Proposed Multi-Purpose Reactor at South African Nuclear Energy Corporation's (Necsa) Pelindaba Site, Northwest Province

Aquatic Compliance Statement

April 2023

Drafted by
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Declaration of Independence

I, **Rudi Bezuidenhoudt**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

Rudi Bezuidenhoudt

2023.04.26

Rudi Bezuidenhoudt (PrSciNat) Date

Ecologist/Botanist

SACNASP Reg. No. 008867

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Client review	Mpho Manyabe	Mpho Manyaba	28 April 2023
Final Report			

EXECUTIVE SUMMARY

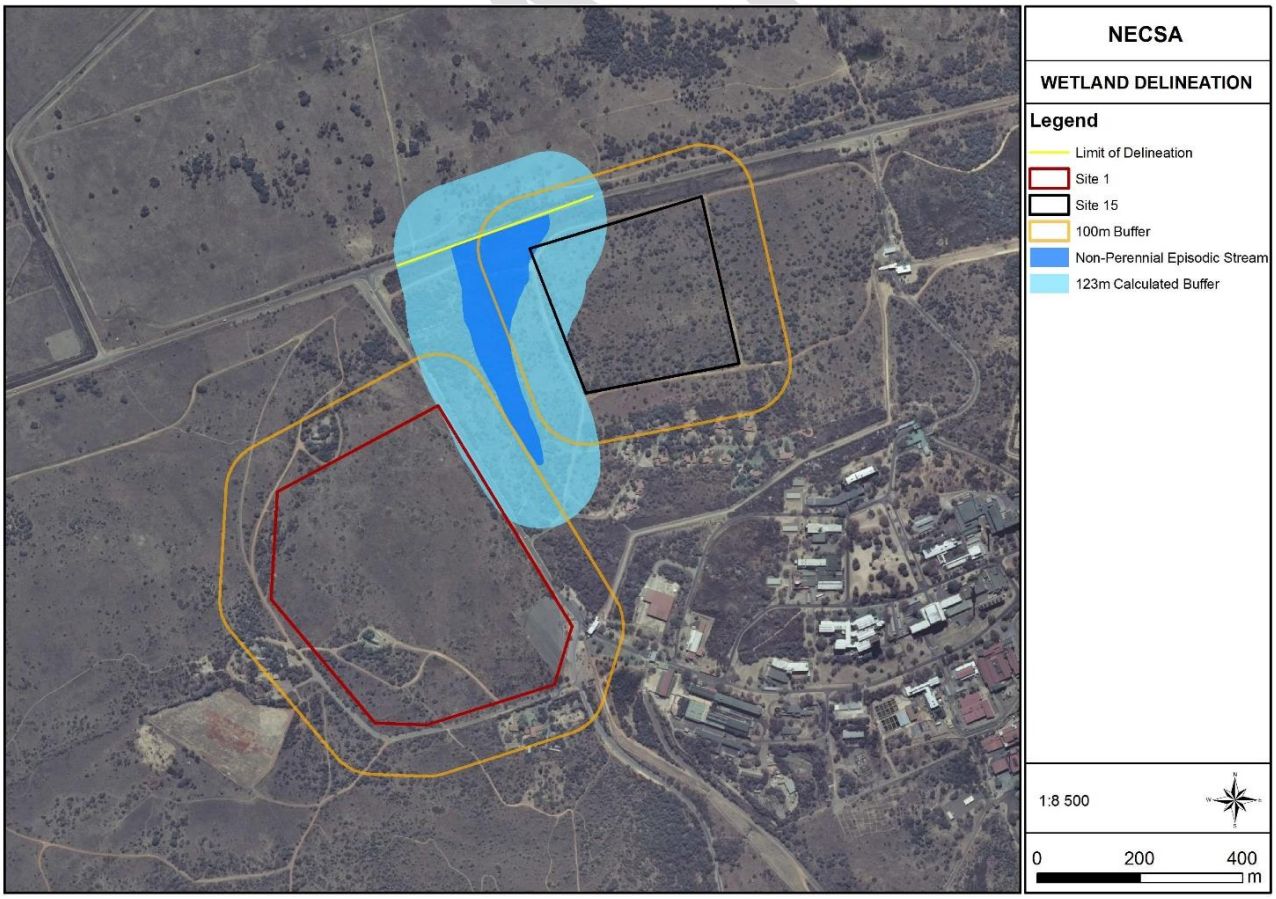
Limosella Consulting has been appointed by Manyabe Consultancy for Specialist Input To Inform Environmental Authorisation (EA) For The Proposed Multi-Purpose Reactor At South African Nuclear Energy Corporation's (Necsa) Pelindaba Site, Northwest Province.

A site assessment was conducted on 15 March 2023.

The terms of reference for the current study were as follows:

- Confirm the presence or absence of watercourses on the study areas.
- Delineate the wetland and riparian areas to inform the placement of infrastructure.
- Classify the watercourse according to the system proposed in the national wetlands inventory if relevant.

One watercourse was identified in close proximity to the two study sites and was classified as a 1st order Non-Perennial Episodic Stream flowing in a northern direction into the Moganwe Spruit before flowing into the Crocodile River before flowing into the Hartbeespoort Dam. Episodic streams are highly variable and highly unpredictable and are generally characterised by having no flow for more than 9 months of the year.



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1 INTRODUCTION

Limosella Consulting was Appointed by Manyabe Consultancy For Specialist Input To Inform Environmental Authorisation (EA) For The Proposed Multi-Purpose Reactor (MPR) At South African Nuclear Energy Corporation's (Necsa) Pelindaba Site, Northwest Province.

A site assessment was conducted on 15 March 2023.

1.1 Project Description

The South African Nuclear Energy Corporation Limited (Necsa), a state-owned public company (SOC), proposes to build a new 20 to (max) 30 MW (thermal) Multi-Purpose Reactor (MPR) to replace the ageing SAFARI-1 at its Pelindaba site just outside of Pretoria in the North-West Province. The key objective of this project is to ensure that the benefits derived from SAFARI-1, and more advanced technologies, are continued in the MPR in a sustainable and ever growing way going forward. The proposed MPR will be a modern nuclear, fuel and material testing research facility (estimated footprint of 215m x 176m [3.8ha]) with an associated 100m x 100m proposed construction laydown areas adjacent to the development site during the construction phase. The MPR facility is proposed to safely operate for over >300 days per annum at full power for the operational life of the facility, which is expected to be more than 60 years. The MPR facility will consist of the following:

- The Reactor Building incorporating a Reactor Beam Hall (RBH) experimental area, Neutron Guide Hall (NGH) (with provision for the latter expansion to a second NGH) and with NGH viewing gallery. The NGH includes a large instrument area, instrument control rooms, meeting rooms, laboratories, workshops and restrooms;
- The reactor core which functions as a source of neutrons for producing medical radioisotopes (in-core irradiation of target materials), beam line applications and fuel and material testing; and
- Fuel and Material Testing (FMT) facility.

1.2 Terms of Reference

The terms of reference for the current study were as follows:

- Confirm the absence or presence of watercourses on the study areas;
- Delineate the wetland and riparian areas to inform the placement of infrastructure;
- Classify the watercourse according to the system proposed in the national wetlands inventory if relevant; and
- Recommend suitable calculated buffer zones, as specified in General Notice 267 of 24 March 2017, following Macfarlane *et al* 2015.

1.3 Assumptions and Limitations

- Sampling by its nature means that the entire study area cannot be assessed. In this case, the entirety of the study site could not be assessed due to time constraints and access restrictions. Therefore, the

assessment findings are only applicable to the areas sampled and extrapolated to the rest of the study site. Some reliance was also made on a previous wetland assessment done in the area.

- Formal vegetation sampling was not done by the specialist. All vegetation information recorded was based on the onsite visual observations of the author. Furthermore, only dominant, and noteworthy plant species were recorded. Thus, the vegetation information provided has limitations for true botanical applications.
- The information provided by the client forms the basis of the planning and layouts discussed.
- It should be noted that at the time of the assessment, the exact location of the infrastructure was not available.
- All watercourses within 500 m of any developmental activities should be identified as per the DWS authorization regulations. In order to meet the timeframes and budget constraints for the project, watercourses within the study sites were delineated on a fine scale based on detailed soil and vegetation sampling. Watercourses that fall outside of the site, but that fall within 100 m of the proposed activities were delineated based on desktop analysis of vegetation gradients visible from aerial imagery.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.
- The specialist responsible for this study reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light.
- Description of the depth of the regional water table and geohydrological and hydropedological processes falls outside the scope of the current assessment.
- Floodline calculations fall outside the scope of the current assessment.
- A Red Data scan, fauna and flora, and aquatic assessments were not included in the current study.
- Species composition described for landscape units aimed at depicting characteristic species and did not include a survey for cryptic or rare species.
- The recreation grade GPS used for wetland and riparian delineations is accurate to within five meters.
- Watercourses delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, while converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go areas identified in the current report be pegged in the field in collaboration with the surveyor for precise boundaries. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by for example photocopying and printing.
- The calculation of buffer zones does not consider climate change or future changes to watercourses resulting from increasing catchment transformation.

1.4 Definitions and Legal Framework

This section outlines the definitions, key legislative requirements and guiding principles of the wetland study and the Water Use Authorisation process.

The National Water Act, 1998 (Act No. 36 of 1998) [NWA] provides for Constitutional water demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and are regulated by the Department of Water and Sanitation (DWS). The NWA sets out a range of water use related principles that are to be applied by DWS when taking decisions that significantly affect a water resource. The NWA defines a water resource as including a watercourse, surface water, estuary or aquifer. A watercourse includes a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, pan or dam, into which or from which water flows; any collection of water that the Minister may declare to be a watercourse; and were relevant its beds and banks.

The NWA defines a wetland as "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil." In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often times performs important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river's footprint (DWAF, 2005). It is defined by the NWA as follows: "Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas".

Water uses for which authorisation must be obtained from DWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) is applicable to any activity related to a watercourse:
Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

Authorisations related to wetlands are regulated by Government Notice 509 of 2016 regarding Section 21(c) and (i). This notice grants General Authorisation (GA) for the above water uses should the Risk Assessment matrix (DWS, 2016) reflect a Low score. Activities that obtain a Medium or High-risk score requires authorisation through a Water Use Licence (WUL) from the Department.

Conditions for impeding or diverting the flow of water or altering the bed, banks, course or characteristics of a watercourse (Section 21(c) and (i) activities) include:
9. (3) (b). The water user must ensure that the selection of a site for establishing any impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse works:
(i) is not located on a bend in the watercourse; and
(ii) avoid high gradient areas, unstable slopes, actively eroding banks, interflow zones, springs, and seeps.

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.982, R.983, R. 984 and R.985 of 2014, promulgated under NEMA.
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983).
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA.
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).
- GN 267 (Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals).

1.5 Locality of the study site

Necsa proposes to build a MPR to replace the ageing SAFARI-1 Research Reactor on one of the two proposed sites indicated as Site 1 and Site 15. The study site is located on the Farm Weldaba 567 JQ located in Ward 29 of the Madibeng Local Municipality, North-West Province. The approximate central coordinates of the study site is 25°47'41.58"S and 27°54'42.23" **(**Figure 1).

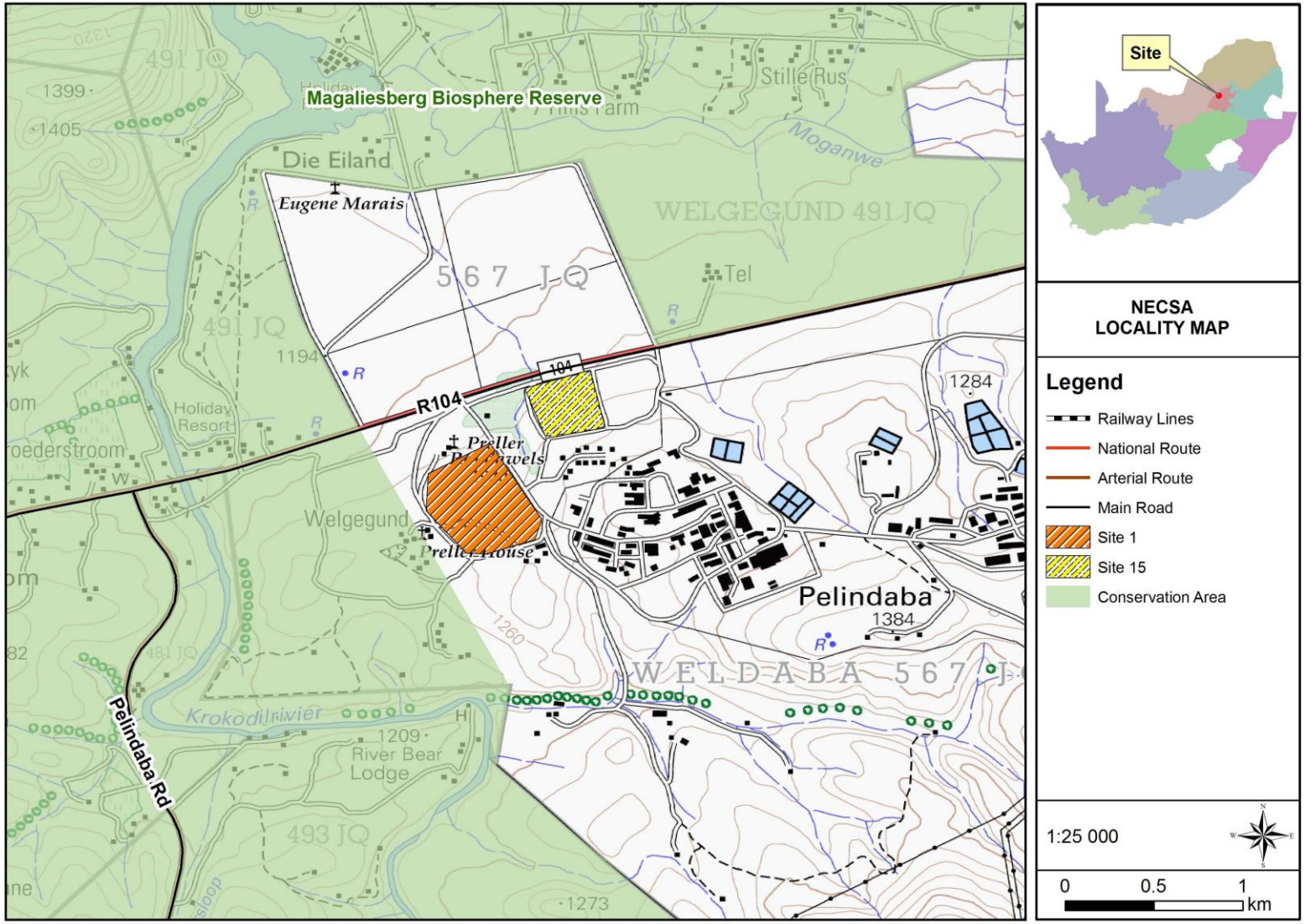


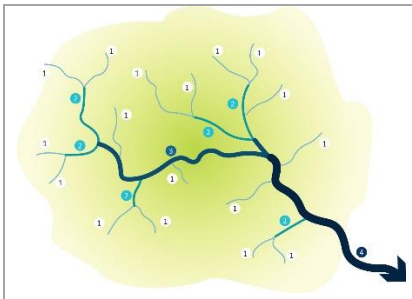
Figure 1: Locality Map

1.6 Description of the Receiving Environment

A review of available literature and spatial data formed the basis of a characterisation of the biophysical environment in its theoretically undisturbed state and consequently an analysis of the degree of impact to the ecology of the study site in its current state. Table 1 below provides a summary of the important aspects.

Table 1: A summary of relevant site information obtained from a review of available spatial data

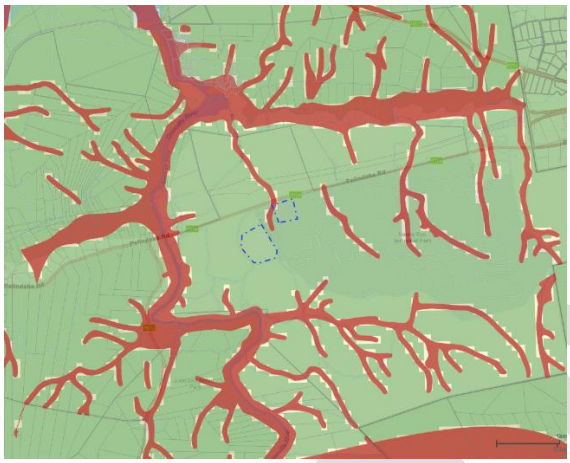
General Description (Mucina & Rutherford, 2006)	
GPS Coordinates	25°47'41.58"S and 27°54'42.23"E
Topography	Low, broken ridges varying in steepness and with high surface rock cover
Climate	Summer rainfall with very dry winters. MAP 600–750 mm, increasing from west to east as well as with higher elevation. Frost frequent, higher in the west and south.
Geology and Soils	Dominated by shale and some coarser clastic sediments as well as significant andesite from the Pretoria Group (Transvaal Supergroup), all sedimentary rocks.
Land Type	The land Type associated with the study area is known as Ib4b - Andesite of the Hekpoort Formation; shale, slate, quartzite and conglomerate of the Rooihoogte and Timeball Hill Formations. Rocks dip 25 degrees to the northwest and north. Occasional narrow dykes of diabase, syenite and dolerite.
Land Use (from available aerial imagery)	Both sites are currently vacant with service roads, old pump stations and historical buildings close to site 1.
Broad Vegetation Units	Gauteng Shale Mountain Bushveld
Hydrology and National Freshwater Ecosystem Priority Area (NFEPA) (2011) Database	
Important Rivers (CDSM, 1996) (Figure 2)	One small non-perennial stream associated with site 15 that drains into Moganwe Spruit before flowing into the Crocodile River
Wetland Vegetation Type	Central Bushveld Group 1
Quaternary Catchment	A21H
WMA (Government Gazette, 16 September 2016)	Water Management Area 1, Limpopo: Major rivers include the Limpopo, Matlabas, Mokolo, Lephalala, Mogalakwena,Sand, Nzhelele, Mutale, and Luvuvhu
NFEPA Wetlands	None in close association
Stream Order	Episodic River – 1st Order



Known site sensitivities

https://screening.environment.gov.za/

screeningtool



High Aquatic Sensitivity close to Site 15

Critical Biodiversity Sector Plan and other Threatened Ecosystems (Figure 3**)**

- The study area is classified as Vulnerable
- The sites are adjacent to Magaliesburg Biosphere Reserve
- The sites are within 2 km from the Fossil Hominid Sites of South Africa and Crocodile River Reserve Protected Environment
- The site are located in Critical Biodiversity 2 Area (CBA2)

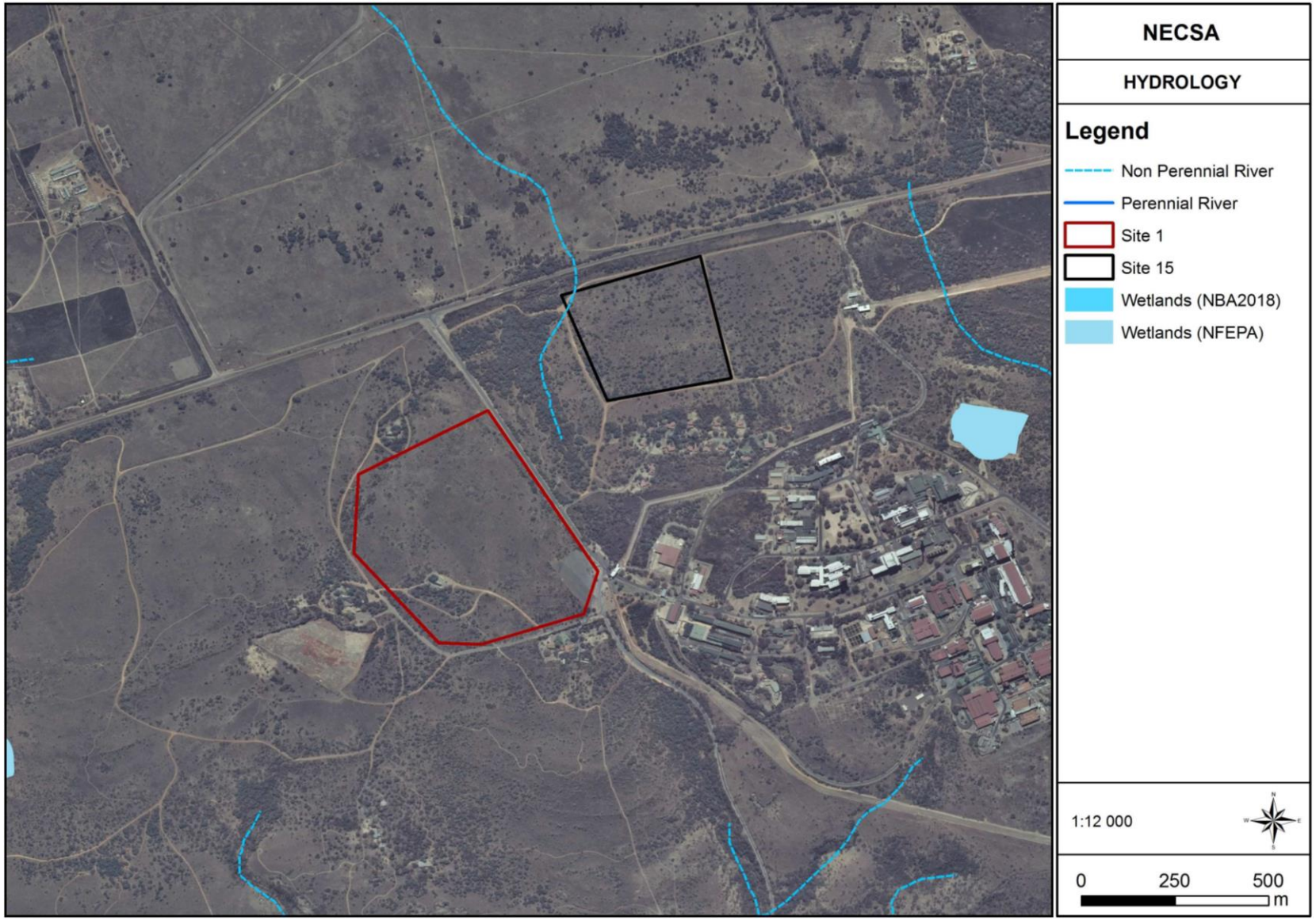


Figure 2: Regional hydrological features relative to the study site.

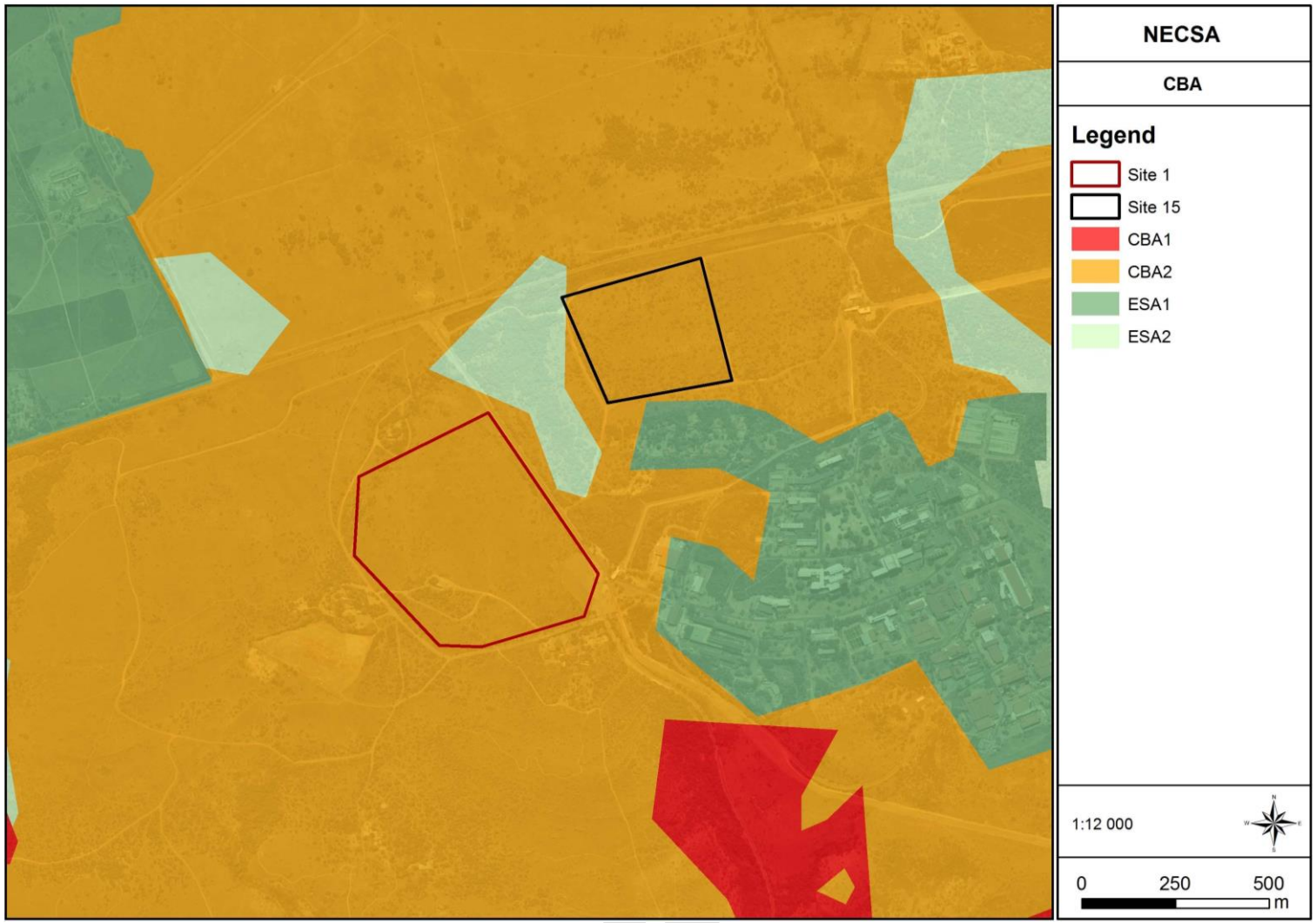


Figure 3: North West Critical Biodiversity Areas

2 METHODOLOGY

The delineation method documented by the DWS in their document "Updated manual for identification and delineation of wetlands and riparian areas" (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2014) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*, 2013) was followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

A hand held Garmin Montana 650 and/or a Samsung S10 smartphone will be used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These will be converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey. Applications used on the smartphone includes GPX Viewer Pro and Google Earth.

Following the initial desktop assessment that highlighted wetland or riparian boundaries to be groundtruthed in the field, soil and vegetation sampling on site informed a fine scale delineation. Functional and integrity assessments were conducted to indicate the baseline status of the wetlands identified. In the current study the wetland area was assessed using, WET-Health (Macfarlane *et al*, 2020), EIS and WetEcoServices, (Kotze *et al*, 2020). The assessment of potential impacts follows the 2014 NEMA regulations (as amended) and the DWS 2016 Risk Assessment.

In order to ease the legibility of the report, details regarding the methods used in each phase of the wetland assessment are presented in Appendix B.

3 RESULTS

3.1 Land Use, Cover and Ecological State

The study site is located on a generally low elevation with a higher elevation towards the Pelindaba complex. No other watercourses were recorded on either study site although a small section does encroach onto the northwestern corner of site 15 (Figure 4). Based on historical imagery of 1949, it can be seen that the area was generally undeveloped with some small-scale farming and agriculture. The watercourse associated with the study site as well as other watercourses in the same catchment was characterised by less dense woody vegetation compared to aerial images of more recent times (Figure 5). The upper regions of the wetland remains relatively natural with a few changes while downstream areas have been transformed.

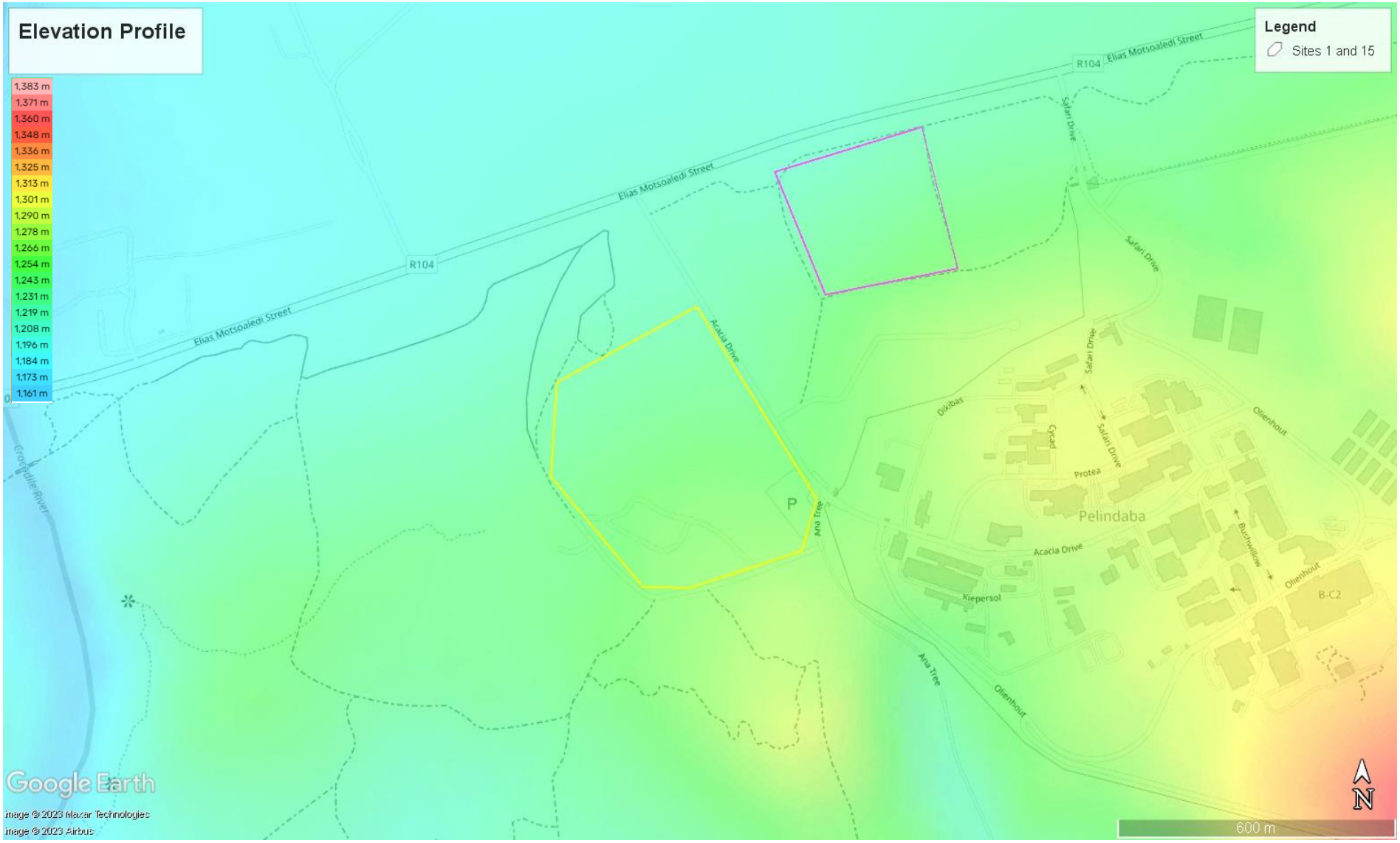


Figure 4: Elevation Profile of the study site (https://tessadem.com/)

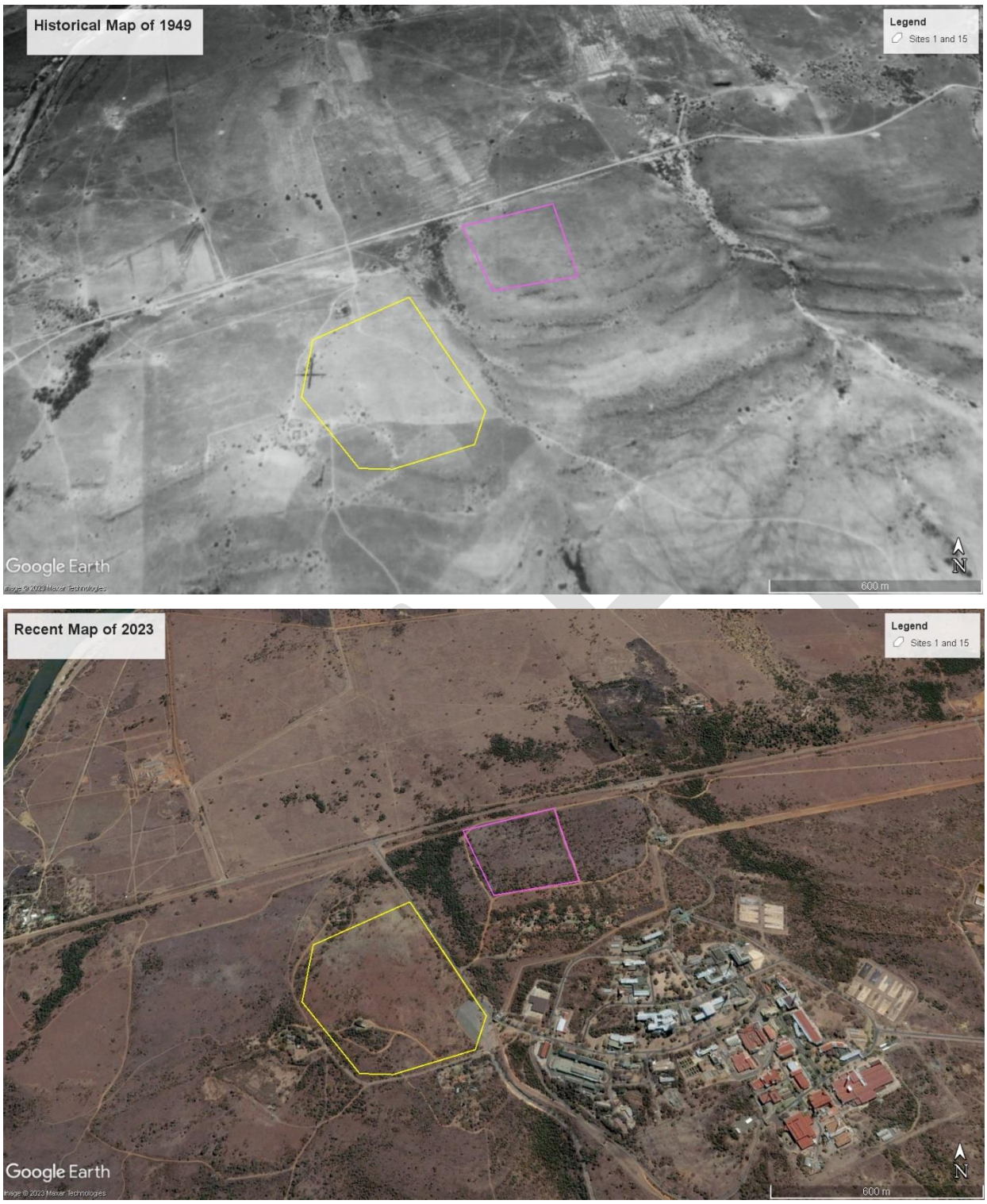


Figure 5: Historic aerial imagery from 1949 (top) and 2023 (bottom).

3.2 Wetland/Riparian Classification and Delineation

One watercourse was recorded on the study site (Figure 6). One watercourse was identified in close proximity to the two study sites and was classified as a 1st order Non-Perennial Episodic Stream flowing in a northern direction into the Moganwe Spruit before flowing into the Crocodile River before flowing into the Hartbeespoort Dam. Episodic streams are highly variable and highly unpredictable and are generally characterised by having no flow for more than 9 months of the year. and further classified per level according to the classification guidelines (Ollis *et al,* 2013) in Table 2. It should be noted that the watercourse did not have sufficient flow to conduct a baseline aquatic assessment using tools such as The South African Scoring System (SASS) Version 5 and Integrated Habitat Assessment System (IHAS).

Table 2: Summary of the result of the application of Levels 1- 4 of the classification System of the Non-Perennial Stream (Ollis *et al*, 2013)

Level 1	Level 2	Level 3	Level 4:HGM unit	
System	**NFEPA Wetland Vegetation Group**	**Landscape Unit**	**Level 4A**	**Level 4B**
Inland	Mesic Highveld Grassland Group 3	Valley Floor	River	Mountain Stream

A level 5 application was conducted for the wetland inundation period (Ollis *et al,* 2013) in (Table 3).

Table 3: Summary of the dominant Level 5 hydroperiod of the Non-Perennial Stream (Ollis *et al*, 2013)

Wetland Name	Dominant Hydroperiod	
	Level 5A: Inundation Period	**Level 5B: Saturation Period**
Non-Perennial Episodic Stream	Temporarily inundated	Temporarily Saturated

3.3 Buffer Zones

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAF, 2005). A development has several impacts on the surrounding environment and on a watercourse. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is, therefore, often characteristic of transformed catchments. The buffer zone identified in this report serves to highlight an ecologically sensitive area in which activities should be conducted with this sensitivity in mind.

Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include (i) maintaining basic hydrological processes; (ii) reducing impacts on water resources from upstream activities and adjoining landuses; (iii) providing habitat for various aspects of biodiversity. Buffer zones are therefore

proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. Although buffer zones can be effective in addressing diffuse source pollution in storm water run-off, they should typically be seen as part of a treatment train designed to address storm water impacts (MacFarlane & Brendin, 2017).

Authorisation from the DWS requires a calculation of a site-specific buffer zone [General Notice (GN) 267 of 24 March 2017], following Macfarlane et al 2015. This Excel-based tool calculates the best-suited buffer for each watercourse based on numerous on-site observations.

It should be noted that Regulated areas are zones within which a Water Use Authorisation is required. The DWS specify a 500 m regulated area around all wetlands and 100 m around all riparian zones (unless a fine scale delineation and/or floodline are available) within which development must be authorised from their department. Development within 32m of the edge of the watercourse triggers the requirement for Environmental Authorisation (EA) under the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA): Environmental Impact Assessment (EIA) Regulations of 2014, as amended. In the case of this report, a fine-scale buffer zone was calculated for the riparian area using the worst-case scenario for service infrastructure, and can thus be reassessed once site specifics are known. The buffer zone was calculated at 123 m from the edge of the watercourse and no development is allowed within this area (Figure 5). Based on this buffer zone approximately 1.94 hectares of Site 15 (of a total of 10.3 ha) should not be developed or approximately 19% of Site 15. However, only a small section of the buffer zone falls within Site 1. Only 0.42 hectares of Site 1 fall within the buffer zone of the watercourse, or approximately 1.75% of the total area of Site 1. From these calculations, Site 1 is thus the preferred option and has ample space for the proposed development without encroaching into the watercourse buffer zone. Figure 6 shows current watercourse conditions, generic and calculated buffer zones area relative to the study site. It should be noted that in these urban areas the majority of the existing houses fall within the watercourse buffer zones.

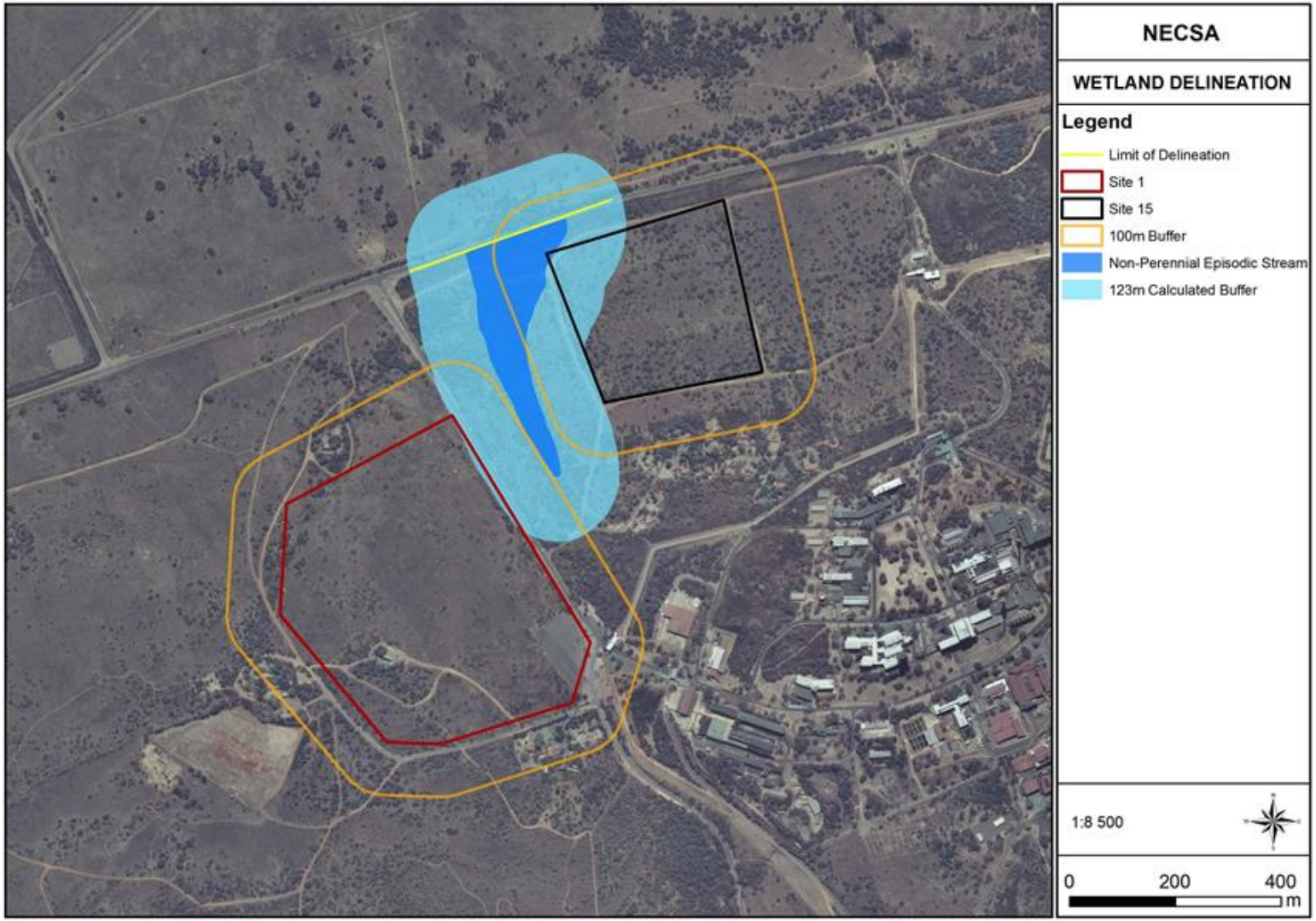


Figure 6: Delineated watercourses, their calculated buffers and the DWS regulated area relative to the study site.

3.3.1 Vegetation and Soil (Figure 7)

The vegetation of the watercourse was dominated by woody vegetation and some wetland-like vegetation located adjacent to the R104 road and likely due to Stormwater input and artificial canals. The Non-Perennial stream did not have a clear distinct well-defined channel and marginal zone of the macro-channel floor in the higher slopes while the lower elevation areas indicated some features of a low-flow channel. The dominant woody vegetation of the watercourse includes *Celtis afircana, Olea europea, Senegalia caffra, Searsia lancea, Ziziphus mucronata*. The area was also densely colonised by several woody Alien Invasive Species (AIS) including *Lantana camara, Melia azadarch, Solanum mauritiunum, Jacaranda mimosfolia* and areas with overgrown with *Macfadyena unguis-cati*. Other AIS recorded included Zinnia peruviana, Tagetus minuta, *Campuloclinium macrocephalum, Cortoderia selloana, Conyza spp*. Where the stream approaches the R104 road in the north and received some additional Stormwater, some Stormwater canals were recorded, in these, some wetland vegetation such as *Typha capensis* occurred. Some of the features of the watercourse are illustrated in the figures below. A summary of the dominant vegetation and soil characteristics for a level 6 assessment are described in the table below (Table 4) and illustrated in the images below (Figure 7).

Table 4: Summary of the Level 6 dominant soil and vegetation characteristics of the channelled valley bottom wetland.

Dominant Descriptor Categories (Level 6)					
6A: Natural vs Artificial	**Vegetation Cover, Form and Status**			**Substratum Type**	
	6A: Veg Cover	**6B, C & D Primary Form**	**6E: Veg Conditions**	**6A: Primary Category**	**6B: Secondary Category**
Natural Watercourse	Vegetated	Riparian Vegetation	Dominated by Alien Invasive woody vegetation	Shale with Sandy Soil	Alluvial Sand




Figure 7: Vegetation and soil Characteristics of the watercourses.

4 Expected Impacts and Mitigations

A discussion on impacts to the aquatic environment (as required in GN320 of March 2020) is summarised in Table 5.

Table 5: Impacts as per GN320 of March 2020

Requirements of a Compliance Statement as set out in GN 320	**MPR wetland specialist findings**
The compliance statement / assessment must be prepared by a suitably qualified specialist registered with the SACNASP, with expertise in the field of aquatic sciences;	Rudi Bezuidenhoudt, SACNASP Reg. No. 008867 (Ecological Sciences) Expertise in the field of aquatic sciences evident from CV (Appendix A)
The compliance statement / assessment must: be applicable to the preferred site and the proposed development footprint;	A specialist study was conducted on the alternative sites earmarked for development. One site will be the preferred site for development.
2.7 The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix A
2.7.2. a signed statement of independence by the specialist;	Appendix B
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	A site assessment was conducted on 15 March 2023.
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	Methods followed to determine compliance to the definition of wetland conditions followed the DWAF 2005 and 2008 delineation guidelines and included both soil and vegetation sampling as well as verification of visible moisture gradients on available aerial imagery between 2001 and 2020 (Google Earth Timeline Function) within the 500m Department of Water and Sanitation's (DWS) regulated area. Further historic aerial imagery from 1937 was sourced to show historic conditions.
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	Extrapolation was used for wetlands within 500 m.
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	No-go areas were identified on the study site and comprise of the watercourse and calculated buffer zone.
2.7.7. additional environmental impacts expected from the proposed development;	Not expected.

Requirements of a Compliance Statement as set out in GN 320	MPR wetland specialist findings
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	Indirect and cumulative impacts to downslope wetlands could occur unless effective stormwater management is implemented.
2.7.9. the degree to which impacts and risks can be mitigated;	Implementation of best practice, and well documented Sustainable Urban Drainage (SUD) principles will mitigate risks.
2.7.10. the degree to which the impacts and risks can be reversed;	If development remains outside of the buffer zone, impacts are expected to be easily mitigated.
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	None.
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	Figure 6 presents the delineated wetlands/ rivers within the Area of Investigation.
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	Implement best practice and principles of SUD.
2.7.14, a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	The watercourse, together with its associated buffer zone are considered to be of High sensitivity
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	Development on site 1 is supported if the construction and development footprint remain outside of the 123m buffer.
2.7.16. any conditions to which this statement is subjected.	Applicability of authorisation from the DWS should be confirmed with the relevant representative since the site falls in the regulated area of wetlands

5 EXPECTED IMPACTS

No proposed layout was available at the time of the watercourse assessment. Potential impacts to the watercourse include the following:

- Changes to runoff characteristics of the catchment of the watercourses leading to a cumulative increase in high energy runoff which may result in erosion and sedimentation;
- Disturbance of soil is likely to result in further densification of Alien Invasive species

If the development footprint remains outside of the calculated buffer zone, the potential impacts are expected to be easily mitigated.

6 CONCLUSION

Although a watercourse was recorded close to the two study sites, only a small corner (northwestern) of Site 15 is located within the watercourse, however, due to the uncertain nature of the development, a buffer zone was calculated at 123 m (Based on worst case scenario) from the edge of the watercourse and no development are allowed within this area. Based on this buffer zone, approximately 1.94 hectares of Site 15 (of a total of 10.3 ha) should not be developed or approximately 19% of Site 15. However, only a small section of the buffer zone falls within Site 1. Only 0.42 hectares of Site 1 falls within the buffer zone of the watercourse, or approximately 1.75% of the total area of Site 1. From these calculations, Site 1 is thus the preferred option and has ample space for the proposed development without encroaching into the watercourse buffer zone. The exact footprint of the development is not currently known, therefore, once it becomes available it should be assessed to determine if it falls outside of the 123 m buffer zone and determine a DWS Risk assessment score.

7 REFERENCES

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APPENDIX A: Requirements for Aquatic Biodiversity Assessments

The NEMA regulations of 2014 (as amended) specify required information to be included in specialist reports. Table 18 presents a summary of these requirements following GNR982 as amended by GN326. In March 2020, the Department of Environmental Affairs issued General Notice 320 set out requirements of the EIA Screening Tool Protocols for the Assessment and Reporting of Environmental Themes including Aquatic Biodiversity. These specifications overlap somewhat with the 2014 EIA regulations as amended (GN 982 as amended by GN326). Table 6 presents a summary of the requirements of this protocol with notes on sections of the report applicable to each aspect.

Table 6: Legislative report requirements GNR982

GNR982 as amended by GN326	Report Section
(1) A specialist report prepared in terms of these Regulations must contain—	
(a) details of—	
(i) the specialist who prepared the report; and	Page 4
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	APPENDIX C: Abbreviated CVs of participating specialists
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 2
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.6
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	APPENDIX B: Detailed methodology
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3
(g) an identification of any areas to be avoided, including buffers;	Section 3

(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 6
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 3
(k) any mitigation measures for inclusion in the EMPr;	Should be indicated when the layout is received
(l) any conditions for inclusion in the environmental authorisation;	Remain outside the buffer zone/ floodlines
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Should be indicated when the layout is received
(n) a reasoned opinion—	
(i) whether the proposed activity, activities or portions thereof should be authorised;	Section 6
(iA) regarding the acceptability of the proposed activity or activities; and	Section 6
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 6
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not Applicable
(q) any other information requested by the competent authority.	Not Applicable
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not Applicable

APPENDIX B: Detailed methodology

The delineation method documented by the Department of Water affairs and Forestry in their document "Updated manual for identification and delineation of wetlands and riparian areas" (DWAF, 2008), and the Minimum Requirements for Biodiversity Assessments (GDACE, 2009) as well as the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al,* 2013) was followed throughout the field survey. These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

A hand held Garmin Montana 650 was used to capture GPS co-ordinates in the field. 1:50 000 cadastral maps and available GIS data were used as reference material for the mapping of the preliminary watercourse boundaries. These were converted to digital image backdrops and delineation lines and boundaries were imposed accordingly after the field survey.

Wetland and Riparian Delineation

Wetlands are delineated based on scientifically sound methods, and utilizes a tool from the DWS 'A practical field procedure for identification and delineation of wetlands and riparian areas' (DWAF, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (DWAF, 2008). The delineation of the watercourses presented in this report is based on both desktop delineation and groundtruthing.

Desktop Delineation

A desktop assessment was conducted with wetland and riparian units potentially affected by the proposed activities identified using a range of tools, including:

- 1: 50 000 topographical maps;
- Recent, relevant aerial and satellite imagery, including Google Earth;
- NFEPA wetlands and Rivers (http://bgisviewer.sanbi.org/)
- Municipal and DWS spatial datasets.

All areas suspected of being wetland and riparian habitat based on the visual signatures on the digital base maps were mapped using google earth.

Ground Truthing

Field investigations confirmed fine-scale wetland and riparian boundaries.

Wetland Indicators

Wetlands were identified based on one or more of the following characteristic attributes (DWAF, 2005) (**Error! Reference source not found.**and Figure 9):

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The presence of plants adapted to or tolerant of saturated soils (hydrophytes);
- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation; and

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

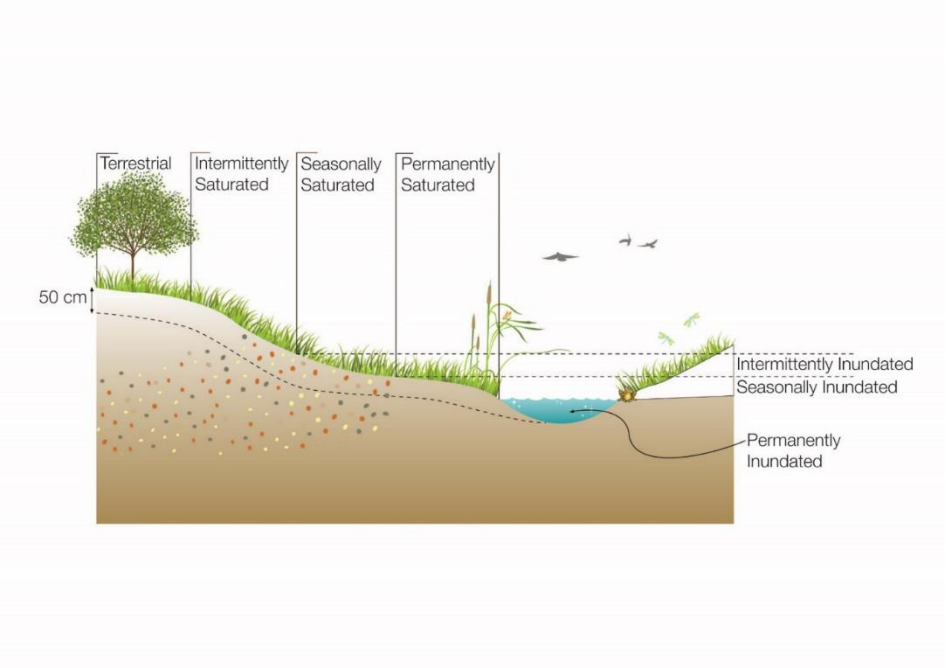


Figure 8: Typical cross section of a wetland (Ollis, 2013)

The Terrain Unit Indicator

The terrain unit indicator is an important guide for identifying the parts of the landscape where wetlands might possibly occur. Some wetlands occur on slopes higher up in the catchment where groundwater discharge is taking place through seeps. An area with soil wetness and/or vegetation indicators, but not displaying any of the topographical indicators should therefore not be excluded from being classified as a wetland. The type of wetland which occurs on a specific topographical area in the landscape is described using the Hydrogeomorphic classification which separates wetlands into 'HGM' units. The classification of Ollis, *et al*. (2013) is used, where wetlands are classified on Level 4 as either Rivers, Floodplain wetlands, Valley-bottom wetlands, Depressions, Seeps, or Flats (Figure 10 and Figure 9).

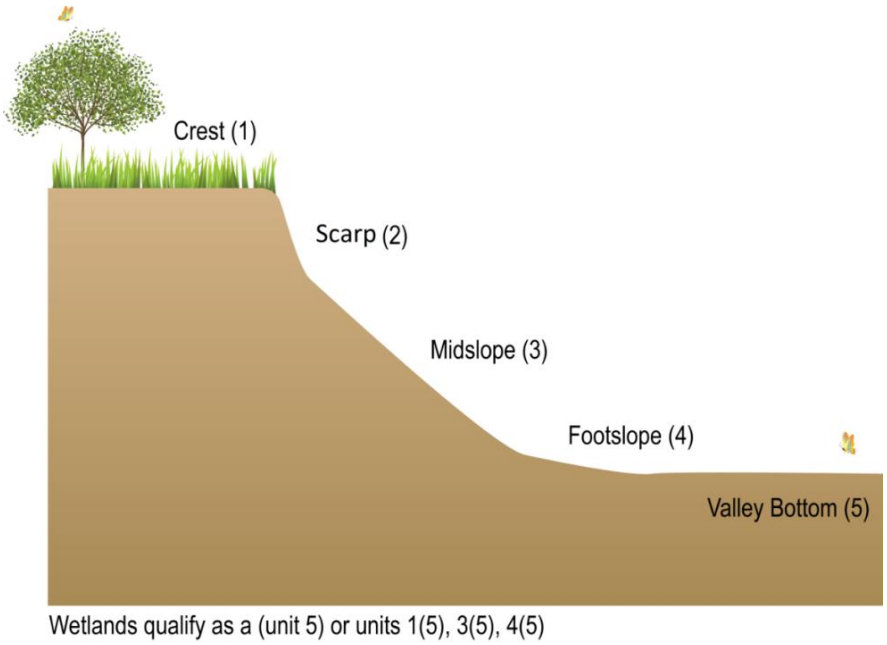


Figure 9. Terrain units (DWAF, 2005).

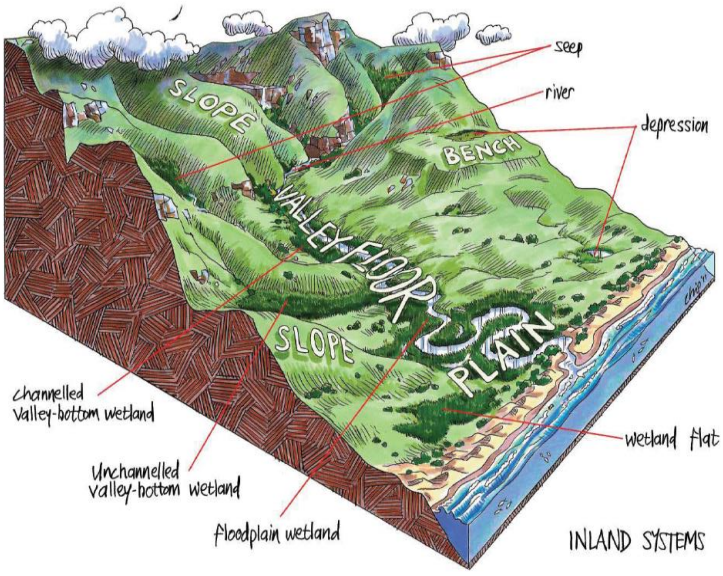


Figure 10: Wetland Units based on hydrogeomorphic types (Ollis *et al.* 2013)

Riparian Indicators

Riparian habitat is classified primarily by identifying riparian vegetation along the edge of the macro stream channel. The macro stream channel is defined as the outer bank of a compound channel and should not be confused with the active river bank. The macro channel bank often represents a dramatic change in the energy with which water passes through the system. Rich alluvial soils deposit nutrients making the riparian area a highly productive zone. This causes a very distinct change in vegetation structure and composition along the edges of the riparian area (DWAF, 2008). The marginal zone includes the area from the water level at low flow, to those features that are hydrologically activated for the greater part of the Year (WRC Report No TT 333/08 April, 2008). The non-marginal zone is the combination of the upper and lower zones (Figure 11).

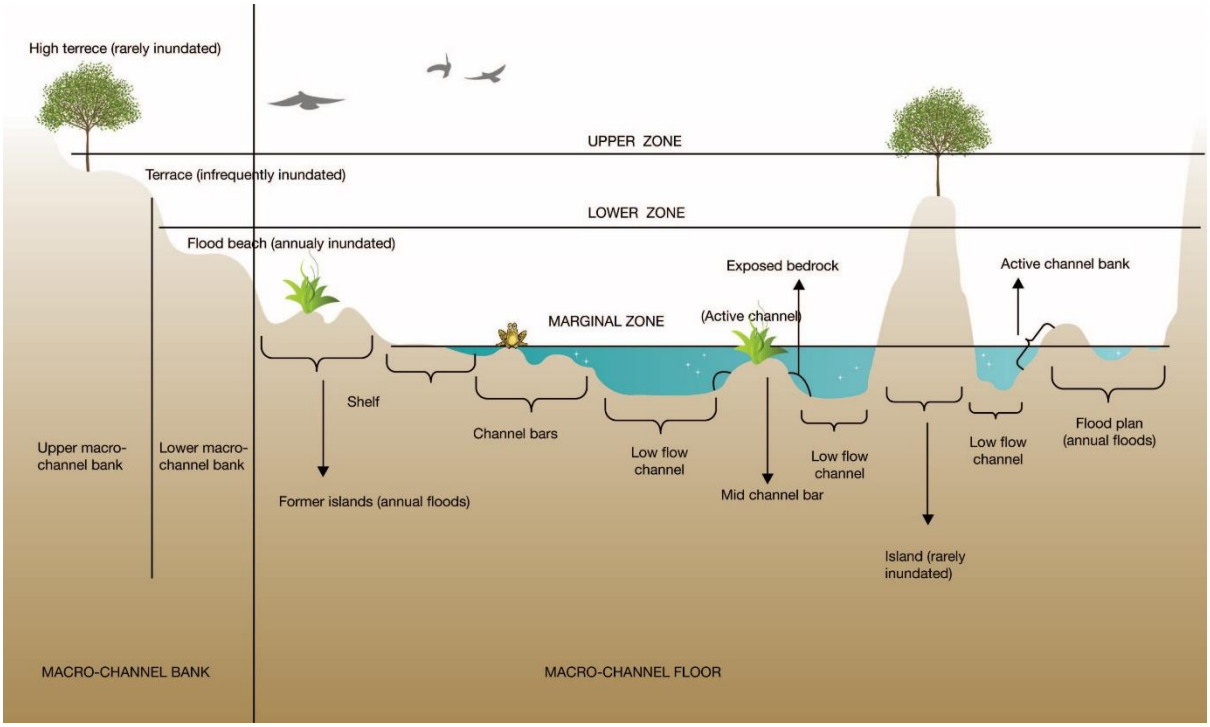


Figure 11: Schematic diagram illustrating an example of where the 3 zones would be placed relative to geomorphic diversity (Kleynhans *et al*, 2007)

Riparian areas can be grouped into different categories based on their inundation period per year. Perennial rivers are rivers with continuous surface water flow, intermittent rivers are rivers where surface flow disappears but some surface flow remains, temporary rivers are rivers where surface flow disappears for most of the channel (Figure 12). Two types of temporary rivers are recognized, namely "ephemeral" rivers that flow for less time than they are dry and support a series of pools in parts of the channel, and "episodic" rivers that only flow in response to extreme rainfall events, usually high in their catchments (Seaman *et al.*, 2010).

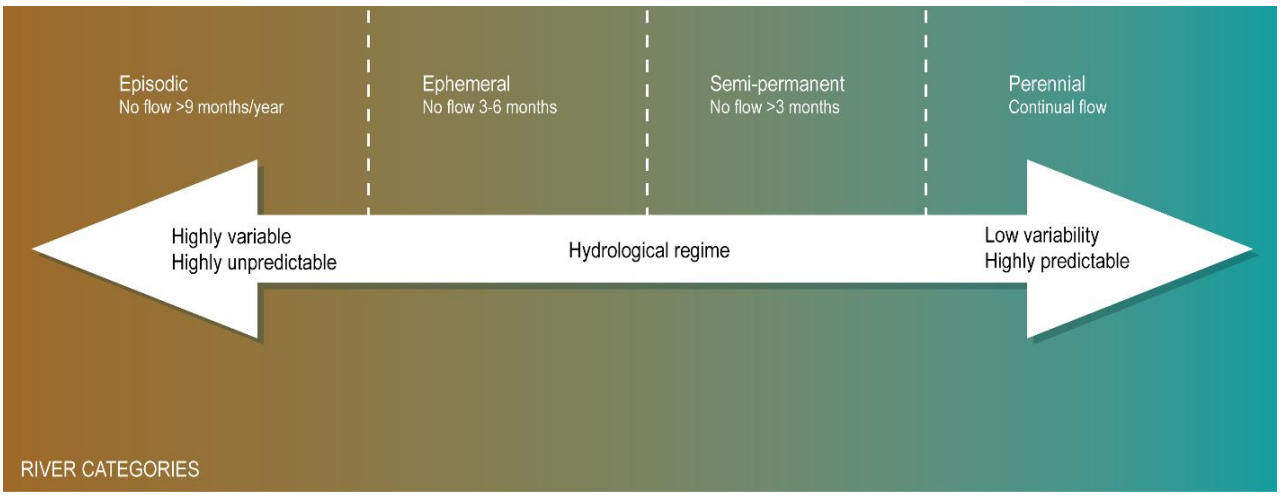


Figure 12: The four categories associated with rivers and the hydrological continuum. Dashed lines indicate that boundaries are not fixed (Seaman *et al*, 2010).

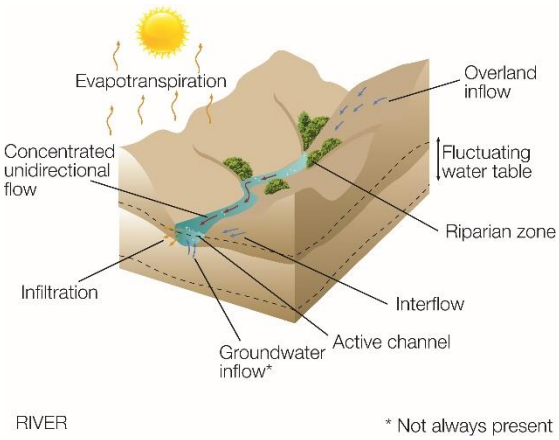
Wetland/Riparian Classification

The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2013). The current watercourse assessment follows the same approach by classifying watercourses in terms of a functional unit recognised in the classification system proposed in SANBI (2013). HGM units take into consideration factors that determine the nature of water movement into, through and out of the watercuorse system. In general, HGM units encompass three key elements (Kotze *et al.*, 2005):

- Geomorphic setting - This refers to the landform, its position in the landscape and how it evolved (e.g. through the deposition of river borne sediment);
- Water source - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
- Hydrodynamics - This refers to how water moves through the wetland.

The classification of watercourse areas found within the study site and/or within 500 m of the study site (adapted from Brinson, 1993; Kotze, 1999, Marneweck and Batchelor, 2002 and DWAF, 2005) are as follows (Table 7):

Table 7: Watercourse Types and descriptions

Watercourse Type:	Description:
Riparian habitat  	Linear fluvial, eroded landforms which carry channelized flow on a permanent, seasonal or ephemeral/episodic basis. The river channel flows within a confined valley (gorge) or within an incised macro-channel. The "river" includes both the active channel (the portion which carries the water) as well as the riparian zone.

Buffer Zones and Regulated Areas

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAF, 2005). A development has several impacts on the surrounding environment and on a watercourse. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of stormwater runoff, peak discharges, and frequency and severity of flooding is, therefore, often characteristic of transformed catchments. The buffer zone identified in this report serves to highlight an ecologically sensitive area in which activities should be conducted with this sensitivity in mind.

Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include (i) maintaining basic hydrological processes; (ii) reducing impacts on water resources from upstream activities and adjoining landuses; (iii) providing habitat for various aspects of biodiversity. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. Although buffer zones can be effective in addressing diffuse source pollution in storm water run-off, they should typically be seen as part of a treatment train designed to address storm water impacts (MacFarlane & Brendin, 2017).

Authorisation from the DWS requires calculation of a site-specific buffer zone (General Notice 267 of 24 March 2017), following Macfarlane *et al* 2015. This Excel-based tool calculates the best suited buffer for each wetland or section of a wetland based on numerous on-site observations. The resulting buffer zone can thus have large differences depending on the current state of the wetland as well as the nature of the proposed development. Developments with a high-risk factor such as mining are likely to have a larger buffer area compared to a residential development with a lower risk factor.

Figure 13 images represent the buffer zone setback for the watercourse types discussed in this report.

It should be noted that the buffer calculation tool does not take into account the effects of climate change or cumulative impacts to floodflows resulting from transformed catchments. Therefore, a conservative approach to the application of buffer zones is encouraged.

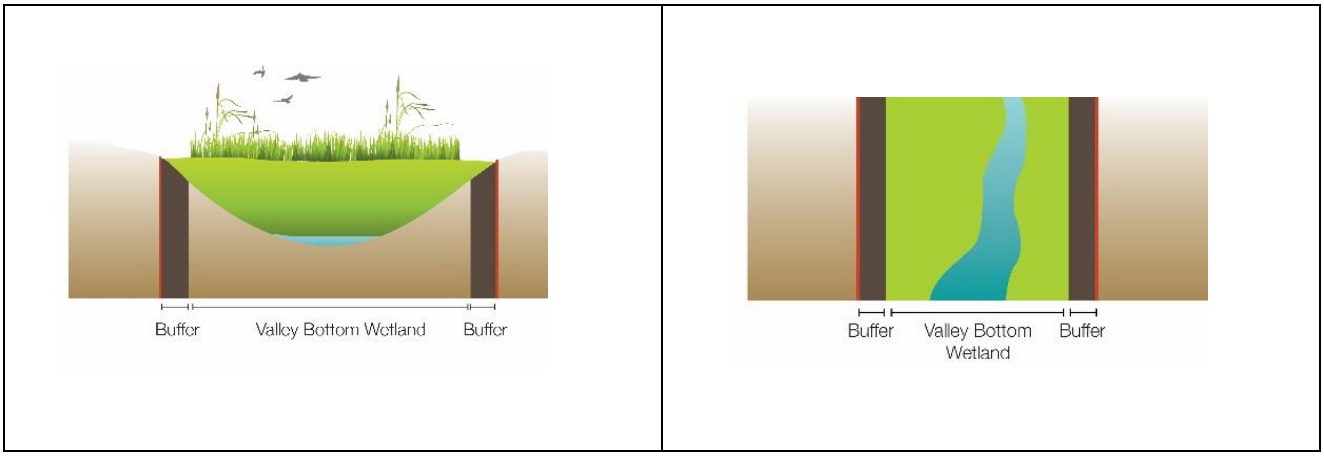


Figure 13: A represent the buffer zone setback for the watercourse discussed in this report

Regulated areas are zones within which authorisation is required. The DWS specify a 500m regulated area around all wetlands and 100m around all riparian zones (unless a fine scale delineation and floodline are available) within which development must be authorised from their department. Development within 32m of the edge of the watercourse triggers the requirement for authorisation under the National Environmental Management Act (NEMA): Environmental Impact Assessment (EIA) Regulations of 2014 (GNR 326) as amended.

It should be noted that the buffer calculation tool does not take into account the effects of climate change or cumulative impacts to floodflows resulting from transformed catchments. Therefore, a conservative approach to the application of buffer zones is encouraged.

APPENDIX C: Abbreviated CVs of participating specialists

RUDI BEZUIDENHOUDT

880831 5038 081

Ecologist / Botanist / Aquatic Specialist

Pr. Sci Nat (Reg. No. 008867)

South African

Single

EDUCATIONAL QUALIFICATIONS

- B.Sc. (Botany & Zoology), University of South Africa (2008 - 2012)
- B.Sc. (Hons) Botany, University of South Africa (2014 – 2016)
- Aquatic & Wetland Plant identification, Cripsis Environment (2019)
- Introduction to wetlands, Gauteng Wetland Forum (2010)
- Biomimicry and Constructed Wetlands. Golder Associates and Water Research Commission (2011)
- Wetland Rehabilitation Principles, University of the Free State (2012)
- Wetland Plant Identification Course, SANBI (2015)
- Tools for Wetland Assessment, Rhodes University (2011)
- Wetland Legislation, University of Free-State (2013)
- Understanding Environmental Impact Assessment, WESSA (2011)
- SASS 5, Groundtruth (2012)
- Wetland Operations and Diversity Management Master Class, Secolo Consulting Training Services (2015)
- Tree Identification, Braam van Wyk – University of Pretoria (2015)
- Wetland Buffer Legislation – Eco-Pulse & Water Research Commission (2015)
- Wetland Seminar, ARC-ISCW & IMCG (2011)
- Invasive Species Training, SAGIC (2016)
- Hydropedology Course. Department of Water and Sanitation (2019)
- Tropical Coastal Ecosystems, edX (2020)
- The Science of Hydropedology – Department of Water and Sanitation (2020)
- Hydropedological Grouping of SA Soil Forms - Department of Water and Sanitation (2020)

- Hydropedological Classification of South Africa Soil Forms - Department of Water and Sanitation (2020)
- Contribution of Hydropedological Assessments to the Availability and Sustainable Management of water for all - Department of Water and Sanitation (2020)

▸ WETLAND SPECIALIST/ECOLOGIST

Experience in the delineation and functional assessment of wetlands and riparian areas in order to advise proposed development layouts, project management, report writing and quality control. This entails all aspects of scientific investigation associated with a consultancy that focuses on wetland specialist investigations. This includes the following:

- Approximately 200+ specialist investigations into wetland and riparian conditions on strategic, as well as fine scale levels in all 9 Provinces of South Africa as well as in bordering countries.
- Ensuring the scientific integrity of wetland reports including peer review and publications.

Major Projects Involve:

- Numerous Eskom Powerline Projects some spanning more than one Province.
- Proposed New Kruger National Camp and Infrastructure (2016)
- Numerous Mining Projects
- Numerous Water infrastructure upgrades
- Numerous Residential and Housing Developments

▸ BIODIVERSITY ACTION PLAN

This entails the gathering of data and compiling of a Biodiversity action plan for various private and government entities.

▸ REHABILITATION

This entailed the management of vegetation and rehabilitation related projects in terms of developing proposals, project management, technical investigation and quality control as well as on-site monitoring.

COURSES PRESENTED

- Riparian Vegetation Response Assessment Index (VEGRAI) Training presented to DWA (Department of Water Affairs) (2017)
- Numerous Wetland Talks

- **ENVIRONMENTAL CONTROLLING OFFICER:**

Routine inspection of construction sites to ensure compliance with the City's environmental ordinances, the Environmental Management Program and other laws and by-laws associated with development at or near wetland or riparian areas.

- Soweto Zola Park 2011-2013
- Orange Farm Pipeline 2010-2011
- Juksei River Rehabilitation 2018- 2020
- Ga-Mawela Bridge 2019-2020

- **ENVIRONMENTAL AUDIT:**

Audit of Eskom Kusile power station to comply with the Kusile Section 21G Water Use Licence (Department of Water Affairs, Licence No. 04/B20F/BCFGIJ/41, 2011), the amended Water Use Licence (Department of water affairs and forestry, Ref. 27/2/2/B620/101/8, 2009) and the WUL checklist provided by Eskom.

- Kusile Powerstation 2012-2013.

- **INVASIVE SPECIES MANAGEMENT**

- Identifying and classifying invasive species on numerous sites.
- Creating invasive species control and management plans
- Monitoring invasive species control measures

PUBLICATIONS

Bezuidenhoudt. R., De Klerk. A. R., Oberholster. P.J. (2017). Assessing the ecosystem processes of ecological infrastructure on post-coal mined land. COALTECH RESEARCH ASSOCIATION NPC. University of South Africa. Council for Scientific Industrial Research.