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FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND WATER USE LICENSE APPLICATION (WULA) PROCESSES FOR THE PROPOSED THERMAL DUAL FUEL FACILITY TO FORM PART OF A HYBRID GENERATION FACILITY TOGETHER WITH THE HYPERION 1 & 2 SOLAR PHOTOVOLTAIC (PV) FACILITIES, NEAR KATHU, NORTHERN CAPE PROVINCE

SCOPING REPORT

Prepared for

Red Rocket South Africa (Pty) Ltd

October 2020

Prepared by: Scientific Aquatic Services
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MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental impact assessment (EIA) and Water Use License Application (WULA) processes for the proposed Thermal Dual Fuel Facility to form part of a Hybrid Generation Facility together with the Hyperion 1 & 2 Solar Photovoltaic (PV), near Kathu in the Northern Cape Province. The proposed Solar Energy Facility (SEF) is proposed to include multiple arrays (static and tracking) of photovoltaic (PV) solar panels with a contracted capacity of up to 75MW and will be developed on the remaining portion of Farm Lyndoch 432, hereafter referred to as the "study area". The study area is situated approximately 12 km north-east of the town of Kathu. The N14 is located approximately 3.6 km from the study area. The study area is situated within the Gamagara Metropolitan Municipality which is an administrative area of the John Taolo Gaetses District Municipality.

The proposed development will comprise the following (hereafter collectively referred to as the focus area):

- Bellmouth;
- Thermal generating facility;
- Laydown area;
- Energy storage;
- Administration building;
- On-site substation and cabling;
- A 300 m corridor was utilised along the proposed route of the access road as the exact location of the road has yet to be determined;
- The authorised Hyperion 1 & 2 PV SEF site and internal access roads;
- Gas turbines or reciprocating Engines;
- Truck entrance and parking facility;
- Regasification plant and fuel preparation plant;
- Dry cooling system for operating oils/chemicals;
- Fuel storage facility;
- Water demineralisation plant;
- O&M building; and
- Fencing.
- Warehouses and workshops.

In order to identify all potential watercourses that may potentially be impacted by the proposed development, a 500 m "zone of investigation" around the focus area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), 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 study area - will henceforth be referred to as the "investigation area".

This specialist desktop freshwater ecological baseline report was compiled as part of the scoping phase for the project. Included in the scoping report is the watercourse delineations as defined during the field assessment undertaken by SAS in 2018 and 2019, as well as delineations of watercourses identified within the investigation area which were mapped using desktop methods. Additionally, the method of assessment that will be utilised for the development of the Environmental Impact Assessment (EIA) phase of the study, a preliminary literature review, and the results of the analyses of various spatial databases (such as, but not limited to, the National Freshwater Ecosystem Priority Area (NFEPA) and the Northern Cape Critical Biodiversity Areas (2016) database are included in this scoping report.

The following results were obtained from the various national and provincial databases:

- A desktop study was conducted, in which possible watercourses were identified, and relevant national and provincial databases were consulted;
- The episodic Vlermuisleegte River was identified by the NFEPA database (2011) to be located east of the focus area;
- The NFEPA database (2011) identified a natural depression which is located within the eastern portion of the investigation area around the study 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 is also located within this investigation area, which are considered heavy

to critically modified (Class Z3). These three features are located within the Vlermuisleegte River.

- A natural flat wetland is located within the southern portion of the investigation area, in close proximity to the 300m corridor. According to the NFEPA Database, the natural flat wetland is in a natural or good ecological condition (Class AB).
- According to the Northern Cape Critical Biodiversity Areas (NC CBAs) Database, the Vlermuisleegte and a buffer zone thereof is considered an Ecological Support Area (ESA), and the rest (majority) of the focus area is defined as "Other Natural Areas".
- According to the National Biodiversity Assessment: South African Inventory of Inland Aquatic Ecosystems (NBA: SAIIAE (2018)) there is one natural depression feature located within the southern portion of the investigation area, bordering the 300 m corridor. The depression wetland is indicated as being in a natural or good ecological condition (Class AB).

The watercourses identified by the NFEPA Database were verified during the field assessment undertaken in 2018 and 2019 (SAS, 2019). Based on the field assessment, no watercourses were identified to be associated with the focus area, however, the Vlermuisleegte River which drains in a south-eastern to north-western direction is located directly east of the study area (SAS, 2019). A perched depression wetland was also identified on the north-eastern boundary of the investigation area within the Vlermuisleegte River (as identified by NFEPA (2011) (SAS, 2019). Additionally, a pan wetland was identified within the investigation area, in the vicinity of the 300 m corridor (SAS, 2019).

The field assessment identified several instream impoundments, created by earth berms to contain water for livestock, within the Vlermuisleegte River (SAS, 2019). Other anthropogenic activities identified which have impacted the integrity of the watercourses include: small scale sand mining and historical agricultural activities (SAS, 2019). The table below provides a brief summary of the watercourses identified and assessed (SAS, 2019).

Table A: Summary of the outcome of the ecological assessment of the watercourses identified. Watercourse (SAS, 2019).

	PES	Ecoservices	EIS	REC / RMO
Vlermuisleegte River	C/D (Moderately to Largely modified)	Moderately Low	Moderate	RMO: C (Maintain) REC: C (Moderately modified) BAS: C
Perched depression wetland	B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B
Pan wetland	B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B

BAS = Best Attainable State; EIS = Ecological Importance and Sensitivity; PES = Present Ecological States; REC = Recommended Ecological Category; RMO = Resource Management Objective

Based on further investigation of digital signatures two additional cryptic wetlands and a pan has been identified within the investigation area, in the vicinity of the 300m corridor. These features will be verified during the EIA Phase of this Project.

Since no watercourses are located within the focus area, no direct impacts from the construction of the SEF and related infrastructure are expected to occur on the watercourses outside of the focus area. Nevertheless, the potential occurrence of impacts associated with edge effects on the watercourses must be considered. If these edge effects are managed accordingly, the impact significance on the watercourses is expected to be low to very low. The outcome of the impact assessment is summarised below:

- Disturbance to vegetation and habitat of the watercourses which could lead to the proliferation of alien invasive vegetation species.;

- Clearing of land leading to erosion and sedimentation of the Vlermuisleegte River;
- Potential trampling by construction personnel within the watercourses beyond the construction footprint, impacting the geomorphological processes of the Vlermuisleegte River.
- Potential creation of temporary haul roads through the watercourses, although this is deemed unlikely;
- Alterations to stormwater run-off within the focus area and altering the hydrology of the systems could potentially lead to increased sedimentation. Sediment laden stormwater runoff entering the Vlermuisleegte River is a potential impact that might occur during the operational phase of the SEF.
- Encroachment of internal road infrastructure and construction activities may result in the contamination of the watercourses (if surface water is present). This impact may be direct or indirect.
- The potential for increased erosion as a result of disturbance of soil in the vicinity of watercourses.
- The potential loss of catchment yield due to stormwater management during the construction activities.
- The potential for siltation and changes in the hydrological functioning of these areas.

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

- Construction vehicles must use existing roads only and not be allowed to indiscriminately drive through watercourses;
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed;
- All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site so as to prevent the proliferation of alien and invasive species;
- Avoid unnecessary site clearing/vegetation clearing as far as possible;
- Concurrent rehabilitation of the watercourses impacted by the proposed SEF is to take place and footprint areas should be minimised as far as possible;
- Any concrete and other foreign material used during construction must be demolished and removed from the site. All rubble and waste must be disposed of at a suitably registered landfill site;
- Any soil excavated should be reinstated and re-profiled as much as possible. Any remaining soil is to be removed from the site to a registered landfill site;
- Any area where active erosion is observed in the watercourses, within the focus area and investigation area, must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; and
- All watercourses impacted by the proposed SEF should be continuously monitored for any erosion and incision associated with construction activities.

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

The impact significance will be accurately stated once ground-truthing of the watercourses have taken place, during the EIA Phase, which will assist in defining the characteristics, Eco-status, Ecological Importance and Sensitivity (EIS), and goods and services provision of the watercourses.

The information as provided in this report is, considered sufficient to aid the layout of the infrastructure components associated with the proposed SEF, in order to limit the potential impact thereof on the identified watercourses and guide the EIA phase of the environmental authorisation process.

DOCUMENT GUIDE

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

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Annexure C
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 3 (Detailed assessment will be undertaken in EIA Phase)
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 3.1
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 3.1
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 3.1 (Detailed assessment will be undertaken in EIA Phase)
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:	Applicable to EIA Phase of assessment
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Will be answered during the EIA Phase
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Detailed assessment will be undertaken in EIA Phase
2.4.4	How will the development impact on the functionality of the aquatic feature including:	Detailed assessment will be undertaken in EIA Phase

	a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, 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.	Detailed assessment will be undertaken in EIA Phase
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.	Annexure C
3.2	A signed statement of independence by the specialist.	Annexure C
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.	Applicable to EIA Phase of assessment
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Annexure B
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 4
3.7	Additional environmental impacts expected from the proposed development.	Section 5 (Detailed assessment will be undertaken in EIA Phase)
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	
3.9	The degree to which impacts and risks can be mitigated.	
3.10	The degree to which impacts and risks can be reversed.	
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	
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.	Applicable to EIA Phase of assessment
3.16	Any conditions to which this statement is subjected.	

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ACRONYMS

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

1 INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental impact assessment (EIA) and Water Use License Application (WULA) processes for the proposed Thermal Dual Fuel Facility to form part of a Hybrid Generation Facility together with the Hyperion 1 & 2 Solar Photovoltaic (PV), near Kathu in the Northern Cape Province. The proposed Solar Energy Facility (SEF) is proposed to include multiple arrays (static and tracking) of photovoltaic (PV) solar panels with a contracted capacity of up to 75MW and will be developed on the remaining portion of Farm Lyndoch 432, hereafter referred to as the "study area". The study area is situated approximately 12 km north-east of the town of Kathu. The N14 is located approximately 3.6 km from the study area. The study area is situated within the Gamagara Metropolitan Municipality which is an administrative area of the John Taolo Gaetses District Municipality.

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1.1 Scope of work

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

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

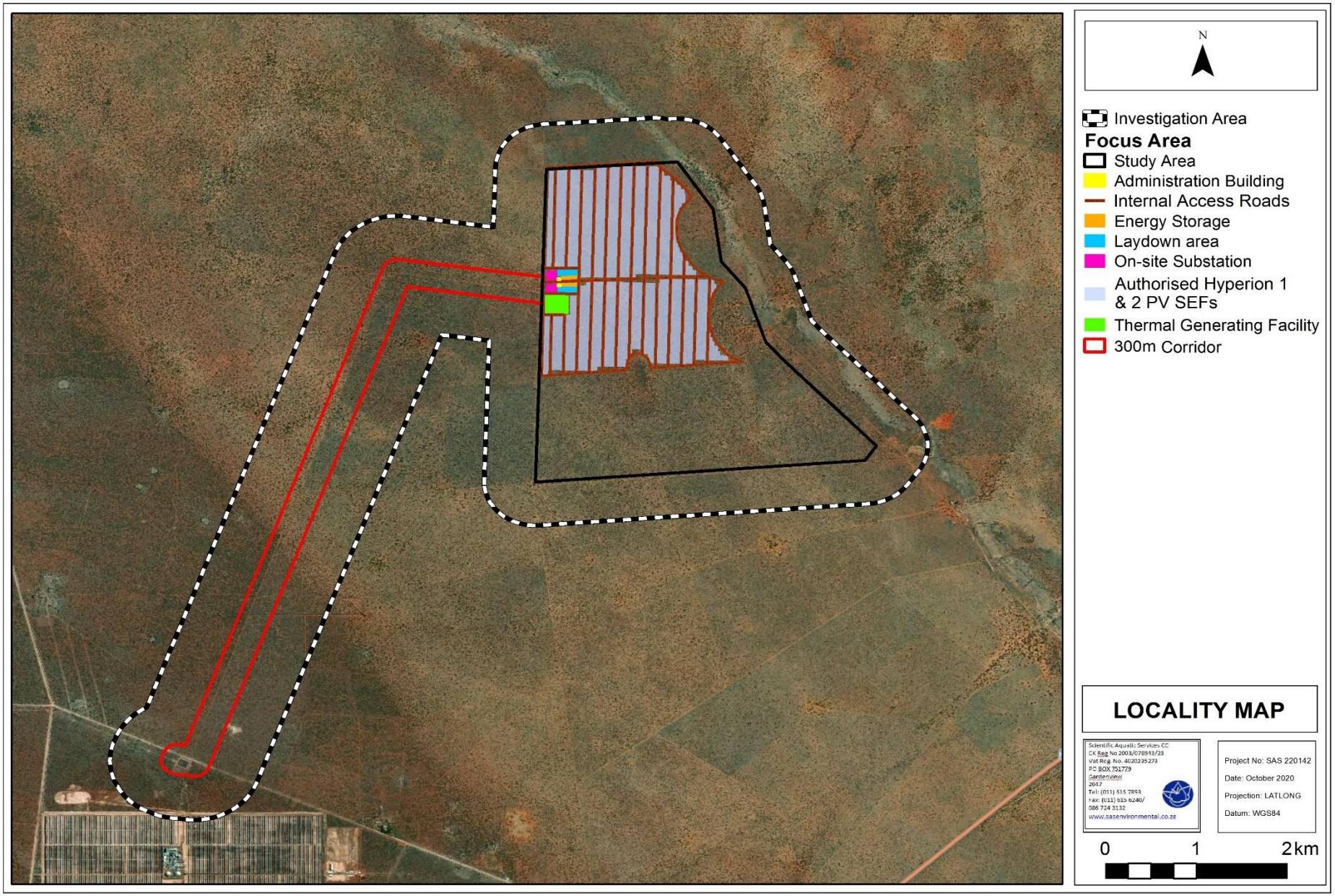

Figure 1: Digital satellite image depicting the focus area and associated investigation area in relation to surrounding areas.

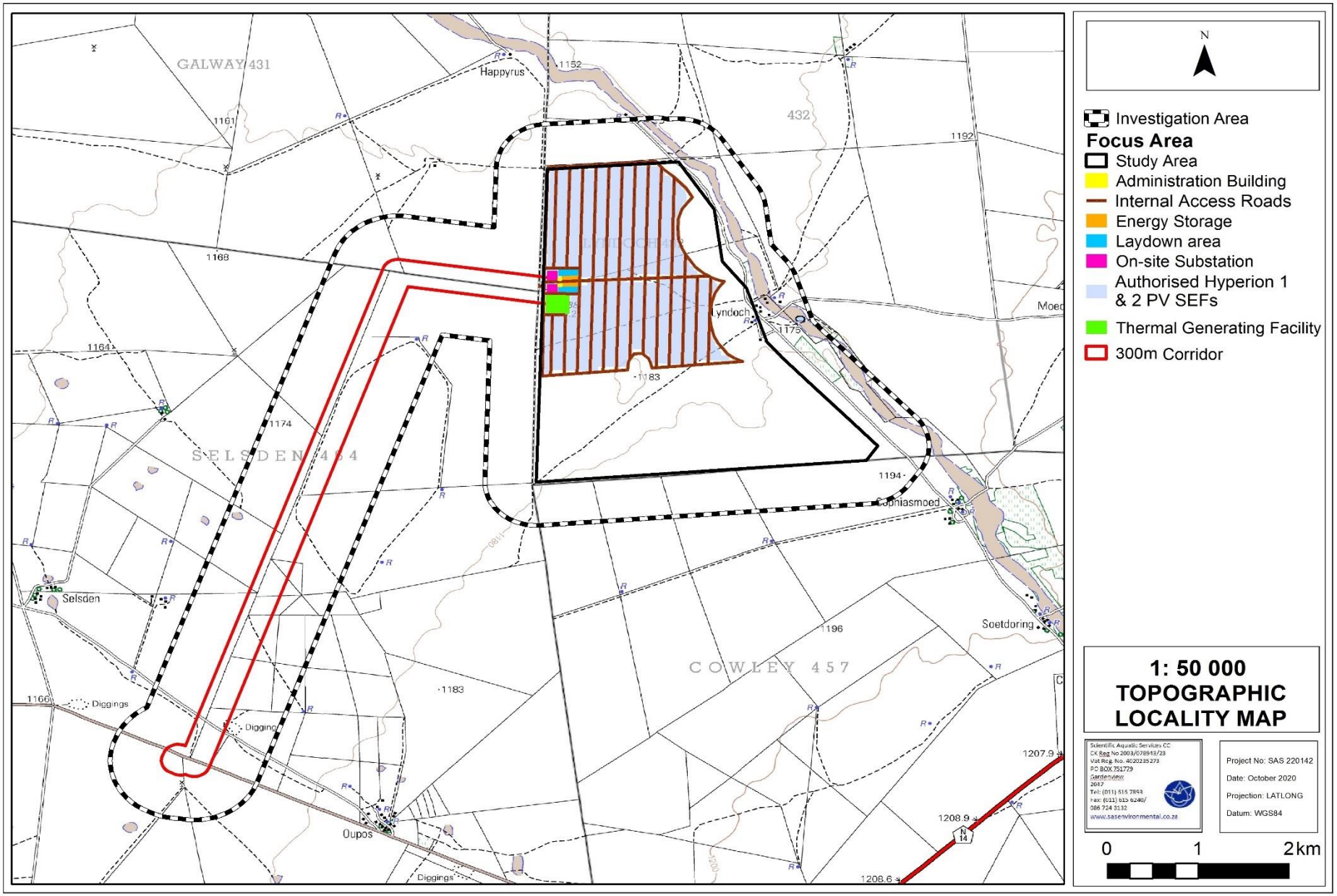

Figure 2: Location of the focus area and investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

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

1.3 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 August 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act No. 107 of 1998); and
- The Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009).

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

2 SCOPING PHASE - METHOD OF ASSESSMENT

2.1 Desktop Study

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

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

3 SCOPING PHASE – RESULTS

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

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

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

Table 1: Desktop data relating to the character of the watercourses associated with the 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 in the vicinity of the study 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 is also located within this investigation area, which are considered to be heavy to critically modified (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. A natural flat wetland is located within the southern portion of the investigation area, in close proximity to the 300m corridor. According to the NFEPA Database, the natural flat wetland is in a natural or good ecological condition (Class AB).
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 associated with the study area. This river is considered largely natural according to the PES 1999, however, according to NFEPA database, the river is moderately modified (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. The southern portion of the 300 m corridor also falls within an area classified as an ESA. According to the Technical Guidelines for CBA Maps document ESAs are areas which must retain their ecological processes to meet biodiversity targets for ecological processes that have not been met in CBAs or protected areas; meet biodiversity targets for representation of ecosystem types or species of special concern when it's not possible to meet them in CBAs; support ecological functioning of protected areas or CBAs or a combination of these (SANBI, 2017).
Other Natural Areas (ONA)	The majority of the study area and 300 m corridor is located within an area defined as "other natural areas" (ONA). According to the Technical Guidelines for CBA, Maps document ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 6)	
According to the NBA (2018):SAIIAE there is one natural depression feature located within the southern portion of the investigation area, bordering the 300 m corridor. The depression wetland is indicated as being in a natural or good ecological condition (Class AB). The depression wetland is currently poorly protected (Ecosystem Protection Level (EPL)), and of least concern (Ecosystem Threat Status (ETS)). The Vlermuisleegte River is currently not protected (EPL), and is therefore endangered (ETS). 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). 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 WMA = Water Management Area**

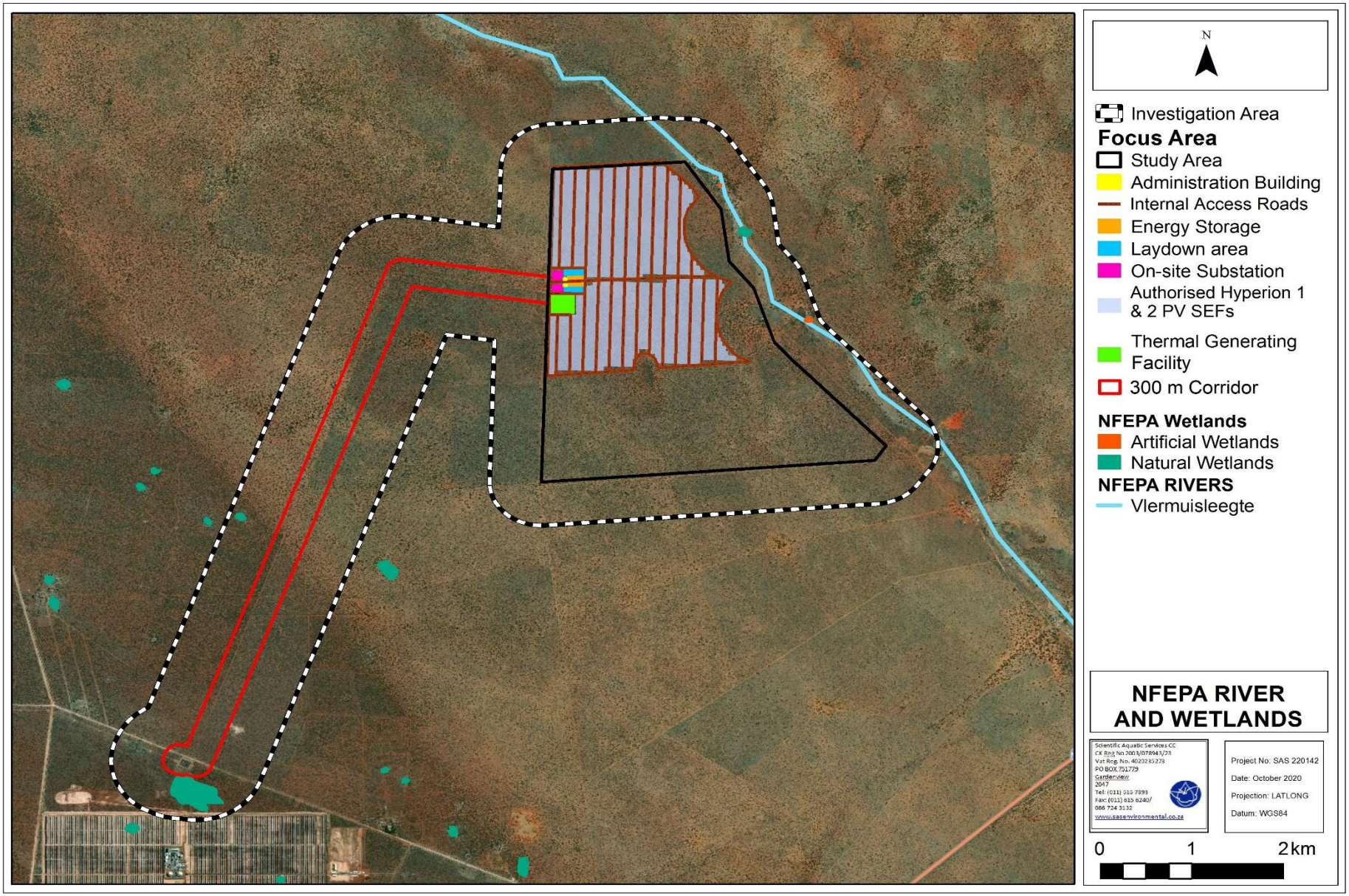

Figure 3: The natural and artificial wetlands and Vlermuisleegte River associated with the focus and investigation areas according to the NFEPA database (2011).

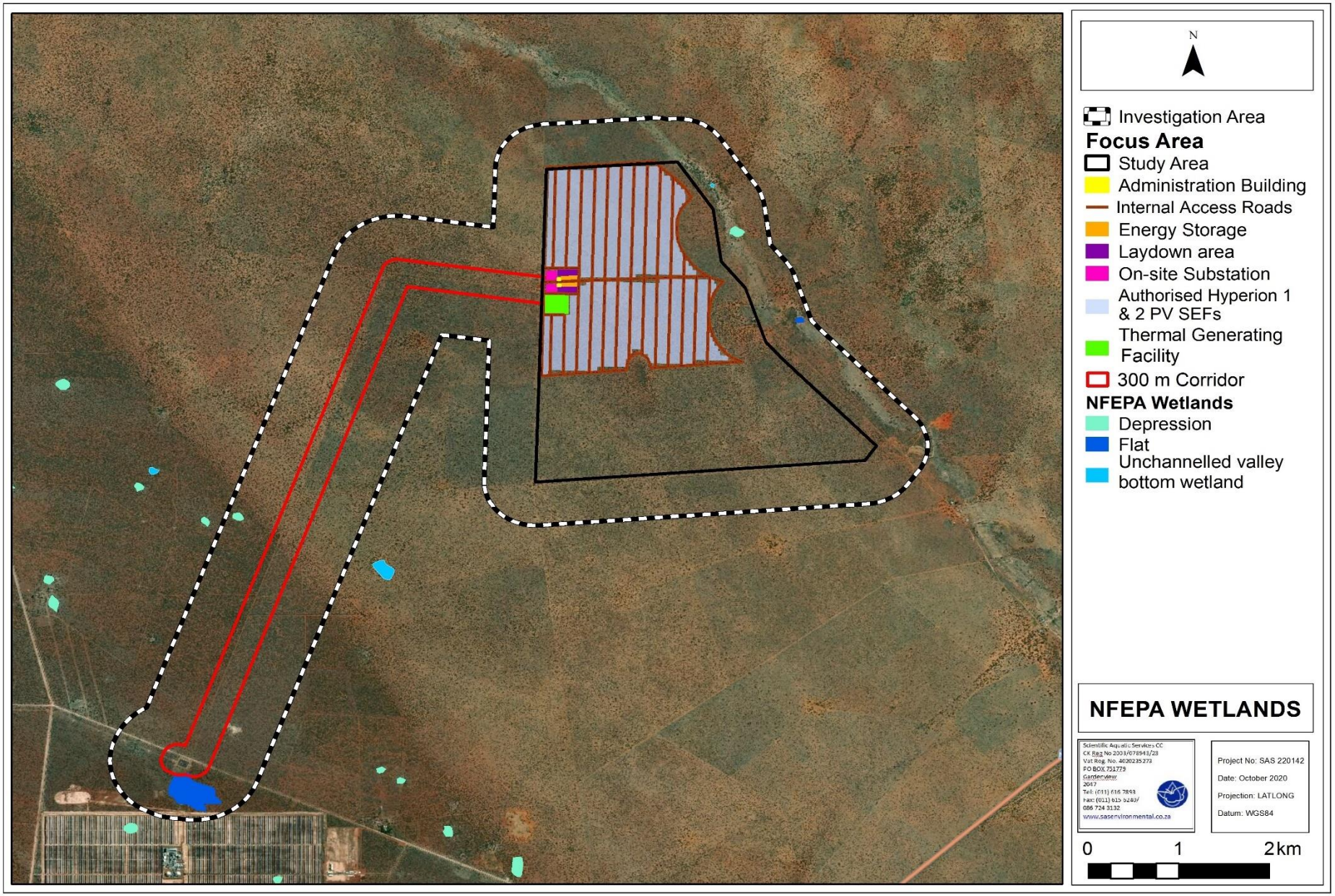

Figure 4: The hydrogeomorphic (HGM) units associated with the focus and investigation areas according to the NFEPA database (2011).

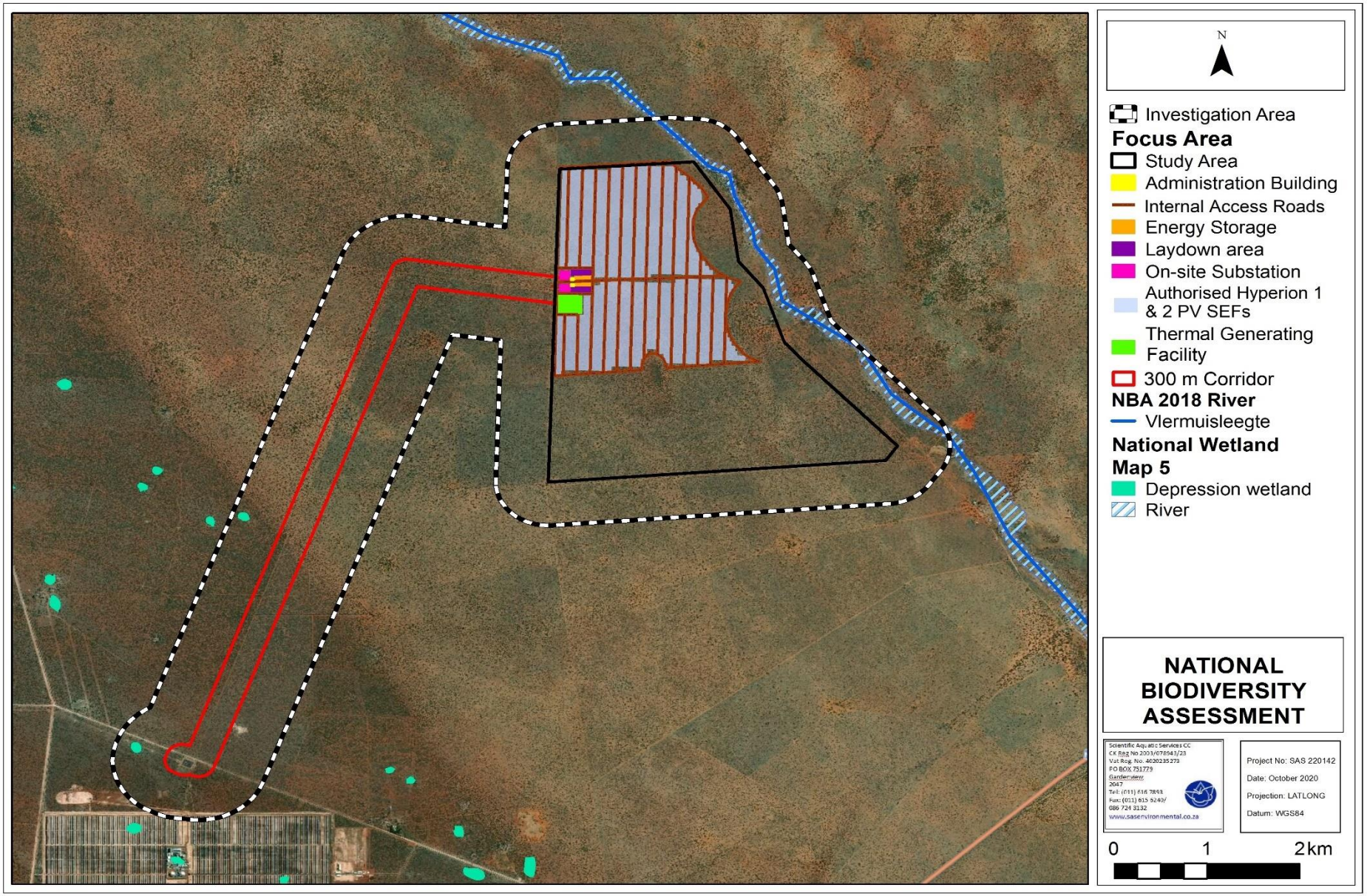

Figure 5: Vlermuisleegte River and natural depression wetlands associated with the focus and investigation areas according to the National Biodiversity Assessment (NBA) (2018).

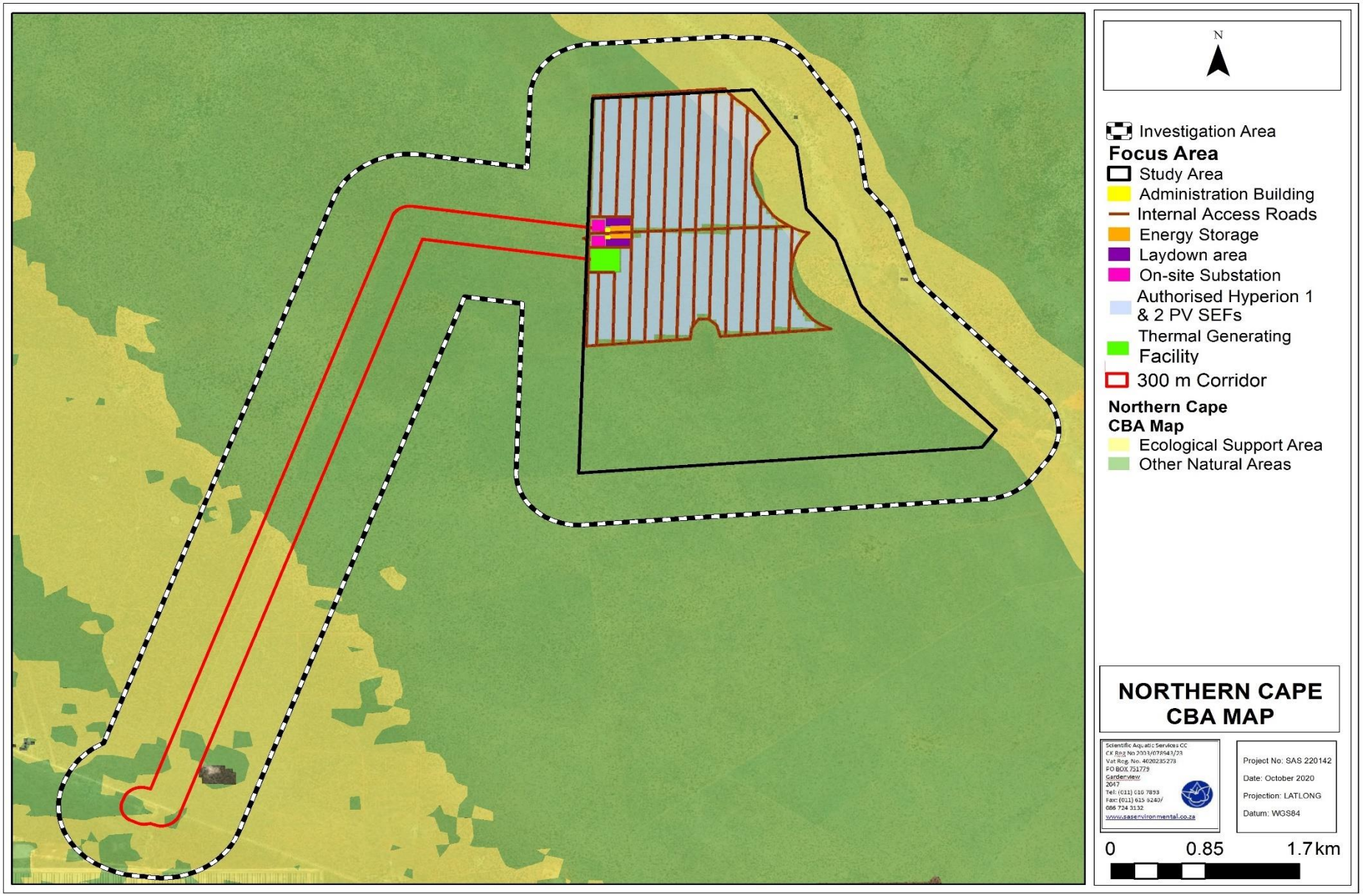

Figure 6: The Ecological Support Areas associated with the focus and investigation areas according to the Northern Cape Critical Biodiversity Area Database (2016).

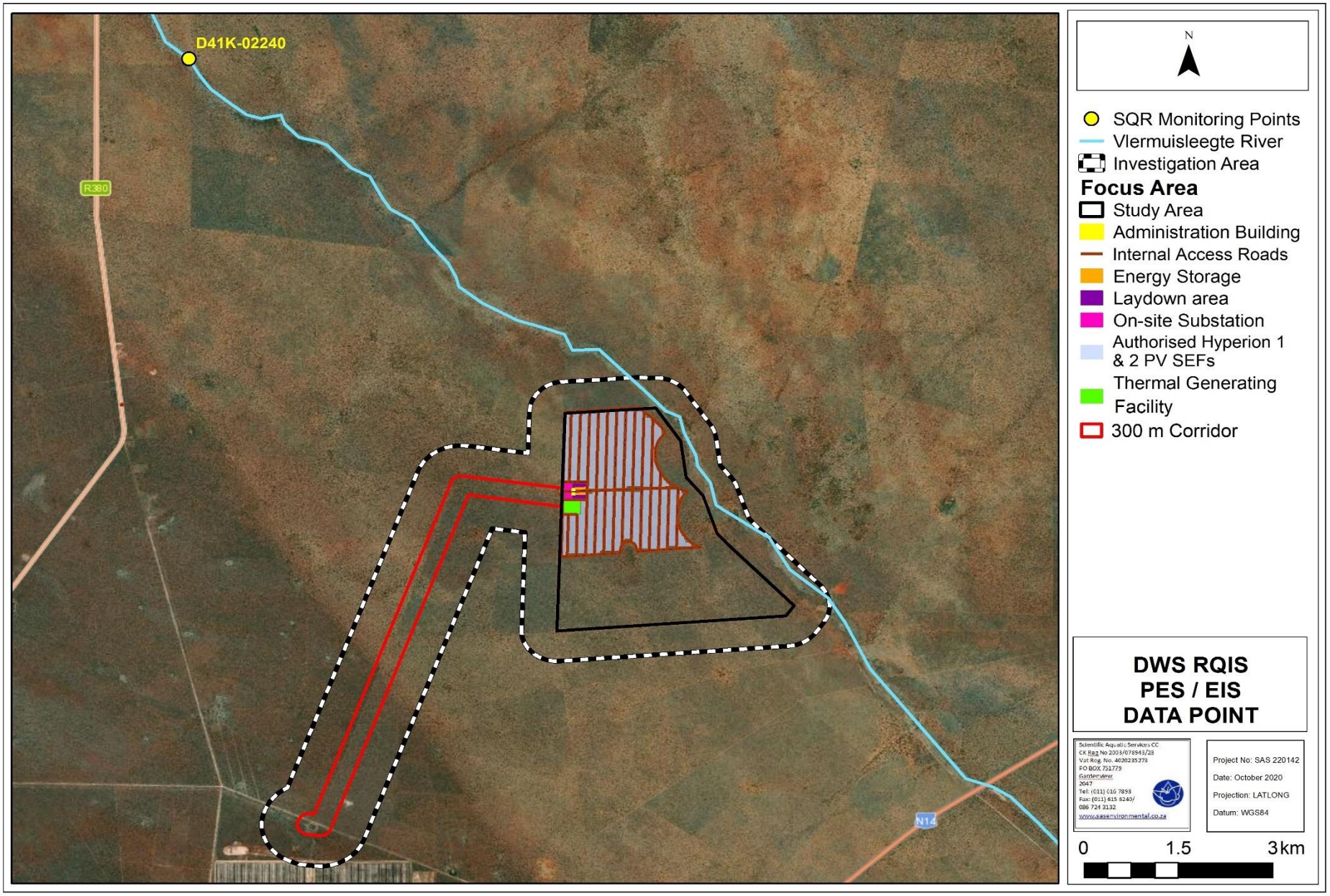

Figure 7: The SQR Monitoring Point associated with the Vlermuisleegte River, in relation to the focus area.

3.2 Preliminary delineation of watercourses making use of existing data (SAS, 2018) and desktop analysis and classification of the watercourses associated with the investigation areas

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

Watercourse means-

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

Wetland means-
"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

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

Cryptic wetlands are often "hidden" in the landscape, due to their highly ephemeral nature caused by, for example, arid or semi-arid climatic conditions. There is no standard definition of a "cryptic wetland", but according to Day *et al* (2010) these are generally accepted to be systems which may remain dry (and potentially desiccated) for several seasons, only displaying certain characteristics when sufficient rainfall has occurred. Based on satellite imagery SAS identified two potential cryptic wetlands based on a distinct topographic setting, specifically an endorheic (inward -draining) depression, and subtle yet easily discernible changes in the vegetation assemblages associated with the cryptic wetlands.

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

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

The watercourses identified by the NFEPA Database was verified during the field assessment undertaken in 2018 and 2019 (SAS, 2019). Based on the field assessment, no watercourses were identified to be associated with the focus area, however, the Vlermuisleegte River which drains in a south-eastern to north-western direction is located directly east of the study area (SAS, 2019). A perched depression wetland was also identified on the north-eastern boundary of the investigation area within the Vlermuisleegte River (as identified by NFEPA (2011) (SAS, 2019). Additionally, a pan wetland was identified within the investigation area, in the vicinity of the 300 m corridor (SAS, 2019).

The field assessment further identified several instream impoundments, created by earth berms to contain water for livestock, within the Vlermuisleegte River (SAS, 2019). Other anthropogenic activities identified which have impacted the integrity of the watercourses include: small scale sand mining and historical agricultural activities (SAS, 2019). The table below provides a brief summary of the watercourses identified and assessed (SAS, 2019).

Table 2: Summary of the outcome of the ecological assessment of the watercourses identified. Watercourse (SAS, 2019).

	PES	Ecoservices	EIS	REC / RMO
Vlermuisleegte River	C/D (Moderately to Largely modified)	Moderately Low	Moderate	RMO: C (Maintain) REC: C (Moderately modified) BAS: C
Perched depression wetland	B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B
Pan wetland	B (Largely natural with few modifications)	Moderately Low	Marginal/ Moderate	RMO: B (Maintain) REC: B (Largely natural with few modifications) BAS: B

BAS = Best Attainable State; EIS = Ecological Importance and Sensitivity; PES = Present Ecological States; REC = Recommended Ecological Category; RMO = Resource Management Objective

Based on further investigation of digital signatures two additionally cryptic wetlands and another pan has been identified within the investigation area, in the vicinity of the 300 m corridor. These features will be verified during the EIA Phase of this Project.

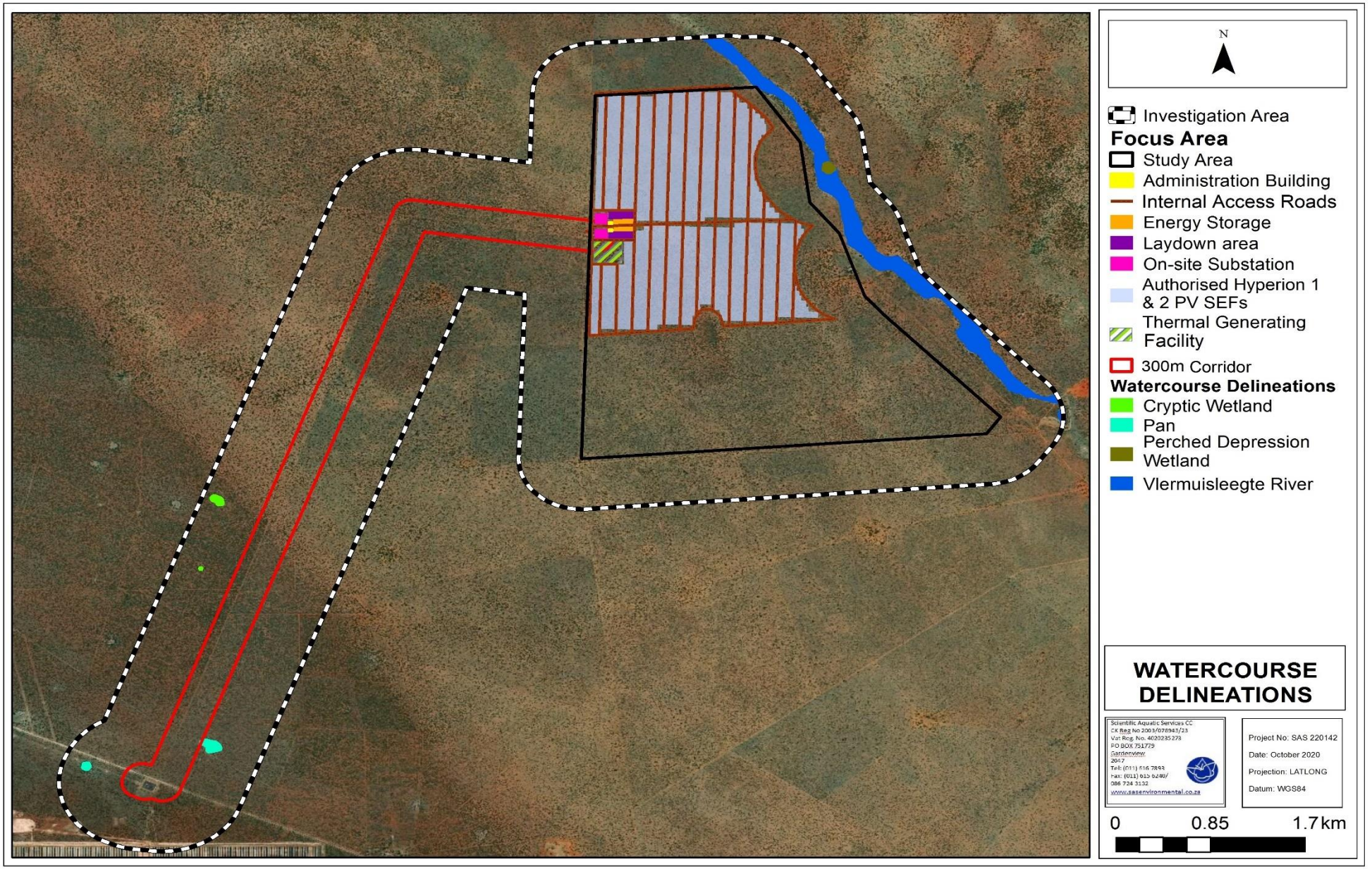

Figure 8: Locality and extent of the delineated watercourses associated with the focus area and investigation area.

4 APPLICATION OF LEGISLATIVE REQUIREMENTS

As part of the Scoping Phase, a preliminary sensitivity map was developed incorporating all relevant legislative requirements applicable to the field verified (SAS, 2019) and additional desktop delineations of the watercourses associated with the focus area and the investigation area.

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

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

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

Table 3: Articles of Legislation and the relevant regulated areas of the applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act	In accordance with GN 509 of 2016 as it relates to the NWA, a regulated area of a watercourse applicable to water uses as per section 21c and 21i of the NWA, 1998 is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation, as well as Government Notice no. 509 of 2016 as it relates to the NWA.
Listed activities in terms of the NEMA (1998) EIA Regulations as amended in April 2017 must be taken into consideration if any activities (for example, stockpiling of soils) are to take place within the applicable regulated area of a watercourse. This must be determined by the EAP in consultation with the relevant authorities.	32m from the edge of a watercourse, applicable if a proposed development exceeds the relevant thresholds, which will then require environmental authorisation.

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

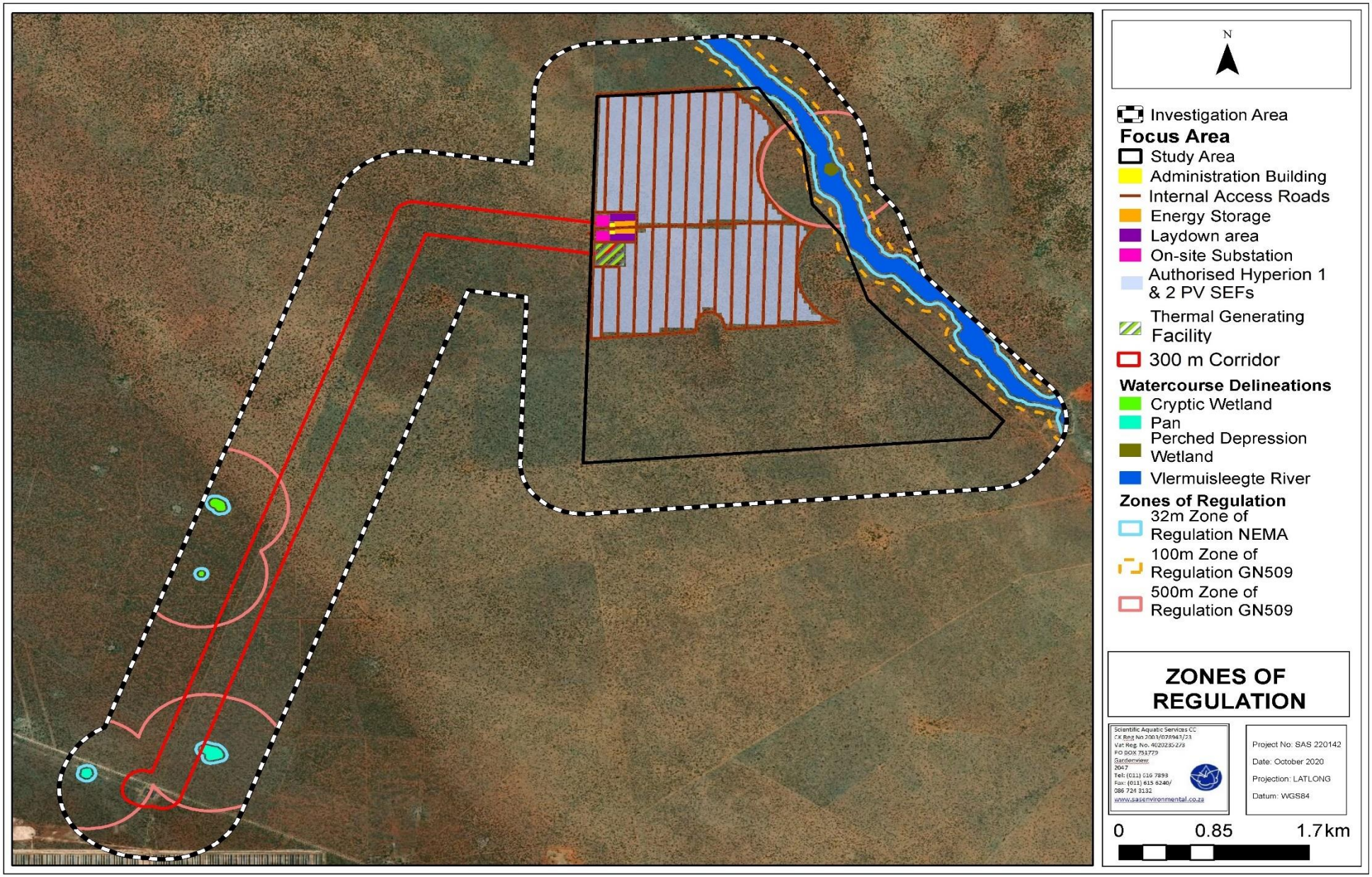

Figure 9: Map indicating the NEMA and GN509 regulated areas applicable to the watercourses associated with the focus and investigation areas.

5 POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED DEVELOPMENT

This section of the scoping report aims to provide a brief summary of the most likely impacts that the proposed development may have on the surrounding natural area.

This section of the scoping report aims to provide a summary of the most likely impacts that the proposed development may have on the surrounding natural area. Table 4 below provides the potential impacts the proposed SEF and associated infrastructure may have on the watercourses within the focus area, as well as the nature and extent of the impact. Desktop data (as presented in this report) was utilised to determine the preliminary impact significance of the proposed development on the watercourses, which will be further refined and assessed during the EIA Phase of this project.

Table 4: Potential impacts associated with the proposed SEF and associated infrastructure within the development area.

Impacts			
Impacts associated with the construction activities (within the focus area) include potential encroachment and direct disturbance of the watercourses, alterations to stormwater run-off within the development area, altering the hydrology of the systems and increased sedimentation. Sediment laden stormwater runoff entering the Vlermuisleegte River is a potential impact that might occur during the operational phase of the SEF.			
Desktop Sensitivity of the Site			
All watercourses identified in the desktop assessment have been impacted by surrounding agricultural activities. Many of the areas adjacent to the watercourses have been altered (e.g. by ploughing and road crossings), increasing the likelihood of sediment run-off and proliferation of alien and invasive species. Based on the relevant databases, these watercourses are in a relatively good ecological condition (NFEPA, 2011), however, based on the investigation of digital satellite imagery, the watercourses have been impacted upon by agricultural activities and road crossings. As no watercourses are within the focus area, no new infrastructure associated with the SEF is likely to be located within the delineated watercourses and associated 32m NEMA regulated area of a watercourse, which is deemed sufficient for the protection of these resources. The 300m corridor traverses the 32m zone of regulation of a potential pan. This feature will however have to be ground truthed during the EIA Phase.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-go Areas**
Direct disturbance of watercourse habitat.	The potential loss of biodiversity as a result of construction related activities within the watercourses, including construction or upgrading of roads and placement of cables within watercourses. Decrease in the provision of watercourse ecoservices due to the potential degradation of the watercourses.	Local	All delineated watercourses should be considered no-go areas for new developments. The applicable GN509 regulated area of a watercourse should also be avoided where feasible. This is only recommended to prevent triggering the application of a water use application. If infrastructure were to be proposed within this area, it would not be considered a fatal flaw.
The decrease of watercourse habitat integrity.	Encroachment of internal road infrastructure and construction activities may result in the contamination of the watercourses (if surface water is present). This impact may be direct or indirect.	Local	
Alteration of runoff patterns	The potential for increased erosion as a result of earthworks in the vicinity of watercourses.	Local	
Altered hydrology of the watercourses	The potential loss of catchment yield due to stormwater management during the construction activities.	Local	
Altered stream and baseflow patterns	Potential that the construction of stream crossings may impact on the hydrology and sedimentation of systems.	Local	
Mismanagement and ineffective rehabilitation of watercourses.	The potential for siltation and changes in the hydrological functioning of these areas.	Local	

Description of the expected significance of the impact
Since no watercourses are located within the focus area, no direct impacts from the construction of the SEF and related infrastructure are expected to occur on the watercourses outside of the focus area. Nevertheless, the potential occurrence of impacts associated with edge effects on the watercourses must be considered. If these edge effects are managed accordingly, the impact significance on the watercourses is expected to be low to very low. The significance of impact will be defined during the EIA Phase.
Gaps in knowledge & recommendations for further study
As the watercourses have only been assessed by using desktop analysis, their characteristics, Present Ecological State (PES) and goods and services could not accurately be described. Thus, a gap in the knowledge of the condition of these watercourses exists, and it is anticipated that these gaps will be sufficiently addressed during a site investigation as part of the EIA Phase of this project. It is not expected that the delineation of the watercourses will change significantly.

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

- Construction vehicles must use existing roads only and not be allowed to indiscriminately drive through watercourses;
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed;
- All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site so as to prevent the proliferation of alien and invasive species;
- Avoid unnecessary site clearing/vegetation clearing as far as possible;
- Concurrent rehabilitation of the watercourses impacted by the proposed SEF is to take place and footprint areas should be minimised as far as possible;
- Any concrete and other foreign material used during construction must be demolished and removed from the site. All rubble and waste must be disposed of at a suitably registered landfill site;
- Any soil excavated should be reinstated and re-profiled as much as possible. Any remaining soil is to be removed from the site to a registered landfill site;
- Any area where active erosion is observed in the watercourses, within the focus area and investigation area, must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; and
- All watercourses impacted by the proposed SEF should be continuously monitored for any erosion and incision associated with construction activities.

6 EIA PHASE – PLAN OF STUDY

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

- Ground-truthing of delineation of the outermost edge of the watercourses associated with the focus area and investigation area in accordance with "DWAF[1]2005[2]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the watercourses;
- The watercourse classification assessment will be undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the watercourses will be determined according to the method described by Rountree & Kotze (2013);
- The PES of the watercourses will be determined according to the resource-directed measures guideline of Macfarlane *et al.* (2008);

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

[2] Even though an updated manual has been available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

- The watercourses will be mapped according to the ecological sensitivity of the watercourses in relation to the focus area. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated regulated areas will be depicted where applicable;
- Allocation of a suitable REC (Recommended Ecological Category) to the watercourses based on the results obtained from the PES and EIS assessments;
- Evaluation of environmental issues and potential impacts (direct, indirect and cumulative impacts and residual risks) identified, including:
  - The nature of the impact;
  - The extent of the impact;
  - Anticipated duration of the impact;
  - Magnitude;
  - Probability of occurrence
  - The significance of the impact;
  - The status of the impact (positive, negative or neutral);
  - The degree to which the impact can be reversed/cause irreplaceable loss of resources and/or can be mitigated; and
  - Assessment of cumulative Impacts.
- Development of recommendations for mitigating potential impacts on the receiving environment.

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

7 CONCLUSION

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental impact assessment (EIA) and Water Use License Application (WULA) processes for the proposed Thermal Dual Fuel Facility to form part of a Hybrid Generation Facility together with the Hyperion 1 & 2 Solar Photovoltaic (PV), near Kathu in the Northern Cape Province. The proposed Solar Energy Facility (SEF) is proposed to include multiple arrays (static and tracking) of photovoltaic (PV) solar panels with a contracted capacity of up to 75MW and will be developed on the remaining portion of Farm Lyndoch 432, hereafter referred to as the "study area".

It is evident from the Scoping Phase that no watercourses are located within the focus area. However, several watercourses are within the investigation area, namely the episodic Vlermuisleegte River, a natural depression, an artificial unchanneled valley bottom wetland an artificial flat as well as a natural flat wetland. The Vlermuisleegte River and depression feature was refined and assessed during the site visit in 2018 and 2019 (SAS, 2019). In addition to these wetlands a pan was also identified in the southern portion of the investigation area, around the 300 m corridor (SAS, 2019). Based on digital signatures two additional cryptic wetlands and a pan was identified within the investigation area, these will be verified and refined accordingly during the EIA Phase.

Since no watercourses are located within the focus area, no direct impacts from the construction of the SEF and related infrastructure are expected to occur on the watercourses outside of the focus area. Nevertheless, the potential occurrence of impacts associated with edge effects on the watercourses must be considered. If these edge effects are managed accordingly, the impact significance on the watercourses is expected to be low to very low.

The information as provided in this report is considered sufficient to aid the layout of the infrastructure components associated with the proposed SEF, in order to limit the potential impact thereof on the identified watercourses and guide the EIA phase of the environmental authorisation process.

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

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APPENDIX A: 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 (Act No. 108 of 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 realisation 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 (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental	NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the NEMBA as:

Management Biodiversity Act, 2004 (Act No 10 of 2004)	(a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017): ➢ **Category 1a:** Invasive species that require compulsory control; ➢ **Category 1b:** Invasive species that require control by means of an invasive species management programme; ➢ **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➢ **Category 3:** Ornamentally used plants that may no longer be planted.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
The Northern Cape Nature Conservation Act (NCNCA, Act No 9 of 2009)	The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.

APPENDIX B: WATERCOURSE ASSESSMENT APPROACH

Wetland and Riparian Delineation

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

- A wetland is "a land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil";
- Riparian habitat is defined as "including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas".

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

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

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

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

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

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

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

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

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

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

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

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[3] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

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

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

Level 3: Landscape Setting

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

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

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

Level 4: Hydrogeomorphic Units

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

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

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

Index of Habitat integrity

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

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

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

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

WET-Health

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

Level of Evaluation

Two levels of assessment are provided by WET-Health:

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

Framework for the Assessment

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

Units of Assessment

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

Quantification of Present State of a wetland

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

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

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

Assessing the Anticipated Trajectory of Change

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

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

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

Overall health of the wetland

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

Watercourse Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[4] The assessment of the ecosystem services supplied by the identified watercourses was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

[4] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

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

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

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

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

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

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

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

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

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

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

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

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

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

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

Table B8: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

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

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

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

Table B9: Description of Recommended Ecological Category (REC) classes.

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

Ecological Impact Assessment Method of assessment

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[5]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the

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

impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary6.

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

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

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

- 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 from0-10, 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.*

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

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).

Risk Assessment Methodology

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

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

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

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of

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

the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[8].

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

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

Table B10: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

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

Table B11: Spatial Scale (How big is the area that the aspect is impacting on)

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

Table B12: Duration (How long does the aspect impact on the resource quality)

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

Table B13: Frequency of the activity (How often do you do the specific activity)

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

Table B14: The frequency of the incident or impact (How often does the activity impact on the resource quality)

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

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

Table B15: Legal issues (How is the activity governed by legislation)

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

Table B16: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

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

Table B17: Rating Classes

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

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

Table B18: Calculations

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

The following points were considered when undertaking the assessment:

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

vii) Risks/Impacts were assessed for construction phase and operational phase; and
  - Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Mitigation Measure Development

The following points present the key concepts considered in the development of mitigation measures for the proposed construction.

- Mitigation and performance improvement measures and actions that address the risks and impacts[9] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.

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

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

Reversibility and/or irreplaceable loss

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

Table B19: Reversibility of impacts on the watercourse

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

APPENDIX C: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Sanja Erwee BSc (Zoology) (University of Pretoria)

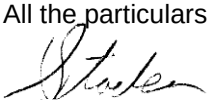
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

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 STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource discipline lead, Managing member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland assessment short course Rhodes University	2016
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2013

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

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
- 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

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

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

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	GIS Technician and Visual Specialist
Joined SAS Environmental Group of Companies	2014

EDUCATION

Qualifications

BSC Zoology (University of Pretoria)	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017
ESRI MOOC ARCGIS Cartography	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Western Cape Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Plant species and Landscape Plan

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil and land capability).