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FRESHWATER ECOLOGICAL IMPACT ASSESSMENT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED 75 MW THERMAL POWER DUAL FUEL FACILITY AND ACCESS ROAD AS PART OF THE HYPERION 1 & 2 SOLAR PV ENERGY FACILITY, NEAR KATHU, NORTHERN CAPE PROVINCE

Prepared for

Hyperion Solar Development (Pty) Ltd

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EXECUTIVE SUMMARY

A 75 MW thermal power dual fuel facility is proposed to form part of a hybrid generation facility together with the environmental authorised Hyperion 1 Solar Photovoltaic (PV) Energy and Hyperion 2 Solar PV Energy Facility, near Kathu, Northern Cape Province, hereafter collectively referred to as the 'Hyperion hybrid generation facility'. Additionally, upgrading of an existing road for access to the facility is proposed. No watercourses are located within the footprint of the Hyperion hybrid generation facility building infrastructure (including that of the thermal power dual fuel facility). These infrastructure components are located at least 420 m from the Vlermuisleegte River, with only the proposed access road located directly adjacent to the delineated extent thereof.

Based on the distance of the proposed Hyperion hybrid generation facility, the construction and operation thereof pose no direct negative impact to the Vlermuisleegte River, due to it being located at least 420 m from the river. The construction of the proposed access road is expected to pose a direct negative impact to the Vlermuisleegte River. It is highly recommended that the width of the road be extended to the western side of the existing road reserve rather than to the east there of (if considered feasible) to avoid encroaching on the Vlermuisleegte River. The operation of the access road, with the implementation of the recommended mitigation measures will pose a low impact significance to the Vlermuisleegte River.

It is the opinion of the freshwater ecologist that the proposed Hyperion hybrid generation facility and access road be considered acceptable, provided that the essential mitigation measures as listed in this report are strictly adhered to.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to determine the impact of the proposed 75 MW thermal power dual fuel facility to potential watercourses, which will form part of a hybrid generation facility together with the environmental authorised Hyperion 1 Solar Photovoltaic (PV) Energy Facility and Hyperion 2 Solar PV Energy Facility, near Kathu, Northern Cape Province (hereafter collectively referred to as the 'Hyperion hybrid generation facility'). SAS undertook a freshwater ecological assessment for the Hyperion 1 and 2 PV Solar Energy Facility (SEF) complex in 2019, which assessed the impacts of the proposed SEF complex (and associated infrastructure) and various access road alternatives on the identified watercourses. As such this report provides a summary of the previously assessed watercourses as per the freshwater ecological assessments conducted by SAS (2019 a,b) and determines the impact of the proposed 75 MW thermal power dual fuel facility and access road on these watercourses to inform the required Environmental Impact Assessment (EIA) process for the proposed 75 MW thermal power dual fuel facility and access road.

Based on the layout of the proposed Hyperion hybrid generation facility, no watercourses are located within the immediate footprint of the proposed infrastructure, including the footprint of the thermal power dual fuel facility. The proposed Hyperion hybrid generation facility are located approximately 420 m from the delineated extent of the Vlermuisleegte River. The proposed access road is located directly west of the delineated extent of the Vlermuisleegte River. A perched depression wetland was also identified within the Vlermuisleegte River. All infrastructure components are located at least 522 m from the delineated extent of the perched depression wetland. Presently the footprint area of the Hyperion hybrid generation facility, including the footprint of the proposed thermal power dual fuel facility as well as the immediate surroundings have remained fairly similar to the site conditions during the initial site visit by SAS in late 2018. As such, the outcome of the ecological assessment of the Vlermuisleegte River and perched depression wetland as presented in SAS (2019 a,b) are considered accurate and sufficient to inform the impact assessment as per Section 6 of this report. The outcome of the ecological assessment of the watercourses as per SAS (2019 a,b) is provided in the table below.

Table A: Summary of the outcome of the ecological assessment of the watercourses identified as per SAS (2019 a,b).

Watercourse	Locality	PES	Ecoservices	EIS	REC / RMO
Vlermuisleegte River	Located within the eastern portion of the investigation area of the development area and proposed to be traversed by proposed access road Alternative 1.	C/D (Moderately to Largely modified)	Moderately Low	Moderate	RMO: C (Maintain) REC: C (Moderately modified) BAS: C
Perched depression wetland	Located within the eastern portion of the investigation area associated with the development area.	B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B

An impact assessment was applied to ascertain the significance of possible impacts to the watercourses which may occur as a result of the proposed Hyperion hybrid generation facility and access road. The impact assessment considered that no infrastructure of the Hyperion hybrid generation facility is located within the 32 m Zone of Regulation as it pertains to the National Environmental Management Act, 1998 (Act No. 107 of 1998), of the Vlermuisleegte River and perched depression wetland. Thus, the proposed construction and operational activities associated with these activities do not pose any legislative or freshwater conservation constraints in terms of the abovementioned Act and no change in the outcome of impact assessment for the Hyperion hybrid generation facility components from that presented in SAS (2019 a,b) is anticipated, since the proposed thermal power dual fuel facility will be located within the authorised project footprint of the Hyperion 1 and 2 PV SEF complex located at least 420 m west of the Vlermuisleegte River. The proposed access road is located directly west of the delineated extent of the Vlermuisleegte River. Table B below provides a summary of the outcome of the impact assessment.

Table B: A summary of the outcome of the impact assessment.

Activity/Nature:	Phase	Without Mitigation	With Mitigation
Access Road	Construction Phase	Medium	Medium
	Operational Phase	Medium	Low
Hyperion hybrid generation facility	Construction Phase	Low	Low
	Operational Phase	Low	Low

Based on the outcome of the impact assessment, the proposed Hyperion hybrid generation facility, including the thermal power dual fuel facility, is not expected to pose a direct negative impact to the identified Vlermuisleegte River and perched depression wetland. This can be attributed to the distance the proposed Hyperion hybrid generation facility (located at least 420 m from the edge of the river and 522 m from the edge of the perched depression wetland) is located from the watercourses.

The proposed access road is located immediately adjacent to the delineated extent of the Vlermuisleegte River. As such, the construction of the road may pose a direct negative impact to the Vlermuisleegte River with the implementation of mitigation measures. It is highly recommended that the width of the road be extended to the western side of the existing road reserve rather than to the east there of (if considered feasible). This will reduce the impact significance of the proposed access road construction activities on the Vlermuisleegte River. During the operational phase of the access road, if the recommended mitigation measures are implemented, the impacts significance would be low.

DOCUMENT GUIDE

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

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Appendix E.
2.2	Description of the preferred development site , including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 4. Please refer to SAS (2019 a,b) for detailed assessments.
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3: Table 1
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3: Table 1
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3: Table 1
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	None. Entire site considered very high sensitivity.
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6: Table 5 to 8
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	No. Implementation of the proposed mitigation measures will minimise the impacts.
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regime (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Section 6: Table 5 to 8
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system);	Section 6: Table 5 to 8

	b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soil, etc).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 6: Table 5 to 8
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	N/A
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	N/A
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Appendix E
3.2	A signed statement of independence by the specialist.	Appendix E
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Please refer to SAS (2019 a,b) for detailed assessments.
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Please refer to SAS (2019 a,b) for detailed assessments.
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.2
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 5
3.7	Additional environmental impacts expected from the proposed development.	Section 6
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Section 6
3.9	The degree to which impacts and risks can be mitigated.	Section 6
3.10	The degree to which impacts and risks can be reversed.	Section 6
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 6
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 5
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	None. The entire study area falls within a very high aquatic biodiversity sensitivity
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 7
3.16	Any conditions to which this statement is subjected.	Section 7

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ACRONYMS

°C	Degrees Celsius.
AC	Alternating Current
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DC	Direct Current
DM	District Municipality
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
LM	Local Municipality
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
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

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Alluvial river:	Alluvial river channels are self-formed features, meaning that they are shaped by the magnitude and frequency of the floods that they experience, and the ability of these floods to erode, deposit, and transport sediment. Alluvial channels are, therefore, formed in material that is able to move during moderate floods. This means that the bed and banks of an alluvial river channel are characteristically made up of unconsolidated mobile sediment such as silt, sand or gravel, or (in some cases) cobbles and small boulders. Alluvial river channels tend to erode their banks and deposit the eroded material on bars and on their floodplains.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Base flow:	Long-term flow in a river that continues after storm flow has passed.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Chroma:	The relative purity of the spectral colour which decreases with increasing greyness.
Cryptic wetland	Temporary wetlands in very arid areas often too shallow, too saline or too temporarily inundated to exhibit typical wetland features in their soil. Such wetlands are called “cryptic”, and cannot reliably be identified as wetlands during the dry season on the basis of standard wetland identification and delineation tools
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region”.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Intermittent flow:	Flows only for short periods.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the “background colour” referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.

RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to determine the impact of the proposed 75 MW thermal power dual fuel facility to potential watercourses, which will form part of a hybrid generation facility together with the environmental authorised Hyperion 1 Solar Photovoltaic (PV) Energy Facility (DEA Reference: 14/12/16/3/3/2/1109) and Hyperion 2 Solar PV Energy Facility (DEA Reference: 14/12/16/3/3/2/1110), near Kathu, Northern Cape Province (hereafter collectively referred to as the 'Hyperion hybrid generation facility').

A description of the project is provided in Section 2. SAS undertook a freshwater ecological assessment for the Hyperion 1 and 2 PV Solar Energy Facility (SEF) complex in 2019, which assessed the impacts of the proposed SEF complex (and associated infrastructure) and various access road alternatives on the identified watercourses. As such this report provides a summary of the previously assessed watercourses as per the freshwater ecological assessments conducted by SAS (2019 a,b) and determines the impact of the proposed 75 MW thermal power dual fuel facility and access road on these watercourses. This report further informs the required Environmental Impact Assessment (EIA) process for the proposed 75 MW thermal power dual fuel facility and access road.

To identify all watercourses that may potentially be impacted by the proposed Hyperion hybrid generation facility and access road, a 500 m "zone of investigation" around the proposed Hyperion hybrid generation facility and access road in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving watercourse environment. This area – i.e. the 500 m zone of investigation around the Hyperion hybrid generation facility and access road - will henceforth be referred to as the "investigation area".

1.2 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- The information provided in this report is extracted from the freshwater ecological assessments undertaken by SAS in 2019 for the proposed Hyperion 1 and 2 SEF complex. No additional site visits or assessments were undertaken as part of the scope of this report;
- This report serves to present the outcome of the impact assessment for the proposed additional infrastructures as part of the Hyperion hybrid generation facility, i.e. the proposed 75 MW thermal power dual fuel facility and access road. The assessment of impacts expected from all other infrastructures (such as the SEF complex and boreholes) did not form part of this report as it is assumed that the impacts thereof has been accurately assessed in previous reports;
- The determination of the watercourse boundaries and the assessment thereof is confined to the watercourses within the study and investigation areas. The watercourses identified were delineated based on the findings of the field assessment undertaken by SAS in 2019, and in fulfilment of Government Notice 509 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The general surroundings were considered in the desktop assessment of the investigation area;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. This is especially applicable given the semi-arid climatic conditions of the Northern Cape Province;
- The delineations as presented in this report are regarded as the best estimate of the boundaries of the watercourse based on the site conditions present at the time of assessment (November

2018). Limitations in the accuracy of the delineation due to low water levels within the systems and anthropogenic disturbances are deemed possible;
- Watercourse and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate freshwater species. Within this transition zone some variation of opinion on the watercourse boundary may occur, however, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- Global Positioning System (GPS) technology is inherently inaccurate, and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles.

2 PROJECT DESCRIPTION

The Hyperion hybrid generation facility is proposed on the remaining extent of the Farm Lyndoch 432 (focus area), which is located approximately 16 km north of Kathu in the Gamagara Local Municipality (LM) and within the greater John Taolo Gaetsewe District Municipality (DM), in the Northern Cape Province (Figure 1 and 2). The proposed thermal power facility is to be located within the authorised footprint of the Hyperion 1 and 2 SEF complex site. The solar PV component will make use of either fixed-tilt, single-axis tracking, or dual-axis (double-axis) tracking PV solar technology for the generation of electricity. The proposed dispatchable, dual fuel (liquid or gas) thermal generation plant will work in combination with the authorised Hyperion 1 and 2 PV SEF complex. The power generated by the thermal facility and authorised Hyperion PV SEF complex will connect via an overhead 132 kV power line a substation. The thermal generation plant will include the following infrastructure:

- Reciprocating Gas Engines;
- Access road;
- Truck entrance and parking facility;
- Regasification plant and fuel preparation plant;
- Dry cooling system for operating oils/chemicals;
- Fuel off-loading facility;
- Fuel storage facility;
- Water demineralisation plant; and
- Cabling, Operations and Management (O&M) building, fencing, warehouses and workshops.

Various access road alternatives were assessed as part of the freshwater ecological assessments conducted by SAS (2019 a,b) for the Hyperion 1 and 2 PV SEF complex. The proposed Hyperion hybrid generation facility will be serviced by an access road which entails the upgrade of approximately 3.6 km of the existing T26 gravel road situated between the focus area and the N14 national road. The use of the T26 gravel road was also approved as part of the environmental authorisation process for the Hyperion 1 Solar PV Energy Facility and Hyperion 2 Solar PV Energy Facility. It is, however, proposed to upgrade the T26 road from approximately 5 m to 15 m in width and will be tarred. The tarring of the road requires an amendment to the existing EA, which also entails assessing the impact of the proposed activities on watercourses. The proposed access road will traverse four properties: the remaining extent of the Farm Lyndoch 432; Portion 1, 2 and the remaining extent of the Farm Cowley 457. As part of the SAS 2019 assessments, it was identified that this proposed access road is located directly adjacent to the delineated extent of the Vlermuisleegte River. At the time of compiling this report no detailed design of the road or construction method was available.

Figure 1 and 2 below depicts the focus area comprising of the study area (the section of the remaining extent of the Farm Lyndoch 432 where the proposed Hyperion hybrid generation facility is located) and all other proposed infrastructures as described above.

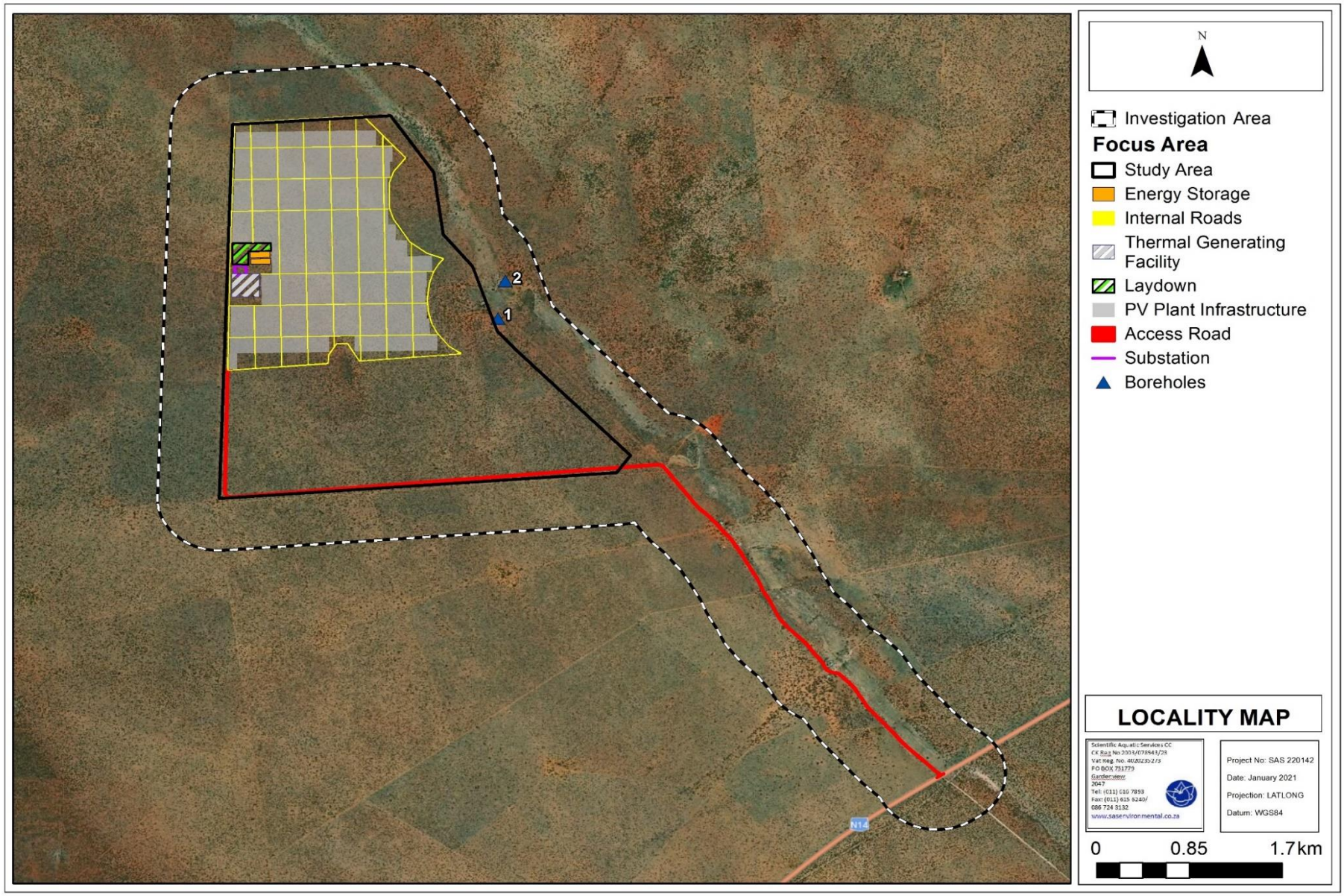

Figure 1: Digital satellite image depicting the focus area and investigation area in relation to surrounding areas. The boreholes and PV plant infrastructure have already been authorised.

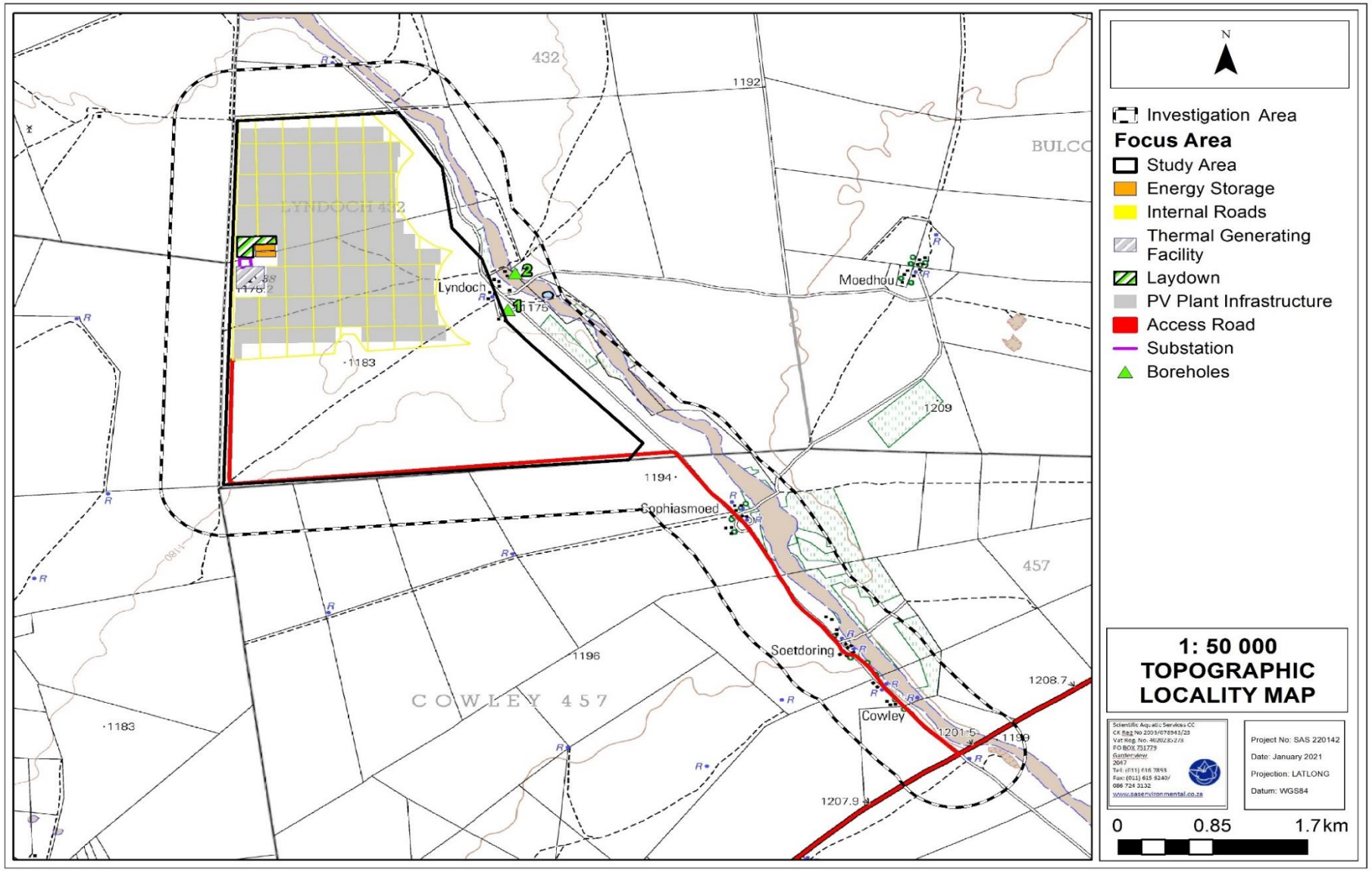

Figure 2: Location of the focus area and investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area. The boreholes and PV plant infrastructure have already been authorised.

3 RESULTS OF THE DESKTOP ANALYSIS

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

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

Aquatic ecoregion and sub-regions in which the focus area is located	
Ecoregion	Southern Kalahari Ecoregion
Catchment	Orange
Quaternary Catchment	D41K
WMA	Lower Vaal
subWMA	Molopo
Dominant characteristics of the Southern Kalahari (29.01) Aquatic Ecoregion Level 2 (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Plains; moderate relief, closed hills, mountains; moderate and high relief. Extremely irregular plains, lowlands and hills. Slightly irregular plains and pans
Dominant primary vegetation types	Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld
Altitude (m a.m.s.l)	700 to 1500
MAP (mm)	0 to 500
Coefficient of Variation (% of the MAP)	30 to 40
Rainfall concentration index	60 to >65
Rainfall seasonality	Late Summer
Mean annual temp. (°C)	16 to 22
Winter temperature (July)	0 to 22
Summer temperature (Feb)	16 to >32
Median annual simulated runoff (mm)	<5 to 40

Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)	
Sub-quaternary reach	D41K-02240 (Vlermuisleegte River)
Proximity to the focus area?	± 7,8 km north-west of the focus area
Assessed by an expert?	No (Episodic river*)
Mean Ecological Importance (EI) Class	Moderate
Mean Ecological Sensitivity (ES) Class	High
Stream Order	1
Default Ecological Class (based on median PES and highest EI or ES mean)	Moderate (Class C)

Detail of the focus area in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
FEPACODE	The focus area is situated in an area defined as an upstream management catchment. Upstream management catchments are required to prevent the downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).
NFEPA Wetlands (Figure 3 & 4)	According to the NFEPA database (2011) a natural depression is located within the eastern portion of the investigation area and is considered to be in a natural or good ecological condition (Class AB). An artificial unchannelled valley bottom wetland and an artificial flat wetland are also located within the investigation area, which are considered to be in a heavy to critically modified ecological condition (Class Z3). These three features are located within the Vlermuisleegte River. Based on the investigation of available digital satellite imagery, these artificial features could be identified as farm dams. This will be confirmed during the field investigation.
Wetland Vegetation Type	Eastern Kalahari Bushveld Group 1 (Least Threatened according to SANBI, 2012 and Mbona *et al*, 2014))
NFEPA Rivers (Figure 3)	The episodic Vlermuisleegte River bisects the eastern portion of the investigation area. This river is considered to be in a largely natural ecological condition according to the PES 1999, however, according to NFEPA database, the river is in a moderately modified ecological condition (Class C). Additionally, the river is considered an upstream management river.
Detail of the focus area in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 5)	
Ecological Support Areas (ESA)	A buffer around the Vlermuisleegte River is classified as an Ecological Support Area (ESA), thus a portion of the study area and the access road falls within the 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).
Other Natural Areas (ONA)	The majority of the focus area and the remaining portion of the access road is located within an area defined as "other natural areas" (ONA). According to the Technical Guidelines for CBA Maps document ONA consist of all 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).
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 6)	
According to the NBA (2018):SAIIAE there are no natural or artificial wetland features associated with the focus area. The National Wetland Map 5 does however identify the Vlermuisleegte River as a river. The Vlermuisleegte River is currently not protected (Ecosystem Protection Level), and is therefore considered endangered (Ecosystem Threat Status). At the time of the compilation of the NBA Dataset the Vlermuisleegte River was dry and therefore it is data deficient.	

National Web Based Environmental Screening Tool (2020)	
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	The aquatic sensitivity for the focus area and surrounds has a very high sensitivity, as a result of wetlands located within the focus area. Additionally, the focus area is located within a groundwater strategic water source area (SWSA) namely Sishen and Kathu. Groundwater SWASs are areas which have a high groundwater recharge / availability and are classified as a nationally important resource.

*** With the Vlermuisleegte River being classified as an episodic river, no fish or macro-invertebrates could be recorded. 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; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; ONA = Other Natural Areas; PES = Present Ecological State; PV = Photovoltaic; WMA = Water Management Area**

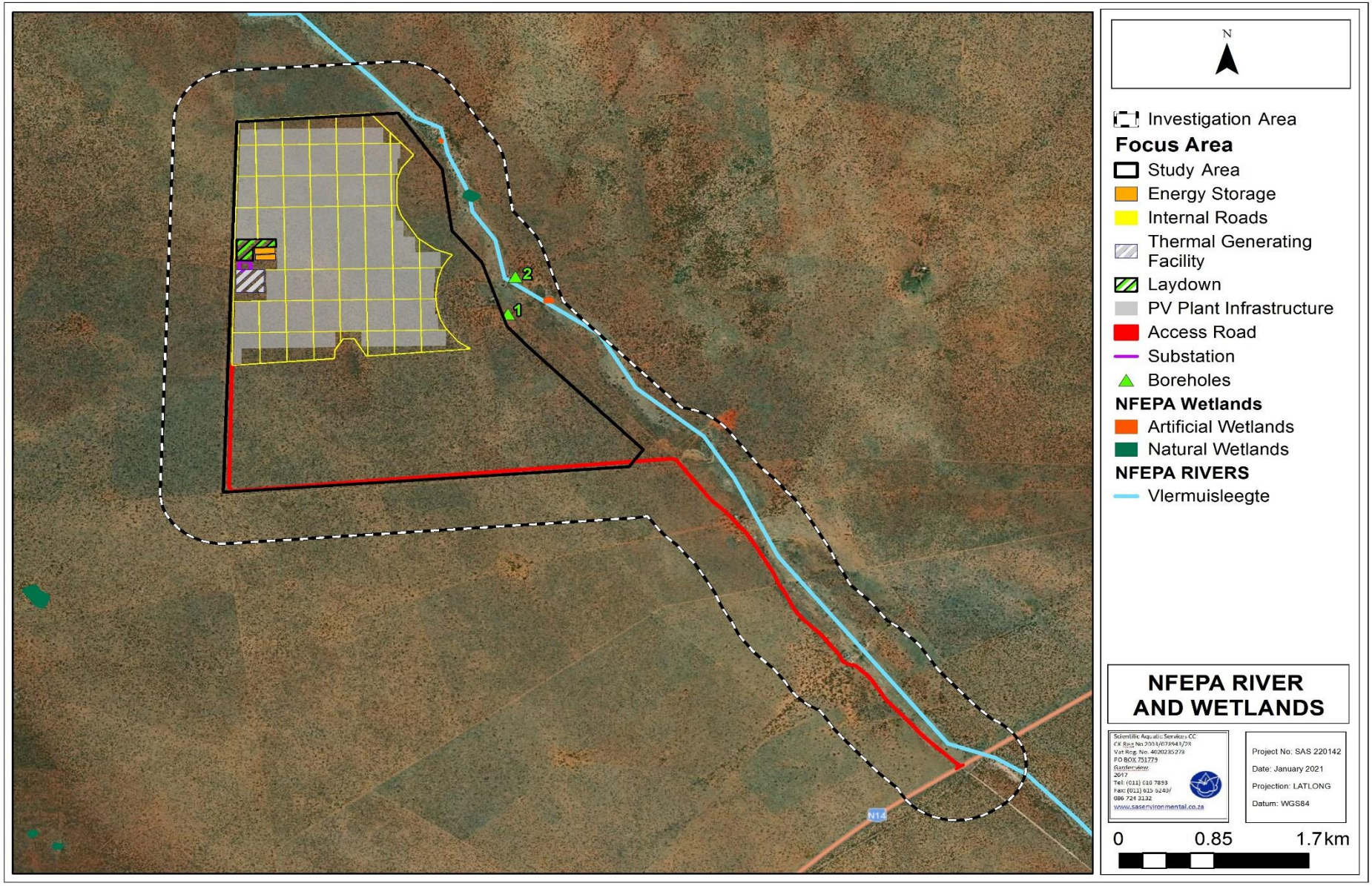

Figure 3: The natural and artificial wetlands and Vlermuisleegte River associated with the focus and investigation areas according to the NFEPA database (2011).

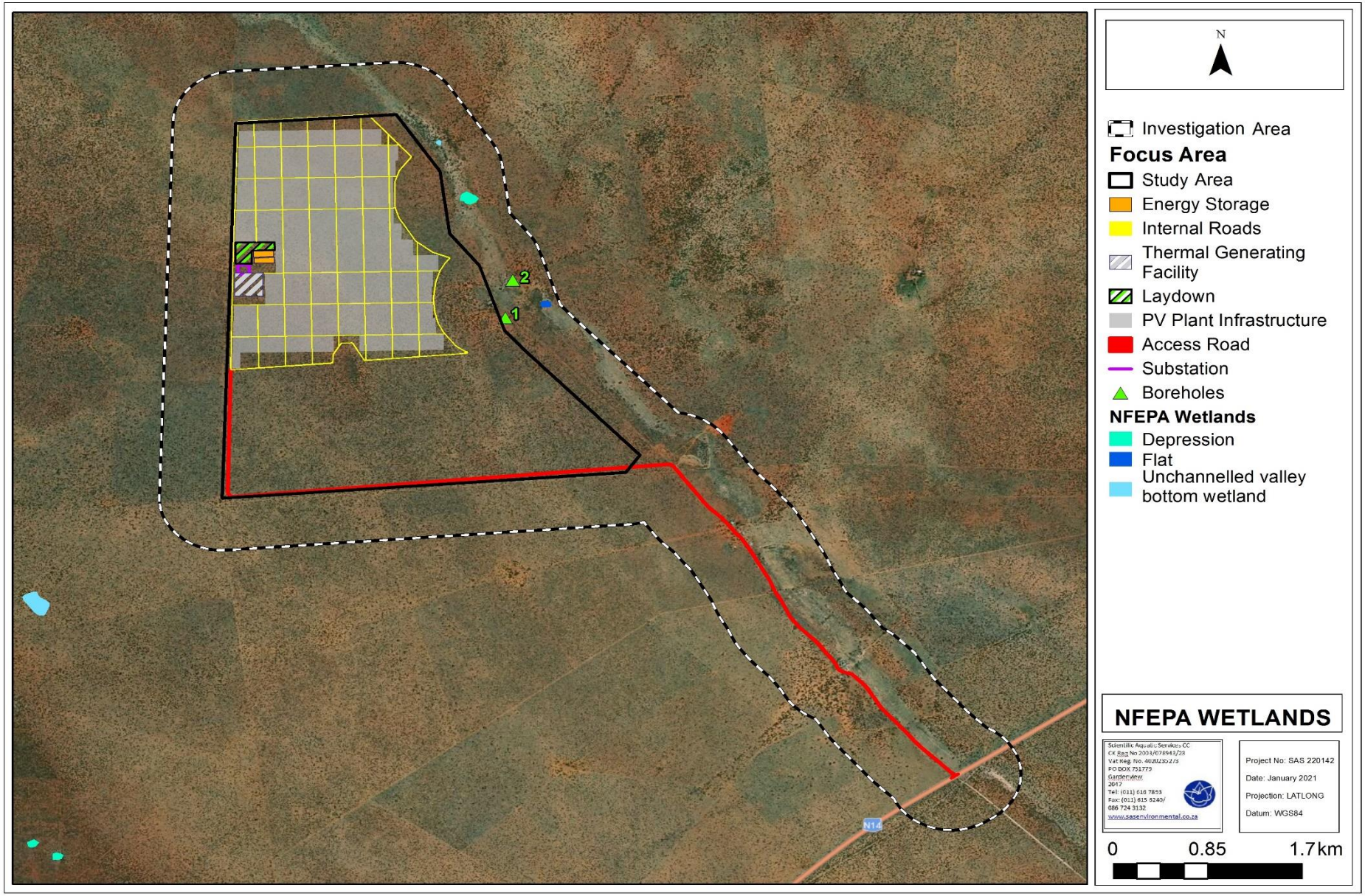

Figure 4: The hydrogeomorphic (HGM) units associated with the focus and investigation areas according to the NFEPA database (2011).

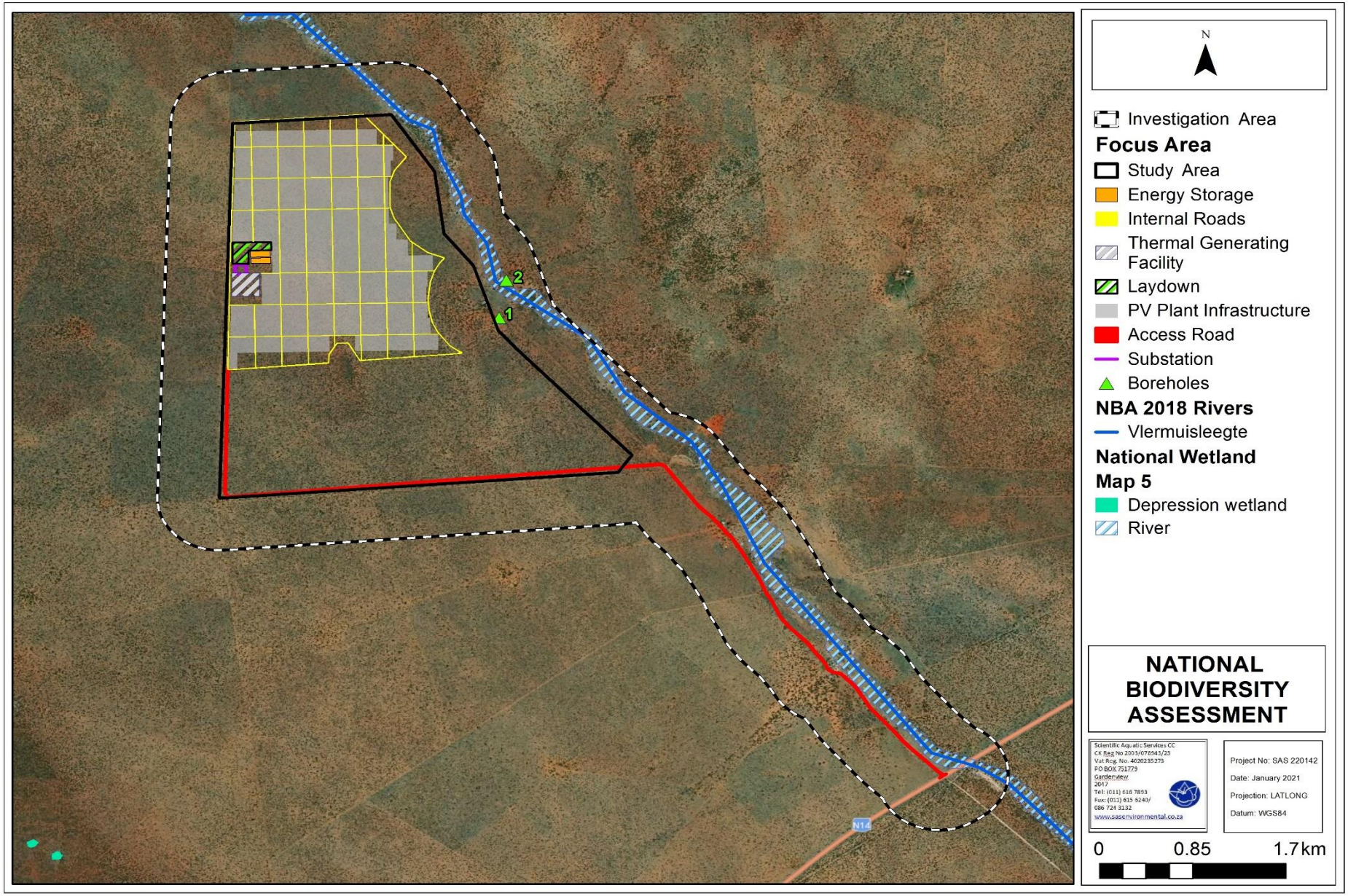

Figure 5: Vlermuisleegte River associated with the focus and investigation areas according to the National Biodiversity Assessment (NBA) (2018).

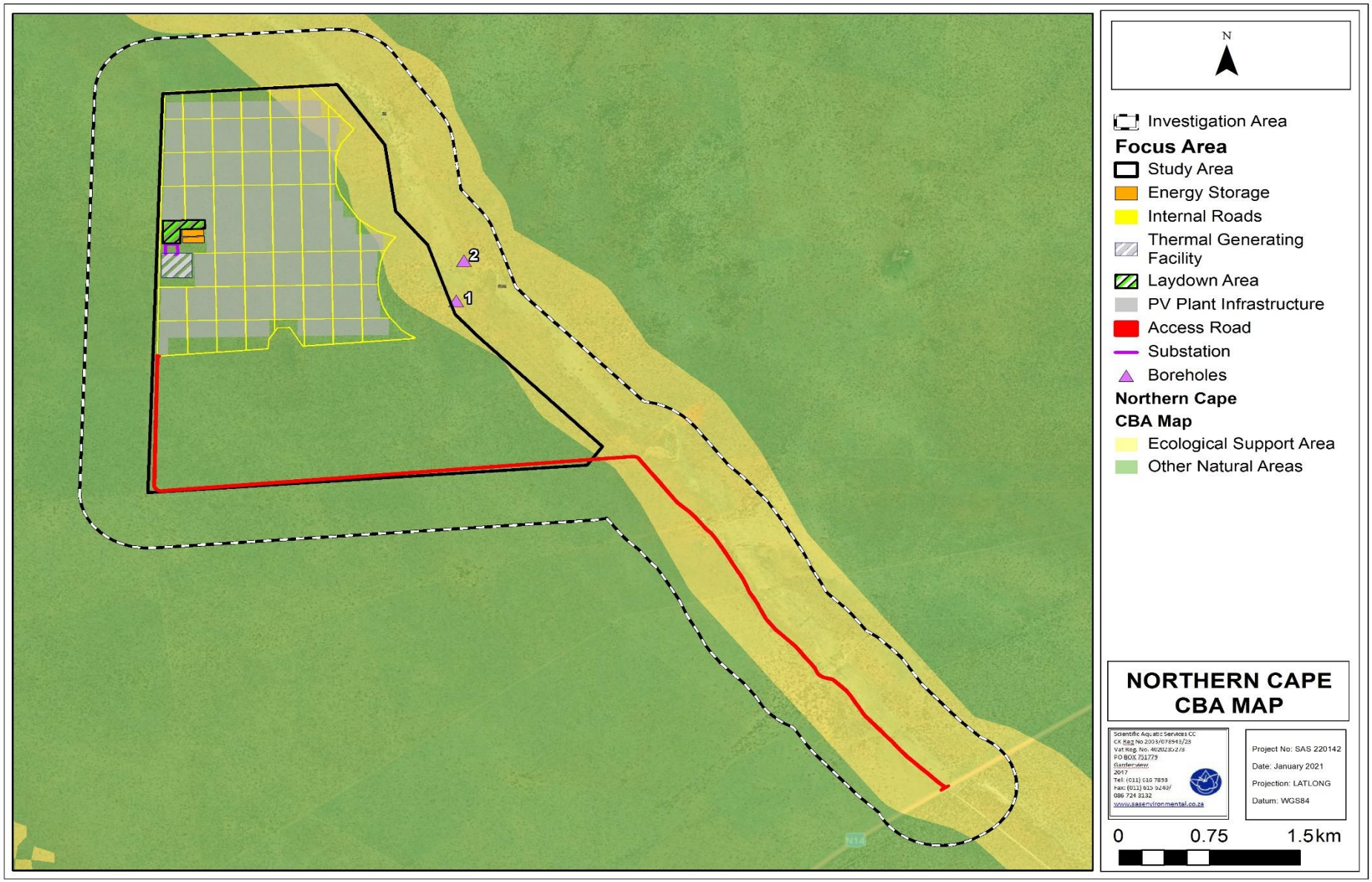

Figure 6: The Ecological Support Areas and Other Natural Areas associated with the focus and investigation areas according to the Northern Cape Critical Biodiversity Area Database (2016).

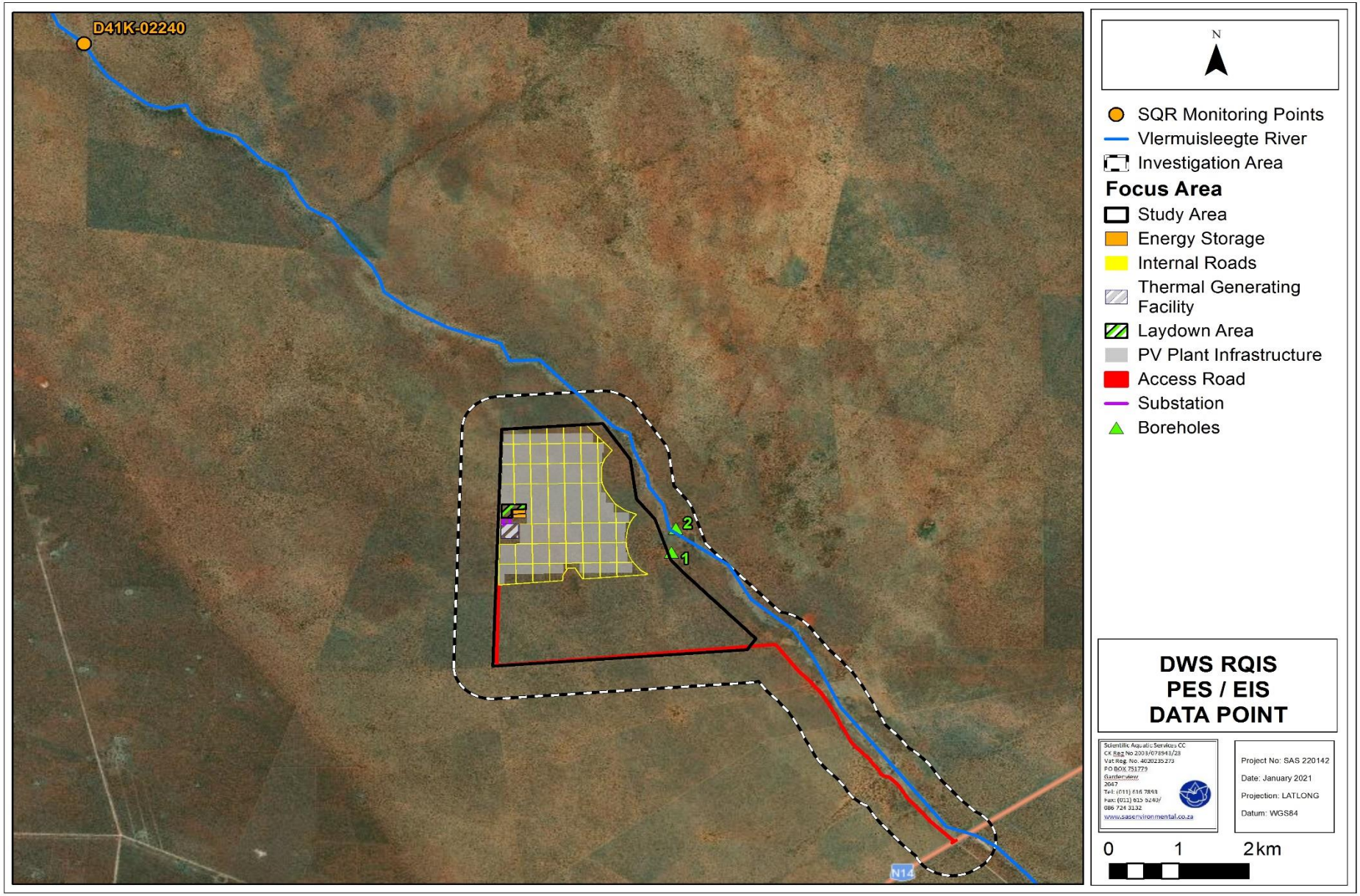

Figure 7: The SQR Monitoring Point associated with the Vlermuisleegte River, in relation to the focus and investigation areas.

4 RECEIVING FRESHWATER ENVIRONMENT

The following section presents a summary of the outcome of the freshwater ecological assessments undertaken by SAS in 2019 titled: “Watercourse Impact Assessment as part of the Environmental Impact Assessment (EIA) for the proposed Hyperion Solar Development 1, near Kathu, Northern Cape Province” (SAS, 2019a) and “Watercourse Impact Assessment as part of the Environmental Impact Assessment (EIA) for the proposed Hyperion Solar Development 2, near Kathu, Northern Cape Province” (SAS, 2019b). Please refer to these reports for a detailed analysis of the identified watercourses, however a summary of the applicable watercourses are provided below.

Based on the layout of the proposed Hyperion hybrid generation facility, no watercourses are located within the footprint area of the Hyperion hybrid generation facility, including the footprint of the proposed thermal power dual fuel facility. The eastern portion of the investigation area associated with the focus area is bisected by the Vlermuisleegte River which flows in a south-eastern to north-western direction. A perched depression wetland was also identified within the eastern portion of the investigation area located within the delineated extent of the Vlermuisleegte River. The proposed access road is located directly west of the Vlermuisleegte River (Figure 8). Table 2 and 3 below provides a summary of the ecological assessment of the Vlermuisleegte River and perched depression wetland as per SAS (2019 a,b).

Presently the focus area (footprint area of the Hyperion hybrid generation facility, including the footprint of the proposed thermal power dual fuel facility) as well as the immediate surroundings have remained fairly similar to the site conditions during the initial site visit by SAS in late 2018. As such, the outcome of the ecological assessment of the Vlermuisleegte River and perched depression wetland as presented in SAS (2019 a,b) are considered accurate and sufficient to inform the impact assessment as per Section 6 of this report.

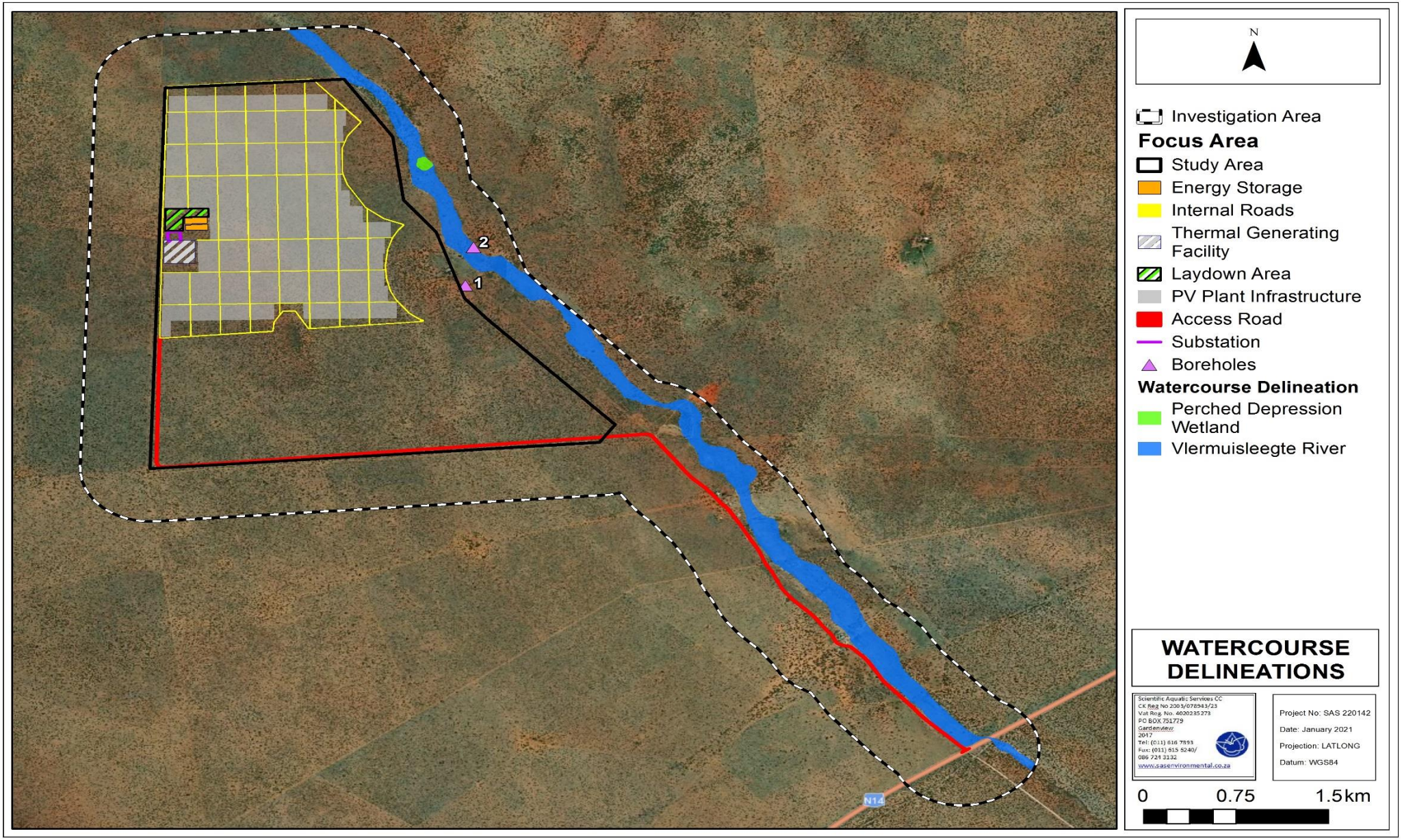

Figure 8: The locality of the watercourses associated with the focus and investigation areas.

Table 2: Summary of the ecological assessment of the Vlermuisleegte River as per SAS (2019 a,b).

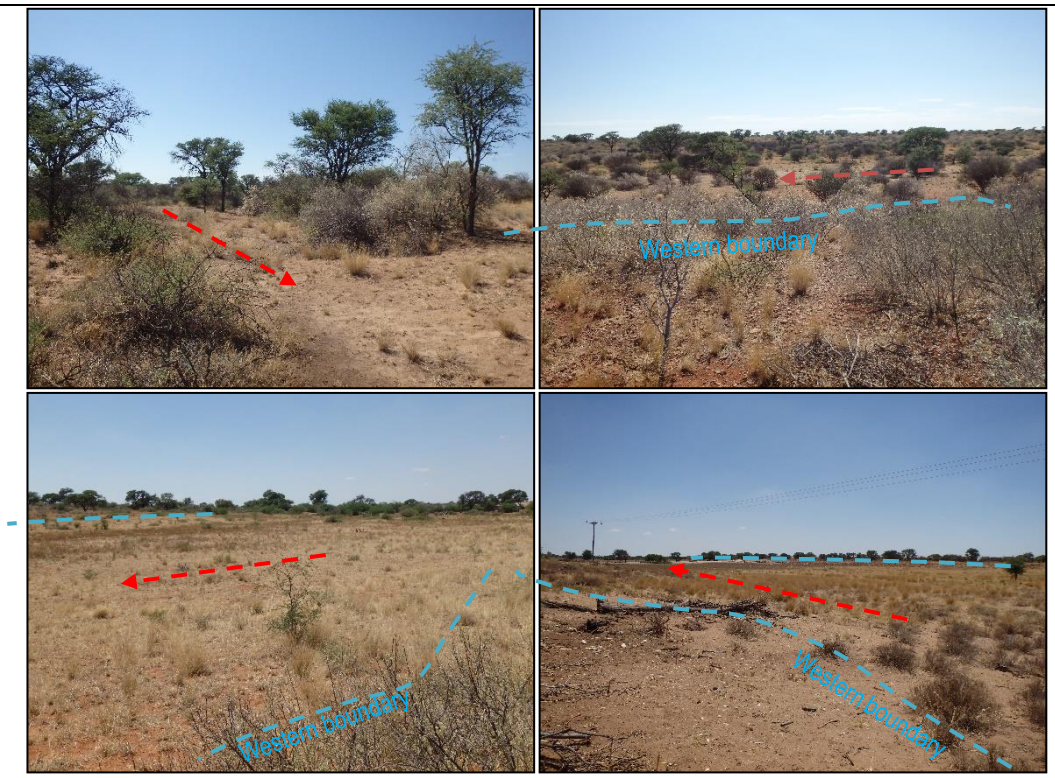

Figure 9: Representative photographs of the reach of the Vlermuisleegte River located east of the proposed access road. (Top left and right). The northern portion of this river is well vegetated, consisting of grasses, shrubs and a variety of tree species. Alluvial soils were identified in areas where the vegetation density is low. (Bottom left and right) The southern portion of the Vlermuisleegte River has been historically cultivated. In channel vegetation is dominated by grass species, while larger tree and shrub species are located along the river boundary. Boundary of the Vlermuisleegte river is indicated by the blue line and flow direction is indicated by the red arrow.

Watercourse	The Vlermuisleegte River is highly episodic[1], only flowing for brief periods during irregular flood events. The climate in which the focus and investigation areas are located is considered to be semi-arid with the Mean Annual Rainfall (MAR) ranging from 200 to 500 mm (see Section 3), most of which falls from late November to March (usually as heavy downpours of short duration). The Vlermuisleegte River is also considered to be an alluvial river. These systems are known to be self-formed rivers, that are shaped by the magnitude and frequency of the floods that they experience, and as part of these floods, erode, deposit, and transport sediment (Ollis *et al.,* 2013). Alluvial rivers are therefore formed by materials that can move during moderate floods. In this case, the Vlermuisleegte River is characterised by thick, red sandy soils which have been deposited within the valley bottom position, forming a floodplain landform (due to the uniformity and thickness of the sand) rather than having a distinctive river channel.
Vlermuisleegte River	

Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
C/D (Moderately to Largely modified)	Moderately Low	Moderate	RMO: C (Maintain) REC: C (Moderately modified) BAS: C

[1] "Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period, or may flow only once in several years." (Uys and O'Keeffe, 1997, in Rossouw *et al*., 2006).

Table 3: Summary of the ecological assessment of the perched depression wetland as per SAS (2019 a,b).

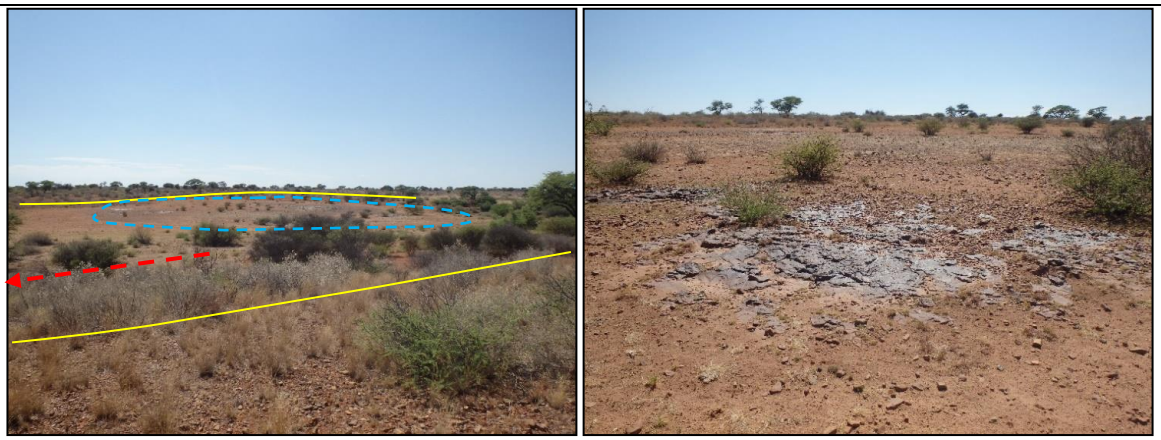

Figure 10: (Left) The perched depression wetland (dashed blue outline) located within the Vlermuisleegte River (yellow line). (Right) Rocky outcrops line the base of the pan. Very few vegetation species were present within the depression itself, with only a few shrub species identified.

Watercourse Perched depression wetland	Since very few anthropogenic factors are within close proximity to this depression, it is considered to be mostly unaffected. A slight change in ecosystem processes is discernible, and a small loss of natural habitat and biota may have taken place due to livestock trampling and grazing. Grazing from livestock was the only apparent factor, impacting the vegetation component of the depression.

Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B

5 LEGISLATIVE REQUIREMENTS

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

- The Constitution of the Republic of South Africa, 1996[1]; and
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

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

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

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

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

Regulatory authorisation	Zone of applicability
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998). ***Department of Environmental Affairs and Development Planning***	The EIA Regulations (2014), as amended in April 2017, must be taken into consideration if any activities (for example, stockpiling of soil) are to take place within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities. The following activities are considered as part of this freshwater assessment: **Activity 12** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *Where such development occurs—* *(a) Within a watercourse;* *(b) In front of a development setback; or* *(c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.* Excluding – where such development occurs within existing roads, [or] road reserves **Activity 19** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states "*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse".*

Based on the above applicable legislation, a 32m Zone of Regulation (ZoR) in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) was applied to the Vlermuisleegte River and perched depression wetland (Figure 11).

Since the proposed thermal power dual fuel facility will be located within the authorised footprint of the Hyperion 1 and 2 PV SEF complex, located at least 420 m west of the Vlermuisleegte River and 522 m west of the perched depression wetland, and thus outside the 32 m ZoR, it is expected that no additional impacts from the proposed thermal power dual fuel facility to the Vlermuisleegte River and perched depression wetland are anticipated. As such, the outcome of the freshwater ecological assessments (2019 a,b) is considered valid and no reporting results or increased impacts are expected. Please refer to Section 6 for further details regarding the impact assessment outcome, with specific mention of determining the impact of the proposed access road on the Vlermuisleegte River.

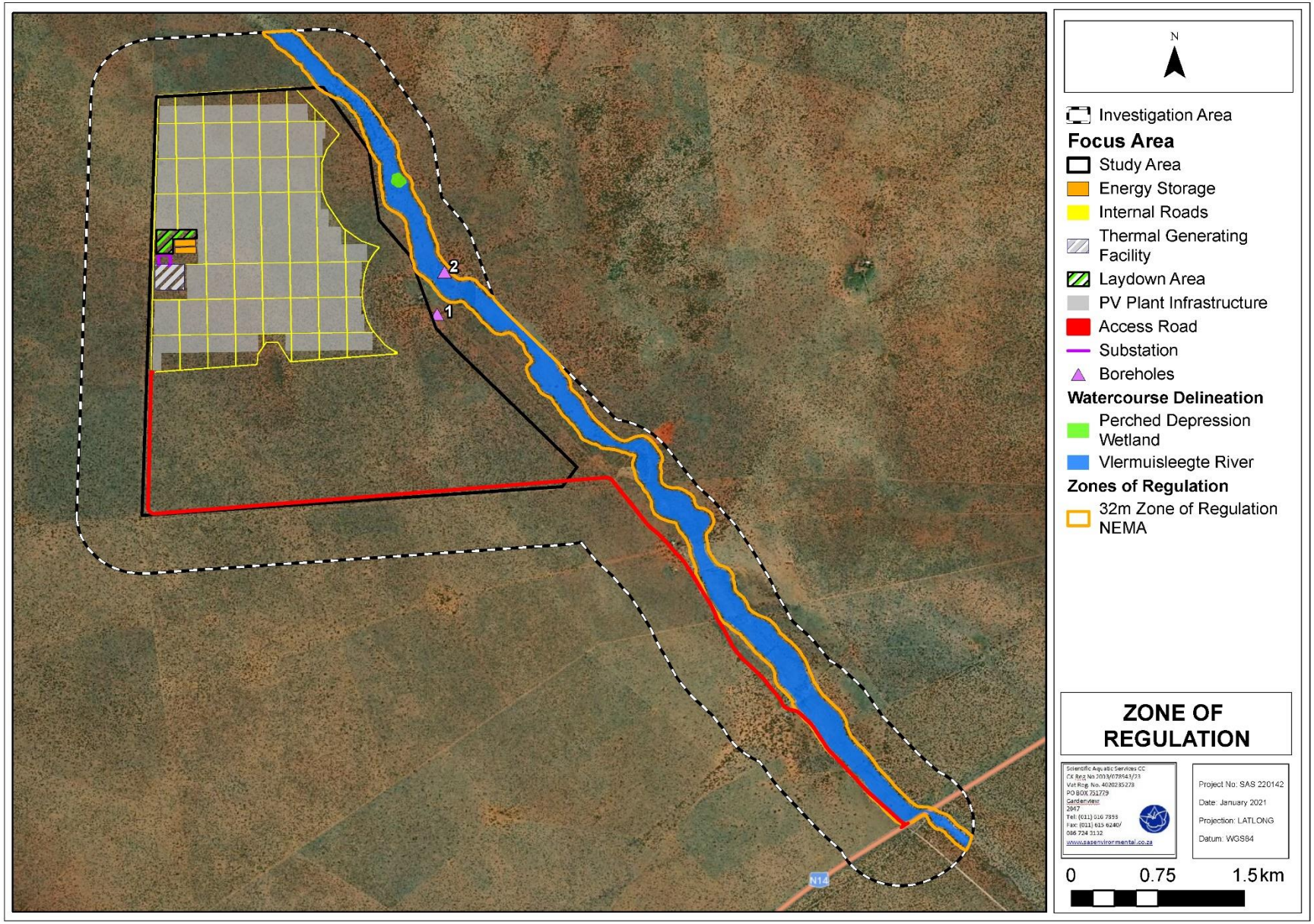

Figure 11: Map indicating the NEMA and GN509 regulated areas applicable to the perched depression wetland and Vlermuisleegte River.

6 IMPACT ASSESSMENT

6.1 Impact Assessment Outcome

The outcome of the ecological assessment of the Vlermuisleegte River and perched depression wetland as per SAS (2019 a,b) was used to inform the impact assessment. The impact assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat, and biota) of these watercourses. The points below summarise the considerations made when applying the impact assessment:

- The outcomes of the ecological assessment of the Vlermuisleegte River as per SAS (2019 a,b) were used to inform the impact assessment and no additional watercourses assessments was undertaken. The outcome of the freshwater ecological assessment of SAS (2019 a,b) of the watercourses associated with the Hyperion 1 and 2 PV SEF complex are considered valid to inform the impact assessment for the proposed proposed thermal power dual fuel facility and access road;
- Based on Figure 11, no infrastructure of the Hyperion hybrid generation facility (including the proposed thermal power dual fuel facility) within the focus area is located within the 32 m NEMA ZoR of the Vlermuisleegte River and perched depression wetland. Thus, the proposed construction and operational activities associated with these activities do not pose any legislative or freshwater conservation constraints and no change in the outcome of impact assessment for the Hyperion hybrid generation facility components from that presented in SAS (2019 a,b) is anticipated, since the proposed thermal power dual fuel facility will be located within the authorised project footprint of the Hyperion 1 and 2 PV SEF complex located at least 420 m west of the Vlermuisleegte River. A summary of the outcome of the impact assessment of the proposed Hyperion hybrid generation facility is presented in Table 5 and 6; and
- The proposed access road is located directly west of the delineated extent of the Vlermuisleegte River. A summary of the outcome of the impact assessment of the proposed Hyperion hybrid generation facility is presented in Table 7 and 8. At the time of compiling this report no detailed design of the road or construction method was available.

Tables 5 to 8 below provide the outcome of the impact assessment for the above-listed activities, based on the methods presented in Appendix C. All general good housekeeping mitigation measures are provided in Appendix D.

Table 5: Impact table summarising the impact significance with and without mitigation for the <u>construction</u> of the proposed Hyperion hybrid generation facility (including the proposed thermal power dual fuel facility) and internal access roads associated with the development area.

Nature:
Construction of the proposed surface infrastructure and internal access roads in the focus area are located outside of the 32 m NEMA ZoR of the watercourses. As these activities are located outside of the applicable ZoR of the river/ perched depression wetland in accordance with National Environmental Management Act, 1998 (Act No. 107 of 1998), the proposed construction and operational activities thereof do not pose legislative or freshwater conservation constraints in terms of the abovementioned act. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River) were considered as a precautionary approach. The construction of the proposed Hyperion hybrid generation facility and internal access roads in the focus area will entail the following activities, and their resulting edge effect impacts on the closest watercourse (i.e. the Vlermuisleegte River) is provided below: *Disturbance to the natural buffer zone surrounding the Vlermuisleegte River, including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the river.

	Without Mitigation		With Mitigation	
Extent	Local	2	Local	2
Duration	Very short (0–1 years)	1	Very short (0–1 years)	1
Magnitude	Minor	2	Minor	2
Probability	Improbable	2	Very Improbable	1
Significance	**Low**	**10**	**Low**	**5**
Status	Neutral		Neutral	
Reversibility	High		High	
Irreplaceable loss of recourses?	No		No	
Can impacts be mitigated?	Yes		Yes	
Mitigation				
*Contractor laydown areas, material storage facilities, and refuelling of construction activities must remain outside the 32 m ZoR of the watercourses, preferably be contained within the dedicated laydown area in the focus area; *All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential; *Retain as much indigenous vegetation as possible; *Water imported to the construction site may not be allowed to drain into the Vlermuisleegte River or perched depression wetland, and should be managed with appropriate stormwater management systems; *Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only; *All stockpiles created from excavated soils may not be higher than 2 m and must be protected from wind erosion. These stockpiles should be levelled, or the soil be used as part of rehabilitation activities within the focus area; *It should be feasible to utilise existing roads to gain access to the construction area; *After construction of the surface infrastructure, the surrounding area thereof must be revegetated with suitable indigenous vegetation (terrestrial vegetation) to prevent the establishment of alien vegetation species and their potential spread into the river.				
Cumulative Impacts				
Increased hardened surfaces in the vicinity of the Vlermuisleegte River and perched depression wetland may potentially increase the volume and velocity of runoff that enters the watercourses during rainfall events. This is not considered to be a significant contribution to the overall cumulative impacts on the Vlermuisleegte River and perched depression wetland as the proposed development activities are located at least 420 m from the edge of the river and 522 m from the edge of the perched depression wetland, and the surrounding natural buffer zone (terrestrial vegetation) would prevent any concentrated runoff from entering the river.				
Residual Risks				
There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River may occur due to vegetation not being able to re-establish within and surrounding the construction footprint area.				

Table 6: Impact table summarising the impact significance with and without mitigation for the operation of the proposed Hyperion hybrid generation facility (including the proposed thermal power dual fuel facility) and internal access roads associated with the development area.

Nature:				
Operation of the proposed surface infrastructure and internal access roads in the focus area are located outside of the 32 m NEMA ZoR of the watercourses. As these activities are located outside of the applicable ZoR of the river/ perched depression wetland in accordance with National Environmental Management Act, 1998 (Act No. 107 of 1998), the proposed construction and operational activities thereof do not pose legislative or freshwater conservation constraints in terms of the abovementioned act. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River) were considered as a precautionary approach: *Disturbance to the natural buffer zone surrounding the Vlermuisleegte River during maintenance activities (such as cleaning of the PV panels), including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the area surrounding the river. *Increased hardened surfaces in the vicinity of the river may potentially alter the pattern of runoff entering the river.				
	Without Mitigation		**With Mitigation**	
Extent	Local	2	Local	2
Duration	Permanent	5	Permanent	5
Magnitude	Minor	2	Minor	2
Probability	Improbable	2	Very Improbable	1
Significance	**Low**	**18**	**Low**	**9**
Status	Neutral		Neutral	
Reversibility	High		High	
Irreplaceable loss of recourses?	No		No	
Can impacts be mitigated?	Yes		Yes	
Mitigation				
*Regular inspection of the area surrounding the surface infrastructure should occur to monitor the establishment of vegetation, prevent the establishment of alien and invasive vegetation species, and their potential spread into the river; *Stormwater runoff from the internal roads should be monitored, to ensure no erosion occurs and that all water is diffusely spread across the landscape; *Stormwater generated within the focus area must be suitably managed according to a site specific stormwater management plan. No water may be directly released from the focus area into the river but must rather be suitably managed and released diffusely into the landscape. It is highly recommended that the stormwater management plan for the proposed Hyperion hybrid generation facility be consulted in this regard; *If repair activities to the infrastructure components are required, the mitigation measures as per that of the construction phase must be implemented.				
Cumulative Impacts				
Increased hardened surfaces in the vicinity of the Vlermuisleegte River and perched depression wetland may potentially increase the volume and velocity of runoff that enters the watercourses during rainfall events. This is not considered to be a significant contribution to the overall cumulative impacts on the Vlermuisleegte River and perched depression wetland as the proposed development activities are located at least 420 m from the edge of the river and 522 m from the edge of the perched depression wetland, and the surrounding natural buffer zone (terrestrial vegetation) would prevent any concentrated runoff from entering the watercourses.				
Residual Risks				
There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River and perched depression wetland may occur due to vegetation not being able to re-establish within the area surrounding the development area.				

Table 7: Impact table summarising the impact significance with and without mitigation for the construction of the proposed access road located immediately west of the Vlermuisleegte River.

Nature:				
The upgrading (through widening and tarring) of the existing T26 gravel road to a tarred road of up to 15 m in width. This will entail the following activities and their resulting impacts on the Vlermuisleegte River: *Site preparation before construction activities surrounding the existing road, including widening the road footprint to a total width of 15 m. A 5 m construction buffer surrounding the proposed road footprint area is allowed for the duration of the construction activities. The 5 m construction buffer is expected to encroach into the Vlermuisleegte River to some degree. This will disturb the vegetation and soil associated with the Vlermuisleegte River and potentially increase the volume of sediment entering the river system. *Potential risk of flooding of the construction footprint due to the proposed access road locality relative to the modelled 1:100 year floodline (Highlands Hydrology, 2020). *Disturbance to the vegetation and habitat of the Vlermuisleegte River and its surrounding buffer area could lead to the proliferation of alien invasive vegetation species. *Potential trampling by construction personnel within the Vlermuisleegte River beyond the construction footprint, impacting on the geomorphology of the river. *Altered topography/geomorphology of the river, leading to altered runoff patterns and formation of preferential flow paths.				
	Without Mitigation		**With Mitigation**	
Extent	Local	1	Local	1
Duration	Very short (0–1 years)	1	Very short (0–1 years)	1
Magnitude	High	8	Moderate	6
Probability	Definite	5	Highly Probable	4
Significance	**Medium**	**55**	**Medium**	**32**
Status	Negative		Negative	
Reversibility	Low		Medium	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes		Yes	
Mitigation				
*Contractor laydown areas, and material storage facilities to remain outside of the Vlermuisleegte River and its 32 m NEMA ZoR; *All vehicle re-fuelling is to take place outside of the Vlermuisleegte River and its 32 m NEMA ZoR; *All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential; *Retain as much indigenous riparian vegetation as possible; *It is highly recommended that the width of the road be extended to the western side of the existing road reserve rather than to the east there of (if considered feasible) (Figure 12). This may potentially prevent the encroachment of the road into the delineated extent of the Vlermuisleegte River;				

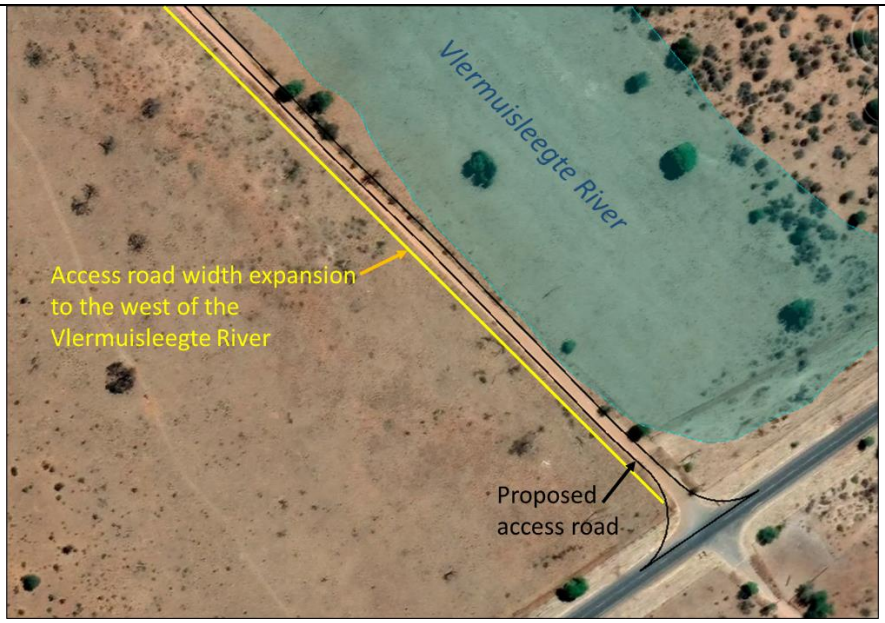

Figure 12: It is highly recommended that the width of the proposed access road (black line) only be expanded to the west (yellow line) to avoid encroaching on the Vlermuisleegte River (blue).

*Construction of the road must be undertaken during low flow or no flow conditions. Although the crossing of the river is not proposed, undertaking construction during low flow periods minimises the potential for the activities to impact on the downstream reach of the river (potentially increase the cumulative impacts);
*The recommendations to mitigate the risk of flooding of the access road as per the hydrological assessment (Highlands Hydrology, 2020) mut be adhered to;
*All vegetation removed as part of the road widening should be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility;
*During the construction of the access road, a buffer of no more than 5 m on either side of the proposed road reserve may be impacted. This area, along with the delineated edge of the Vlermuisleegte River must be cordoned off with danger tape or any suitable materials (hessian or geotextile fabric), and no vehicles or personnel are permitted outside of the authorised construction area;
*It should be feasible to utilise existing roads to gain access to the proposed access road construction area. No crossing of the river is permitted since all development activities are located to the west of the river;
*Material to be used (asphalt, bitumen, sand) as part of the widening of the road must be stockpiled outside the 32 m NEMA ZoR of the river to prevent sedimentation of the river. These stockpiles may not exceed a height of 2 m and should be protected from wind using tarpaulins;
*Any concrete/asphalt mixing of materials as part of the construction activities should be done within a designated batching area only and must not be mixed within the 32 m NEMA ZoR of the Vlermuisleegte River.
*Suitable stormwater management structures should be implemented to allow for water to drain from the road without causing erosion. The stormwater management plan must be consulted in this regard;
*Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River occurs from excessive dust settling;
*After construction of the road, the area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring;
*All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species.
*It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction.

Cumulative Impacts

As this access road entails upgrading of an existing road (T26), initial impacts to the vegetation and geomorphological components of this Vlermuisleegte River have already occurred. Nevertheless, widening of the road would entail a larger road footprint area which may potentially encroach into the delineated extent of the Vlermuisleegte River and add to the cumulative negative impact (with specific mention of its vegetation component) this access road would have on the river, such as increased hardened surfaces within its catchment.

Residual Risks

There is a residual risk that a decrease in habitat provision by the Vlermuisleegte River may occur due to vegetation not being able to re-establish within and directly surrounding the construction footprint area.

Table 8: Impact table summarising the impact significance with and without mitigation for the operation of the proposed access road located immediately west of the Vlermuisleegte River.

Nature:				
Operation of the proposed access road. This will entail the following activities, and their resulting impacts on the Vlermuisleegte River: *Runoff from the road entering the river could be contaminated and could impact on the surface water quality of the river (if surface water is present). *Runoff from the road can potentially create preferential flow paths in the river, thus causing erosion of the embankment of the river.				
	Without Mitigation		**With Mitigation**	
Extent	Local	1	Local	1
Duration	Permanent	5	Permanent	5
Magnitude	Low	4	Minor	2
Probability	Probable	3	Probable	3
Significance	**Medium**	**30**	**Low**	**24**
Status	Negative		Negative	
Reversibility	High		High	
Irreplaceable loss of recourses?	No		No	
Can impacts be mitigated?	Yes		Yes	
Mitigation				
*Ensure that routine inspections and monitoring of the road are implemented. Monitoring should occur biannually (or as specified by the relevant engineer), and specifically after significant rainfall events; *Regular inspection (during the rehabilitation phase by the appointed Environmental Compliance Officer (ECO) and during the operational phase by the Operation and Maintenance (O&M) Manager) for alien and invasive vegetation along the road should occur, to limit their spread into the river; *Stormwater runoff from the road into the river may form preferential surface flow paths into the river. If this does occur, the areas should be rehabilitated (erosion gullies infilled) and revegetated to aid in dispersing the flow of water from the road into the river; *No unauthorised or indiscriminate movement of vehicles in the Vlermuisleegte River may be permitted during the visual inspection; *If repair activities to the road are required, the mitigation measures as per that of the construction phase must be implemented.				
Cumulative Impacts				
The larger footprint area of this road contributes to the cumulative impact on the river, although this is considered to be of limited extent since the road is already existing (T26 road) prior to the upgrade thereof.				
Residual Risks				
Constant usage of the road could potentially decrease the biodiversity (mainly faunal species) within and directly surrounding the portion of the river associated with the access road, due to more frequent usage of the road.				

6.2 Impact Assessment Discussion

Due to the distance of the proposed Hyperion hybrid generation facility from the Vlermuisleegte River and perched depression wetland, with the implementation of the recommended mitigation measures (Table 5 and 6), a low to very low impact on the watercourses are expected to occur. As this infrastructure is located outside of the applicable 32 m NEMA of the Vlermuisleegte River and perched depression wetland, the proposed construction and operational activities associated with these activities do not pose any legislative or freshwater conservation constraints in terms of the abovementioned Act.

As per the outcome of the impact assessment, the proposed access road was determined to pose a Medium impact significance to the Vlermuisleegte River during the construction phase, with the application of the recommended mitigation measures (Table 7). Although this access road will entail the upgrading of an existing road (increasing its width), which have already caused an impact to the Vlermuisleegte River, increasing the footprint of this access road that may result in encroachment into the delineated extent of the Vlermuisleegte River which will result in further disturbance to the vegetation

and geomorphological components of the river during the construction phase. It is, however, not expected that the potential impacts will have a significant impact on the downstream reach of the river considering the non-perennial nature of the river (impacts are expected to be limited in extent) and its present ecological condition. Nevertheless, it is highly recommended that the width of the road be extended to the western side of the existing road reserve rather than to the east there of (if considered feasible) (Figure 12). During the operational phase of the access road, if the recommended mitigation measures are implemented, the impacts significance would be Low (Table 8).

6.3 Cumulative Impacts

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future considered together with the impacts identified in Section 6.1 above. Due to the distance of the proposed Hyperion hybrid generation facility from the Vlermuisleegte River and perched depression wetland, the significance of impacts relating to the construction and operation of these infrastructures contributing the cumulative impact to the watercourses can be considered insignificant. Direct impacts from the proposed access road on the Vlermuisleegte River are expected. This impact is expected to be localised and not expected to exceed beyond the investigation area. Considering the proposed Hyperion hybrid generation facility project, its associated access road and all other existing and proposed infrastructure within the surrounding area, with management and mitigation measures implemented during the construction phase and monitoring of alien and invasive plant species in the Vlermuisleegte River the impacts from the proposed Hyperion hybrid generation facility project and access road can further be reduced, thus no significant cumulative contribution to the above mentioned impacts is considered likely (Table 9).

Table 9: Cumulative Impact Table

Nature:
Other activities within the vicinity of the proposed Hyperion hybrid generation facility project and access road include an existing SEFs (approximately 9.3 km south west of the focus area), natural and untransformed areas, road crossings and bridges as well as urban areas (the Hyperion hybrid generation facility is located approximately 14 km north of Kathu). Aspects pertaining to the cumulative impacts include: *Site clearing, compaction and disturbance of soil in the vicinity of watercourses; *Changes to biodiversity maintenance, streamflow regulation capabilities, sediment balance etc. of the watercourses; and *Erosion, canalisation, increased runoff and sedimentation of the watercourses. The proposed Hyperion hybrid generation facility and access road would contribute in a similar way to the cumulative impacts on the natural environment in the vicinity of the proposed project as the existing SEFs within a 30 km radius of the focus area and other anthropogenic activities would. Since no building surface infrastructure is located within any of the identified watercourses, the significance of the cumulative impacts of the proposed building infrastructure are therefore regarded to be low. However, since the proposed access road is located directly adjacent to a watercourse, direct negative impacts are expected, however this is not considered to be extensive given the non-perennial nature of the river and its present ecological state. If the mitigation measures, as set out in this report are adhered to, impacts from the proposed Hyperion hybrid generation facility and access road construction activities will not exceed the boundaries of the investigation area and the cumulative impact on the larger catchment can, therefore, be considered low.

	The overall impact of the proposed project considered in isolation		The cumulative impact of the project and other projects in the area	
Extent	Local	2	Local	2
Duration	Permanent	5	Permanent	5
Magnitude	Minor	2	Minor	2
Probability	Improbable	2	Very Improbable	1
Significance	**Low**	**18**	**Low**	**9**
Status	Neutral		Neutral	
Reversibility	High		High	
Loss of resources?	No		No	
Can impacts be mitigated?	Yes		Yes	
Confidence in findings:	**High**			
Mitigation:				
Please refer to all mitigation stipulated in Tables 5 to 8				

The cumulative impact of this project is considered to be of low impact significance on the freshwater environment should the recommended mitigation measures as provided in this report be adhered to. Impacts arising from the proposed project can be attributed to the construction of the proposed access road adjacent to the Vlermuisleegte River which is expected to have a direct negative impact on a section of the Vlermuisleegte River. The impacts are, however, expected to be localised and not of significant extent considering the overall size of the river and its catchment. It is also highly recommended that the construction of the road be undertaking in the dry period to avoid potential impacts to impact on the downstream reach of the river. As such, the cumulative impact of the proposed Hyperion hybrid generation facility and access road and other similar projects in the area are considered of Low cumulative impact significance to the freshwater environment.

7 CONCLUSION

SAS was appointed to determine the impact of the proposed Hyperion hybrid generation facility and access road on the watercourses located within the investigation area. The watercourses identified to be potentially impacted by the proposed Hyperion hybrid generation facility and access road was previously assessed by SAS in 2019. The outcomes of the existing freshwater ecological studies undertaken by SAS in 2019 were used to inform the impact assessment. Considering the limited changes to the focus area and surrounding area between the initial SAS site assessment in November 2018 up to now, no significant changes to the local area or catchment were noted, and as such, the outcome of the freshwater ecological assessments of SAS in 2019 are still considered accurate.

Based on the outcome of the impact assessment, the proposed Hyperion hybrid generation facility is not expected to pose a direct negative impact to the identified Vlermuisleegte River and perched depression wetland. This can be attributed to the distance the proposed Hyperion hybrid generation facility (located at least 420 m from the edge of the river and 522 m from the edge of the perched depression wetland) is located from the watercourses.

The proposed access road is located immediately adjacent to the delineated extent of the Vlermuisleegte River. As such, the construction of the road may pose a direct negative impact to the Vlermuisleegte River with the implementation of mitigation measures. It is highly recommended that the width of the road be extended to the western side of the existing road reserve rather than to the east there of (if considered feasible). This will reduce the impact significance of the proposed access road construction activities on the Vlermuisleegte River. During the operational phase of the access road, if the recommended mitigation measures are implemented, the impacts significance would be low. The information as provided in this report is considered sufficient to inform the environmental authorisation process for the proposed Hyperion hybrid generation facility and access road.

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APPENDIX A: INDEMNITY AND TERMS OF USE OF THIS REPORT

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

Although SAS CC exercises due care and diligence in rendering services and preparing documents, SAS CC accepts no liability and the client, by receiving this document, indemnifies SAS CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by SAS CC and by the use of the information contained in this document.

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

APPENDIX B: LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.

APPENDIX C: IMPACT ASSESSMENT METHODOLOGY

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.

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:

- 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) x 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).

Assessment of Cumulative Impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[2].

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

The specialist is required to conclude if the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area.

[2] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 982

APPENDIX D: ADDITIONAL GOOD HOUSEKEEPING MITIGATION MEASURES

General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to a development of this nature and must be implemented during all phases of the proposed SEF development.

Development and operational footprint

- Sensitivity maps have been developed for the focus area, indicating the freshwater environments, their relevant buffer zones and regulatory zones in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as shown in Section 5 It is recommended that these sensitivity maps be considered during all phases of the development and with special mention of the planning of infrastructure layout, to aid in the conservation of the freshwater habitats and environmental resources within the investigation area;
- All development footprint areas should remain as small as possible and should not encroach onto surrounding more sensitive areas. It must be ensured that the freshwater resources, and their associated buffer zones are off-limits to construction vehicles and personnel;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Planning of temporary roads and access routes should take the site sensitivity plan into consideration, and wherever possible, existing roads should be utilised;
- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel;
- Appropriate sanitary facilities must be provided for the life of the development and all waste removed to an appropriate waste facility;
- All hazardous chemicals should be stored on bunded surfaces and no storage of such chemicals should be permitted within the freshwater buffer zones;
- Access to the construction site(s) should be limited to a single entry point as much as feasible to minimise compaction of soils, loss of vegetation and increased erosion;
- No informal fires should be permitted in or near the construction areas;
- Ensuring that an adequate number of rubbish and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills; and
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed.

Vehicle access

- All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil;
- All spills, should they occur, should be immediately cleaned up and treated accordingly; and
- During maintenance activities, vehicles must only be driven on existing, maintained access roads and not drive indiscriminately through natural areas.

Alien plant species

- Proliferation of alien and invasive species is expected within any disturbed area, even though there were only a few areas where alien and invasive species were identified within the investigation area at the time of the assessment. These species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, must be controlled;

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

Freshwater feature habitat

- Ensure that as far as possible all infrastructure is placed outside of freshwater resource areas and their respective buffer zones. If these measures cannot be adhered to, strict mitigation measures, will be required to minimize the impact on the receiving watercourses;
- Permit only essential construction personnel within 32 m of the freshwater habitat, if absolutely necessary that they enter the regulatory zone;
- Limit the footprint area of the construction activities to what is only essential in order to minimise environmental damage;
- During the construction phase, no vehicles should be allowed to indiscriminately drive through the freshwater resource areas; and
- Implement effective waste management in order to prevent construction related waste from entering the freshwater environments.

Soil

- The duration in which soils are exposed during construction activities should remain as short as possible, and all disturbed areas are to be monitored throughout the construction phase for incision and erosion;
- No soil stockpiling is to take place within freshwater habitat or associated buffer zones, and all soil stockpiles must be suitably protected with geotextiles;
- To prevent the erosion of soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas particularly susceptible to erosion;
- Install erosion berms during construction to prevent gully formation. Berms every 50 m should be installed where any disturbed soils have a slope of less than 2%, every 25 m where the track slopes between 2% and 10%, every 20 m where the track slopes between 10% and 15% and every 10 m where the track slope is greater than 15%;
- Sheet runoff from access roads and internal roads to be constructed, should be slowed down by the strategic placement of berms and sandbags;
- Maintain topsoil stockpiles below 2 m in height;
- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and
- Monitor all areas for erosion and incision, particularly any freshwater resource crossings. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible and in conjunction with other role players in the catchment.

Rehabilitation

- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive vegetation control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat to the freshwater features that would possibly be impacted on by the proposed development construction;
- Rehabilitate all freshwater feature areas possibly affected by the proposed development to ensure that the ecology of these areas is re-instated during all phases.
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;

- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier summer months.
- As much vegetation growth as possible should be promoted within the proposed development in order to protect soils;
- All alien vegetation identified should be removed from rehabilitated areas and reseeded with indigenous vegetation as specified by a suitably qualified specialist (ecologist);
- All areas affected by the proposed development should be rehabilitated upon completion of all activities

APPENDIX E: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Christel du Preez	MSc Environmental Science (North West University)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Stephen van Staden	MSc (Environmental Management) (University of Johannesburg)

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

Company of Specialist:	Scientific Aquatic Services (Pty) Ltd		
Name / Contact person:	Christel du Preez		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	074 580 6823
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	christel@sasenvgroup.co.za		
Qualifications	MSc Environmental Science		
Registration / Associations	Registered Member of the South African Council for Natural Scientific Professions (SACNASP)		

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

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

I, Christel du Preez, declare that -

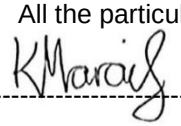
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

C du Preez

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

I, Kim Marais, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



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

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTEL DU PREEZ

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
(SACNASP – Reg No. 120240/19)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

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

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Legislative Requirements, Processes and Assessments

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

SAS ENVIRONMENTAL GROUP OF COMPANIES
SPECIALIST CONSULTANT INFORMATION –

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing Member, Group CEO, Water Resource Discipline Lead, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SEGC	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 the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

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

Short Courses

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

CORE FIELDS OF EXPERTISE

Legislative Requirements, Processes and Assessments
- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

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

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

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

Soil and Land Capability Assessment
- Soil and Land Capability Assessment
- Hydropedological Assessment

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