SCIENTIFIC AQUATIC SERVICES

FRESHWATER ECOSYSTEM COMPLIANCE REPORT

AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SEKURUWE WATER TREATMENT WORKS IN THE LIMPOPO PROVINCE.

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Authorisation (EA) process for a proposed water treatment works (WTW) and associated access road near the settlement of Sekuruwe in the Limpopo Province. The area of assessment consists of the development site of the WTW (the 'study area'), along with a 500 m "zone of investigation" (the investigation area), in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA).

A field-based assessment of the study and investigation areas was undertaken in late August 2023 to identify any freshwater occurrence and potential impacts of the proposed development on the freshwater environment. An episodic drainage line (EDL) was identified to the north-east of the study area, draining northwards through the investigation area. Three other EDLs were identified in the investigation area of the proposed access road.

The proposed development will not result in any direct transformative impacts related to the footprint of the proposed WTW on any freshwater ecosystems, however indirect and edge effects could result due to the proximity of the upper parts of the EDL located to the north-east of the development site and as the EDL is downgradient of the development site. There is accordingly a quantum of risk associated with the proposed development on the freshwater environment and potential impacts were thus identified and assessed using the method defined in Appendix A Regulation 509 of 2016 and requisite mitigation measures identified and implemented. The proposed WTW is located in the regulated area of a watercourse as defined by GN 509 and accordingly a Water Use Authorisation (WUA) in terms of the NWA would need to be acquired by the proponent.

The Department of Forestry Fisheries and the Environment's (DFFE) National Web-based Environmental Screening Tool (2020) designated the study and investigation areas as LOW aquatic biodiversity (freshwater) sensitivity. This designation has been verified by the assessment as there are no freshwater ecosystems located in the study area (development site) and all freshwater ecosystems in the investigation area are first order episodic drainage lines characterised by a very limited hydroperiod. In line with 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, a freshwater compliance statement has been compiled. Nonetheless it is critical that mitigation measures be implemented to avoid any potential impacts on the freshwater environment associated with the proposed development.

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.
Alluvial Material / deposits	Sedimentary deposits resulting from the action of rivers, including those deposited within river channels, floodplains, etc.
Anaerobic	The absence of molecular oxygen.
Apedal	A term indicating the degree of aggregation of soil particles within a soil horizon, where the material is well aggregated, but without well-formed peds (individual soil aggregates); in the context of the South African Soil Classification System, apedal soils also include structureless soils (e.g. sands) and somewhat more structured soils than the above description.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Delineation (of a wetland / riparian zone):	To determine the boundary of a wetland / riparian zone 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."
Episodic	Relating to rivers and drainage lines typically located within arid or semi-arid environments that only carry flow in response to isolated rainfall events. According to Rossouw *et al* (2005) episodic drainage systems are characterised by no flow at least 76% of the time
Hydrology:	The study of the occurrence, distribution, and movement of water over, on and under the land surface.
Land Type	Distinct areas defined as part of the Land Type Survey of South Africa based on a unique combination of soil pattern, macroclimate and terrain form.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Reach	A longitudinal stretch of a river, wetland or watercourse
Riparian Area /Zone	The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may, in turn, influence the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DEA	Department of Environmental Affairs (currently the DFFE)
DFFE	Department of Forestry, Fisheries and Environment
DWA	Department of Water Affairs (currently the DWS)
DWAF	Department of Water Affairs and Forestry (currently the DWS
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
m	Meter
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub-quaternary catchment reach
subWMA	Sub-Water Management Area
SWSA	Strategic Water Source Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas

DOCUMENT GUIDE

Table 1 below provides the specialist report requirements for the assessment and reporting of impacts to the 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) as amended (NEMA). It is important to note that the aquatic biodiversity theme replaces Appendix 6 of NEMA.

Table A: Specialist report requirements for the assessment and reporting of impacts to the aquatic biodiversity.

No.	Requirements	Section in Report
3.1	The compliance statement must be prepared by a suitably qualified specialist registered with the SACNASP, with expertise in the field of aquatic sciences.	Appendix F
3.2	The compliance statement must:	-
3.2.1	be applicable to the preferred site and the proposed development footprint;	Section 1, 2, 6
3.2.2	confirm that the site is of "low" sensitivity for aquatic biodiversity; and	Section 6.2
3.2.3	indicate whether or not the proposed development will have an impact on the aquatic features.	Section 8;9
3.3	The compliance statement must contain, as a minimum, the following information:	-
3.3.1	contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix E
3.3.2	a signed statement of independence by the specialist;	Appendix A
3.3.3	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 3.2
3.3.4	a baseline profile description of biodiversity and ecosystems of the site;	Section 6
3.3.5	the methodology used to verify the sensitivities of the aquatic biodiversity features on the site including the equipment and modelling used where relevant;	Section 3, 6.1
3.3.6	in the case of a linear activity, confirmation from the aquatic biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;	N/A
3.3.7	where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;	Section 8;9
3.3.8	a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and	Section 1.2
3.3.9	any conditions to which this statement is subjected.	Section 10
3.4	A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	EAP to ensure this requirement is met.

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1. INTRODUCTION AND BACKGROUND SETTING

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater ecological assessment as part of the Environmental Authorisation (EA) process in terms of the Environmental Impact Assessment (EIA) regulations of 2014 (as amended) for the proposed development of a water treatment works (WTW) and access road located near the settlement of Sekuruwe in the Mogalakwena Local Municipality in the Limpopo Province.

In order to identify all freshwater ecosystems that may potentially be impacted by the development of the proposed WTW and proposed access road upgrading, a 500 m “zone of investigation” was implemented around the proposed development site and access road, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA), in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e., the 500 m zone of investigation around the proposed Sekuruwe WTW development site and access road – will` henceforth be referred to as the ‘investigation area’.

In line with 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, a compliance report has been compiled as the proposed development is not located within any areas of very high freshwater / aquatic biodiversity sensitivity. The compliance statement has however identified impact and management actions and impact management outcomes (mitigation measures) to ensure that any potential impacts of the development on the freshwater environment when it is constructed and operated are negated.

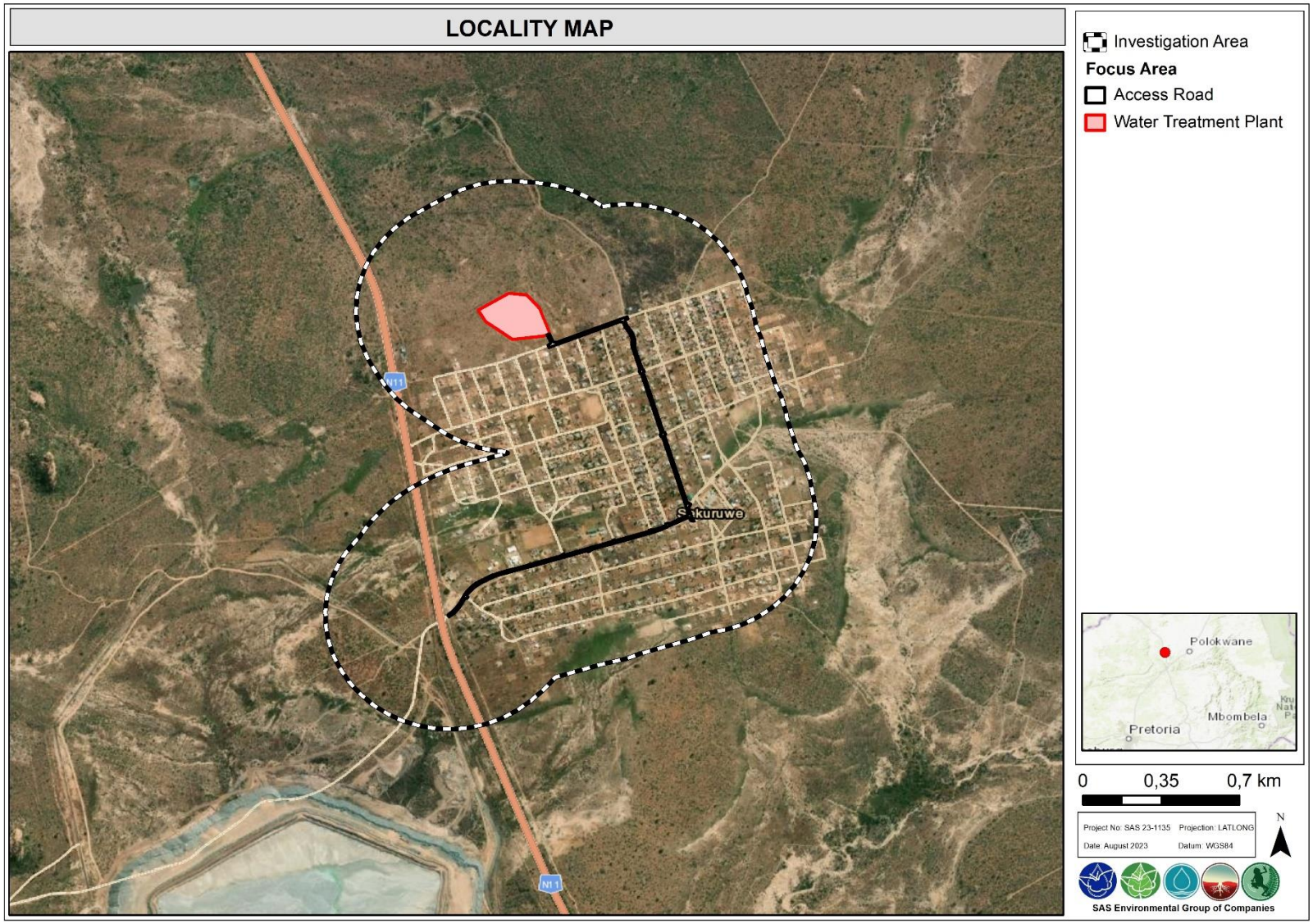

Figure 1: Digital satellite image depicting the location of the proposed Sekuruwe WTW study area and associated investigation area in relation to the surrounding area.

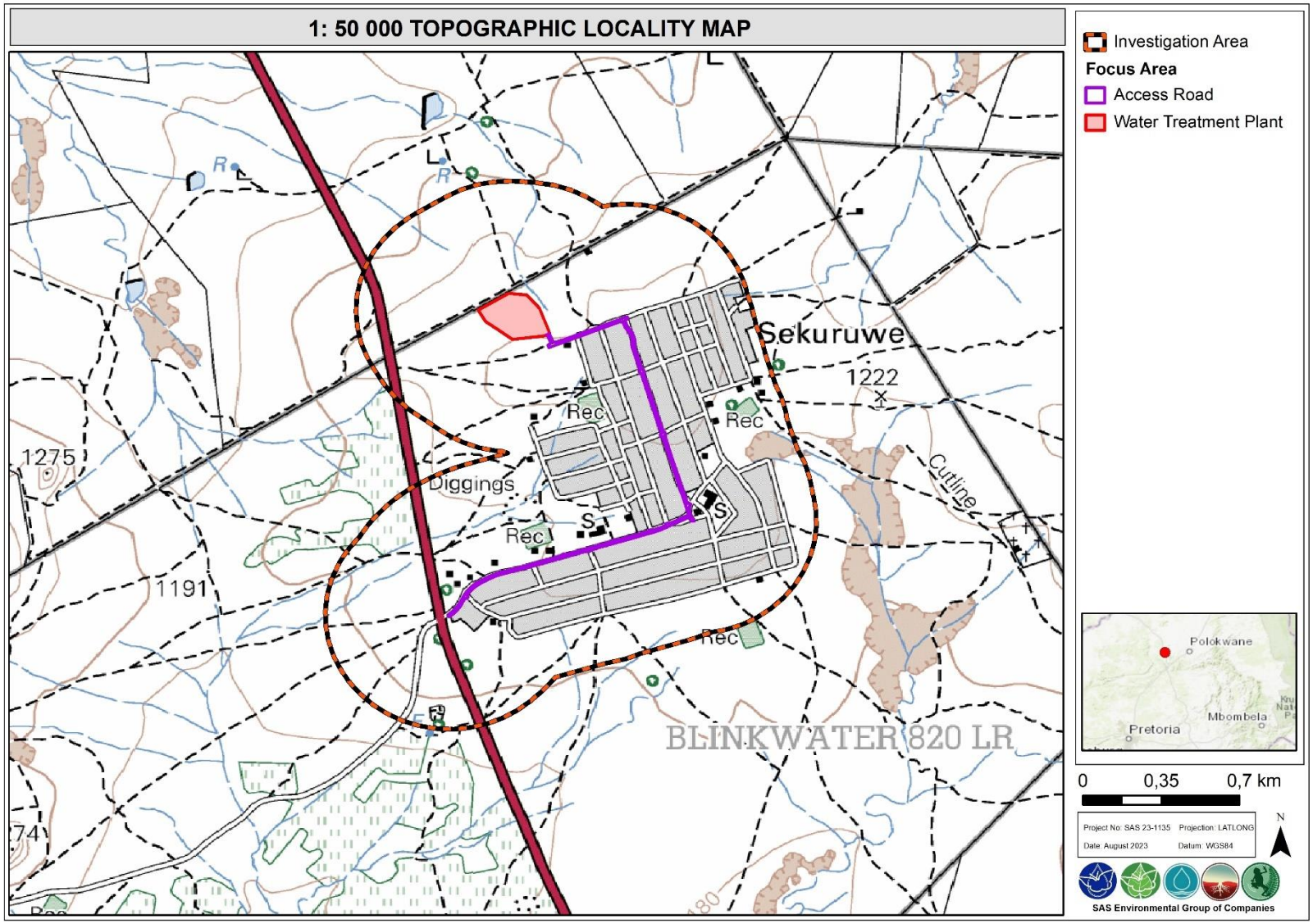

Figure 2: The proposed Sekuruwe WTW, and associated investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.1 Scope of Work

Specific outcomes in terms of this (EIA-phase) freshwater compliance statement report are outlined below:

- A background study of relevant national, provincial, and municipal datasets (such as National Freshwater Ecosystem Priority Areas [NFEPA] (2011), and the National Biodiversity Assessment 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE) databases was undertaken to aid in defining the Ecological Importance and Sensitivity (EIS) of the freshwater ecosystems;
- All freshwater ecosystems within the investigation area were delineated using desktop methods in accordance with GN 509 of 2016 as it relates to activities as stipulated in the NWA and verified where possible according to the "Department of Water Affairs and Forestry (DWAF)[1] (2005)[2]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as terrain setting, hydrological characteristics, vegetation indicators (e.g. vegetation species composition and structure), and soil wetness were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The freshwater ecosystems were mapped in relation to the study area. In addition to the freshwater ecosystem boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Areas of freshwater sensitivity in relation to the study and investigation areas were confirmed and all potential risks to the freshwater environment as posed by the proposed development assessed;
- The DWS Risk Assessment Matrix (2016) and the impact assessment methodology as applied by the EAP was applied to identify potential impacts that may affect the freshwater ecosystems as a result of the proposed activities and infrastructure associated with the Sekuruwe WTW, and to aim to quantify the significance thereof; and

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently 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.
[2] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

- Management and mitigation measures to ensure that the development poses an acceptable quantum of risk to the freshwater environment when it is constructed and operated were identified.

1.2 Assumptions and limitations

The following assumptions and limitations are applicable to this report:

- SAS has been appointed to undertake a freshwater compliance statement for the proposed development based on the designation of low aquatic biodiversity (freshwater) sensitivity to the study and investigation areas based on the DFFE web-based environmental screening tool (refer to Section 4). The site assessment conducted verified the presence of a freshwater ecosystem (EDL) in relatively close proximity to the development site. This report does not meet the requirements for a freshwater report in support of a Water Use Authorisation and will need to be updated to include such requirements if an application for WUA is required to be undertaken;
- Although a project technical description has been provided by the EAP, no technical details regarding the potential upgrading of access roads have been provided. Accordingly it has been assumed that the current tarred section of the access road will be resurfaced and that the un-tarred section of the access road will be tarred;
- All freshwater ecosystems associated with the proposed Sekuruwe WTW development site and within 500 m in fulfilment of GN509, were delineated using various desktop methods including the use of topographic maps, digital satellite imagery, and aerial photographs. As it is the only freshwater ecosystem associated with a quantum of risk associated with the proposed development, only the EDL located north-east of the proposed development site was ground-truthed;
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- The delineations as presented in this report are regarded as the best estimate of the boundaries based on the site conditions present, as observed during the site assessment, and are deemed accurate enough to guide the EA process;
- Wetland, riparian, and terrestrial ecosystem 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 freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;

- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Sekuruwe WTW's actual site characteristics at the scale required to inform the environmental authorisation and water use authorisation processes;
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the existing activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of aquatic, riparian, and wetland ecology; and
- The only activities which were assessed were the Sekuruwe WTW, associated access road upgrading and identified freshwater ecosystems within 500 m thereof that may be impacted by the development footprint. All other activities located outside these boundaries that may intercept/create other potential impacts were not considered.

2. PROJECT DESCRIPTION

Please note that the ensuing project description was provided by the EAP.

The Mogalakwena Local Municipality (MLM) is a Water Services Authority (WSA) as contemplated in the Water Services Act (No. 108 of 1997). Therefore, the municipality is responsible for the realisation of the right to access to basic water services: ensuring progressive realisation of the right to basic water services, subject to available resources (that is, extension of services), the provision of effective and efficient ongoing services (performance management, by laws) and sustainability (financial planning, tariffs, service level choices, environmental monitoring). The WSA has developed a Water Services Development Plan (WSDP) in conjunction with master plans for water and sanitation.

The planning for water and wastewater services in Mogalakwena culminated in the Mogalakwena Water Master Plan (MWMP). As part of the MWMP, two new WTWs are to be provided, namely a works serving the Mokopane Town with an ultimate capacity of 28Ml/d and another servicing the areas north of Mokopane located near Sekuruwe Township with an ultimate design capacity of 21Ml/d.

The Lebalelo Water User Association is proposing to construct the Sekuruwe WTW and associated infrastructure located north of the town of Sekuruwe near the Mogalakwena Platinum Mine, in the Mogalakwena Local Municipality on the Farm Blinkwater 820 LR. The overall objective of the proposed development is to supply potable water for commercial and residential purposes. The elevation at the Sekuruwe site would be sufficient to receive raw water and supply potable water under gravity.

The principal treatment objectives for the WTW can be summarised as follows:

- reduction of suspended solids (turbidity);
- reduction of natural organic matter (NOM);
- removal and destruction of pathogens;
- accommodation and removal of algae and removal of algal metabolites; and
- stabilisation of the final water.

The principal components of the various process configurations that were considered as options to deal with the expected raw water quality, include:

- Conventional treatment: coagulation – flocculation – sedimentation –media filtration –
- disinfection – stabilisation
- Direct filtration: coagulation – flocculation – media filtration – disinfection – stabilisation
- Direct filtration with combined dissolved air flotation (DAFF): coagulation – flocculation
- combination dissolved air flotation/media filtration – disinfection – disinfection
- Slow sand filtration (SSF): SSF – disinfection - stabilisation
- Membrane filtration: coagulation – membrane filtration – disinfection - stabilisation

The process configuration that meets all the treatment objectives and is proposed for both Mokopane WTW and Sekuruwe WTW, is direct filtration with combined dissolved air flotation (DAFF). This configuration is cost effective in terms of both capital and operating costs, achieving significant savings over conventional treatment. Targeted removal of algae can be achieved without the need for constructing additional process units that would stand idle when there is no algal activity.

The infrastructure required for each WTWs is summarised as follows:

- a paved access road, and paved internal roads;
- fencing of the site, including the process silt drying lagoons that will be located remotely from the main site (down the hill) at Mokopane WTW;
- power supply to the sites, anticipated at 150kVA and 120kVA for the Mokopane WTW and Sekuruwe WTW respectively;
- a diesel back-up generator sized to provide sufficient power for core operation of the entire WTW;
- process structures, including flash mix cascade/inlet works, flocculation reactors,
- flotation/filtration units, clear well, chlorine contact reactor, stabilisation reactor/buffer tank,
- backwash recovery tanks and pump station, process silt drying silt lagoons;
- various buildings, including an administration building, machine room, chemical dosing
- building, and chlorine building, workshop, and operator accommodation; and
- a service water reservoir to supply the service and domestic water needs for the sites.

The typical components of a water treatment facility include two major sections namely the main treatment works and ancillary works.

The main treatment works may be sub-divided into the following;

- Inlet pipelines and structures,
- Main production units,
- Disinfection units, and
- On-site storage of potable water.
- The ancillary works typically include:
- Electricity supply,
- Access and on site circulation roads (with storm water management),
- Sludge drainage pipe or drying beds,
- Office building and equipment,
- Staff accommodation,
- Storage rooms,
- Laboratory facilities and equipment, and
- Fencing.

3. ASSESSMENT APPROACH

3.1 Freshwater Ecosystem Definition

The NWA is aimed at the protection of the country's water resources, defined in the Act as "a watercourse, surface water, estuary or aquifer." According to the NWA, a **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 in the *Gazette,* declare a watercourse;

For the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the NWA and carries the same meaning as "watercourse" as defined by the Act.

The NWA further provides definitions of wetland and riparian habitats as follows:

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 the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with composition and physical structure distinct from those of adjacent areas.

3.2 Freshwater Ecosystem Site Verification

Use was made of historical and current digital satellite imagery, topographic maps, and available provincial and national databases to aid in the delineation of the freshwater ecosystems at a desktop level prior to the undertaking of a site assessment.

The following were taken into consideration when utilising the above desktop methods:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with freshwater ecosystems: a distinct increase in density as well as shrub size near flow paths;

- Hue: with water flow paths often showing as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology, and soil conditions. Changes in the hue of vegetation, with freshwater ecosystem 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 which are distinct from the adjacent terrestrial areas, created by varying vegetation cover and soil conditions within the freshwater ecosystems.

A freshwater ecosystem site verification and assessment was undertaken on the 29th of August 2023 (late winter season) during which the presence of any freshwater ecosystem characteristics as defined by the Department of Water Affairs and Forestry (2008) and the NWA were noted and delineated (please refer to Section 6 of this report).

The freshwater ecosystem delineation took place, as far as possible, 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 freshwater ecosystems have several distinguishing factors including the following:

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

3.3 Risk Assessment, Impact Assessment and Recommendations

Following the completion of the assessment, a risk assessment (please refer to Appendix B for the method of approach) and an impact assessment using the methodology provided the EAP (refer to Appendix D for the method and approach) were conducted. Recommendations were developed to address and mitigate impacts associated with the proposed Sekuruwe WTW activities. These recommendations also include general 'best practice' management measures, which apply to the proposed development activities as a whole, and which are presented in Appendix E. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 6 of this report.

4. APPLICATION OF THE DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

The protocol for the assessment of freshwater and aquatic biodiversity prepared in support of the DFFE (previously the Department of Environmental Affairs (DEA)) National Web-based Environmental Screening Tool (2020), provides the criteria for the assessment and reporting of impacts on aquatic/freshwater biodiversity for activities requiring Environmental Authorisation (EA). For the aquatic / freshwater biodiversity theme, the requirements are for sites which support various levels of biodiversity. The relevant aquatic / freshwater biodiversity theme in the web based environmental screening tool has been provided by the South African National Biodiversity Institute (SANBI). Based on the sensitivity rating, a suitably qualified specialist must prepare the relevant report or opinion memorandum which is to be submitted as part of the EA application.

According to the guidelines, an applicant intending to undertake an activity on a site identified as being of “very high sensitivity” for an aquatic biodiversity theme must submit an Aquatic Biodiversity Impact Assessment, or if the area is identified as being of “low sensitivity”, an Aquatic Biodiversity Compliance Statement must be compiled and submitted to the competent authority. It is noted, however, that during a site survey undertaken by a suitably qualified freshwater ecologist should the sensitivity be determined to be different from that assigned by the screening tool (i.e. that a high risk to the regional aquatic biodiversity or freshwater ecosystems in the area is likely even though it is assigned as a “low” sensitivity, or if it is assigned a high sensitivity, however, the proposed development risks are deemed low) then the relevant assessment approach must be followed based on the site survey results and not the DFFE screening tool allocation.

As part of the process of the background information gathering, the EAP applied the DFFE screening tool to the study area. According to the environmental screening tool, the entirety of the study area and the investigation area is located within an area of **low aquatic / freshwater biodiversity significance** (Figure 3).

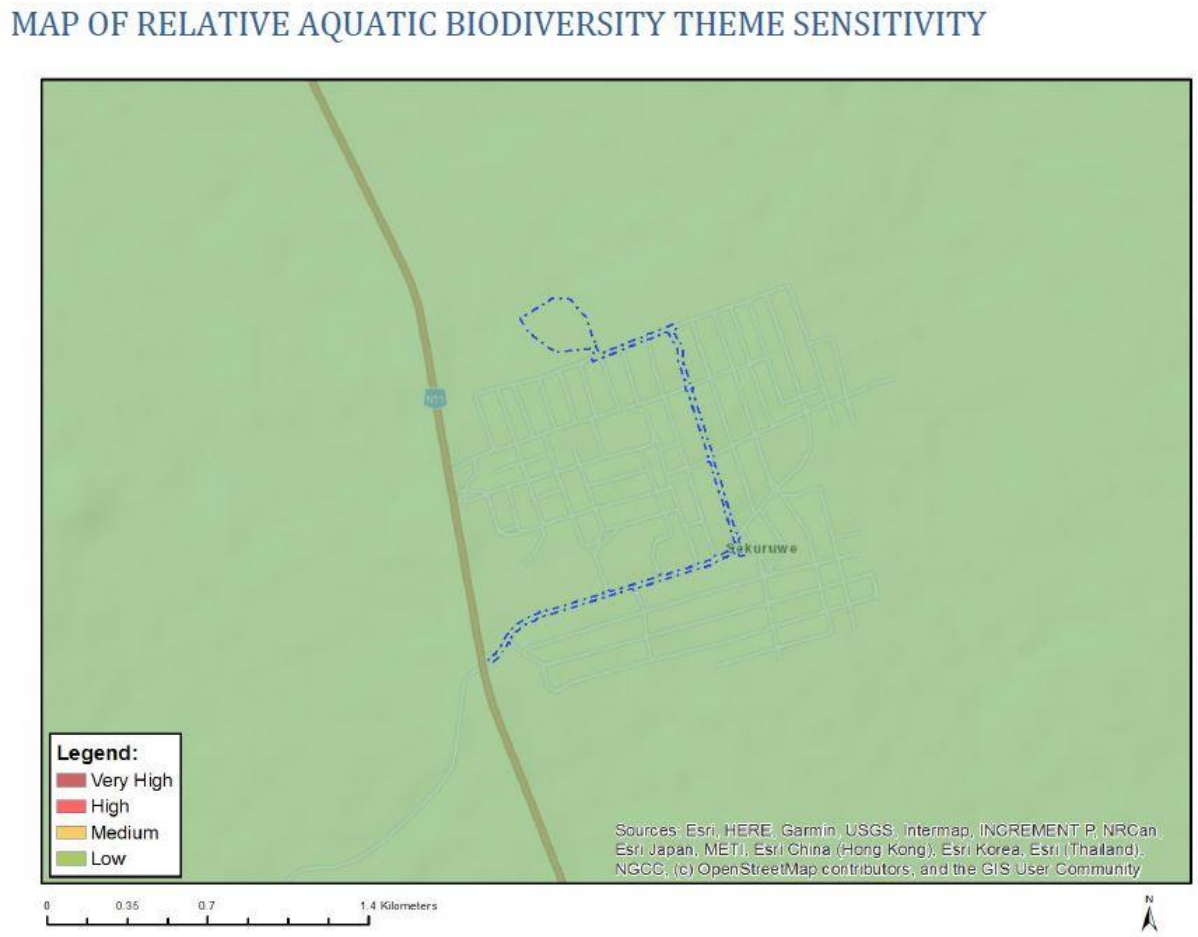

Figure 3: Map of relative aquatic biodiversity according to the Web-based DFFE Screening Tool, indicating 'low' sensitivity for the study and investigation areas.

As detailed in Section 6 below, certain freshwater ecosystems were confirmed to occur in the investigation area, including an EDL located in relatively close proximity to the north-eastern edge of the WTW development site. No freshwater ecosystems are located within the footprint of the Sekuruwe WTW development site or along the access road. Accordingly, as only indirect impacts are likely to be able to be generated and due the physical characteristics of the freshwater ecosystems – i.e. their episodic nature as first order drainage lines, the proposed development will be unlikely to pose a high risk to the regional aquatic biodiversity or freshwater ecosystems in the area. Accordingly the sensitivity assigned to the study and investigation areas is not disputed and the assessment approach of undertaking an Aquatic Biodiversity Compliance Statement has been undertaken.

5. DESKTOP INVESTIGATION FINDINGS

The following section contains data accessed as part of the desktop assessment and is presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for the integration of results by the reader to take place. Where required, further discussion and interpretation are provided, and information that was considered of importance was emboldened.

It is important to note that although all data sources are used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Sekuruwe WTW’s actual site characteristics at the scale required to inform the EA process. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment 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. The information contained in the dashboard report below is intended to provide background to the landscape of the proposed Sekuruwe WTW and the associated investigation area. Actual site conditions at the time of the assessment may differ from the background information provided by various datasets. The results are summarised in the dashboard and relevant maps below.

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the Sekuruwe WTW Study Area and investigation area [Quarter Degree Square (QDS) 2328DD].

Aquatic ecoregion and sub-regions in which the study and investigation areas are located	
Ecoregion	Eastern Bankenveld
Catchment	Limpopo
Quaternary Catchment	A61G
WMA	Limpopo
subWMA	Mogalakwena
Dominant characteristics of the Eastern Bankenveld Aquatic Ecoregion Level 2 (9.01) (Kleynhans et al., 2007)	
Terrain morphology	Closed hills, mountains; moderate and high relief
Dominant primary vegetation types	Clay Thorn Bushveld
Altitude (m a.m.s.l)	1100 to 1700
MAP (mm)	300 to 600
Coefficient of Variation (% of MAP)	25 to 34
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	16 to 20
Winter temperature (July)	2 to 20
Summer temperature (Feb)	12 to 28
Median annual simulated runoff (mm)	20 to 40; 40 to 80

Landtype Data

The study area and investigation area are characterised by the **Ae335** land type. Ae land type groupings consist of red and yellow, freely drained apedal soils of the Hutton, Griffin and Clovelly soils occupying more than 40% of the landscape. Deeper (> 300 mm, but generally 500 to 1 000 mm) red soils of the Hutton form are dominant. Mispah and Glenrosa soils usually occupy significant proportions of the landscape. Soils with neocutanic, plinthic, duplex horizons and shallow black clay soils may occupy small proportions of the landscape. Katspruit, duplex soils and black clay soils usually occupy bottomland terrain positions with streambeds and erosion.

Detail of the study and investigation areas in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The study area is located within an Upstream Management Catchment which is required to prevent the downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).
NFEPA Wetlands	According to the NFEPA Database, there are no wetland features located within the study area and investigation area.
Wetland Vegetation Type (Figure 4)	The majority of the study area and investigation area is situated within the Central Bushveld Group 6 Wetland Vegetation Type, considered Critically Endangered as provided by Mbona *et al.* (2015). The remaining southern portion of the investigation area is situated within the Central Bushveld Group 4 Wetland Vegetation Type, considered Vulnerable.
NFEPA Rivers	According to the NFEPA Database, no rivers occur within the study or investigation areas. The closest river is an unnamed tributary of the Mogalakwena River approximately 6 km to the south. The unnamed tributary is considered moderately modified (Class C) and an upstream management river.

National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE)

According to the NBA SAIIAE (2018) database, there are no wetland features located within the study and investigation areas, corresponding with the NFEPA Database. The NBA Database corresponds with the NFEPA Database, with regards to the unnamed tributary of the Mogalakwena River. The Ecosystem Threat Status (ETS) of the river is critically endangered (CR) and the Ecosystem Protection Level (EPL) is Poorly Protected (PP).

National Web Based Environmental Screening Tool (2020) (Figure 4)

The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed residential development footprint to avoid sensitive areas.

The Aquatic Sensitivity of the entire study and investigation area is considered to be of low sensitivity.

Strategic Water Source Areas (SWSA, 2017) for groundwater or surface water

The study area and investigation area is not situated within a SWSA.

Limpopo Conservation Plan (C-Plan, 2018; Figure 5)

Other Natural Areas	The entire water treatment works plant and small sections of the access road are located within an area considered to be **other natural areas (ONAs)**. These are natural and intact areas but are not required to meet targets, nor have they been identified as CBAs or ESAs.

	Land Management Recommendations: No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing "Not Natural" areas should be favoured for development before "ONAs".
No Natural Remaining	Most of the access road is located within areas considered to have **No Natural Habitat Remaining.** These are areas with no significant direct biodiversity value. These are either not natural areas or degraded natural areas that are not required as ESA. These areas include intensive agriculture, urban, industry, and human infrastructure. **Land Management Recommendations:** No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing "Not Natural" areas should be favoured for development before "Other natural areas".

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; EPL = Ecosystem Protection Level; ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; LT = Least Threatened; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA= National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; NP = Not Protected; ONA = Other Natural Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area; OHPL = Overhead Powerline..

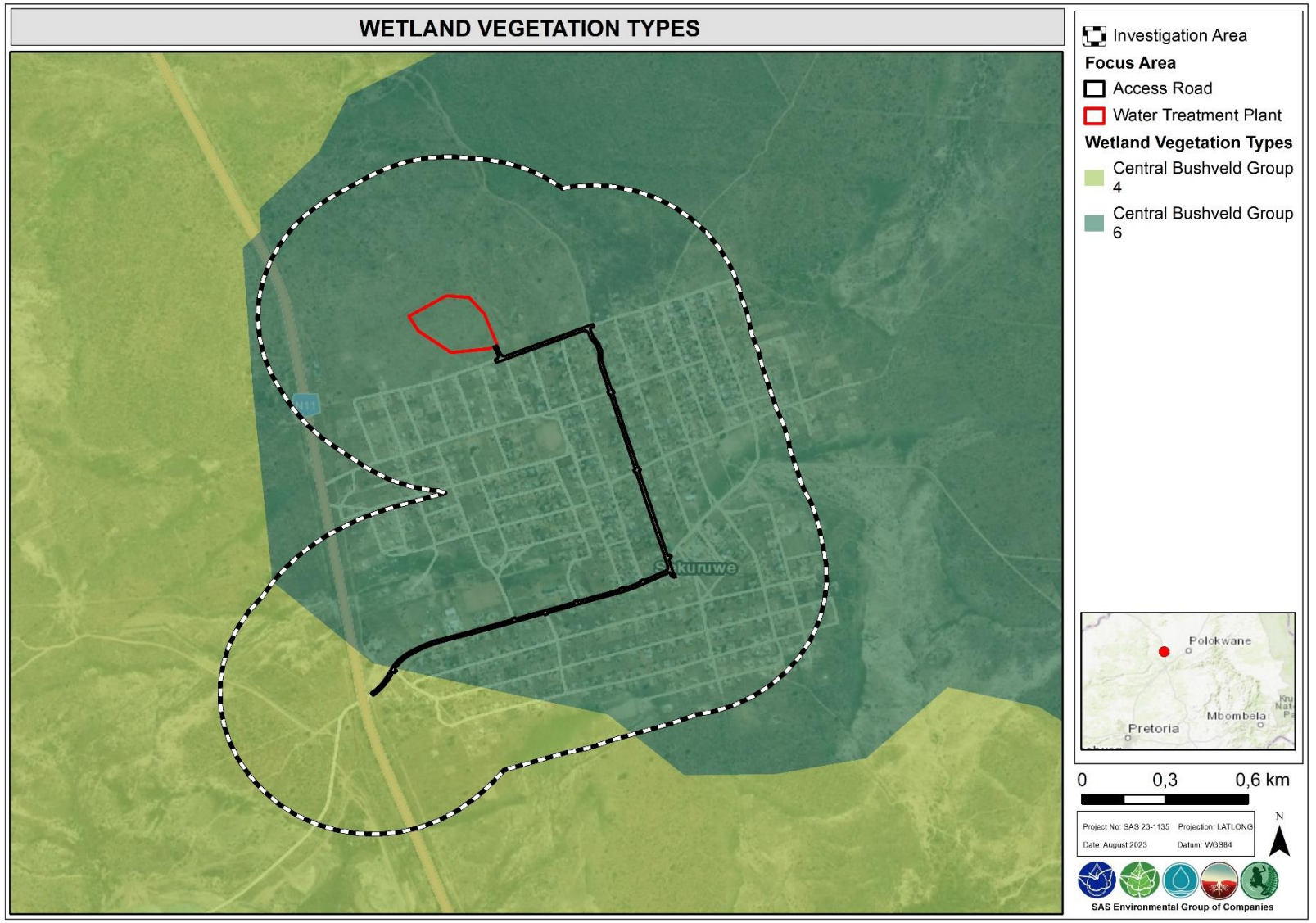

Figure 4: Wetland Vegetation (WetVeg) types associated with the proposed Sekuruwe WTW study area and associated investigation area according to the NFEPA (2011) database.

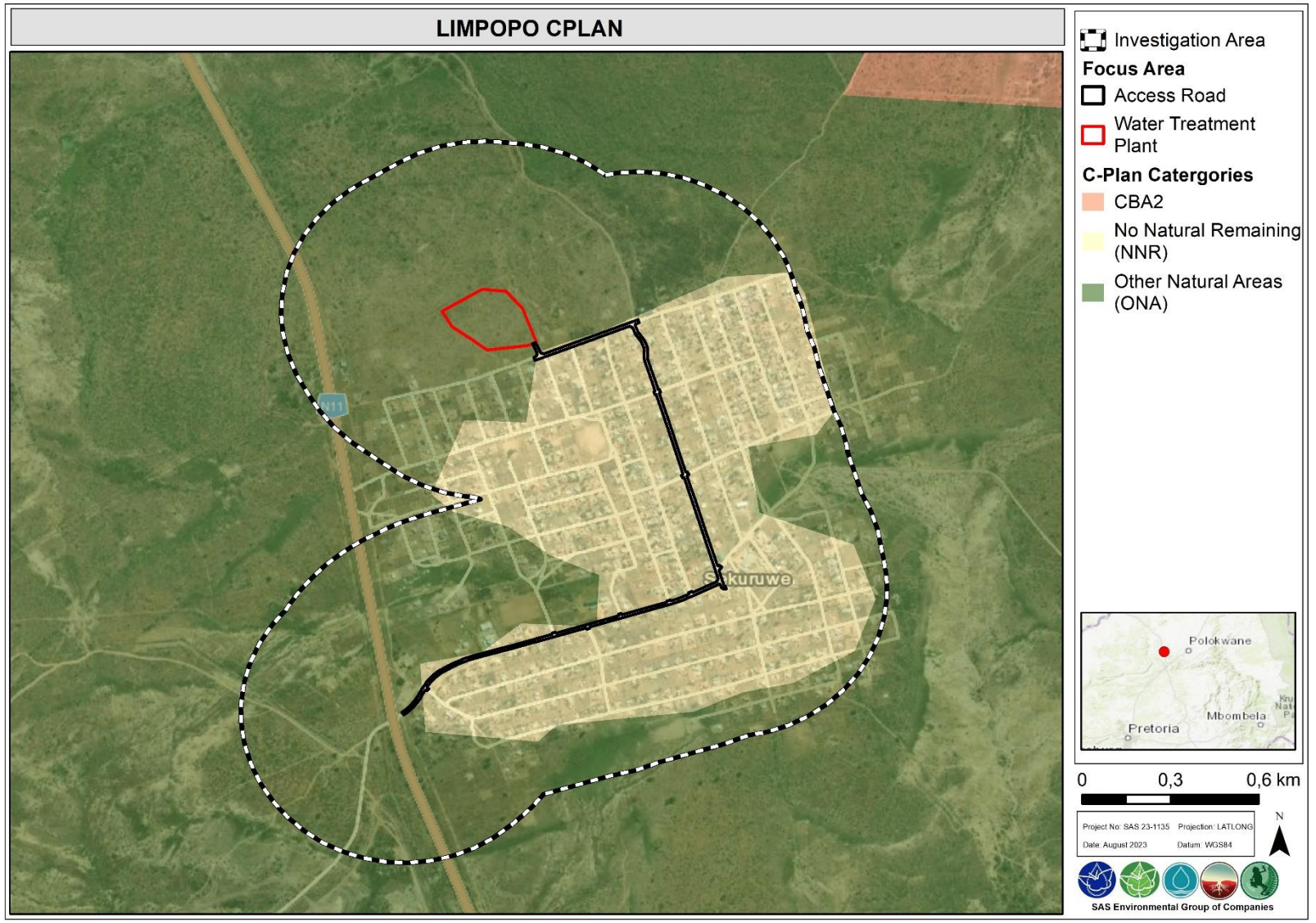

Figure 5: Areas of ecological importance associated with the proposed Sekuruwe WTW study area and associated investigation area according to the Waterberg District Bioregional Plan (2019) (Limpopo Conservation Plan v2).

6. RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

6.1 Freshwater Ecosystem Characterisation and Delineation

The desktop and site assessment confirmed the presence of four (4) freshwater ecosystems associated with the investigation area, with no freshwater ecosystems occurring in the study area (development site). All such freshwater ecosystems are episodic drainage lines (EDLs):

- An EDL that rises in the area just to the north of the edge of the Sekuruwe Settlement and located close to the north-eastern boundary of the study area, draining northwards through the investigation area;
- An EDL located in the north-western part of the investigation area; and
- Two EDLs draining south-westwards from the edge of Sekuruwe in the south-western part of the investigation area.

The absence of any freshwater ecosystems on the development site (i.e. within the study area) has important implications for the development of the site as no freshwater-related development constraints are associated with the site as detailed in Section 7.

The freshwater ecosystems identified were classified according to the Classification System (Ollis *et al*., 2013) as Inland Systems. The freshwater ecosystems fall within the Bankenveld Ecoregion and the Central Bushveld Groups 4 and 6 WetVeg (wetland vegetation) groups, classified by Mbona *et al*. (2015) as "Vulnerable" and "Critically Endangered" respectively. At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 2, below.

Table 2: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al*., 2013) of the freshwater ecosystems associated with the Sekuruwe WTW study and investigation areas.

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

The delineated extent of the freshwater ecosystems relative to the proposed Sekuruwe WTW study area and associated investigation area are depicted in Figure 6 below.

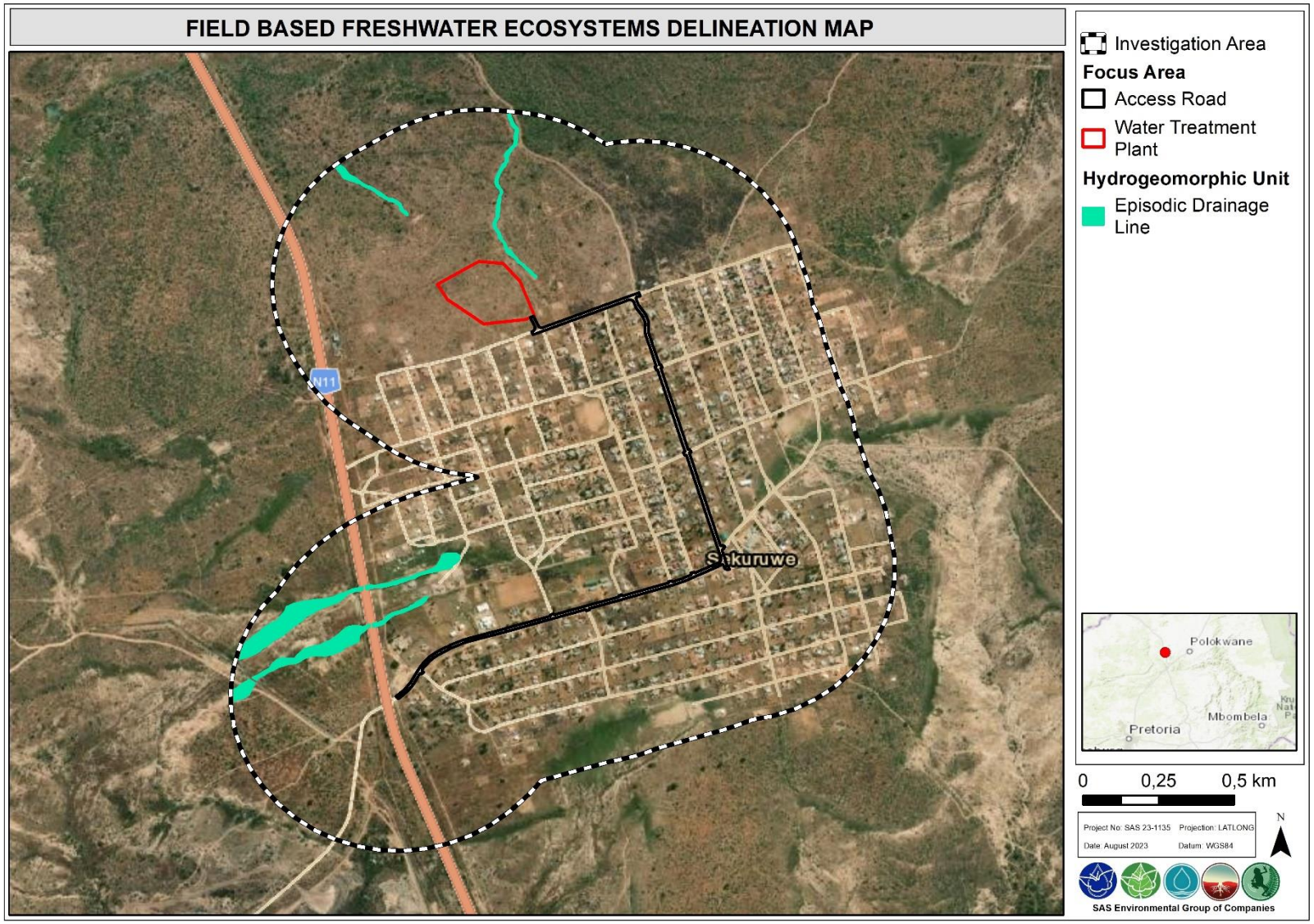

Figure 6: Delineated freshwater ecosystems associated with the proposed Sekuruwe WTW study area and associated investigation area.

6.2 Freshwater ecosystem: Site Verification Results

As detailed above, four (4) freshwater ecosystems were confirmed to occur within the investigation area of the proposed development. The settlement of Sekuruwe straddles a local high point and catchment divide, with most of the settlement being located on a crest or on the upper parts of the midslopes in a terrain setting context. Accordingly there is very limited freshwater occurrence within the confines of the settlement and due to its terrain position all surface water drainage flows away from the settlement. The proposed WTW study area is located on ground that slopes downwards in a northerly direction and thus the two EDLs located in the north of the investigation area rise in the area to the north of Sekuruwe, draining northwards. The two EDLs in the south-western part of the investigation similarly rise on the outskirts of the settlement close to the N11 national road, draining south-westwards towards the Mogalakwena Mine Waste Rock Dump.

The EDL located in relatively close proximity to the north-eastern boundary of the WTW (approximately 32m at its closest point) rises in a degraded area to the north of the settlement. The EDL is a narrow channelled feature that is characterised by a poorly defined channel which has largely eroded down to shallowly-outcropping bedrock and which contains some gravelly alluvial material. The EDL is characterised by a relatively steep longitudinal profile The EDL is characterised by a narrow riparian zone, which naturally consists of a mix of herbaceous vegetation and scattered small trees and shrubs. Many of the larger trees have been felled or cut back for firewood, however the woody vegetation and herbaceous substrate is of a different structure to the surrounding woody vegetation, thus constituting riparian vegetation. The hydrology of the EDL is expected to be highly episodic, only experiencing surface flows when precipitation events of sufficient duration and intensity occur to generate sufficient surface runoff. Such surface runoff is expected to be partly enhanced by the degradation (denudation of surface cover) of the upper parts of the catchment of the EDL, but much of the catchment of the EDL, especially as one moves further away from the settlement is more natural in character.

Figure 7: The upper part of the reach of the EDL (top left), gravelly alluvial material in the channel bed (top right) and the channel and riparian zone in the lower parts of the reach (bottom).

7. LEGISLATIVE REQUIREMENTS

The following legislative requirements were considered during the assessment.

- The Constitution of the Republic of South Africa, 1996[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) as amended (NWA);
- 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).

The legislative context of a regulated zone(s) of activity for the protection of freshwater ecosystems as based on the above legislation can be summarised as follows:

Table 3: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use Authorisation. Application for water uses as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) as amended. **Department of Water and Sanitation (DWS)**	**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 No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21 (c) and 21(i) is defined as: • **the outer edge of the 1 in 100 year flood line 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 in 100 year flood line 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 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 in 2017.	**Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations (as amended in 2017)** The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs—; a) within a watercourse; b) in front of a development setback; or c) **if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse**. excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". 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 nor the acts amending it are allocated act numbers.

Regulatory authorisation required	Zone of applicability
	(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.

As the development site is not located within any freshwater ecosystem (watercourse) or within the riparian zone of any of the freshwater ecosystems (as delineated), the WTW development site would not be located within the regulated area of a watercourse in terms of the delineated riparian zone, however in applying the NEMA precautionary principle, a 100m ZoR has been applied to the EDLs in the investigation area, thus a GN509-related zone of regulation (regulated area) will apply to the proposed development. A small portion of the study area is located within 32m of the delineated boundaries of the EDL located to the north-east of the development site**.** Thus a NEMA EIA Regulations-related 32m Zone of Regulation would apply to the application for the development of the WTW, as contemplated.

Figure 8 below indicates the Zones of Regulation as they related to the episodic drainage line located to the east of the development site.

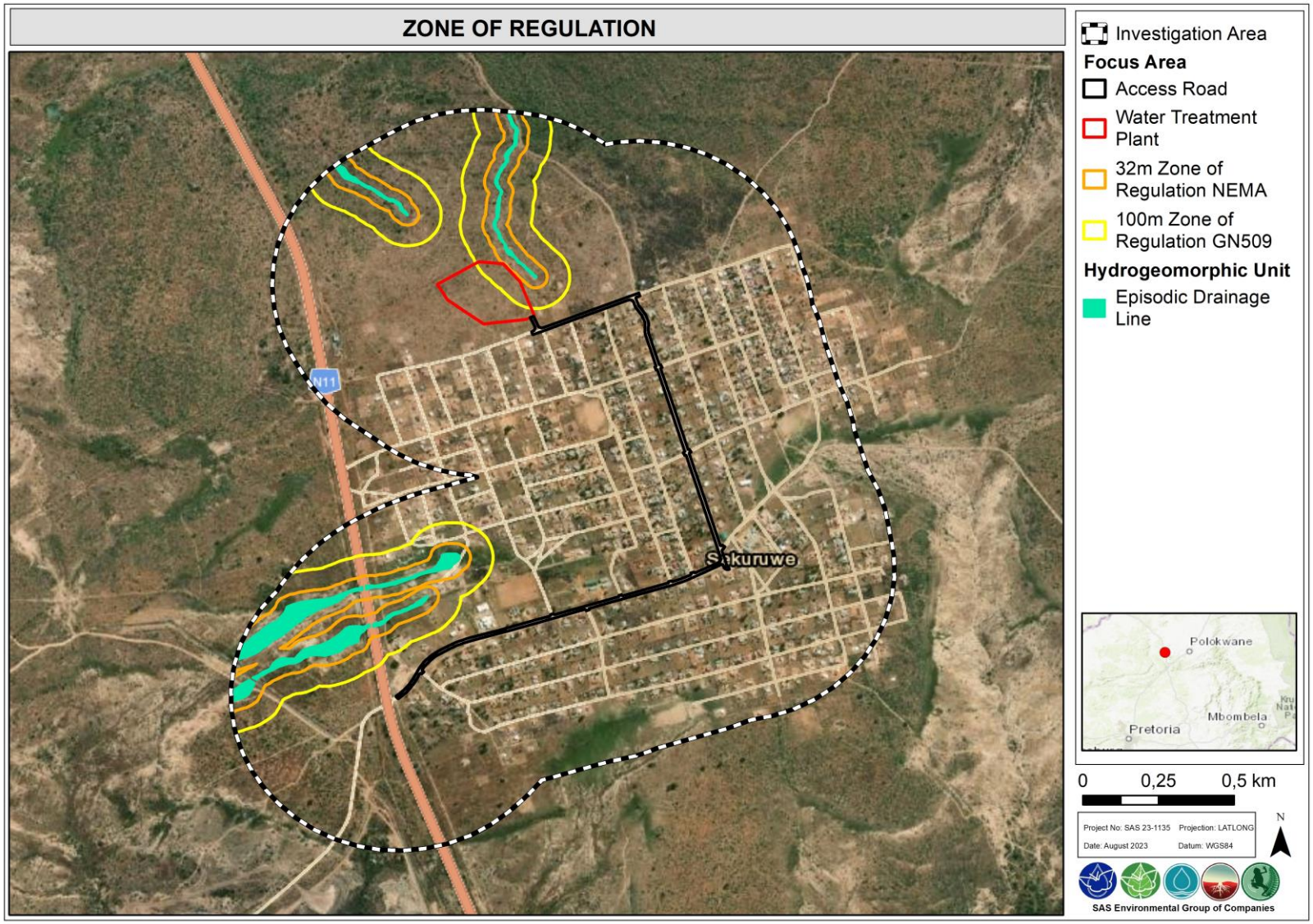

Figure 8: Potential Zones of Regulation related to NEMA and GN509 in the study and investigation areas.

8. RISK ASSESSMENT

This section presents the significance of potential impacts on the freshwater ecology of the freshwater ecosystems. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed activities and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

8.1 Risk assessment analysis

8.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the freshwater ecosystems associated with the proposed Sekuruwe WTW development, the DWS prescribed Risk Assessment Matrix (2016) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these freshwater ecosystems.

The points below summarise the considerations taken when applying the DWS Risk Assessment Matrix (2016):

- The DWS Risk Assessment Matrix (2016) was applied assuming that a high level of mitigation will be implemented, thus the results, provided in this report presents the perceived impact significance post-mitigation;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. (2013) (Please refer to Figure B1, Appendix B) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- As the WTW development footprint is partially located within the regulated area of a watercourse as defined by GN509, all legal issues pertaining to aspects and activities of the development were scored as “5”;
- While the operation of the proposed development will be a permanent activity, the construction thereof is envisioned to take no more than a few months to a year. However, the frequency of the construction impacts may be daily during this time; and
- Most impacts are considered to be easily detectable, with the exception of potential contamination of surface and groundwater which will require some effort. Assessing these potential impacts falls outside of the scope of this freshwater ecosystem study.

8.2 Risk Assessment discussion of anticipated ecological impacts

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of freshwater ecosystem habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the freshwater ecosystems; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the DWS Risk Assessment Matrix applied to the proposed development activities, is provided in the table below, whilst a comprehensive outcome of the risk assessment is presented in Appendix C.

Table 4: Summary of the results of the DWS risk assessment matrix applied to the freshwater ecosystems associated with the proposed WTW.

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment	Mitigation measures
Construction Phase	1	Site clearing prior and the set-up of contractor camps.	•Removal of vegetation leading to exposure and associated disturbances to soil; •Increased likelihood of dust generation in adjacent freshwater ecosystems due to exposed soil; •Removal of topsoil and creation of topsoil stockpiles; •Potential creation of access roads on the development site to facilitate contractor laydown and subsequent construction activities; •Laydown of construction offices and ablution facilities.	•Increased runoff and possible development of erosion, or exacerbation of existing erosion resulting in increased potential sedimentation and within the channel and riparian zone of the drainage line on the boundaries of the study area; •Anthropogenic and noise-pollution to surrounding biota.	1	3	10	**45**	**L**	**N/A**	• The design of the facility must ensure that the construction and development footprint does not encroach upon the delineated EDL, or the NEMA 32m ZoR as a buffer. • The riparian zone (outer boundary of the riparian zone) of the adjacent EDL must be cordoned off using a suitable barrier or material which is also able to control sedimentation.  **Figure A: Example of a barrier fence used to demarcate the no-go area around the 32mZoR around a freshwater ecosystem.** •All construction and site clearing must take place during the dry season to limit potential stormwater-related impacts to downgradient drainage lines as a result of construction activities; •Areas which are to be cleared of vegetation including contractor laydown areas must remain as small as possible and it must be ensured as far as possible that vegetation clearing is focused to the proposed infrastructure footprint on the development site; •Areas to be cleared of vegetation must be cleared in a controlled, phased manner and no indiscriminate clearing of vegetation must occur; •Contractor laydown areas must remain within the development footprint;

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment	Mitigation measures
											•An Environmental Control Officer (ECO) must be appointed in order to ensure all water related aspects are adequately mitigated for the construction phase of the proposed development.
	2	General Construction Activities on the WTW Site	•Storage and handling of hazardous materials; •General construction waste management; •Movement of construction personnel and equipment / machinery.	•Potential pollution of the adjacent drainage line due to poor management of hazardous materials such as paint, hydrocarbons, etc; •Damage to / degradation of (including pollution of) freshwater habitat due to dumping of construction material / construction waste within the delineated extent of the adjacent drainage line.	1.5	4.5	12	**54**	**L**	**N/A**	•Storage of hazardous materials on parts of the construction site >100m from the riparian zone boundaries; •Storage of hazardous materials in a bunded contained space; •Immediate remediation of hazardous material spills; •Clear demarcation of the riparian boundaries of the adjacent drainage line as a no-go area; •Establish a formal construction waste control system that is properly controlled and enforced.
	3	Ground-breaking, excavation of foundations and other construction related earthworks	•Removal of topsoil and creation of soil stockpiles upgradient of the drainage lines on the boundaries of the site; •Potential runoff of sediment and waste	•Disturbances of soil leading to increased alien vegetation proliferation, and in turn to altered freshwater ecosystem habitat;	1	4	13	**52**	**L**	**N/A**	•The following measures are recommended to mitigate against indirect impacts with regards to excavation and soil compaction activities associated with both site construction activities and access road upgrading: • A construction-phase stormwater control system must be implemented as part of the development and implementation of stormwater controls across all development phases. Temporary measures must be used to control construction phase stormwater - e.g. the use of berms, silt traps

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment	Mitigation measures
		upgradient of / within the catchment of the drainage line on the north-eastern side of the development site.	material into the drainage line to the north-east of the site boundary; •The movement of construction machinery, personnel and equipment upgradient of the drainage line to the north-east of the site boundary; •Mixing and casting of concrete for construction purposes upgradient of the drainage line.	•Altered runoff patterns within the landscape, leading to increased potential erosion and sedimentation of freshwater ecosystem habitat; •Potential for deteriorated water quality, including increased likelihood of dust generation, turbidity and sedimentation within the drainage line located to the north-east of the site boundaries; •Noise disturbance to avifauna and aquatic biota associated with the drainage line on the site boundaries.							/ silt curtains, along with the retention of natural vegetation where possible; •During excavation activities, it must be ensured that stockpiles are not higher than 2 m in height and 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 drainage line. Furthermore, measures must be undertaken to limit the time in which soil is exposed; •Dust suppression measures must be implemented (such as spray watering on gravel roads) throughout the proposed development activities to prevent excessive dust which may adversely affect riparian vegetation within the drainage lines; With regards to concrete mixing on site: Concrete and cement-related mortars can be toxic to aquatic life and other biota. Proper handling and disposal are considered imperative to minimise or eliminate discharge into the drainage lines. High alkalinity associated with cement can dramatically affect and contaminate both soil and ground water. The following recommendations must be adhered to: •Fresh concrete and cement mortar must not be mixed near the north-eastern site boundaries or within 100m of the edge of the delineated extent of the drainage line riparian zone; •Mixing of cement must only be undertaken within the construction camp and may not be mixed on bare soils; •Mixing of cement is also to be strictly undertaken within a lined, bound or bunded portable mixer. Ready mix concrete must preferably be used; •A batter board or other suitable platform/mixing tray is to be provided onto which any mixed cement can be deposited whilst it awaits placing; •A washout area must be designated within the part of the development site that is located outside of the 100m buffer of the delineated riparian zone boundary;
	4	Upgrading of the access road to the WTW that traverses Sekuruwe.	•Potential upgrading of the surface of the tarred section of the access road within Sekuruwe; •Potentially tarring of the unsurfaced	•Degradation of the freshwater resource quality of freshwater ecosystems due to potential transport of pollutants, such as bitumen, paints,	1	4	12	**48**	**L**	**N/A**	

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment	Mitigation measures
			section of the access road in the northern part of Sekuruwe and on the northern outskirts of Sekuruwe.	other chemicals and silt into downgradient freshwater ecosystems by means of stormwater;							•Cement bags must be disposed of in the demarcated hazardous waste receptacles; •Liquid cement spillage outside of the demarcated area must be promptly removed and taken to a suitably licenced waste disposal site.
Operational phase	**5**	Design and Operation of stormwater attenuation facilities on the development site.	•Operation of stormwater infrastructure and discharge of stormwater into drainage line on the north-eastern boundary of the development site.	•Potential pollutants and toxicants entering into the downgradient drainage lines; •Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines; •Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased	1	5	11	**55**	**L**	**N/A**	•Stormwater infrastructure on the development site must be designed in line with the principles of SuDS in order to polish stormwater by trapping sediments and by removing pollutants that could pollute downgradient freshwater ecosystems, and in order to allow the gradual discharge of stormwater into the drainage lines following rainfall events. •As such the use of 'soft' engineering features such as bioswales that are vegetated with suitable vegetation that are tolerant of both wet and dry conditions is strongly recommended. •The use of stone pitching to reduce velocity of stormwater is strongly recommended; •The proposed stormwater infrastructure must also be incorporated into a suitable and site-specific Stormwater Management Plan (SWMP).

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment		Mitigation measures
				stormwater discharge causing increased scour and velocity.								
	6	Operations and maintenance of the development.	•Potential failure of infrastructure that could lead to leakage of, or accidental discharge of untreated raw water from the WTW that could enter the downgradient drainage line, resulting in potential pollution of, and alteration of the hydrology of the drainage line; •Indiscriminate movement of vehicles and vegetation trampling within the adjacent drainage line as part of maintenance activities.	•Potential contamination and deterioration of water quality within the drainage line in the event of a spill of untreated raw water; •Change to the flow regime of the episodic drainage line if large volumes of water over a longer time period are discharged into the drainage line from the WTW; •Damage to riparian habitat within the drainage lines and potentially decreased ecoservice provision and disturbance to biota during maintenance activities.	1.25	6.25	9	**56.25**	**M**	**56.25-1.25=55**	**L**	**•It should be ensured that regular maintenance takes place to prevent failure of any water treatment infrastructure associated with the proposed development;** •Maintenance activities must be confined to the developed footprint of the WTW which must be fenced off to prevent accidental access into the adjacent freshwater ecosystems (riparian zones); **•Immediate remediation and repair in the event of a breakdown;** •A formal waste management and disposal system must be implemented at the WTW.

Phase	No	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Manual Adjustment	Mitigation measures
	7	Operations and maintenance of the development.	•Handling of / disposal of water treatment residue (waste by product)	•Potential discharge of water treatment residue into the adjacent drainage line (as one of the potential options for handling residue / waste from the water treatment process)[4]; that could permanently alter the hydrological characteristics and water quality of the receiving EDL;	1.75	6.75	12	**81**	**M**	**N/A**	•It is recommended that water treatment residue (waste byproduct from the treatment process) not be discharged into the adjacent (downgradient) EDL or other EDL in the investigation area, and that options for the disposal of the residue at a suitable landfill site, or its re-use for mining / agricultural activities.

[4] As detailed in "Mogalakwena Water Scheme Technical Memorandum 2.0: Water Treatment Residue Management Review"

The activities associated with the construction of the proposed Sekuruwe WTW pose a “Low” risk significance to the freshwater ecosystems within the study and investigation areas, provided that all mitigation measures as detailed are implemented. However operational activities pose a “Medium” risk. The general operations and maintenance of the WTW risk rating falls with the borderline Low/Medium margin and provided that certain mitigation measures (detailed in red above) are implemented this risk can be lowered to a “Low” risk significance.

The potential disposal of water treatment residue into the EDL located to the north-east of the WTW site, or into another EDL in the investigation area would pose a “Medium” risk rating. This risk is related to the pollution risk of such residues as these can contain coagulants which can contain heavy metals, for example (Mokonyama *et al*, 2017), as well as changes to the hydrological regime of the EDL. It is thus recommended that the residues not be discharged into a freshwater resource (one of the options for handling of residue as detailed in the design for the WTW) but should rather be disposed of at a registered landfill site, or re-utilised for agricultural or mining purposes. Should the residue not be discharged into the downgradient or other EDL, then this impact will not materialise.

In addition, all mitigation measures as stipulated in the above table, must be implemented to prevent any edge effects and cumulative impacts from occurring on the freshwater ecosystems within the study and investigation areas.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed WTW are likely to be reduced during the construction and operational phases assuming that a high level of mitigation takes place. Additional “good practice” mitigation measures applicable to a project of this nature are provided in **Appendix E** of this report.

9. IMPACT ASSESSMENT

Tables 5 and 6 have assessed all potential impacts on the freshwater environment in the study area and investigation areas according to the method described in Appendix D (as provided by the EAP). It should be noted that the tables also provide the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 5 – Construction-phase impacts and recommended mitigation

Impact	Pre-mitigation:						Recommended mitigation	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Potential sedimentation of drainage line due to site clearing and poor stormwater management	Short-term	Local	Moderate negative	Slightly detrimental	Unlikely	Very low - negative	•Implementation of construction-phase stormwater controls - e.g. use of silt curtains, berms etc., as part of a multi-phase SWMP for the WTW; •Limiting of clearing of natural vegetation in non-developed parts of the development site footprint.	Short-term	Site-specific	Low negative	Negligible	Unlikely	Very low - negative
Potential pollution of the adjacent drainage line due to poor management of hazardous materials such as paint and hydrocarbons	Short-term	Local	Moderate negative	Slightly detrimental	Unlikely	Very low - negative	•No storage of hazardous materials on parts of the construction site within 100m from the riparian zone boundaries; •Storage of hazardous materials in a bunded contained space; •Immediate remediation of hazardous material spills.	Short-term	Site-specific	Low negative	Negligible	Unlikely	Very low - negative
Potential pollution of the adjacent drainage line due to poorly controlled cement mixing / batching	Short-term	Local	Moderate negative	Slightly detrimental	Unlikely	Very low - negative	•Fresh concrete and cement mortar must not be mixed near the north-eastern site boundaries or within 100m of the edge of the delineated extent of the drainage line riparian zone; •Mixing of cement must only be undertaken within the construction camp and may not be mixed on bare soils; •Mixing of cement is also to be strictly undertaken within a lined, bound or bunded portable mixer. Ready mix concrete must preferably be used; •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; •A washout area must be designated within the part of the development site that is located outside of a 100m buffer of the delineated riparian zone boundary; •Cement bags must be disposed of in the demarcated hazardous waste receptacles; •Liquid cement spillage outside of the demarcated area must be promptly removed and taken to a suitably licenced waste disposal site.	Short-term	Site-specific	Low negative	Negligible	Unlikely	Very low - negative

Impact	Pre-mitigation:						Recommended mitigation	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Indiscriminate movement of vehicles and personnel in the adjacent drainage line and potential dumping of construction material / construction waste in the adjacent drainage line	Short-term	Local	Moderate negative	Slightly detrimental	Unlikely	Very low - negative	•Clear demarcation of the riparian boundaries of the adjacent drainage line as a no-go area; •Establish a formal construction waste control system that is properly controlled and enforced	Short-term	Site-specific	Low negative	Negligible	Unlikely	Very low - negative
Potential pollution of downgradient drainage lines by sediment and other pollutants such as paint / bitumen resulting from road upgrading activities	Short-term	Local	Moderate negative	Slightly detrimental	Unlikely	Very low - negative	•Clear demarcation of the riparian boundaries of the adjacent drainage line as a no-go area; •Establish a formal construction waste control system that is properly controlled and enforced	Short-term	Site-specific	Low negative	Negligible	Unlikely	Very low - negative

Table 6 – Operational-phase impacts and recommended mitigation

Impact	Pre-mitigation:						Recommended mitigation	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Alteration of hydrology and geomorphology of adjacent drainage line due to poor operational stormwater management at the WTW	Long-term	Local	Moderate negative	Moderately detrimental	Unlikely	Low - negative	•Inclusion of formal stormwater controls in the operational design of the WTW facility; •Inclusion of SuDS principles in the operational stormwater design for the WTW facility.	Long-term	Site-specific	Low negative	Slightly Detrimental	Unlikely	Very low - negative
•Potential discharge of treatment residue into the adjacent drainage line (as one of the potential options for handling residue / waste from the water treatment process) ; that could permanently alter the hydrological characteristics and water quality of the receiving EDL.	Long-term	Local	High negative	Highly detrimental	Fairly likely	Moderate - negative	•It is recommended that water treatment residue (waste byproduct from the treatment process) not be discharged into the adjacent (downgradient) EDL or other EDL in the investigation area, and that options for the disposal of the residue at a suitable landfill site, or its re-use for mining / agricultural activities.	Long-term	Site-specific	Moderate-gative	Moderately Detrimental	Unlikely	Low – negative

9.1.1 Cumulative and Residual Impacts

Freshwater ecosystems within the region are under continued threat due to urban and mining related development and expansion, alien invasive vegetation encroachment and pressures associated with landuse practices in a communal rural setting. As detailed above, no direct impacts on the nearest freshwater ecosystems are likely to be generated as the footprint of WTW will be kept outside of the delineated extent of the adjacent drainage line and a certain area of vacant land located between the WTW and the delineated edge of the riparian zone. Accordingly only indirect impacts could materialise on the drainage line draining to the north-east of the WTW site.

Should indirect impacts associated with stormwater runoff and potential pollution materialise, this would constitute a cumulative impact in terms of the further overall degradation of freshwater ecosystems in the wider area, especially as downstream reaches and other components of the wider drainage system could be impacted. Such a cumulative impact associated with the proposed development would be able to be avoided if the potential indirect impacts associated with the WTW were effectively mitigated or avoided.

Residual impacts arise from activities of which the effects persist long after the activity has ceased due to the self-perpetuating nature of such impacts (e.g. erosion). Residual impacts may cease with human remediation or when the trajectory of ecosystem imbalance caused by such an impact is complete. Due to the disturbance of soil and removal of vegetation that will commence with the WTW construction activities, there may be an increase in alien and invasive species entering the system, which may then persist long after construction activities have been completed. In addition, the possible onset of erosion associated with construction activities and extending into the operational period of the development could transpire, given the nature of soils and the sloping nature of terrain in the area in which the proposed WTW and adjacent drainage line area located. Such initiation of further erosion in the catchment of the drainage lines, in particular erosion associated with the clearing of vegetation and resultant, long term exposure of soils and associated altered runoff patterns may result in greater inputs of sediment into and eventual smothering of riparian vegetation over time.

It is expected that the impacts associated with the proposed WTW on the freshwater ecosystems in the adjacent area would be unlikely to contribute to residual effects on freshwater ecosystem habitat within the local area provided that cognisant, well-planned design is implemented.

10. CONCLUSION

10.1 Summary of Desktop Verification Outcome/Findings

Based on the site verification undertaken by Scientific Aquatic Services and the findings thereof presented in this report, no freshwater ecosystems were confirmed to be located in the study area (i.e. within the footprint of the proposed development), and the only freshwater ecosystem located in relatively close proximity to the study area is an episodic drainage line that is located north-east of the study area boundary. Further drainage lines are located in the northern and south-western parts of the investigation area.

Due to the absence of any freshwater ecosystems within the study area (development footprint) the development is unlikely to result in any direct, transformative impacts on any freshwater ecosystems. At its closest point, the delineated riparian boundary of the EDL is located approximately 30m from the site boundary. This entails that indirect impacts could materialise if construction and operational activities are not properly controlled / managed.

The designation of low sensitivity to freshwater ecosystem features in the area by the DFFE web-based Environmental Screening Tool has been supported through the findings of the freshwater assessment. However this does not negate the need to protect and prevent impacts associated with the proposed development from impacting the episodic drainage lines that are located within the investigation area.

Under the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity, (GN320 of March 2020), for areas of low aquatic biodiversity sensitivity an Aquatic Compliance Statement has been produced. The findings of the Compliance Statement are detailed in Table 7 below.

Table 7: Outcome of Freshwater Assessment Findings

Screening Tool Assigned Sensitivity	Verified Sensitivity	Outcome Statement / Plan of Study	Relevant Section Motivating Verification
Low	The study and investigation areas have been verified to be **low** sensitivity in an aquatic biodiversity (freshwater) context. No freshwater ecosystems are located in the study area. Certain freshwater ecosystems in the form of episodic drainage lines – first order drainage features of limited extent and very limited hydroperiod are located in the investigation area but are not considered to be of very high aquatic biodiversity sensitivity.	Due to the low risk posed by the proposed WTW to the freshwater environment and due to the absence of freshwater ecosystems on the development site, an aquatic compliance statement is considered adequate for the application for EA for the Sekuruwe WTW development.	Section 6.3

10.2 Compliance Statement/Impact Statement

The Sekuruwe WTW, as being applied for, would be unlikely to directly affect or impact any freshwater ecosystems as no such freshwater ecosystems are located on the WTW development site. The closest freshwater ecosystem is located approximately 30m to the north-east of the development site boundaries and thus the potential for indirect impacts to materialise is possible. The risk profile to the freshwater environment associated with the proposed development is considered low to negligible, however in order to ensure that no indirect impacts on freshwater ecosystems materialise, it is critical that the mitigation measures identified in this report are implemented for all development phases.

10.3 Reasoned Opinion for issuing of EA.

Due to the absence of any freshwater ecosystems on the development site and due to the designation of low aquatic biodiversity sensitivity to the study and investigation areas, the development of the Sekuruwe WTW will not exert any significant impact on the freshwater environment, provided that the mitigation measures as stipulated in this report are implemented and adhered to. As such it is the professional opinion of the freshwater specialist that the proposed Sekuruwe WTW development be granted Environmental Authorisation, subject to the implementation of all construction and operational mitigation measures as detailed in Section 8 and 9 of this report.

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APPENDIX A - INDEMNITY AND DECLARATION OF INDEPENDENCE

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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This report must not be altered or added to or used for any other purpose other than that for which it was produced without the prior written consent of the author(s). This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)
Paul da Cruz BA Hons (Geography and Environmental Studies) (University of Witwatersrand)

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

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural 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		

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

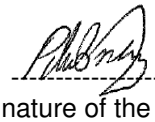
I, Stephen van Staden, declare that -

- 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

I, Paul da Cruz, 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

APPENDIX B – RISK 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 proponent 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'[5]. 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, 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[6].

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

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

Environmental Management Act (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, 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 freshwater ecosystems and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on freshwater ecosystems are notably and require mitigation measures on a higher level, which costs more and require specialist input. License required.
170 – 300	(H) High Risk	Freshwater ecosystem(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve License 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 proponent 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[7] 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

[7] Mitigation measures should address both positive and negative impacts.

- 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.

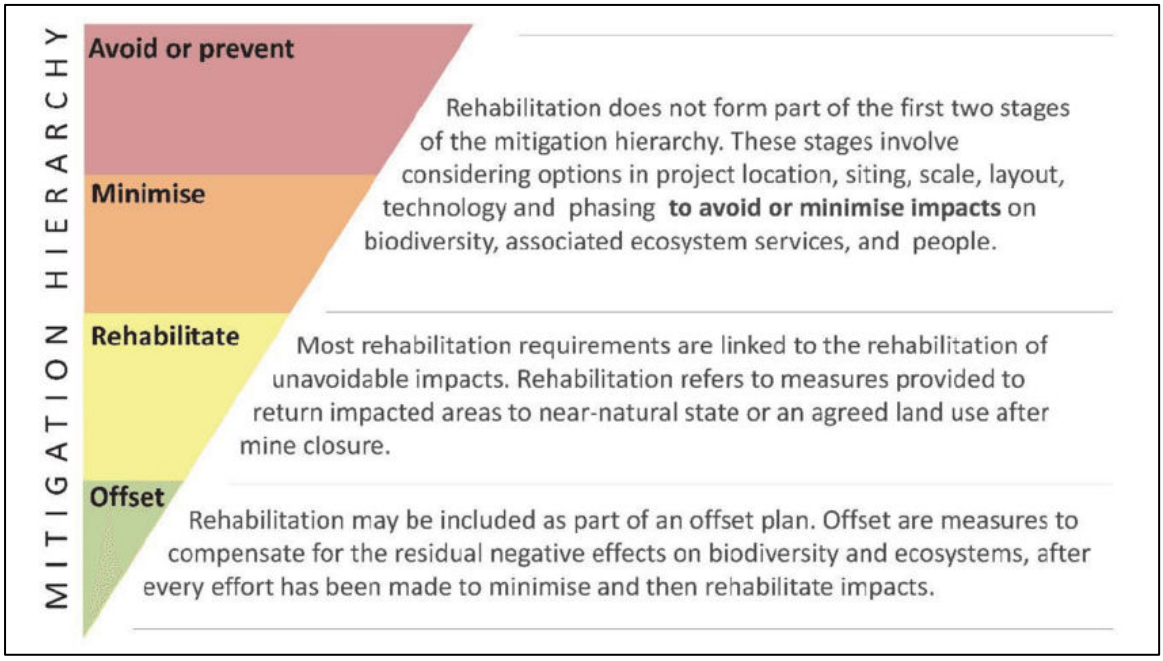


Figure D1: Impact Minimisation hierarchy as advocated by the DEA *et al.,* (2013)

Recommendations

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

Table D10: Reversibility of impacts on the freshwater ecosystems

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)

APPENDIX C – RISK ASSESSMENT OUTCOME

	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph+V	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Manual Adjustment
1	Construction phase	Site clearing prior and the set-up of contractor camps.	•Removal of vegetation leading to exposure and associated disturbances to soil; •Increased likelihood of dust generation in adjacent freshwater ecosystems due to exposed soil; •Removal of topsoil and creation of topsoil stockpiles; •Potential creation of access roads on the development site to facilitate contractor laydown and subsequent construction activities; •Laydown of construction offices and ablution facilities.	•Increased runoff and possible development of erosion, or exacerbation of existing erosion resulting in increased potential sedimentation and within the channel and riparian zone of the drainage line on the boundaries of the study area; •Anthropogenic and noise-pollution to surrounding biota.	1	1	1	1	1	1	1	3	5	4	5	1	15	45	L	N/A
2		General Construction Activities on the WTW Site	•Storage and handling of hazardous materials; •General construction waste management; •Movement of construction personnel and equipment / machinery.	•Potential pollution of the adjacent drainage line due to poor management of hazardous materials such as paint, hydrocarbons, etc; •Damage to / degradation of (including pollution of) freshwater habitat due to dumping of construction material / construction waste within the delineated extent of the adjacent drainage line.	1	2	2	1	1.5	1	2	4.5	4	2	5	1	12	54	L	N/A

	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph+V	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Manual Adjustment
3		Ground-breaking, excavation of foundations and other construction related earthworks upgradient of / within the catchment of the drainage line on the north-eastern side of the development site.	•Removal of topsoil and creation of soil stockpiles upgradient of the drainage lines on the boundaries of the site; •Potential runoff of sediment and waste material into the drainage line to the north-east of the site boundary; •The movement of construction machinery, personnel and equipment upgradient of the drainage line to the north-east of the site boundary; •Mixing and casting of concrete for construction purposes upgradient of the drainage line.	•Disturbances of soil leading to increased alien vegetation proliferation, and in turn to altered freshwater ecosystem habitat; •Altered runoff patterns within the landscape, leading to increased potential erosion and sedimentation of freshwater ecosystem habitat; •Potential for deteriorated water quality, including increased likelihood of dust generation, turbidity and sedimentation within the drainage line located to the north-east of the site boundaries; •Noise disturbance to avifauna and aquatic biota associated with the drainage line on the site boundaries.	1	1	1	1	1	1	2	4	4	3	5	1	13	52	L	N/A

	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph+V	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Manual Adjustment
4		Upgrading of the access road to the WTW that traverses Sekuruwe.	•Potential upgrading of the surface of the tarred section of the access road within Sekuruwe; •Potentially tarring of the unsurfaced section of the access road in the northern part of Sekuruwe and on the northern outskirts of Sekuruwe.	•Degradation of the freshwater resource quality of freshwater ecosystems due to potential transport of pollutants, such as bitumen, paints, other chemicals and silt into downgradient freshwater ecosystems by means of stormwater;	1	1	1	1	1	1	2	4	4	2	5	1	12	48	L	N/A
5	Operational phase	Design and Operation of stormwater attenuation facilities on the development site.	•Operation of stormwater infrastructure and discharge of stormwater into drainage line on the north-eastern boundary of the development site.	•Potential pollutants and toxicants entering into the downgradient drainage lines; •Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines; •Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased stormwater discharge causing increased scour and velocity.	1	1	1	1	1	1	3	5	3	2	5	1	11	55	L	N/A

	Phase	Activity	Aspect	Impact	Flow Regime	Water quality	Habitat (Geomorph+V	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Manual Adjustment	
6		Operations and maintenance of the development.	•Potential failure of infrastructure that could lead to leakage of, or accidental discharge of untreated raw water from the WTW that could enter the downgradient drainage line, resulting in potential pollution of, and alteration of the hydrology of the drainage line; •Indiscriminate movement of vehicles and vegetation trampling within the adjacent drainage line as part of maintenance activities.	•Potential contamination and deterioration of water quality within the drainage line in the event of a spill of untreated raw water; •Change to the flow regime of the episodic drainage line if large volumes of water over a longer time period are discharged into the drainage line from the WTW; •Damage to riparian habitat within the drainage lines and potentially decreased ecoservice provision and disturbance to biota during maintenance activities.	2	1	1	1	1.25	2	3	6.25	1	2	5	1	9	56.25	M	56.25-1.25=55	L
7			•Handling of / disposal of water treatment residue (waste by product)	•Potential discharge of water treatment residue into the adjacent drainage line (as one of the potential options for handling residue / waste from the water treatment process) ; that could permanently alter the hydrological characteristics and water quality of the receiving EDL.	2	2	2	1	1.75	2	3	6.75	3	3	5	1	12	81	M	N/A	

APPENDIX D – IMPACT ASSESSMENT METHODOLOGY

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

This section briefly outlines the proposed method for assessing the significance of the potential environmental and socio-economic impacts identified during the construction, operational and decommissioning phase.

For each predicted impact, criteria are applied to establish the significance of the impact based on likelihood (probability) and consequence, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place.

The criteria that contribute to the consequence of the impact are **INTENSITY** (the degree to which pre-development conditions are changed); the **DURATION** (length of time that the impact will continue); and the **EXTENT** (spatial scale) of the impact. The sensitivity of the receiving environment and/or sensitive receptors is incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria, based on expert knowledge. For each impact, the specialist applies professional judgement to ascribe a numerical rating for each criterion according to the ratings provided. The consequence is then established using the formula:

Consequence = intensity x (duration + extent)

Depending on the numerical result of this calculation, the impact's consequence would be classified as one of the following:

- Extremely; highly; moderately; slightly detrimental;
- Negligible; or
- Slightly, moderately, highly or extremely beneficial.

To determine the significance of an impact, the probability (or likelihood) of that impact occurring is also taken into account. In assigning probability, the specialist must take into account the likelihood of occurrence and the degree of uncertainty and detectability of the impact. Significance is calculated according to the following formula:

Significance = consequence x probability

Depending on the numerical result of this calculation, the impact would fall into a significance category of one of the following:

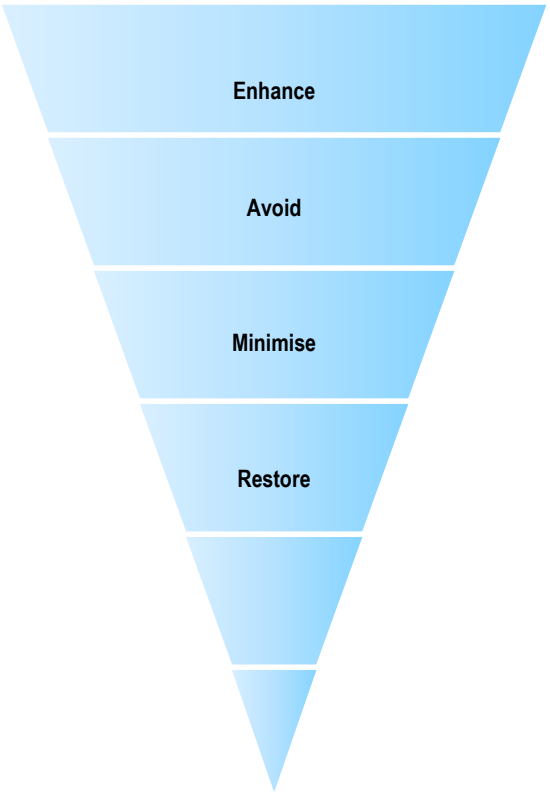
- Very Low;
- Low (negative or positive);
- Moderate (negative or positive);
- High (negative or positive);
- Very High (negative or positive).

METHODOLOGY FOR IDENTIFICATION OF MITIGATION MEASURES

The mitigation hierarchy (Figure D1) illustrates the actions which can be undertaken to respond to negative impacts and the preference give to mitigation measures. The topmost measures are preferred, and the preference for mitigation measures decreases the further one moves down the hierarchy.

For each impact assessed, mitigation measures will be proposed to reduce and/ or avoid negative impacts and enhance positive impacts. The mitigation measures identified by the specialists will be reviewed for feasibility with the proponent and then incorporated into the Environmental Management Programme (EMPr) during the EIA Phase to ensure that they are implemented throughout the lifecycle

of the proposed project. The EMPr would become a legally binding document should this project receive an Environmental Authorisation.



Impact avoidance: This step is most effective when applied at an early stage of project planning. It can be achieved by:

- Not undertaking certain projects or elements that could result in adverse impacts;
- Avoiding areas that are environmentally sensitive; and
- Putting in place preventative measures to stop adverse impacts from occurring.

Impact minimisation: This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- Scaling down or relocating the proposal;
- Redesigning elements of the project; and
- Taking supplementary measures to manage the impacts.

Impact compensation: This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- Example, by habitat enhancement;
- Restoration of the affected site or environment to its previous state or better; and
- Replacement of the same resource values at another location (off-set), for example, by wetland engineering to provide

The mitigation described in the above diagram represents the full range of plausible and pragmatic measures that can be implemented.

APPENDIX E – GENERAL "GOOD HOUSEKEEPING" MITIGATION MEASURES

General construction management and good housekeeping practices

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

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem if considered absolutely essential;
- 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 should avoid freshwater ecosystem areas and be restricted to existing or pre-approved access roads and should not traverse the freshwater ecosystem;
- Appropriate sanitary facilities must be provided for the life of the repair and maintenance 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 practised 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

- Proliferation of alien and invasive species is expected within any disturbed areas. Whilst not considered severe at this time, the vegetation component within the freshwater ecosystem environment is already transformed. However, alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystem 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); and
- Species-specific and area-specific eradication recommendations:
    - 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 freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- Sheet runoff from compacted areas should be slowed down by the strategic placement of berms;
- It is considered ideal that activities occur within the current season (low rainfall) to minimise impacts of sedimentation;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- Temporary stockpiling of excavated material from trenches can be retained alongside trenches, as required for backfilling. Any soil to be stockpiled for longer than a month should be moved to a designated stockpile area, as approved by the Environmental Control Officer (ECO);
- All soils compacted during the repair and maintenance phase 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 must be collected and disposed of at a suitable landfill site; and

All alien vegetation in the footprint area, as well as the immediate vicinity of the proposed work area should be removed.

APPENDIX F - CV OF SPECIALISTS

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 Licence 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

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF PAUL DA CRUZ

PERSONAL DETAILS

Position in Company	Senior Ecologist
Joined SAS Environmental Group of Companies	2022

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Certificated Scientist at South African Council for Natural Scientific Professions (SACNASP)
Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
Member of the South African Wetland Society (SAWS)

EDUCATION

Qualifications

BA (Hons) (Geography and Environmental Studies) (University of the Witwatersrand)	1998
BA (Geography) (University of the Witwatersrand)	1997

Short Courses

Taxonomy of Wetland Plants (Water Research Commission)	2017
Advanced Grass Identification (Frits van Outshoorn)	2010
Grass Identification (Frits van Outshoorn),	2009
Soil Form Classification and Wetland Delineation; (TerraSoil Science)	2008

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana
International – United Kingdom (England and Scotland

DEVELOPMENT SECTORS OF EXPERIENCE

1. Renewable energy (Wind and solar)
2. Linear developments (energy transmission, telecommunication, pipelines, roads, border infrastructure)
3. Nature Conservation and Ecotourism Development
4. Commercial development
5. Residential development
6. Environmental and Development Planning and Strategic Assessment
7. Industrial/chemical; Non-renewable power Generation