WETLAND DELINEATION STUDY FOR THE PROPOSED TUNA PARK OPEN SPACE PROJECT, NIGEL, GAUTENG PROVINCE

Draft Report

Date: October 2019

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background

Imperata Consulting were appointed by NuLeaf Planning and Environmental (Pty) Ltd to conduct a baseline wetland delineation study for the proposed Tuna Park Open Space Project, situated in Nigel, Gauteng Province. The study area, henceforth also referred to as the site or property, has a size of approximately 32.3 ha (Figure 1). Prominent features on the property include a school, community centre, sport fields with a pavilion, tennis courts, a swimming pool, and open water with emergent aquatic macrophytes around its margins. The surrounding area consists of a built-up residential suburbs, such as Cerutiville, Mackenzieville and Alra Park (Figure 1).

The open space project will include the development and rehabilitation of Tuna Park. This will include clean-up and rehabilitation activities within wetland habitat and its surroundings. It will also include the improvement of the recreational quality of the park through the development of a community park that will incorporate pedestrian pathways, sports fields and bridges. This will guide the rehabilitation, landscape design and open space optimisation of the existing Tuna Park. Figure 2 illustrates a conceptual plan of proposed open space features.

The objective behind the proposed Tuna Park Open Space Project is for the development of an open space that integrates ecological and social factors, thereby providing a safe, accessible and well-managed area for the community to utilize in their daily lives. This project will serve to:

- Develop much needed formalized public open space adjacent watercourse for local community enjoyment.
- Ensure public safety through the formalizing of movement routes, access points and crossings along the watercourse.
- Support and formalize appropriate and compatible existing activities within the open space, including sport and recreation.
- Foster community buy-in and civic pride.

1.2 Experience of the Author

Retief Grobler has undergrad majors in Botany and Soil Science, a BSc Hons degree in Botany (cum laude) and an MSc in Botany (cum laude) from the University of Pretoria (UP). The post graduate studies focussed on peatland wetland systems. He is a registered Pr. Sci. Nat. professional natural scientist in the fields of Botanical and Ecological Sciences (Reg. no. 400097/09) and has been working as a specialist consultant based in Gauteng for the last 13 years (Appendix A). Wetland-related working experience include projects in various provinces throughout South Africa and one project in southern Mozambique. Areas of interest include wetlands, peatlands and headwater drainage systems.

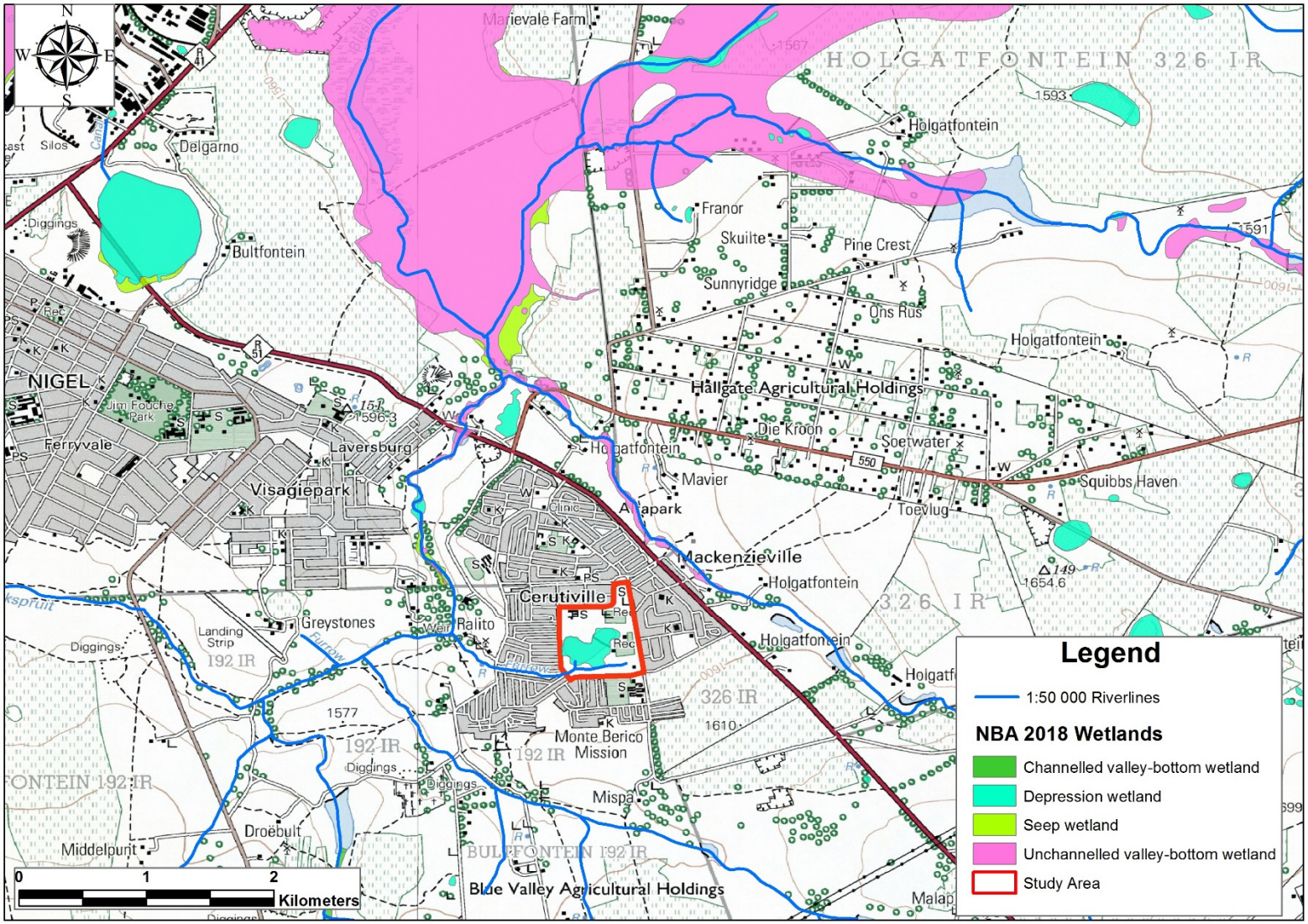

Figure 1: Location map of the study area with river lines obtained from the 1:50000 topographical map 2628BC (Endicott) and the latest national wetland layer from the 2018 National Biodiversity Assessment (NBA).

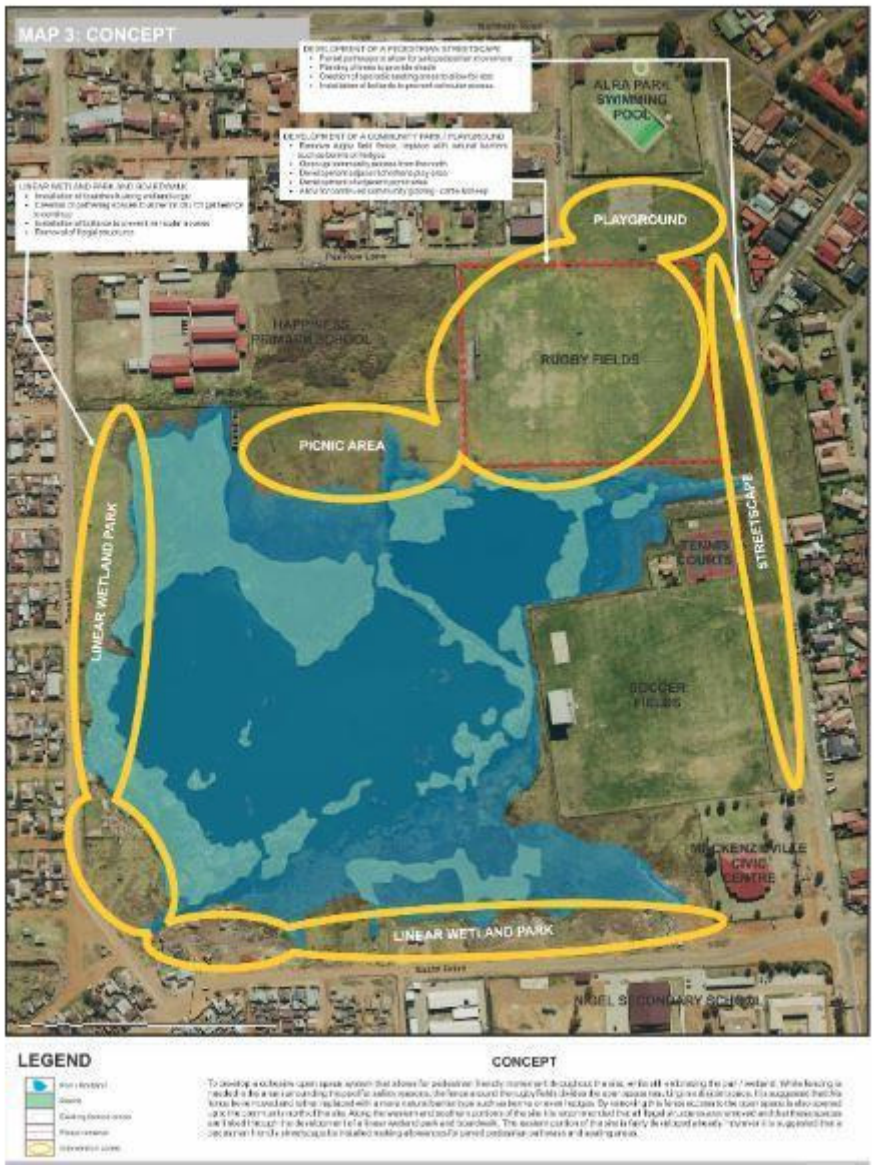

Figure 2: A conceptual plan for the Tuna Park Open Space Project.

1.3 Terms of Reference

The study includes the following:

- The identification and delineation of wetlands and other watercourse on site according to the DWS delineation documents (DWAF, 2005; DWAF, 2008).
- 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 (NWA):
    - 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.
- A secondary desktop level delineation of wetlands within a 500 m radius around the study area.

- The description and classification of delineated wetlands areas into corresponding hydro-geomorphic (HGM) units according to Ollis *et al.* (2013).
- Present Ecological State assessment of delineated wetland areas within the study area. Wetland areas located outside of the study area, but within a 500 m radius of the site are assessed at a desktop level.
- Ecological Importance and Sensitivity (EIS) assessment of identified wetlands areas within the study area. Wetland areas located outside of the study area, but within a 500 m radius of the site are assessed at a desktop level.
- A risk matrix impact assessment based on GN509 (published in August 2016) for the evaluation of Section 21 (c) and (i) water use activities within the regulated area.
- The risk matrix assessment will include recommended mitigation measures associated with the proposed project.

1.4 Legislative Context

- Wetlands and other watercourses are protected water resources in the NWA. The development or transformation of a watercourse is regarded as a water use, which can only be allowed through an approved Water Use License, irrespective of the condition of the affected watercourse.
- The NWA defines Section 21 (c) and (i) water use activities in a watercourse, specifically related to wetlands and riparian areas, as follows:
    - (c) impeding or diverting the flow of water in a watercourse; and
    - (i) altering the bed, banks, course or characteristics of a watercourse;
- A requirement from the Department of Water Affairs (now the Department of Water and Sanitation), published in Government Gazette No 32805 on 18 December 2009, also require that a Water Use License (WUL) or General Authorisation (GA) should be applied for when any wetland is present within a 500 m radius of Section 21 (c) and (i) water use activities.
- The 500 m radius around any wetland is referred to as the regulated area for Section 21 (c) an (i) water use activities.
- Wetlands are also protected in other pieces of environmental legislation, such as the National Environmental Management Act (NEMA), Act 107 of 1998. The act lists several activities that require authorisation before they can be implemented.
- NEMA lists various activities that require authorisation when located within 32 m or less from the edge of a wetland or other watercourse. Special mention is also made regarding listed activities and watercourses that contain peat.

2. METHODS

2.1. General

This study investigates the potential occurrence of wetlands within the site and in a surrounding 500 m radius. The latter is also known as the regulated area for Section 21 (c) and (i) water use activities. The following methods and approach were applied as part of the study:

- Existing spatial datasets that indicate potential wetlands and other watercourses were used as part of an initial desktop approach. These include the following:
    - The 1:50 000 river line dataset of the study area and its surroundings was used, as illustrated on the relevant topographic map (2628BC Endicott).
    - The National Biodiversity Assessment (NBA) spatial wetland layer (Van Deventer, 2018).
    - The 2013-14 South African National Land Cover dataset, which indicates wetlands based on the globally available Landsat 8 imagery (GTI, 2015). This dataset was used to further help identify the presence of wetlands and other watercourses within the study area.
- A site survey was undertaken on 6 August 2019. Areas in the site that may contain wetlands were investigated in order to delineate verified wetlands. Procedures provided by the Department of Water and Sanitation (DWS; previously also known as DWAF and DWA) were used for this purpose (DWAF 2005 & DWAF, 2008).
- Available wetland indicators that were investigated included the presence of hydromorphic (wetland soil) features, the presence of wetland plant species (facultative and obligate hydrophytes) and terrain unit indicators.
- A 500 m radius area outside of the property was also investigated, albeit through a mainly desktop approach, to determine whether any potential wetlands occur in the area.
- Identified wetland areas were delineated into GIS polygon shapefiles, 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 Present Ecological State (PES) of any identified natural wetland was be determined through a Level 1 Wet-Health assessment for non-depression wetlands (Macfarlane *et al*., 2008).
- No specific method is currently prescribed in South Africa for the purpose of determining the PES of depression wetlands. Depression, or pan wetlands, do not respond in the same manner to geomorphological changes compared to other wetland types, with processes, such as erosion, often being absent. DWAF (1999) provided a method for determining, at the 'Intermediate level', the PES of palustrine wetlands according to a modified 'Habitat Integrity' approach developed in 1996 and 1999 by the same author. This simple and rapid method is presently considered as the best option to determine the PES of depression wetlands and is applied here.
- This wetland PES assessment method developed by DWAF (1999), as well as subsequent PES wetland assessment techniques, do not provide a direct determination or estimate of biological integrity, but rather relies heavily on selected habitat characteristics such as 'types of development and land use', hydrology (probable modifications to flow regime), water quality and sedimentation levels to estimate 'Present Ecological Status'.

- Results from the PES assessments can be rated into one of six categories ranging from unmodified / pristine wetlands (Class A) to critically / totally modified wetlands (Class F), (Table 1).
- The Ecological Importance and Sensitivity (EIS) of identified natural and artificial wetlands will be determined through the method developed by Rountree & Malan (2013), (Table 2).
- Each delineated wetland are also assessed in terms of their direct human benefits and hydro functional importance (Rountree and Malan, 2013).

Table 1: Description of A – F Present Ecological State (PES) categories for wetlands, ranging from "Natural" (Category A) to "Critically Modified" (Category F), (DWAF, 1999, Macfarlane *et al.,* 2008).

Category		Description	Combined impact score (Macfarlane *et al.,* 2008)	*Mean score (DWAF, 1999)
A	Natural	Unmodified, Natural.	0-0.9	>4
B	Largely Natural	Few modifications, small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	1-1.9	>3 and <=4
C	Moderately Modified	A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	2-3.9	>2.5 and <=3
D	Largely Modified	Large loss of natural habitat, biota and basic ecosystem functions has occurred.	4-5.9	<=2.5 and >1.5
E	Seriously Modified	The losses of natural habitat, biota and basic ecosystem functions are extensive.	6-7.9	>0 and <=1.5
F	Critically Modified	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	8-10	0

*If any of the attributes are rated <2 using the DWAF 91999) method, then the lowest rating for the attribute should be taken as indicative of the PES category and not the mean.

Table 2: Indicates Ecological Importance and Sensitivity (EIS) categories for wetlands, as well as categories for direct human benefits and hydro functional importance (Rountree *et al.*, 2013).

Ecological Importance and Sensitivity Category (EIS)	**Range of Median**	**EIS Class**
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these watercourses is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	4	**A**
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these watercourses may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>3 and <4	**B**
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these watercourses 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.	>2 and </=3	**C**
Low/Marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these watercourses 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.	>1 and </=2	**D**
None: Wetlands that are rarely sensitive to changes in water quality/hydrological regime.	0 and </=1	**E**

2.2. Risk Matrix Impact Assessment Method Based on GN 509

The DWS Risk assessment protocol that was used was obtained from GN 509. Risk posed to "resource quality", as defined in the NWA, must be scored according to the Risk Rating Table for Severity (Table 3). A Severity score is then generated. Consequence, Likelihood and finally Significance scores are automatically calculated with the rest of parameters according to respective Risk Rating Tables (Tables 3-10).

Risk is determined after considering all listed control /mitigation measures. Borderline LOW /MODERATE risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures considered and listed in RED font. ONLY LOW RISK ACTIVITIES located within the regulated area of the watercourse will qualify for a General Authorisation (GA) according to GN 509 (Table 10). Medium and High risk activities will require a Section 21 (c) and (i) water use licence. The risk rating is determined by combined scores from the following matrix components (Tables 3-10):

Consequence= Severity + Spatial Scale + Duration

Likelihood = Frequency of the Activity+ Frequency of the Impact + Legal Issues + Detection

Risk = Consequence x Likelihood

Table 3: Severity - How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table 4: Spatial scale - How big is the area that the aspect is impacting on? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 5: Duration -How long does the aspect impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table 6: Frequency of the activity - How often do you do the specific activity? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 7: Frequency of the incident/impact - How often does the activity impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 8: Legal issues - How is the activity governed by legislation? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
This is a constant, will always be regulated in terms of Section 21 water use, if not then the affected activity should not be subject to the Risk Matrix. **Located within the regulated areas refers to location within the 1 in 100 year flood line or delineated riparian area as measured from the middle of the watercourse measured on both banks, or within a 500 m radius of the boundary of any wetland.**	

Table 9: Detections – How quickly/easily can the impacts/risks of the activity be observed on the resource quality, people and property? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table 10: Significance rating score and risk classes based on the DWS Risk Matrix Impact Assessment method (GN 509).

SIGNIFICNACE RATING	RISK CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. **Licence required.**
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. **Licence required.**

2.3. Limitations

The results of the wetland assessment are based on a winter study, undertaken on 6 August 2019. Summer surveys are not critical for wetland assessments, but are preferred as they provide an opportunity to make better use of all available wetland indicators, specifically wetland-associated plant species that are often dormant during the dry winter season. Localised fire events have further restricted the use of plant species as an indicator of wetland conditions, as described by the DWS (DWAF, 2005 and 2008).

The accurate delineation of wetland boundaries in urban areas is often constrained by disturbances, such as infill and dumping. These impacts restrict the identification of wetlands indicators, such as hydromorphic and hydrophytic features.

3. FINDINGS

3.1. Wetland Delineation

The site is located in Quaternary Catchment C21E, within the Upper Vaal Water Management Area (WMA). Quaternary Catchment C21E has a largely modified (class D) Present Ecological State (PES) and a High Ecological Importance and Sensitivity (EIS), (Middleton and Bailey, 2008). The Blesbokspruit River is located approximately 0.85 km west of the site (Figure 1).

All existing wetland-associated spatial datasets indicate the present of wetland habitat, within the study area. These include the NFEPA (2011), NBA (2018), 2013-2014 Landcover dataset (GTI, 2015), (Figure 1). The entire site is dominated by a depression hydro-geomorphic (HGM) wetland unit that has been modified by infilling, dumping, alien plants, stormwater inflows and infrastructure, specifically sport fields and hard surface structures (Figure 3). The depression wetland is already visible in an aerial photograph from 1952 (Figure 4).

A second wetland, is located southwest of the site, but falls within a separate catchment (Figure 3). Depression wetland are endorheic wetland types that drain inward and are therefore not connected to the rest of the drainage network. The second wetland is a channelled valley bottom wetland with a prominent stormwater drain in its centre. It is also visible on the historical aerial photograph from 1952, but has been reduced in size due to residential development encroachment (Figure 4).

The depression wetland has a size of 27.4 ha and overlap with 84.82 % of the 32.3 ha site, while the channelled valley bottom has a size of 3.1 ha and does not overlap with the site (Figure 3).

The large central zone of the site, referred to as the core wetland zone in Section 3.2, is characterised by permanent to seasonal wetland conditions. Standing water is present during winter and increases in size during summer. Recorded obligate hydrophytes include the rush *Typha capensis*, the sedges *Juncus effuses, J. oxycarpus, J. exsertus, J. dregeanus, Cyperus denudatus, C. fastigiatus, C. laevigatus, Schoenoplectus corymbosus* and the grasses *Phragmites australis, Leersia hexandra, Hemarthria altissima, Paspalum dilatatum* and *P. urvillei.*

Indicators in the outer margins of the wetland were obscured by soil disturbances, but hydromorphic features, such as mottling and spots of localised iron depletion, were still recorded in-between disturbances throughout the study area (Figure 5). The school property, located within the north-western portion of the site was not surveyed as the proposed Open Space Development Plan does not currently include this area (Figures 2 and 3).

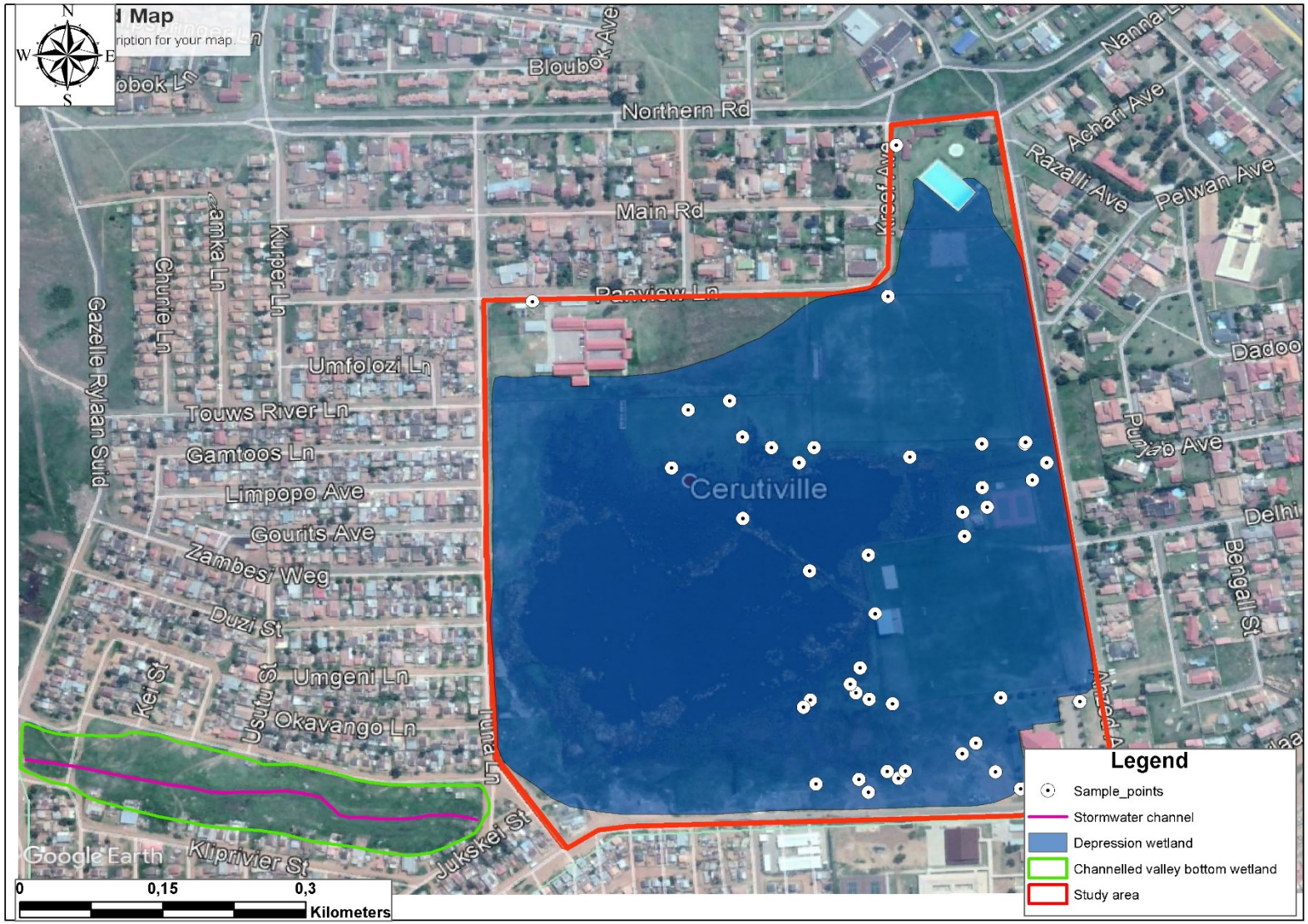

Figure 3: Delineated wetland habitat within the study area consists of a prominent depression hydro-geomorphological (HGM) unit, while a channelled valley bottom wetland with a stormwater drain in its center is present to the southwest of the site

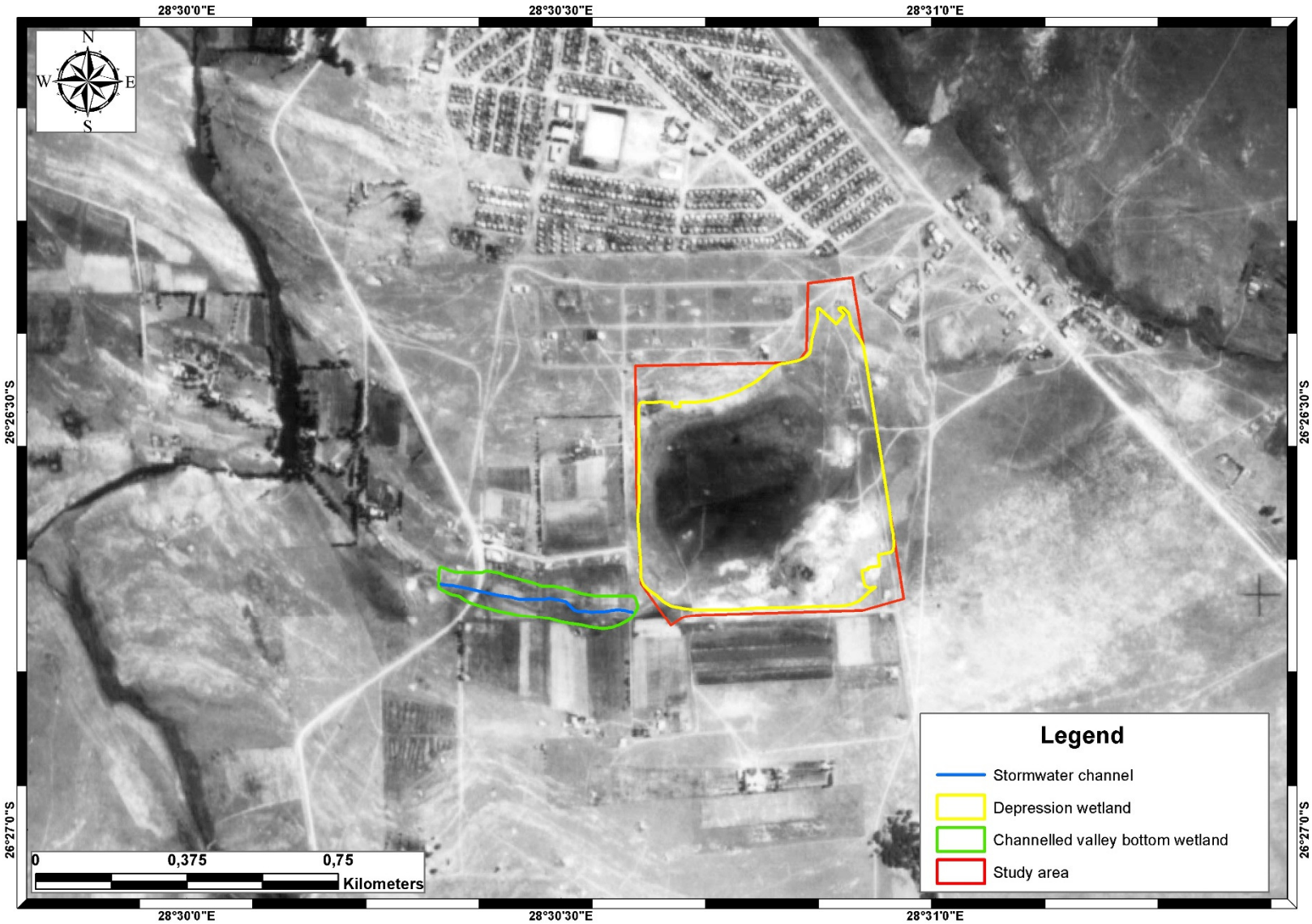

Figure 4: Illustrates the property and delineated wetland habitat on a georeferenced aerial photograph from 1952.

Figure 5: Examples of recorded hydromorphic features, such as mottling and areas of iron removal (depletion).

3.2. Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

3.2.1. Depression wetland

Five different zones are present within the depression wetland (Figures 6 to 9). These zones were identified based on a combination of factors that include wetness regime, land use and type of disturbance. Each zone has a similar level of disturbance and are used to help determine the PES of the depression wetland. The school property wetland zone primarily indicates an area that was not surveyed and also partially burned in August 2019. **The school property wetland zone has a surface area of 1.11 ha and overlaps with 4.03 % of the depression wetland.**

The margins of the depression wetland are clearly more disturbed than the central core area. **The core wetland zone has a surface area of 12.84 ha and forms 46.83 % of the depression wetland.** Impacts in the wetland margins include the following (Figures 6 to 9):

- Infrastructure encroachment, specifically the present of sport fields that have been raised above the natural ground level, as well as hard surface development, such as tennis courts and a pavilion. **The infrastructure wetland zone has a combined surface area of 6.51 ha and forms 23.75 % of the depression wetland.**
- Infill forms a raised semicircle within a portion of the depression wetland with temporary structures, such as an informal car wash along Sastri Road. Infill also encroaches into the centre of the core area as an old dam wall. **The infill wetland zone has a combined surface area of 3.09 ha and forms 11.28 % of the depression wetland.**
- A disturbed outer zone where localised dumping and dense stands of alien plant species are present, specifically the grass *Pennisetum clandestinum* (kikuyu). A high grazing pressure by cattle and a tied horse is also present in this zone. **The disturbed outer wetland zone has a combined surface area of 3.86 ha and forms 14.07 % of the depression wetland.**

Localised dumping extends into the core area; the area contains permanent inundation that fluctuates depending on rainfall (Figures 6, 7 and 9). The entire catchment of the depression wetland consists of a built-up area that drains into the wetland. Stormwater inflows into the wetland occurs at different outlets (Figure 6). One such stormwater inlet in the east, next to Ahzed Avenue, has been converted into a stormwater channel. It contained a distinct smell of sewage pollution, as well as visible evidence of sewage pollution (Figures 3 and 8). Low water quality inflows into the wetland is therefore regarded as a common occurrence.

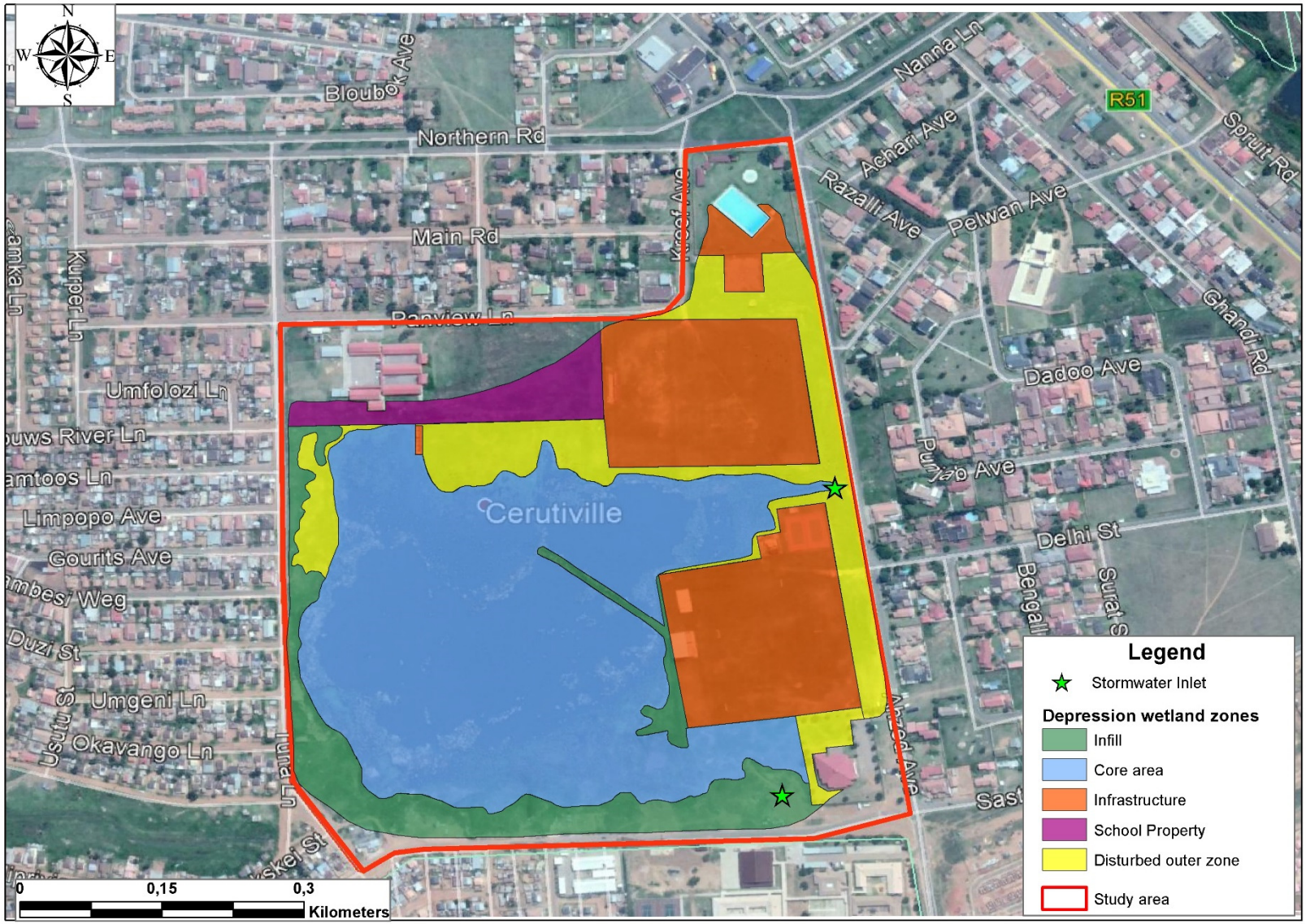

Figure 6: Illustrate different zones within the depression wetland based on wetness regime and different types of disturbances.

Figure 7: Examples of the infill zone within the depression wetland include impacts along the outer margins of the wetland (top); and an old dam wall and footpaths within the core area (bottom).

Figure 8: Examples of the disturbed outer zone include a highly grazed area dominated by the alien grass *Pennisetum clandestinum* south of the school property (top); and an area around a stormwater channel with signs of sewage pollution in the eastern portion of the site (bottom).

Figure 9: Example of a sport field with a pavilion in the depression wetland (top) and localised dumping covered by *Pennisetum clandestinum* within the central zone (bottom).

The combined Present Ecological State (PES) of the depression wetland is a class E (Seriously modified) based on an assessment of identified impacts (Tables 1 and 11). The Seriously modified state of the wetland has a high level of confidence associated with it.

Ecological Importance and Sensitivity (EIS) assessments do not compare a wetland to its reference condition, but to the provision of ecosystem services, which include their value to biodiversity, hydrological functioning and direct human benefits. This includes the provision of grazing habitat and other natural resources (Rountree *et al*., 2013).

The EIS of the wetland is regarded as Moderate (class C), (Tables 2 and 12). This is mainly due to overlap with a Critically Endangered Threatened Ecosystem, namely the Blesbokspruit Highveld Grassland (GP1). No "species of conservation concern" (*sensu* Raimondo *et al*., 2009) were recorded within the depression wetland. The level of confidence associated with the occurrence of 'species of conservation concern" is low, as the site survey was undertaken during the dry season. The wetland is, however, seriously modified (class E PES) and natural habitat is disturbed by different impacts throughout the study area. The ecological investigation also regard the likelihood for the occurrence of wetland-associated plant 'species of conservation concern" as Low (Niemand, 2019)

The Hydro-functional Importance and Direct Human Benefits categories are respectively calculated as Low/Marginal (class D) and None (Class E), (Table 12). Depression wetlands provide minimum hydrological ecosystem services as they are endorheic systems that are not connected to the drainage network. The only distinct direct human benefit is the provision of grazing habitat for cattle.

Table 11: Results of the current PES assessment for the depression wetland (also refer to Table 1 and Figure 3).

PES criteria & attributes	Scores for each wetland heath component	Confidence level scores
Hydrologic		
Flow modification [e.g. changes in the flow regime, volumes, velocity that affect inundation of wetland habitats]	2	3
Permanent Inundation (as a result of impoundments)	2	3
Water Quality		
Water quality modification (e.g. from point or diffuse sources)	1	3
Sediment load modification (e.g. due to increased erosion, accretion or **infilling** of wetlands habitats.)	2	3
Hydraulic/ Geomorphic		
Canalisation (e.g. channel diversions or drainage that result in desiccation)	Not applicable to depression wetland in general (excluded from this assessment)	-
Topographic alteration (e.g. as a result of infilling, ploughing, bridges, roads, and railway lines)	1	3
Biota		
Terrestrial encroachment / Loss of species richness (e.g. due to the desiccation of wetland habitat)	Not applicable to depression wetland in general (excluded from this assessment)	-
Indigenous vegetation removal (e.g. due to land use activities)	2	3
Invasive plant encroachment	1	2
Over utilisation of biota	2	2
TOTAL	**13**	**22**
MEAN	**1.63**	**2.75**
Motivation for an adjustment, and general comments	The presence of two seriously modified scores result in an automatic E (seriously modified) PES for the depression wetland.	
PES	**E**	**High confidence**

Scoring guidelines per attribute:
Natural, unmodified = 5; Largely natural = 4, Moderately modified = 3; Largely modified = 2;
Seriously modified = 1; Critically modified = 0.
Relative confidence of score:
Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1.
If any of the attributes are rated <2, then the lowest rating for the attribute should be taken as indicative of the PES category and not the mean.

Table 12: Ecological Importance and Sensitivity (EIS), hydro-functional importance and direct human benefit values and categories for the delineated depression wetland.

	Depression wetland	
	Range of median and category	**Level of confidence**
Ecological Importance and Sensitivity (EIS) score	2.4	2.6
Ecological Importance and Sensitivity (EIS) Category	**C (Moderate)**	Moderate
Hydro-functional Importance score	1.1	2.5
Hydro-functional Importance Category	**D (Low/Marginal)**	Moderate
Direct Human Benefits score	0.8	3.5
Direct Human Benefits Category	**E (None)**	High

3.2.2. Channelled valley bottom wetland

The channelled valley bottom wetland is located outside of the study and in a separate catchment, but is still located within a 500 m radius of the property (Figure 3). The wetland overlaps with convergent contour lines and existed previously as an unchannelled valley bottom wetland. A stormwater channel was created in the wetland after the area became increasingly urbanised and development infrastructure encroached into the wetland. Grazing by livestock and alien plant species, such as *Pennisetum clandestinum*, are expected to occur within the wetland.

The combined Present Ecological State (PES) of the depression wetland is a class E (Seriously modified) based on an assessment of identified impacts (Tables 1 and 13).

Table 13: Summary of the current Present Ecological State of the channelled valley bottom wetland (also refer to Table 1 and Figure 3).

Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
3.1 ha	100 %	6.5	-1	6.7	-1	5.3	-1
PES Category		**E**	↓	**E**	↓	**D**	↓
Wetland Impact Score		6.21					
Wetland PES		**E**					

The EIS of the wetland is regarded as Low/Marginal (class D), (Tables 2 and 14). This is mainly due to overlap with a Critically Endangered Threatened Ecosystem, namely the Blesbokspruit Highveld Grassland (GP1). The channelled valley bottom wetland has habitat diversity compared to the depression wetland.

No "species of conservation concern" (*sensu* Raimondo *et al*., 2009) were recorded within the depression wetland. The level of confidence associated with the occurrence of 'species of conservation concern" is low, as the site survey was undertaken during the dry season. The wetland is, however, seriously modified (class E PES) and natural habitat is disturbed by different impacts throughout the study area.

The Hydro-functional Importance and Direct Human Benefits categories are respectively calculated as Low/Marginal (class D) and None (Class E), (Table 14).

Table 14: Ecological Importance and Sensitivity (EIS), hydro-functional importance and direct human benefit values and categories for the delineated channelled valley bottom wetland (also refer to Table 1 and Figure 3).

	Depression wetland	
	Range of median and category	**Level of confidence**
Ecological Importance and Sensitivity (EIS) score	1.8	2.1
Ecological Importance and Sensitivity (EIS) Category	**D (Low/Marginal)**	Low
Hydro-functional Importance score	1.4	2.5
Hydro-functional Importance Category	**D (Low/Marginal)**	Moderate
Direct Human Benefits score	0.5	3.0
Direct Human Benefits Category	**E (None)**	Moderate-High

4. RISK MATRIX IMPACT ASSESSMENT

4.1 Proposed Open Space Development Layout

The proposed Tuna Park Open Space Master Plan indicate that existing sport fields remain in place, but areas along the Infill zone and Disturbed outer zone will be converted into parks and pathways (Figures 6 and 10). Hard surface infrastructure associated with the proposed open space development appear to be limited within the depression wetland (Figure 10), There is evidence of a tent occurring in the southwestern corner of the property and an unknown structure in the south along Sastri Road (Figures 3 and 10).

The use of existing zones of disturbance for the creation of recreational areas is regarded as an appropiate means of impact mitigation. It will also provide an opportunity for positive impacts, such as the partially removal of infilled areas through landscaping. The replacement of areas dominated by aliens, such as the grass *Pennisetum clandestinum*, by indigenous species (e.g. the grass *Cynodon dactylon*), is also expected to be possible. The replacement of *Pennisetum clandestinum* by indigenous wetland species is, however, not easily achieved, as this aggressive species is difficult to eradicate permanently from wetland habitat. Revegetation of affected areas, can, however, help to improve the indigenous plant diversity of the area. Recommendations of which alien plant species to control within the study area are provided by Niemand (2019).

Figure 10: The proposed Tuna Park Open Space Project Master Plan.

4.2 Impacts Associated with the Construction Phase

Results from the Risk assessment protocol with associated matrix for expected project-related impacts, based on the impact assessment method published in GN 509 (26 August 2016), are provided in Table 13. The impact risk assessment table pertains specifically to Section 21 (*c*) and (*i*) water uses, as defined in the National Water Act (Act No. 36 of 1998) (NWA), which include:

(c) Impeding or diverting the flow of water in a watercourse

(i) Altering the bed, banks, course or characteristics of a watercourse

A wetland buffer is not applicable to this proposed development, as the development is located directly within wetland habitat. As a result the severity of various wetland impacts are automatically scored as High, as per the GN509 risk matrix assessment method (Tables 3 and 15)

4.2.1. Onsite construction (clearing, landscaping, stockpiling and vehicle movement)

Onsite construction activities can result in the transportation of sediment from bare areas and the creation of stockpiles in wetland habitat, as well as landscaping of wetland habitat along its disturbed margins. Runoff from these activities can cause erosion and/or sedimentation within the depression wetland. Other impacts include spillage of hydrocarbons by construction vehicles, littering on site and the generation of uncontrolled biological waste during the construction phase. Onsite construction activities can only be reduced to a Moderate risk class through mitigation measures (Table 15).

Recommended mitigation

- Locate stockpiles outside of wetland habitat where possible.
- Protect stockpiles of topsoil and subsoil material with silt fences that should be maintained during the entire construction phase on site. This is especially important when construction occurs during the wet summer and autumn months.
- Revegetate landscaped areas with indigenous wetland species during the start of the growing season.
- Check vehicles regularly for oil leaks and only refuel in designated areas outside of wetland habitat.
- Provide clearly marked bins for litter and the discard of other waste materials.
- Provide and maintain portable toilets outside of wetland habitat during the construction phase.
- No new furrows, drains or dams should be created within delineated wetland areas.
- Footpaths and landscape areas should be located on areas designated as Infill and Disturbed outer zones as far as possible (Figure 6).
- A rehabilitation plan should be implemented near the end of the construction phase to address remnant impacts and control alien plants within the depression wetland. Several aliens are present in the wetland and targeted control using mechanical removal, landscape management (e.g. controlled burning) and herbicides will result in a positive project-associated impact.

4.2.2. Operational phase impacts (reduction of vegetation cover due to recreational use)

Once construction is complete the study area will have increased used as a recreational area. This will result in an increase in people movement in the outer margins of the wetland where facilities have been created. Onsite operational impacts can be reduced to a Low risk class through mitigation measures (Table 15).

Table 15: Risk matrix impact table for the assessments of project related Section 21 *(c)* and *(i)* water use activities that could affect wetlands delineated within a 500 m radius of the site, specifically the depression wetland located within the site. Impacts are assessed for both the construction and operational phases of the proposed development. This impact table only assessed identified impacts with mitigation measures, as per the the DWS risk assemssnt protocol (GN 509) (refer to Tables 3 to 10 in Section 2.2.)

Phase	Activity	Aspect	Impact	Flow Regime	Physico & Chemical	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Construction	Onsite construction (clearing, excavation and landscaping, stockpiling and vehicle movement)	Stormwater runoff from bare areas	Pollution of surface water resources (e.g. wetlands); Erosion on site; Sedimentation in wetlands Change in wetland vegetation	5	5	5	5	5	1	1	7.0	1	1	5	1	8	56	**M**	60	Refer to Section 4.2.1. in this report
		Spillage of hydrocarbons		2	4	4	4	3.5	1	1	5.5	1	1	5	2	9	50	**L**	70	
		Landscaping and revegetation in wetland habitat		5	5	5	5	5	1	4	10.0	2	2	5	1	10	100	**M**	70	
		Biological waste and littering		2	2	2	2	2	1	1	4.0	1	1	5	1	8	32	**L**	70	
Operation	Disturbances caused by used of area for recreational activities	Reduction of vegetation cover	Encroachment of alien plant species and habitat erosion	5	5	5	5	5	1	1	7.0	4	2	5	1	12	84	**M**	60	Refer to Section 4.2.2. in this report

Recommended mitigation

- New erosion features, such as rills and headcut that may develop, should be stabilised once observed.
- Alien control of species identified by Niemand (2019) should be undertaken once a year.

5. CONCLUSION

The proposed open space plan development is not expected to cause further degradation of the wetland even though the activities are located within wetland habitat. The affected depression wetland is Severely modified (class E PES) and will remain in this PES class in spite of the proposed development on the condition that indigenous species are used for the proposed open space development and that alien control is applied. An opportunity is therefore available to improve wetland habitat through the removal, or partial removal, of existing infill material and the control of alien plant species.

The proposed development is not associated with a fatal flaw from a wetland health and functioning consideration. However, all of the identified project-related impacts associated with section 21 (c) and (i) water uses during the Construction and Operational Phase of the proposed development cannot be reduced to a Low risk class with mitigation (Table 15). This is mainly due to the methodology applied in the GN 509 risk matrix impact assessment protocol, which results in an automatic High severity for any development activity located within wetland habitat. **A full WULA will therefore be required to obtain authorisation for Section 21 (c) and (i) water use activities based on results from the GN 509 risk matrix assessment (Table 15).**

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Van Deventer, H. 2010. Using landscape data to classify wetlands for country-wide conservation planning. CSIR, Pretoria.

APPENDIX A: CURRICULUM VITAE

Name:	Lourens Erasmus Retief Grobler
Name of Firm:	Imperata Consulting CC
Position:	Wetland Ecologist
Nationality:	South African
Languages:	Afrikaans (mother tongue), English

EDUCATIONAL QUALIFICATIONS

BSc (Botany), University of Pretoria (1999–2001)

BSc Hons (Botany) (cum laude), University of Pretoria (2004)

Title of Thesis: "*The Impact of subsistence banana (Musa x paradisiaca) farming on the vegetation of peat swamp forest surrounding the Kosi Bay Lake System.*"

MSc Botany (cum laude), University of Pretoria (2009)

Title of Thesis: "*Phytosociology of Peat Swamp Forests of the Kosi Bay Lake System."*

KEY QUALIFICATIONS

Watercourse Investigations, Including Wetland and Riparian Habitat Delineation (Mapping), Assessments, Management & Rehabilitation:

Involved in wetland inventories, classification and description of watercourses, mapping of drainage lines (e.g. wetlands, rivers and ephemeral headwaters), ecological assessments, and wetland rehabilitation studies. A selection of projects demonstrating relevant experience, include:

Wetland rehabilitation

- Wetland rehabilitation assessment plans for the South African National Biodiversity Institute (SANBI) for several wetlands in the Eastern Free State. 2005.
- Wetland health and rehabilitation assessments for the Gauteng Province, as part of the Working for Wetlands Project under the auspices of the South African National Biodiversity Institute (SANBI). Wetland Ecologist and sub-consultant to Land Resources International (Pty) Ltd. 2007-2009.

- Wetland health and rehabilitation assessments for the Gauteng Province, as part of the Working for Wetlands Project under the auspices of the South African National Biodiversity Institute (SANBI). Wetland Ecologist sub-consultant to Aurecon South Africa (Pty) Ltd. 2010-2011
- Wetland health and rehabilitation assessments for two wetland rehabilitation projects, upstream of Boksburg Lake, Ekurhuleni Metropolitan Municipality, Gauteng. Wetland Ecologist and sub-consultant to Land Resources International (Pty) Ltd. 2011
- Wetland rehabilitation and assessment report for the Hogsback area (Eastern Cape Province), as part of the Working for Wetlands Project under the auspices of the South African National Biodiversity Institute (SANBI). Wetland Ecologist sub-consultant to Aurecon South Africa (Pty) Ltd. 2011
- Wetland & river reinstatement and monitoring guideline report for the New Multi Product Pipeline (NMPP) Project, Trunkline Section (Jameson Park, Gauteng to Durban, KwaZulu-Natal). Transnet Capital Projects. 2010
- Alien plant control in watercourse crossings (wetlands & rivers) report for the New Multi Product Pipeline (NMPP) Project, Trunkline Section (Jameson Park, Gauteng to Durban, KwaZulu-Natal). Transnet Capital Projects. 2012

Wetland studies for a variety of strategic planning, residential, commercial and industrial projects

- Ecological functional assessment of wetland areas surrounding the Orlando Power Station for the proposed Ekhaya development, Soweto, Gauteng. Strategic Environmental Focus (SEF), (Pty) Ltd 2005.
- Wetland Audit for the City of Johannesburg. Reviewer and sub-consultant for Strategic Environmental Focus (SEF), (Pty) Ltd. 2008
- Elsburgspruit wetland and habitat assessment, Ekurhuleni Metropolitan Municipality, Gauteng Province. Sub-consultant for Van Riet & Louw Landscape Architects (Pty) Ltd. 2008
- Wetland and watercourse delineation and assessment for the proposed Sun City Vacation Club and Golf Course Phase 3 Development, North West Province. EkoInfo CC. 2008
- Wetland delineation & assessment study for the proposed construction and operation of an aluminium fluoride production facility and associated infrastructure on the farm Jobarne 489 JR, Ekandustria, Gauteng Province. African Geo-Environmental Services (AGES). 2010
- Development of a prioritisation framework for wetland rehabilitation in Ekurhuleni Metropolitan Municipality. Land Resources International (Pty) Ltd. 2011
- Surface watercourse and wetland desktop investigation for the Ivory Park Urban Development Framework, City of Johannesburg, Gauteng Province. Aurecon Group. 2011

- Wetland Study (Delineation & Assessment) for the proposed Witfontein Commercial & Residential Development, Ekurhuleni Metropolitan Municipality, Gauteng Province. Aurecon Group. 2011

Wetland & watercourse assessments in linear developments (power lines, roads, railway. and pipeline projects) and other projects in the energy sector (e.g. solar electricity installations):

- Wetland investigation for The Hills road alternatives, Pretoria-East, Gauteng. African-EPA. 2007
- Wetland and river bio-monitoring assessments for the New Multi Product Pipeline (NMPP) Project, Trunkline Section (Jameson Park, Gauteng to Durban, KwaZulu-Natal). Transnet Capital Projects. 2009-2013
- Wetland and surface watercourse study for the proposed Ariadne-Venus 475 kV transmission line, Kwa-Zulu Natal. Baagi Environmental Consultancy. 2010
- Surface watercourse assessment study for the proposed R5 Rand Water pipeline between Rietvlei N.R. and Mamelodi, Gauteng. Aurecon Group. 2010
- Wetland and surface watercourse study for the proposed Paulputs-Aggeneys 220kV transmission line, Northern Cape. SSI Engineers and Environmental Consultants. 2011
- Surface watercourse investigation for a proposed 20MW solar electricity installation at Kalgold Mine, North West Province. Mark Wood Consultants. 2011
- Wetland and surface watercourse study for the proposed Arnot-Ginaledi 475 kV transmission line, Mpumalanga Province. Baagi Environmental Consultancy. 2012
- Watercourse investigation for the proposed upgrade of a section of the N4 Platinum Highway, Rustenburg, North West Province. Environamic. 2012.
- Wetland delineation review for the proposed 80 MW photovoltaic solar electricity installation, Grootvlei, Mpumalanga Province. Mark Wood Consultants. 2012
- Wetland and watercourse assessment study for a proposed 75MW Photovoltiac (PV) plant and associated infrastructure on a portion of the remaining extent of Erf 1, Prieska Northern Cape Province. Enviro Insight. 2012
- Water Use License application & watercourse assessment for permanent access roads on Section PL1-PL4 (Durban to Kendal) of Transnet's New Multi Product Pipeline (NMPP) Project. Transnet Capital Projects. 2012-2014
- Watercourse assessments for the Ngqura 16 MTPA manganese ore rail expansion: Area 1 & 3 (Coega – De Aar; Eastern & Northern Cape). Hatch South Africa. 2013
- Watercourse assessment for the Douglas-Hopetown road upgrade project, Northern Cape. EIMS. 2013.

- Specialist Wetland & Drainage Line Investigation for the Proposed Hermes 132 kV Distribution Line and Substation, Klerksdorp, North West Province. Envirolution Consulting. 2013
- Specialist Medupi-Borutho 400 kV Power Line Environmental Management Plan (EMP) – Watercourses & Drainage Lines. North West Province. Baagi Environmental Consultancy. 2013.
- Specialist Gromis-Orangemund 400 kV Power Line Environmental Management Plan (EMP) – Watercourses & Drainage Systems, Northern Cape Province. Baagi Environmental Consultancy. 2013
- Watercourse delineation, PES & EIS assessment specialist study for a Water Use License Application for 8 proposed distribution lines around Ngwedi MTS, SA Chrome, Boschkoppie, Impofu Substation, Styldrift, Bakubung, Ledig, Sun City, Mokwase Industries, and Manyane Substations, North West Province. Baagi Environmental Consultancy. 2014
- Environmental Impact Assessment for the Sasol PSA and LPG Project: Botanical Biodiversity and Terrestrial and Wetland Habitat. Specialist Report, Inhassoro, Mozambique. In collaboration with De Castro & Brits C.C. for Mark Wood Consultants on behalf of SASOL. 2014.
- Specialist Watercourse and Wetland Study For the Proposed 500kV Nzhelele to Triangle Eskom Powerline Project (RSA Section Only) EIA Project, Limpopo Province. Baagi Environmental Consultancy. 2014

Green Star eco-conditional office development assessments:

- Green Star eco-conditional office assessment for the Lynnwood Bridge retail phase 2 development, Gauteng. Aurecon Group. 2011
- Green Star eco-conditional office assessment for the GCIS Hatfield head office development, Gauteng. Aurecon Group. 2012
- Green Star eco-conditional office assessment for the USAID expansion development, Gauteng. Aurecon Group. 2012
- Green Star eco-conditional office assessment for the Atrium on 5th development, Gauteng. Aurecon Group. 2012
- Green Star eco-conditional office assessment for the Lynnwood Bridge retail phase 3 development, Gauteng. Aurecon Group. 2013
- Green Star eco-conditional office assessment for the Athol Towers development, Gauteng. Aurecon Group. 2013

Wetlands and surface watercourse assessments for mining-related developments:

- Wetland and drainage line watercourse study for a proposed Fluorspar Mine in Dinokeng, Gauteng Province. African Geo-Environmental Services (AGES), (Pty) Ltd. 2009.

- Wetland assessment study for the proposed Northern Coal Colliery near Breyton, Mpumalanga Province. Terra Soil Science. 2010.
- Desktop wetland & watercourse assessment for Harmony Gold's Kusasalethu Mine as part of their ISO 14000 environmental management certification, North West Province. DD Science. 2012.
- Watercourse assessment for a water re-use and reclamation project at Mponeng Mine, North West Province, De Castro & Brits Ecological Consultants. 2013

Additional Wetland Related Training:

- Attended a two-day DWAF (DWA) facilitated wetland training course on the Wetland Index of Habitat Integrity assessment technique (Wetland IHI methodology) presented by Mark Rountree, June 2009.

Training - Course Lecturer:

- Co-lecturer and founding member of an Introductory Wetland Training Course, presented by the Department of Botany (University of Pretoria) through the University's Continued Education at UP (CE@UP) program, and the Gauteng Department of Agriculture, Conservation and Environment (GDACE). Aspects focused on include the legislation, delineation, drivers and ecology, assessments, management and rehabilitation of wetlands. This course was started in November 2004 and presented since then on September 2005, November 2005, May 2006, July 2007, May 2008, May 2010, and May 2012.

Publications:

1. Grobler, R., Bredenkamp, G. & Grundling, P-L. 2004. Subsistence farming and conservation constrains in coastal peat swamp forests of the Kosi Bay Lake System, Maputaland, South Africa. Géocarrefour 79: 4.
2. Grundling, P-L. & Grobler, R. 2005. Peatlands and mires of South Africa. In: Steiner, G.M. (ed.) Mires from Siberia to Tierra Del Fuego. Stapfia 85, Landesmuseen Neue Serie 35, pp. 379-396.
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MEMBERSHIPS IN PROFESSIONAL AND GENERAL SOCIETY

Professional Society

- Pr. Sci. Nat (Professional Natural Scientist) in the fields of Botanical and Ecological Science (Registration No. 400097/09).

- Please refer to the SACNASP website to undertake a search of their registered scientists in order to authenticate that Mr. LER Grobler is registered SACNASP member and is registered for the two fields indicated. Searches can be done according to employer (Imperata Consulting) or other criteria provided in this document.

  http://www.sacnaspregister.co.za/search/

General Society

- International Mire Conservation Group (IMCG), since 2003.
- Gauteng Wetland Forum (GWF), since 2006.
- South African Wetland Society (SAWS), since 2007.

EMPLOYMENT EXPERIENCE

Wetland Ecologist and Project Manager: Imperata Consulting (March 2007 – Present) Tasks include:

- Wetland and riparian habitat delineation according to the DWAF (2005) prescribed delineation guideline, as well as the demarcation of other drainage line types (e.g. headwater streams or A Section Channels)
- Wetland Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) assessments.
- Ecosystem assessments based on phytosociological investigations (vegetation unit identification, description, and assessment), as well as associated mapping and sensitivity rating of vegetation assemblages.
- Inventory, classification and mapping of wetland ecosystems.
- Wetland rehabilitation and monitoring.
- Wetland management and recommendation of impact mitigation measures.
- Environmental risk assessments related to the presence of wetland and riparian ecosystems.
- Project management related to specialist wetland, riparian and headwater ecosystem investigations.

Wetland Ecologist: SEF (January 2006 – February 2007) Tasks included:

- Wetland and riparian habitat delineation and wetland ecosystem functional assessments.
- Strategic wetland assessments and mapping.

- Vegetation analysis and description, including mapping of sensitive vegetation assemblages.

Nature Conservator: Tshwane Nature Conservation (July 2005 – December 2005) Tasks included:

- General management of the ecological integrity of greenbelt areas in the eastern section of the City of Tshwane Metropolitan Municipality, including the Colbyn Valley Peatland, Faerie Glen Nature Reserve, Moreletakloof Nature Reserve, Meyerspark Bird Sanctuary, and Murrayfield Koppie.

REFERRALS

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Mr. Piet-Louis Grundling: Independent Wetland Consultant and Researcher, as well as Chair of the South African Wetland Society (SAWS) and the International Mire Conservation Group (IMCG).

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