FRESH WATER RESOURCE VERIFICATION AND DELINEATION AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED SAB GLASS BOTTLE MANUFACTURING PLANT; NEAR VEREENIGING, GAUTENG PROVINCE.

Prepared for

SLR Consulting (Pty) Ltd

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DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to GN267 of 24 March 2017, as it pertains to NEMA.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix C
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix C
b)	A declaration that the specialist is independent	Appendix D
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
cA)	An indication of the quality and age of base data used for the specialist report	N/A
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	N/A
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix B
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4
g)	An identification of any areas to be avoided, including buffers	N/A
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	N/A
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 3
k)	Any mitigation measures for inclusion in the EMPr	Section 3
l)	Any conditions for inclusion in the environmental authorisation	Section 4
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
n)	A reasoned opinion -	Section 5
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	N/A
(iA)	Regarding the acceptability of the proposed activity or activities	N/A
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 3
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Chroma:	The relative purity of the spectral colour which decreases with increasing greyness.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecological Importance and Sensitivity	Ecological importance refers to the diversity, rarity or uniqueness of the habitats and biota. Ecological sensitivity refers to the ability of the ecosystem to tolerate disturbances and to recover from certain impacts.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Episodic stream:	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period, or may flow only once in several years.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Index of Habitat Integrity	The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Intermittent flow:	Flows only for short periods.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Resource Water Quality Objectives	*Guidelines set by the South African Department of Water and Sanitation (DWS), formerly DWA or DWAF, for various physico-chemical and biological parameters for various uses as well as ecosystem functioning.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Sub-quaternary Reach	A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments).
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Water Use License	The National Water Act (Act 36 of 1998) gives the Department of Water and Sanitation the tools to gather the information that we need for the optimal management of our water resources. The registration of water use is one of these tools.
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

LIST OF ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DEMC	Desired Ecological Management Class
DO	Dissolved Oxygen
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly known as DWA, DWAF, see above)
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
FRAI	Fish Response Assessment Index
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GN	General Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHAS	Invertebrate Habitat Assessment System
IHI	Index of Habitat Integrity
m	Meter
MAP	Mean Annual Precipitation
NA	Not Applicable
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
Ref	Reference
RHP	River Health Program
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WET	Whole Effluent Toxicity
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission

1. INTRODUCTION

1.1 Background

Scientific Aquatic Services was appointed to conduct a freshwater resource verification and delineation as part of the environmental assessment and authorisation process for the proposed development of SAB Glass Bottle Manufacturing Plant to be located on Portion 238 of the farm Leeuwkuil 596 IQ, near Vereeniging, within the Gauteng Province, hereafter referred to as the "study area" (Figure 1 and 2).

The study area is situated immediately north of the R28 (Boy Louw Str), east of Lager Road, and west of the R59 (Sybrand van Niekerk Freeway). The R54 (Houtkop Road) is situated approximately 2.7 km north of the study area. The suburb of Leeuhof is situated approximately 380m to the north east, and Sharpeville 1 km southeast of the study area.

Prior to the site investigation, a background study was undertaken, during which the relevant national and provincial spatial databases were consulted.

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

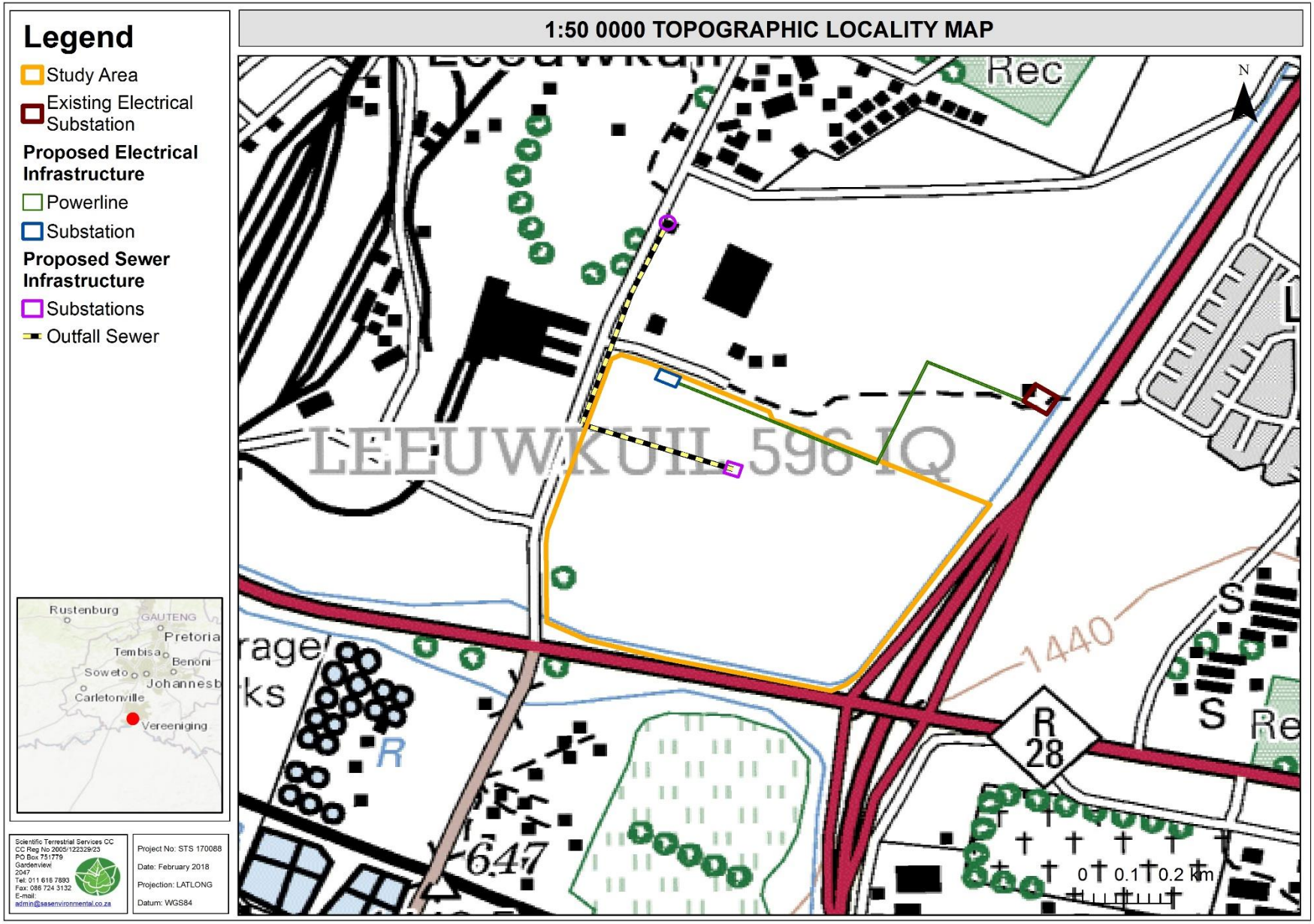

Figure 2: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To verify and delineate water resources within the study area on site, delineate and freshwater resources occurring within 500m of the study area on a desktop basis;
- To determine whether the water resources within the study area are natural or artificial;
- To determine the environmental impacts of the proposed development on the water resources associated with the study area; and
- Present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; except where bulk service infrastructure associated with the project, such as electrical and sewer infrastructure, were situated outside the study area.
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the proposed development activities have been accurately assessed and considered, based on the field observations.

1.4 Legislative Requirements

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix A:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Water Act (NWA) (Act No. 36 of 1998); and
- General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998); and
- The Gauteng Department of Agriculture and Rural Development's (GDARD) Requirements for Biodiversity Assessments, Version 3 (GDARD, 2014).

2. RESULTS OF THE DESKTOP ANALYSIS

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

It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the study area’s actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. However, this information is considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

Table 1: Summary of the conservation characteristics for the study area.

Aquatic ecoregion and sub-regions in which the study area is located		Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Highveld	FEPACODE	The study area is located within a subWMA currently not considered important in terms of fish species or freshwater resource conservation.
Catchment	Vaal		
Quaternary Catchment	C22F	NFEPA Wetlands	According to the NFEPA database, there are no wetland features located within the study area, however one natural wetland feature is situated within 500m of proposed infrastructure.
WMA	Upper Vaal		
subWMA	Downstream Vaal Dam		
Dominant characteristics of the Highveld Ecoregion Level 2 (11.03) (Kleynhans *et al.*, 2007)		Wetland vegetation Type	The study area is located within the Mesic Highveld Grassland Group 3, a least threatened wetland vegetation type.
Dominant primary terrain morphology	Plains; Low and Moderate Relief;		
Dominant primary vegetation types	Moist Cool Highveld Grassland	NFEPA Rivers	According to the NFEPA database, there are no Rivers located within the study area or the immediate vicinity (within 500m).
Altitude (m a.m.s.l)	1300-2100		
MAP (mm)	400 to 800	Detail of the study area in terms of the Gauteng Conservation Plan (C-Plan V3.3, 2011)	
Coefficient of Variation (% of MAP)	20 to 34	The study area and its immediate surrounding area (500m thereof) is not associated with any areas or features of conservation concern, namely Critical Biodiversity Areas (CBAs), Ecological Support areas (ESAs), Wetlands, Rivers or Ridges according to the Gauteng Conservation Plan. The study area does however fall within the urban area according to the Gauteng C-Plan. Although the Urban Edge was rescinded as a policy document in the Gauteng Spatial Development Framework (2011), it nevertheless remains a useful indicator of where concentration [of development] should occur. Therefore, for the purposes of this report, the Urban Edge boundaries as defined by the C-Plan v3.3 are utilised as a guideline to inform decision making	
Rainfall concentration index	45 to 64		
Rainfall seasonality	Early to late summer		
Mean annual temperature. (°C)	12 to 18		
Winter temperature (July)	-2 – 18 ºC		
Summer temperature (Feb)	10 – 28 ºC		
Median annual simulated runoff (mm)	5 to 10 (limited); 10 to 150		

CBA = Critical Biodiversity Area, ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; mm = Millimetres; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Area; WMA = Water Management Area

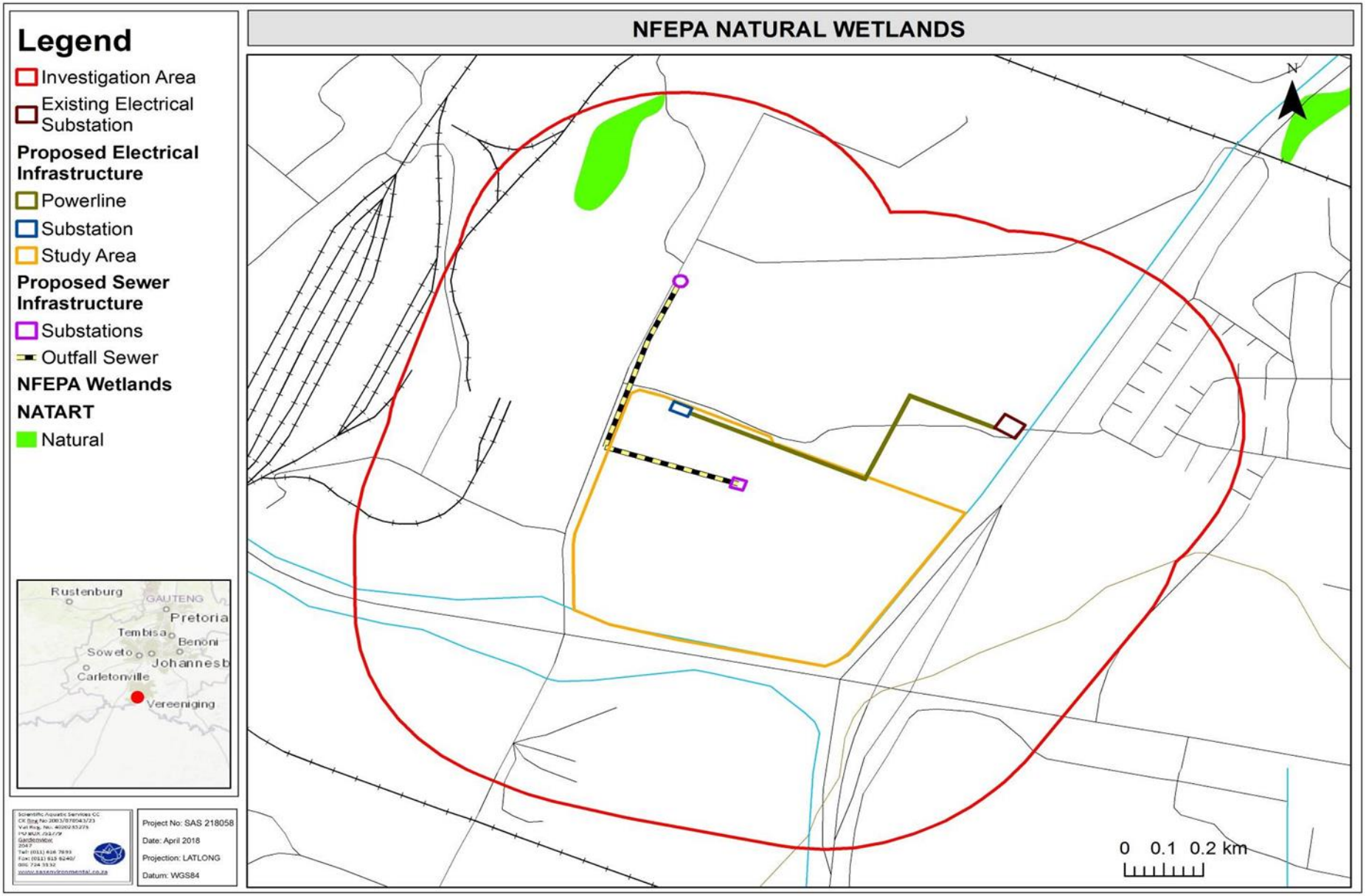

Figure 3: NFEPA natural wetlands, associated with the study area.

3. RESULTS: WATER RESOURCES ASSESSMENT

Following the desktop assessment, and site visit undertaken in April 2018, the following key observations were made:

1. According to the NFEPA database, there are no rivers located within the study area, however one natural wetland feature is located within the north-eastern portion of the 500m investigation areas. Refer to Figure 3;
2. During the site assessment, several water resources were identified within the study area, and a formalised tributary of the Vaal was confirmed to be within the 500m investigation area;
3. Based on observations and through consultation of historical imagery, the water resources identified within the study area were classified as artificial or man-made, due to their nature and proximity to man-made features such as furrows, water canals and roads located to the south and eastern portion of the study area. It is likely that the furrows within the study area were developed to drain the higher lying areas.

Based on site observations, the construction and excavation of the canals has resulted in the formation of small berms adjacent to these canals. This, together with additional runoff from the roads adjacent to the study area, has resulted in artificial ponding of water adjacent to these canals, which has resulted in the formation of artificial wetland features. These artificial features were then delineated using the methods as presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

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

Vegetation did not depict any distinction between terrestrial and wetland vegetation, and the topography was relatively flat within the extent of the study area, thus soils took precedence. The soil form identified within the wetlands was classified as Rensburg and this type of soil form is a distinctive feature of wetland areas, since they are found in lower lying landscape positions. Gleyed soils, or gleyed soils with mottles are indications that the soil exists in an anaerobic state. They are characterised as hydric soils. Figure 4 depicts a wet area within the study area and soil indicators of wetland characteristics. Figure 5 presents some of the artificial

water canals observed within the study area, which are located in close proximity to the wetlands identified.

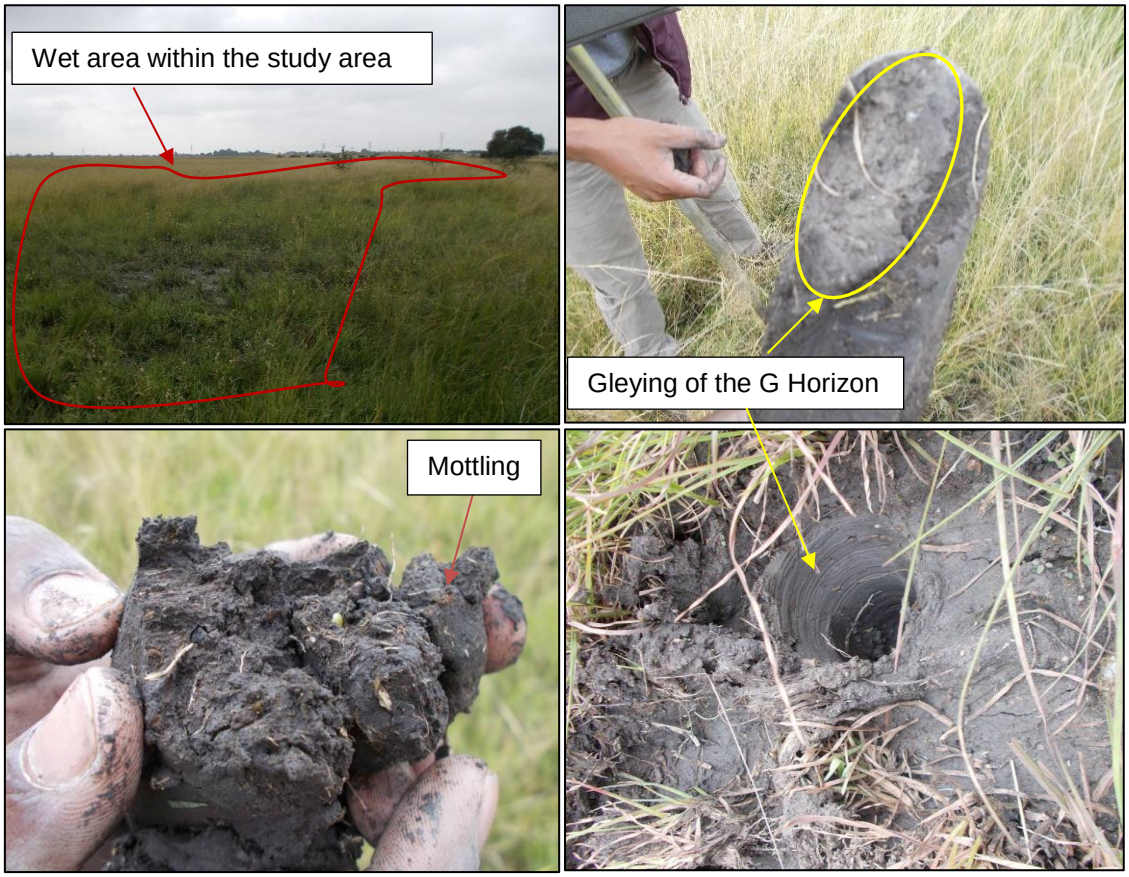

Figure 4: Imagery depicting wet characteristics

The left imagery above depicts a wet area within the study area. Imagery (top and bottom right) depicting a grey matrix (gleying) of the G horizon which is indicative of wetland soils (Top) Rensburg soil form was identified. (Bottom left) gleyed soils with mottles (areas of contrasting color) also served as an indication that the soil exists in an anaerobic state for sufficient periods of time for redoximorphic characteristics catena to form.

Figure 5: Imagery depicting stormwater canals within the study area located in close proximity to the artificial wetland features

The study area is dominated by increaser 2 and 3 subclimax and climax grass species such as *Sporobolus africanus*, *Eragrostis chloromelas*, and *Aristida congesta*. Increaser 2 and 3 species are grass species which are dominant in overgrazed veld, and as such is an indication of prolonged overgrazing by domestic livestock. Figure 6 below depicts current land use within the study area.

Figure 6: Imagery depicting current land uses within the study area

Scrutiny of historical Imagery was made in order to ascertain whether the water resources identified within the study area are natural or artificial. Below is the historical imagery of the southern and eastern portion of the study area. During the year of 1970, the imagery only portrays land cultivation but with no signatures of wetlands and artificial water canals evident. It appears that the cultivation has discontinued around the year 1980 and roads were visible in close proximity of the study area. However, in 2010 and 2015 water resources and artificial canals became visible within the area.

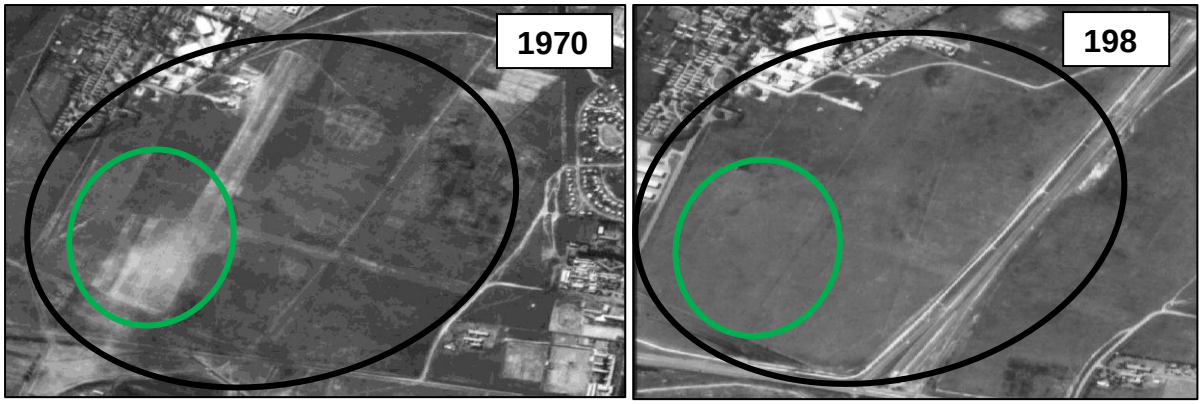

Figure 7: A 1970 imagery (left) depicting cultivation activities within the southwestern portion of the study area highlighted by the green circle. A 1980 imagery (right) depicting no signs of cultivation (indicated by a green circle).

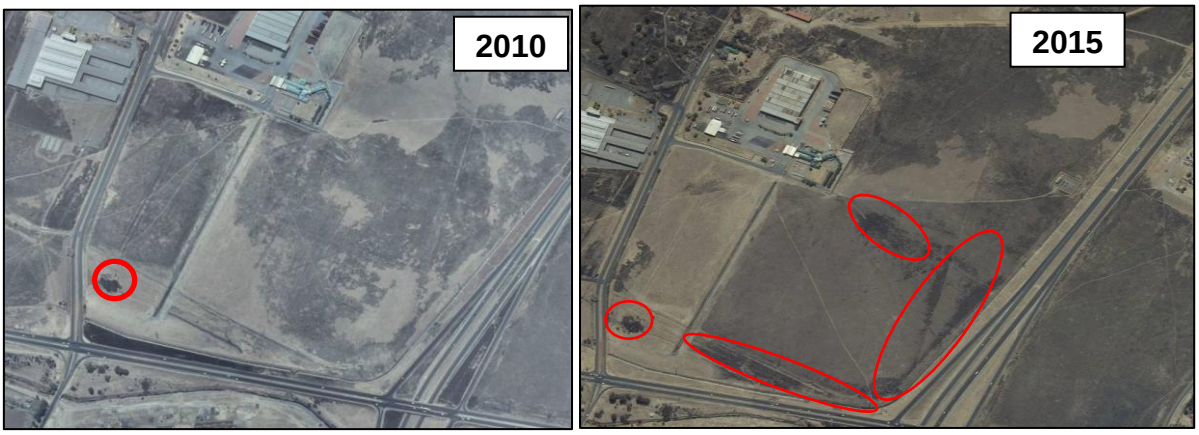

Figure 8: Historical imagery depicting artificial water resource signatures

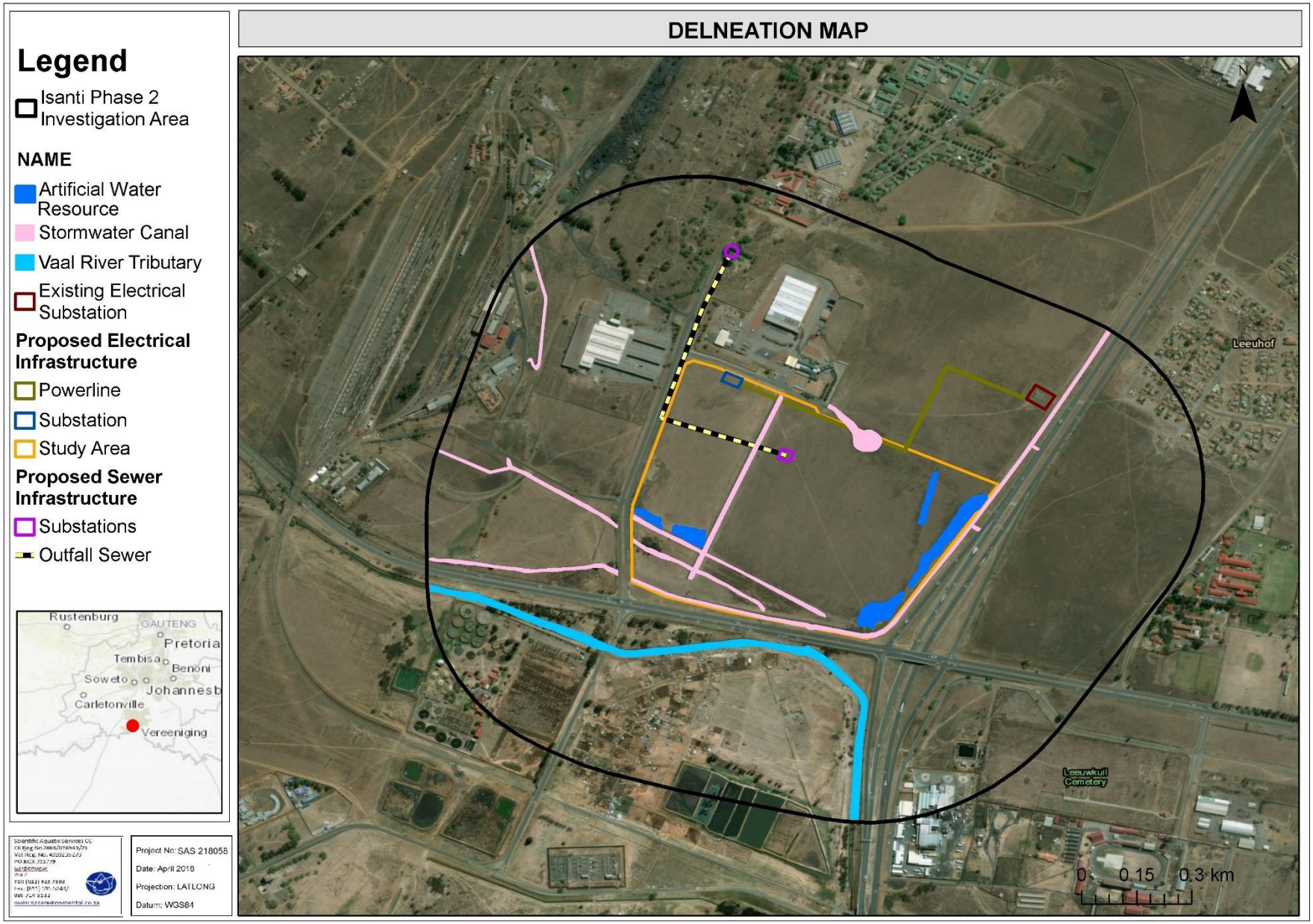

Figure 9: Map depicting the delineated features within the study area and 500m investigation area.

Based on the findings of the study, the following is recommended:

1. The water resources identified within the study area are regarded as artificial features. Although they are artificial, the features would persist under normal circumstances given the permanent changes to the landscape. Therefore, these features should be avoided where possible;
2. A tributary of the Vaal River was identified approximately 90m to the south of the study area, which is protected under the National Water Act, 1998 (Act 36 of 1998) since it is a regarded as a watercourse despite being formalised for an extensive portion of its course.
3. In terms of the listed activities stipulated in the National Environmental Management Act, 1998 (Act 107 of 1998), 2014 EIA regulations (as amended), a 32m zone of regulations is applicable to the Tributary of the Vaal;
4. According to the Gauteng C-Plan (2011), the study area is located inside of the Urban Edge, thus in terms of the GDARD guidelines, a 32m buffer or setback is applicable to the Vaal tributary;
5. In accordance with GN509 of 2016 as it relates to the National Water Act(NWA), 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 100m 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.
6. If any proposed activities are located within the unnamed tributary of the Vaal River as defined by the 1:100 year floodline (the extent of the watercourse), authorisation by means of a Water Use Licence is required in terms of Section 21 c&i of the NWA.

Figure 10 below provides the conceptual representation of the abovementioned zones of regulation and setback areas.

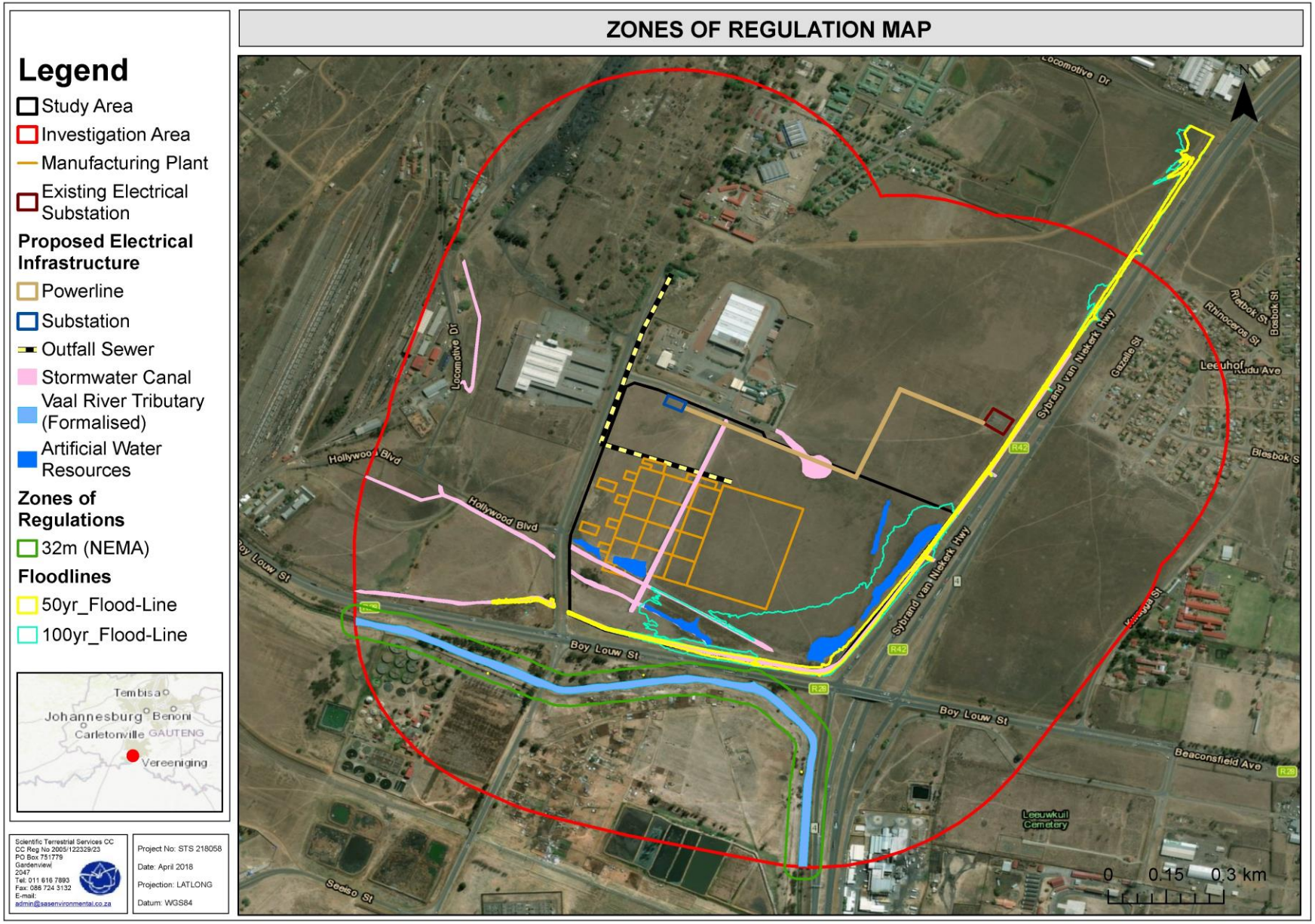

Figure 10: Map depicting the applicable zones of regulation associated with the Tributary of the Vaal River.

4. IMPACT ASSESSMENT

This section presents the significance of perceived potential impacts on the artificial water resources ecology within the study area. In addition, it also indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed development and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

4.1 Impact Analyses

4.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the artificial water resources within the study area, the below listed mitigation measures were compiled for all development phases. The points below summarise the factors considered in impact assessment as well as the development of mitigation measures:

- As this is an artificial water resource and not connected to any natural system it is not considered to be a natural watercourse, however, the features are likely to persist under “normal circumstances”;
- Due to the artificial nature of these water resources, the impact on ecoservice provision and water quality did not form the part of assessment.
- It must be must be noted that the artificial water resources situated on the southern portion of the study area will be unavoidably severely impacted due to their close proximity to the footprint of the proposed development.
- It is advisable to minimise the extent of the activities associated with the development (i.e. during construction) within proximity to the artificial water resources, to reduce impacts on the habitat and ecological structure.
- At the time of this assessment, the overall freshwater environment was of low ecological importance and sensitivity.

4.1.2 Impact discussion and essential mitigation measures

There are two key ecological impacts on the artificial water resources that are anticipated to occur namely,

- Loss of freshwater feature habitat and ecological structure; and
- Impacts on the hydrology and sediment balance of the freshwater features.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, and mitigation is cogently planned and executed, these impacts can be avoided or adequately minimized where avoidance is not feasible. Although, these water resources are classified as artificial with low ecological importance, they have created a habitat for some protected species such as *Crinum Macowanii*.

4.1.3 Activities and aspect register

The table below identifies potential activities that are likely take place during the various phases of the proposed development, which could possibly impact on the habitat and ecological structure of within the surrounding of the artificial water resources. It should be noted that these activities listed in the table below were used during the impact assessment as pre-mitigated impacts.

Table 2: A summary of the perceived activities to occur within the study area

Construction	Operational
Site clearing and the removal of vegetation leading to increased runoff and erosion during rainfall events.	Potential poor management and monitoring measures of alien vegetation control within the artificial water resources as a result of the construction activities.
Potential indiscriminate movement of construction vehicles within the 1:100 year floodline and close proximity to the artificial water resource edge leading to increased soil compaction.	Potential indiscriminate movement of vehicles within close proximity to the artificial water resources edge during alien vegetation control, leading to habitat alterations through soil compaction, vegetation removal and altered flow patterns.
Earthworks surrounding the artificial water resources leading to loss of habitat, erosion and altered runoff patterns.	
Spillage from construction vehicles and dumping of waste leading to soil contamination within the artificial water resources.	
Changes to the artificial water resources vegetation community due to alien invasion resulting in altered conditions.	

4.1.4 Impact assessment of the artificial water resources on the south western portion of the study area

The artificial water resources that are situated on the southwestern portion of the study area will be significantly impacted during the development phase due to the loss of surface runoff and the removal of nearly all the storm water channels feeding these water resources during

intense rainfall events. Although these water resources will be highly impacted, the impact significance remains very low since they are artificially formed, as the result of anthropogenic activities. Table 3 and 4 below provide the results of the unmanaged and managed impact scoring for the potential loss of the resource habitat and ecological structure as well as the potential change in the hydrological functioning respectively.

Table 3: Potential Impact loss of the artificial water resource habitat and ecological structure (Unmanaged and Managed)

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	1	3	1	3	6	7	42(low)
Operational phase	1	1	1	1	2	2	4	8(very low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	5	1	1	1	2	6	4	24(Very Low)
Operational phase	1	1	1	1	1	2	3	6 (Very Low)

Table 4: Potential changes to the hydrological functioning of the water resource (Unmanaged and managed)

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	1	3	1	3	6	7	42(Low)
Operational phase	1	1	1	1	2	2	4	8(very low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	5	1	1	1	2	6	4	24(Very low)
Operational phase	1	1	1	1	1	2	3	6 (Very Low)

4.1.5 Impact assessment of the artificial water resources on the eastern portion of the study area

The artificial water resources situated on the eastern portion of the study area are unlikely to be impacted is due to their positioning further away the footprint of the proposed development. Table 5 and 6 below provide the results of the unmanaged and managed impact scoring for the potential loss of the resource habitat and ecological structure as well as the potential change in the hydrological functioning respectively.

Table 5: **Potential impact loss of the habitat and ecological structure resource (Unmanaged and Managed)**

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	1	1	1	3	3	5	15(Very low)
Operational phase	1	1	1	1	2	2	4	8(very low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	1	1	1	1	2	2	4	8(Very Low)
Operational phase	1	1	1	1	1	2	3	6(Very Low)

Table 6: **Potential change to the hydrological functioning of the water resource (Unmanaged and Managed)**

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	1	1	1	3	3	5	15(Very low)
Operational phase	1	1	1	1	2	2	4	8(very low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	1	1	1	1	2	2	4	8(Very Low)
Operational phase	1	1	1	1	1	2	3	6(Very Low)

4.1.6 Impact Mitigation

General “good practice” mitigation measures applicable to a development of this nature are stipulated below. The following recommendations are made in order to minimise further impacts which may occur during the operational phase, should authorisation to proceed be granted:

- Storage facilities and all other non-essential activities should be located away from the water resources in order to avoid water and soil contamination, which would affect the structure and function of the artificial water resources;
- No unnecessary stockpiling of construction material must take place within the 1:100 year floodline or close to the artificial water resources and beyond the planned footprint of the proposed development, and all stockpiles must be removed immediately following construction;
- A comprehensive storm water management plan must be developed for the proposed facility;
- If feasible, construction must be scheduled for the drier winter period in order to minimise the risk of sediment-laden runoff reaching the downstream water resources as a result of the construction activities;
- Should it be necessary to clear any areas of vegetation, these areas, including contractor laydown areas, must remain as small as possible, to reduce the risk of further proliferation of alien vegetation, and to retain a level of protection to the wetland during construction (e.g. sediment trapping, slowing of stormwater runoff etc.);
- Contractor laydown areas and all non-essential activities are to remain outside of the 1:100 year floodline and as far from the water resources as possible;
- All exposed soils must be protected for the duration of the construction phase with a suitable material to prevent erosion and sedimentation of the artificial water resources;
- Soils should not be stockpiled within close proximity to the artificial water resources, but should rather be outside of the temporary zone boundaries to prevent sedimentation of the artificial water resources;
- Stockpiles should not exceed 2m in height. If 2m is exceeded, erosion control measures should be implemented;
- Any remaining soils following the completion of construction activities are to be levelled and re-seeded with indigenous flora species to minimise the risk of further sedimentation of the artificial water resources, and to aid in the natural reclamation process; and

- It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction. This plan should also be implemented during the operational phase under recommendation of the ECO.

The GN 704 regulations were consulted during this study, although this article of legislation is not applicable to the proposed development since Regulation GN704 applies specifically to mining, however it provides useful guidelines for best practice for dirty water management. Given the above, the following recommendations are applicable:

- Confine any unpolluted water to a clean water system and direct it away from any dirty area;
- The outlet structure of the clean water diversion system should include the use of energy dissipaters to slow the velocity of water inflow into the artificial water resources and to mitigate erosion;
- Collect the water arising within any dirty area, including water seeping from the manufacturing plant operations and direct it into a dirty water system;
- Design, construct, maintain and operate any dirty water system or activity so that it is not likely to spill into any clean water system more than once in 50 years; and
- Design, construct and maintain all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

5. CONCLUSION

In conclusion the water resources identified on site can best be defined as artificial water resources which are likely to persist under the “normal circumstances”, due to the presence of the furrow and the roads in the area. The systems are, however, of limited ecological importance and sensitivity and serves no true socio-cultural function nor does it provide any essential goods and services. It is therefore recommended that this information be presented to the DWS, as the custodian of water resources in South Africa, to obtain guidance on any Water Use Authorisation process that may need to be followed given the characteristics of the water features in the area.

A summary of the results obtained from the impact assessment conducted on the water resources within the eastern portion of the study area.

Impact 1: Loss of habitat and ecological structure	Pre-mitigation	Post-Rehabilitation/ Post-mitigation
Construction phase	Low	Very Low
Operational phase	Very Low	Very Low
Impact 2: Impacts on hydrological function	**Pre-mitigation**	**Post-mitigation**
Construction phase	Low	Very Low
Operational phase	Very Low	Very Low

A summary of the results obtained from the impact assessment conducted on the water resources within the eastern portion of the study area.

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Construction phase	Very Low	Very Low
Operational phase	Very Low	Very Low
Impact 2: Impacts on hydrological function	**Pre-mitigation**	**Post-mitigation**
Construction phase	Very Low	Very Low
Operational phase	Very Low	Very Low

It is the opinion of the freshwater ecologists that development within the study area will not lead to an unacceptable loss of water resources as they do not hold any true ecological importance and the risk to any natural wetlands and rivers is negligible. Mitigation measures should, however, be implemented, and the disturbance avoided where possible to minimise impacts on the watercourses of the general area.

6. REFERENCES

Department of Water Affairs and Forestry (DWAF). 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

National Environmental Management Act (NEMA) 107 of 1998

National Water Act 36 of 1998

NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murruy, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Water Research Commission. Report No. 1801/1/11. Online available: http://bgis.sanbi.org/nfepa/project.asp

APPENDIX A: Legislative requirements and Indemnity

National Environmental Management Act (NEMA, Act 107 of 1998)

- The National Environmental Management Act (Act 107 of 1998) and the associated Environmental Impact Assessments Regulations, 2014), 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 process or the Environmental Impact Assessment (EIA) process depending on the nature of the activity and scale of the impact.

National Water Act, 1998 (NWA, Act 36 of 1998)

- The 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 DWS or registered;
- A watercourse is defined by the NWA as:
  - A river or spring;
  - A natural channel in which water flows regularly or intermittently;
  - A wetland, lake or dam into which, or from which, water flows; and
  - Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
- Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWA in terms of Section 21.

General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)

In accordance with 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 Table A1 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 have a LOW risk class as determined through the Risk Matrix; and

vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol.

Table A1: Activities that are generally authorized for any person subject only to compliance to the conditions of this notice:

Any Person	ACTIVITY
Farmers and any other landowners	Emergency River crossings for vehicles to gain access to livestock, crops or residences etc.
Any landowner	Maintenance to private roads and river crossings provided that footprint remains the same and the road is less than 4 m wide
Any landowner	Erection of fences provided that the fence will not in any way impede or divert flow, or affect resource quality detrimentally in the short, medium or long term

The 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.

GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014).
The biodiversity assessment must comply with the minimum requirements as stipulated by GDARD Version 3 of 2014 and must contain the following information:

- The riparian delineation must be undertaken according to the DWAF guidelines; and
- The riparian zone and a protective buffer zone, beginning from the outer edge of the riparian zone, must be designated as sensitive in a sensitivity map. Guidelines for buffer zone widths pertaining to riparian zones are as follows:
  - 32m for riparian zones for rivers/streams occurring inside urban areas; and
  - 100m for riparian zones for rivers/streams occurring outside urban areas.

APPENDIX B: Indemnity and Terms of use of this Report

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

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

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

APPENDIX C: Method of Assessment

FRESHWATER RESOURCE ASSESSMENT APPROACH

Literature Review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the subject property included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
- NFEPA water management area (WMA)
- FEPA (sub)WMA % area
- Sub water catchment area FEPAs
- Water management area FEPAs
- Fish sanctuaries
- Wetland ecosystem types
- Gauteng Conservation Plan, Version 3.3 (2011)

National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

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

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

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present within the subject property.

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

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

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

<table>
<tr><th colspan="3">WETLAND / AQUATIC ECOSYSTEM CONTEXT</th></tr>
<tr><th>LEVEL 1:
SYSTEM</th><th>LEVEL 2:
REGIONAL SETTING</th><th>LEVEL 3:
LANDSCAPE UNIT</th></tr>
<tr><td rowspan="4">Inland Systems</td><td rowspan="4">DWA Level 1 Ecoregions
OR
NFEPA WetVeg Groups
OR
Other special framework</td><td>Valley Floor</td></tr>
<tr><td>Slope</td></tr>
<tr><td>Plain</td></tr>
<tr><td>Bench
(Hilltop / Saddle / Shelf)</td></tr>
</table>

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

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

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[1] (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.

[1] 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 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.
The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

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

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

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

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **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), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

Wetland Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act (1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".
The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas. An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

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

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008). Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant periods 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 object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

Ecological Impact Assessment Method

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 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'[2]. 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.

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

- **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 C3. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary[3].

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

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

Table C3: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

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

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

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected <	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected <	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table C4: Significance Rating Matrix.

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

Table C5: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operation.
- If applicable, transboundary or global effects were assessed.
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

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

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[4] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- 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*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[4] *Mitigation measures should address both positive and negative impacts*

APPENDIX D – Declaration and Specialists CV's

Declaration

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

APPENDIX E: Specialist CV's and Declaration

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES OF WORK EXPERIENCE

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

SELECTED PROJECT EXAMPLES

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

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

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF MTHOKOZISI MBANGEZELI

PERSONAL DETAILS

Position in Company	Soil Scientist
Date of Birth	11th March 1990
Nationality	South African
Languages	IsiXhosa, English
Joined SAS	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

SACNASP – Registered as a Candidate Natural Scientist

EDUCATION

Qualifications

B. Tech Crop Production and Soil Sciences (Tshwane University of Technology)	2015
BA (Hons) Development Studies (Nelson Mandela University)	2017

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng and Limpopo

SELECTED PROJECT EXAMPLES

Soil, Land Use and Land Capability Assessments

- Soil, land use and land capability scoping assessment as part of the environmental assessment and authorisation process for the proposed Dwarsrivier expansion project, Limpopo province

Freshwater Ecological Assessments

- Freshwater resource verification and delineation as part of the environmental assessment and authorisation process for the proposed ab InBev glass bottle manufacturing plant; near Vereeniging, Gauteng province.