

**WATERCOURSE SCOPING ASSESSMENT AS PART OF
THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR
THE PROPOSED HYPERION SOLAR DEVELOPMENT 2,
NEAR KATHU, NORTHERN CAPE PROVINCE**

Prepared for

Savannah Environmental

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse scoping assessment as part of the environmental impact assessment for the proposed Hyperion Solar Development 2, near Kathu in the Northern Cape Province. The proposed Solar Energy Facility (SEF) will have a maximum capacity output of 75MW and will be developed on the remaining portion of Farm Lyndoch 432 (the project site), hereafter referred to as the “development area”. The development area is situated approximately 12km north-east of the town of Kathu. The N14 is located approximately 3.6km from the project site.

The following infrastructure is associated with the proposed development:

- Arrays of PV panels (static and tracking PV system) with a contracted capacity of up to 75MW;
- Mounting structures to support the PV panels;
- Cabling between the project components, to be laid underground where practical;
- On-site inverters to convert the power from a direct current to an alternating current;
- An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid;
- A new 132kV overhead power line (OHPL) between the on-site substation and the existing Ferrum Substation;
- Battery storage mechanism with a storage capacity of up to 300MWh;
- Water purification plant;
- Site Offices and Maintenance Buildings, including workshop areas for maintenance and storage;
- Batching plant;
- Temporary laydown areas; and
- Internal access roads and fencing around the development area.

It is also proposed to upgrade an existing gravel road which links the development area to the N14. Two alternatives are proposed:

- Upgrade approximately 3,6km of the T26 (Alternative 1) gravel road between the development area and the N14; and
- The construction of a new access road and the formalisation of the informal T25 access road (consisting a two-tyre track serving as a fire break in some places) between the development area and the N14, approximately 5km in length (Alternative 2).

The SEF will be connected to an onsite collector substation via a 132kV power line. The collector substation will, in turn, be connected to the Eskom Ferrum substation in Kathu via a double circuit power line. The 132kV power line will be assessed as part of a separate Basic Assessment process.

In order to identify all potential watercourses that may potentially be impacted by the proposed development, a 500m “zone of investigation” around the development area, and the proposed access roads was investigated. This is a precautionary principle where the presence of any watercourses within the outer most extent of the Government Notice (GN) Regulation 509 of 2016 (referred to the GN 509 regulated area of a watercourse) of watercourses within the development area, are identified.

This specialist watercourse report was compiled as part of the scoping phase for the project. Included in the scoping report is the desktop delineation of watercourses within the development area, the method of assessment that will be utilised for the development of the Environmental Impact Assessment (EIA) phase of the study, a preliminary literature review, and the results of the analyses of various spatial databases (such as, but not limited to, the National Freshwater Ecosystem Priority Area (NFEPA) database).

The assessment took the following approach:

- A desktop study was conducted, in which possible watercourses were identified, and relevant national and provincial databases were consulted;
- The episodic Vlermuisleegte River was identified by the NFEPA database (2011) to be located east of the development area and just east of the proposed Alternative 1 road (existing access road), which is to potentially be upgraded;
- According to the NFEPA database (2011) a natural wetland, classified by NFEPA as a depression, is located outside of the development area (along its north eastern boundary), and



within the Vlermuisleegte River. This depression is considered to be in a natural or good ecological condition (Class AB). A second depression is located outside the investigation area associated with the proposed Alternative 2 road, considered to be moderately modified (Class C);

- Desktop delineation of the abovementioned watercourses was undertaken. No watercourses are located within the development area. The Vlermuisleegte River and a depression was identified to be located within the investigation area of the development area. The proposed Alternative 1 road does directly traverse the Vlermuisleegte River.

Upon investigation of the available digital satellite imagery, it is apparent that agricultural fields have been developed within the floodplain associated with the Vlermuisleegte River. Due to these activities, the natural indigenous riparian vegetation has been removed. However, analysis of digital satellite imagery indicates that some natural riparian vegetation remains within the portion of the river east of the development area. Several informal roads traverse this river, including the proposed Alternative 1 road. The depression located within the Vlermuisleegte River is also traversed by an informal road.

Potential 'areas of sensitivity' were developed using the available background data and following the delineation of watercourses using desktop analysis, and after determining their applicable regulated areas, to guide the placement of infrastructure associated with the proposed SEF. These areas include:

- **No-go Area (only applicable to new developments):** includes the extent of the watercourses delineated using desktop analysis;
- **High Sensitivity Area:** the 32m regulated area of a watercourse as stipulated by the NEMA EIA Regulations of 2017 (as amended) applicable to the watercourses. No infrastructure should be placed in these areas. Roads should only be planned within these areas if it is absolutely unavoidable to circumnavigate these watercourses;
- **Moderate Sensitivity Area:** includes the GN 509 regulated area of the watercourse (100m zone surrounding the identified river, and 500m zone surrounding the depression) where development could take place but should be avoided, if possible, to avoid triggering Section 21 (c) & (i) water uses (exception for specified activities as per Appendix D2 of GN 509 of 2016 as it relates to the NWA); and
- **Low Sensitivity Area:** all other areas remaining in the development area and investigation areas. These areas are considered the least sensitive from a watercourse conservation point of view.

Following the delineation of watercourses by using desktop analysis and assessment which utilise available digital satellite imagery, the potential occurrence of impacts as a result of the proposed development on the watercourses were assessed. The outcome of the impact assessment is summarised below:

- The impact significance of potential impacts due to the development of the proposed SEF on the watercourses located outside of the eastern boundary of the development area is expected to be low. Edge effects (i.e. stormwater runoff) associated with the development (during the construction and operational phase) may potentially impact on the watercourses. If these edge effects are managed accordingly, the impact significance thereof, from a watercourse ecological perspective, is expected to be low to very low;
- Despite the river being considered a No-go Area, upgrading of the existing road is not considered a no-go as it is not for new infrastructure but rather, it is considered an existing impact. The proposed Alternative 1 road (existing access road) has an existing impact on the Vlermuisleegte River. Upgrading thereof has the potential to impact on the river, with specific mention of causing erosion and associated sedimentation of the river. It is recommended that the current route of Alternative 1 be used to limit any new disturbance footprint, and therefore, limit the impact significance of the upgrading of the access road on the river; and
- Since no activities associated with the proposed Alternative 2 road are within close proximity of any watercourses, the significance of impacts expected from the proposed Alternative 2 road could be considered low.

Gaps in the knowledge of the overall condition of these watercourses exist. Thus, the impact significance cannot be accurately stated until the characteristics, Eco-status, Ecological Importance and Sensitivity (EIS), and goods and services provision of the watercourses have been determined and



informed by the ground-truthing component and until the layout of the proposed development has been finalised, both of which will occur as part of the EIA Phase.

The information as provided in this report is, considered sufficient to aid the final design and layout of the infrastructure components associated with the proposed SEF, in order to limit the potential impact thereof on the identified watercourses and guide the EIA phase of the environmental assessment. The “sensitivity map”, as provided in Section 4, should be used to guide the layout of all the infrastructure components relevant to the proposed SEF. The impact significance of the SEF is expected to be low to very low, provided that infrastructure be placed outside of the No-go and High Sensitivity Areas. However, if linear infrastructure would to be aligned along existing infrastructure within the watercourses, it is not considered to be a fatal flaw. Depending on the construction method associated with the upgrading of the Alternative 1 road, impacts are expected to occur on the Vlermuisleegte River. However, the significance thereof can only be determined if the site-specific assessment of the river and its PES has been determined. This will be further refined and assessed during the EIA Phase of this project.



DOCUMENT GUIDE

The table below provides the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) Regulations 2017 (as amended in 2014) for Specialist Reports and also the relevant sections in the reports where these requirements are addressed.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix C
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix C
b)	A declaration that the specialist is independent	Appendix C
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A – Desktop assessment only for scoping phase
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modeling used	Section 2 and Appendix B
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	N/A – no infrastructure layout available at this stage. To be undertaken as part of the EIA phase
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.2
j)	A description the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5 – Site-specific information to be provided in the EIA Phase
l)	Any conditions for inclusion in the environmental authorisation	Site-specific information to be provided in the EIA Phase
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Site-specific information to be provided in the EIA Phase
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Assessed in EIA Phase
(iA)	Regarding the acceptability of the proposed activity or activities	Assessed in EIA Phase
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 5 and 7. Details to be investigated in the EIA Phase
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A



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ACRONYMS

°C	Degrees Celsius.
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
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
IHI	Index of Habitat Integrity
kV	KiloVolt
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NBA	National Biodiversity Assessment
NC CBA	Northern Cape Critical Biodiversity Areas
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
NWCS	National Wetland Classification System
OHPL	Overhead Power Line
ONA	Other Natural Area
PES	Present Ecological State
PoSEIA	Plan of Study for Environmental Impact Assessment
PV	Photovoltaic
REC	Recommended Ecological Category
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
SEF	Solar Energy Facility
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission
WULA	Water Use License Application



1 INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse scoping assessment as part of the environmental impact assessment for the proposed Hyperion Solar Development 2, near Kathu in the Northern Cape Province. The proposed Solar Energy Facility (SEF) is proposed to include multiple arrays (static and tracking) of photovoltaic (PV) solar panels with a contracted capacity of up to 75MW and will be developed on the remaining portion of Farm Lyndoch 432 (the project site), hereafter referred to as the “development area”. The development area is situated approximately 12km north-east of the town of Kathu. The N14 is located approximately 3.6km from the project site.

The following infrastructure is associated with the proposed development:

- Arrays of PV panels (static and tracking PV system) with a contracted capacity of up to 75MW;
- Mounting structures to support the PV panels;
- Cabling between the project components, to be laid underground where practical;
- On-site inverters to convert the power from a direct current to an alternating current;
- An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid;
- A new 132kV overhead power line (OHPL) between the on-site substation and the existing Ferrum Substation;
- Battery storage mechanism with a storage capacity of up to 300MWh;
- Water purification plant;
- Site Offices and Maintenance Buildings, including workshop areas for maintenance and storage;
- Batching plant;
- Temporary laydown areas; and
- Internal access roads and fencing around the development area.

It is also proposed to upgrade an existing gravel road which links the development area to the N14. Two alternatives are proposed:

- Upgrade approximately 3,6km of the T26 (Alternative 1) gravel road between the development area and the N14; and
- The construction of a new access road and the formalisation of the informal T25 access road (consisting a two-tyre track serving as a fire break in some places) between the development area and the N14, approximately 5km in length (Alternative 2).

The SEF will be connected to an onsite collector substation via a 132kV power line. The collector substation will, in turn, be connected to the Eskom Ferrum substation in Kathu via a double circuit power line. The potential impacts associated with the 132kV power line will be assessed as part of a separate Basic Assessment process.

In order to identify all potential watercourses that may potentially be impacted by the proposed development, a 500m “zone of investigation” around the development area, and the proposed access roads was investigated. This is a precautionary principle where the presence of any watercourses within the outer most extent of the Government Notice (GN) Regulation 509 of 2016 (referred to the GN 509 regulated area of a watercourse) of watercourses within the development area, are identified.

The development area will be refined during the EIA Phase Assessment during which the footprint areas, as well as the zone of influence of the development, will be assessed in more detail.

This specialist watercourse report was compiled as part of the scoping phase for the project. Included in the scoping report is the desktop delineation of watercourses within the development area, the method of assessment that will be utilised for the development of the Environmental Impact Assessment



(EIA) phase of the study, a preliminary literature review, and the results of the analyses of various spatial databases (such as, but not limited to, the National Freshwater Ecosystem Priority Area (NFEPA) database).

1.1 Scope of work

Specific outcomes in terms of the Scoping Phase report are as follows:

- Compile a desktop study with all relevant information as presented by the South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System (GIS) website (<http://bgis.sanbi.org>) as well as the location of Freshwater Ecosystem Priority Areas (FEPAs) in relation to the development area;
- Compile a report presenting the results of the scoping assessment and findings, highlight key constraints and opportunities associated with the proposed development, including the identification of potential watercourses within the development area as well as the 500m investigation zone around the development area (in line with Regulation GN 509 of 2016); and
- Present the plan of study for the EIA phase of the project including the methods of assessment to be used.



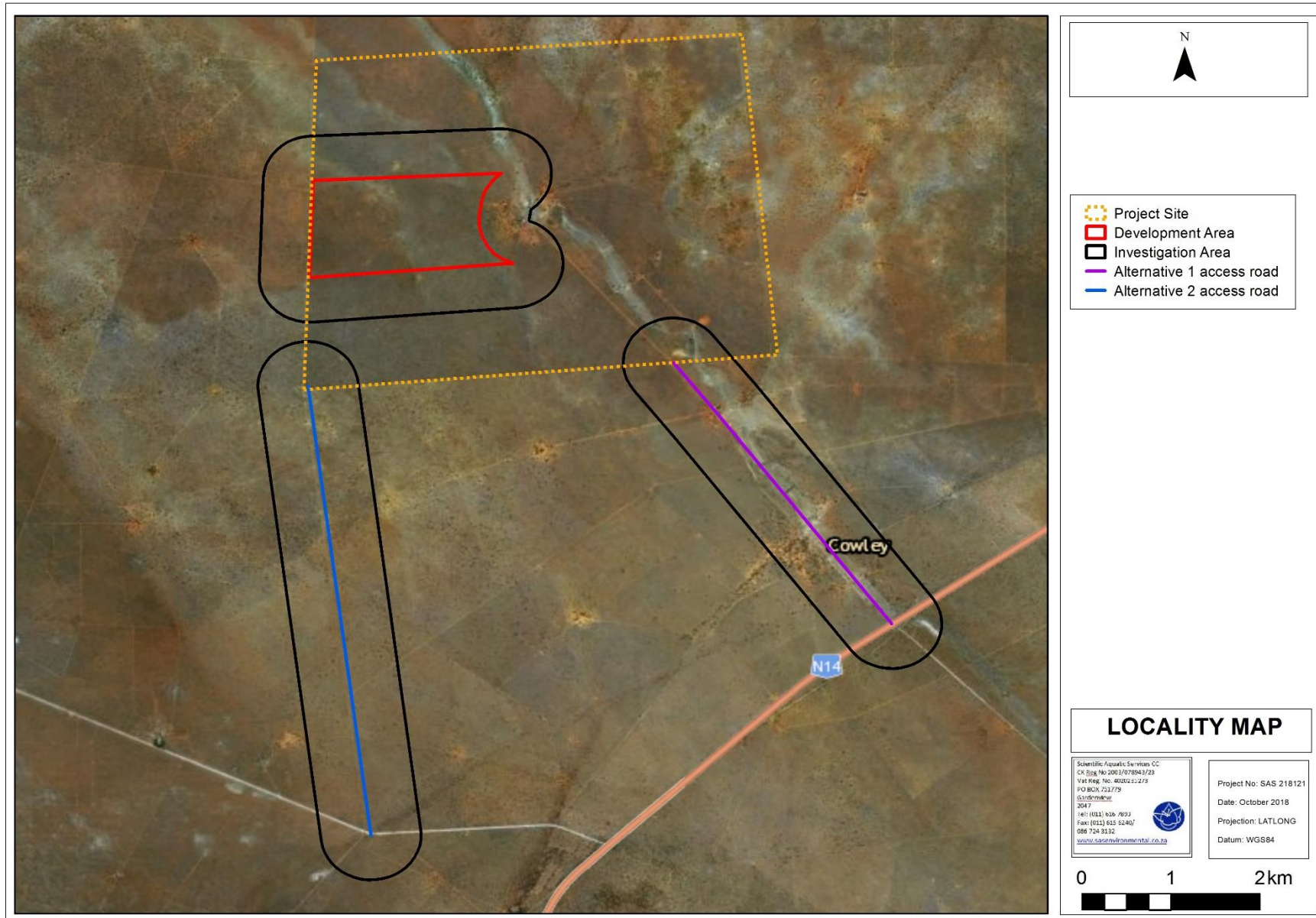


Figure 1: Digital satellite image depicting the development area and associated 500m investigation area in relation to surrounding areas.



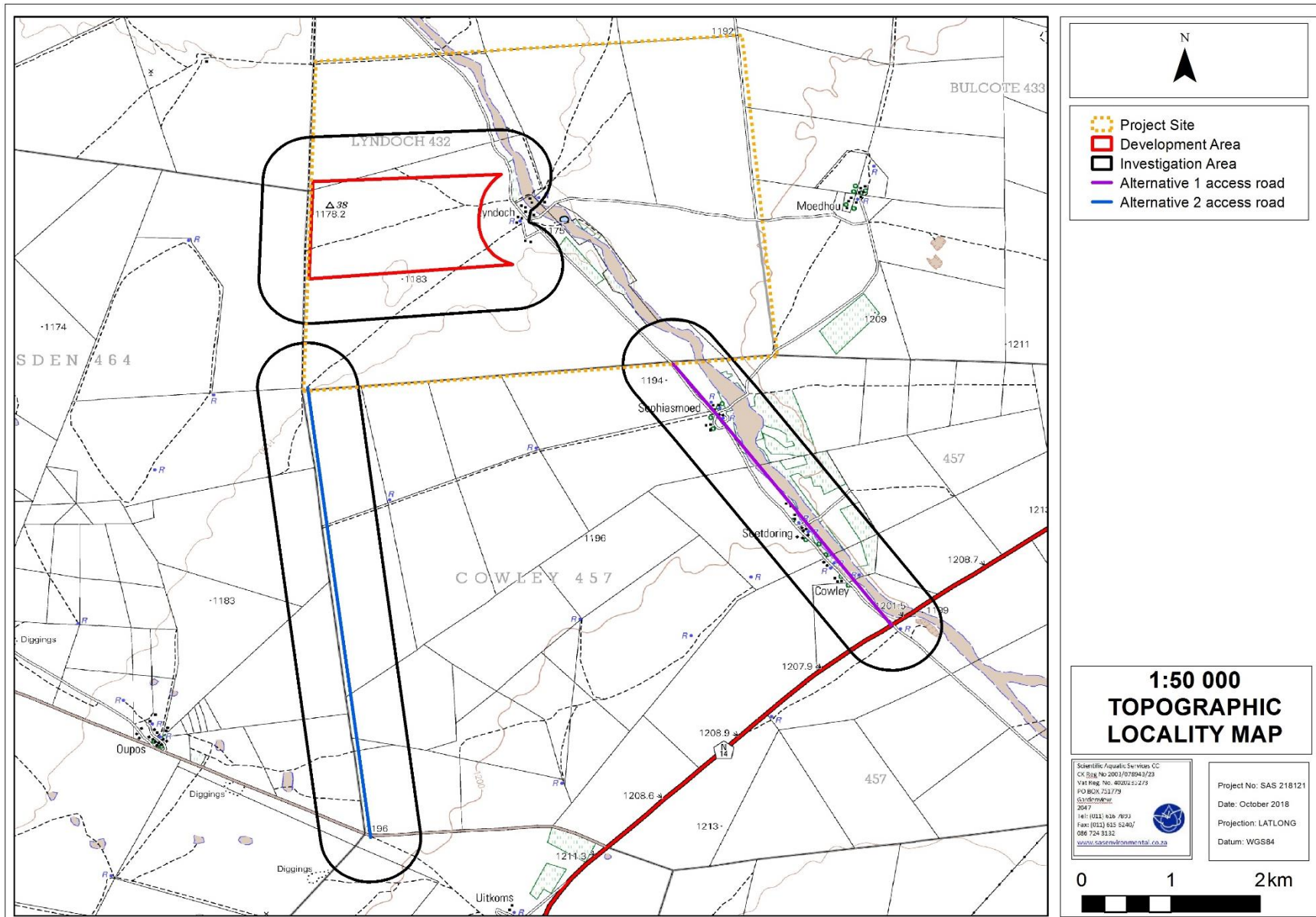


Figure 2: Location of the development area and associated 500m investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.



1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The watercourse desktop assessment is confined to the development area, the access roads and the associated investigation areas as depicted in Figures 1 and 2 above. The study does not include the neighbouring and adjacent properties because no watercourses have been identified on these properties;
- This study was undertaken as a desktop assessment only. As such, the information gathered must be considered with caution, as inaccuracies and data capturing errors are often present within these databases. Since this information forms part of the scoping phase, this desktop assessment is considered to provide adequate information for informed decision making to take place and in order to inform the Plan of Study (PoSEIA); and
- A site assessment of the identified watercourses will take place during the EIA Phase of the project. During the site assessment, the identified watercourses will be verified, and delineations confirmed. There is always the possibility that additional watercourses are identified on-site, which could have a further impact on the design of the proposed facility.

1.3 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA);
- The NEMA EIA Regulations (2017 as amended);
- The National Water Act, 1998 (Act 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998); and
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA).

The details of each of the above, as they pertain to this study, are provided in **Appendix A** of this report.

2 SCOPING PHASE - METHOD OF ASSESSMENT

2.1 Desktop Study

A desktop study was compiled with all relevant information as presented by the SANBI's Biodiversity GIS website (<http://bgis.sanbi.org>). Relevant databases and documentation that were considered during the assessment of the development area included the following:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011);
- Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], 2014 database; and
- Northern Cape Critical Biodiversity Areas (NCCBA, 2016).



3 SCOPING PHASE – RESULTS

3.1 Ecological importance and sensitivity of the development area based on National and Provincial datasets

The following section contains data accessed as part of the desktop assessment which is presented as a “dashboard-style” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible, to allow for the reader to understand how this information has been integrated into the findings of this report.

It is important to note that although all data sources used within this report are useful and often verifiable and of high quality, some of the information and databases may not be entirely accurate, provide actual site characteristics at the scale required to inform this environmental permitting process and/or water use licensing processes. However, this information is considered to be the most relevant and accurate information for use as a starting point to inform the Scoping Phase of this Project. Thus, this data will be used as a guideline to inform the assessment, and to focus on areas and aspects of increased conservation importance during the site-specific field verification survey as part of the EIA Phase.



Table 1: Desktop data relating to the character of the watercourses associated with the development area and surrounding region.

Aquatic ecoregion and sub-regions in which the development area is located		Detail of the development area in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database (Figure 3)	
Ecoregion	The development area is located within the Southern Kalahari Ecoregion	FEPACODE	The development area is situated in an area defined as an upstream management catchment (FEPACODE 4). Upstream management catchments are required to prevent the downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).
Catchment	Orange		
Quaternary Catchment	D41K		
WMA	Lower Vaal		
subWMA	Molopo		
Dominant characteristics of the Southern Kalahari (29.02) Aquatic Ecoregion Level 2 (Kleynhans <i>et al.</i> , 2007)		NFEPA Wetlands (Figure 3)	According to the NFEPA database (2011) a natural wetland, classified by NFEPA as a depression, is located within the north eastern portion of the investigation area around the development area and is considered to be in a natural or good ecological condition (Class AB). A second depression is located approximately 2,3km east of the proposed Alternative 2 road (outside of the investigation area), considered to be moderately modified (Class C).
Ecoregion	Southern Kalahari	Wetland Vegetation Type	Eastern Kalahari Bushveld Group 1 (Least Threatened according to SANBI, 2012 and Mbona <i>et al</i> , 2014))
Dominant primary terrain morphology	Mountains: moderate to high relief, Closed Hills		
Dominant primary vegetation types	Kimberley Plateau Bushveld, Kimberley Plains Thornveld Bushveld	NFEPA Rivers (Figure 3)	The episodic Vlermuisleegte River bisects the eastern portion of the investigation area associated with the development area and is located just east of the proposed Alternative 1 road. This river is considered largely natural according to the PES 1999, however, according to NFEPA database, the river is moderately modified (Class C).
Altitude (m a.m.s.l)	1100 to 1700		
MAP (mm)	200 to 500		
Coefficient of Variation (% of the MAP)	30 to 40		
Rainfall concentration index		Detail of the development area in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 4)	
Rainfall concentration index	50 to 65	Critical Biodiversity Area (CBA) 1	The most southern portion of the proposed Alternative 2 road and its associated investigation area is categorised as a Critical Biodiversity Area 1. According to the Technical Guidelines for CBA Maps document (SANBI, 2017), CBAs are areas that must remain in good ecological condition for meeting biodiversity targets for ecosystem types, species of special concern or ecological processes. CBA 1 area areas that are irreplaceable or near irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting these targets for the features associated with these areas.
Rainfall seasonality	Late Summer		
Mean annual temp. (°C)	16 to 20		
Winter temperature (July)	0 to 20	Critical Biodiversity Area (CBA) 2	The surrounding areas to the abovementioned CBA 1 area within the southern portion of the investigation area associated with the proposed Alternative 2 road falls within areas categorised as CBA2. CBA2 are areas that have been selected as the best option for meeting biodiversity targets, based on complementary, efficiency, connectivity and/or avoidance of conflict with other land or resource users.
Summer temperature (Feb)	16 to 32		
Median annual simulated runoff (mm)	5 to 60		
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)		Ecological Support Areas (ESA)	The north eastern corner of the development area and its associated investigation area, as well as the investigation area associated with the proposed Alternative 1 road is located within an ESA. According to the Technical Guidelines for CBA Maps document ESAs are areas which must retain their ecological processes to meet biodiversity targets for ecological processes that have not been met in CBAs or protected areas; meet biodiversity targets for representation of ecosystem types or species of special concern when it's not possible to meet them in CBAs; support ecological functioning of protected areas or CBAs or a combination of these (SANBI, 2017).
Sub-quaternary reach	D41K-02240 (Vlermuisleegte River)		
Proximity to the development area?	Approximately 8,8 km north-west of the development area		
Assessed by an expert?	No		
Mean Ecological Importance (EI) Class	Moderate	Other Natural Areas (ONA)	The remaining extent of the development area and the northern portion of the investigation area associated with the proposed Alternative 2 road, are areas defined as "other natural areas" (ONA). According to the Technical Guidelines for CBA, Maps document ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).
Stream Order	1		
Default Ecological Class (based on median PES and highest EI or ES mean)	Moderate (Class C)		

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Areas; ONA = Other Natural Areas; PES = Present Ecological State WMA = Water Management Area



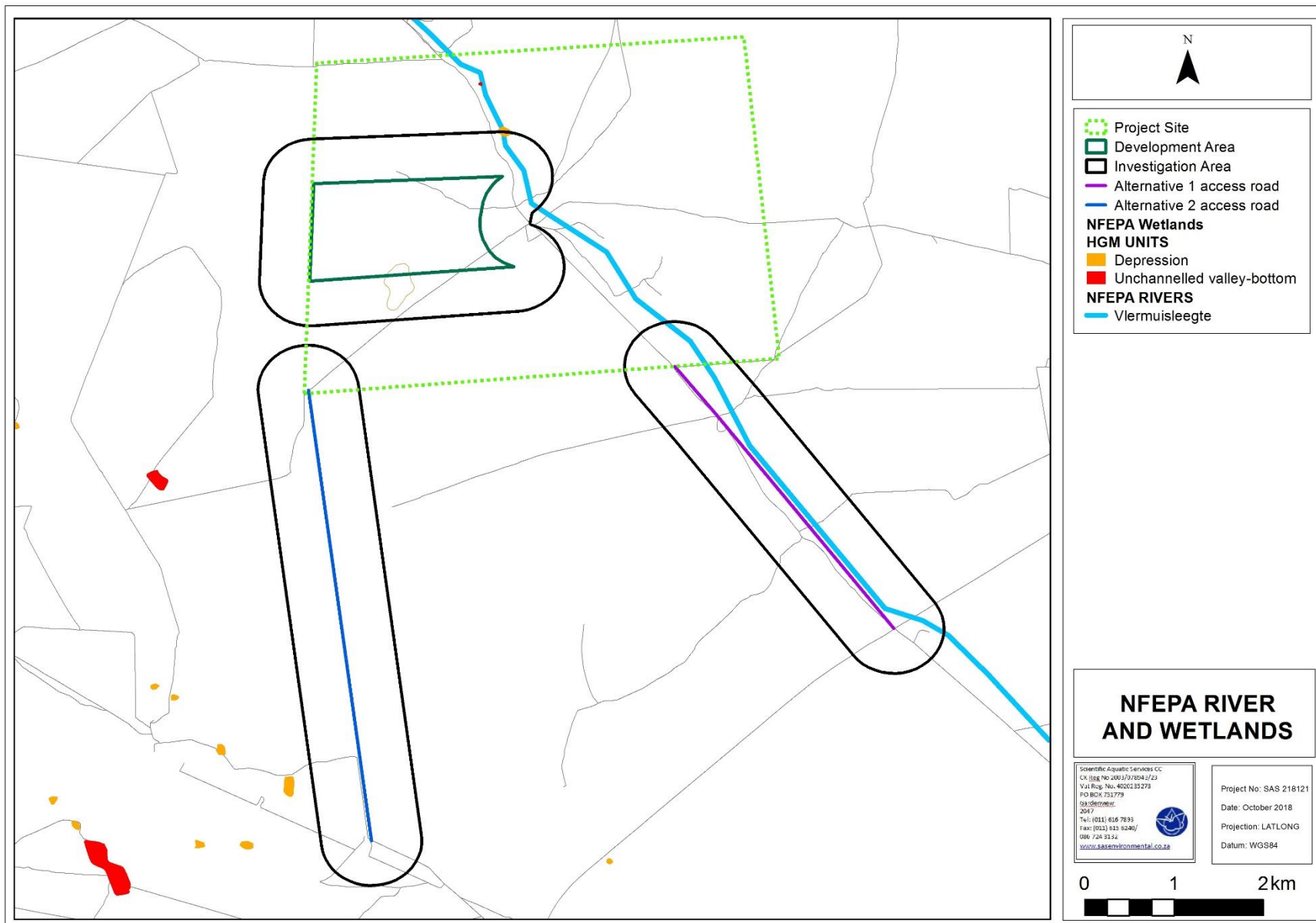


Figure 3: The hydrogeomorphic (HGM) units and rivers associated with the development area and investigation areas according to the NFEPA database (2011).



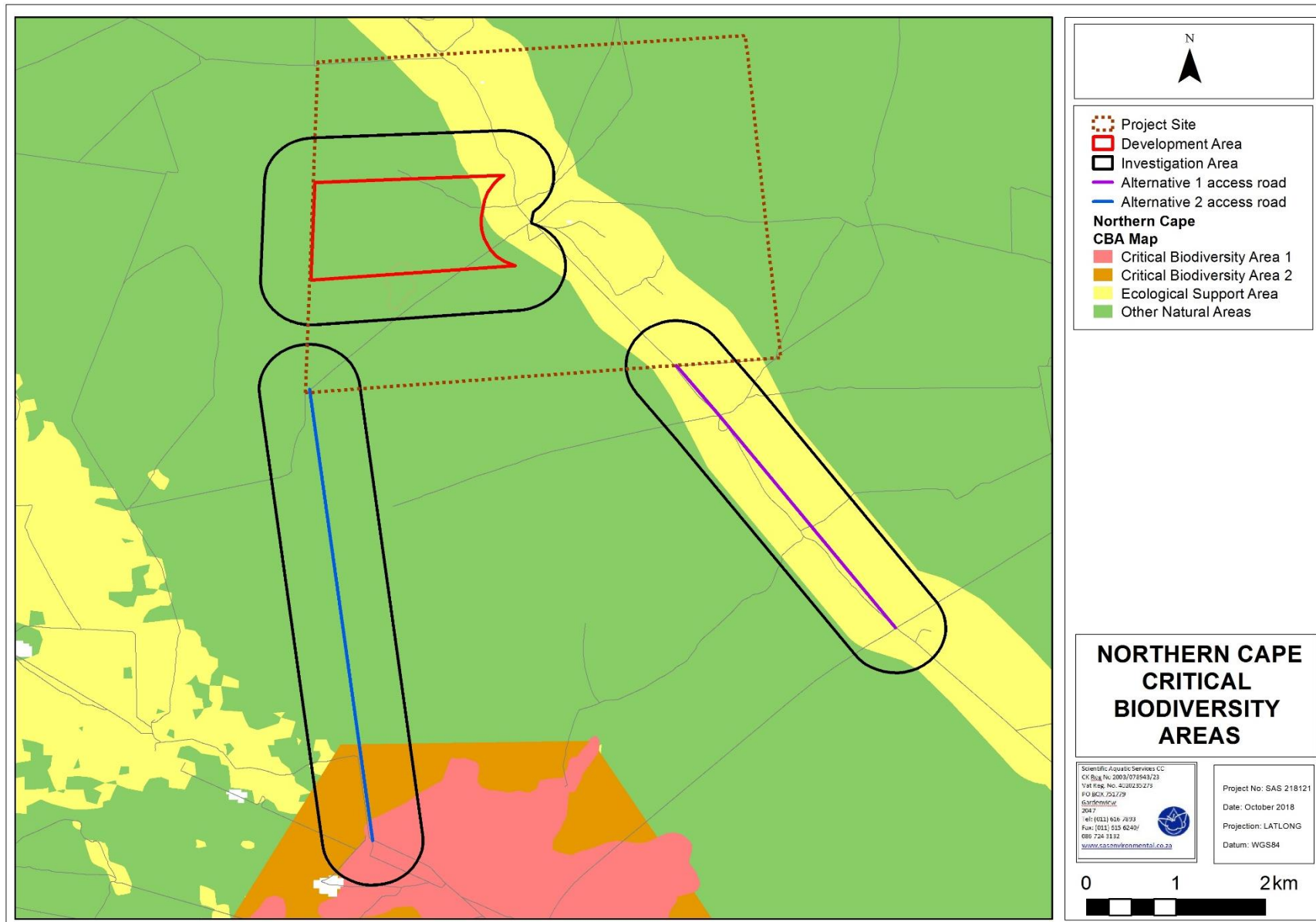


Figure 4: The Critical Biodiversity Areas and Ecological Support Areas associated with the development area and investigation areas according to the Northern Cape Critical Biodiversity Area Database (2016).



3.2 Preliminary delineation of watercourses making use of desktop analysis and assessment of the watercourses associated with the investigation areas

As part of this report, the following definitions, as per the National Water Act, 1998 (Act 36 of 1998) are of relevance:

Watercourse means-

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

Wetland means-

“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 characterized 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 areas”.

The delineation of the watercourses, using desktop analysis, taking into consideration the desktop database information as per Section 2 above, and making use of the latest Google Earth digital satellite imagery, is based on identifying features displaying a diversity of digital signatures. In this regard, specific mention is made of the following:

- Vegetation associated with wetlands and riparian zones: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often shown as white/grey or black. Outcrops or bare soils display varying chroma created by varying vegetation cover, geology and soil conditions; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

Based on the abovementioned characteristics, and the professional experience of the watercourse ecologist in delineating and assessing watercourses within the Northern Cape Province, a delineation of the watercourses associated with the development area and investigation areas, developed using desktop analysis, is presented in Figure 5 below.

Based on the results of the desktop delineation, a river has been identified (as per the NFEPA database, the Vlermuisleegte River) east of the development area, and which is traversed by the proposed Alternative 1 road (existing access road). This river drains in a south-eastern to north-western direction. A depression wetland has also been identified by the NFEPA database within the Vlermuisleegte River, north east of the development area. Another depression wetland is also identified to be located outside the investigation area of the proposed Alternative 2 road, south of the N14. However, this depression was not considered as part of this assessment, due to its locality relative to the proposed activities.

Upon investigation of the available digital satellite imagery, it is apparent that agricultural fields have been developed within the floodplain associated with the Vlermuisleegte River. This is most likely due to the episodic nature of the river, and the river having enriched, deep soils deposited through alluvial



processes. Due to these activities, the natural indigenous riparian vegetation has been removed. However, analysis of digital satellite imagery indicates that some natural riparian vegetation remains within the portion of the river east of the development area. Several informal roads traverse this river, including the proposed Alternative 1 road (existing access road). The depression located within the Vlermuisleegte River is also traversed by an informal road.



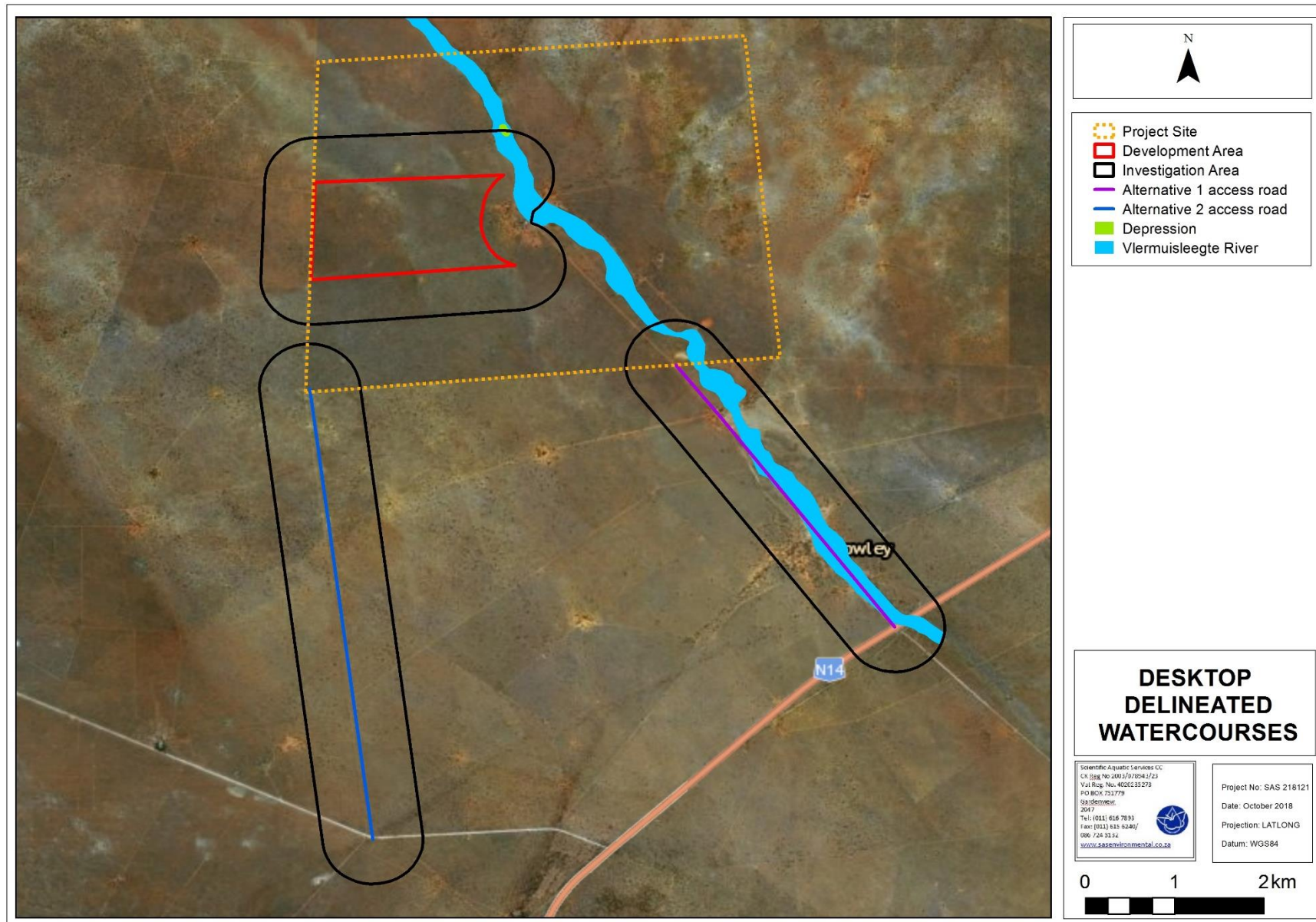


Figure 5: Locality and extent of the desktop delineated watercourses associated with the development area and investigation area.



4 APPLICATION OF LEGISLATIVE REQUIREMENTS

As part of the Scoping Phase, a preliminary sensitivity map was developed incorporating all relevant legislative requirements applicable to the desktop delineation of the watercourses associated with the development area and the investigation areas.

A regulated zone is a legally stipulated area around the delineated watercourses that:

- a) may be considered a 'high sensitivity' area, as deemed necessary by the specialist; and/or
- b) would require authorisation by the relevant authorities for any activities (both construction and operation) within the identified zone.

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

Table 2: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act	<p>In accordance with GN 509 of 2016 as it relates to the NWA, a regulated area of a watercourse applicable to water uses as per section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> • 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 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation, as well as Government Notice no. 509 of 2016 as it relates to the NWA.
Listed activities in terms of the NEMA (1998) EIA Regulations as amended in April 2017 must be taken into consideration if any activities (for example, stockpiling of soils) are to take place within the applicable regulated area of a watercourse. This must be determined by the EAP in consultation with the relevant authorities.	32m from the edge of a watercourse, applicable if a proposed development exceeds the relevant thresholds, which will then require environmental authorisation.

The figure below illustrates the NEMA and GN 509 regulated areas relevant to the watercourses identified within the development area and investigation area.



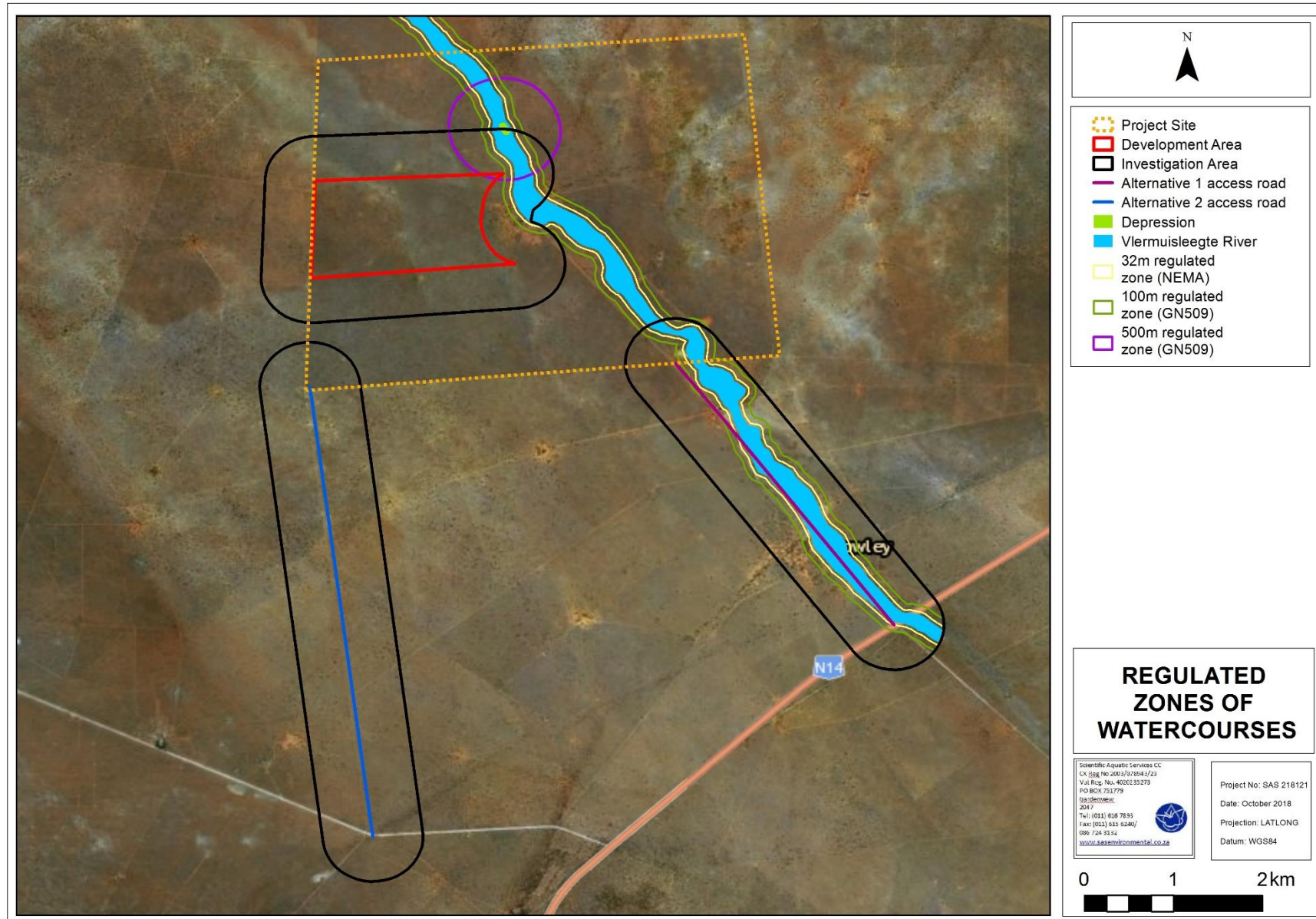


Figure 6: Map indicating the NEMA and GN509 regulated areas applicable to the watercourses associated with the development area and investigation areas.



Potential 'areas of sensitivity' were developed using the available background data and following the delineation of watercourses using desktop analysis, and after determining their applicable regulated areas, to guide the placement of infrastructure associated with the proposed SEF.

Based on the provided map (see Figure 7 below), the following was concluded:

- **No-go Area (only applicable to new developments):** includes the extent of the watercourses delineated using desktop analysis
- **High Sensitivity Area:** the 32m regulated area of a watercourse as stipulated by the NEMA EIA Regulations of 2017 (as amended) applicable to the watercourses. No infrastructure should be placed in these areas. Roads should only be planned within these areas if it is absolutely unavoidable to circumnavigate these watercourses;
- **Moderate Sensitivity Area:** includes the GN 509 regulated area of the watercourse (100m zone surrounding the identified river, and 500m zone surrounding the depression) where development could take place but should be avoided, if possible, to avoid triggering Section 21 (c) & (i) water uses (exception for specified activities as per Appendix D2 of GN 509 of 2016 as it relates to the NWA); and
- **Low Sensitivity Area:** all other areas remaining in the development area and investigation areas. These areas are considered the least sensitive from a watercourse conservation point of view.

These areas should be used to guide the preliminary layout of the infrastructure associated with the proposed SEF, as well as associated infrastructure.





Figure 7: Potential areas of sensitivity identified in accordance with the watercourses (No-go areas – only applicable to new developments) and their and 32m NEMA regulated area (High Sensitivity Area), their respective GN509 regulated areas (Moderate Sensitivity Area) and all other areas in which development could occur (Low Sensitivity Area).



5 POTENTIAL IMPACTS ASSOCIATED WITH THE DEVELOPMENT

This section of the scoping report aims to provide a summary of the most likely impacts that the proposed development may have on the surrounding natural area. Table 3 below provides the potential impacts the proposed SEF and associated infrastructure may have on the watercourses within the development area, as well as the nature and extent of the impact. Desktop data (as presented in this report) was utilised to determine the preliminary impact significance of the proposed development on the watercourses, which will be further refined and assessed during the EIA Phase of this project.

Table 3: Potential impacts associated with the proposed SEF within the development area.

Impacts			
Impacts associated with the construction activities (within the development area) include potential encroachment and direct disturbance of the Vlermuisleegte River and depression located north east of the development area as a result of the potential creation of temporary haul roads through the watercourses, alterations to stormwater run-off within the development area, altering the hydrology of the systems and increased sedimentation. Sediment laden stormwater runoff entering the Vlermuisleegte River is a potential impact that might occur during the operational phase of the SEF.			
Desktop Sensitivity of the Site			
All watercourses identified in the desktop assessment have been impacted by surrounding agricultural activities. Many of the areas adjacent to the watercourses have been altered (e.g. by ploughing and road crossings), increasing the likelihood of sediment run-off and proliferation of alien and invasive species. Based on the relevant databases, these watercourses are in a relatively good ecological condition (NFEPA, 2011), however, based on the investigation of digital satellite imagery, the watercourses have been impacted upon by agricultural activities and road crossings. As no watercourses are within the development area, no new infrastructure associated with the SEF is likely to be located within the delineated watercourses (No-Go Areas for new developments) and associated 32m NEMA regulated area of a watercourse (High Sensitivity Area), which is deemed sufficient for the protection of these resources.			
Issue	Nature of Impact	Extent of Impact	No-go Areas
Direct disturbance of watercourse habitat.	The potential loss of biodiversity as a result of construction related activities within the watercourses, including construction or upgrading of roads and placement of cables within watercourses. Decrease in the provision of watercourse ecoservices due to the potential degradation of the watercourses.	Local	All delineated watercourses should be considered no-go areas for new developments. The applicable GN509 regulated area of a watercourse should also be avoided where feasible. This is only recommended to prevent triggering the application of a water use application. If infrastructure were to be proposed within this area, it would not be considered a fatal flaw.
The decrease of watercourse habitat integrity.	Encroachment of internal road infrastructure and construction activities may result in the contamination of the watercourses (if surface water is present). This impact may be direct or indirect.	Local	
Alteration of runoff patterns	The potential for increased erosion as a result of earthworks in the vicinity of watercourses.	Local	
Altered hydrology of the watercourses	The potential loss of catchment yield due to stormwater management during the construction activities.	Local	
Altered stream and baseflow patterns	Potential that the construction of stream crossings may impact on the hydrology and sedimentation of systems.	Local	
Mismanagement and ineffective rehabilitation of watercourses.	The potential for siltation and changes in the hydrological functioning of these areas.	Local	
Description of the expected significance of the impact			
Since no watercourses are located within the development area, no direct impacts from the construction of the SEF are expected to occur on the watercourses outside of the development area. Nevertheless, the potential occurrence of impacts associated with			



<p>edge effects on the watercourses must be considered. If these edge effects are managed accordingly, the impact significance on the watercourses is expected to be low.</p> <p>If linear infrastructure (such as roads (upgrading thereof) and underground cabling) is proposed as part of the development, and crossing any of the watercourses, an impact is expected to occur, unless existing road crossings are utilized.</p> <p>The significance of impact cannot be stated until the layout of the proposed development has been finalised, which will be available during the EIA Phase.</p>
<p>Gaps in knowledge & recommendations for further study</p> <p>As the watercourses have only been assessed by using desktop analysis, their characteristics, Present Ecological State (PES) and goods and services could not accurately be described. Thus, a gap in the knowledge of the condition of these watercourses exists, and it is anticipated that these gaps will be sufficiently addressed during a site investigation as part of the EIA Phase of this project. It is not expected that the delineation of the watercourses will change significantly.</p> <p>The positioning of the SEF and infrastructure must, however, be determined. Infrastructure located within the applicable 500m/100m GN 509 regulated area of the watercourses must be considered by the developer in light of the potential requirements for water use licensing, in line with the requirements of the National Water Act.</p>

Table 4: Potential impacts associated with the proposed Alternative 1 road.

Impacts			
<p>Direct impacts are expected to occur as a result of the upgrading of the proposed Alternative 1 road (construction phase). During the construction phase, upgrading of this road (potentially, by means of culverts) entail activities within to occur within the active channel of the river. This could disrupt the riparian habitat (albeit considered already impacted upon by the existing road crossing) and impact on the surface water flow (only when the river has surface water flow, during periods of rainfall), which would then potentially be diverted.</p> <p>During the operational phase, the culvert crossings would convey water within a concentrated manner, instead of its current natural draining pattern (albeit already impacted upon by the existing road). If proper stormwater management measures are not implemented, erosion could occur at these crossing points.</p>			
Desktop Sensitivity of the Site			
<p>Despite the river being considered a "No-go Area" (as per the 'areas of sensitivity' discussed in Section 4) to new development, upgrading of the existing road is not considered a no-go as it is not for new infrastructure but rather, it is considered an existing impact. Based on the relevant databases, the Vlermuisleegte River is in a relatively good ecological condition (NFEPA, 2011). However, based on the investigation of digital satellite imagery, the river has been impacted upon by agricultural activities and road crossings, increasing the likelihood of sediment run-off and proliferation of alien and invasive species within the river.</p>			
Issue	Nature of Impact	Extent of Impact	No-go Areas
Direct disturbance of the remaining habitat of the river.	The potential loss of biodiversity as a result of upgrading of the road. Decrease in the provision of watercourse ecoservices due to the potential degradation of the river.	Local	<p>Despite the river being considered a "No-go Area" (as per the 'areas of sensitivity' discussed in Section 4) to new developments, upgrading of the existing road is not considered a no-go as it is not for new infrastructure but rather, it is considered an existing impact.</p> <p>It is recommended that no new crossings should be created, and that the route and crossings of the existing road be followed.</p>
The decrease of riparian vegetation and habitat integrity.	Encroachment of road infrastructure and construction activities may result in the contamination of the river (if surface water is present). This impact may be direct or indirect.	Local	
Alteration of runoff patterns.	The potential for increased soil compaction and erosion as a result of road crossings.	Local	
Altered stream and baseflow patterns.	Potential that the crossings (if to be upgraded) may further impact on the hydrology and sediment balance of the river.	Local	
Mismanagement and ineffective rehabilitation of the river.	The potential for siltation and changes in the hydrological functioning of the river.	Local	



Description of the expected significance of the impact
The proposed Alternative 1 road (existing access road) has an existing impact on the Vlermuisleegte River. Upgrading thereof has the potential to impact on the river, with specific mention of causing erosion and associated sedimentation of the river. It is recommended that the current route of the access road be used to limit any new disturbance footprint, and therefore, limit the impact significance of the upgrading of the access road on the river. During the construction phase, stormwater management devices could be integrated with the upgrading activities of the road, to limit the impact of stormwater runoff into the river. However, the significance of the impact cannot be accurately determined as yet, as the site-specific assessment of the river and its Present Ecological State (PES) needs to be determined. This will be further refined and assessed during the EIA Phase of this project.
Gaps in knowledge & recommendations for further study
As this river has only been assessed using desktop analysis, the PES could not accurately be described. Thus, a gap in the knowledge of the condition of the watercourse exists, which will be accurately assessed and refined during a site investigation as part of the EIA Phase of this project.

Table 5: Potential impacts associated with the proposed Alternative 2 road.

Impacts			
This proposed Alternative 2 road is located approximately 4.3 km west of the Vlermuisleegte River and approximately 2,3 km west of a depression (as identified by the NFEPA database), thus a very low to insignificant impact from the activities (i.e. edge effects) associated with the proposed Alternative 2 road (during both the construction and operational phases) on these watercourses are expected.			
Desktop Sensitivity of the Site			
Due to the distance the proposed Alternative 2 road is from the watercourses (No-Go Areas), it is not considered to pose a quantum of risk to these watercourses			
Issue	Nature of Impact	Extent of Impact	No-go Areas
Alteration of runoff patterns	The potential for increased erosion as a result of earthworks in the vicinity of the watercourse.	Local	The delineated depression should be considered a No-go area.
Altered hydrology of the watercourse	The potential loss of catchment yield due to stormwater management during the construction activities.	Local	
Description of the expected significance of the impact			
Since no activities associated with the proposed Alternative 2 road is within close proximity to any of the watercourses, the significance of impacts expected from this road could be considered very low.			
Gaps in knowledge & recommendations for further study			
The potential of impact from this road on any watercourses is based on desktop analysis only. The significance of the impact (if any) will be determined as part of the EIA Phase of this project.			

The following general management and construction management mitigation measures are recommended:

- Planning of temporary roads and access routes should take the site sensitivity maps (Figures 6 and 7) into consideration, and wherever possible, existing roads should be utilised. If existing roads are to be upgraded and other alternatives are unavoidable, such upgrades, as far as possible, should exclude widening of the road. Where widening of the roads is required, this must be kept to the absolute minimum within the applicable watercourse and the immediately adjacent areas. Where crossings are unavoidable, the crossing should be made at a 90-degree angle to the watercourse to reduce the extent of the impact;
- Construction vehicles must use existing roads only and not be allowed to indiscriminately drive through watercourses;
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed;
- All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site so as to prevent the proliferation of alien and invasive species;
- Avoid unnecessary site clearing/vegetation clearing as far as possible;
- Concurrent rehabilitation of the watercourses impacted by the proposed SEF is to take place and footprint areas should be minimised as far as possible;



- Any concrete and other foreign material used during construction must be demolished and removed from the site. All rubble and waste must be disposed of at a suitably registered landfill site;
- Any soil excavated should be reinstated and re-profiled as much as possible. Any remaining soil is to be removed from the site to a registered landfill site;
- Any area where active erosion is observed in the watercourses, within the development area and investigation areas, must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; and
- All watercourses impacted by the proposed SEF should be continuously monitored for any erosion and incision associated with construction activities.

6 EIA PHASE – PLAN OF STUDY

Specific outcomes in terms of the EIA Phase report are presented in the points below:

- Ground-truthing of delineation of the outermost edge of the watercourses associated with the development area and investigation area in accordance with “DWAFF¹2005²: A practical field procedure for identification of wetlands and riparian areas”. Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the watercourses;
- The watercourse classification assessment will be undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al.*, 2013);
- The EIS of the watercourses will be determined according to the method described by Rountree & Kotze (2013);
- The PES of the watercourses will be determined according to the resource-directed measures guideline of Macfarlane *et al.* (2008);
- The watercourses will be mapped according to the ecological sensitivity of the watercourses in relation to the development area. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated zones of regulation will be depicted where applicable;
- Allocation of a suitable REC (Recommended Ecological Category) to the watercourses based on the results obtained from the PES and EIS assessments;
- Evaluation of environmental issues and potential impacts (direct, indirect and cumulative impacts and residual risks) identified, including:
 - The nature of the impact;
 - The extent of the impact;
 - Anticipated duration of the impact;
 - Magnitude;
 - Probability of occurrence
 - The significance of the impact;
 - The status of the impact (positive, negative or neutral);
 - The degree to which the impact can be reversed/cause irreplaceable loss of resources and/or can be mitigated; and
 - Assessment of cumulative Impacts.
- Development of recommendations for mitigating impacts on the receiving environment.

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

² Even though an updated manual has been 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.



The details of the various methodologies employed, as they pertain to this study, are provided in **Appendix B** of this report.



7 CONCLUSIONS

Scientific Aquatic Services (SAS) was appointed to conduct a scoping assessment considering watercourses as part of the environmental assessment and authorisation process for the proposed Hyperion Solar Development 2. The desktop study included the 500m investigation area around the development area, and the investigation areas surrounding the proposed access roads (Alternative 1 and 2). The development area will be refined during the EIA Phase study during which the actual footprint areas of the proposed SEF and placement thereof will be identified.

It is evident from the Scoping Phase that no watercourses are located within the development area. However, watercourses are within the investigation areas, one of which, namely the Vlermuisleegte River, is crossed by the existing access road (Alternative 1). Two depression wetlands were also identified; one within the central portion of the Vlermuisleegte River, north east of the development area and the other located outside of the investigation area of the proposed Alternative 2 road, but did not form part of this assessment. These watercourses could be considered of increased ecological importance and sensitivity. It is therefore considered important that the location of these watercourses be considered during the planning of the layout design in order to avoid or decrease the potential impact on these watercourses. The presence of these watercourses is not considered a fatal flaw to the project; however, all watercourses should be considered as no-go areas for any future new developments, with the exception of the existing access road (Alternative 1) which will be an upgrade. Their GN509 regulated areas (Moderate Sensitivity Areas) should also be avoided (as far as feasibly possible), however, development in these areas can be undertaken if the required authorisations, in terms of the NWA, are obtained.

The information as provided in this report is, considered sufficient to aid the final design and layout of the infrastructure components associated with the proposed SEF, in order to limit the potential impact thereof on the identified watercourses and guide the EIA phase of the environmental assessment. The "sensitivity map", as provided in Section 4, should be used to guide the layout of all the infrastructure components relevant to the proposed SEF. The impact significance of the SEF is expected to be low to very low, provided that infrastructure be placed outside of the No-go and High Sensitivity Areas. However, if linear infrastructure would to be aligned along existing infrastructure within the watercourses, it is not considered to be a fatal flaw. Depending on the construction method associated with the upgrading of the Alternative 1 road, impacts are expected to occur on the Vlermuisleegte River. However, the significance thereof can only be determined if the site-specific assessment of the river and its PES has been determined. This will be further refined and assessed during the EIA Phase of this project.

During the EIA Phase of this project, a site assessment will be undertaken during which the watercourses will be assessed in detail and the delineation thereof verified on-site, in order to accurately determine the potential occurrence and significance of potential impacts on the watercourses resulting from the proposed development.



8 REFERENCES

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APPENDIX A: LEGISLATIVE REQUIREMENTS

<p>National Environmental Management Act (NEMA) (Act No. 107 of 1998)</p>	<p>The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.</p>
<p>National Water Act (NWA) (Act No. 36 of 1998)</p>	<p>The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may, therefore, take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).</p>
<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)</p>	<p>In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> ➤ 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. <p>This notice replaces GN1199 and may be exercised as follows:</p> <ol style="list-style-type: none"> i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determined through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. <p>A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA.</p> <p>Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.</p>



APPENDIX B: FRESHWATER RESOURCE ASSESSMENT APPROACH

Wetland and Riparian Delineation

For the purposes of this investigation, a wetland and a riparian habitat are defined in the National Water Act (NWA) (1998) as stated below:

- A wetland is “a 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 is defined as “including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized 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 areas”.

The wetland and riparian zone delineations will take place according to the method presented in the “The practical field procedure for identification and delineation of wetlands and riparian areas” published by DWAF in 2005. The foundation of the method is based on the fact that wetlands have several distinguishing factors including the following:

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

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005).

Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The objective of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland or riparian area.

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

All watercourses will be classified according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the “Classification System” (Ollis *et. al.*, 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.



Table B1: Classification System for Inland Systems, up to Level 3.

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

Table B2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

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



FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean³** (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically**. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

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

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

Level 3: Landscape Setting

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

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

³ Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.



Level 4: Hydrogeomorphic Units

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

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

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

Index of Habitat integrity

To assess the PES of the river identified, the IHI for South African floodplain and channelled valley bottom wetland types (Department of Water Affairs and Forestry Resource Quality Services, 2007) was used.

The WETLAND-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP). The WETLAND-IHI has been developed to allow the NAEHMP to include floodplain and channelled valley bottom wetland types to be assessed. The output scores from the WETLAND-IHI model are presented in A-F ecological categories (table below), and provide a score of the PES of the habitat integrity of the wetland or riparian system being examined.



Table B3: Descriptions of the A-F ecological categories (after Kleynhans, 1996, 1999).

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

WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores, and Present State categories are provided in the table below.



Table B4: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table B5: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole need to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

Wet-Ecoservices (2009)

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



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

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

Table B6: Classes for determining the likely extent to which a benefit is being supplied.

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

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

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

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

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

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C7) of the wetland system being assessed.



Table B7: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

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

Recommended Ecological Category (REC)

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

The REC (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the resource (sections above), and is followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

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

Table B8: Description of REC classes.

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

Ecological Impact Assessment Method of assessment

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

The first stage of 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 possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'⁴. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **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 below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary⁵.

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

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) (NEMA) 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.

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

⁴ The definition has been aligned with that used in the ISO 14001 Standard.

⁵ Some risks/impacts that have low significance will however still require mitigation



- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate
- (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
 - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - medium-term (5–15 years) – assigned a score of 3;
 - long term (> 15 years) - assigned a score of 4; or
 - permanent - assigned a score of 5;
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
 - 0 is small and will have no effect on the environment
 - 2 is minor and will not result in an impact on processes
 - 4 is low and will cause a slight impact on processes
 - 6 is moderate and will result in processes continuing but in a modified way
 - 8 is high (processes are altered to the extent that they temporarily cease)
 - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated*.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E+D+M) \times P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Mitigation Measure Development

The following points present 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 impacts⁶ 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;

⁶ Mitigation measures should address both positive and negative impacts



- Minimisation of impact;
 - Rehabilitation; and
 - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
 - Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.



APPENDIX C: 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)

Christel du Preez MSc (Environmental Sciences) (North West University)

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

Company of Specialist:	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:	011 615 6240/ 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		





SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

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 IAIA South Africa

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
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES 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



SELECTED PROJECT EXAMPLES

Client	Project	Project Description	Area
RESIDENTIAL			
GIBB (PTY) LTD	Bloemwater Knelpoort Project	Full ECO Assessment	Free State
DLC Town Plan (Pty) Ltd	Bongwini and Toekomsrus Project Gold 1	Environmental Sensitivity Analyses as part of the development of site Development Plans and Precinct Planning on the outskirts of Takoradi Ghana (2000 ha)	Randfontein
SRK Consulting (PTY) Ltd	Skoenmaker River	Wetland, Aquatic & ECO Assessment	Somerset East
Century Property Development	The Hills Eco Estate	Wetland delineation and ecological assessment, and rehabilitation plan	Midrand, Gauteng
ROADS, PIPELINES, POWERLINES AND OTHER LINEAR DEVELOPMENTS			
Delta Built Environment Consultants	Lesotho Border Road Project	Soil & Land Capability Assessment, full wetland ecological assessment and aquatic assessment as part of the EIA process	Lesotho
Spoor Environmental	Thabazimbi Waste Water Treatment Works; Upgrade of Sewer Pipeline	Freshwater resource ecological assessment and rehabilitation and management plan	Limpopo
Royal Haskoning DHV (Pty) Ltd	N11 Ring Road	Freshwater Ecological Assessment	Limpopo
Chameleon Environmental	N7 Road Upgrade Cederberg & Kransvleikloof	Floral RDL scan and delineation of the wetland areas along the proposed N7 road upgrade between Clanwilliam and Citrusdal	Western Cape
Iiso Consulting (Pty Ltd)	N3TC De Beers Pass Route	Variation order for additional work on N3TC De Beers pass route and existing N3 route	Kwa-Zulu Natal
MINING			
Anglo Platinum	Der Brochen Mine	Ongoing bi-annual seasonal aquatic biomonitoring from 2011 to present	Steelport Limpopo
Anglo Platinum	Der Brochen Mine	Wetland Ecological Assessment (2014) Full terrestrial, wetland and aquatic ecological assessment, soil and land capability assessment (2018)	Steelport, Limpopo
Bokoni Platinum Mine	Bokoni Platinum Mine	Annual Soil Monitoring & Soil Contamination	Free State
GIBB (PTY) LTD	Rustenburg Bridges	Aquatic Biomonitoring Assessment	Rustenburg, North West
Assmang Chrome Machadodorp	Assmang Chrome Machadodorp Works	Biomonitoring & Toxicological Monitoring for the 2015 period	Machadodorp, Mpumalanga
Globesight Advisory, Consulting & Training	Sabie TGME Project	Freshwater Ecological Assessment as part of the environmental assessment and authorization process for the proposed development (gold mining project – pre-mined residue and hard rock mining near Sabie)	Mpumalanga
Ikwezi Mining (Pty) Ltd	Ikwezi Doornkop Colliery	Develop freshwater resource rehabilitation and management plans, and conduct ecological biomonitoring in fulfillment of the water use licensing process for the Ikwezi Doornkop Colliery near Newcastle	Newcastle
Sappi Southern Africa (Pty) Ltd	Blesbokspruit Enstra Mill	Biomonitoring studies, whole effluent toxicity (WET) studies, bioaccumulation assessment and sediment heavy metal contaminant analyses	Johannesburg
Stibium Mining	Malati Opencast	Freshwater ecological assessment, risk assessment and freshwater rehabilitation and management plan and plant species plan as part of the water use authorization process for a proposed Malati opencast near Tzaneen	Limpopo
EXM Advisory Services	Heuningkranz Mine	Freshwater assessment, soil and land capability assessment done for Sishen Iron Ore Company (Pty) Ltd part of Kumba Iron Ore limited as part of the environmental management services for the Heuningkranz project	Northern Cape
Shangoni Management Services (Pty) Ltd	Leslie Colliery	Project manager, freshwater ecological assessment as part of the environmental impact assessment process for the underground coal mine to determine the status of the freshwater resources within the proposed mining area	Mpumalanga



SLR Consulting (Africa) (Pty) Ltd	Commissiekraal Colliery	Full Ecological investigation, including a terrestrial fauna and flora assessment as well as an assessment of the wetland and aquatic PES and wetland ecoservices on the site.	Kwa-Zulu Natal
Jacana Environmental CC	Leandra Colliery	Full Ecological Assessment, including a terrestrial fauna and flora assessment as well as an assessment of the wetland and aquatic PES and wetland ecoservices on the site.	Mpumalanga
SRK Consulting (PTY) Ltd	Marula Platinum Mine	Freshwater resource ecological assessment. Development of a plant species plan in line with the project's rehabilitation objectives	Burgersfort
Jacana Environmental CC	Donkerhoek Dam development	Full ecological assessment (Fauna, floral, wetland and aquatic assessment) as part of the EIA process	Mpumalanga
EXM Advisory Services	Evander Gold Mining (Pty) Ltd	Determination of the Wetland Offset Requirements for the proposed expansion of the Elikhulu Tailings Storage Facility	Mpumalanga
EXM Advisory Services	Canyon Coal - Witfontein mining project	Delineate and characterize the wetland and aquatic resources for the Witfontein mining project located by the farms Holfontein and Witrand near Bethal	Mpumalanga
SRK Consulting (South Africa) (PTY) Ltd	The Sierra Rutile Mine	Specialist terrestrial ecology, aquatic ecology and wetland ecology studies	Moyamba District - Sierra Leona
INFRASTRUCTURE			
GIBB (Pty) Ltd	Bronkhorstspuit Feeder Line	Monthly Aquatic Biomonitoring as part of the environmental assessment and authorization process for the proposed conversion of the Bronkhorstspuit plots feeder from 6.6kv to 22kv	Bronkhorstspuit
SRK Consulting (PTY) Ltd	South Dunes Precinct Project	Full Ecological Assessment	Richards Bay
SRK Consulting (PTY) Ltd	Braamfonteinspruit Rehabilitation	Terrestrial, Freshwater and Aquatic Ecological Assessment as part of the rehabilitation and management plan for the Braamfonteinspruit, Johannesburg	Johannesburg
Iliso Consulting (Pty Ltd)	City of Johannesburg	Aquatic Ecological Assessment, monitoring and managing the ecological state of rivers in the City Of Johannesburg Metropolitan area	Johannesburg
Maanakana Projects and Consulting (Pty) Ltd	Lethabo Pump Station	Aquatic present ecological state assessment of the Vaal river	Vereeniging
SRK Consulting	CTIA runway re-alignment project – Wetland Offset	Determination of the Wetland offset requirements for Cape Town international Airport runway realignment, identification of a suitable offset location and compilation of relevant baseline assessments (Wetland and faunal), Khayelitsha. (2017)	Cape Town
GIBB (Pty) Ltd	Musami Dam	Determination of the draft environmental water quality requirements for the project	Zimbabwe
Nemai Consulting (PTY) Ltd	uMkhomazi Water Project	Determination of the Wetland and Terrestrial Biodiversity Offset Requirements for the proposed uMkhomazi Water Project	Richmond - KZN
POWER GENERATION			
Iliso Consulting	Mzimvubu Dam	Full Terrestrial (Flora and Faunal), Wetland and Aquatic Baseline Ecological Assessment	Eastern Cape
WKN-Wind current SA C/O Alan Wolfrohm	HGA HAGA WEF	Hydrological Assessment	Eastern Cape
SRK Consulting (PTY) Ltd	RPM Crossing	Wetland Delineation	Free State
SRK Consulting (Pty) Ltd	Eskom Denova Powerline and sub-station	Freshwater assessment as part of the EIA process for the proposed Eskom powerline (1, 75 km in length) and sub-station (132kV) near Denova, Western Cape. (2014)	Western Cape
CSIR Consulting & Analytical Services	Sutherland WEF	Freshwater Ecological Assessments	Northern Cape
CSIR Consulting & Analytical Services	Victoria West WEF	Freshwater Ecological Assessments	Northern Cape





SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION CURRICULUM VITAE OF **CHRISTEL DU PREEZ**

PERSONAL DETAILS

Position in Company	Wetland Ecologist
Date of Birth	22 March 1990
Nationality	South African
Languages	English, Afrikaans
Joined SAS	January 2016

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

South Africa – KwaZulu Natal, Northern Cape, Gauteng, Mpumalanga, Free State, Eastern Cape

SELECTED PROJECT EXAMPLES

Wetland Assessments

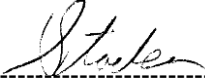
- Baseline freshwater assessment as part of the environmental assessment and authorisation process for the proposed National Route 3 (N3) Van Reenen Village Caltex Interchange, KwaZulu Natal.
- Basic assessment for the proposed construction of supporting electrical infrastructure for the Victoria West Wind Farm, Victoria West, Northern Cape Province.
- Freshwater Ecological Assessment in Support of the WULA Associated with the Rehabilitation of the Wetland Resources in Ecopark, Centurion, and Gauteng.
- Wetland Ecological Assessment for the Proposed Mixed Land Use Development (Kosmosdal Extension 92) on the remainder of Portion 2 of the farm Olievenhoutbosch 389 Jr, City of Tshwane Metropolitan Municipality, Gauteng Province.
- Freshwater Ecological Assessment for the Mokate Pig Production and Chicken Broiler Facility on the farm Rietvalei Portion 1 and 6 near Delmas, Mpumalanga.
- Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Relocation of a Dragline from the Kromdraai Section to Navigation Section of the Anglo American Landau Colliery in Mpumalanga.
- Freshwater Assessment as part of the Environmental Assessment and Authorisation Process for a proposed 132kv powerline and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces.
- Freshwater Ecological Assessment of the Freshwater Prospect Stream in the AEL Operational Area, Modderfontein, Gauteng.
- Specialist Freshwater Scoping and Environmental Impact Assessment for the Proposed Development of the Platberg and Teekloof Wind Energy Facility and Supporting Electrical Infrastructure near Victoria West, Northern Cape Province.
- Wetland Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Development of Wilgedraai, Vaaldam Settlement 1777, Free State Province.
- Freshwater Resource Delineation and Assessment as part of the consolidation of four Environmental Management Plans at the Graspan Colliery, in Middelburg, Mpumalanga Province.
- Freshwater Assessment as part of the Water Use Authorisation for the proposed Copperton Wind Energy Facility, Northern Cape.
- Freshwater Resource and Water Quality Ecological Assessment for the Lakefield Manor Residential project, Boksburg, Gauteng Province.



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

