Name: Stephen van Staden
Date: Tuesday, 12 November 2024
Project Nr: FEN 24-5092

Sharples Environmental Services (SES)
Tel: 044 834 4923
Cell: 083 326 9599
Email: michael@sescc.net

Attention: Mr Michael Jon Bennett

RE: ADDENDUM TO A FRESHWATER ASSESSMENT UNDERTAKEN FOR THE PROPOSED DEVELOPMENT ON ERF 19374, GEORGE, WESTERN CAPE AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS.

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd undertook a freshwater assessment in May 2022 (updated March 2023) to assess the potential impacts of the proposed residential development on Erf 19374, George on the freshwater ecosystems associated with the proposed development, with specific mention of the Malgas River, as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes (FEN 22-5024). Subsequent to the compilation of the freshwater assessment report, the EA application was withdrawn as the WUA and EA applications were not syncronised and the development layout has since been revised. FEN Consulting (Pty) Ltd was therefore reappointed to provide specialist opinion on the new layout.

1. PROJECT BACKGROUND

Erf 19734 (hereafter referred to as the 'study area') is located in the north-eastern side of George, immediately south of the N12 (Figures 1 and 2). The study area is an open space area, bounded by the Malgas River to the west, and a residential development to the east. The initial development layout included 77 residential units, an apartment block, numerous open space areas, and internal linear and service (including stormwater management) infrastructure (Figure 3; Architecure in Africa Architects, October 2022). In the optimised development layout, the number of residential units have been reduced to 70 and the construction of an underground stormwater chamber has been removed from the proposed development layout, with the remainder of the development components remaining unchanged (Figure 4; CHEL Building & Civil Supplies, 2024). According to the revised Preliminary Stormwater Management Environmental Method Statement prepared by CHEL Building & Civil Supplies (2024), onsite stormwater management will entail attenuation of stormwater in attenuation ponds within the study area prior to low velocity release via a series of energy breaking structures including a series of "steps" (Figure 5), to a lower elevation attenuation pond system located outside the study area into the Malgas River (CHEL Building & Civil Supplies, 2024). The energy breaking structures, steps and lower elevation attenuation pond system outside the study area is hereafter referred to as the 'stormwater attenuation system'. The proposed onsite stormwater management system would also allow for the utilisation of water within the estate for irrigation, thus reducing the municipal water requirement as well as minimising potential impacts on the river as a result of the discharge of stormwater therein. Refer to CHEL Building & Civil Supplies (2024) for the detailed stormwater management system design. Areas adjacent to the stormwater attenuation system will also be landscaped for slope protection and the creation of a green space to be used by the residents of the proposed residential development (CHEL Building & Civil Supplies, 2024). A landscaped water fountain will also be developed within the study area, and an incomplete building located in the south eastern portion of the study area is proposed to be demolished prior to the commencement of construction.

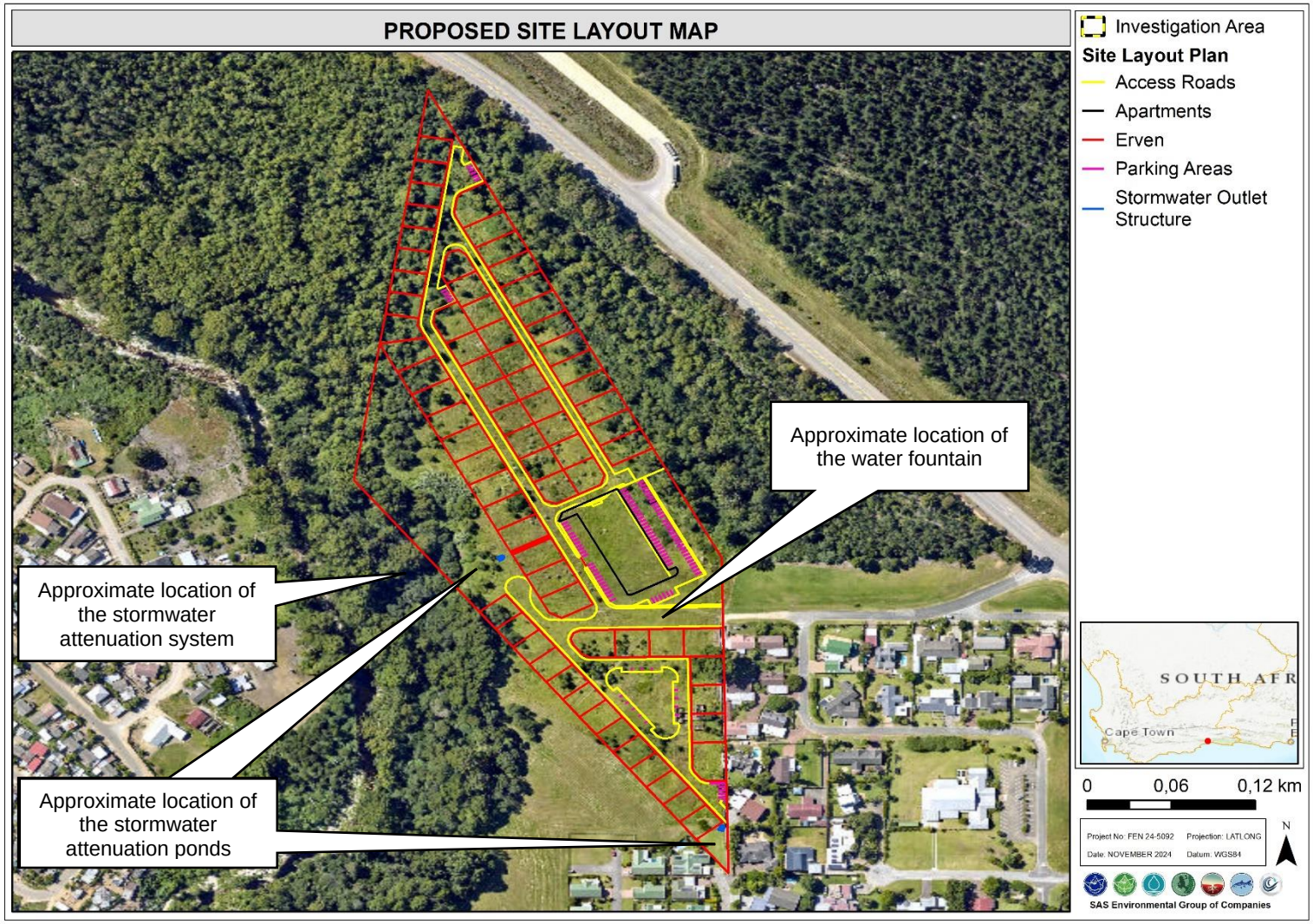


Figure 1: A digital satellite image depicting the location and layout of the study and investigation areas in relation to the surrounding area. Note that the public open space areas are not indicated in the map.

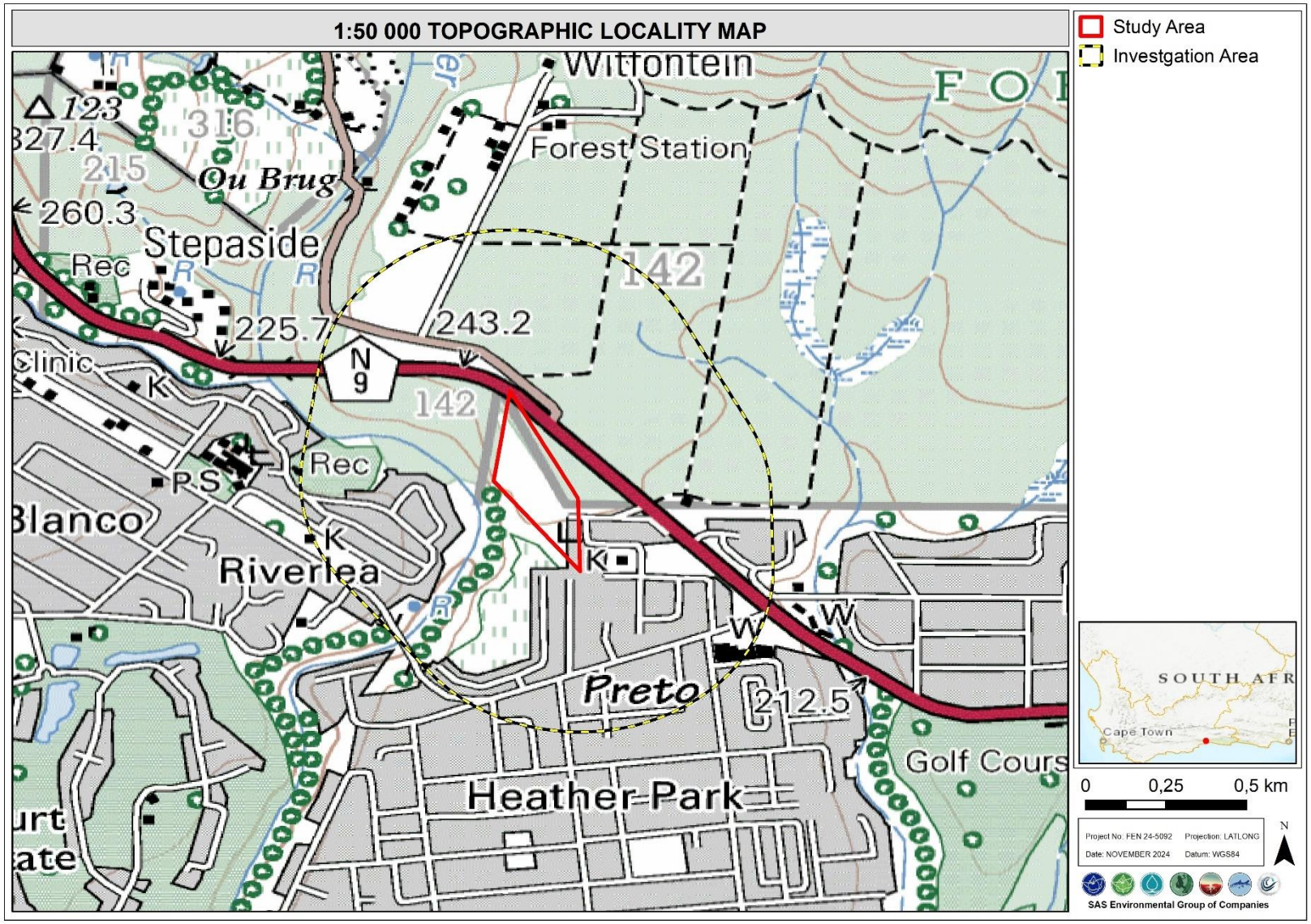


Figure 2: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

Figure 3: The initial residential development layout of Erf 19374 (Architecure in Africa Architects, 2022).

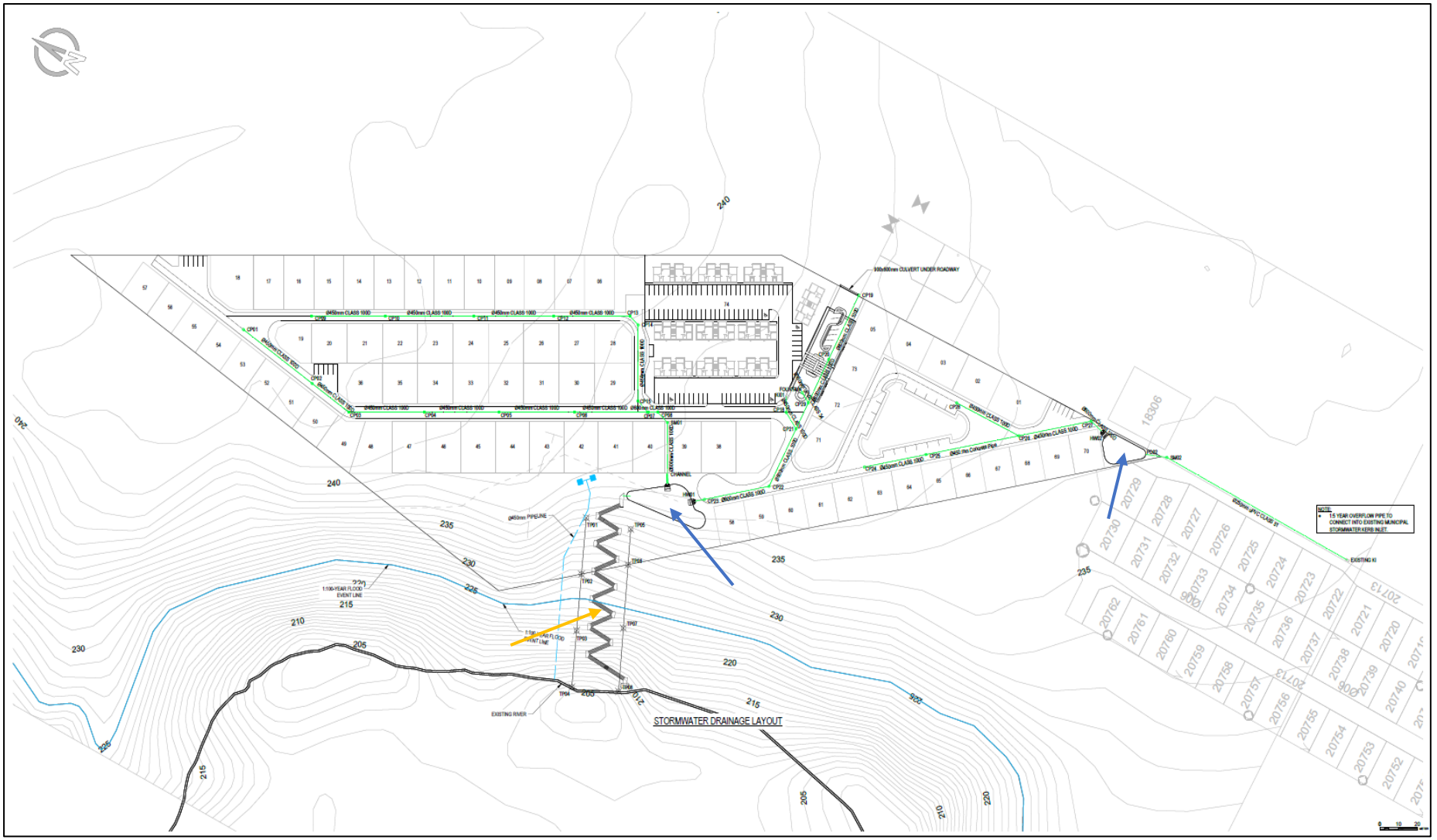


Figure 4: Stormwater drainage layout of Erf 19374 (CHEL Building & Civil Supplies, 2024) with updated development layout. The location of the two stormwater attenuation ponds associated with the proposed development and the stormwater attenuation system is indicated by the blue and orange arrows, respectively. The green lines indicate the internal stormwater pipeline network.

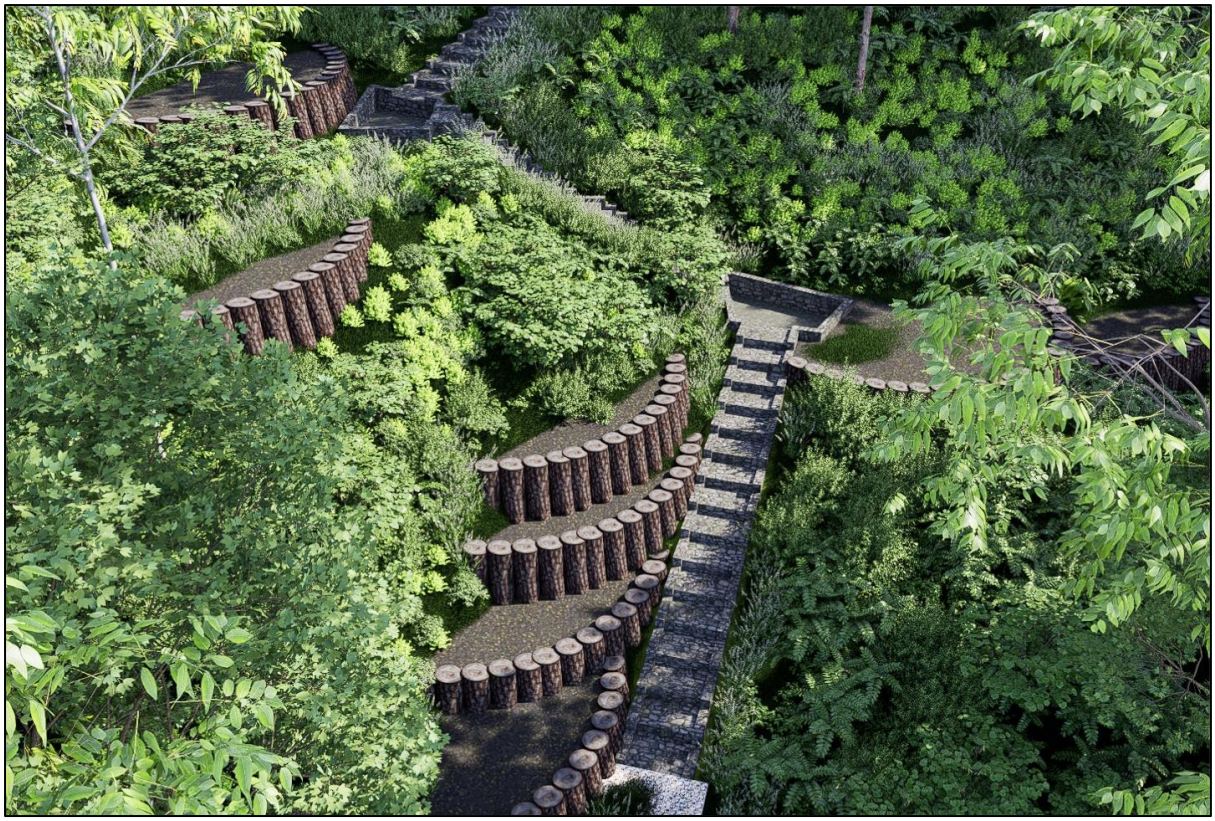


Figure 5: Conceptual design of the proposed stormwater cascade system to attenuate flow and minimize risk of scouring and erosion as stormwater moves downslope from the development towards the Malgas River (image courtesy of CHEL Building & Civil Supplies (2024)).

2. SUMMARY OF FRESHWATER ASSESSMENT

2.1. Desktop Background Results

The following background ecological data is applicable to the study and investigation areas (refer to the desktop ecological dashboard and associated maps in FEN, 2022):

- The study area is located in the South Eastern Coastal Belt Ecoregion, in the quaternary catchment K30B of the Coastal Gouritz sub-water management area;
- The study area is located a sub-quaternary catchment tha hosts rivers that are considered to be fish sanctuaries (Freshwater Ecosystem Priority Area Code 2);
- According to the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database, there are no wetlands or rivers located within the study area. The moderately modified (RIVCON = C) Malgas River is indicated to be located outside the western boundary of the study area;
- According to the National Biodiversity Assessment (2018) database, there are no wetlands or rivers located in the study and investigation areas;
- The study and investigation areas are indicated to be situated in the critically endangered Eastern Fynbos Renesterveld Shale Fynbos wetland vegetation type; and
- As indicated by the Western Cape Biodiversity Spatial Plan (2017), the study area and portions of the investigation area are considered to be Critical Biodiversity Areas (1 and 2) as well as Ecological Support Areas 2.

2.2. Freshwater Ecosystems associated with the Study Area

During the site assessment undertaken in April 2022 by FEN (2022), no freshwater ecosystems were identified within the study area, however, the Malgas River was identified approximately 15 m west of the study area (Figure 6). As part of the ecological assessment, it was determined that the ecological

condition of the system is largely modified (Present Ecological State category D), with moderate to high ecological importance and sensitivity and moderately high to very low ecoservice provision. As indicated by FEN (2022), the modified ecological condition of the system is as a result of catchment land changes, specifically urban development and forestry developments resulting in alteration to hydrological regime and vegetation composition of the river.

A 15 conservation buffer was calculated for the Malgas River using the “Preliminary Guideline for the Determination of Buffer zones for Rivers, Wetlands and Estuaries” as developed by Macfarlane *et al.* (2015) which is anticipated to suitably protect the river from the proposed development (FEN, 2022). The conservation buffer and zones of regulation as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Government Notice (GN) 4167 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are depicted in Figure 7 below.

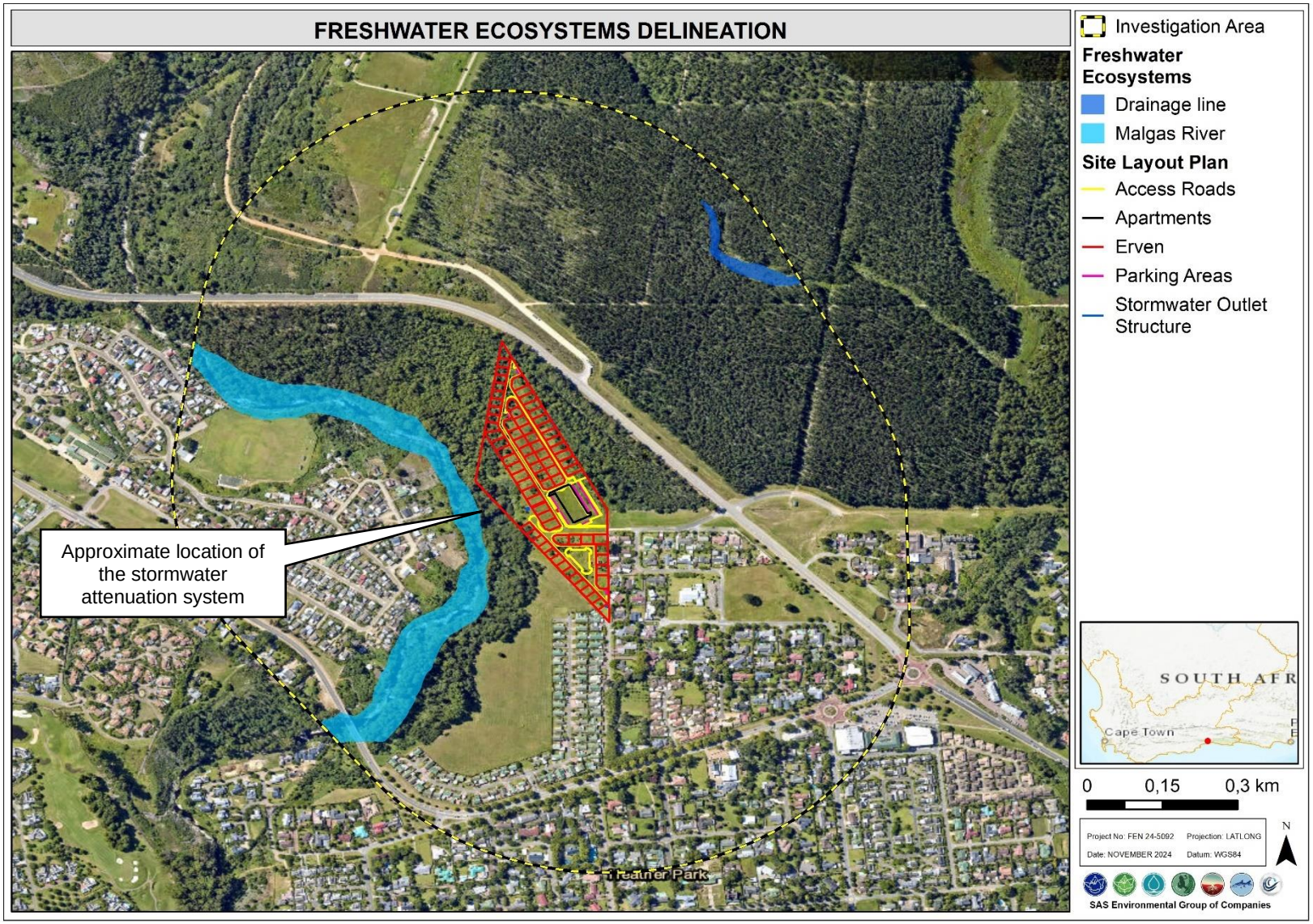


Figure 6: Delineation of all freshwater ecosystems associated with the study and investigation areas. Note that the public open space areas are not indicated in the map.

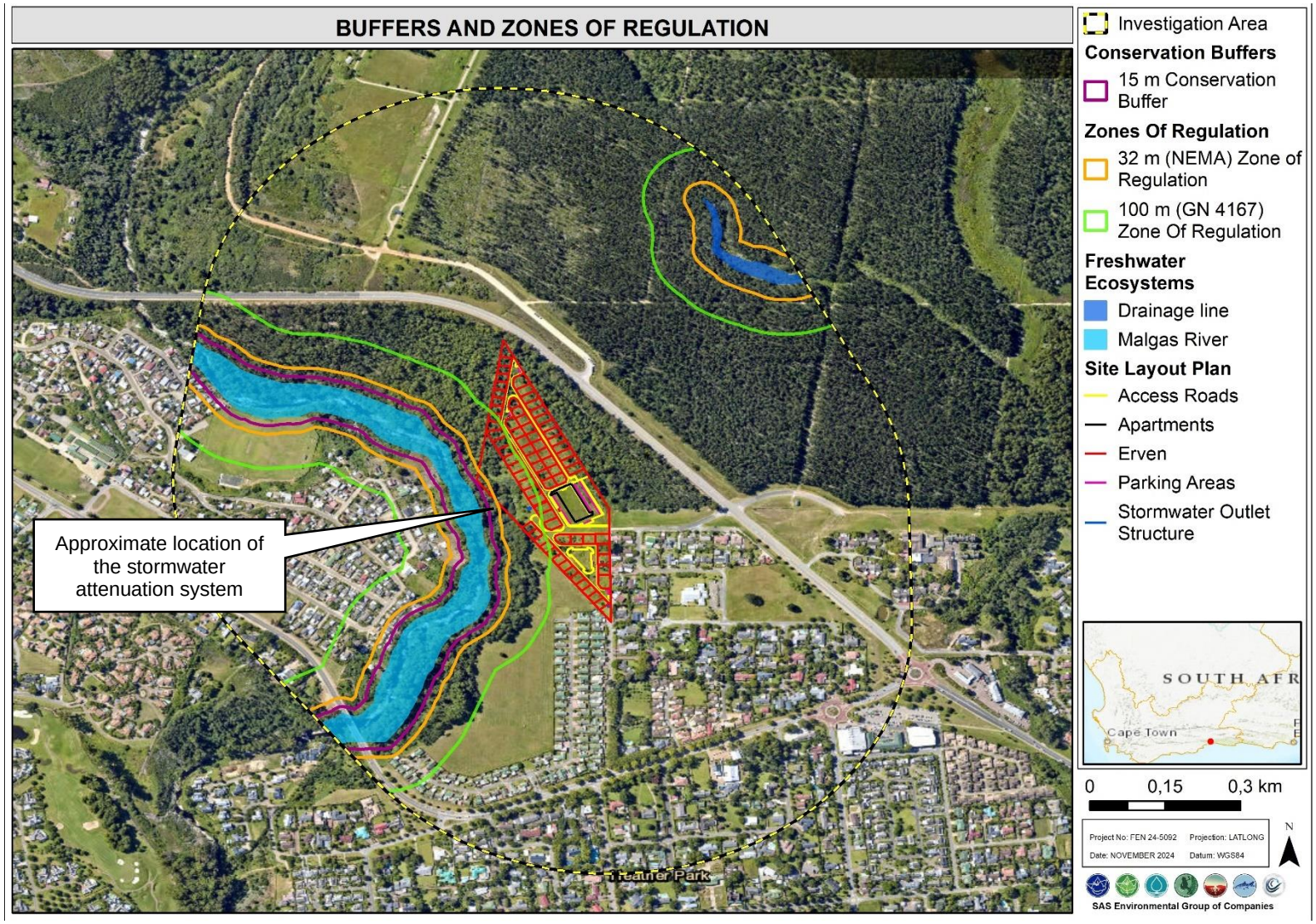


Figure 7: The NEMA and GN 4167 zones of regulation associated with the Malgas River, relative to the proposed development and 15 m conservation buffer. Note that the public open space areas are not indicated in the map.

3. SPECIALIST OPINION ON THE AMENDED LAYOUT

The assessment undertaken by FEN (2022) indicated that a 'Low' impact significance to the overall integrity of the Malgas River is expected, with the implementation of the mitigation measures set out in FEN (2022) and in particular, ecologically sensitive design of the proposed stormwater management system. The updated development layout is largely similar to the initial development layout, and as such is anticipated to pose a low impact significance on the Malgas River during both the construction and operational phases of the development. Stormwater management of the proposed development was not assessed in FEN (2022) as the layout was not available at the time. The construction of the stormwater attenuation system is anticipated to pose a medium impact significance, without the implementation of mitigation measures, but a low impact significance with the implementation of mitigation measures as the stormwater attenuation system will be constructed within the 15 m conservation buffer of the Malgas River. A routine monitoring and maintenance plan must be compiled and implemented to manage stormwater associated with the proposed development. This is to include monitoring and maintenance of the attenuation ponds, pipelines and stormwater attenuation system in terms of the integrity of the structures, damage (including erosion) control, and the removal of litter, rubble, sediment and weeds, as outlined in the Stormwater Management Method Statement (CHEL Building & Civil Supplies, 2024). The demolition activities are anticipated to pose a low impact significance on the Malgas River assuming that the rubble will not be discarded in the Malgas River or 15 m conservation buffer and that the rubble will be discarded at a licenced waste facility on completion of all demolition activities. Construction rubble may however be used on site as part of the road construction should the developer so desire.

The following mitigation measures are applicable to the to the stormwater attenuation system:

- Construction of the stormwater attenuation system must be undertaken during the dry summer period to minimise the volumes of sediment entering the Malgas River and to minimise water quality impacts;
- Areas outside the construction footprint of the stormwater attenuation system must be marked as a no-go area;
- Vegetation clearance must be kept to a minimum;
- Vehicle movement within the 15 m conservation buffer must be kept to a minimum, and preference should be given to undertaking construction activities by hand, where feasible. Drip trays are to be used for all vehicles not in use. All vehicles used as part of the construction of the stormwater attenuation system must be parked outside the 15 m conservation buffer when not in use;
- Sediment traps must be installed downgradient of the construction works prior to the commencement of construction. Sediment traps are to be inspected daily and accumulated sediment to be removed by hand on a weekly basis;
- Soil removed from the construction area must be stockpiled outside the 15 m conservation buffer and exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) to prevent erosion and sedimentation of the river. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum, so as for later usage as backfill material or as part of rehabilitation activities and the stockpiles may not exceed 2 m in height;
- Where possible, natural timber products and vegetation must be used for slope stabilisation considering the steep slope between the study area and the river;
- The gabion mattresses to be installed below the lowest stilling pond must be installed to be in line with the beds of the river and not below the ground level;
- Mitigation measures applicable to cement/ concrete use as outlined in FEN (2022) must also be implemented where the stormwater attenuation system will be constructed. A designated area within the construction footprint of the stormwater attenuation system may be assigned for the mixing and management of cement / concrete and the location thereof is to be agreed upon by

the independent Environmental Control Officer or freshwater specialist. Spilled or excess concrete must be cleaned up immediately and disposed of at a suitable landfill site;

- It is highly recommended that the stormwater attenuation system be vegetated with suitable indigenous wetland and/or riparian vegetation to assist in water quality management and velocity reduction. This will also improve the aesthetics of the stormwater attenuation system;
- Rehabilitation of the disturbed area must be undertaken, including re-vegetation with indigenous vegetation, inclusive of the 15 m conservation buffer that might have been impacted by the construction of the stormwater attenuation system. Only indigenous vegetation species may be used as part of the landscaping of the slopes adjacent to the Malgas River, and alien and invasive plants are to be eradicated;
- The operation of the stormwater attenuation system must ensure that stormwater is released into the Malgas River in a dissipated manner to mimic natural flow velocities;
- Silt removed from the siltation ponds may under no circumstances be stockpiled within the 15 m conservation buffer or discarded into the Malgas River and must be disposed of at a registered waste management facility; and
- Regular inspection of the stormwater attenuation system and and associated landscaped areas must be undertaken (specifically after large storm events) in order to monitor the occurrence of erosion, particularly of the landscaped areas surrounding the stormwater attenuation system. If erosion has occurred, it must immediately be rehabilitated through stabilisation of the embankments and revegetation.

As part of the development and operation of the stormwater attenuation ponds, the following mitigation measures must be implemented:

- Attenuation ponds must be vegetated with indigenous obligate and facultative species suitable for seasonal saturation. This will assist with energy dissipation and prevent sedimentation and erosion as well as improve habitat provision. Wooden boardwalks could be developed over these ponds for pedestrian walkways should the developer so desire;
- Cobbles must be placed on the concrete aprons to further assist with energy dissipation;
- All materials used to construct the attenuation ponds should not generate toxic leachates or lead to significant changes in pH or dissolved salt concentrations; especially considering that outflow of the pond drains into the Malgas River;
- No plastic lining may be used as part of the attenuation pond construction as this has various ecological impacts, with special mention of impacts to faunal assemblages; and
- Rocks must be placed at any outlet pipes (downgradient of the attenuation pond), as required and indigenous vegetation established to bind the soil of the bed and to prevent erosion. This will also promote diffuse flow and decrease the velocity of water released downgradient towards the Malgas River.

In conclusion, considering that significant effort has been made to avoid direct impacts on the Malgas River, particularly with regards to stormwater management, and that there has been no change to the risk significance previously determined by FEN (2022), it is the opinion of the specialist that the proposed residential development may be considered for environmental authorisation.

Yours Faithfully,

Digital Documentation Not Signed for Security Purposes

Stephen van Staden[1]

[1] Co-authored by Bianca Bleuler and peer reviewed by Amanda Mileson

4. REFERENCES

Architecure in Africa Architects. 2022**.** Site Development Plan. Drawing name: Plans. Drawing number 20221012 – 1.

CHEL Building & Civil Supplies. 2024. Urban Country Estate: Remainder Erf 6182; Erf 6179; Erf 6156 of Lapsed Erf 19374. Preliminary Stormwater Management Environmental Method Statement. Unpublished specialist report.

FEN Consulting (Pty) Ltd. 2022. Freshwater Assessment for the Proposed Development on Erf 19374, George, Western Cape Province. Report prepared for Sharples Environmental Services. FEN 22-5024. May 2022, updated March 2023.

APPENDIX A: Details, Expertise and Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report

Bianca Bleuler	MPhil Environmental Management (University of Stellenbosch)
Amanda Mileson	Postgraduate Diploma (Nature Conservation) (UNISA)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	FEN Consulting (Pty) Ltd		
Name / Contact person:	Bianca Bleuler		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	0845122100
Telephone:	011 616 7893	Fax:	N/A
E-mail:	bianca@sasenvgroup.co.za		
Qualifications	MPhil Environmental Management		
Registration / Associations	N/A		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Bianca Bleuler, declare that -

- I act as the independent specialist in this application;
- I will 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;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- 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;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist.

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Amanda Mileson, declare that -

- I act as the independent specialist in this application;
- I will 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;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- 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;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist.

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- I will 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;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- 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;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist.

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF BIANCA BLEULER

PERSONAL DETAILS

Position in Company	Field Specialist
Joined SAS Environmental Group of Companies	2023

MEMBERSHIP IN PROFESSIONAL SOCIETIES

None

EDUCATION

Qualifications

MPhil Environmental Management (Stellenbosch University)	2022
PGD Environmental Management (Stellenbosch University)	2018
BSc Hons Biodiversity and Ecology (Stellenbosch University)	2017
BSc Biodiversity and Ecology (Stellenbosch University)	2016

Short Courses

Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2020

AREAS OF WORK EXPERIENCE

South Africa –Western Cape

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Environmental Control Officer (ECO) work
- Environmental Management Programme (EMPr) compilation

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Wetland Offset Plans
- Freshwater Ecosystem Maintenance and Management Plans

Biodiversity Assessments

- Biodiversity Offset Plans

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF AMANDA MILESON

PERSONAL DETAILS

Position in Company	Senior Ecologist: Wetland Ecology
Joined SAS Environmental Group of Companies	2013

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society (SAWS)

Member of the International Society of Wetland Scientists

Member of the Gauteng, Western Cape and Northern Cape Wetland Forums

EDUCATION

Qualifications

N. Dip Nature Conservation (UNISA)	2017
Advanced Diploma Nature Conservation (UNISA)	2020
Postgraduate Diploma Nature Conservation (UNISA)	2023

Short Courses

Wetland Management: Introduction and Delineation (University of the Free State)	2018
Tools for Wetland Assessment (Rhodes University)	2017
Wetland Rehabilitation (University of the Free State)	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape

Africa – Zimbabwe, Zambia

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Watercourse Delineation
- Watercourse Verification Assessment
- Watercourse (wetland / riparian) Delineation and Assessment
- Watercourse EcoService and Status Determination
- Watercourse Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Watercourse Plant Species Plans
- Watercourse Offset Plans

Biodiversity Assessments

- Biodiversity Ecological Assessments
- Biodiversity Offset Plans

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation

4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

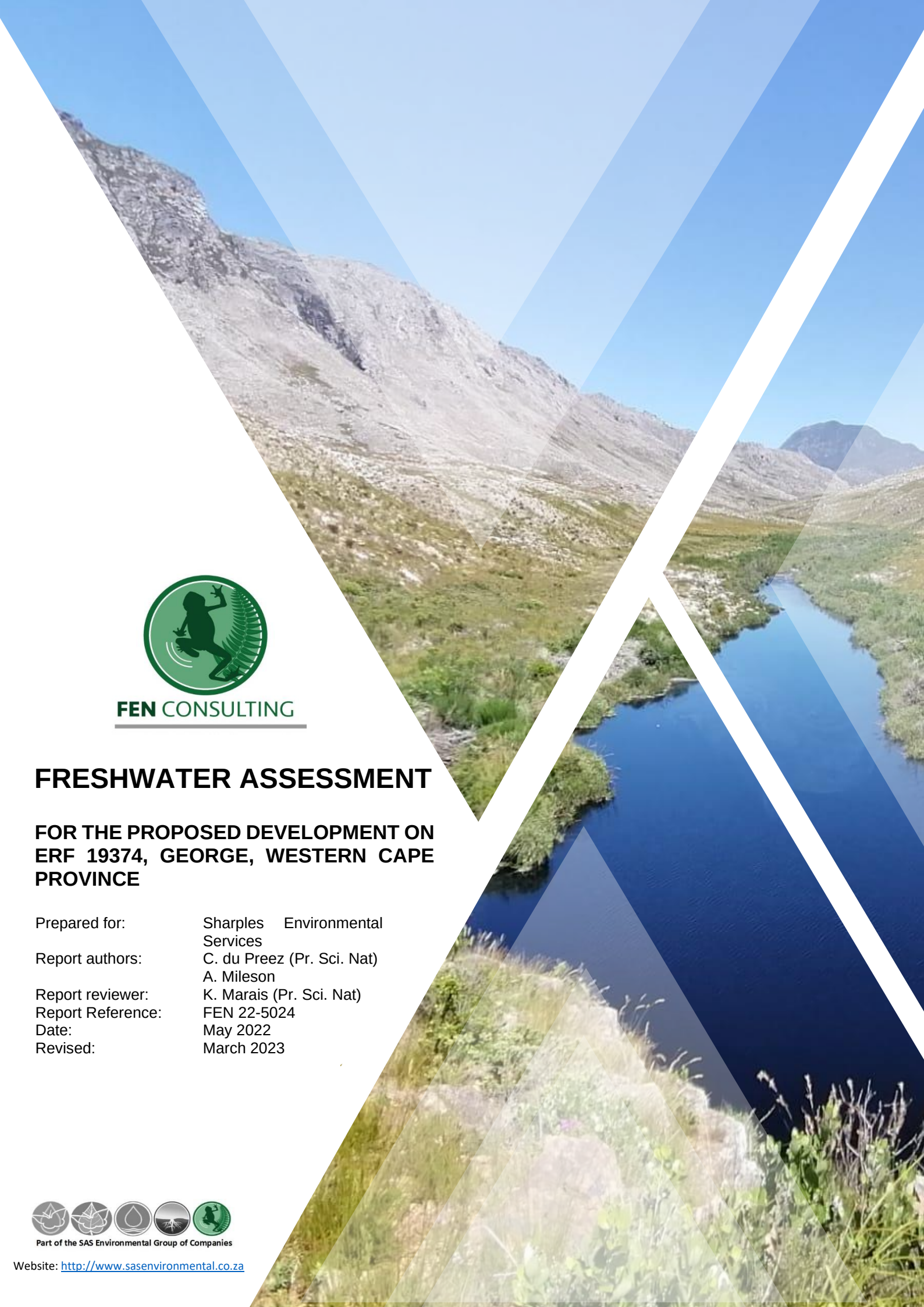
- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments



FEN CONSULTING

FRESHWATER ASSESSMENT

FOR THE PROPOSED DEVELOPMENT ON ERF 19374, GEORGE, WESTERN CAPE PROVINCE

Prepared for:	Sharples Environmental Services
Report authors:	C. du Preez (Pr. Sci. Nat) A. Mileson
Report reviewer:	K. Marais (Pr. Sci. Nat)
Report Reference:	FEN 22-5024
Date:	May 2022
Revised:	March 2023

Part of the SAS Environmental Group of Companies

Website: http://www.sasenvironmental.co.za

EXECUTIVE SUMMARY

The proponent wished to develop a residential development on Erf 19734, George (herafter referred to as the study area). During the site visit, the Malgas River, noted to be in a largely modified ecological condition, was identified outside of and along the western boundary of the study area, approximately 15 m from the study area. No other wetlands or watercourses were identified in the study area. As such, the study area is considered of low aquatic biodiversity sensitivity.

Following the ecological assessment of the Malgas River, the DWS Risk Assessment and an impact assessment was applied in order to ascertain the significance of possible impacts which may occur as a result of the proposed residential development. The results of this assessment show that assuming mitigation measures are strictly enforced, a 'Low' risk/impact to the overall integrity of the Malgas River is expected. This can be attributed to the assignment of a 15 m conservation buffer which will assist with limiting any direct and indirect impacts from occurring on the river. No building infrastructure will be located within the 15 m conservation buffer with the exception of stormwater discharge outlets into the Malgas River, and a fence will most likely be constructed along the study area boundary which will traverse through the 15 m conservation buffer. To ensure a 'Low' risk significance, the mitigation measures as set out in this report must be adhered to, with specific mention of rehabilitating the 15 m conservation buffer.

It is, therefore, the opinion of the freshwater ecologist that the proposed residential development be considered acceptable provided that all mitigation measures as set-out in this report are implemented. The proposed development intersects both the 32 m ZoR (NEMA) (albeit planned open spaces) and the 100 m ZoR (NWA) which would necessitate the application for Environmental Authorisation from the Department of Forestry, Fisheries and Environment (DFFE), and Water Use Authorisation from the Department of Water and Sanitation (DWS). It must, however, be noted that any sewer pipelines (no pipeline alignments were available at the time of compilation of this report) that may be required as part of the development may trigger the need for a Water Use Licence Application (WULA) as a portion of the development is located within the 100 m ZoR. In accordance with GN 509 the construction, installation or maintenance of any sewer pipelines is excluded from authorisation by means of a General Authorisation (GA), regardless of the risk significance.

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the as part of the Environmental Assessment (EA) and Water Use Authorisation (WUA) processes for the proposed residential development on Erf 19734, George, Western Cape Province, hereafter referred to as the 'study area'. The proposed development comprises various subdivided ervens.

The purpose of this report is to define the ecology of the study area in terms of the natural watercourse characteristics, including mapping of all watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the watercourses associated with the study area. The Department of Water and Sanitation (DWS) Risk Assessment Matrix was applied to determine the significance of the impacts associated with the development and mitigatory measures were identified which aim to minimise the potential impacts.

A desktop study was conducted, in which the watercourses were identified for on-site investigation, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 4 of this report.

During the site assessment undertaken in April 2022, no watercourses (wetlands or rivers) were identified within the study area. As such, the study area is considered of low aquatic biodiversity sensitivity. The study area is a relatively flat area, with a significant westerly facing slope along the western boundary. The Malgas River was identified outside of the western boundary of the study area.

The detailed results of the field assessment are contained in Section 5 of this report and summarised in the table below.

Table A: Summary of the results of the Malgas River

Watercourse	Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Malgas River	D (Largely modified)	Moderately high to very low (indicator dependent)	Moderate to High	REC: Category D (Maintain) BAS: Category D (Largely modified) RMO: Maintain
Extent of modification	**None.** Since the proposed development is located at least 15 m from the delineated extent of the river, no modification to the river is expected, should the recommended mitigation measures be implemented.			

Following the ecological assessment of the Malgas River, the DWS Risk Assessment Matrix (2016) was applied to ascertain the significance of possible impacts which may occur as a result of the proposed residential development construction and operational activities. The results of the risk assessment are presented in Section 7 of this report and are summarised in Table B following below.

Table B: Summary of the DWS Risk Assessment/Impact Assessment outcomes, with the implementation of mitigation measures.

Impact and Aspect		Risk	Reversibility of Impact
Construction Phase	Site clearing prior to commencement of construction activities: • Removal of vegetation within the study area	**Low**	Fully Reversible
	Possible indiscriminate driving within the 15 m conservation buffer along the western boundary of the study area	**Low**	Fully Reversible
	Construction activities related to building activities outside the delineated extent of the river and outside the 15 m construction buffer but within the 100 m GN509 Zone of Regulation assigned to the river	**Low**	Fully Reversible
Operational Phase	Operation of the residential development • Potential fertilizers entering the river through stormwater run-off; • Potential indiscriminate movement of vehicles within the river for perimeter inspections/ maintenance of the study area fence	**Low**	Fully Reversible
	Discharge of stormwater from the proposed development into the Malgas River	**Low**	Fully Reversible

Based on the outcome of the DWS Risk Assessment/Impact Assessment, the activities associated with both the construction and operational phases of the proposed residential development, including the removal of vegetation, excavation activities, casting of concrete and road surfacing as part of the construction works within the study area pose a 'Low' risk to the overall integrity of the Malgas River. This is attributed to the assignment of a 15 m conservation buffer which will assist with limiting any indirect impacts from occurring on the Malgas River. No building infrastructure will be located within the 15 m conservation buffer with the exception of stormwater discharge outlets, however, a fence (such as ClearVu fencing) will most likely be constructed along the study area boundary which will traverse the 15 m conservation buffer. To ensure a 'Low' risk significance, the mitigation measures as set out in this report must be adhered to, with specific mention of rehabilitating the 15 m conservation buffer. Although it is likely that the western slope down to the Malgas River can be rehabilitated following construction, it is strongly recommended that a suitably qualified specialist be appointed to compile a rehabilitation plan in order to provide site-specific guidance to the proponent in this regard.

The proposed development intersects both the 32 m Zone of Regulation (ZoR) (NEMA) and the 100 m ZoR (NWA) which would necessitate the application for Environmental Authorisation from the Department of Forestry, Fisheries and Environment (DFFE), and Water Use Authorisation from the Department of Water and Sanitation (DWS) respectively. It must, however, be noted that any sewer

pipelines that may be required as part of the development will trigger the need for a Water Use Licence Application (WULA) as portions of the development are located within the 100 m ZoR. In accordance with GN 509 the construction, installation or maintenance of any sewer pipelines is excluded from authorisation by means of a General Authorisation (GA), regardless of the risk significance.
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DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Annexure G.
2.2	Description of the preferred development site , including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 4 and 5
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 4: Table 1
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 4: Table 1
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 4: Table 1
2.3	Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	NA – entire study area is of low sensitivity (as confirmed during the field investigation).
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 7: Table 5
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed mitigation measures
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Section 5: Table 2
2.4.4	How will the development impact on the functionality of the aquatic feature including:	Section 5: Table 3

	a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soil, etc).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 5: Table 3
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 5: Table 3
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	N/A
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Annexure G
3.2	A signed statement of independence by the specialist.	Annexure G
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 5
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 3, Annexure C and Annexure D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 7: Table 5
3.7	Additional environmental impacts expected from the proposed development.	Section 7: Table 5
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Section 7.2
3.9	The degree to which impacts and risks can be mitigated.	Section 7
3.10	The degree to which impacts and risks can be reversed.	Section 7
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 6
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7: Table 5
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	Section 7 and 8
3.15	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.	Section 8
3.16	Any conditions to which this statement is subjected.	Section 8

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission

1 INTRODUCTION

1.1 *Background*

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Environmental Assessment (EA) and Water Use Authorisation (WUA) processes for the proposed residential development on Erf 19734, George, Western Cape Province, hereafter referred to as the 'study area' (Figures 1 and 2) (Refer to Section 2 for the project description). In order to identify all watercourses that may potentially be impacted by the proposed residential development, a 500 m "zone of investigation" was implemented around the study area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e. the 500 m zone of investigation around the study area – will henceforth be referred to as the "investigation area".

The purpose of this report is to define the ecology of the watercourses associated with the study area in terms of the natural watercourse characteristics, including mapping of the watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the watercourses associated with the study area. The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the impacts associated with the proposed residential development and mitigatory measures were identified which aim to minimise the potential impacts.

This study further aims to provide detailed information to guide the proposed residential development in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development. This report, after consideration of the above, must guide the Environmental Assessment Practitioner (EAP), by means of a reasoned opinion and recommendations, as to the viability of the proposed development activities from a watercourse management perspective.

1.2 *Structure of this report*

This report investigates the impact significance of the proposed residential development, as explained in Section 2 below, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as the National Water Act, 1998 (Act No. 36 of 1998) (NWA) by means of the DWS Risk Assessment Matrix. The following structure is applicable to this report:

Section 1: Introduction
Provides an introduction, the structure of this report and the assumptions and limitations.

Section 2: Project Description
Provides the location of the study area as well as a brief summary of the activities associated with the proposed residential development.

Section 3: Assessment Approach
Provides the relevant methodology and definitions applicable to this report, a description of the sensitivity mapping and the risk assessment approach.

Section 4: Desktop Assessment Results

Reports on the findings from the relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA], 2011 database; the DWS Resource Quality Information System (RQIS) PES/ EIS, 2014 database and Western Cape Biodiversity Spatial Plan (2017) was undertaken to aid in defining the PES and EIS of the watercourse.

Section 5: Site Based Watercourse Assessment Results

This section reports the following:

- A description and delineation of all watercourses associated with the study area according to "Department of Water Affairs and Forestry (DWAF)[1] (2008): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". All features are mapped according to their ecological sensitivity;
- Delineation of all watercourses (using desktop methods) within 500 m of the study area in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998);
- The classification of the watercourses according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the watercourse according to the method described by Rountree and Kotze, (2013);
- The services provided by the watercourses associated with the study area were assessed according to the method of Kotze *et al*. (2009);
- The PES of the watercourses according to the resource directed measures guideline as advocated by MacFarlane *et al.* (2008); and
- The allocation of a suitable Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) to the watercourse based on the results obtained from the PES, Ecoservices and EIS assessments.

Section 6: Legislative Requirements

Provides the applicable legislative requirements based on the findings from Section 5 and indicates any applicable zones of regulation that may trigger various enviro-legal authorisation requirements.

Section 7: Risk and Impact Assessment

Provides the outcomes from the DWS Risk Assessment Matrix and the Impact Assessment which highlights all potential impacts and that may affect the watercourses. Management and mitigation measures are provided which should be implemented during the various development activities (planning, construction and operational phases) in order to assist in minimising the impact on the receiving environment. The anticipated cumulative impacts and reversibility/irreplaceable loss that the proposed residential development may have on the watercourses is expanded upon in this section.

Section 8: Conclusion

Summarises the key findings and recommendations based on the risk assessment outcomes and legislative requirements.

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

1.3 *Assumptions and Limitations*

- The determination of the wetland or riparian zone boundaries is confined to the watercourses associated with the study area and is based on a single site visit undertaken on the 8th of April 2022. All watercourses identified within the investigation area were delineated in fulfilment of GN509 of the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including the use of topographic maps, historical and current digital satellite imagery, and historical aerial photographs;
- At the time of this assessment, no sewer pipeline or bulk water pipeline routes were provided and as such it was assumed that only internal sewer and bulk water pipelines would be required and trenched within the internal road network. Similarly, it was assumed that a connection point to the main municipal sewer and water networks is available within the study area;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. However, the delineations as provided in this report are deemed accurate enough to fulfil the environmental authorisation requirements as well as the implementation of the mitigation measures provided;
- Watercourses and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the watercourse has been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.

2 PROJECT DESCRIPTION

The study area is located in the north-eastern side of George, immediately south of the N12 (Figures 2 and 3). The study area is an open space area, bounded by the Malgas River to the west, and a residential development to the east. The proponent wishes to develop 94 residential units within the study area. The development will also comprise access roads and open space areas (Figure 4).

According to the Preliminary Stormwater Management Environmental Method Statement prepared by CHEL Building & Civil Supplies (2023), there are no pre-existing stormwater management systems within the site nor along the tarred road known as Plantation Road. The proposed stormwater management system would entail attenuation of stormwater in attenuation ponds within the study area prior to low velocity release via a series of energy breaking structures including a series of “steps” (Figure 1), to a lower elevation attenuation pond system into the Malgas River (CHEL Building & Civil Supplies, 2023). The proposed stormwater management system would also allow for the utilisation of water within the estate for irrigation, thus reducing the municipal water requirement as well as minimising potential impacts on the river as a result of the discharge of stormwater therein. Please refer to CHEL Building & Civil Supplies (2023) for the detailed stormwater management system design.

At the time of this assessment, no sewer pipeline or bulk water pipeline routes were provided and as such it was assumed that only internal sewer and bulk water pipelines would be required and trenched within the internal road network. Similarly, it was assumed that a connection point to the main municipal sewer and water networks is available within the study area.

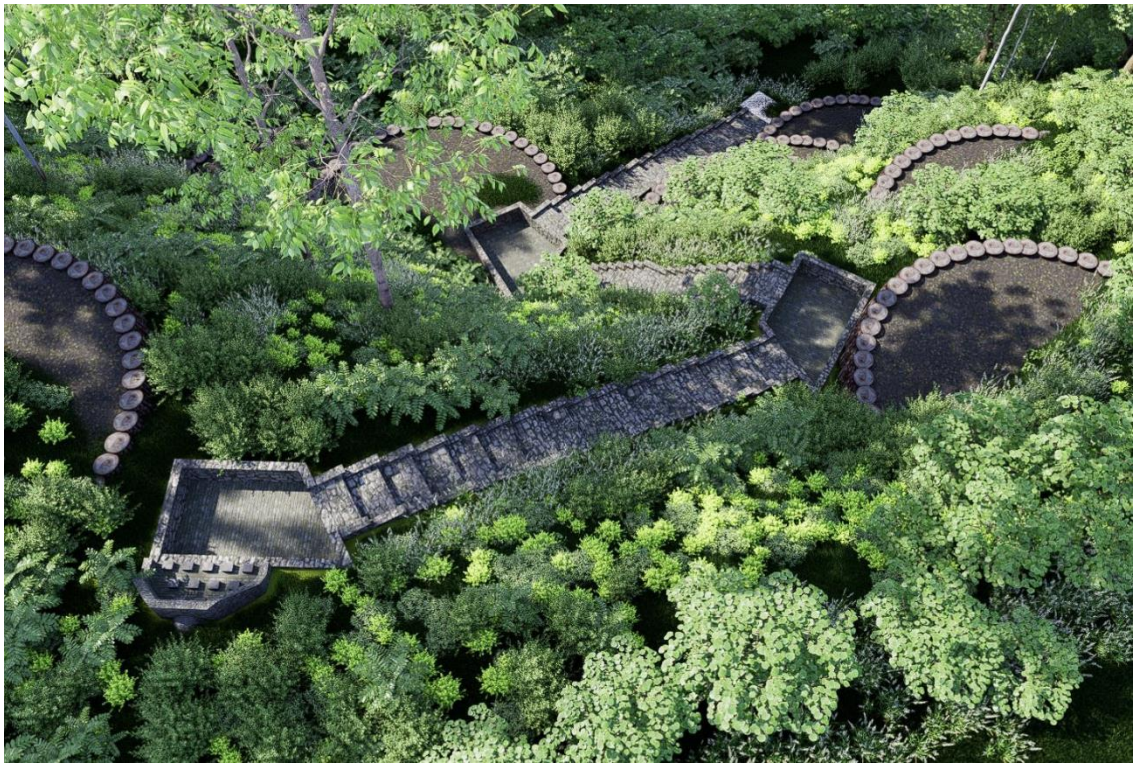


Figure 1: Conceptual design of the proposed stormwater cascade system to attenuate flow and minimize risk of scouring and erosion as stormwater moves downslope from the development towards the Malgas River (image courtesy of CHEL Building & Civil Supplies (2023)).

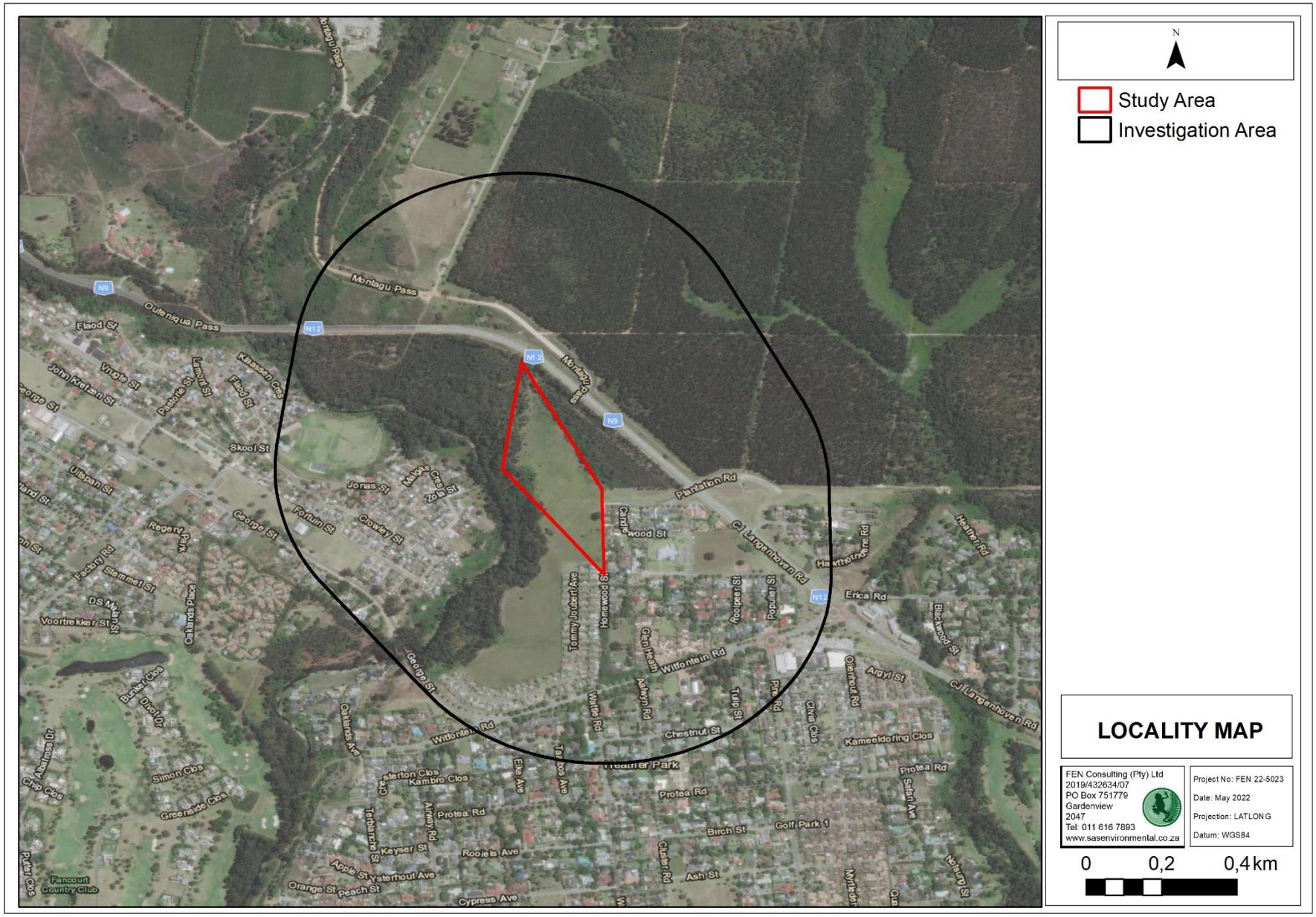


Figure 2: A digital satellite image depicting the location of the study and investigation areas in relation to the surrounding area.

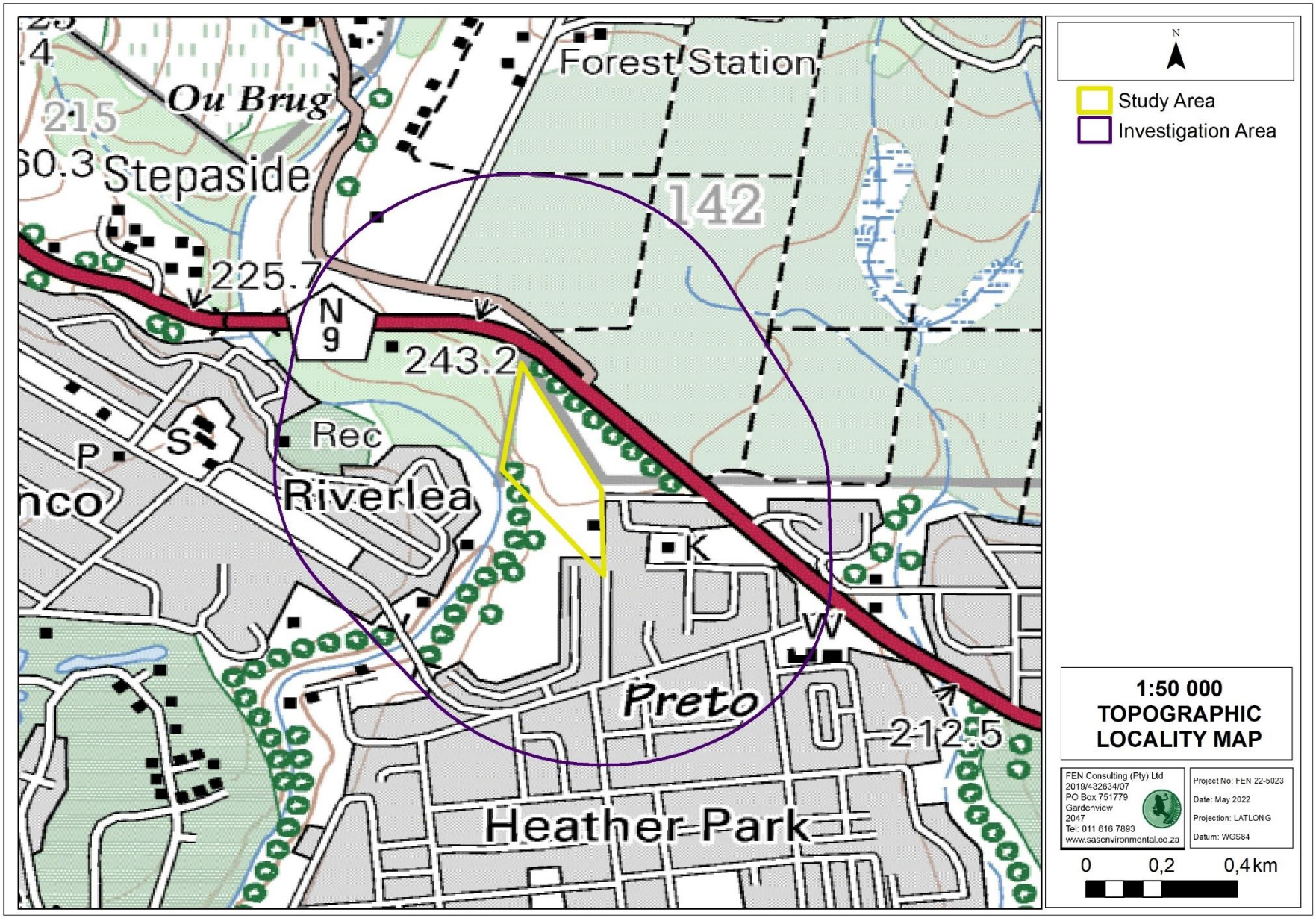


Figure 3: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

Figure 4: Proposed site development layout plan for the study area (provided by Architecure in Africa Architects, October 2022).

3 ASSESSMENT APPROACH

3.1 *Watercourse Verification*

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

Watercourse means-

(a) A river or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, lake or dam into which, or from which water flows; and
(d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

Wetland habitat is "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."

Riparian habitat includes the physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soil, 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**.**

The watercourse delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

A site assessment was undertaken on the 8th of April 2022, during which the presence of any watercourse characteristics as defined by DWAF (2008) or wetlands and riparian habitats as defined by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Sections 4 and 5 of this report). In addition to the delineation process, a detailed assessment of the delineated watercourses was undertaken, at which time factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourses. A detailed explanation of the methods of assessment undertaken is provided in **Annexure C** of this report.

3.2 *Sensitivity Mapping*

All watercourses associated with the study area were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map presented in Section 6 should guide the design, layout and management of the proposed residential development.

3.3 *Risk/Impact Assessment and Recommendations*

Following the completion of the assessment, a risk and impact assessment was conducted (please refer to **Annexure D** for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed residential development. These recommendations also include general management measures, which apply to the proposed construction and operational/maintenance activities. The detailed mitigation measures are outlined in Section 7 of this report, while the general management measures which are considered best practice mitigation applicable to this project, are outlined in **Annexure F.**

4 DESKTOP ASSESSMENT RESULTS

4.1 *National and Provincial Datasets*

The following section contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the proposed residential development at the scale required to inform the environmental authorisation and/or water use authorisation processes. Given these limitations, this information is considered useful as background information to the study and is important in legislative contextualisation of risk and impact and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process.

Table 1: Desktop data (from desktop databases only) relating to the characteristics of the associated with the study area.

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	South Eastern Coastal Belt
Catchment	Keurboom/Storm/K
Quaternary Catchment	K30B
WMA	Gouritz
subWMA	Coastal Gouritz
Dominant characteristics of the South Western Coastal Belt Ecoregion Level II (20.02) (Kleynhans *et al.*, 2007)	
Level II Code	20.02
Dominant primary terrain morphology	Closed hills, moderate and high relief, Plains, moderate relief.
Dominant primary vegetation types	Mountain fynbos, Afromontane forest, dune thicket, grasst fynbos, south and south-west coast renosterveld
Altitude (m a.m.s.l)	0 - 1300
MAP (mm)	500 - 800
The coefficient of Variation (% of MAP)	<20 - 30
Rainfall concentration index	<15
Rainfall seasonality	All year
Mean annual temp. (°C)	14 - 18
Winter temperature (July)	6 - 18
Summer temperature (Feb)	14 - 28
Median annual simulated runoff (mm)	80 - >250
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)	
Sub-quaternary reach	K30B-09082 (Malgas River)
Sample point proximity to the study area	Approximately 3.4 km north of study area
Is it assessed by an expert?	Yes
PES Category Median	B (Largely natural with few modifications)
Mean EI Class	High
Mean ES Class	Very High
Default Ecological Class (based on median PES and highest EI or ES mean)	A (Unmodified, natural)

Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The study area is located within a sub-quaternary catchment that hosts rivers that are considered to be fish sanctuaries, which are essential for protecting threatened freshwater fish that are indigenous to South Africa (FEPA CODE = 2).
NFEPA Wetlands (Figure 5)	According to the NFEPA database, no wetlands are associated with the study or investigation areas.
Wetland Vegetation Type	The study and investigation areas are situated within Eastern Fynbos-Renosterveld Shale Fynbos (Critically Endangered) Wetland Vegetation Type. The threat status is provided by Mbona *et al.* (2015).
NFEPA Rivers (Figure 5)	As per the NFEPA database, no rivers are associated with the study area. The Malgas River is located outside the western boundary of the study area. According to this dataset and the PES1999 dataset, the river is considered to be in a moderately modified ecological condition (RIVCON = C).

Importance of the study area according to the Western Cape Biodiversity Spatial Plan (2017) (Figure 6)
According to the Western Cape Biodiversity Spatial Plan (2017), a small area along the western boundary of the study area is classified as a Critical Biodiversity Area (CBA) 1 of terrestrial importance, with the majority of the study area classified as a CBA 2, of terrestrial importance. The Malgas River located outside the western boundary of the study area is classified as a CBA 1 (of aquatic importance). CBAs are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure, in this case specifically for riverine environments. The most north-western corner of the study area is classified as an Ecological Support Area (ESA) 2. These areas are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. ESA 2s are areas which are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas (PAs) or CBAs and are often vital for delivering ecosystem services.

Detail National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 7)
According to the NBA 2018: SAIIAE no wetlands or rivers are located in the study or investigation area.

National web based environmental screening tool (2020)	
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The study area is located in an area considered of **very high aquatic biodiversity sensitivity**. This is due to the study area located within a strategic water source area, and due to the presence of rivers and aquatic CBAs. According to the Strategic Water Source Area Database (2017), the study area is situated within the Boland Surface Water Area.

CBA = Critical Biodiversity Area; CESA = Critical Ecological Support Area; CR = Critically Endangered; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; EN = Endangered; m.a.m.s.l = Metres above mean sea level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Area; OESA = Other Ecological Support Area; PES = Present Ecological State; WMA = Water Management Area.

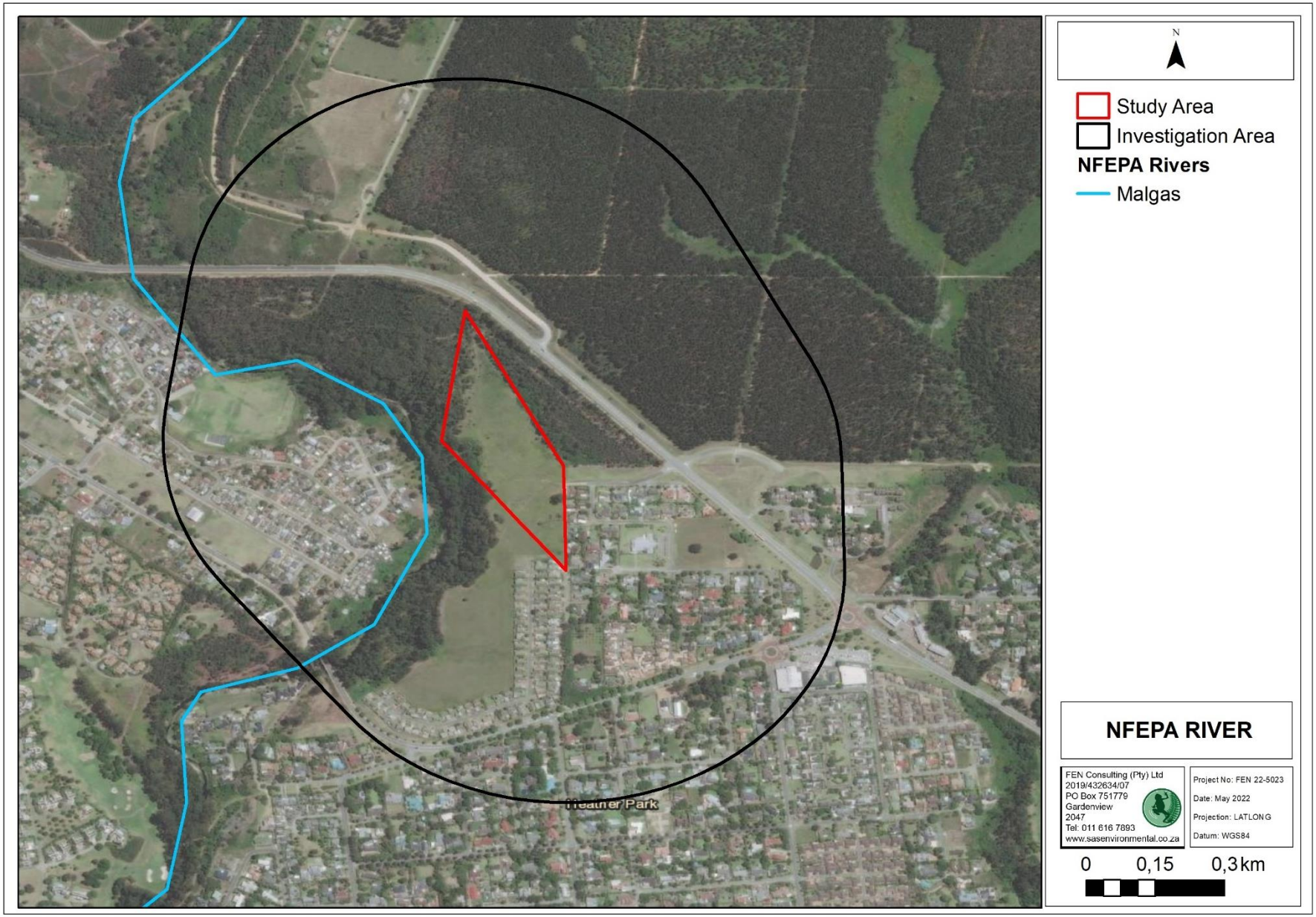


Figure 5: Rivers, natural and artificial wetlands associated with the study and investigation areas according to the NFEPA database (2011).

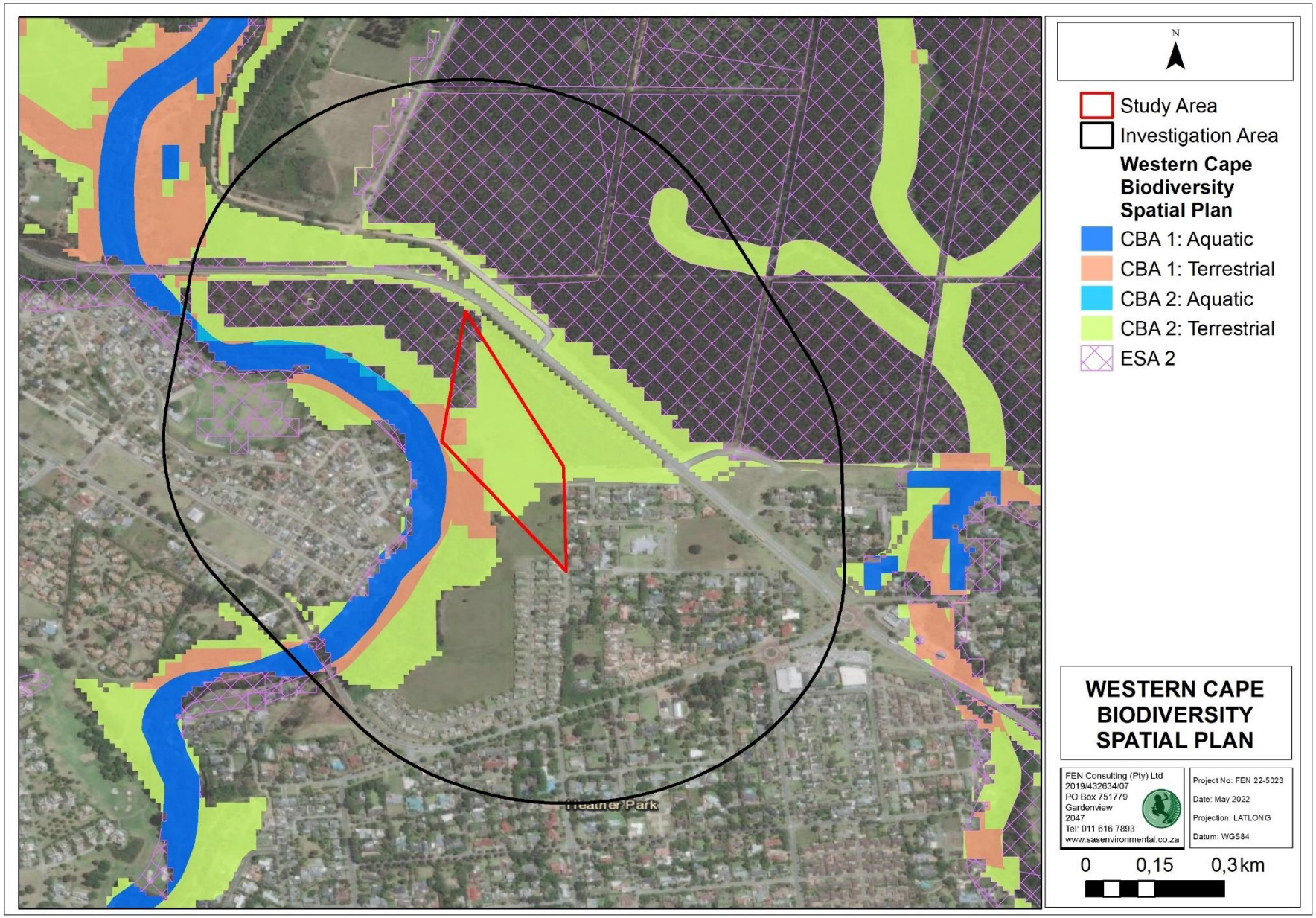


Figure 6: Areas of importance associated with the study and investigation areas, as identified by the Western Cape Biodiversity Spatial Plan (2017).

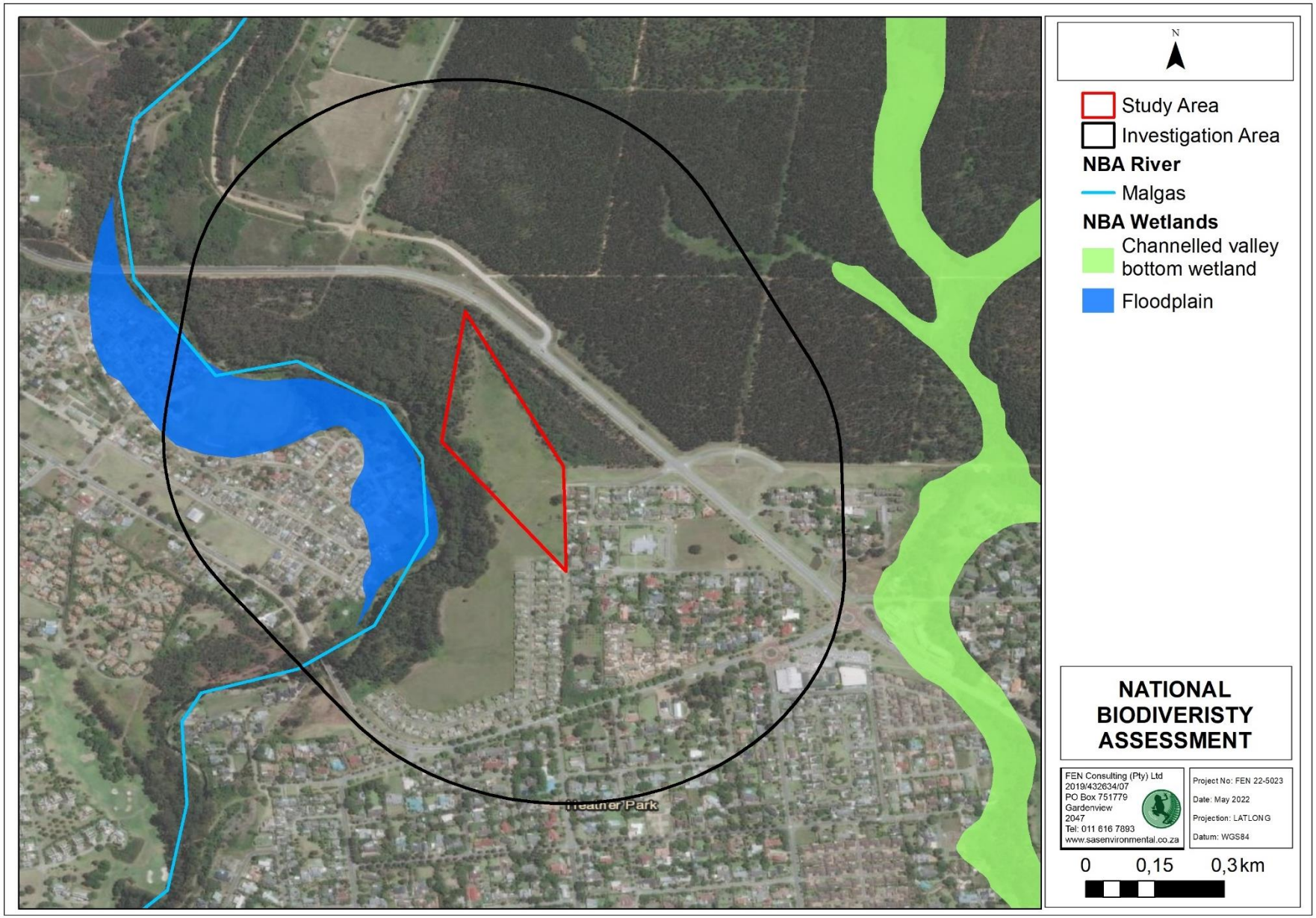


Figure 7: Wetlands identified to be associated with the study and investigation areas, as identified by the National Biodiversity Assessment (2018).

5 RESULTS: WATERCOURSE ASSESSMENT

5.1 *Desktop assessment of historical vs. most recent imagery*

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national wetland databases (as outlined in Section 4 of this report) were used to identify points of interest in the surrounding area at a desktop level. Aerial photographs (Figure 8) were specifically investigated for digital signatures that may potentially represent watercourses. In this regard, specific mention is made to the following:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernable on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

On review of the location of the study area (indicated in red), the available historical aerial photograph from 1936 indicates that the study area and surrounding areas to the south have been under cultivation, likely forestry practices, to the north east (Figure 8, left). The Malgas River is easily noticeable along the outside western boundary of the study area. Similarly, the aerial photograph of the study area in 1980 (Figure 8, right) indicate ongoing cultivation of the study area and further catchment transformation. Other than the Malgas River located to the west of the study area, no obvious digital watercourse signatures are noted in the study area.

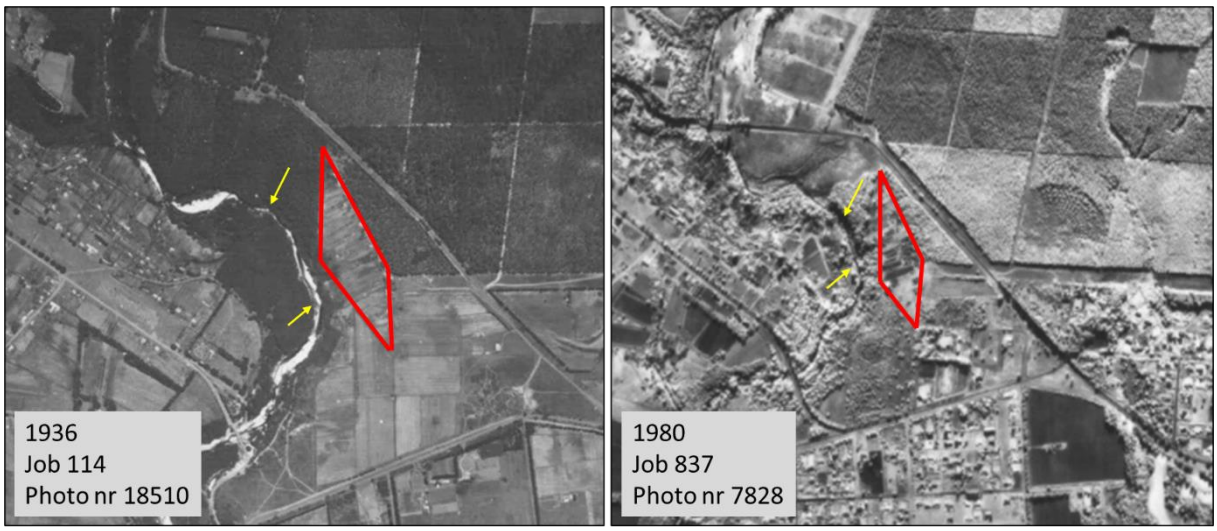


Figure 8: Historical aerial photographs from 1936 (left) and 1980 (right) indicating the study area (red outline) and the Malgas River (yellow arrows). No other prominent wet signatures are noted in these photographs.

Upon investigation of digital satellite imagery between 2003 to 2022 (Figure 9), the study area has been transformed as vegetation clearing is evident between 2003 and 2015 (Figure 9, top). No digital signatures are noticeable in 2019 (Figure 9, bottom left), with some greening signatures noted in the 2022 image (Figure 9, bottom right). The Malgas River is easily discernible along the western boundary of the study area.

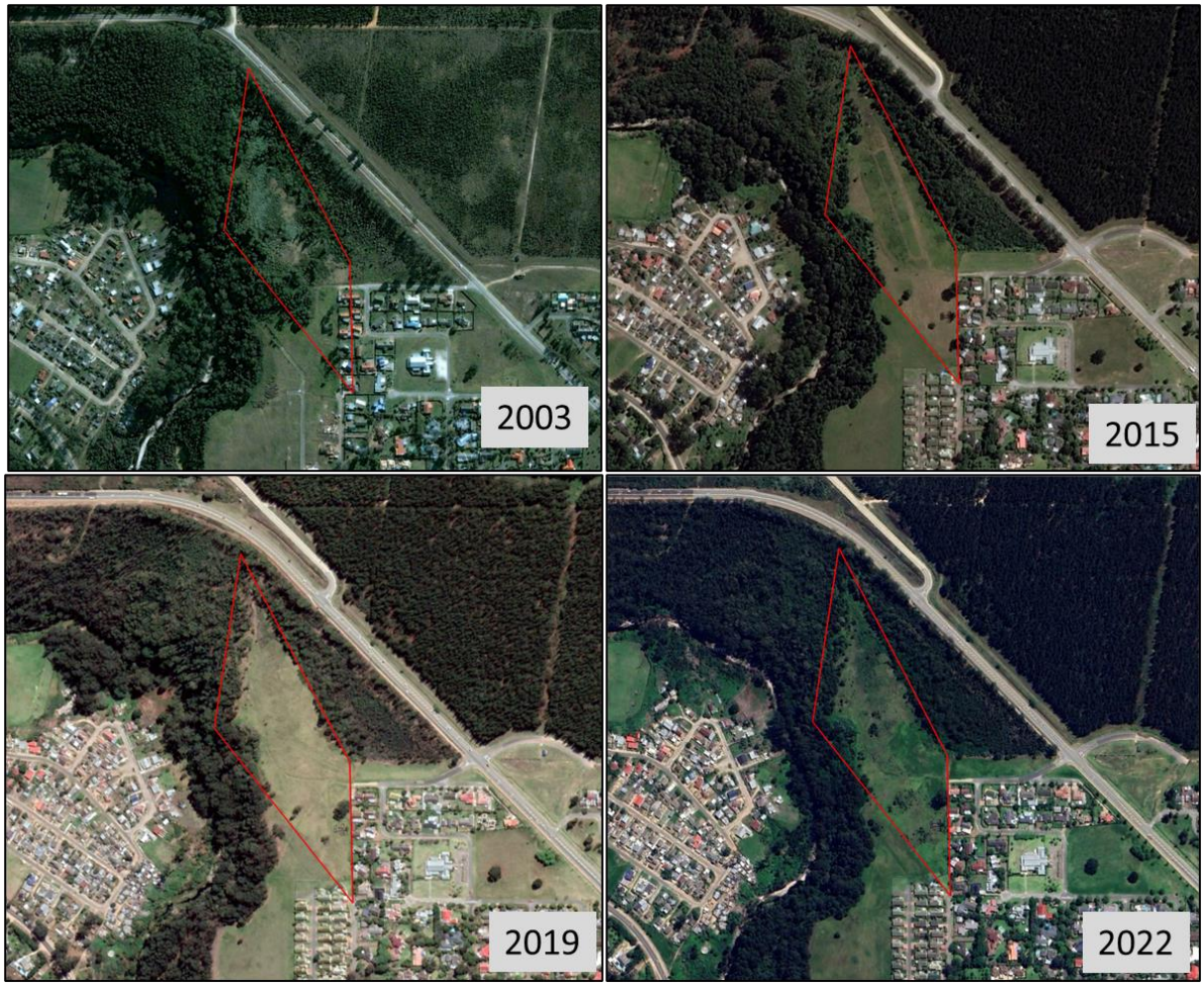


Figure 9: Digital satellite imagery of the study area from 2003 to 2022, depicting changes to the study area.

5.2 *Watercourse identification*

During the site assessment undertaken in April 2022, no watercourses (wetlands or rivers) were identified within the study area. As such, the study area can be considered of low aquatic biodiversity sensitivity. The study area is a relatively flat area, with a significant westerly facing slope along the western boundary. The overall condition of the study area can be described as transformed (as verified by the historical aerial photographs) and hosts terrestrial vegetation typical of disturbed areas. The Malgas River was identified outside the western boundary of the study area, within the investigation area (Figure 12).

Although *Arundo donax* and *Cortaderia selloana*, both exotic and opportunistic wetland plant species, were identified in scattered patches throughout the study area, its presence can be prescribed to the historical transformation of the study area (Figure 10). Historical and ongoing disturbance has resulted in the infestation of alien species that are adapted to disturbed areas, such as the study area. Upon

investigation of the soil profile of the study area (Figure 10), no wetland soil morphological characteristics were observed, thus confirming that no wetlands are present within the study area.

Figure 10: Photographs providing an overview of the study area, noting patches of *Cortaderia selloana* (pink arrows) and *Arundo donax* (blue arrows).

Figure 11: Photographs of the study area soil profile, increasing in depth from left to right. The soil between the surface and a depth of 60 cm is dark, somewhat organic with a relatively high clay content. A laterite soil layer (right) was encountered at a depth of 80 cm and deeper.

The delineated extent of the Malgas River located outside the western extent of the study area is presented in Figure 12.

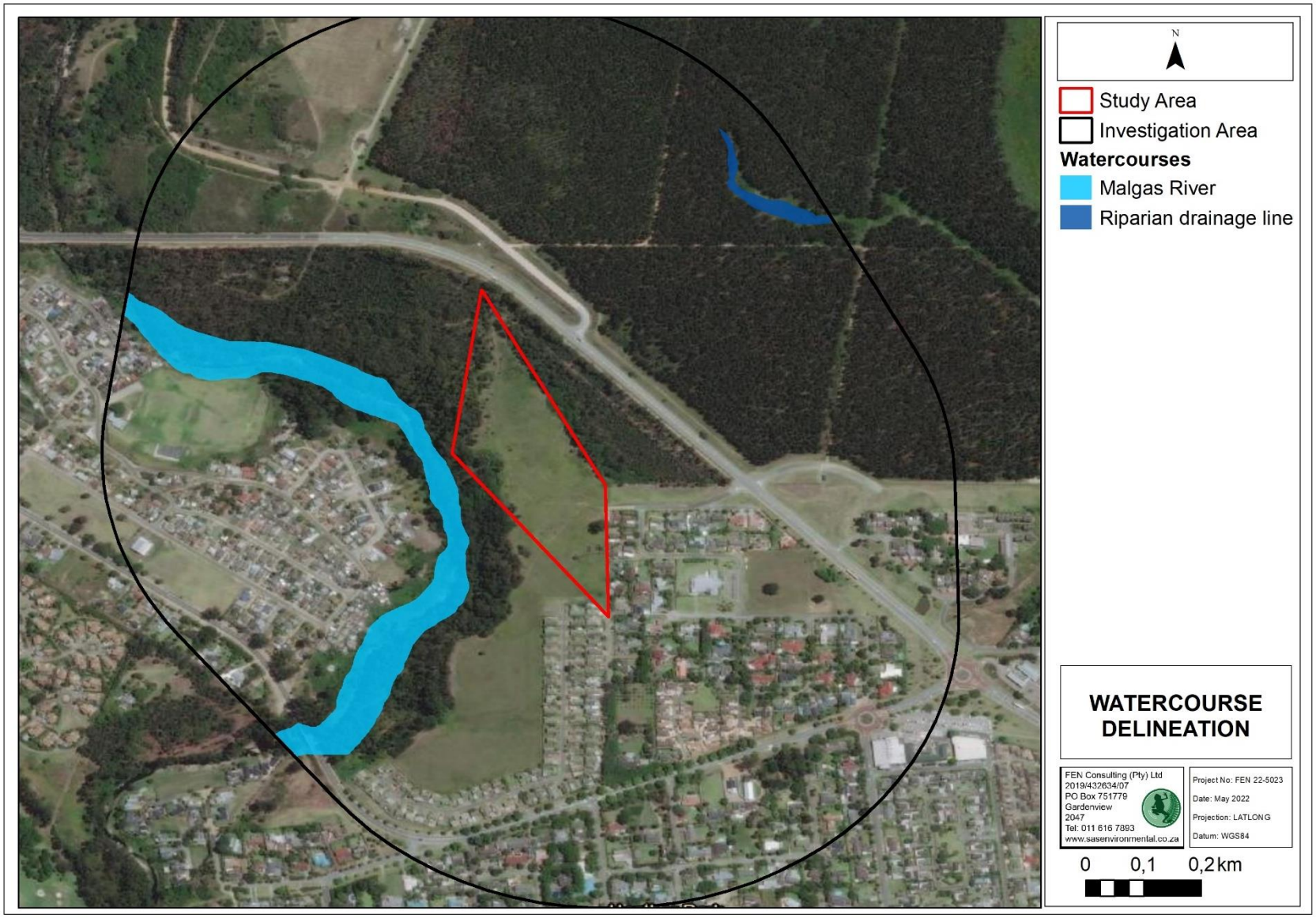


Figure 12: Delineation of all watercourses associated with the study and investigation areas.

5.3 *Watercourse delineation*

The outer boundary of the identified watercourse, the Malgas River, was delineated according to the guidelines advocated by DWAF (2008) taking into consideration soil characteristics as defined by Job (2009). The delineations as presented in this report are regarded as the best estimate based on the site conditions present at the time of the assessment. During the field assessment, the following indicators were used in order to determine the boundary of the Malgas River:

- **Terrain units** are used to determine in which parts of the landscape a watercourse is most likely to occur. Figure 13 provides the profile of the study area's elevation/topography. The study area is relatively flat, with a steep western facing slope along the western boundary;

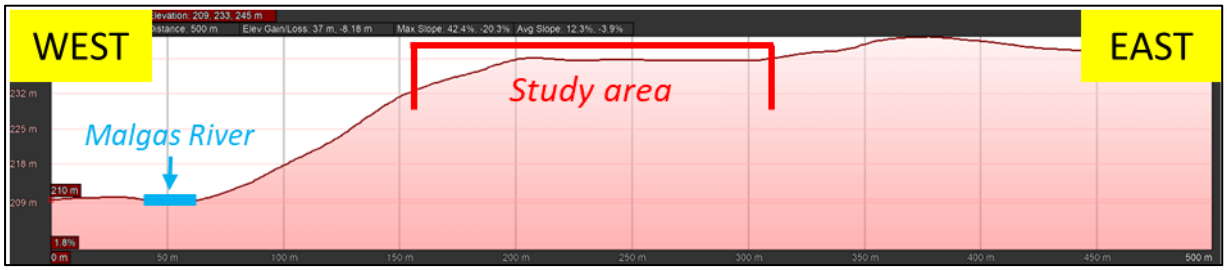


Figure 13: The elevation profile of the study area.

- **Surface water and/or saturated soil/alluvial soil** can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of a watercourse. Surface water was present within the Malgas River.
- The **presence of alluvial soil within a river system**: The National Water Act, 1998 (Act No. 36 of 1998) definition of riparian zones refers to the structure of the banks and likely presence of alluvium. A good indicator of the presence of riparian zones is the occurrence of alluvial deposited material adjacent to the active channel. Alluvial soil is soil derived from material deposited by flowing water, especially in the valleys of large rivers. Riparian areas often, but not always, have alluvial soil. While the presence of alluvial soil cannot always be used as a primary indicator to delineate riparian areas accurately, it can be used to confirm the topographical and vegetation indicators.
- **Vegetation associated with riparian areas**: the identification of riparian areas relies heavily on vegetation indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
    - in species composition relative to the adjacent terrestrial area; and
    - in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, compactness, crowding, size, structure and/or numbers of individual plants.

  Due to the catchment transformation of the Malgas River, the river is dominated by large alien and invasive tree species, most notably *Eucalyptus* species.

5.4 *Watercourse classification & assessment*

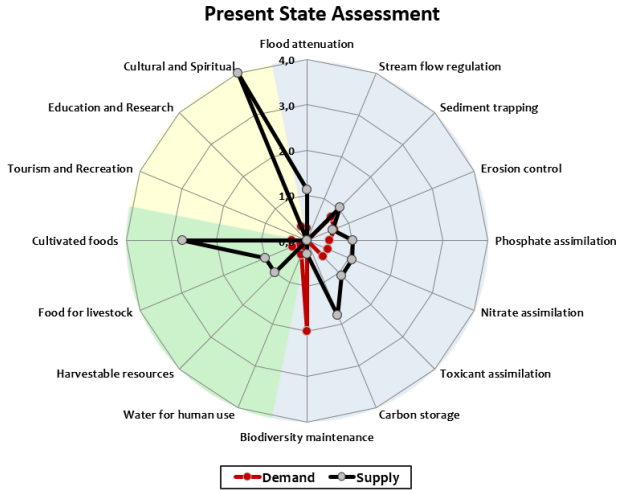
The watercourses as described above were classified according to the Classification System outlined in Annexure C of this report as an Inland System, located within the South Easter Coastal Belt Ecoregion wetland vegetation type. Table 2 below presents the classification from level 3 to 4 of the 'Classification System of Wetlands and other Aquatic Ecosystems' (Ollis *et al*, 2013).

Table 2: Classification of the watercourses located in the investigation area.

Watercourse	Level 3: Landscape Unit	Level 4: Hydrogeomorphic (HGM) Type
Malgas River	Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	River—a linear landform with clearly discernable bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel.

Table 3 below provide a summary of the field verification findings in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the Malgas River located outside the western boundary of the study area but downgradient of the study area. The details pertaining to the methodology used to assess the river contained in **Annexure C.**

Table 3: Summary of the ecological assessment of the Malgas River located outside the western boundary of the study area

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2"> 
Figure 14: Representative photographs of the Malgas River. (Left) The study area (red dashed line) is located upgradient and east of the river, as there is a steep westerly facing slope between the study area and the river (yellow arrow). (Centre and right) the understory of the riparian marginal zone is invaded by a variety of alien shrubs and litter was also noted in and along the active channel.</td></tr>
<tr><td>IHI Discussion</td><td>IHI Category: D (Largely modified)
Due to catchment land changes, specifically the surrounding urban developments (Blanco) and forestry developments, significant alteration to the vegetation composition and hydrological regime of the river is evident. This has resulted in the overall degradation of the system, including impacting on ecosystem service delivery, and has reduced the ecological sensitivity thereof.</td><td>Ecoservice provision</td><td>Ecoservice Provisioning: Moderately high to very low (indicator dependent)
The river was calculated to have an overall low to very low importance of providing ecosystem services. This can mainly be attributed to the changing of the catchment land uses which have impacted on the ability of the river to deliver a variety of services. Due to the Blanco community located along the western embankment of the river, the river is considered of moderately high importance for cultural services and cultivated food. Due to the modified condition of the river very low regulating and supporting services are delivered.</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: Moderate to High
This river is considered of moderate ecological importance on a landscape scale, primarily due to the protection level of the wetland vegetation type it is associated with, as well as the river partially classified as a CBA 1 by the WCBSP (2017, Figure 6). Considering the overall ecological state of the river, it is not considered to be sensitive to changes in the landscape and water quality impacts. This can be prescribed to the already transformed landscape in which the river is located.</td></tr>
<tr><td>REC Category and RMO</td><td colspan="3">REC: Category D (Maintain)
BAS: Category D (Largely modified)
RMO: Maintain
The outcome of the RMO indicates that the PES of the river must be maintained at a Category D (largely modified). Although the development will be located outside the delineated extent of the river, considering the slope along the eastern embankment of the river and the study area, indirect impacts (such as sediment laden runoff into the river from the development) are deemed likely. Should appropriate mitigation measure be applied during the construction phase, and the development improve the buffer zone surrounding the river through the removal of alien and invasive plants (AIPs), the RMO, BAS and REC can be maintained.</td></tr>
</table>

Watercourse characteristics:	
The Malgas River originates from the Outeniqua mountains, almost 6 km north of the study area. Although the headwaters of this system are protected (within the Witfontein Nature Reserve) and thus considered to be in an unmodified ecological condition, the reach of this river within the agricultural and forestry land use setting outside of the protected area has been impacted upon over many decades, which also includes water abstraction, adjacent mining activities (Much Asphalt mining) and various linear infrastructure crossings. Due to the significant invasion of a variety of large tree species, most notably *Eucalyptus* species but also other species such as *Solanum mauritianum*, *Acacia mearnsii* and *A. malanoxylon*, and a variety of *Lantana* species, the vegetation component and overall biodiversity of the river is considered degraded. This can also be the result of the adjacent anthropogenic activities from the close by urban Blanco community such as contaminated stormwater inputs and rubble disposal. It is acknowledged that the large *Eucalyptus* trees species do stabilize the slope between the river and study area, however, some erosion of the active channel of the river was noted, specifically at the George Street bridge crossing as the understory of the marginal zone is not vegetated and is susceptible to erosion and scouring. Despite this, and considering all other impacts, no significant sediment deposition in the assessed reach of the river was noted. Additionally, the water quality of the river is also considered fair despite the presence of an urban community within very close proximity to the river. This can, however be attributed to this section of river being located at the top of the catchment with relatively less severe impacts compared to the downstream reach which are surrounded by urban and agricultural developments.	
Extent of modification anticipated	**None.** Since the proposed development is located at least 15 m from the delineated extent of the river, no modification to the river is expected, should the recommended mitigation measures be implemented.
Impact Significance and Business Case:	**Low**
	The activities associated with the construction of the proposed residential development within the study area pose a 'Low' risk/impact to the overall integrity of the river (with the implementation of mitigation measures). This can be attributed to the assignment of a 15 m conservation buffer which will assist with limiting any indirect impacts from occurring on the wetland. No building infrastructure will be located within the 15 m conservation buffer, however, a fence (such as ClearVu fencing) will most likely be constructed along the study area boundary which will minimally traverse through the 15 m conservation buffer. To ensure a 'Low' risk/impact significance, the mitigation measures as set out in this report (Section 7) must be adhered to, with specific mention of rehabilitating the 15 m conservation buffer and the installation of sediment drift fences along the western boundary of the study area to avoid sediment laden runoff entering the river.

All comprehensive results calculated are available in **Appendix D.**

6 LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in **Annexure B** of this report:

- The Constitution of the Republic of South Africa, 1996[2];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on watercourses arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity for the protection of the assessed watercourses can be summarised as follows:

Table 4: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	**Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1:100 year floodline and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • **in the absence of a determined 1:100 year floodline or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench**; or • a 500 metre radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended.	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.*

[2] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it not the acts amending it are allocated act numbers.

Regulatory authorisation required	Zone of applicability
	Excluding where such development occurs within an urban area **Activity 19** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states "*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse".*

In accordance with the above, a 32 m (NEMA) Zone of Regulation (ZoR) and a 100 m (GN509) ZoR were implemented (Figures 15 and 16). A conservation buffer was calculated using the "Preliminary Guideline for the Determination of Buffer zones for Rivers, Wetlands and Estuaries" as developed by Macfarlane *et al.* (2015). A 15 m construction and operational phase buffer was calculated to be applied to the Malgas River (hereafter referred to as the 'conservation buffer' – outcome is presented in Appendix E), which will suitably protect the river from the proposed development. As such, it is recommended that as far as possible, no activities associated with the proposed development should be undertaken within the delineated boundaries of the river and associated 15 m conservation buffer. Notwithstanding this it is acknowledged that outlets for the proposed stormwater management system will need to be placed within the conservation buffer (please refer to Section 7.1 for mitigation measures).

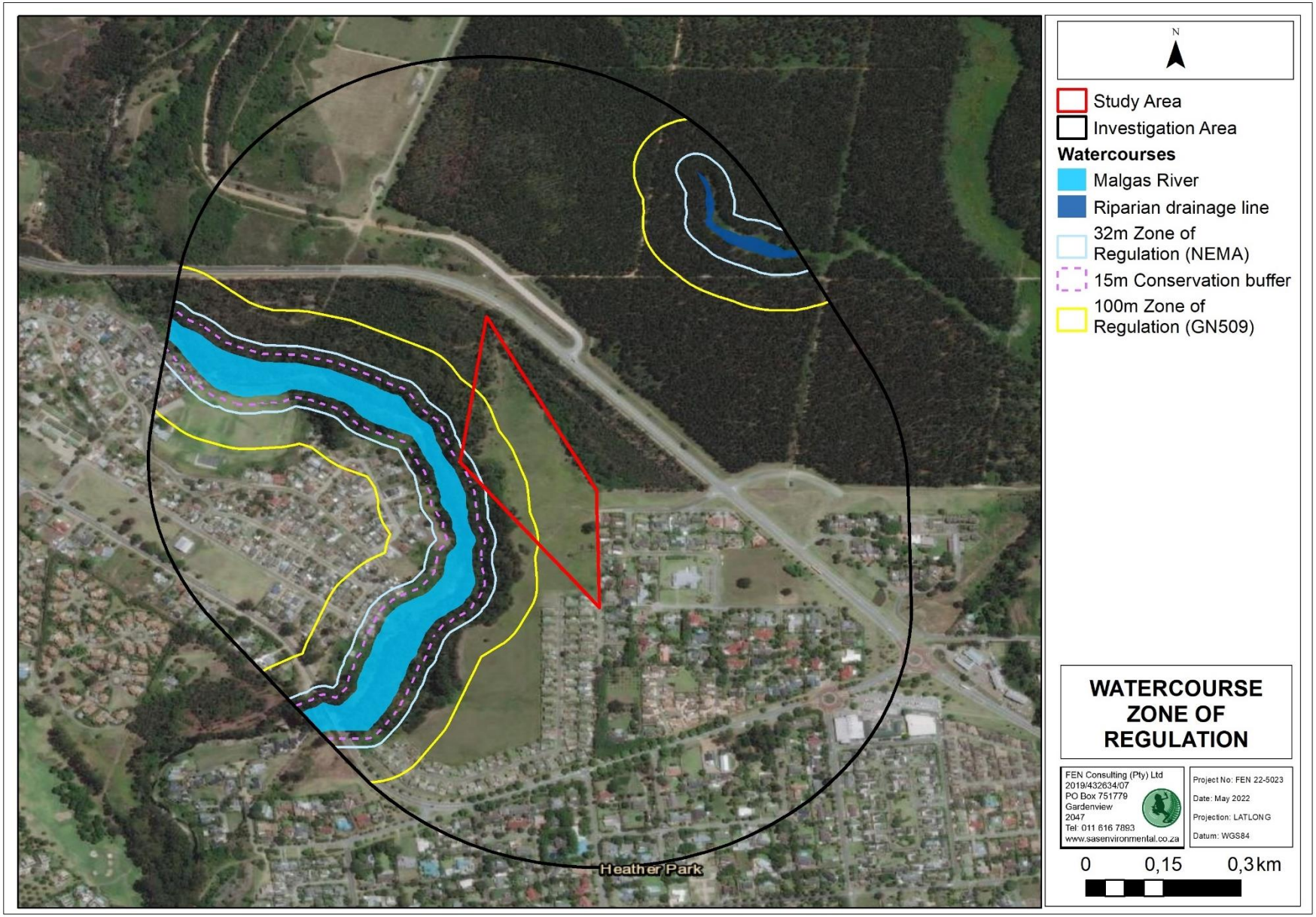


Figure 15: **The NEMA and GN509 zones of regulation associated with the watercourses within the study and investigation areas.**

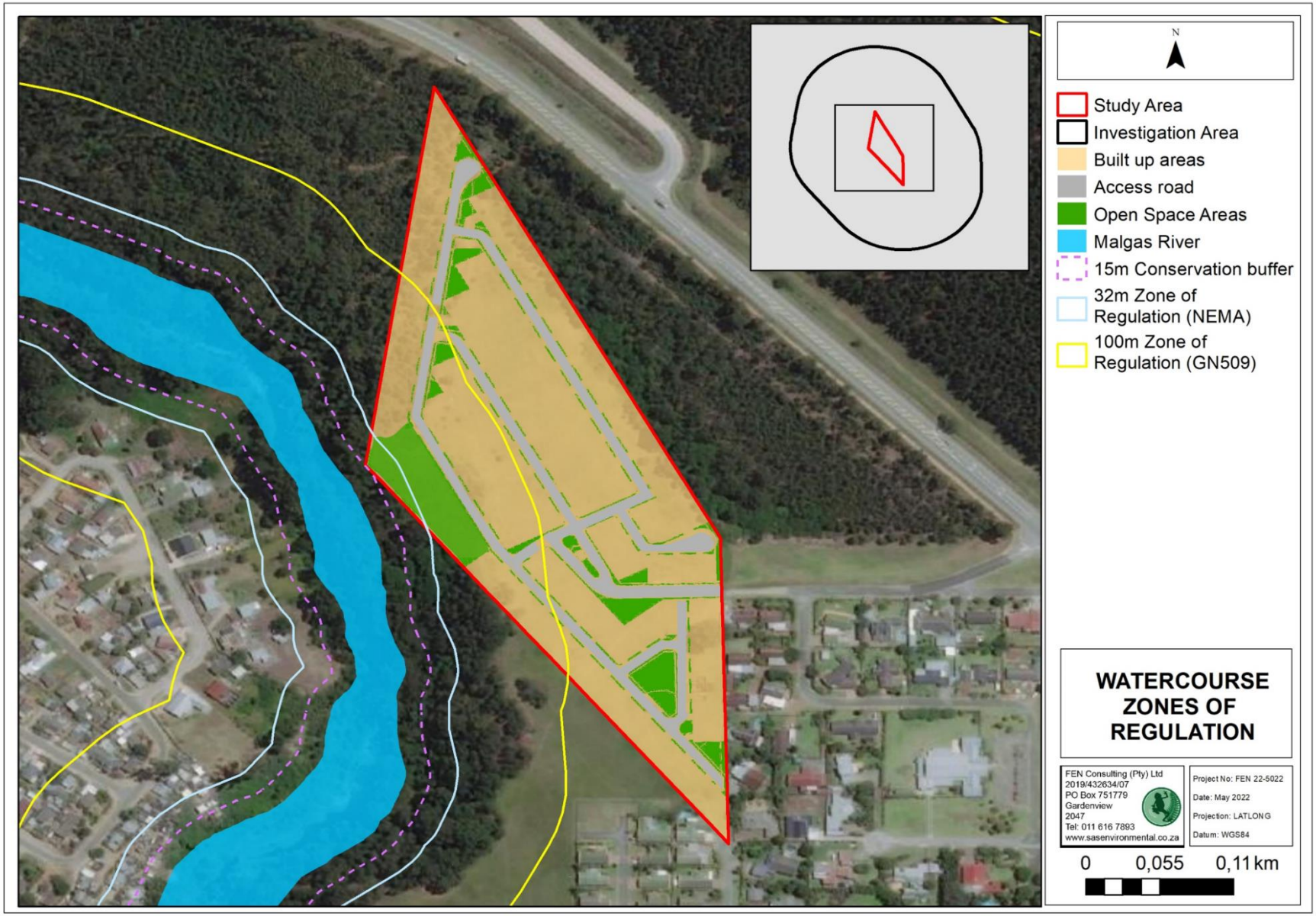


Figure 16: The NEMA and GN509 zones of regulation associated with the Malgas River, relative to the proposed development and 15 m conservation buffer.

7 RISK AND IMPACT ASSESSMENT

7.1 *DWS Risk Assessment*

Following the assessment of the wetlands located in the study area, the DWS specified Risk Assessment Matrix (as promulgated in GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)) was applied to ascertain the significance of risk associated with the proposed residential development on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the Malgas River. The points below summarise the considerations undertaken:

- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DFFE *et al.* (2013) would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- Thus, the DWS risk assessment was applied assuming that all listed mitigation measures are implemented, therefore the results of the DWS risk assessment provided in this report presents the perceived impact significance ***post-mitigation***;
- The proposed residential development is located at least 15 m from the delineated extent of the river. No building infrastructure will be located within the 15 m conservation buffer nor the 32 m NEMA ZoR, however, a fence (such as ClearVu fencing) will most likely be constructed along the study area boundary which will traverse through or be located on the boundary of the 15 m conservation buffer (with specific mention to the most western corner of the study area);
- No details pertaining to management of service infrastructure (i.e. bulk sewer or water pipelines) was available at the time of this assessment. It is assumed that no pipelines will traverse the river and municipal connection points should be planned to prevent any trenching required within the 100 m GN509 ZoR, and the 15 m conservation buffer;
- Whilst a preliminary stormwater management design report was made available in March 2023, the precise location of the attenuation dams had not been finalised or provided to the consultant, however based on the information provided (CHEL Building & Civil Supplies, 2023) the risk assessment was applied on the assumption that the attenuation dams will be located outside of the 15 m conservation buffer;
- The default score for legal issues (since a portion of the proposed development is located within the 100 m ZoR) is ‘5’;
- The proposed development activities and the associated risks they pose are all highly site specific, not of a significant extent relative to the area of the river assessed, and therefore have a limited spatial extent (i.e. within the study area);
- While the operation of the proposed residential development will be a permanent activity, the construction thereof is envisioned to take no more than a few months. The frequency of the construction impacts may, however, be daily during this time;
- Most impacts are considered to be easily detectable and mitigation measures thereof are considered to be easily practicable; and
- It is highly recommended that the proponent make provision for rehabilitation of the 15 m conservation buffer between the study area and the river. The area specifically along the study area boundary must be rehabilitated and revegetated with suitable indigenous vegetation species.

7.1.1 Risk Assessment Discussion

The following potential ecological risks to the Malgas River were considered as part of this assessment:

- Loss of watercourse habitat and ecological structure resulting in impacts to biota;
- Changes to the socio-cultural and service provision;
- Impacts on the hydrology and sediment balance of the river;
- Impacts on water quality.

The results of the risk assessment are summarised in Table 5 below, including key mitigation measures for each activity that must be implemented.

Table 5: Summary of the results of the DWS risk assessment applied to the Malgas River located outside the western boundary of the study area.

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
1	Construction Phase	Site access, clearing and preparation for civil works.	· Removal of vegetation within the study area, specifically along the western boundary of the study area.	· Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and · Decreased ecoservice provision.	1,8	3,8	12	**45**	**L**	• The 15 m conservation buffer must be demarcated as a no-go area and no unauthorised activities are allowed within the delineated extent of the river. If a more permanent fencing is desired, a pole and electric wire fence is considered suitable as this will still allow movement of faunal species (Figure A). It is acknowledged that a permanent fence will be constructed along the western boundary of the study area which will encroach on the 15 m conservation buffer or be directly on the boundary of the 15 m conservation buffer; however, this fence line can then be the distinction between the construction footprint in the study area and the 15 m conservation buffer; • It is advised that a drift fence be erected (such as heavy duty plastic) in order to prevent any sediment run-off or construction related earth works from entering the 15 m conservation buffer and the downgradient river (Figure A). This drift fence can be erected along the inside of the permanent fence and must be manually inspected and cleared of any sediment.	Fully Reversible
2			Possible indiscriminate driving within the 15 m conservation buffer along the western boundary of the study area.	· Indirect impacts to the river, leading to exposed/compacted soil, in turn leading to increased runoff and erosion; · Decreased ecoservice provision; and · Further decreased ability to support biodiversity.	1,8	3,8	12	**45**	**L**	  **Figure A: (Left) example of temporary fencing used to demarcate the 15 m conservation buffer. (Right) an example of a post and wire fence that could be used along the western boundary during the construction phase.**	

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
2	Construction Phase									• The clearing of vegetation in preparation for the construction of the stormwater discharge outlets into the Malgas River must be minimised and clearing must only occur within the authorised footprint; • Areas which are to be cleared of vegetation within the study area, including Contractor laydown areas, must remain as small as possible, in order to reduce the risk of proliferation of alien vegetation, and in order to retain a level of protection to the river during construction (e.g. dust generation, sediment trapping, slowing of stormwater runoff – specifically due to the steep slope between the river and study area); • Contractor laydown areas and equipment storage are to remain within the study area and outside the 15 m conservation buffer; and • No indiscriminate driving within the 15 m conservation buffer is allowed. All vehicles and machinery must utilise existing roads or pre-planned construction roads within the authorised construction footprint area.	Fully Reversible
3		Construction activities related to building activities outside the delineated extent of the river and outside the 15 m construction buffer but within the 100 m GN509 Zone of Regulation assigned to the river.	Earth works involving removal of topsoil and creation of soil stockpiles.	· Disturbances of soil potentially leading to increased alien vegetation proliferation, and in turn to altered riparian habitat; and · Altered runoff patterns, leading to increased erosion and sedimentation of the river.	2	4	12	**48**	L	• Excavated materials may not be contaminated, and it must be ensured that the minimum surface area is taken up, and the stockpiles may not exceed 2 m in height to reduce dust generation that may impact the river. • Any AIPs within the study area should ideally be removed prior to soil stripping to reduce seed loads within the topsoil (which will be used to revegetated post construction). This will assist in reducing the long-term AIP management requirements. • All stockpiles should not exceed 2 m in height. All exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) to prevent erosion and sedimentation of the downgradient river. **Cement usage** • Concrete and cement-related mortars can be toxic to aquatic life. Proper handling and disposal should minimize or eliminate discharges into wetland. High alkalinity associated with cement, which can dramatically affect and contaminate both soil and ground water. The following recommendations must be adhered to: Proper handling and disposal should minimize or eliminate discharges into wetland. High alkalinity associated with cement, which can dramatically affect and contaminate both soil and ground water. The following recommendations must be adhered to:	Fully Reversible

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
4	Construction Phase		Construction of: · Residential households; · Stormwater management infrastructure (attenuation and holding ponds, descending water stairs, gabion mattress before discharge into Malgas River); · Casting of concrete · Boundary fence, and · Internal roads.	· Disturbances of soil potentially leading to increased alien vegetation proliferation, and in turn to altered river habitat; · Altered runoff patterns, leading to increased erosion and sedimentation of the river; and · Proliferation of alien and invasive plants (AIP), which could lead to dispersal of AIP seeds into the river.	1,8	3,8	12	**45**	**L**	• Fresh concrete and cement mortar may only be mixed within the authorized construction footprint (limited to the study area). Mixing of cement may be done within the construction camp, may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be taken to use ready mix concrete; • No mixed concrete shall be deposited directly onto the ground. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing; • Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be suitably disposed of; • Spilled or excess concrete must be disposed of at a suitable landfill site. • Rehabilitation of the disturbed area must be undertaken, including re-vegetation with indigenous vegetation, inclusive of the 15 m conservation buffer that might have been impacted by the construction of the boundary fence or the stormwater management infrastructure. It is recommended that provision be made for the compilation of a rehabilitation plan by a suitably qualified specialist to guide the rehabilitation activities; and • Only indigenous vegetation species may be used as part of the landscaping of the development, and AIPs should be eradicated	Fully Reversible
5	Operational Phase	Operation of the residential development.	· Potential fertilizers entering the river through stormwater run-off; · Potential indiscriminate movement of vehicles within the river marginal zone for perimeter inspections/ maintenance of the study area fence.	· Potential eutrophication of water as a result of increased nitrates and phosphate loads into the river; and · Proliferation of alien and invasive plant species within the river.	1,5	3,5	10	**35**	**L**	• No vehicles are permitted to enter the river or its marginal riparian vegetation zone. Any maintenance works must be undertaken manually or the relevant authorisations obtained beforehand. • As much indigenous terrestrial, wetland and riparian vegetation should be included into the landscaping of the erven located along the western boundary of the study area. Indigenous vegetation will reduce the irrigation requirements as well as fertilizers and prevent garden ornamentals dispersing into the adjacent river marginal zone. • Care must be taken when using herbicides and pesticides within gardens, especially during the rainy season when stormwater runoff is high. These chemicals must be used in accordance with the prescribed quantities to prevent contamination of surface water in the nearby and downgradient river. • The study area and the eastern embankment of the river must be annually inspected for any erosion or gully formation that may transport contaminated run-off water to the river. Any erosion/gullies must be actively repaired.	Fully Reversible

No.	Phase	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures	Reversibility of Impact
6		Discharge of stormwater from the proposed development into the Malgas River	Increased impermeable surfaces within the study area due to the presence of hardened surfaces resulting in an increase in stormwater runoff as well as potential contaminants into the river.	- Altered runoff patterns and increased water inputs to the river, altering the flow regime, and potentially leading to erosion and incision; - Increased catchment yield (due to increased runoff) and altered flow regime may lead to changed riparian zonation; - Increased water contamination due to hydrocarbons in stormwater from the internal road network.	3,5	5,5	10	**55**	**L**	• Regular inspection of the stormwater outlet structures must be undertaken (specifically after large storm events) in order to monitor the occurrence of erosion. If erosion has occurred, it must immediately be rehabilitated through stabilisation of the embankments and revegetation; • All pipelines and open swales must be regularly cleaned, and all outlet structures checked to ensure there is no debris/blockages. • Only indigenous vegetation species may be used as part of the landscaping of the development and open space area, and invasive plant species must be eradicated.	Fully Reversible

The activities associated with the construction of the proposed residential development, including the removal of vegetation, excavation activities, casting of concrete and road surfacing as part of the construction works within the study area pose a 'Low' risk to the overall integrity of the Malgas River. This can be attributed to the assignment of a 15 m conservation buffer which will assist with limiting any indirect impacts from occurring on the river. No building infrastructure will be located within the 15 m conservation buffer, however, a fence (such as ClearVu fencing) will most likely be constructed along the study area boundary which will minimally encroach on the 15 m conservation buffer. To ensure a 'Low' risk significance, the mitigation measures as set out in this report (Section 7) must be adhered to, with specific mention of rehabilitating the 15 m conservation buffer.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place (and the implementation of general construction management and good housekeeping practices, as per Appendix F), the significance of impacts arising from the proposed residential development can be adequately managed. Furthermore, with rehabilitation and long-term management of alien and invasive plant species within the 15 m conservation buffer, the overall ecological condition of the river is unlikely to be impacted by the proposed residential development.

7.2 *Impact Assessment*

The impact assessment summarises the probability of occurrence and what the extent and duration of its impact is, together with the degree that the impact can be avoided, else mitigated, else managed, else reversed and the degree that the impact can cause irreplaceable loss of resources. These are considered in the assessment outputs which refer to the significance of impacts prior to and post mitigation and thereafter the consequences of impact or risk, and cumulative impacts prior to and post mitigation.

The results of the impact assessment are summarised in Tables 6 to 9 that follow, including reference to key mitigation measures which are summarised in the DWS Risk Assessment Matrix for each activity, that must be implemented in order to reduce the impacts of the proposed development activities.

Table 6: Construction phase impact assessment for site access, clearing and preparation for civil works.

CONSTRUCTION PHASE								
Activity: Site access, clearing and preparation for civil works. **Aspect:** - Removal of vegetation within the study area, specifically along the western boundary of the study area - Possible indiscriminate driving within the 15 m conservation buffer along the western boundary of the study area. **Nature of impact:** - Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; - Indirect impacts to the river, leading to exposed/compacted soil, in turn leading to increased runoff and erosion; - Decreased ecoservice provision; and - Further decreased ability to support biodiversity.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	2	3	2	2	5	7	35 (Low)
MITIGATED	1	2	1	1	2	3	4	12 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity 1 and 2 as per Table 5								

Table 7: Construction phase impact assessment for all building activities within the study area

CONSTRUCTION PHASE								
Activity: Construction activities related to building activities outside the delineated extent of the river and outside the 15 m construction buffer but within the 100 m GN509 Zone of Regulation assigned to the river. **Aspect:** - Earth works involving removal of topsoil and creation of soil stockpiles - Construction of: • Residential households; • Stormwater management infrastructure (attenuation / holding ponds, descending water stairs, gabion mattress prior to release into the Malgas River); • Casting of concrete; • Boundary fence, and • Internal roads. **Nature of impact:** - Disturbances of soil potentially leading to increased alien vegetation proliferation, and in turn to altered river habitat; - Altered runoff patterns, leading to increased erosion and sedimentation of the river; and - Proliferation of alien and invasive plants (AIP), which could lead to dispersal of AIP seeds into the river.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	3	2	3	2	3	5	8	40 (Low)
MITIGATED	1	2	1	1	3	3	5	15 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity 3 and 4 as per Table 5								

Table 8: Operational phase impact assessment for the residential development.

OPERATIONAL PHASE								
Activity: Operation of the residential development. **Aspect:** - Potential fertilizers entering the river through stormwater run-off; - Potential indiscriminate movement of vehicles within the river marginal zone for perimeter inspections/ maintenance of the study area fence. **Nature of impact:** - Potential eutrophication of water as a result of increased nitrates and phosphate loads into the river; and - Proliferation of alien and invasive plant species within the river.								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	2	2	2	2	5	4	9	36 (Low)
MITIGATED	1	2	1	1	5	3	7	21 (Very Low)
Applicable mitigation measures: Refer to mitigation measures for Activity 5 as per Table 5								

Table 9: Operational phase (release of stormwater into the Malgas River) impact assessment for the residential development.

OPERATIONAL PHASE								
Activity: Discharge of stormwater from the proposed development into the Malgas River. **Aspect:** - Increased impermeable surfaces due to the presence of hardened surfaces resulting in an increase in stormwater runoff as well as potential contaminants into the river. **Nature of impact:** - Altered runoff patterns and increased water inputs to the river, altering the flow regime, and potentially leading to erosion and incision; - Increased catchment yield (due to increased runoff) and altered flow regime may lead to changed riparian zonation; - Increased water contamination due to hydrocarbons in stormwater from the internal road network								
	Probability of Impact	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
UNMITIGATED	5	2	3	3	5	7	11	77 (Medium-High)
MITIGATED	2	2	2	3	4	4	9	36 (Low)
Applicable mitigation measures: Refer to mitigation measures for Activity 6 as per Table 5								

As per the outcome of the DWS Risk Assessment, the activities associated with the construction of the proposed residential development, including the removal of vegetation, excavation activities, casting of concrete and road surfacing as part of the construction works within the study area pose a 'Low' impact to the overall integrity of the Malgas River, with the implementation of the mitigation measures as per Table 5. The majority of impacts associated with the operational phase are perceived to pose a 'very low' impact significance, however the release of stormwater into the Malgas River, if not undertaken in an ecologically sensitive manner and in the absence of mitigation measures, could conceivably pose a 'medium-high' impact to the river and associated riparian zone. Provided that mitigation measures are implemented however, the impact significance of this activity can be reduced to acceptable levels.

7.3 *Cumulative Impacts*

Rivers and their associated riparian zones within the region are under continued threat due to urbanisation, agricultural development and linear infrastructure. Direct and indirect impacts identified within watercourses bordering urban development include an increase in AIP species entering the system due to regular disturbance of soil and removal of indigenous vegetation. This results in greater inputs of sediment, and nutrients from runoff that are of higher concentrations.

The impacts associated with the proposed residential development on the assessed reach of the Malgas River are unlikely to contribute to the cumulative effect on the loss of riparian habitat within the region provided that cognisant, well-planned design is implemented. As such, the PES and ecoservice provision of the river must be maintained, as per the REC and RMO. Long term AIP management and utilisation of indigenous vegetation as part of any landscaping will assist in the positive cumulative impacts to the river catchment.

8 CONCLUSION

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the EA and WUA processes for the proposed residential development on the remaining extent of Portion 1 of the Farm 1592, Paarl.

During the site assessment undertaken in April 2022, no watercourses (wetlands or rivers) were identified within the study area. As such, the study area can be considered of low aquatic biodiversity sensitivity. The Malgas River was identified outside the western boundary of the study area, within the investigation area. The results of the ecological assessment of the Malgas River located in the study area are discussed in Section 5 of this report is summarised in the table below:

Table 10: Summary of results of the field assessment as discussed in Section 5.

Watercourse	PES	Ecoservices	EIS	REC and RMO
Malgas River	D (Largely modified)	Moderately high to very low (indicator dependent)	Moderate to High	REC: Category D (Maintain) BAS: Category D (Largely modified) RMO: Maintain
Extent of modification	**None.** Since the proposed development is located at least 15 m from the delineated extent of the river, no modification to the river is expected, should the recommended mitigation measures be implemented.			

Following the ecological assessment of the Malgas River, the DWS Risk Assessment and an impact assessment was applied in order to ascertain the significance of possible impacts which may occur as a result of the proposed residential development. The results of this assessment are presented in Section 7 of this report and show that assuming mitigation measures are strictly enforced, a 'Low' risk/impact to the overall integrity of the Malgas River is expected, with the implementation of the set-out mitigation measures and in particular, ecologically sensitive design of the proposed stormwater management system. This can be attributed to the proposed development located at least 15 m from the delineated extent of the river, and the assignment of a conservation buffer between the proposed development and the river. The 15 m conservation area will limit any direct and indirect impacts to the river and must be rehabilitated post-construction (with specific mention of AIP control).

The proposed development intersects both the 32 m ZoR (NEMA) and the 100 m ZoR (NWA) which would necessitate the application for Environmental Authorisation from the Department of Forestry, Fisheries and Environment (DFFE), and Water Use Authorisation from the Department of Water and Sanitation (DWS). It must, however, be noted that any sewer pipelines that may be required as part of the development will trigger the need for a Water Use Licence Application (WULA) as portions of the development is located within the 100 m ZoR. In accordance with GN 509 the construction, installation or maintenance of any sewer pipelines is excluded from authorisation by means of a General Authorisation (GA), regardless of the risk significance.

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ANNEXURE A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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ANNEXURE B: Legislative Requirements

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Water Act, 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act , 1998 (Act No. 36 of 1998)	In accordance with Government Notice (GN)509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1:100 year floodline and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1:100 year floodline or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

ANNEXURE C: Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses and drainage line features present in close proximity of the proposed development are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland feature present in the vicinity of the proposed development.

1.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)*

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the watercourse traversed by the proposed linear development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the study area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis et. al., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4:HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems
From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean** (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.*, 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting
At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.*, 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units
Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchanneled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

3. Wet-Ecoservices (2009)

“The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class” (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Riparian Vegetation Response Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: ‘riparian habitat’ includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, 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.

The Riparian Vegetation Response Assessment Index (VEGRAI) is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results3. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

[3] Kleynhans et al, 2007

Table C4: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota & basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota & basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

5. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C5) of the wetland system being assessed.

Table C5: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C6: Recommended management objectives (RMO) for watercourses based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C7: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

7. Watercourse Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and

- The presence of redoxymorphic soil feature, which are morphological signatures that appear in soil with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).
Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soil and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

ANNEXURE D: Risk and Impact Assessment Methodology

DWS Risk Assessment

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[4]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[5].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances,

[4] The definition has been aligned with that used in the ISO 14001 Standard.
[5] Some risks/impacts that have low significance will however still require mitigation

where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 (c) and (i) water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

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

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

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

Table D3: Duration (How long does the aspect impact on the resource quality)

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

Table D4: Frequency of the activity (How often do you do the specific activity)

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

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

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

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

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

Table D8: Rating Classes

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

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[6] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

Reversibility and/or irreplaceable loss

[6] Mitigation measures should address both positive and negative impacts

The following indicates the rationale for the reversibility scoring in relation to the watercourses.

Table D10: Reversibility of impacts on the watercourse

Reversibility Rating:	**Irreversible** (the activity will lead to an impact that is permanent)
	Partially reversible (The impact is reversible to a degree e.g. acceptable revegetation measures can be implemented but the pre-impact species composition and/or diversity may never be attained. Impacts may be partially reversible within a short (during construction), medium (during operation) or long term (following decommissioning) timeframe
	Fully reversible (The impact is fully reversible, within a short, medium or long-term timeframe)

Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[7]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact;
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor;

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and

[7] The definition has been aligned with that used in the ISO 14001 Standard.

consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[8].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table D11 Criteria for assessing significance of impacts.

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / linear features affected > 3000m	5

[8] Some risks/impacts that have low significance will however still require mitigation

Duration of impact	RATING
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table D12: Significance rating matrix.

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table D13: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.

- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed;
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

ANNEXURE E: Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the IHI assessment applied to Malgas River

	MRU
INSTREAM IHI	
Base Flows	-1,0
Zero Flows	1,0
Floods	1,0
HYDROLOGY RATING	**1,0**
pH	1,0
Salts	1,0
Nutrients	1,0
Water Temperature	1,0
Water clarity	1,0
Oxygen	1,0
Toxics	1,0
PC RATING	**3,5**
Sediment	3,0
Benthic Growth	1,5
BED RATING	**2,0**
Marginal	2,0
Non-marginal	2,0
BANK RATING	**2,0**
Longitudinal Connectivity	2,0
Lateral Connectivity	4,0
CONNECTIVITY RATING	**2,6**
INSTREAM IHI %	**56,5**
INSTREAM IHI EC	**D**
INSTREAM CONFIDENCE	**3,0**

	MRU
RIPARIAN IHI	
Base Flows	-1,0
Zero Flows	1,0
Moderate Floods	2,0
Large Floods	2,0
HYDROLOGY RATING	**1,6**
Substrate Exposure (marginal)	4,0
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	4,0
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	2,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	2,0
Physico-Chemical (non-marginal)	1,0
Marginal	4,0
Non-marginal	1,0
BANK STRUCTURE RATING	**2,8**
Longitudinal Connectivity	2,0
Lateral Connectivity	2,0
CONNECTIVITY RATING	**2,0**
RIPARIAN IHI %	**55,6**
RIPARIAN IHI EC	**D**
RIPARIAN CONFIDENCE	**3,0**

Table E2: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the Malgas River

		Present State			
ECOSYSTEM SERVICE		**Supply**	**Demand**	**Importance Score**	**Importance**
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1,1	0,3	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	1,0	0,8	0,0	Very Low
	Erosion control	0,6	0,7	0,0	Very Low
	Phosphate assimilation	1,0	0,5	0,0	Very Low
	Nitrate assimilation	1,1	0,5	0,0	Very Low
	Toxicant assimilation	1,1	0,5	0,0	Very Low
	Carbon storage	1,8	0,0	0,3	Very Low
	Biodiversity maintenance	0,3	2,0	0,0	Very Low
PROVISIONING SERVICES	Water for human use	0,0	0,3	0,0	Very Low
	Harvestable resources	1,0	0,0	0,0	Very Low
	Food for livestock	1,0	0,3	0,0	Very Low
	Cultivated foods	2,8	0,3	1,4	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	0,0	0,0	0,0	Very Low
	Education and Research	0,0	0,0	0,0	Very Low
	Cultural and Spiritual	4,0	0,3	2,7	Moderately High

Table E3: Presentation of the EIS assessment applied to the Malgas River

			Hugos River
Ecological Importance and Sensitivity			Score (0-4)
Biodiversity support			**A (average)**
			0,67
Presence of Red Data species			0
Populations of unique species			0
Migration/breeding/feeding sites			2
Landscape scale			**B (average)**
			2,00
Protection status of the wetland			3
Protection status of the vegetation type			4
Regional context of the ecological integrity			1
Size and rarity of the wetland type/s present			1
Diversity of habitat types			1
Sensitivity of the wetland			**C (average)**
			1,00
Sensitivity to changes in floods			1
Sensitivity to changes in low flows/dry season			1
Sensitivity to changes in water quality			1
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)			**B**
Hydro-Functional Importance			**Score (0-4)**
Regulating & supporting benefits	**Flood attenuation**		1
	Streamflow regulation		1
	Water Quality Enhancement	***Sediment trapping***	1
		Phosphate assimilation	1
		Nitrate assimilation	1
		Toxicant assimilation	1
		Erosion control	1
	Carbon storage		1
HYDRO-FUNCTIONAL IMPORTANCE (average score)			1
Direct Human Benefits			**Score (0-4)**
Subsistence benefits	***Water for human use***		0
	Harvestable resources		0
	Cultivated foods		2
Cultural benefits	***Cultural heritage***		2
	Tourism and recreation		0
	Education and research		0
DIRECT HUMAN BENEFITS (average score)			0,67

Table E4: Presentation of the results of the application of the DWS buffer tool

	Threat Posed by the proposed land use / activity	Specialist Threat Rating	Description of any additional mitigation measures	Refined Threat Class	Specialist justification for refined threat ratings with clear reference to supporting documentation.
Construction Phase	1. Alteration to flow volumes	VL			
	2. Alteration of patterns of flows (increased flood peaks)	VL			
	3. Increase in sediment inputs & turbidity	M			
	4. Increased nutrient inputs	VL			
	5. Inputs of toxic organic contaminants	VL			
	6. Inputs of toxic heavy metal contaminants	L			
	7. Alteration of acidity (pH)	VL			
	8. Increased inputs of salts (salinization)	N/A			
	9. Change (elevation) of water temperature	VL			
	10. Pathogen inputs (i.e. disease-causing organisms)	VL			
Operational Phase	1. Alteration to flow volumes	M			
	2. Alteration of patterns of flows (increased flood peaks)	M			
	3. Increase in sediment inputs & turbidity	L			
	4. Increased nutrient inputs	L			
	5. Inputs of toxic organic contaminants	L			
	6. Inputs of toxic heavy metal contaminants	L			
	7. Alteration of acidity (pH)	VL			
	8. Increased inputs of salts (salinization)	VL			
	9. Change (elevation) of water temperature	VL			
	10. Pathogen inputs (i.e. disease-causing organisms)	L			

	Buffer Segment 1	Buffer Segment 2	Buffer Segment 3	Buffer Segment 4
Revised aquatic impact buffer requirements (including additional mitigation measures)				
Construction Phase	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Operational Phase	Not Assessed	Not Assessed	Not Assessed	Not Assessed

Additional mitigation measures to consider	Y/N	Comments
Have additional mitigation measures been identified to cater for any point-source discharges?		
Have additional mitigation measures been identified to cater for potential groundwater impacts?		

Where necessary review and refine aquatic impact buffer requirements to cater for practical management considerations

	Buffer Segment 1	Buffer Segment 2	Buffer Segment 3	Buffer Segment 4
Final aquatic impact buffer requirements (including practical management considerations)				
Construction Phase	15	Not Assessed	Not Assessed	Not Assessed
Operational Phase	15	Not Assessed	Not Assessed	Not Assessed

ANNEXURE F: Risk/Impact Analysis and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecology and biodiversity, will include any activities which take place in close proximity to the proposed activities that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the watercourse identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into watercourses unless absolutely essential and where project activities are located in the watercourses. It must be ensured that the watercourse habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes (if applicable) should avoid watercourses and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)) Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species; and
  - No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soil

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;

- No stockpiling of topsoil is to take place within the recommended buffer zone around the watercourses (unless specified otherwise), and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the wetland;
- All soil compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble/silt removed from the dam must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed development should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Risk significance on the watercourse ecology of the study area

The table below serves to summarise the anticipated impacts that might occur during the construction and operational phases as well as the mitigation measures that must be implemented in order to maintain and enhance the ecological integrity of the resource.

Table F1: Risk Assessment outcomes for the proposed residential development.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph/vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
1	Construction Phase	Site access, clearing and preparation for civil works.	× Removal of vegetation within the study area, specifically along the western boundary of the study area	× Potential increased dust generation, leading to potential smothering of riparian vegetation and potentially altering surface water quality within the river; and × Decreased ecoservice provision.	1	1	3	2	**1,8**	1	1	**3,8**	5	1	5	1	**12**	**45**	L
2			Possible indiscriminate driving within the 15 m conservation buffer along the western boundary of the study area.	× Indirect impacts to the river, leading to exposed/compacted soil, in turn leading to increased runoff and erosion; × Decreased ecoservice provision; and × Further decreased ability to support biodiversity.	1	1	3	2	**1,8**	1	1	**3,8**	5	1	5	1	**12**	**45**	L
3		Construction activities related to building activities outside the delineated extent of the river and outside the 15 m construction buffer but within the 100 m GN509 ZoR assigned to the river.	Earth works involving removal of topsoil and creation of soil stockpiles	× Disturbances of soil potentially leading to increased alien vegetation proliferation, and in turn to altered riparian habitat; and × Altered runoff patterns, leading to increased erosion and sedimentation of the river.	1	2	3	2	**2,0**	1	1	**4,0**	5	1	5	1	**12**	**48**	L
4			Construction of: × Residential households; × Boundary fence, and × Internal roads.	× Disturbances of soil potentially leading to increased alien vegetation proliferation, and in turn to altered river habitat; × Altered runoff patterns, leading to increased erosion and sedimentation of the river; and × Proliferation of alien and invasive plants (AIP), which could lead to dispersal of AIP seeds into the river.	1	2	2	2	**1,8**	1	1	**3,8**	5	1	5	1	**12**	**45**	L
5	Operational Phase	Operation of the residential development	× Potential fertilizers entering the river through stormwater run-off; × Potential indiscriminate movement of vehicles within the river marginal zone for perimeter inspections/ maintenance of the study area fence.	× Potential eutrophication of water as a result of increased nitrates and phosphate loads into the river; and × Proliferation of alien and invasive plant species within the river.	1	2	2	1	**1,5**	1	1	**3,5**	3	1	5	1	**10**	**35**	L

ANNEXURE G: Details, Expertise and Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report

Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Christel du Preez	MSc Environmental Sciences (North West University)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	FEN Consulting		
Name / Contact person:	Christel Du Preez		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	083 739 2284
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	christel@sasenvgroup.co.za		
Qualifications	MSc Environmental Science		
Registration / Associations	Registered Member of the South African Council for Natural Scientific Professions (SACNASP)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christel du Preez, declare that -

- I act as the independent specialist in this application;
- I will 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;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- 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;
- All the particulars furnished by me in this form are true and correct

C du Preez

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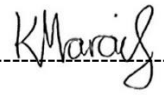
1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Kim Marais, declare that -

- I act as the independent specialist in this application;
- I will 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;
- 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- 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;
- All the particulars furnished by me in this form are true and correct



SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, KwaZulu-Natal, Northern Cape, Eastern Cape,
Africa - Uganda

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plans

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTEL DU PREEZ

PERSONAL DETAILS

Position in Company	Senior Scientist Watercourse ecology
Joined SAS Environmental Group of Companies	2016

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 120240)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Sciences (North West University)	2017
BSc Hons Environmental Sciences (North West University)	2012
BSc Environmental and Biological Sciences (North West University)	2011

Short Courses

Wetland and Aquatic plant Identification presented by Carin van Ginkel	2019
Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State	2018
Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2017
Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plans
- Freshwater Offset Plans