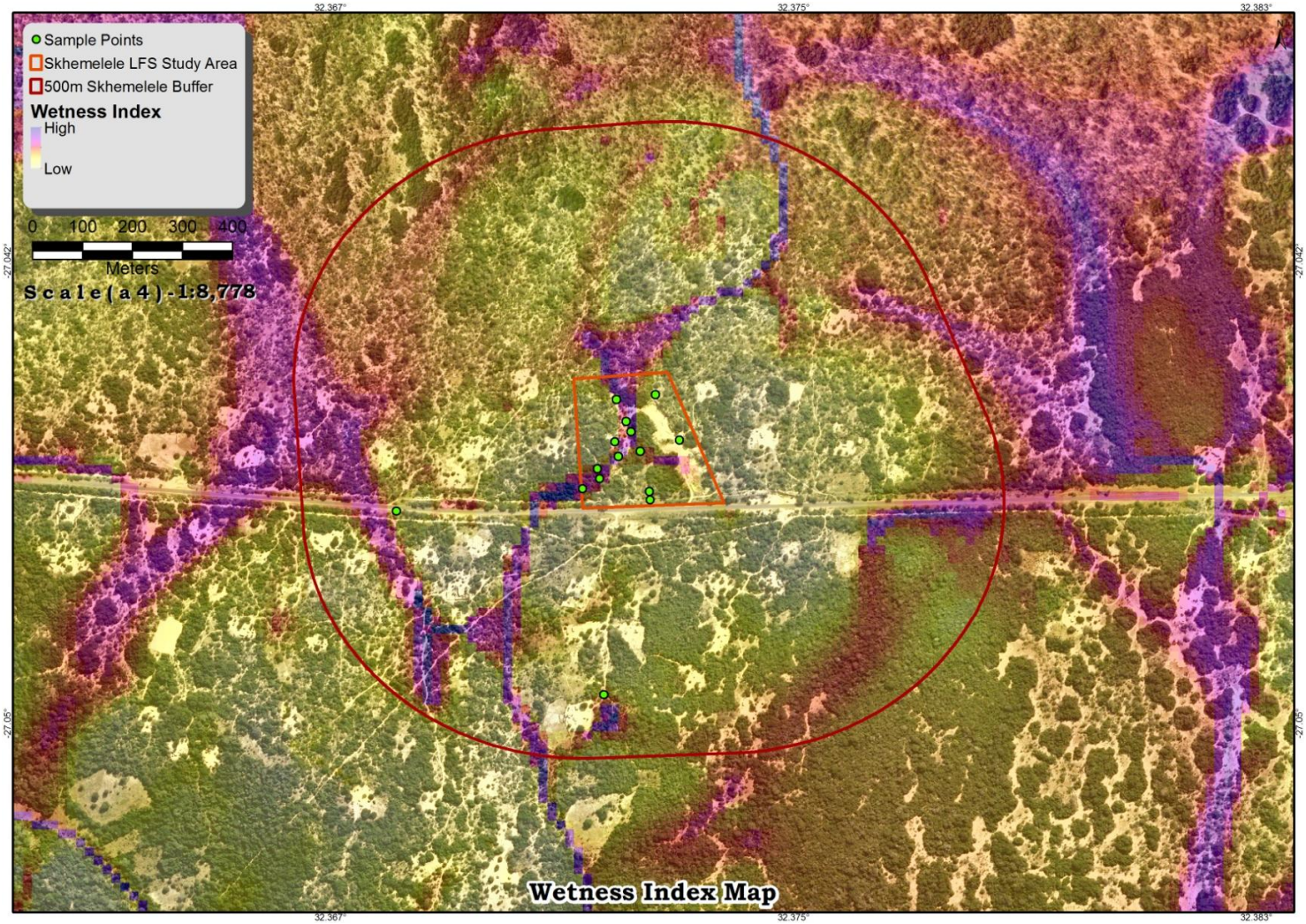

Figure 2: Illustrates landscape positions in the study area and its surroundings that are more likely to contain wetlands and other watercourses, as determined by a Topographical Wetness Index model created with the SAGA GIS program. Areas with increased wetness have only been modeled and may therefore differ from actual site conditions.

Figure 3: Illustrates the interdune swale within the study area , which is not regarded as a wetland or natural channel with regular or intermittent flow.

4.2.Present Ecological State & Ecological Importance and Sensitivity Assessments

No Present Ecological State (PES) or Ecological Importance and Sensitivity (EIS) assessments were undertaken as no wetland or other type of watercourse was identified within the study area.

5. Discussion and Impact Assessment

- No wetlands or other watercourses are present within the study area, and no wetland areas were identified within the 500 m study area buffer.
- Only an interdunal swale feature was recorded within the site, which is not regarded to be consistent with the definition of a watercourse, including a natural channel with regular or intermittent flow, as defined in the NWA.
- No watercourse impact assessment has been undertaken due to the absence of watercourses within the site and its immediate surroundings. The latter does not refer to the entire 500 m study area buffer, but to an area with an approximately 100 m wide radius around the site. First-order (headwater) drainage lines may be present elsewhere within the 500m study area buffer, but were not delineated as information from the survey indicated that these features are very cryptic and not easily demarcated. Distinct channel and flow features were not identified within the study area or its surroundings. This is mainly as a result of the flat terrain topography and deep sandy soils that seldom experience runoff. Uncertainty in the location and extent of headwater drainage lines is also evident from clear differences in areas of expected wetness, indicated in the modeled topographical wetness index map, compared to drainage lines demarcated on the 1:50000 topographical map (2732AB), (Figures 1 & 2).
- Care should however be taken to protect any aquifer that may underlie the landfill site as the risk of leachate from waste through the porous sand matrix is a concern. Groundwater contaminated by leachate can potentially result in the pollution of surrounding watercourses should impacted groundwater be discharged at or near the surface. This impact is expected to form part of the groundwater assessment undertaken for the study area. The groundwater assessment study should be consulted for more detailed recommendations regarding the risk and mitigation of possible groundwater impacts associated with leachate from the Shkemelele landfill site.

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