WETLAND ASSESSMENT

Proposed Lephalale Railway Yard and proposed Borrow Areas, Lephalale, Limpopo Province, South Africa

Culvert underneath railway line at Streamcrossing No3 at the site. Water visible in picture gathered after substantial rains.
Photo: R.F. Terblanche

APRIL 2019

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I) SPECIALIST EXPERTISE

SYNOPTIC CV: REINIER. F. TERBLANCHE

Reinier is an ecologist and in particular a habitat specialist with an exceptional combination of botanical and zoological expertise which he keeps fostering, updating and improving. He is busy with a PhD for which he registered at the Department of Conservation Ecology at the University of Stellenbosch in July 2013. Reinier's experience includes being a lecturer in ecology and zoology at the North West University, Potchefstroom Campus (1998-2008). Reinier collaborates with a number of institutes, organizations and universities on animal and plant research.

Qualifications:

Qualification	**Main subject matter**	**University**
M.Sc *Cum Laude*, **1998:** Botany: Ecology	Quantitative study of invertebrate assemblages and plant assemblages of rangelands in grasslands.	North-West University, Potchefstroom
B.Sc Honns *Cum Laude*, **1992** Botany: Taxonomy	Distinctions in all subjects: Plant Anatomy 75, Taxonomy 84, Modern Systematics 82, System Modelling 75, Plant Ecology 75, Taxonomy Project 77, Statistics Attendance Course.	North-West University, Potchefstroom
B.Sc Botany, Zoology	Main subjects: Botany, Zoology.	North-West University, Potchefstroom
Higher Education Diploma, 1990	Numerous subjects aimed at holistic training of teachers.	North-West University, Potchefstroom

In research Reinier specializes in conservation biology, threatened butterfly species, vegetation dynamics and ant assemblages at butterfly habitats as well as enhancing quantitative studies on butterflies of Africa. He has published extensively in the fields of taxonomy, biogeography and ecology in popular journals, peer-reviewed scientific journals and as co-author and co-editor of books (see 10 examples beneath).

Reinier practices as an ecological consultant and has been registered as a Professional Natural Scientist by SACNASP since 2005: Reg. No. 400244/05. His experience in consultation includes: Flora and fauna habitat surveys, Threatened species assessments, Riparian vegetation index surveys, Compilation of Ecological Management Plans, Biodiversity Action Plans and Status quo of biodiversity for Environmental Management Frameworks, Wetland Assessments, Management of Rare Wetland Species.

Recent activities/ awards: Best Poster Award at Oppenheimer De Beers Group Research Conference 2015, Johannesburg. One of the co-authors of Guidelines for Standardised Global Butterfly Monitoring, 2015, Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany (UNEP-WCMC), GEO BON Technical Series 1. Most recent award: Awarded the prestigious Torben Larsen Memorial Tankard in October 2017; one is awarded annually to the person responsible for the most outstanding written account on Afrotropical Lepidoptera. Lectured as Conservationist-in-Residence in the Wildlife Conservation Programme of the African Leadership University, Kigali, Rwanda, 9-23 February 2019.

EXPERIENCE

Lecturer: Zoology 1998-2008	**Main subject matter and level**	**Organization**
Lectured subjects	- 3rd year level Ecology, Plantparasitology - 2nd year level Ethology - *Master's degree* Evolutionary Ethology, Systematics in Practice, Morphology and Taxonomy of Insect Pests, Wetlands.	North-West University, Potchefstroom and University of South Africa
Co-promoter	PhD: Edge, D.A. 2005. Ecological factors that influence the survival of the Brenton Blue butterfly	North-West University, Potchefstroom
Study leader/ assistant study leader	Six MSc students, One BSc Honn student: Various quantitative biodiversity studies.	North-West University, Potchefstroom
Teacher 1994-1998	Biology and Science, Secondary School	Afrikaans Hoër Seunskool, Pretoria
Owned Anthene Ecological CC 2008 – present	- Flora and Fauna habitat surveys - Highly specialized ecological surveys - Riparian vegetation index surveys - Ecological Management Plans - Biodiversity Action Plans - Biodiversity section of Environmental Management Frameworks - Wetland assessments	Private Closed Corporation that has been subcontracted by many companies
Herbarium assistant 1988-1991	- Part-time assistant at the A.P. Goossens herbarium, Botany Department, North-West University, 1988, 1989, 1990 and 1991 (as a student).	North-West University, Potchefstroom

10 EXAMPLES OF PUBLICATIONS OF WHICH R.F. TERBLANCHE IS AUTHOR/ CO-AUTHOR
(Three books, two chapters in books and five articles are listed here as examples)

1. HENNING, G.A., **TERBLANCHE, R.F.** & BALL, J.B. (eds) **2009.** *South African Red Data Book: butterflies*. *SANBI Biodiversity Series* 13. South African National Biodiversity Institute, Pretoria. 158p. ISBN 978-1-919976-51-8

2. MECENERO, S., BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M, PRINGLE, E.L., **TERBLANCHE, R.F.** & WILLIAMS, M.C. (eds). 2013. *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and atlas.* Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.

3. VAN SWAAY, C., REGAN, E., LING, M., BOZHINOVSKA, E., FERNANDEZ, M., MARINI-FILHO, O.J., HUERTAS, B., PHON, C.-K., KŐRÖSI, A., MEERMAN, J., PE'ER, G., UEHARA-PRADO, M., SÁFIÁN, S., SAM, L., SHUEY, J., TARON, D., **TERBLANCHE, R.F**. & UNDERHILL, L. 2015. Guidelines for Standardised Global Butterfly Monitoring. Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany. GEO BON Technical Series 1.

4. **TERBLANCHE, R.F.** & HENNING, G.A. **2009.** *A framework for conservation management of South African butterflies in practice.* In: Henning, G.A., Terblanche, R.F. & Ball, J.B. (eds). *South African Red Data Book: Butterflies. SANBI Biodiversity Series 13.* South African National Biodiversity Institute, Pretoria. p. 68 – 71.

5. EDGE, D.A., **TERBLANCHE, R.F**., HENNING, G.A., MECENERO, S. & NAVARRO, R.A. 2013. Butterfly conservation in southern Africa: Analysis of the Red List and threats. In: Mecenero, S., Ball, J.B., Edge, D.A., Hamer, M.L., Henning, G.A., Krüger, M., Pringle, E.L., Terblanche, R.F. & Williams, M.C. (eds). *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas.* pp. 13-33. Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.

6. **TERBLANCHE, R.F.**, SMITH, G.F. & THEUNISSEN, J.D. **1993.** Did Scott typify names in *Haworthia* (Asphodelaceae: Alooideae)? *Taxon* **42**(1): 91–95. (International Journal of Plant Taxonomy).

7. **TERBLANCHE, R.F.**, MORGENTHAL, T.L. & CILLIERS, S.S. **2003.** The vegetation of three localities of the threatened butterfly species *Chrysoritis aureus* (Lepidoptera: Lycaenidae). *Koedoe* **46**(1): 73-90.

8. EDGE, D.A., CILLIERS, S.S. & **TERBLANCHE, R.F. 2008**. Vegetation associated with the occurrence of the Brenton blue butterfly. *South African Journal of Science* **104**: 505 - 510.

9. GARDINER, A.J. & **TERBLANCHE, R.F. 2010.** Taxonomy, biology, biogeography, evolution and conservation of the genus *Erikssonia* Trimen (Lepidoptera: Lycaenidae) *African Entomology* **18**(1): 171-191.

10. **TERBLANCHE, R.F.** 2016. *Acraea trimeni* Aurivillius, [1899], *Acraea stenobea* Wallengren, 1860 and *Acraea neobule* Doubleday, [1847] on host-plant *Adenia repanda* (Burch.) Engl. at Tswalu Kalahari Reserve, South Africa. *Metamorphosis* 27: 92-102.

* A detailed CV with more complete publication list is available.

II) SPECIALIST DECLARATION

I, Reinier F. Terblanche, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Reinier F. Terblanche

Signature of the specialist

Date: 15 April 2019

1 INTRODUCTION

A wetland assessment is required for the proposed Lephalale Railway Yard and two proposed Borrow Areas, 30 km west-southwest of Lephalale in the Limpopo Province, South Africa (elsewhere referred to as the site). If wetlands would be present at the site the assessment further focuses on the hydro-geomorphic setting, an estimate of the properties of the wetlands, an assessment of the functional aspects of wetlands and an impact assessment to wetlands, should the development be approved. If riparian zones would be present an indication of the active channel and riparian zone is given.

1.1 Wetlands in South Africa

Wetlands are defined by the National Water Act (Act 36 of 1998) as:
"land which is transitional between terrestrial and aquatic ecosystems 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".

According to *A practical field procedure for identification and delineation of wetlands and riparian areas* (DWAF 2005) wetlands must have one or more of the following attributes:

- 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 50cm of the soil

Wetlands, according to the definition of DWAF (2005) are at the interface of aquatic systems and the terrestrial environment. As such the characteristics of the surface water or near surface water in space and time at this interface between the terrestrial and aquatic environment are fundamental to understand the functioning of a particular wetland. At the higher elevations of South Africa surface water at wetlands are characterised by considerable contrasts between seasons and periodic precipitation events. Generally accepted definitions of wetlands which focus on the wetland attributes of soil and vegetation are therefore useful because of its consistency despite seasonal fluctuations.

The Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013) includes wetland ecosystems defined by the National Water Act (Act 36 of 1998) as well as those “wetland sytems” defined by the Ramsar Convention. The broader definition of wetlands, according to the Ramsar Convention is that wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water to the depth of which at low tide does not exceed six metres (cited by Ramsar Convention Secretariat 2011). This Ramsar definition of “wetlands” overlaps broadly with the definition of aquatic systems according to the South African system of classifying wetlands and other aquatic ecosystems. In South Africa an aquatic ecosystem is an ecosystem that is permanently or periodically inundated by flowing or standing water, or which has soils that are permanently or periodically saturated within 0.5 m of the soil surface (Ollis *et al*., 2013). Therefore an important consideration of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al*., 2013) is that a wetland (narrow definition according to water act and not Ramsar definition) is taken to be a unique type of aquatic system.

1.2 Importance of wetlands

The importance of wetlands for human well-being and the conservation of biodiversity are recognised world-wide. Ecosystem services which directly or indirectly benefit human well-being are of particular importance when wetlands are considered. Wetlands play a major role to enhance supporting services such as nutrient cycling and primary production, which in turn is the basis for other ecosystem services. Wetlands are very important to regulating services such as maintaining water flow and water quality by processing water and regulating water run-off, provisioning services such as providing freshwater, cultural services such as appreciating the landscape and biodiversity. Overall wetlands play a major role in the sustainability of land use from socio-economic and biodiversity conservation perspectives. The setting and function of wetlands at each site should therefore be evaluated to inform land use management.

Wetland vegetation is of significant importance for wetlands to play a role in valuable ecosystem services. Vegetation plays an important role in natural wetland ecosystems. It holds soil together and slows down the flow of water, reducing the risk of erosion and promoting sediment deposition. Plants are the source of organic material in wetland soils, and form the organic soil in peat

wetlands. Vegetation also has an impact on the quality of surface and subsurface water as it (1) provides organic soil matter required by microbes in order to assimilate nutrients and toxicants (2) provides habitat for the microbes in the soil immediately surrounding the roots, and (3) contributes through direct uptake of nutrients and toxicants and incorporation of these into plant tissues (Sieben *et al.* 2009).

1.3 Aims and objectives of the survey

A survey to investigate key elements of habitats on the site, relevant to the conservation of wetlands is conducted. The importance and significance of the site with special emphasis on the current status of biodiversity and ecological services of the wetland are evaluated. Literature investigations are integrated with field observations to identify potential ecological impacts that could occur as a result of the development and to make recommendations to reduce or minimise impacts, should the development be approved.

The objectives of the wetland habitat assessment are to provide:

- An indication of the existence of wetlands at the site and if so:
- An identification of major aspects of the hydro-geomorphic setting and terrain unit at which the wetland occur;
- An estimate of the size and roughness of the wetland
- An indication of the hydric soils at the site;
- An indication of erodability;
- An indication of the presence or absence of peat at the site;
- An outline of hydrological drivers that support the existence and character of the wetland;
- An assessment of the possible presence or absence of threatened or localised plant species, vertebrates and invertebrates of the region, at the site;
- A description of the functions provided by the wetland at the site;
- An interpretation of the priority of the wetland for local communities in the area;
- An interpretation of the priority of the wetland to biodiversity at the site;

2 STUDY AREA

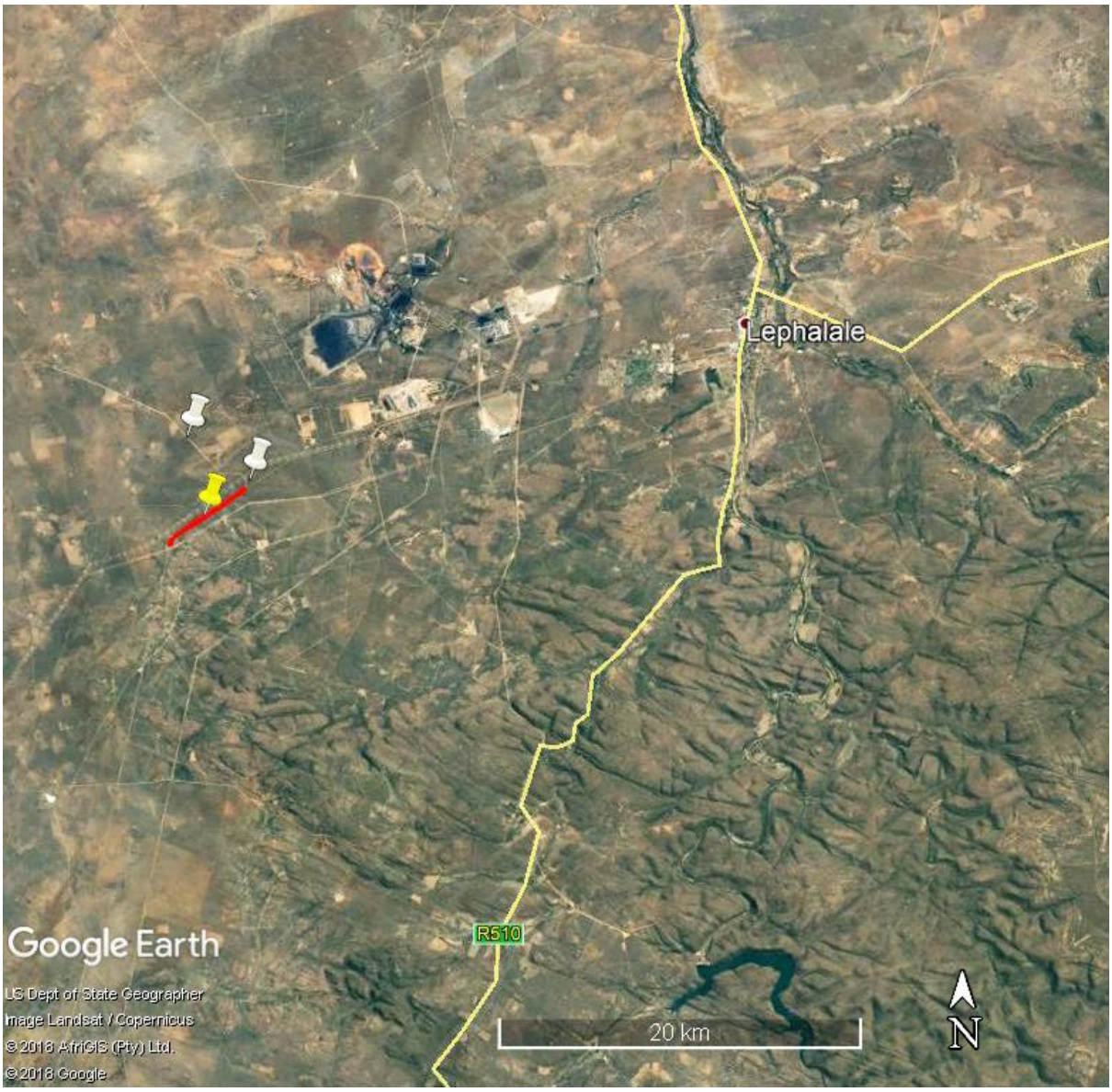

Figure 1 Map with an indication of the location of the site.

Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2019).

Site is 30 km west-southwest of Lephalale in the Limpopo Province, South Africa. The site is located in the Savanna Biome. Northern part of the study area (including the borrow areas) represents the Limpopo Sweet Bushveld (SVcb 19) vegetation type and some of the southern parts of the site represent the Western Sandy Bushveld (SVcb 16) (Mucina & Rutherford 2006). For the ecological context of the landscape, climate and vegetation in which the site is located, a description of the vegetation types from Mucina & Rutherford (2006) follows.

SVcb 19 Limpopo Sweet Bushveld

Distribution: In South Afroca the Limpopo Sweet Bushveld extends from the lower reaches of the Crododile and Marico Rivers around Makoppa and Derdepoort, respectively, down the Limpopo River Valley including Lephalale and into the tropics past Tom Burke to the Usutu border post and Taaiboschgroet area in the north. Altitude about 700 – 1000 m. The unit also occurs on the Botswana side of the border (Mucina & Rutherford, 2006).

Vegetation and landscape features: Plains, sometimes undulating or irregular, traverded by several tributaries of the Limpopo River. Short open woodland, in disturbed areas thickets of *Senegalia erubescens, Senegalia mellifera* and *Dichrostachys cinerea* are almost impenetrable (Mucina & Rutherford, 2006).

Geology & Soils: The northern half of the area is dominated by gneisses, metasediments and metavolcanics of the Malala Drift Group, Beit Bridge Complex (Swazian Erathem), basalts of the Letaba Formation (Lebombo Group of the Karoo Supergroup) are also found in the northeast. Sandstone, siltstone and mudstone of the Clarens Formation (Karoo Supergroup), as well as the Matlabas Subgroup (Mokolian Waterberg Group) are found to the south and west. Soils with calcrete and surface limestone layers, brownish sandy (Clovelly soil from) clayey-loamy soils (Hutton soil form) on the plains and low-lying areas, with shallow, gravelly, sandy soils on the slightly undulating areas, localised areas of black clayey soils (Valsrivier or Arcadia soil forms) and Kalahari sand. Land types mainly Ae, Ah and Fc (Mucina & Rutherford, 2006).

Climate: Summer rainfall with very dry winters including the shoulder months of May and September. Mean Annual Precipitation about 350 mm in the northeast to about 500 mm in the southwest. Frost fairly frequent (Mucina & Rutherford, 2006).

Important Taxa: Tall trees: *Vachellia robusta, Senegalia burkei.* Small Trees: *Senegalia erubescens, Vachellia fleckii, Vachellia nilotica, Senegalia senegal* var. *rostrata*, *Albizia anthelmintica, Boscia albitrunca, Combretum apiculatum, Terminalia sericea.* Tall Shrubs: *Catophractes alexandri, Dichrostachys cinerea, Phaeoptilum spinosum, Rhigozum obovatum, Cadaba aphylla, Combretum hereroense, Commiphora pyracanthoides, Ehretia rigida* subsp. *rigida, Euclea undulata, Grewia flava, Gymnosporia senegalensis.* Low Shrubs: *Vachellia teniuspina, Commiphora africana, Felicia muricata, Gossypium herbaceum* subsp. *africanum, Leucosphaera bainesii*. Graminoids: *Digitaria eriantha* subsp. *eriantha, Enneapogon cenchroides, Eragrostis lehmanniana, Panicum coloratum, Schmidtia pappophoroides, Aristida congesta, Cymbopogon nardus, Eragrostis pallens, Eragrostis rigidior, Eragrostis trichopora, Ischaemum afrum, Panicum maximum, Setaria verticillata, Stipagrostis uniplumis, Urochloa mosambicensis.* Herbs: *Acanthosicyos naudinianus, Commelina benghalensis, Harpagophytum procumbens* subsp. *transvaalense, Hemizygia elliottii, Hermbstaedtia odorata, Indigofera daleoides*. Succulent Herbs: *Kleinia fulgens, Plectranthus neochilus* (Mucina & Rutherford, 2006).

SVcb 16 Western Sandy Bushveld

Distribution: In South Africa the Western Sandy Bushveld is present in the Limpopo and North West Provinces. Western Sandy Bushveld occurs on flats and undulating plaiins from Assen northwards past Thabazimbi and remaining west of the Waterberg Mountains towards Steenbokpan in the north. Some patches occur between the Crocodile and Marico Rivers to the west. Mostly at altitudes of 900 – 1200 m (Mucina & Rutherford, 2006).

Vegetation and landscaope features: Western Sandy Bushveld varies from tall open woodland to low woodland. Broad-leaved as well as microphyllous tree species are prominent. Dominant species include Acacia erubescens on flat areas, Combretum apiculatum on shallow soils of gravelly upland sites and Terminalia sericea on deep sand. Vegetation type occurs on slightly undulating plains (Mucina & Rutherford, 2006).

Geology and soils: Sandstone and mudstone of the Matlabas Subgroup and sandstone, subordinate conglomerate, siltstone and shale of the Kransberg Subgroup (both Mokolian Waterberg Group) are found in the north. Archaean granite and gneiss of the Swazian Erathem and granite of the Lebowa Granite Suite (Bushveld Igneous Complex) are found in the west and southeast of the area, respectively. Soils are plinthic catena, eutrophic, red-yellow apedal, free

drained, high base status, Hutton and Clovely with some Glenrosa and Mispah soil forms. Several areas have less sandy soil than that of SVcb 12 Central Sandy Bushveld. Land types mainly Bd, Ah, Ae and Fa (Mucina & Rutherford, 2006).

Climate: Summer rainfall with very dry winters. Mean annual precipitation from about 450 mm in the north to about 650 mm in the south. Fairly frequent light frost in the winter (Mucina & Rutherford, 2006).

Important taxa: *Vachellia erioloba, Senegalia nigrescens, Sclerocarya birrea* subsp. *caffra.* Small trees: *Senegalia erubescens, Senegalia mellifera* subsp. *detinens, Vachellia nilotica, Vachellia tortilis* subsp. *heteracantha, Combretum apiculatum, Combretum imberbe, Terminalia sericea, Combretum zeyheri, Lannea discolor, Ochna pulchra* and *Peltophorum africanum.* Tall shrubs: C*ombretum hereroense, Euclea undulata, Coptosperma supra-axillare, Dichrostachys cinerea, Grewia bicolor, Grewia flava* and *Grewia monticola*. Low shrubs: *Clerodendrum ternatum, Indigofera filipes, Justicia flava*. Graminoids: *Anthephora pubescens, Digitaria eriantha* subsp. *eriantha, Eragrostis pallens, Eragrostis rigidior, Schmidtia pappophoroides, Aristida congesta, Aristida diffusa, Aristida stipitata* subsp. *graciliflora, Eragrostis superba, Panicum maximum* and *Perotis patens.* Herbs: *Blepharis integrifolia, Chamaecrista absus, Evolovulus alsinoides, Geigeria burkei, Kyphocarpa angustifolia, Limeum fenestratum, Limeum viscosum, Lophiocarpus tenuissimus, Monsonia angustifolia* (Mucina & Rutherford, 2006).

Note: Not all of the above plant species listed for the vegetation types are present at the site.

3 METHODS

A desktop study comprised not only an initial phase, but also it was used throughout the study to accommodate and integrate all the data that become available during the field observations.

A survey consisted of visits by R.F. Terblanche during June 2018, February 2019 and April 2019 to note key elements of habitats on the site and surrounding areas, relevant to the conservation of wetlands and riparian zones.

Classification of any inland wetland systems that could be present at the site is according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al*., 2013). One of the major advantages of the Classification System for South Africa (Ollis *et al*., 2013) is that the functional aspects of wetlands are the focal point of the classification. Wetlands are very dynamic systems and their functionality weighs high against the often rapid changes in their appearance, as could be seen from wetland butterfly studies (Terblanche *In prep*). In this document the main guideline for the delineation and identification of wetlands where present is the practical field procedure for identification and delineation of wetlands by DWAF (2005).

The following sections highlight the materials and methods applicable to different aspects that were observed.

3.1 Classification of wetlands (SANBI: Ollis *et al*., 2013)

3.1.1 System, regional setting and landscape unit (Levels 1, 2 and 3)

Three broad types of Inlands Systems are dealt with in the Classification System namely rivers, open waterbodies and wetlands. These Inland Systems are then classified according to a six-tiered structure that includes six levels.

At the systems level (Level 1) of wetland classification, a distinction is made between Marine, Estuarine and Inland ecosystems using the level of connectivity to the open ocean as discriminator of the biophysical character of each (Ollis *et al*., 2013). Inland wetland systems are aquatic ecosystems with no no existing connection to the ocean (i.e. characterised by the complete absence of marine exchange and/ or tidal influence (Ollis *et al*., 2013). In this case if any wetland is present it obviously qualifies as an Inland wetland system.

At Level 2 the regional setting is a spatial framework that is preferred by the investigator to allow for gaining an understanding of the broad ecological context within which an aquatic system occurs (Ollis *et al*., 2013). A regional setting can be identified according to the DWA ecoregion classification of Kleynhans *et al.* (2005).

A distinction is made between four landscape units at Level 3 of the Classification System for Inland Systems on the basis of the landscape setting (i.e. topographical position) (Ollis *et al*., 2013). Four landscape units are recognized: slope, valley floor, plain and bench.

3.1.2 Hydrogeomorphic units (Level 4)

Seven primary hydrogeomorphic (HGM) units are recognised for Inland Systems at Level 4A of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa, on the basis of hydrology and geomorphology (Ollis *et al*., 2013). These are a River, Channeled valley-bottom wetland, Unchannelled valley-bottom wetland, Floodplain wetland, Depression, Seep and Wetland flat.

3.1.3 Hydrological regime (Level 5)

While the hydrogeomorphic unit (HGM) is influenced by the source of water and how it moves into, through and out of an Inland System, the hydrological regime (as catergorised by the Classification System) describes the behaviour fo the water within the system and, for wetlands, in the underlying soil (Ollis *et al.,* 2013). Together with the hydrogeomorphology the hydrological regime are used to describe the wetland as a functional unit (Ollis *et al.*, 2013). In the case of Inland wetlands which are classified as rivers, perenniality is an important characteristic to describe the hydrological regime. For Inland Systems other than rivers, five categories relating to the frequency and duration of inundation have been provided: Permanently inundated, Seasonally inundated, Intermittently inundated, Never inundated/ rarely inundated and unknown (Ollis *et al*., 2013). Period of saturation within the upper 0.5 m of the soil is a very important discriminator that also links to the wetland delineation system of DWAF (2005). The following categories for saturation of wetland soils are recognised: Permanently saturated, Seasonally saturated, Intermittently saturated and unknown. These categories of period of saturation correspond to the permanent, seasonal and temporary zones of wetlands respectively.

3.1.4 Wetland descriptors (Level 6)

At Level 6 several “descriptors” are included for the structural/ chemical/ biological characterisation of Inland Systems (Ollis *et al.,* 2013). These descriptors are non-hierarchical to one another and can be applied in any order depending on the purpose of a study and the

availability of information. Descriptors include natural vs. artificial, salinity, substratum type, pH, geology and vegetation cover (Ollis *et al*., 2013). Various definitions are given for the descriptors which are likely to increase the consistency and use of the system.

3.2 Delineation of wetland

Together with terrain unit, indirect indicators of prolonged saturation by water: wetland plants (hydrophytes) and wetland (hydromorphic) soils are identified and used to delineate the wetland (DWAF 2005). Three zones, which may not all three be present in all wetlands, namely the permanent zone of wetness, the seasonal zone and the temporary zone are identified. The temporary zone is the outer zone and is saturated for only a short period of the year that is sufficient, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation (DWAF 2005). Hydromorphic soils must display signs of wetness within 50cm of the soil to qualify as wetland soil that can support hydrophytic vegetation. Grid references and altitudes are taken on site with a GPS Garmin E-trex 20 ® instrument. Map information are analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2012).

3.3 Vegetation at and near wetland

Though vegetation is a key component of the wetland definition in the Water Act, using vegetation as a primary indicator requires undisturbed conditions and expert knowledge (DWAF 2005). Modern wetland classification systems in South Africa therefore place more emphasis on the soil wetness indicators. It remains however, that plant assemblages undergo distinct changes in species composition from the centre of a wetland to the edge, and into adjacent terrestrial areas (DWAF 2005). This change in species composition of vegetation provides valuable clues for determining the wetland boundary and wetness zones (DWAF 2005).

Apart from botanical aspects which are integrated into the description of a wetland it is imperative to note the existence or not of threatened plant species or other plant species of conservation concern, such as near-threatened, data deficient or declining species at a wetland. Floristic composition is therefore also considered during the wetland assessment. Voucher specimens of plant species are only taken where the taxonomy is in doubt or where the plant specimens are of significant relevance for invertebrate conservation. Field guides such as those by Germishuizen

(2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997) were used to confirm the taxonomy of the species. Works on specific plant groups (often genera) such as those by Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006) and Van Wyk & Smith (2003) were also consulted to confirm the identification of species. An important source of identifications of plant species for the wetland survey is Van Ginkel, Glen, Gordon-Gray, Cilliers, Muasya & Van Deventer (2011). In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification. For the most recent treatise of scientific plant names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) or Raimondo *et al*. (2009) or updated lists on SANBI websites are followed to compile the lists of species.

3.4 Fauna at and near wetland

Species composition of fauna is not used in wetland characterization and assessments. However, it is important to note species that favour wetlands and especially whether threatened animal species are present at a wetland or not.

Mammals are noted as sight records by day. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner & Chimimba (2005), Cillié, Oberprieler and Joubert (2004) and Apps (2000) are consulted. Sites are been walked, covering as many habitats as possible. Signs of the presence of mammal species, such as calls of animals, animal tracks (spoor), burrows, runways, nests and faeces are recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) are consulted for additional information and for the identification of spoor and signs. Trapping is only done if necessary. Habitat characteristics are also surveyed to note potential occurrences of mammals. Many mammals can be identified from field sightings but, with a few exceptions bats, rodents and shrews can only be reliably identified in the hand, and even then some species needs examination of skulls, or even chromosomes (Apps, 2000).

Birds are noted as sight records, mainly with the aid of binoculars (10x30). Nearby bird calls of which the observer was sure of the identity were also recorded. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Ryan (2001) is followed. For information on identification, biogeography and ecology Barnes (2000), Hockey, Dean & Ryan, P.G. (2005), Cillié, Oberprieler & Joubert (2004), Tarboton & Erasmus (1998) and

Chittenden (2007) are consulted. Ringing of birds falls beyond the scope of this survey. Sites are walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests are additionally been recorded. Habitat characteristics are surveyed to note potential occurrences of birds.

Reptiles are noted as sight records in the field. Binoculars (10x30) can also be used for identifying reptiles of which some are wary. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques, Branch (1998), Marais (2004), Alexander & Marais (2007) and Cillié, Oberprieler and Joubert (2004) are followed. Sites are walked, covering as many habitats as possible. Smaller reptiles are sometimes collected for identification, but this practice was not necessary in the case of this study. Habitat characteristics are surveyed to note potential occurrences of reptiles.

Frogs and toads are noted as sight records in the field or by their calls. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Carruthers (2001), Du Preez (1996), Conradie, Du Preez, Smith & Weldon (2006) and the recent complete guide by Du Preez & Carruthers (2009) are consulted. CD's with frog calls by Carruthers (2001) and Du Preez & Carruthers (2009) are used to identify species by their calls when applicable. Sites are walked, covering as many habitats as possible. Smaller frogs are often collected by pitfall traps put out for epigeal invertebrates (on the soil), but this practice falls beyond the scope of this survey. Habitat characteristics are also surveyed to note potential occurrences of amphibians.

Invertebrates of which enough information is available to be integrated into an assessment, such as butterflies, are recorded as sight records, photographic records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt. Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides*, *Chrysoritis*, *Erikssonia, Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deutschländer & Bredenkamp, 1999; Terblanche, Morghental & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies are therefore also recorded. Other

invertebrate groups such as fruit chafer beetles and mygalomorph spiders are also investigated where relevant.

3.5 Present Ecological Status

Ecological status of wetlands are based on models such as the modified Habitat Integrity approach developed by Kleynhans (1996, 1999). Present ecological status PES methodology is then largely based on criteria for assessing the habitat integrity of floodplain wetlands and notes for allocating a score to attributes and rating the confidence level associated with each score (DWAF 1999). Such criteria are selected on the assumption that anthropogenic modification can generally be regarded as the primary causes of degradation of the ecological integrity of a wetland (see DWAF 1999). This is done by using Table W4-1 given by DWAF (1999):

- Score each attribute according to the guidelines provided in the footnote.
- Calculate a mean score for Table W4-1 using the individual scores for all attributes.
- Provide a confidence rating for each score according to the guidelines provided in the footnote to indicate the areas of uncertainty in the determination.

Table W4-2 provides guidelines for the determination of the Present Ecological Status Class (PESC), based on the mean score determined for Table W4-1. If any of the attributes scores < 2 (i.e., it is considered to be seriously or critically modified) this score and not the mean should be taken into consideration. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the Present Ecological Status Category (PESC). In any case, the mean on which the assessment of the PESC is based should be regarded as a guideline and should also be tested against the opinion of local experts (DWAF 1999).

Biological integrity is not directly estimated through this approach though in some systems or parts of systems, information on biological integrity is available. In such cases, the information on biological integrity can be used as a check of the PES Category determination. The mean is used to relate the ecological state of the wetland to a particular PES Category (Table W4-2) (DWAF 1999).

3.6 Ecological Importance and Sensitivity

The assessment of the ecological importance and sensitivity is according to DWAF (1999) which in turn is adapted from Kleynhans (1996) and Kelynhans (1999). "Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC) DWAF (1999).

In the method outlined here, a series of determinants for EIS according to Table W5-1 of DWAF (1999) are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The method is used as a guideline for the professional judgement of individuals familiar with an area and its wetlands. The assessors must substantiate and document their judgement as far as possible for future reference and revision (DWAF 1999).

3.7 Limitations

Wetlands or riparian zones are very dynamic systems and owing to time constraints a glimpse of conditions at wetlands are taken, even though the hydrogeomorphological setting, soil wetness characteristics and established vegetation constitute some longer term features of a wetland. For each site visited, it should then be emphasized that surveys can by no means result in an exhaustive list of wetland plants and animals present on the site, because of the time constraint. A desktop study comprised not only an initial phase, but also it was used throughout the study to accommodate and integrate all the data that become available during the field observations.

The survey at the site was conducted during June 2018, February 2019 and April 2019 to note key elements of habitats on the site, relevant to the conservation of wetlands and riparian areas. The focus of the survey remains a habitat survey that concentrates on the hydrogeomorphological, hydrological and additional descriptors to classify and assess wetlands where present and to assess for the likelihood of occurrence or not of any wetland fauna and flora of particular conservation concern.

4 RESULTS AND DISCUSSION

4.1 Assessment of presence of non-perennial drainage lines and wetlands at the site

Figure 2 Indications of wetlands (Pan 1 and Pan 2) and Streamcrossings (No1, No2, No3) (non-perennial rivers with active channels and narrow riparian zones) at the site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

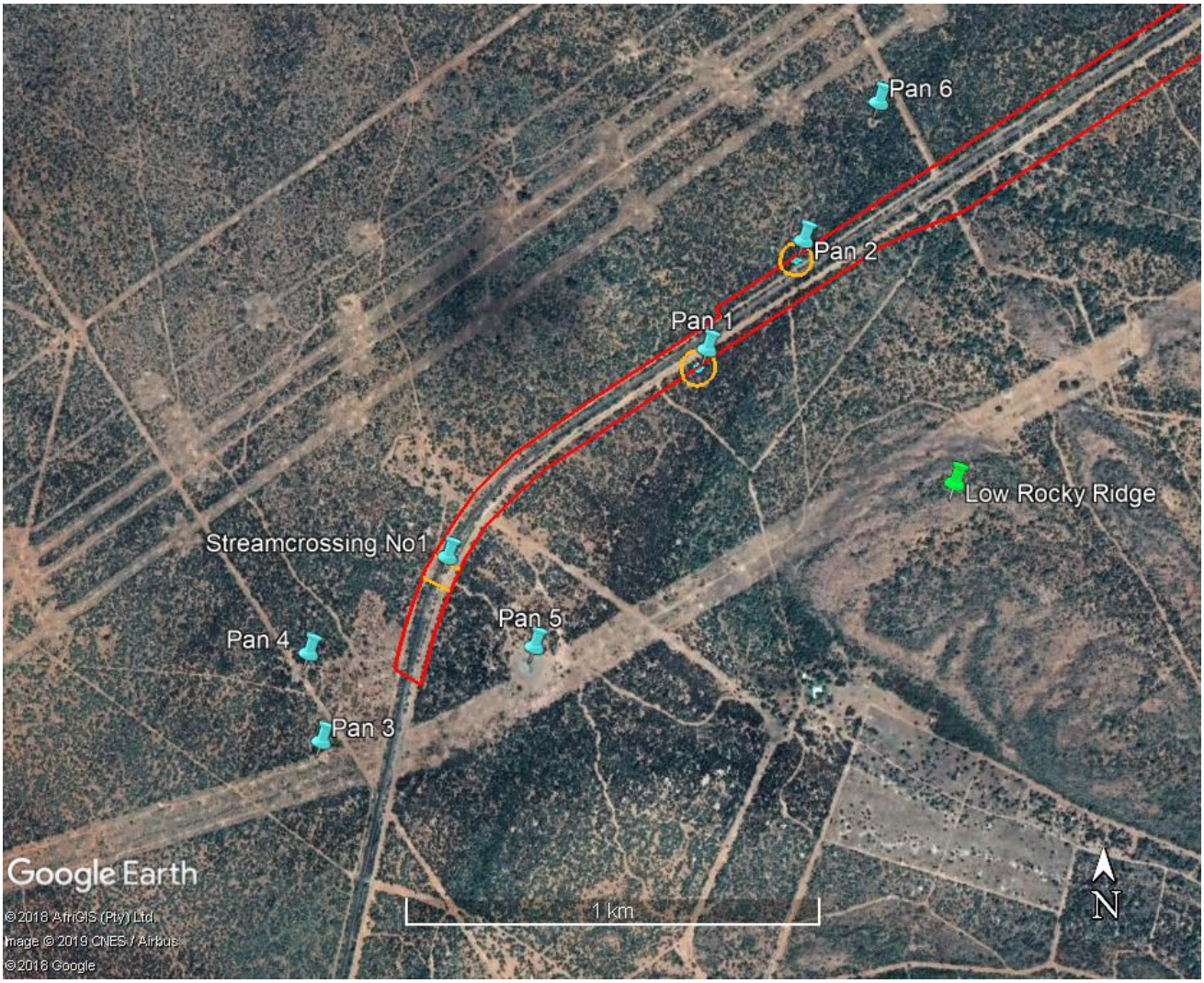

Figure 3 Indications of wetlands and streamcrossings at the western and central-western parts of the railway yard site as well as small wetland depressions which are outside the site but within 500 m from the boundary of the site. Wetland depressions Pan 1 and Pan 2 as well as Streamcrossing No1 are at the site. Wetland depressions Pan 3, Pan 4, Pan 5 and Pan 6 are outside the site but within 500 m from the boundary of the site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

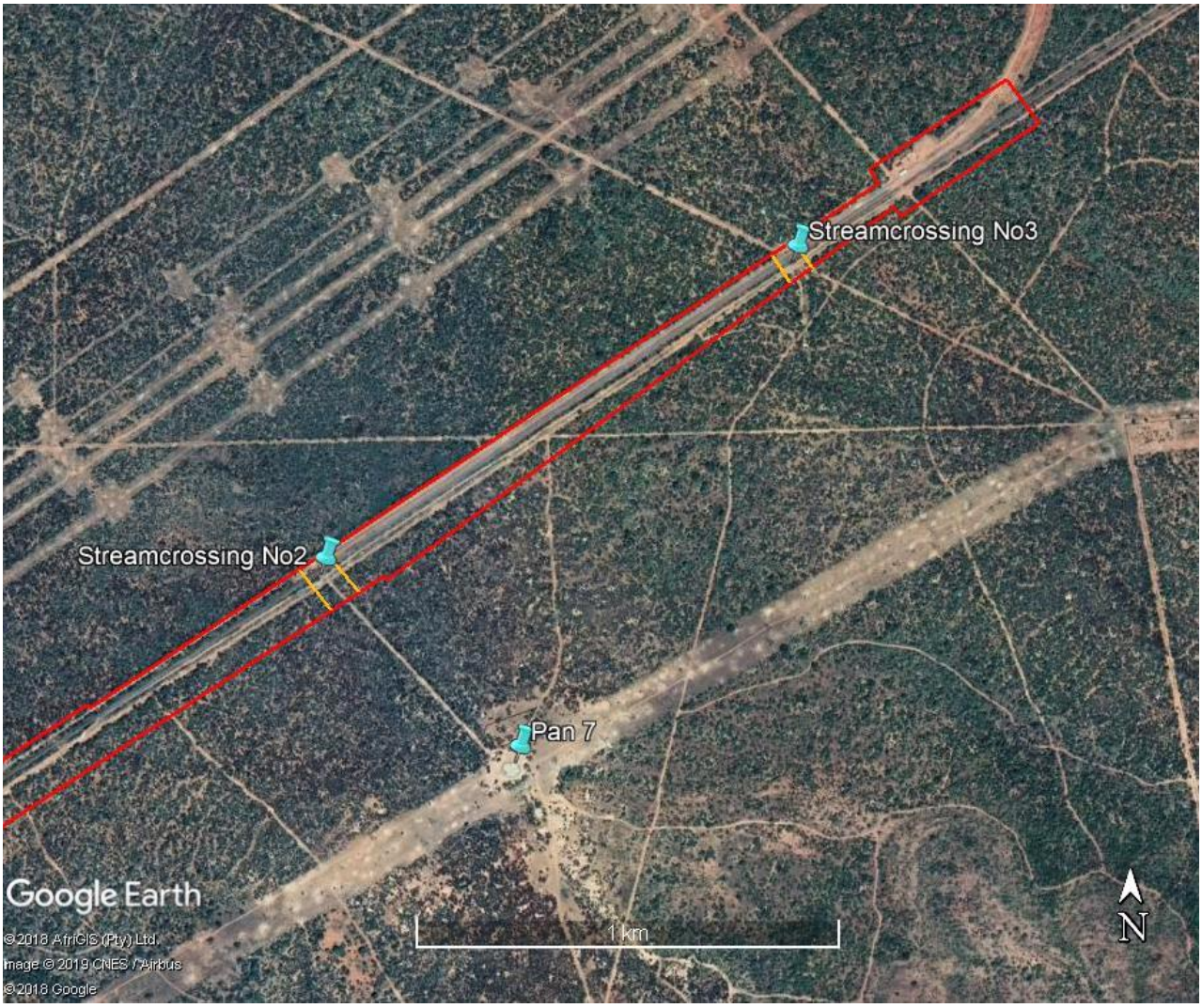

Figure 4 Indications of streamcrossings at the <u>eastern</u> parts of the railway yard site as well as a small wetland depression Pan 7 which is outside the site but within 500 m from the boundary of the site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

Figure 5 Indication of **Streamcrossing No1** at the <u>western end</u> of the proposed Railway Yard site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

Figure 6 Indication of **Streamcrossing No2** at the <u>eastern parts</u> of the proposed Railway Yard site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

Figure 7 Indication of **Streamcrossing No3** closer to the <u>eastern end</u> of the proposed Railway Yard site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

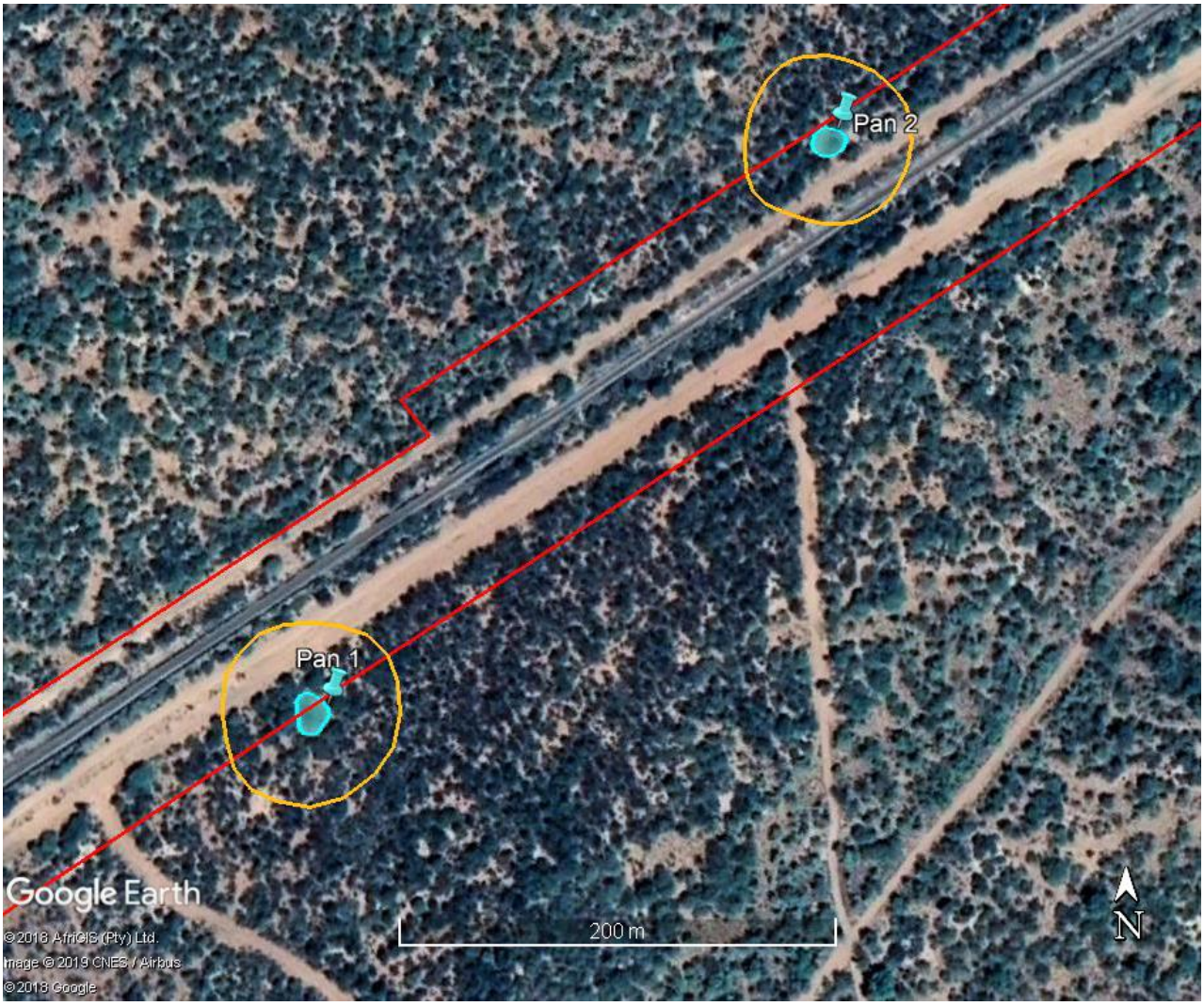

Figure 8 Indications of small wetland depressions (**Pan 1** and **Pan 2**) at the central-western parts of the proposed Railway Yard site.

Light blue outline	Route of active channel/ extent of wetland at the site
Orange outline	Outer edge of buffer zone

4.2 Presence of active channels and riparian zones

Three non-perennial rivers, with their active channels and riparian zones, cross the proposed extension of the Railway Yard (Figures 2-7). These non-perennial active channels with their riparian zones are noted as Streamcrossing No 1, Streamcrossing No 2 and Streamcrossing No 3. Culverts at the existing railway exist for these streamcrossings. Active channel at streamcrossing No 2 is poorly developed as a streambed and possibly enhanced by stormwater drainage. Alltogether these three non-perennial rivers are in essence small seasonal drainage lines which feed into tributaries of rivers downstream. Note: Kindly see the main Ecological and Habitat Survey report which accompanies this report and in which photos, more figures and risk/ impact assessments feature.

Riparian zones of these streamcrossings largely consist of more or less distinct concentrations of trees such as *Dichrostachys cinerea*, *Senegalia erubescens* and *Vachellia karroo*. Grass species such as *Panicum maximum* appear to be frequent at these riparian zones. Megagraminoids such as reeds and sedges appear to be absent.

4.3 Assessment and classification of small wetland depressions at the site

Two very small pan depressions (Pan 1 = 0,02 ha; Pan 2 = 0,1 ha) are present at the site and five pan depressions (Pan 3, Pan 4, Pan 5, Pan 6 and Pan 7) are found adjacent to the site but within 500 m from the site.

4.3.1 Assessment and classification of wetland depressions Pan 1 and Pan 2 at the site

Two small wetland depressions (ephemeral pans), **Pan 1** and **Pan 2,** are found at the site (Figure 2, Figure 3, Figure 8). Pan 1 has a surface area of approximately 0,02 ha and longest diameter of approximately 18 m, and is found south of existing railway reserve. Pan 2 has a surface area of approximately 0,01 ha and longest diameter of approximately 16 m, and is found north of existing railway reserve. The two pans are very similar in terms of their ecological status and are described and classified together.

Obligate wetland plant species appear to be rare at the two small restricted wetland depressions at the site. The small depressions are endorheic, where the water that flows in during rainfall

events mostly leaves through evapotranspiration and infiltration in a low rainfall area (Mean Annual Precipitation < 500 mm).

The restricted wetlands are probably enhanced by water runoff from adjacent roads and the railway reserve. Distinct wetland vegetation is poorly developed at these restricted pans. *Vachellia karroo* (Sweet Thorn), *Grewia* species and *Ziziphus mucronata* include some of the indigenous tree species that surround these pans.

Present ecological status (PES) of the wetland depressions **Pan 1** and **Pan 2** at the site are CATEGORY D which means these wetlands are largely modified and a large loss of natural habitats and basic ecosystem functions has occurred (Table 4.2 and Table 4.3). Ecological importance and sensitivity (EIS) of these wetlands are Low/marginal which means these wetlands are not ecologically important and sensitive at any scale. The biodiversity of the wetlands is ubiquitous and not sensitive to flow and habitat modifications. These wetlands play an insignificant role in moderating the quantity and quality of water of major rivers (Table 4.4 and Table 4.5).

Table 4.1 Classification and outline of characteristics of wetland depressions **Pan 1** and **Pan 2** at the site according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013).

CHARACTERISTIC TYPE WETLAND DISCRIMINATORS AND DESCRIPTORS	**DESCRIPTION**
System (level 1)	Inland wetland
Regional setting (level 2)	Limpopo Plain (Kleynhans *et al.,* 2005)
Landscape unit (level 3)	Plain
Hydrogeomorphic unit (level 4)	Depression
Hydrological regime (Level 5)	Wetland occurs at plain on gentle slopes. Narrow inlets are present mainly as water-runoff areas which are probably enhanced by adjacent roads and railway reserve. These depressions are probably endorheic, so that water that flows in during rainfall events probably leaves mostly through evaporation and infiltration.
Additional descriptors (Levels 5,6)	Shallow brown-greyish soils mixed with some light reddish sands are present at the wetlands. Megagraminoids or sedges are absent. Overall distinct wetland vegetation is poorly developed/ absent. Encroachment by terrestrial vegetation is conspicuous.

Table 4.2 Scoresheet with criteria for assessing habitat integrity of the wetland depression **Pan 1** and **Pan 2** at the site to DWAF (1999) such as adapted from Kleynhans (1996).

Criteria and attributes	**Relevance**	**Score**	**Confidence**
Hydrologic			
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.	2	4
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.	2	4
Water Quality			
Water quality modification	From point or diffuse sources. Measure 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.	2	3
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.	2	3
Hydraulic/Geomorphic			
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	2	4
Topographic alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or change wetland habitat directly or through changes in inundation patterns.	2	4
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.	2	4
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.	2	4
Invasive plant encroachment	Affect habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).	2	4
Alien fauna	Presence of alien fauna affecting faunal community structure.	2	4
Overutilisation of biota	Overgrazing, over-fishing etc.	2	4
TOTAL **MEAN**		**22** **x=2.0**	42 x=2.0

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.

Table 4.3 Interpretation of scores for determining present ecological status **(PES)** of the wetland depressions **Pan 1** and **Pan 2** at the site according to DWAF (1999) such as adapted from Kleynhans (1999). Present ecological status of the wetlands is indicated in blue font.

Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PES Category)
WITHIN GENERALLY ACCEPTABLE RANGE
CATEGORY A >4; Unmodified, or approximates natural condition.
CATEGORY B >3 and <=4; Largely natural with few modifications, but with some loss of natural habitats.
CATEGORY C >2 and <=3; moderately modified, but with some loss of natural habitats.
CATEGORY D **=2; largely modified. A large loss of natural habitats and basic ecosystem functions has occurred**.
OUTSIDE GENERAL ACCEPTABLE RANGE
CATEGORY E >0 and <2; seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
CATEGORY 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.

* 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.

Table4.4 Score sheet for determining ecological importance and sensitivity for floodplains at wetland depressions **Pan 1** and **Pan 2** (DWAF 1999, adapted from Kleynhans 1996, 1999).

Determinant	**Score**	**Confidence**
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	0	3
2. Populations of Unique Species	0	3
3. Species/taxon Richness	1	3
4. Diversity of Habitat Types or Features	1	3
5. Migration route/breeding and feeding site for wetland species	1	3
6. Sensitivity to Changes in the Natural Hydrological Regime	2	3
7. Sensitivity to Water Quality Changes	2	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	1	3
MODIFYING DETERMINANTS		
9. Protected Status	0	4
10. Ecological Integrity	1	4
TOTAL	**9**	32
MEAN	**0.9**	3.2

Score guideline Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0
Confidence rating Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1

Table 4.5 Ecological importance and sensitivity categories. Interpretation of median scores for biotic and habitat determinants (DWAF 1999, adapted from Kleynhans 1996, 1999). Ecological Importance and Sensitivity (EIS) of wetland depressions **Pan 1** and **Pan 2** at the site is indicated in blue font.

Ecological Importance and Sensitivity Category (EIS)	**Range of Median**	**Recommended Ecological Management Class**
Very high Floodplains that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains 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.	>3 and <=4	A
High Floodplains that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate Floodplains that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains 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.	>1 and <=2	C
Low/marginal **Floodplains which are not ecologically important and sensitive at any scale. The biodiversity of these floodplains 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.**	**>0 and <=1**	**D**

5 CONCLUSION

- Three non-perennial rivers, with their active channels and riparian zones, cross the proposed extension of the Railway Yard. These non-perennial active channels with their riparian zones are noted as Streamcrossing No 1, Streamcrossing No 2 and Streamcrossing No 3. Culverts are found at the present railway line for these streamcrossings. Active channel at streamcrossing No 2 is poorly developed as a streambed and possibly enhanced by stormwater drainage. Alltogether these three non-perennial rivers are in essence small seasonal drainage lines which feed into tributaries of rivers downstream.
- Riparian zones of these streamcrossings largely consist of more or less distinct concentrations of trees such as *Dichrostachys cinerea*, *Senegalia erubescens* and *Vachellia karroo*. Grass species such as *Panicum maximum* appear to be frequent at these riparian zones. Megagraminoids such as reeds and sedges appear to be absent.
- Two small restricted wetland depressions Pan 1 and Pan 2 (each far less than 1 ha), are present at the proposed footprint. Narrow inlets at these wetland depressions are present mainly as water-runoff areas which are probably enhanced by adjacent roads and railway reserve. These depressions are probably endorheic, so that water that flows in during rainfall events probably leaves mostly through evaporation and infiltration.
- Present ecological status (PES) of the wetland depressions **Pan 1** and **Pan 2** at the site are CATEGORY D which means these wetlands are largely modified and a large loss of natural habitats and basic ecosystem functions has occurred (Table 4.2 and Table 4.3). Ecological importance and sensitivity (EIS) of these wetlands are Low/marginal which means these wetlands are not ecologically important and sensitive at any scale. The biodiversity of the wetlands is ubiquitous and not sensitive to flow and habitat modifications. These wetlands play an insignificant role in moderating the quantity and quality of water of major rivers (Table 4.4 and Table 4.5).
- Site is part of the Limpopo Water Management Area (WMA 1). Western part of the site falls outside any FEPA (Freshwater Ecosystem Priority Area). Eastern part of the site is included in a River FEPA and associated sub-quaternary catchment (Nel *et al.*, 2011a, 2011b).
- River FEPAs achieve biodiversity targets for river ecosystems and threatened/ near threatened fish species, and were identified in rivers that are currently in good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of

water resources. Surrounding land and smaller stream network in a River FEPA need to be managed in such a way that maintains the good condition (A or B ecological category) of the river reach (Nel *et al.*, 2011a, 2011b). A key issue is therefore avoidance and limitation of pollutants into the soil and water at the proposed footprints.

- Small pans and drainage lines at the site are likely to be impacted by the proposed developments. If the development is approved with modifications or even moving of these small pans and conservation of drainage lines with extended culverts, the construction should be planned in such a manner that surface flow and erosion are limited. There is no distinct indication that interflow plays an important role in the maintenance of the wetlands and drainage lines. The geomorphological setting and flow regime should be as similar as possible post development, if the development is approved. Loss of any wetland animal or plant species of particular conservation importance are not expected.
- Small pans outside the boundaries of the site but within 500 m from the the site are unlikely to be impacted significantly by the proposed developments. If the development is approved these small pans are unlikely to experience significant increase in surface flow and erosion owing to the development. There is no distinct indication that interflow plays an important role in the maintenance of these wetlands outside the site. The geomorphological setting and flow regime are likely to be similar post development, if the development is approved. Loss of any wetland animal or plant species of particular conservation importance are not expected owing to this proposed development in particular at these wetlands outside the site, but within 500 m from the boundaries of the site.
- The non-perennial rivers or drainage lines with their active channels and riparian zones at the site are biodiversity corridors of significant conservation importance in the larger area.
- The small restricted wetland depressions at and near the proposed footprints remain important as part of stepping stone corridors in the larger area.
- Recommendations, if the development is approved, for the three Streamcrossings include the i) restriction of developments to the extension of the culverts, ii) bridge structures at roads right next to the railway reserve so that could take place at dirt roads are limited and iii) the conservation of the remainder of the drainage line and riparian zone downstream.
- The buffer zones of Pan 1 and Pan 2 are already compromised by past development. It should be noted that waterflow to these small pans are probably enhanced by the present railwayline structures (elevated) and water runoff from the roads next to the railway line where some erosion is visible. These pans are very small, not marshlands or any wetlands with

distinct ecological importance and sensitivity and probably partially maintained by the present railway line structures. These pans are also encroached by terrestrial vegetation. In the case of Pan 1 and Pan 2 there is scope to move each of Pan 1 and Pan 2 fourty metres from the edge of the road next to the proposed Railway Line site during construction. Wetland characteristics of these pans may even slightly improve in such a case. It should be noted that these pans are not comparable to larger marshlands or saltpans in the region in which case a no-go zone would have applied.

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