

**BASIC ASSESSMENT AND WATER USE LICENCE APPLICATION
FOR THE PROPOSED CONSTRUCTION AND MAINTENANCE OF
THE RAND WATER 3KM Q6 PIPELINE WITH A DIAMETER OF 1400
MM FROM RAND WATER EIKENHOF PUMP STATION TO
MEREDALE RESERVOIR AS PART OF THE INLET AND OUTLET
PIPES AND ITS ASSOCIATED INFRASTRUCTURES**

Prepared for

Maanakana Projects

September 2016

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Report reference:	SAS 216203
Date:	January 2017

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EXECUTIVE SUMMARY

The findings of the wetland assessment indicate that although the wetlands have been subjected to disturbances, they are able to provide ecoservices at a moderately low level. In addition, the sensitivity of these wetlands range from low to high and they will have to be protected throughout the development phases in order to prevent further degradation and lowering of their Present Ecological Status (PES).

Based on the findings of the wetland assessment and the results of the impact assessment, it is the opinion of the ecologist that the proposed development be considered favourably, provided the proponent obtains a WUL and environmental approval from the relevant authorities. In addition, it is essential that mitigation measures as provided in this report be adhered to. Although the application of buffer zones will not be feasible, due to the linear nature of the proposed development, the sensitivity map presented in Section 4 should be taken into consideration in order to highlight areas where the duration of the proposed construction activities should be limited, and all non-essential activities should be excluded in order to minimise impacts on the wetlands affected by the proposed development.

Scientific Aquatic Services (SAS) was appointed to conduct a Wetland Ecological Assessment as part of the Water Use Licence Application (WULA) process for the proposed construction and maintenance of new potable water pipeline in Meredale, Gauteng Province, hereafter referred to as the "Proposed Q6 Pipeline".

The Proposed Q6 Pipeline is approximately 3km in length and runs from the Eikenhof pump station to the Meredale reservoir. In addition, the pipeline is located between the N1 (approximately 2.7km east of the pipeline) and the R82 (approximately 2km west of the pipeline)

The assessment took the following approach:

- A desktop study was conducted, in which the wetlands traversed or located in close proximity to the Proposed Q6 Pipeline were assessed by consulting the relevant national and provincial databases. The results of the desktop study are presented in Section 3 of this report;
- A field assessment took place in August 2016, during which two wetlands were identified; and
- The detailed results of the field assessment are contained in Section 4 of this report and are summarised in the table below.

Table A: Summary of the results of the field assessment

Resource	Coordinates	(PES) Category	Ecological function and service provision	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Class (REC)
Wetland 1	26°17'29.42" S 27°58'31.60" E	B/C- natural to moderately modified	Moderately low	High	C
Wetland 2	26°18'41.52" S 27°58'38.38" E	D – Largely modified	Moderately low	Low/Marginal	D

Following the assessment of the wetlands, a risk assessment matrix was applied to ascertain the significance of potential impacts on the receiving environment, should the proposed development proceed. The table below summarises the results of the risk assessment.

Table B: Risk Assessment Matrix for wetlands that will be traversed by the Proposed Q6 Pipeline.

Phases	Activity	Aspect	Impact	Risk Rating
Construction	Potential spills and leaks from vehicles delivering	Refuelling of vehicles within the wetlands	<ul style="list-style-type: none"> Vegetation disturbance Contamination of soils and water 	L



Phases	Activity	Aspect	Impact	Risk Rating
	construction material	during delivery of construction material	within the wetlands	
		Leaks from hazardous material containers	<ul style="list-style-type: none"> Contamination of soil and water within the wetlands 	
		Indiscriminate movement of vehicles within the wetlands	<ul style="list-style-type: none"> Soil compaction leading to increased runoff Sedimentation of the wetlands Vegetation disturbance 	
	Miscellaneous activities by construction personnel	Illegal trapping or hunting of faunal species	<ul style="list-style-type: none"> Possible migration of wetland faunal species as a result of habitat disturbance 	L
		Illegal Firewood collection	<ul style="list-style-type: none"> Loss of floral species 	
		Illegal harvesting of medicinal plants	<ul style="list-style-type: none"> Loss of floral species 	
		Creation of informal fires within the wetlands	<ul style="list-style-type: none"> Vegetation disturbance Temporary loss of faunal and floral habitat 	
	Vegetation clearing and disturbance	Site preparation	<ul style="list-style-type: none"> Encroachment of alien vegetation species Alteration of the vegetation communities Exposed bare areas prone to erosion Rendering the wetlands unsuitable to maintain biodiversity Loss of wetland assimilation abilities 	M
		Creation of access roads where existing roads cannot be used		
		Construction of the contractor laydown area		
	Topsoil stock piling adjacent the wetlands	Soil excavations to create trenches within which pipes will be installed	<ul style="list-style-type: none"> Alteration of the soil profile Soil disturbance within the wetlands Runoff from stockpiles resulting in sedimentation of the wetlands and smothering of the short vegetation 	M
		Infilling trenches		
		Rehabilitation of disturbed areas		
	Excavations within the wetlands	To create trenches within which pipes will be installed	<ul style="list-style-type: none"> Disturbance of the interflow and the surface flow Alteration of wetland channel banks Inundation of exposed trenches during rainfall and as a result of improper flow diversion 	H
	Disposal of waste material such as soil, rocks and concrete within the wetlands	Littering and improper disposal of waste	<ul style="list-style-type: none"> Pollution of wetland soils and water 	L
Operational	Operation of the Proposed Q6 Pipeline within the wetlands	Possible leaks from pipes	<ul style="list-style-type: none"> Seepage and incision 	M
			<ul style="list-style-type: none"> Inundation of the area 	
		Indiscriminate driving of vehicles and vegetation trampling within the wetlands during maintenance activities	<ul style="list-style-type: none"> Soil compaction 	L
			<ul style="list-style-type: none"> Ongoing soil disturbance 	
			<ul style="list-style-type: none"> Vegetation disturbance Soil and surface water contamination as a result of oils and hydrocarbons from 	



Phases	Activity	Aspect	Impact	Risk Rating
			maintenance vehicles Encroachment of alien vegetation species • Alteration of the vegetation community structure	
		Presence of pipes within the wetlands	• Disturbance of interflow	H



Table C: Risk Assessment Matrix for wetlands within 500m of the Proposed Q6 Pipeline.

Phases	Activity	Aspect	Impact	Risk Rating
Construction	Potential spills and leaks from vehicles delivering construction material	Refuelling of vehicles within the wetlands during delivery of construction material	<ul style="list-style-type: none"> Vegetation disturbance Contamination of soils and water within the wetlands 	L
		Leaks from hazardous material containers	<ul style="list-style-type: none"> Contamination of soil and water within the wetlands 	
		Indiscriminate movement of vehicles within the wetlands	<ul style="list-style-type: none"> Soil compaction leading to increased runoff Sedimentation of the wetlands Vegetation disturbance 	
	Miscellaneous activities by construction personnel	Illegal trapping or hunting of faunal species	<ul style="list-style-type: none"> Possible migration of wetland faunal species as a result of habitat disturbance 	L
		Illegal Firewood collection	<ul style="list-style-type: none"> Loss of floral species 	
		Illegal harvesting of medicinal plants	<ul style="list-style-type: none"> Loss of floral species 	
	Vegetation clearing and disturbance	Creation of informal fires within the wetlands	<ul style="list-style-type: none"> Vegetation disturbance Temporary loss of faunal and floral habitat 	L
		Site preparation	<ul style="list-style-type: none"> Encroachment of alien vegetation species 	
		Creation of access roads where existing roads cannot be used	<ul style="list-style-type: none"> Alteration of the vegetation communities 	
	Topsoil stock piling adjacent the wetlands	Construction of the contractor laydown area	<ul style="list-style-type: none"> Exposed bare areas prone to erosion Rendering the wetlands unsuitable to maintain biodiversity Loss of wetland assimilation abilities 	L
		Soil excavations to create trenches within which pipes will be installed	<ul style="list-style-type: none"> Alteration of the soil profile Soil disturbance within the wetlands 	
		Infilling trenches	<ul style="list-style-type: none"> Runoff from stockpiles resulting in sedimentation of the wetlands and smothering of the short vegetation 	
	Excavations within the wetlands	Rehabilitation of disturbed areas	<ul style="list-style-type: none"> Disturbance of the interflow and the surface flow Alteration of wetland channel banks Inundation of exposed trenches during rainfall and as a result of improper flow diversion 	L
Operational	Disposal of waste material such as soil, rocks and concrete within the wetlands	Littering and improper disposal of waste	<ul style="list-style-type: none"> Pollution of wetland soils and water 	L
		Possible leaks from pipes	<ul style="list-style-type: none"> Seepage and incision Inundation of the area 	L
		Indiscriminate driving of vehicles and vegetation trampling within the wetlands during maintenance activities	<ul style="list-style-type: none"> Soil compaction Ongoing soil disturbance 	L
			<ul style="list-style-type: none"> Vegetation disturbance Soil and surface water contamination as a result of oils and hydrocarbons from 	



Phases	Activity	Aspect	Impact	Risk Rating
			maintenance vehicles Encroachment of alien vegetation species • Alteration of the vegetation community structure	
		Presence of pipes within the wetlands	• Disturbance of interflow	L

It is essential that mitigation measures be enforced during all phases of the proposed development in order to minimise direct impacts on the wetlands. With effective mitigation in place, the perceived impact significance will be reduced thus reducing the risk of further degradation of the wetlands, and ensuring that the PES is maintained.

Mitigation measures were developed to manage the perceived impacts on the wetlands, as outlined in Section 5 and Appendix F of this report. The following mitigation measures are considered particularly important:

- All soil stockpiles should be placed outside of the wetland buffer zones, and protected with a suitable geotextile, to avoid sedimentation of the wetlands during rainfall events;
- As it is absolutely unavoidable that the wetlands will be affected, it is recommended that the duration of activities within the wetlands be limited to avoid extensive disturbance of the wetlands;
- Should it be required that the culverts currently located below the roads be removed or altered to accommodate the construction of the Proposed Q6 Pipeline, this must be done in such a way that water flow within the active wetland channels is not obstructed or impounded;
- All construction rubble must be cleared immediately and concrete as well as cement may not be allowed to enter the wetlands;
- Alien vegetation species that encroached the wetlands following the proposed construction activities should be eradicated. In addition, ongoing alien vegetation control programme must be implemented;
- Edge effects (impacts on areas beyond the proposed construction footprint due to ineffective care and management) that might occur following the proposed construction activities, need to be rehabilitated and it must be ensured that the banks of the wetland channels are stable and suitably vegetated with no bare exposed soils remaining, particularly within areas where potential alterations to the existing culverts have taken place; and
- Any areas where active erosion is observed, as well as areas cleared for the construction and implementation of the Proposed Q6 Pipeline must be immediately rehabilitated (re-shaping of slopes, revegetation with indigenous species where necessary, etc.) in such a way as to ensure that the hydrology and geomorphological characteristics of the area are re-instated to conditions which are as natural as possible.



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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, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area contributing to runoff at a particular point in a river system.
Delineation (of a watercourse):	To determine the boundary of a watercourse based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
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).



Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface.
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.



ACRONYMS

BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CoJ	City of Johannesburg
CSIR	Council of Scientific and Industrial Research
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ES	Ecological Sensitivity
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
HGM	Hydro-geomorphic
IHI	Index of Habitat Integrity
MAP	Mean Annual Precipitation
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RHP	River Health Programme
RQS	Research Quality Services
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WMA	Water Management Area
WRC	Water Research Commission



1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a Wetland Ecological Assessment as part of the Water Use Licence Application (WULA) process for the proposed construction and maintenance of the potable water pipeline project in Meredale, Gauteng Province, hereafter referred to as the “Proposed Q6 Pipeline” (Figures 1 & 2).

The Proposed Q6 Pipeline is approximately 3km in length and runs from the Eikenhof pump station to the Meredale reservoir. In addition, the Proposed Q6 Pipeline is located between the N1 (approximately 2.7km east of the pipeline) and the R82 (approximately 2km west of the pipeline)

The purpose of this report is to identify and map the areas where the Proposed Q6 Pipeline traverse wetlands and those that are within a 500m radius of the Proposed Q6 Pipeline in fulfilment of Regulation GN509 as it relates to the National Water Act. The characteristics, Ecological Importance and Sensitivity (EIS) of the wetlands, and the Present Ecological State (PES) of the wetlands associated with the Proposed Q6 Pipeline will be defined and determined. In addition, this report aims to define the socio-cultural and ecological service provision and the Recommended Ecological Category (REC) for the wetlands. Furthermore, the report will provide detailed information to guide the proposed project activities in the vicinity of the wetlands, in order to ensure the ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

A risk assessment, considering the perceived impacts on the wetlands will be conducted to determine the significance of the potential impacts on the receiving environment in relation to the development of the Proposed Q6 Pipeline. In addition, proposed mitigation measures will be developed to minimise the impacts, where possible, followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.





Figure 1: A digital satellite image depicting the location of the Proposed Q6 Pipeline in relation to the surrounding area.



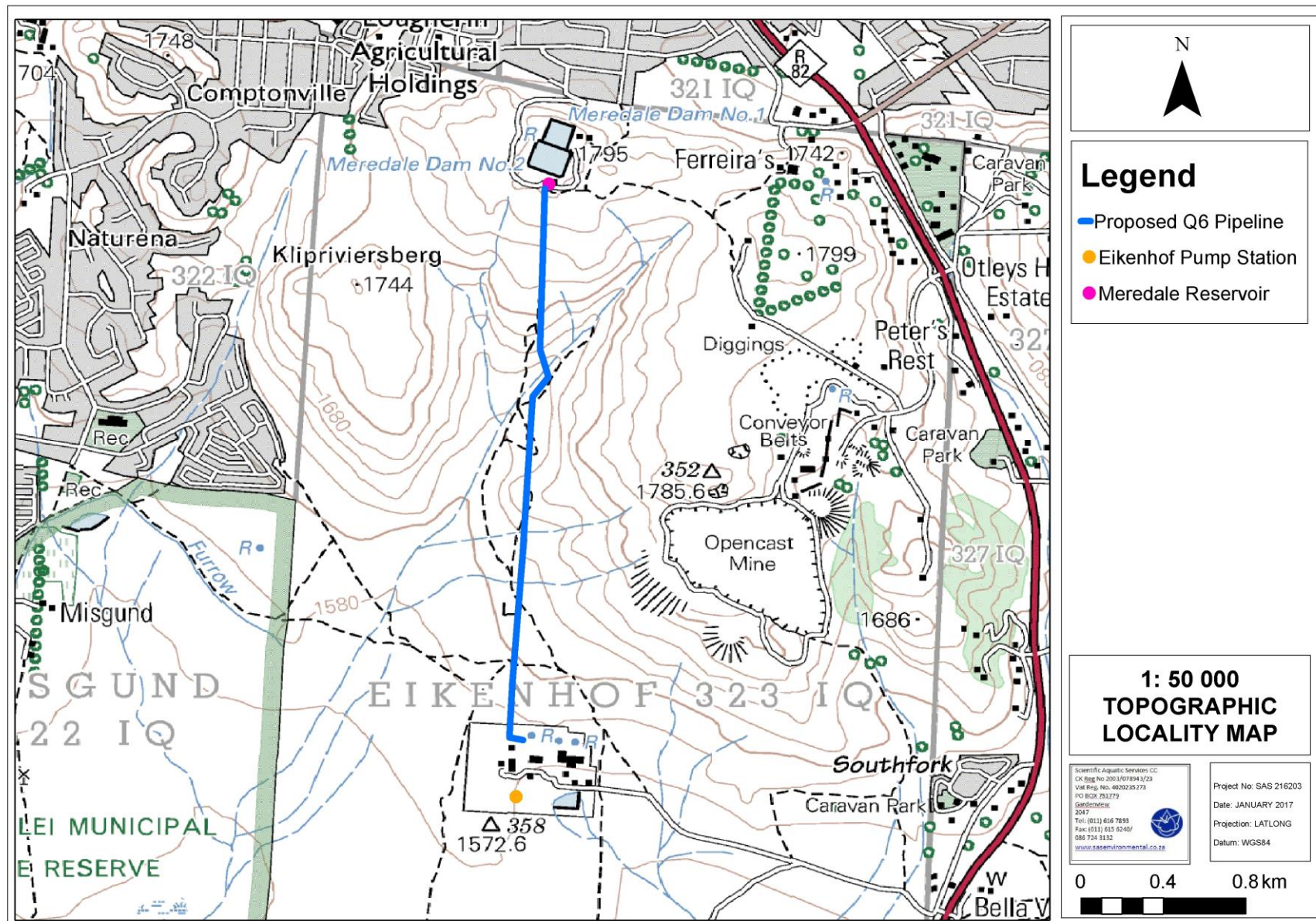


Figure 2: The location of the Proposed Q6 Pipeline depicted on a 1:50 000 topographical map in relation to the surrounding area.



1.2 Scope of Work

Specific outcomes in terms of this report are outlined below:

- A background study of the area in which the development of the Proposed Q6 Pipeline will be undertaken, utilising relevant municipal, national and provincial datasets such as the 2011 National Freshwater Ecosystem Priority Areas (NFEPA) database; the 2014 DWS Resource Quality Information Services (RQIS) PES/EIS database, the 2011 Gauteng Department of Agriculture and Rural Development (GDARD) Gauteng Conservation Plan database as well as the 2014 City of Johannesburg (CoJ) wetland database;
- Delineation of the wetlands according to “Department of Water Affairs and Forestry (DWAF)¹, (2005). Final Draft: A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas. In addition, the desktop delineation of wetlands that are located within 500m radius of the Proposed Q6 Pipeline was also undertaken;
- Classification of the identified wetlands according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al.*, 2013);
- Determining the PES of the wetlands according to the procedure for the assessment of the Index of Habitat Integrity (IHI) status by DWAF (2007);
- To assess the services provided by the wetlands associated with the Proposed Q6 Pipeline according to the method of Kotze *et al.* (2009);
- To determine the EIS and allocate a suitable REC for the wetlands according to the method prepared for DWS and the Water Resource Commission (WRC) by Rountree and Kotze (2013);
- Allocating scientifically derived buffer zones to the wetlands using the wetland buffer zone tool according to the method of Macfarlane *et al.*, 2014; and
- The perceived impacts of the proposed development on the wetlands associated with the Proposed Q6 Pipeline will be determined using the DWS 2016 Risk Assessment matrix. In addition, management and mitigation measures will be implemented during various phases of the proposed development to assist in minimising the impact on the receiving environment.

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.



1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The determination (field verification) of the wetland boundaries, and the assessment thereof is confined to the Proposed Q6 Pipeline, and does not include the neighbouring and adjacent properties, which were only considered as part of the desktop assessment;
- The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundaries, based on the site conditions present at the time of assessment;
- Wetland zones and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/ facultative species. Within this transition zone, some variation of opinion on the wetland boundary may occur. However, if the DWAF (2005) method is followed, all assessors should get largely similar results;
- The areas within which the Proposed Q6 Pipeline is located are mainly dominated by land use activities such as residential developments, roads as well as amenities such as shopping complexes and factories. These activities in conjunction with disturbances such as leaking pipes, infilling and rubble disposal have resulted in the modification of the natural wetlands, which might influence the results of the determination of the wetland boundaries; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the development activities of the Proposed Q6 Pipeline have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of wetland ecology.

1.4 Legislative Requirements and Relevant Provincial Guidelines

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

- National Environmental Management Act (NEMA Act No. 107 of 1998);
- National Water Act (NWA; Act No. 36 of 1998);
- Notice (GN) 509 as published in the Government Gazette 40229 of 2016,
- Gauteng Conservation Plan (C-Plan v3.3, 2011); and
- Gauteng Department of Agriculture and Rural Development (GDARD, 2014).



2 ASSESSMENT APPROACH

2.1 Wetland Field Verification

For the purposes of this investigation, the definition of a wetland habitat as defined in the NWA (1998) was used: A wetland is “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

The wetland zone delineation took place according to the method presented in the “Final Draft: A Practical Field Procedure for Identification and Delineation of Wetland 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.

A field assessment was undertaken in August 2016, during which the presence of any wetland characteristics as defined by DWAF (2005) and wetland habitat as defined by the NWA, were noted. In addition to the delineation process, a detailed assessment of the delineated wetlands was undertaken, at which time factors affecting the integrity of the wetlands were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the wetlands. A detailed explanation of the methods of assessment is provided in Appendix C of this report.

2.2 Sensitivity Mapping

All wetlands associated with the development of the Proposed Q6 Pipeline were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto digital satellite imagery and topographic maps. The sensitivity map presented in Section 4.4 should guide the design and layout of the proposed development.



2.3 Risk Assessment and Recommendations

Following the completion of the assessment, an impact assessment was conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the development of the Proposed Q6 Pipeline. These recommendations also include general control measures, which apply to the installation of the Proposed Q6 Pipeline. Mitigation measures have been developed to address issues in all phases throughout the life of the Proposed Q6 Pipeline including planning, construction and operation (maintenance). The detailed site specific mitigation measures are outlined in Section 5 of this report, whilst the general management measures which are considered to be best practice mitigation applicable to this project, are outlined in Appendix F. The risk assessment was undertaken using the Risk Assessment Matrix presented in Notice 509 of 2016 specifically for the assessment of non-consumptive use risks on watercourses: Section 21 c and i water use Risk Assessment Protocol.

3 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 Proposed Q6 Pipeline’s actual site characteristics. 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: Desktop data relating to the characteristics of the wetlands associated with the Proposed Q6 Pipeline and the surrounding region.

Aquatic ecoregion and sub-regions in which the Proposed Q6 Pipeline is located		Details of the Proposed Q6 Pipeline's development in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database		
Ecoregion	Highveld 11.01	FEPACODE		0 = not important in terms of conservation
Catchment	Vaal	NFEPA Wetlands (Figure 3)	NATART	The Proposed Q6 Pipeline does not traverse any wetland features according to the database. However, two Artificial features are indicated at the Meredale reservoir. Both these artificial features are classified at level 4 as Flat wetlands with Wetcon Z2 and Z3.
Quaternary Catchment	C22A and C22D			
WMA	Upper Vaal			
SubWMA	Downstream Vaal Dam		Rank	6 = Any other wetlands (excluding dams)
Dominant characteristics of the Highveld Ecoregion (Kleynhans <i>et. al.</i> , 2007)				
Terrain morphology: Broad Division	Plains; Low Relief			
Vegetation types	Rocky Highveld Grassland and Mixed Bushveld			
Altitude (m a.m.s.l)	1300 to 1900			
MAP (mm)	500 to 700			
Coefficient of Variation (% of Annual Precipitation)	20 to 34			
Rainfall concentration index	55 to 64			
Rainfall seasonality	Early to late summer			
Mean annual temp. (°C)	14 to 18	WETVEG	The upper portion of the Proposed Q6 Pipeline falls within the Central Bushveld Group 1, whereas the lower portion falls within the Mesic Highveld Grassland Group 2	
Median annual simulated runoff (mm)	20 to 60			
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)				
Sub-quaternary reach	C22A-01315 (Klip)	NFEPA Rivers		None traversed by the Proposed Q6 Pipeline nor indicated within 500m radius of the Proposed Q6 Pipeline
Proximity to the proposed development	± 5.5km & 1.9km	Details of the Proposed Q6 Pipeline's development in terms of the Gauteng Conservation Plan (C-Plan V3.3, 2011) (Figures 4 & 5)		
Assessed by expert?	Yes	Critical Biodiversity Area (CBA): An area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges	The northern half portion of the Proposed Q6 Pipeline traverses a CBA area indicated as a Red Listed plant configuration, Red Listed plant habitat, Orange Listed plant habitat, Red Listed mammal habitat, Red Listed bird habitat, Primary vegetation	
PES Category Median	E			
Mean Ecological Importance (EI) Class	Moderate			
Mean Ecological Sensitivity (ES) Class	Moderate			
Stream Order	1			
Default Ecological Class (based on median PES and highest EI or ES mean)	Moderate (Class C)	Ecological Support Area (ESA): An area considered to provide connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation	No ESA is traversed by the Proposed Q6 Pipeline. However, there is an ESA identified on the southern half of the Proposed Q6 Pipeline traverses an ESA.	
Details of the Proposed Q6 Pipeline's development in terms of the City of Johannesburg Wetland Database (CoJ, 2014) (Figure 6)				
According to the CoJ Wetland Database layer the Q6 pipeline traverse a valley bottom wetland.				
Gauteng Conservation Plan (C-Plan V3.3, 2011) (continued)		River Buffer		
Urban Area	Although the Urban Area 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. The Proposed Q6 Pipeline falls outside the urban area (Figure 5)	Wetland Buffer		Indicated on the middle portion of Proposed Q6 Pipeline
		Ridge transformed		Indicated on upper middle portion of the Proposed Q6 Pipeline
				Indicated south of the Proposed Q6 Pipeline.



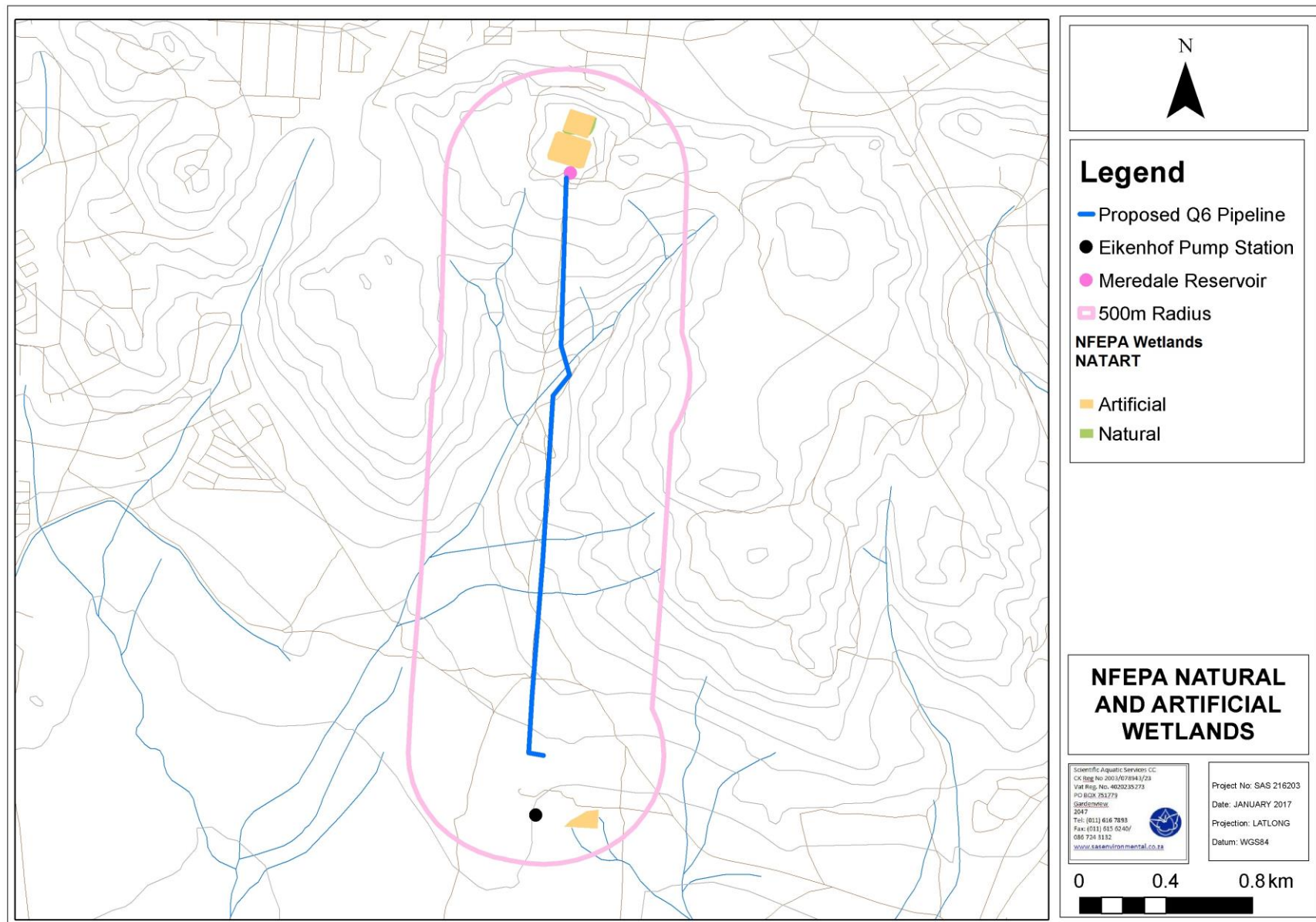


Figure 3: Natural and artificial wetlands associated with the Proposed Q6 Pipeline.



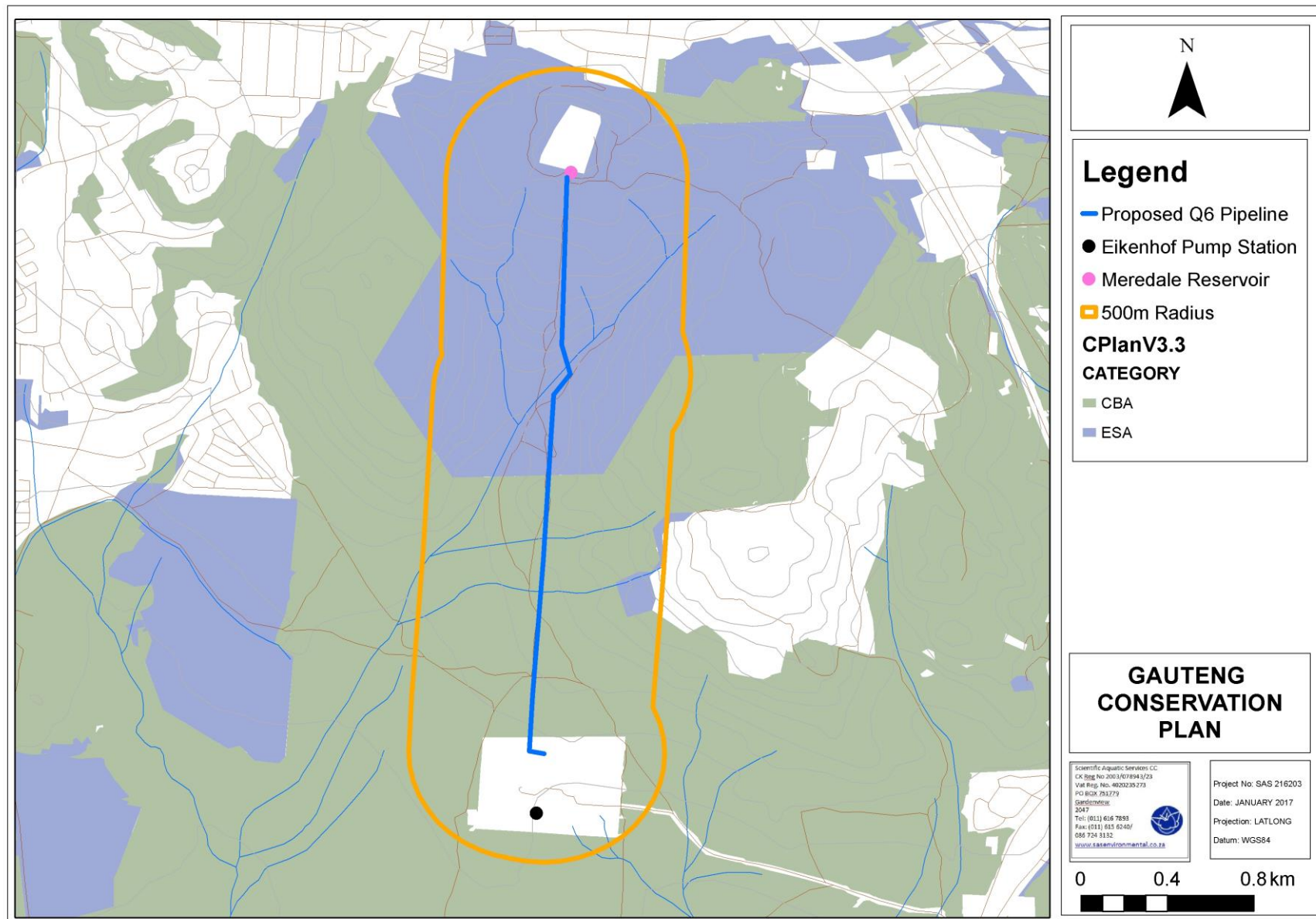


Figure 4: Threatened ecosystems associated with the Proposed Q6 Pipeline according to the Gauteng C-Plan v3.3.



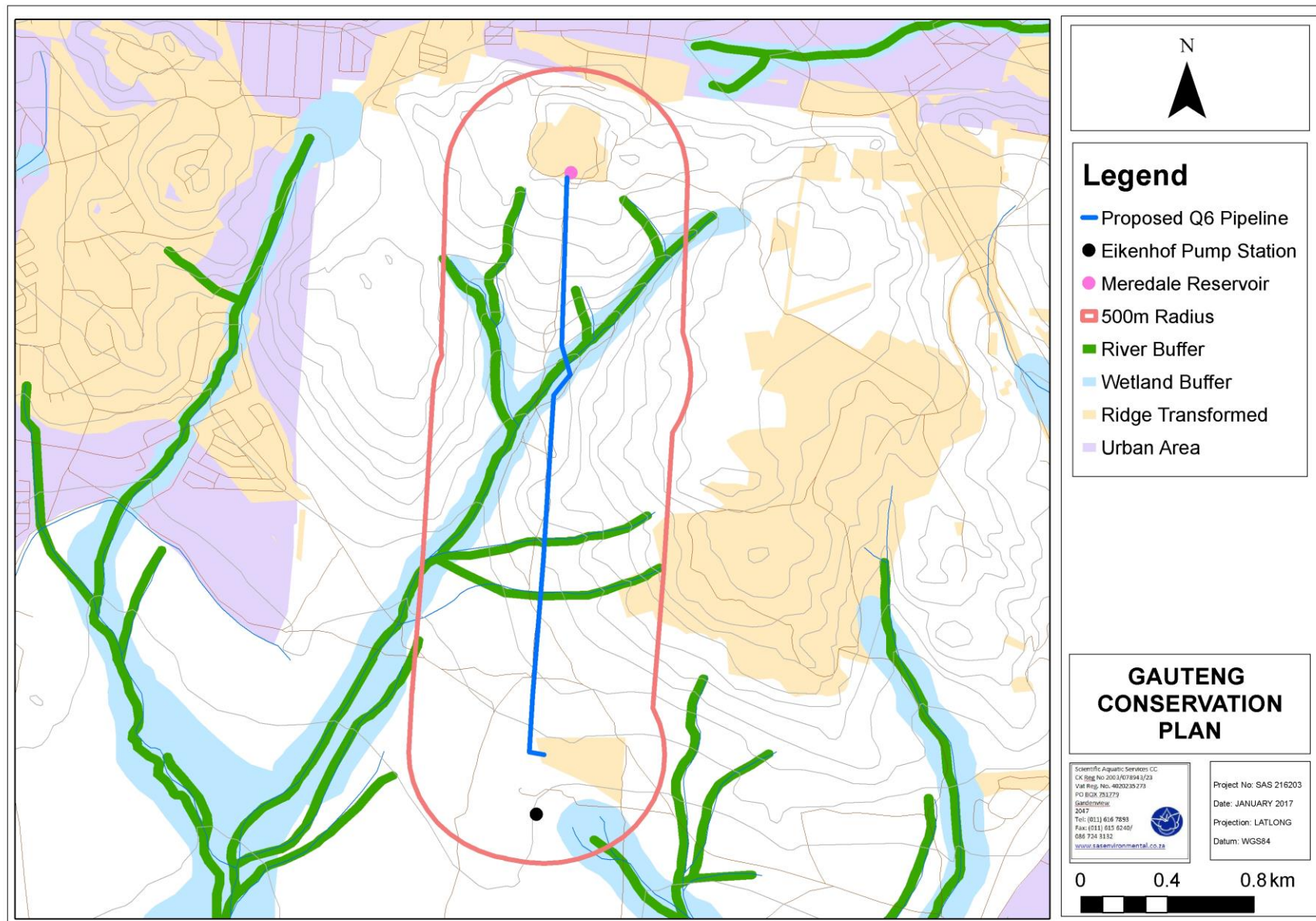


Figure 5: River, wetland, ridges and the urban area associated with the Proposed Q6 Pipeline.



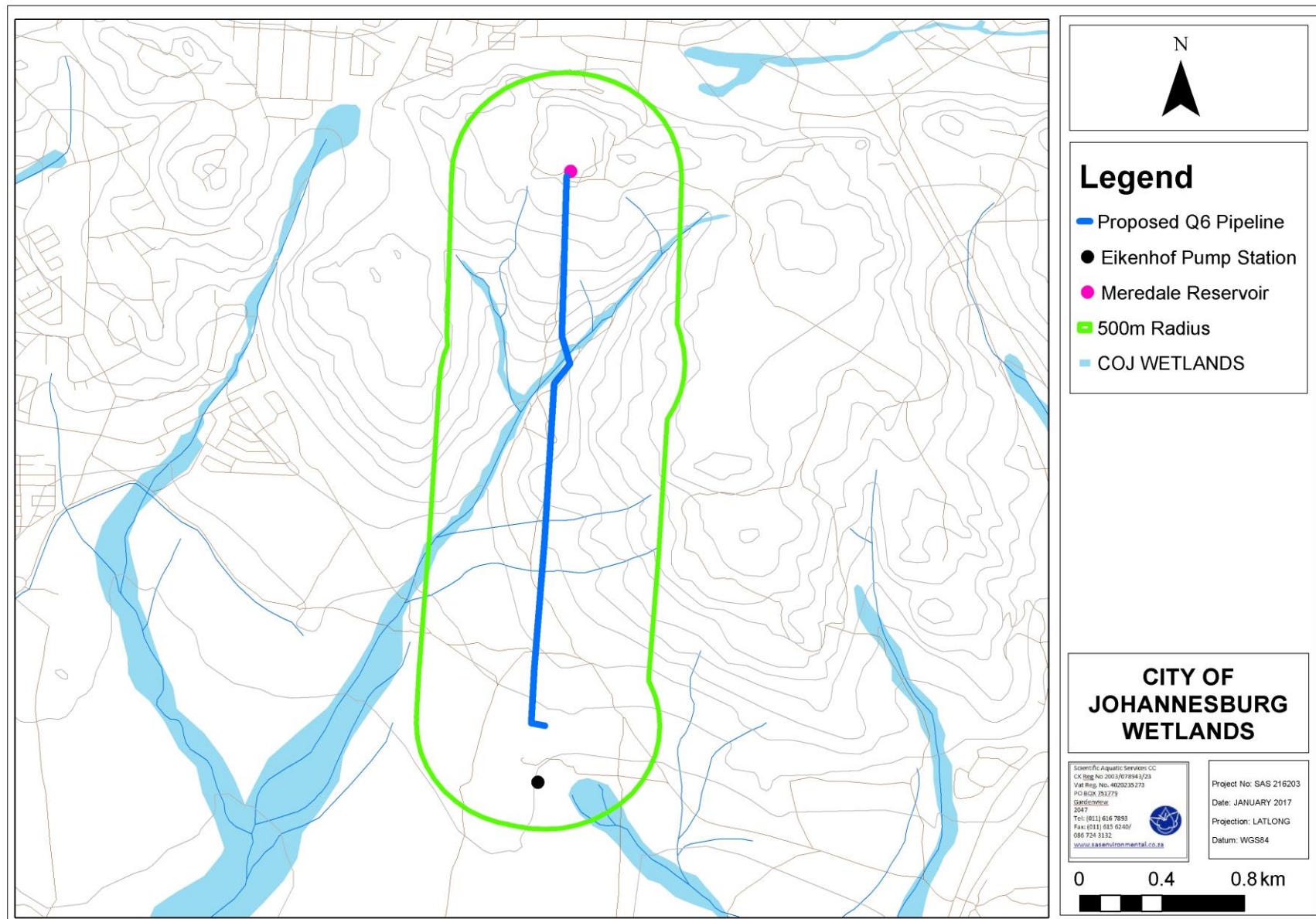


Figure 6: Wetlands associated with the Proposed Q6 Pipeline as indicated by the CoJ Wetland layer (2014).



4 RESULTS

4.1 Wetland Delineation

The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundaries based on site conditions present at the time of the field assessment. Use was made of digital satellite imagery to further aid in the delineation of other wetlands that are located within 500m radius of the Proposed Q6 Pipeline.

During the assessment, the following indicators were used to delineate the boundaries of the wetlands:

- Terrain units were used to determine in which parts of the landscape the wetlands are most likely to occur in;
- Vegetation adapted to saturated soils were used to indicate the boundary in cases where soil augering could not be undertaken;
- Soil form indicator was used to determine the presence of soils that are associated with prolonged and frequent saturation. Soil auger points were developed at various points of the wetlands, and mottles were observed within certain area which were included in the delineated area; and
- Surface water was taken into consideration in defining the permanent zone of a wetland.

Figure 7 presents the observation points from which areas that might be of ecological importance and sensitivity were determined, whilst Figure 8 presents the delineated wetlands.



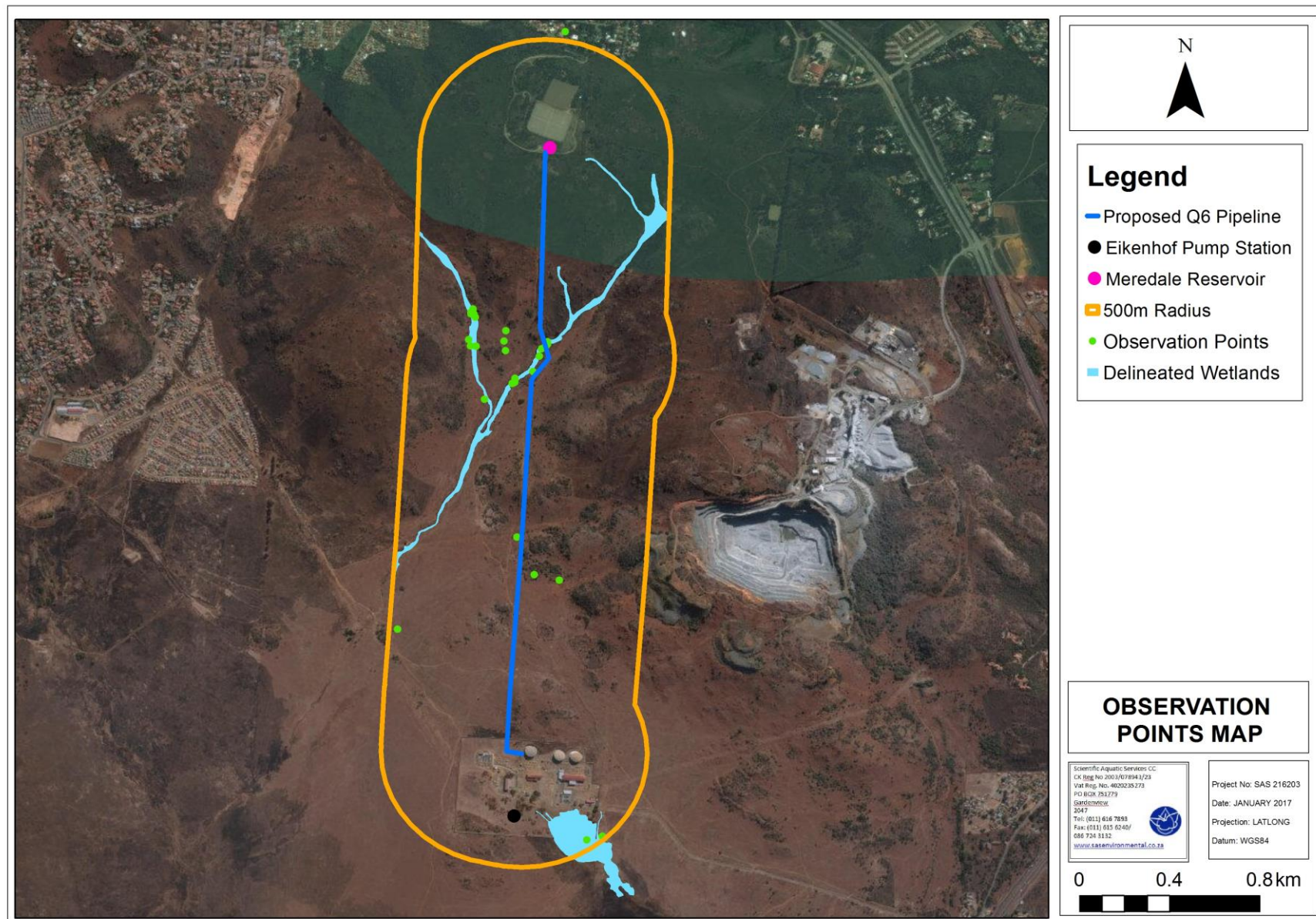


Figure 7: Presentation of observation points and delineated wetlands within the 500m radius of the Proposed Q6 Pipeline.



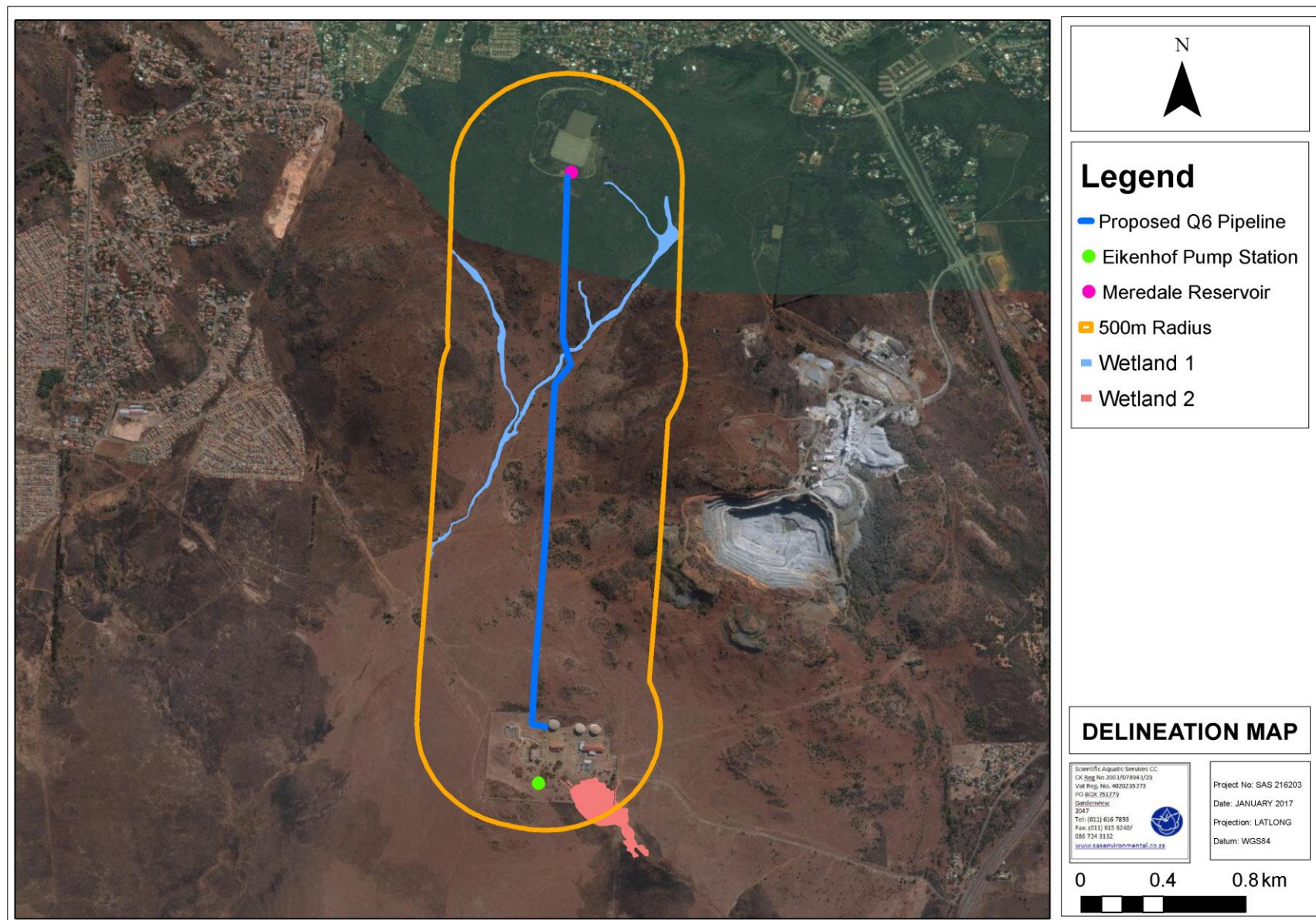


Figure 8: Presentation of the wetlands present within the 500m radius of the Proposed Q6 Pipeline.



4.2 Wetland System Characterisation

The wetlands observed during the field assessment were classified according to the method provided by Ollis *et al.*, 2013, which is explained in detail in Appendix C of this report. The table below summarises the characterisation of the identified wetlands.

Table 2: Characterisation of the wetlands identified during the field assessment.

Resource	Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: HGM Type
Wetland 1	Inland: An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	Ecoregion: The study area falls within the Highveld Ecoregion (11.01).	Valley: The typically gently sloping, lowest surface of a valley.	Channelled valley bottom: A valley bottom wetland with a river channel running through it.
Wetland 2				

In addition to the two channeled valley bottom wetlands observed, two preferential surface flow areas were observed during site visit, traversing the middle portion of Q6 pipeline (located: S 26°18'03.51" E 27°58'34.28" and S 26°17'55.94" E 27°58'28.08") (Figure 9). Furthermore, these areas might have occurred as a result of erosion initiated by heavy rainfall events. No wetland characteristics as described in the wetland definition stated in the NWA were observed within these areas. Due to the steep slope on which these preferential flow areas are located, water will flow through rapidly and the soils will not be saturated long enough for wetland conditions to develop.



Figure 9: Presentation of the preferential surface flow areas.

4.3 Field Verification Results

The tables below summarise the findings of the field assessment in terms of relevant aspects (i.e. hydrology, geomorphology and vegetation components) of the wetland ecology. The details pertaining to the method of assessment used to assess the various aspects is explained in Appendix C of this report whereas Appendix E presents the results of the calculations for the identified wetlands. Only natural wetlands traversed by or are in close proximity to the Proposed Q6 Pipeline were assessed in order to determine their sensitivity, present state, ecoservices provision as well as recommending suitable ecological categories. The tables below present the results of the assessment of these wetlands.

Wetland 2 identified approximately 250m south of the Proposed Q6 Pipeline was previously assessed in a previous study undertaken by SAS in 2014.



Table 3: Summary of the assessment of wetland 1.

Ecological & socio-cultural service provision graph					
<p>Wetland 3 Ecosystem Services</p>					
HGM Unit	Channelled valley bottom wetland associated with an unnamed tributary of the Klip River		Fatal Flaw?	N	Photograph notes
PES Discussion	<p>PES Category: B/C</p> <p>The wetland obtained a PES score that falls between Category B and Category C, which implies that the wetland is largely natural with moderate modifications. Modifiers include the construction of gabion walls across the channel, an existing pipeline and a road that traverses the wetland channel. These modifiers have altered the natural flow of water within the channel and also led to sediment deposition into the wetland. In addition, the wetland is located in an open and isolated area, making it less prone to anthropogenic disturbances.</p>		<p>Wetland characteristics:</p> <p>a) Hydraulic regime</p> <p>The wetland is located in an open, isolated area, and has only been disturbed by the presence of gabion walls and the existing pipeline that traverses the channel. Furthermore, the wetland is a perennial system with a permanent flow of water.</p>		
Ecoservice Provision	<p>Moderately Low: The wetland obtained intermediate scores for flood attenuation, streamflow regulation, sediment trapping and biodiversity maintenance. The wetland has no importance in terms of socio cultural service provision, and this is due to the location of the wetland and since there are no household that depends on the wetland for such services. Furthermore, the wetland has moderately low importance in terms of phosphate assimilation, nitrate assimilation and toxicant assimilation.</p>		<p>b) Water quality</p> <p>Based on site observations, no source of contamination was observed during site visit and therefore the water quality within the wetland is less likely to be polluted.</p>		



EIS Discussion	High: This wetland is considered sensitive to changes in floods, low flow and water quality. In addition, the score allocated to the conservation status of the WetVeg group, as well as the results of the PES of this wetland, have contributed to the outcome of the sensitivity of the wetland. Wetlands in this category are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications.	c) Geomorphology and sediment balance The wetland has been previously disturbed during the construction of the pipeline and installation of gabion mattresses. In addition, dirt roads traversing the wetland has resulted in sediment deposition within the wetland.
REC Category	Category C: Based on the results of the PES, EIS and the ecoservices provision of the wetland, the wetland was allocated Category C which is similar to the PES score, since it has a chance of being improved following the construction activities of the Proposed Q6 Pipeline.	d) Habitat and biota The habitat has been moderately disturbed by previous construction activities which led to the removal of vegetation in turn resulting in patches of bare soil which are then prone to erosion. <i>Cussonia paniculata</i> trees as well as terrestrial grass species such as <i>hyparrhenia hirta</i> were observed on site. No faunal species were observed on site
SUMMARY OF IMPACT ASSESSMENT		
Impact Significance	The wetland will definitely be traversed by the Proposed Q6 Pipeline, the construction activities of which, will alter the bed and banks of this wetland. However, mitigation measures must be implemented and adhered to in order to minimise the level of impacts on this wetland with specific mention of erosion prevention and the need for bank stabilisation.	Business case, Conclusion and Mitigation Requirements: Although the application of buffer zones will not be feasible, the duration and extent of the proposed development activities within the wetland must be minimised in order to lessen the impacts on this wetland. In addition, Water Use License may need to be obtained from the DWS authorities before commencement of the proposed construction activities.



Table 4: Summary of the assessment of wetland 2.

Ecological & socio-cultural service provision graph					
<p>Wetland 4 Ecosystem Services</p>					
HGM Unit	Channelled valley bottom wetland which feeds into the Klip River	Fatal Flaw?	N	Photograph notes	Gabions installed to stabilize the channel banks and control erosion. Eroded areas in the downstream portions of the wetland.
PES Discussion	<p>PES Category: D</p> <p>The wetland obtained a PES score that falls within Category D, which implies that the wetland has been largely modified. Modifiers within the wetland include infilling, erosion, artificial impoundment and the invasion of alien vegetation species.</p>	<p>Wetland characteristics:</p> <p>a) Hydraulic regime</p> <p>The wetland receives increased water input as a result of runoff from leaking pipes and overflow from the artificial impoundment located within the Eikenhof pump station. Furthermore, the presence of roads traversing the wetland have modified the flow pattern within the wetland. A seepage area formed as a result of overflow from the artificial impoundment. In addition, channel competency was altered due to significant erosion.</p>			
Ecoservice Provision	<p>Moderately Low: The wetland is considered of moderately high importance in terms of flood attenuation, and has no importance in terms of erosion control. In addition, the wetland obtained intermediate scores for biodiversity maintenance, streamflow regulation, sediment trapping and toxicant assimilation.</p>	<p>b) Water quality</p> <p>The water quality within the wetland is likely to be altered by domestic activities such as washing of clothing being undertaken within the wetland by members of the nearby communities. In addition, livestock defecates and sediment deposition from eroded areas will also contribute to the alteration of the water quality within the wetland.</p>			
EIS Discussion	<p>Low/Marginal: The wetland obtained an EIS score that falls within a low/marginal category. In addition, this wetland has a hydrological functional importance and has low sensitivity on a landscape scale.</p>	<p>c) Geomorphology and sediment balance</p> <p>The wetland has been disturbed by livestock grazing and trampling Eikenhof pump station. Furthermore, the area outside the Eikenhof pump station was severely eroded.</p>			



REC Category	Category D: Since the wetland will not be directly impacted by this proposed project. The activities associated with the Proposed Q6 Pipeline are highly unlikely to result in further degradation to the wetland. Nevertheless a REC Category D was assigned to the wetland in order to guide the relevant authorities and decision-makers.	<p>d) Habitat and biota</p> <p>The downstream areas of the wetland are eroded and incised however a few wetland indicator species such as <i>Imperata cylindrica</i> and <i>Juncus effusus</i> as well as terrestrial grass <i>Hyparrhenia hirta</i> were observed within the wetland. No faunal species were observed within the wetland.</p>
SUMMARY OF IMPACT ASSESSMENT		
Impact Significance	The wetland will not be affected by the construction activities of the Proposed Q6 Pipeline since is located approximately 250m away from the Proposed Q6 Pipeline. In addition, there is currently existing infrastructure located between the wetland and the Proposed Q6 pipeline, which may form a barrier between the wetland and impacts from the proposed construction activities.	<p>Business case, Conclusion and Mitigation Requirements:</p> <p>Although wetland 2 will not be affected by the proposed development activities, the DWS must be consulted in order to obtain guidance prior to the commencement of the proposed development activities, since the Proposed Q6 Pipeline is located within 500m of wetland 2</p>



4.4 Sensitivity Mapping

Although the Urban Area 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 purpose of this report, the Urban Area boundaries as defined by the Gauteng Conservation Plan Version 3 (2011) are utilised as a guideline to inform decision making when recommending or stipulating a suitable zone of regulation around the wetlands.

Following the delineation of the wetlands, consideration was given to the legislative requirements pertaining to the application of buffer zones around the wetlands. The NEMA (2014) regulations define the regulated zone of wetlands and watercourses as being the watercourse itself, within urban areas, as well as a 32m buffer outside of the urban edge in which impacting activities, as defined in the regulations are controlled. If these activities are to be undertaken, approval in terms of NEMA by the regulating authority is required. In addition, the NWA regulates any activities within a wetland or watercourse in terms of Section 21 c and i of the act. Furthermore, Regulation GN509 as it pertains to the NWA has established a regulatory zone of 500m in which any water use taking place within 500m of a wetland requires authorisation. In a case where an activity is considered to fall within a low risk class according to the scores obtained from the application of a risk assessment matrix, it can be approved by DWS and registered as a water use by means of a General Authorisation (GN 509 of 2016).

According to the GDARD Minimum Requirements for Biodiversity Assessments (2014) a 30m buffer is recommended for wetlands located within an urban area, and a 50m buffer is recommended for wetlands located outside an urban area. Furthermore, a buffer zone tool for the determination of aquatic impact buffers and additional setback requirements for wetland ecosystems (Macfarlane *et. al.*, 2014), was utilised to determine suitable buffer zones for the wetlands during the proposed construction and operational phase. According to the results of the assessment, wetland 1 must be allocated a 34m buffer during the construction phase and a 15m buffer during the operational phase. The wetland buffer zone tool was not applied to wetland 2, since it will not be affected by proposed construction and operational activities.

However, due to the linear nature of the proposed development, application of buffer zones around the wetlands will not be feasible, since the Proposed Q6 Pipeline will definitely traverse wetland 1 and the allocated buffer zones. However, it must be ensured that the duration of activities (i.e. site preparation, construction, rehabilitation and maintenance) within the wetland and the associated buffer zones are limited. Furthermore, development



activities occurring within the wetlands, including rehabilitation, must be authorised by the DWS in terms of Section 21 (c) & (i) of the National Water Act (Act 36 of 1998).

Therefore, in order to prevent further degradation of the wetlands, only essential construction activities and authorised personnel may be permitted within the designated wetland and wetland buffer areas. No unnecessary activities such as the placement of contractor laydown areas, must be permitted within the buffer zones or the applicable zones of regulation. The applicable zones of regulation and buffer zones are indicated in the maps below for illustrative purposes. Since the Proposed Q6 Pipeline will traverse wetland 1, a WUL should be obtained from the DWS authorities before commencement of the proposed construction activities. The figures below conceptually depict the delineated wetlands and the associated operational and construction buffer zones as well as the NEMA zone of regulation.





Figure 10: Conceptual presentation of wetland 1 and the associated construction phase and operational phase buffer zones.



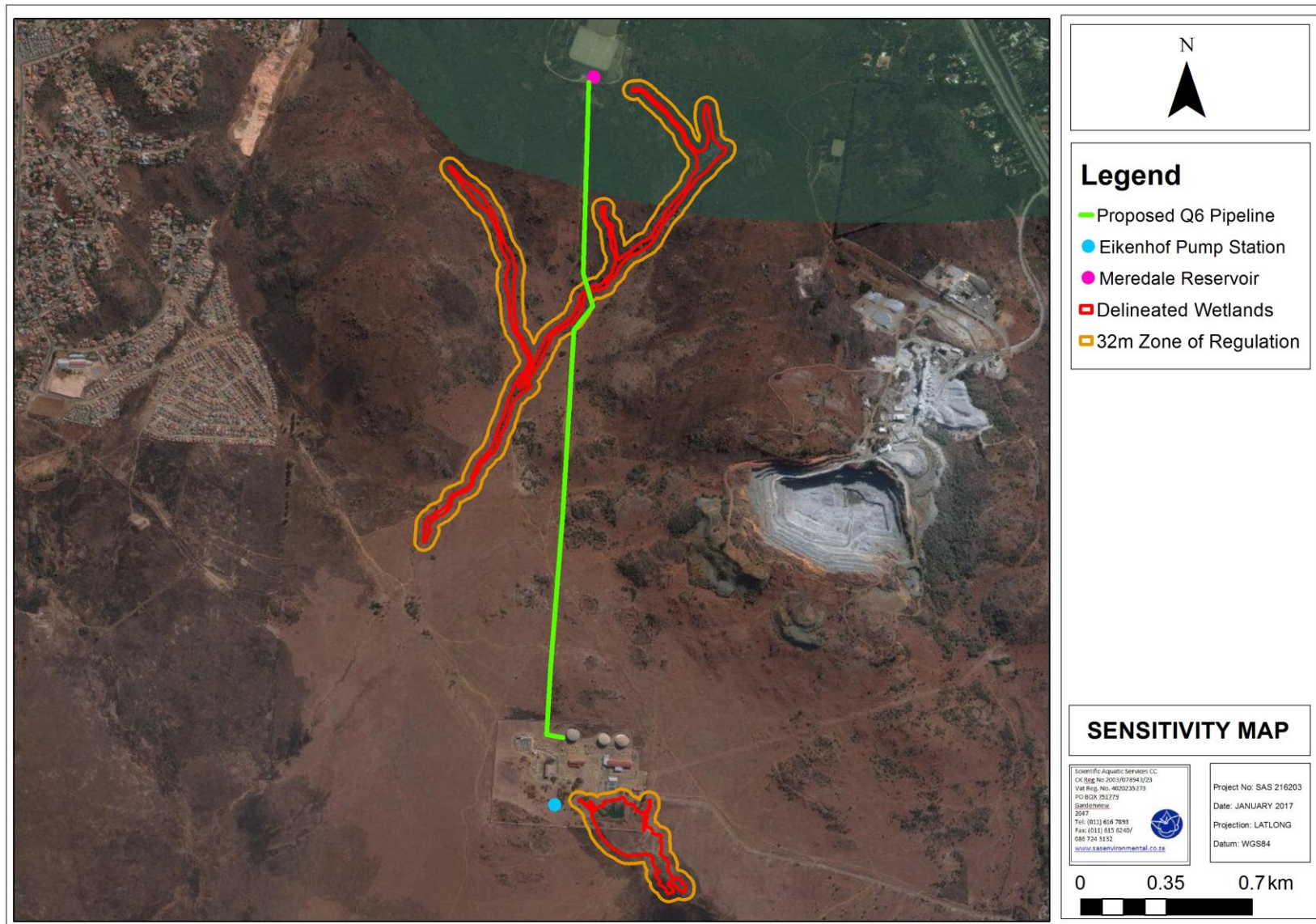


Figure 11: Conceptual presentation of wetland 1 and wetland 2 as well as their associated 32m NEMA zone of regulation in relation to the Proposed Q6 Pipeline.



5 IMPACT / RISK ASSESSMENT

This section presents the significance of potential impacts on the wetland ecology associated with the Proposed Q6 Pipeline. In addition, it also indicates the required mitigation measures needed to minimise the impacts and presents an assessment of the significance of the impacts, taking into consideration the available mitigation measures and assuming that they are fully implemented.

5.1 Impact Analyses

5.1.1 Mitigation measures

Following the assessment of the wetlands to be traversed by the Proposed Q6 Pipeline as well as those that are in close proximity to the Proposed Q6 Pipeline, mitigation measures were compiled to serve as guidance throughout the various phases of the proposed development. The points below summarise the factors considered in the development of mitigation measures:

- All soil stockpiles should be placed outside of the wetland buffer zones, and protected with a suitable geotextile, to avoid sedimentation of the wetlands during rainfall events;
- As it is absolutely unavoidable that wetland 1 will be affected, it is recommended that the duration of activities within the wetland be limited to avoid extensive disturbance of the wetland;
- Should it be required that the culverts currently located below the roads be removed or altered to accommodate the construction of the Proposed Q6 Pipeline, this must be done in such a way that water flow within the active wetland channel is not obstructed or impounded;
- All construction rubble must be cleared immediately and concrete as well as cement may not be allowed to enter the wetlands;
- Alien vegetation species that encroached in the wetlands following the proposed construction activities should be eradicated. In addition, ongoing alien vegetation control programme must be implemented;
- In the case where the flow of water will have to be diverted, sand bags can be used to temporarily divert flow and prevent erosion along the channel banks;
- Edge effects (impacts on areas beyond the proposed construction footprint due to ineffective care and management) that might occur following the proposed construction activities, need to be managed and where necessary, affected areas



must be rehabilitated. It must be ensured that the banks of the wetland channel are stable and suitably vegetated with no bare exposed soils remaining, particularly within areas where potential alterations to the existing culverts have taken place; and

- Any areas where active erosion is observed, as well as areas cleared for the construction and implementation of the Proposed Q6 Pipeline must be immediately rehabilitated following the proposed construction activities (re-shaping of slopes, revegetation with indigenous species where necessary, etc.) in such a way as to ensure that the hydrology and geomorphological characteristics of the area are re-instated to conditions which are as natural as possible.

5.1.2. Impact discussion

The DWS 2016 risk assessment matrix was utilised to determine the class within which the Proposed Q6 Pipeline development falls, which will then guide authorities in decision making. The results of the risk assessment are presented in Appendix F. The assessment was undertaken based on the assumption that mitigation measures are implemented and summarises activities and the level of impacts that are anticipated to occur on the wetland post implementation of mitigation measures.

The main activity that will affect the wetland will be earthworks/excavations undertaken in creating trenches within which pipes will be embedded. In this case, the flow of water will be temporarily obstructed and alteration of the channel banks will occur. During site preparation, vegetation clearing will result in patches of bare areas that are prone to erosion and proliferation of alien vegetation species. This might further lead to loss of biodiversity maintenance and assimilation abilities of the wetland.

Wetland 1 is currently modified by the presence of infrastructure such as gabions, a pipeline and dirt roads. The proposed development activities will lower the PES of this wetland, however with best practise construction methods, the wetland is likely to maintain its current status. In addition, graves were observed along the point where the Proposed Q6 Pipeline traverses wetland 1. These graves must be considered and protected during the proposed development activities.

Wetland 2 will not be affected by the development activities of the Proposed Q6 Pipeline, since it is located approximately 250m from the Proposed Q6 Pipeline. In addition, existing infrastructure (Eikenhof pump station) will serve as a barrier between wetland 2 and impacts from the proposed construction activities.



The tables below summarises the results obtained from the application of the DWS risk assessment matrix and present activities, impacts, significance and risk ratings. Table 5 presents risk assessment results for the wetland that will be traversed by the Proposed Q6 Pipeline. Table 6 presents risk assessment results for wetlands that are within 500m radius of the Proposed Q6 Pipeline.

Table 5: Risk Assessment Matrix for wetlands that will be traversed by the Proposed Q6 Pipeline.

Phase	Activity	Impact	Significance	Risk Rating
Construction	Potential spills and leaks from vehicles delivering construction material	Soil compaction as a result of movement of vehicles	38,5	L
		Vegetation disturbance		
		Contamination of soils and water		
		Contamination of soil and water within the wetlands		
		Soil compaction		
		Sedimentation of the wetland		
		Vegetation disturbance		
	Miscellaneous activities by construction personnel	Possible migration of wetland faunal species as a result of habitat disturbance	37,5	L
		Possible extinction of faunal species		
		Possible extinction of floral species		
		Vegetation disturbance		
	Vegetation clearing and disturbance	Encroachment of alien vegetation species	77	M
		Alteration of the vegetation communities		
		Exposed bare areas prone to erosion		
		Rendering the wetland unsuitable to maintain biodiversity		
		Loss of wetland assimilation abilities		
	Topsoil stock piling adjacent the wetland	Alteration of the soil profile	38,5	L
		Soil disturbance within the wetland		
		Runoff from stockpiles resulting in sedimentation of the wetland and smothering of the short vegetation		
	Excavations within the wetland areas	Disturbance of the interflow and the surface flow	170	H
		Alteration of the channel banks		
		Inundation of exposed trenches during rainfall and as a result of improper flow diversion		
	Dumping waste material such as soil, rocks and concrete	Pollution of wetland soils and water	19,5	L
	Creation of access roads	Alteration of the vegetation communities	78	M
		Alien species encroachment		
	Indiscriminate movement of vehicles within the wetland	Soil compaction	120	M
		Vegetation disturbance		



Phase	Activity	Impact	Significance	Risk Rating
Operational		Increased runoff		
		Topsoil disturbance		
	Possible leakage from pipes	Seepage and incision	41,25	M
		Inundation of the area		
	Indiscriminate driving of vehicles within the wetland	Soil compaction	45	L
		Ongoing soil disturbance		
		Vegetation disturbance		
	Vegetation trampling within the wetland	Alteration of the vegetation community structure	44	L
		Encroachment of alien vegetation species		
	Presence of pipes within the wetland	Disturbance of interflow and surface flow	200	H



Table 6: Risk Assessment Matrix for wetlands within 500m of the Proposed Q6 Pipeline.

Phase	Activity	Impact	Significance	Risk Rating
Construction	Potential spills and leaks from vehicles delivering construction material	Soil compaction as a result of movement of vehicles	18	L
		Vegetation disturbance		
		Contamination of soils and water		
		Contamination of soil and water within the wetlands		
		Soil compaction		
		Sedimentation of the wetlands		
		Vegetation disturbance		
	Miscellaneous activities by construction personnel	Possible migration of wetland faunal species as a result of habitat disturbance	18	L
		Possible extinction of floral species		
		Possible extinction of faunal species		
		Vegetation disturbance		
	Vegetation clearing and disturbance	Encroachment of alien vegetation species	21	L
		Alteration of the vegetation communities		
		Exposed bare areas prone to erosion		
		Rendering the wetlands unsuitable to maintain biodiversity		
	Topsoil stock piling adjacent the wetlands	Alteration of the soil profile	27	L
		Soil disturbance within the wetlands		
		Runoff from stockpiles resulting in sedimentation of the wetlands and smothering of the short vegetation		
	Excavations within the wetland areas	Disturbance of the interflow and the surface flow	21	L
		Alteration of the channel banks		
		Inundation of exposed trenches during rainfall and as a result of improper flow diversion		
	Dumping waste material such as soil, rocks and concrete	Pollution of wetland soils and water	15	L
	Creation of access roads	Alteration of the vegetation communities	21	L
		Alien species encroachment		
	Indiscriminate movement of vehicles within the wetlands	Soil compaction	27	L
		Vegetation disturbance		
		Increased runoff		
		Topsoil disturbance		
Operational	Possible leakage from pipes	Seepage and incision	21	L
		Inundation of the area		
	Indiscriminate driving of vehicles within the wetlands during maintenance activities	Soil compaction	15	L
		Ongoing soil disturbance		



Phase	Activity	Impact	Significance	Risk Rating
		Vegetation disturbance		
	Vegetation trampling within the wetlands during maintenance activities	Alteration of the vegetation community structure	12	L
		Encroachment of alien vegetation species		
	Presence of pipes within the wetlands	Disturbance of interflow and surface flow	36	L

6 CONCLUSION

Scientific Aquatic Services (SAS) was appointed to conduct a wetland assessment as part of the Water Use Licence Application process for the construction of the Proposed Q6 Pipeline in Meredale, Gauteng province.

The Proposed Q6 Pipeline will traverse wetland 1. However, wetland 2 will not be traversed by the Proposed Q6 Pipeline, as a result of the distance from the Proposed Q6 Pipeline as well as existing infrastructure located between wetland 2 and the Proposed Q6 Pipeline.

Based on the results of the risk assessment, if control measures are implemented, the risks will range from high to low in wetland 1, since it will be directly impacted. Furthermore, for wetlands that will not be impacted by the development activities of the Proposed Q6 Pipeline the risks falls within a low risk class.

Based on the findings of the wetland assessment and the results of the impact assessment, it is the opinion of the ecologist that the proposed development be considered favourably provided the proponent obtains approval from the relevant authorities, and that the mitigation measures as outlined in Section 5 as well as the general housekeeping rules provided in Appendix F are implemented and adhered to. Although the application of buffer zones will not be feasible, based on the linear nature of the proposed development, the sensitivity map presented in Section 4 should be taken into consideration in order to highlight areas where the duration of the proposed construction activities should be limited and all non-essential activities should be excluded in order to minimise impacts on the wetland affected by the proposed development.



7 REFERENCES

- Department of Water Affairs (DWA). 1999. *South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources*. [Appendix W3].
- Department of Water Affairs and Forestry (DWAF). 2005. *Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas*.
- Department of Water Affairs and Forestry (DWAF). 2007. *Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types* by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.
- Department of Water and Sanitation (DWS). 2014. *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: A2* Compiled by RQIS-RDM: Online available: <https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx> as retrieved in July 2016
- Department of Water and Sanitation (DWS). 2016. Section 21 c and i water use Risk Assessment Protocol.
- Gauteng Department of Agriculture and Rural Development. 2011. GIS Data – C-Plan Version 3.3
- Gauteng Department of Agriculture and Rural Development. 2014. *Minimum Requirements for Biodiversity Assessments*. Version 3. Johannesburg.
- Kleynhans, C.J. 1996. *A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River*. Journal of Aquatic Ecosystem Health 5: 41 - 54
- Kleynhans C.J. 1999. *A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River*. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.
- Kleynhans C.J., Thirion C., Moolman J. and Gaulana L. 2007 *A Level 2 Ecoregion Classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria



- Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2009. *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No. TT 339/09. Water Research Commission, Pretoria.
- Macfarlane, D.M. Bredin, I.P. Adams, J.B., M.M. Zungu, Bate, G.C. and Dickens, C.W.S. 2014. *Buffer zone tool for the determination of aquatic impact buffers and additional setback requirements for wetland ecosystems*. Version 1.0. Prepared for the Water Research Commission, Pretoria.
- Mucina, L. & Rutherford, M.C. (Eds). 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria, RSA.
- National Environmental Management Act (NEMA) 107 of 1998
- National Water Act (NWA) 36 of 1998.
- Nel, J.L., Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources*. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria.
- NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murray, 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>
- Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.
- Rountree, M.W. and Kotze, D.C. 2013. *Appendix A3: Ecological Importance and Sensitivity Assessment*. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/12. Pretoria
- SAS. 2014. *Wetland assessment for the proposed expansion of the disinfection plants at Eikenhof pumping station, Gauteng*. Unpublished report.



APPENDIX A – Indemnity

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.

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

National Environmental Management Act, 1998

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations (GNR 982) as amended in 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 Report (BAR) process (GNR 983) or the Environmental Impact Assessment (EIA) (GNR 984) process depending on the scale of the impact. Provincial regulations as set out in GNR 985 must also be considered.

National Water Act, 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).

However, according to Government Notice 1199 as published in the Government Gazette No. 32805 of 2009, it must be noted that as defined by the Replacement General Authorisation in terms of Section 39 of the National Water Act, on account of the extremely sensitive nature of wetlands and estuaries, the section 21(c) and (i) water use General Authorisation does not apply to:

- Any development within a distance of 500 meters upstream or downstream from the boundary of any wetland; and
- Any estuary or any water resource within a distance of 500 meters upstream from the salt mixing zone of any estuary.

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.*

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 wetland delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas;
- The Delineation must be undertaken according to the DWAF guidelines;
- The wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. Rules for buffer zone widths are as follows:
 - 30m for wetlands occurring inside urban areas; and
 - 50m for wetlands occurring outside urban areas.



APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the wetlands traversed by the Proposed Q6 Pipeline or those that are in close proximity to the Proposed Q6 Pipeline's development is located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 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), 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 habitats and wetland features present in the vicinity of or traversed by the Proposed Q6 Pipeline.

1.2 Gauteng Conservation Plan (C-Plan Version 3.3, 2011)

Conservation planning was started in Gauteng in the year 2000 and the aim was to revise C-Plan at least every 5 years. C-Plan 3 is based on the systematic conservation protocol developed by Margules & Pressey (2000) and is based on the principles of complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability. Systematic conservation planning is an iterative process. Knowledge of the distribution of biodiversity, the status of species, approaches for dealing with aspects such as climate change, methods of data analysis, and the nature of threats to biodiversity within a planning region are constantly changing, especially in the Gauteng Province which is developing at an extremely rapid rate. This requires that the conservation plan be treated as a living document with periodic review and updates

2. Wetland Delineation

For the purpose of this investigation, the definition of a wetland habitat as defined in the NWA (1998) were used: 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."

The wetland zone delineation took place according to the method presented in the "Final draft: A practical field procedure for identification and delineation of wetland 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 part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation.

3. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The wetlands traversed or encountered in close proximity of the Proposed Q6 Pipeline were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al.*, 2013), hereafter referred to as the “Classification System”. A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.



Table C1: Proposed classification structure 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 C2: Hydrogeomorphic (HGM) Unit 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
		With channelled inflow Without channelled inflow
	Endorheic	With channelled inflow Without channelled inflow
		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 ocean² (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 at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.*, 2007). 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 National Freshwater Ecosystem Priority Areas (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.
- 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.

² 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.



- **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
- **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).

4. Index of Habitat Integrity (IHI)

To assess the PES of the wetlands, 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 C3: 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.



5. Wetland 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”.³ The assessment of the ecosystem services supplied by the identified resource was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

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

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

Table C4: 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

6. Ecological Importance and Sensitivity (EIS)

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

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

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

³ Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999



- 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 C5) of the wetland system being assessed.

Table C5: 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
<u>Very high</u> Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and ≤4
<u>High</u> Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and ≤3
<u>Moderate</u> Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and ≤2
<u>Low/marginal</u> Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and ≤1

7. Recommended Ecological Category (REC)

A REC is determined based on the results of the PES and the Ecological Importance and/or Sensitivity of the water resource. Depending on the PES category within which the water resource falls within, the EIS components must be checked to determine if aspects such as Ecological importance, hydrological functions and direct human benefits are either high or very high. The points below serve as a guide that can be utilised to determine suitable RECs for water resources:

- In the case where the PES falls within category E or F the resource must be allocated to REC D;
- In the case where the PES falls within category A, B, C or D and the EIS criteria are low or moderate or they are high or very high and it is not feasible or practicable for the PES to be improved, the REC can be set at the current PES; and
- In the case where the PES falls within category B, C or D and the EIS criteria are high or very high and it is feasible or practicable for the PES to be improved, the REC is set one category higher than the current PES.

An appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the wetland.

Table C6: Description of REC classes.

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



8 Buffer Zone Tool

A buffer zone is defined in Macfarlane *et al.*, (2015), as a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another. In addition buffer zones have proposed as a standard measure to protect by performing a wide range of functions such as:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species as well as terrestrial species; and
- A range of ancillary societal benefits.

South Africa's aquatic ecosystems are under increasing pressure, as a result of high development rate. The ecological conditions of these ecosystems are subjected to impacts such as regulation of flow by impoundments, pollution, over-extraction of water and the breakdown of natural biogeographical barriers. Therefore, preventative measures such as establishment of buffer zones need to be put in place in order to avoid further degradation of these resources in order to conserve and protect them.

Assessment procedure

The assessment procedure has been structured in an eight step process and provides the user with a step-by-step approach to determining appropriate buffer zones or rather setback areas. The assessment steps are outlined below:

- Define the objective and scope to determine the appropriated level of assessment
- Map and categorise water resources in the study area;
- Refer to the Department of Water and Sanitation (DWS) management objectives for mapped water resources;
- Assess the risks from proposed development and define mitigation measures to protect water resources;
- Assess risks posed by proposed development on biodiversity and identify management zones for biodiversity protection;
- Delineate and demarcate recommended setback requirements;
- Compile management measures to maintain effectiveness of setback areas; and
- Monitor effectiveness of buffer zones.



APPENDIX D – Risk Assessment Methodology

METHOD OF RISK ASSESSMENT

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'⁴. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the tables below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary⁵.

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.

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

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



"RISK ASSESSMENT KEY" (Based on DWS 2016 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat))

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

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

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

Table D3: Duration (How long does the aspect impact on the resource quality)

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

Table D4: Frequency of the activity (How often do you do the specific activity)

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

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

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

Table D6: Legal issues (How is the activity governed by legislation)

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



Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

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

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to 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 D9: Calculations

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

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
 - Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase of the proposed development; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts⁶ are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
 - Avoidance or prevention of impact;
 - Minimisation of impact;
 - Rehabilitation; and
 - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and

⁶ Mitigation measures should address both positive and negative impacts



- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the wetland ecology of the wetlands in traversed or in close proximity of the Proposed Q6 Pipeline.



APPENDIX E – Wetland Assessment Results

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL

Table E1: Presentation of the results of the WET-IHI assessment applied to wetland 1.

OVERALL PRESENT ECOLOGICAL STATE (PES) SCORE					
	Ranking	Weighting	Score	Confidence Rating	PES Category
DRIVING PROCESSES:		100	1,4		
Hydrology	1	100	1,3	2,6	C
Geomorphology	2	80	1,5	3,0	C
Water Quality	3	30	0,9	2,0	B
WETLAND LANDUSE ACTIVITIES:		80	0,7	3,0	
Vegetation Alteration Score	1	100	0,7	3,0	B
OVERALL SCORE:			1,0		
	PES %		79,1	Confidence Rating	
	PES Category:		B/C		

Table E2: Presentation of the results of the WET-IHI assessment applied to wetland 2.

OVERALL PRESENT ECOLOGICAL STATE (PES) SCORE					
	Ranking	Weighting	Score	Confidence Rating	PES Category
DRIVING PROCESSES:		100	3,1		
Hydrology	1	100	2,8	3,1	D
Geomorphology	2	80	3,8	4,0	E
Water Quality	3	30	2,0	2,0	C/D
WETLAND LANDUSE ACTIVITIES:		80	2,3	4,0	
Vegetation Alteration Score	1	100	2,3	4,0	D
OVERALL SCORE:			2,7		
	PES %		45,7	Confidence Rating	
	PES Category:		D		



Table E3: Presentation of the results of the ecosystem services provided by the wetlands.

Ecosystem services	Wetland 1	Wetland 2
Flood attenuation	1,4	2,1
Streamflow regulation	1,6	1,4
Sediment trapping	1,5	1,6
Phosphate assimilation	0,8	0,8
Nitrate assimilation	1	1
Toxicant assimilation	1,1	1,4
Erosion control	1,3	0
Carbon Storage	1,7	1,3
Biodiversity maintenance	1,8	1,3
Water Supply	0,8	1,5
Harvestable resources	0	0,8
Cultural value	0	0,3
Cultivated foods	0	0
Tourism and recreation	0	0
Education and research	0	0,3
SUM	13,0	13,8
Average score	0,8	0,9

Table E4: Presentation of the EIS assessment applied to wetland 1.

Ecological Importance and Sensitivity	Score (0-4)	Confidence (1-5)
Biodiversity support	A (average)	(average)
	0,67	3,00
<i>Presence of Red Data species</i>	0	3
<i>Populations of unique species</i>	0	3
<i>Migration/breeding/feeding sites</i>	2	3
Landscape scale	B (average)	(average)
	1,60	3,00
<i>Protection status of the wetland</i>	0	3
<i>Protection status of the vegetation type</i>	4	3
<i>Regional context of the ecological integrity</i>	3	3
<i>Size and rarity of the wetland type/s present</i>	0	3
<i>Diversity of habitat types</i>	1	3
Sensitivity of the wetland	C (average)	(average)
	2,33	2,67
<i>Sensitivity to changes in floods</i>	2	2
<i>Sensitivity to changes in low flows/dry season</i>	3	3
<i>Sensitivity to changes in water quality</i>	2	3
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A, B or C)	(average of A, B or C)
Highest score	C	2,33
High	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	



Hydro-Functional Importance		Score (0-4)	Confidence (1-5)	
Regulating & supporting benefits	Flood attenuation		1	3
	Streamflow regulation		2	3
	Water Quality Enhancement	Sediment trapping	2	3
		Phosphate assimilation	1	2
		Nitrate assimilation	1	2
		Toxicant assimilation	1	2
		Erosion control	1	3
	Carbon storage		2	2
HYDRO-FUNCTIONAL IMPORTANCE		(average score)	(average confidence)	
		1	3	

Direct Human Benefits		Score (0-4)	Confidence (1-5)
Subsistence benefits	Water for human use	0	3
	Harvestable resources	0	2
	Cultivated foods	0	2
Cultural benefits	Cultural heritage	0	3
	Tourism and recreation	0	3
	Education and research	0	3
DIRECT HUMAN BENEFITS		(average score)	(average confidence)
		0,00	3



Table E5: Presentation of the EIS assessment applied to wetland 2.

Ecological Importance and Sensitivity	Score (0-4)	Confidence (1-5)
Biodiversity support	A (average)	(average)
	0,00	3,00
<i>Presence of Red Data species</i>	0	3
<i>Populations of unique species</i>	0	3
<i>Migration/breeding/feeding sites</i>	0	3
Landscape scale	B (average)	(average)
	1,00	3,00
<i>Protection status of the wetland</i>	0	3
<i>Protection status of the vegetation type</i>	4	3
<i>Regional context of the ecological integrity</i>	1	3
<i>Size and rarity of the wetland type/s present</i>	0	3
<i>Diversity of habitat types</i>	0	3
Sensitivity of the wetland	C (average)	(average)
	0.67	2,67
<i>Sensitivity to changes in floods</i>	2	2
<i>Sensitivity to changes in low flows/dry season</i>	0	3
<i>Sensitivity to changes in water quality</i>	0	3
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A,B or C)	(average of A, B or C)
Highest score	B	1,00
Low/Marginal	Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	

Hydro-Functional Importance			Score (0-4)	Confidence (1-5)
Regulating & supporting benefits	Flood attenuation		2	3
	Streamflow regulation		1	3
	Water Quality Enhancement	Sediment trapping	2	3
		Phosphate assimilation	1	3
		Nitrate assimilation	1	3
		Toxicant assimilation	1	3
		Erosion control	0	2
	Carbon storage		1	2
HYDRO-FUNCTIONAL IMPORTANCE		(average score)	(average confidence)	
		1	3	



Direct Human Benefits		Score (0-4)	Confidence (1-5)
Subsistence benefits	<i>Water for human use</i>	2	3
	<i>Harvestable resources</i>	0	3
	<i>Cultivated foods</i>	0	3
Cultural benefits	<i>Cultural heritage</i>	1	3
	<i>Tourism and recreation</i>	0	3
	<i>Education and research</i>	0	3
DIRECT HUMAN BENEFITS		(average score)	(average confidence)
		0,50	3



APPENDIX F – Impact / Risk Assessment

IMPACT ANALYSIS AND CONTROL MEASURES

General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to a development of this nature, and must be implemented throughout all phases of the proposed development activities in order to minimise impacts on the wetlands:

Development footprint

- Ensure that contractor laydown areas as well as storage of construction materials and vehicles are placed outside the wetland zones and the associated buffer zones;
- All hazardous storage containers and storage areas must comply with the relevant South African Bureau of Standards (SABS) standards to prevent leakage;
- Planning of temporary roads and/or access routes should be restricted to existing roads where possible. In addition, access to the construction site where the wetland areas would be affected, should be limited to a single entry point to minimise soil compaction, increased erosion and loss of vegetation;
- Appropriate sanitary facilities must be provided for the life of the proposed construction phase and all waste must be removed to an appropriate waste facility;
- Any hazardous chemicals or construction material such as cement that may pollute wetlands should be stored in a designated area which is not located near the wetlands;
- No informal fires should be permitted in or near the construction area;
- Restrict the proposed construction to the drier winter periods if possible to avoid further sedimentation of the wetland;
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed; and
- An adequate number of litter bins should be provided and ensure the proper disposal of waste and spills for the entire proposed construction phase.

Vehicle access

- It must be ensured that the wetlands are off-limits to construction vehicles and non-essential personnel;
- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Soils

- No stockpiles must be permitted within the wetlands or the associated buffer zones. In the case where excavated soil is to be reused, the soil must be covered with plastic to avoid being blown by the wind or sediment runoff from reaching the wetlands;
- Such stockpiles must either be removed or levelled following the completion of the proposed construction activities;
- Storm water must be managed accordingly to ensure that no sediment deposits occur within the wetlands; and
- Monitor areas close to the wetlands for further erosion and incision, throughout various phases of the proposed development.



Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation species that encroached the wetlands as a result of edge effects from the proposed construction activities should be removed upon completion of the construction phase. Alien vegetation control within the wetlands should take place for a minimum period of two growing seasons after the proposed construction activities are completed. Alien vegetation control should take place with manual labour; no vehicles must be permitted during the control / monitoring phase. The table below was extracted from the risk assessment matrix and it states the possible impacts that might occur following implementation of certain activities. In addition, control measures are provided in the table in order to guide the construction and operational activities of the proposed development, and should be implemented throughout the various phases of the proposed development.



Table F1: Risk Assessment Matrix for the wetland that will be traversed by the Proposed Q6 Pipeline.

Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
Construction	Potential spills and leaks from vehicles delivering construction material	Refuelling of vehicles within the wetland during delivery of construction material	<ul style="list-style-type: none"> Vegetation disturbance Contamination of soils and water within the wetland 	3,5		11	38,5	L	<ul style="list-style-type: none"> Should any leakages occur they should be cleaned up immediately Refuelling of vehicles should take place on a sealed surface to prevent ingress of hydrocarbons into the soil Construction vehicles should be restricted to designated roads only A contractor laydown area should be located outside the wetland and the associated buffer zones to avoid contamination of the wetland as a result of leakages from storage containers and vehicles
		Leaks from hazardous material containers	<ul style="list-style-type: none"> Contamination of soil and water within the wetland 						
		Indiscriminate movement of vehicles within the wetland	<ul style="list-style-type: none"> Soil compaction leading to increased runoff Sedimentation of the wetland Vegetation disturbance 						
	Miscellaneous activities by construction personnel	Illegal trapping or hunting of faunal species	<ul style="list-style-type: none"> Possible migration of wetland faunal species as a result of habitat disturbance 	3,75		10	37,5	L	<ul style="list-style-type: none"> Trapping and hunting of faunal species should be prohibited Firewood collection and medicinal plant harvesting should be prohibited Informal fires should be prohibited within and in the vicinity of the wetlands
		Illegal Firewood collection	<ul style="list-style-type: none"> Loss of floral species 						
		Illegal harvesting of medicinal plants	<ul style="list-style-type: none"> Loss of floral species 						
		Creation of informal fires within the wetlands	<ul style="list-style-type: none"> Vegetation disturbance Temporary loss of faunal and floral habitat 						
	Vegetation clearing and disturbance	Site preparation	<ul style="list-style-type: none"> Encroachment of alien vegetation species Alteration of the vegetation communities Exposed bare areas prone to erosion Rendering the wetland unsuitable to maintain 	7		11	77	M	<ul style="list-style-type: none"> Footprint area should be demarcated and kept as small as possible The extent of vegetation clearing should be limited for the contractors laydown area and outside of the wetlands The contractor laydown area
		Creation of access roads where existing roads cannot be used							
		Construction of the contractor laydown area							



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
			<ul style="list-style-type: none"> biodiversity Loss of wetland assimilation abilities 						<p>should be rehabilitated with indigenous terrestrial grass species when the proposed construction activities completed. Monitoring of these rehabilitated areas should take place a year after the proposed construction has been are completed to ensure vegetation growth</p> <ul style="list-style-type: none"> An alien vegetation monitoring programme should be developed and implemented for 2 years after the proposed construction activities have taken place The duration of activities within the wetlands should be minimised in order to reduce the flow and functioning of the wetlands
	Topsoil stock piling adjacent the wetland	Soil excavations to create trenches within which pipes will be installed Infilling trenches Rehabilitation of disturbed areas	<ul style="list-style-type: none"> Alteration of the soil profile Soil disturbance within the wetland Runoff from stockpiles resulting in sedimentation of the wetland and smothering of the short vegetation 	4,75		12	57	M	<ul style="list-style-type: none"> Excavated soils should be placed outside the wetland areas and the associated buffer zones Soil should be covered to avoid being blown by the wind and prevent sediment runoff during rainfall events The area must be rehabilitate after the completion of the construction phase. In addition, alien vegetation eradication programme must be implemented. if the stockpiled soil is to be used for



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
									rehabilitation purposes such revegetation, weeds should be removed from the soil before use, to avoid the spread of alien vegetation
	Excavations within the wetlands	To create trenches within which pipes will be installed	<ul style="list-style-type: none"> Disturbance of the interflow and the surface flow Alteration of wetland channel banks Inundation of exposed trenches during rainfall and as a result of improper flow diversion 	10		17	170	H	<ul style="list-style-type: none"> Excavated soil should be used to close off the trenches, immediately after inserting the pipes Flow diversion should be done properly to avoid inundation of the area as well as drying out of downstream areas The area must be rehabilitated immediately after the completion of the proposed construction activities. In addition, excavated soils can be used to level the area as well as revegetating the area
	Disposal of waste material such as soil, rocks and concrete within the wetlands	Littering and improper disposal of waste	<ul style="list-style-type: none"> Pollution of wetland soils and water 	3,25		6	19,5	L	<ul style="list-style-type: none"> No dumping of waste should take place within the wetlands All construction rubble should be removed from the wetland areas Waste dumping bins must be provided for the duration of the construction phase Waste bins must be emptied regularly and the waste must be removed to a suitable waste dumping facility
Operational	Operation of the Proposed Q6 Pipeline within the wetlands	Possible leaks from pipes	<ul style="list-style-type: none"> Seepage and incision Inundation of the area 	3,75		11	41,25	M	<ul style="list-style-type: none"> Infrastructure should be monitored regularly to enable early detection of leaks An emergency plan should be



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
									compiled to ensure a quick response and attendance to the matter in case of a leakage or bursting of the pipes
		Indiscriminate driving of vehicles and vegetation trampling within the wetland during maintenance activities	<ul style="list-style-type: none"> • Soil compaction • Ongoing soil disturbance • Vegetation disturbance • Soil and surface water contamination as a result of oils and hydrocarbons from maintenance vehicles • Encroachment of alien vegetation species • Alteration of the vegetation community structure 	5		9	45	L	<ul style="list-style-type: none"> • Vehicles should be prohibited within the wetlands and only existing roadways can be utilised during maintenance and monitoring activities • The duration of the presence of maintenance vehicles within the wetlands must be limited in order to minimise disturbance on the soil and vegetation
		Presence of pipes within the wetland	<ul style="list-style-type: none"> • Disturbance of interflow 	10		20	200	H	<ul style="list-style-type: none"> • The flow of water will continue uninhibited since the pipes will be located underground. However, the topsoil must be levelled and aerated in order to achieve proper flow of water and improve infiltration capabilities of the soil
		Operation of the Proposed Q6 Pipeline	<p>Cumulative impacts: The proposed Q6 Pipeline will be located within portions of the wetland identified in the report, and therefore, it is possible that over a long period of time exposed to regular inundation that increased erosion and scouring around the pipeline might occur, contributing to sedimentation of the wetland.</p> <p>Latent Impacts: Loss of habitat quality overtime as a result of not undertaking rehabilitation activities</p>						



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
			and not adhering to the stipulated control measures within the wetland, during the construction phase as well as the operational phase. Furthermore, inadequate maintenance of the pipeline and improper and/or inefficient rehabilitation of the wetlands following the proposed construction activities might lead to edge effects thus reducing the ability of the wetland to provide wet-ecoservices.						



Table F2: Risk Assessment Matrix for wetlands within 500m of the Proposed Q6 Pipeline.

Phases	Activity	Aspect	Impact	Consequence	Likelihood	Significance	Risk Rating	Control Measures
Construction	Potential spills and leaks from vehicles delivering construction material	Refuelling of vehicles within the wetlands during delivery of construction material	<ul style="list-style-type: none"> Vegetation disturbance Contamination of soils and water within the wetlands 	3	6	18	L	<ul style="list-style-type: none"> Should any leakages occur they should be cleaned up immediately to avoid contamination of downstream areas The proposed development footprint area must be demarcated and kept as minimum as possible to avoid impacting the neighbouring wetlands in close proximity to the proposed development area A contractor laydown areas should be located outside of the wetlands and their associated buffer zones but should not encroach into neighbouring wetlands
		Leaks from hazardous material containers	<ul style="list-style-type: none"> Contamination of soil and water within the wetlands 					
		Indiscriminate movement of vehicles within the wetlands	<ul style="list-style-type: none"> Soil compaction leading to increased runoff Sedimentation of the wetlands Vegetation disturbance 					
	Miscellaneous activities by construction personnel	Illegal trapping or hunting of faunal species	<ul style="list-style-type: none"> Possible migration of wetland faunal species as a result of habitat disturbance 	3	6	18	L	<ul style="list-style-type: none"> Trapping and hunting of faunal species should be prohibited Firewood collection and medicinal plant harvesting should be prohibited Informal fires should be prohibited within and in the vicinity of the wetlands
		Illegal Firewood collection	<ul style="list-style-type: none"> Loss of floral species 					
		Illegal harvesting of medicinal plants	<ul style="list-style-type: none"> Loss of floral species 					
		Creation of informal fires within the wetlands	<ul style="list-style-type: none"> Vegetation disturbance Temporary loss of faunal and floral habitat 					
	Vegetation clearing and disturbance	Site preparation	<ul style="list-style-type: none"> Encroachment of alien vegetation species Alteration of the vegetation communities Exposed bare areas prone to erosion 	3	7	21	L	<ul style="list-style-type: none"> Footprint area should be kept as small as possible
		Creation of access roads where existing roads cannot be used						
		Construction of the contractor laydown area						



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
			<ul style="list-style-type: none"> Rendering the wetlands unsuitable to maintain biodiversity Loss of wetland assimilation abilities 						
	Topsoil stock piling adjacent the wetlands	Soil excavations to create trenches within which pipes will be installed	<ul style="list-style-type: none"> Alteration of the soil profile Soil disturbance within the wetlands Runoff from stockpiles resulting in sedimentation of the wetlands and smothering of the short vegetation 	3		9	27	L	<ul style="list-style-type: none"> Excavated soils should be placed outside the wetland areas and the associated buffer zones and should be covered to avoid sediment deposition in neighbouring wetlands
		Rehabilitation of disturbed areas							
	Excavations within the wetlands	To create trenches within which pipes will be installed	<ul style="list-style-type: none"> Disturbance of the interflow and the surface flow Alteration of wetland channel banks Inundation of exposed trenches during rainfall and as a result of improper flow diversion 	3		7	21	L	<ul style="list-style-type: none"> Demarcate and keep the footprint area as small as possible Flow diversion should be done properly to avoid inundation of the area as well as drying out of downstream areas
	Disposal of waste material such as soil, rocks and concrete within the wetlands	Littering and improper disposal of waste	<ul style="list-style-type: none"> Pollution of wetland soils and water 	3		5	15	L	<ul style="list-style-type: none"> Disposal bins must be placed only in a designated location within the proposed development footprint area to ensure that the traversed wetlands as well as the neighbouring wetlands are not polluted
Operational	Operation of the Proposed Q6 Pipeline within the wetlands	Possible leaks from pipes	<ul style="list-style-type: none"> Seepage and incision Inundation of the area 	3		7	21	L	<ul style="list-style-type: none"> To ensure that neighbouring wetlands are not inundated as a result of leaks or bursting of the pipes, an emergency plan should



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
									be compiled to ensure a quick response and attendance to the matter in case of a leakage or bursting of the pipes
		Indiscriminate driving of vehicles and vegetation trampling within the wetlands during maintenance activities	<ul style="list-style-type: none"> • Soil compaction • Ongoing soil disturbance • Vegetation disturbance • Soil and surface water contamination as a result of oils and hydrocarbons from maintenance vehicles • Encroachment of alien vegetation species • Alteration of the vegetation community structure 	3		5	15	L	<ul style="list-style-type: none"> • Only existing roadways should be utilised during maintenance and monitoring activities to avoid indiscriminate movement of vehicles
		Presence of pipes within the wetlands	<ul style="list-style-type: none"> • Disturbance of interflow 	3		12	36	L	N/A
		Operation of the Proposed Q6 Pipeline	<i>Cumulative impacts:</i> The Proposed Q6 Pipeline will be located within portions of the wetland identified, and no impacts are anticipated in neighbouring wetlands provided control measures are implemented and adhered to						
			<i>Latent Impacts:</i> If the affected wetland is not effectively rehabilitated, downstream areas might be affected. For instance, should connection between wetland areas not be						



Phases	Activity	Aspect	Impact	Consequence		Likelihood	Significance	Risk Rating	Control Measures
			properly restored after the proposed construction activities, downstream areas might dry out						



APPENDIX G – 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; and
- All the particulars furnished by me in this form are true and correct.



Signature of the Specialist



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)

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

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2002
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2000
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	1999

COUNTRIES OF WORK EXPERIENCE

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

SELECTED PROJECT EXAMPLES

Development compliance studies

- Project co-leader for the development of the EMP for the use of the Wanderers stadium for the Ubuntu village for the World Summit on Sustainable Development (WSSD).
- Environmental Control Officer for Eskom for the construction of an 86Km 400KV power line in the Rustenburg Region.
- Numerous Environmental Impact Assessment (EIA) and EIA exemption applications for township developments and as part of the Development Facilitation Act requirements.
- EIA for the extension of mining rights for a Platinum mine in the Rustenburg area by Lonmin Platinum.
- EIA Exemption application for a proposed biodiesel refinery in Chamdor.
- Compilation of an EIA as part of the Bankable Feasibility Study process for proposed mining of a gold deposit in the Lofa province, Liberia.
- EIA for the development of a Chrome Recovery Plant at the Two Rivers Platinum Mine in the Limpopo province, South Africa.
- Compilation of an EIA as part of the Bankable Feasibility Study process for the Mooihoek Chrome Mine in the Limpopo province,



South Africa.

- Mine Closure Plan for the Vlakfontein Nickel Mine in the North West Province.

Specialist studies and project management

- Development of a zero discharge strategy and associated risk, gap and cost benefit analyses for the Lonmin Platinum group.
- Development of a computerised water balance monitoring and management tool for the management of Lonmin Platinum process and purchased water.
- The compilation of the annual water monitoring and management program for the Lonmin Platinum group of mines.
- Analyses of ground water for potable use on a small diamond mine in the North West Province.
- Project management and overview of various soil and land capability studies for residential, industrial and mining developments.
- The design of a stream diversion of a tributary of the Olifants River for a proposed opencast coal mine.
- Waste rock dump design for a gold mine in the North West province.
- Numerous wetland delineation and function studies in the North West, Gauteng and Mpumalanga Kwa-Zulu Natal provinces, South Africa.
- Hartbeespoort Dam Littoral and Shoreline PES and rehabilitation plan.
- Development of rehabilitation principles and guidelines for the Crocodile West Marico Catchment, DWAF North West.

Aquatic and water quality monitoring and compliance reporting

- Development of the Resource Quality Objective framework for Water Use licensing in the Crocodile West Marico Water Management Area.
- Development of the Resource Quality Objectives for the Local Authorities in the Upper Crocodile West Marico Water Management Area.
- Development of the 2010 State of the Rivers Report for the City of Johannesburg.
- Development of an annual report detailing the results of the Lonmin Platinum groups water monitoring program.
- Development of an annual report detailing the results of the Everest Platinum Mine water monitoring program.
- Initiation and management of a physical, chemical and biological monitoring program, President Steyn Gold Mine Welkom.
- Aquatic biomonitoring programs for several Xstrata Alloys Mines and Smelters.
- Aquatic biomonitoring programs for several Anglo Platinum Mines.
- Aquatic biomonitoring programs for African Rainbow Minerals Mines.
- Aquatic biomonitoring programs for several Assmang Chrome Operations.
- Aquatic biomonitoring programs for Petra Diamonds.
- Aquatic biomonitoring programs for several coal mining operations.
- Aquatic biomonitoring programs for several Gold mining operations.
- Aquatic biomonitoring programs for several mining operations for various minerals including iron ore, and small platinum and chrome mining operations.
- Aquatic biomonitoring program for the Valpre bottled water plant (Coca Cola South Africa).
- Aquatic biomonitoring program for industrial clients in the paper production and energy generation industries.
- Aquatic biomonitoring programs for the City of Tshwane for all their Waste Water Treatment Works.
- Baseline aquatic ecological assessments for numerous mining developments.
- Baseline aquatic ecological assessments for numerous residential commercial and industrial developments.
- Baseline aquatic ecological assessments in southern, central and west Africa.
- Lalini Dam assessment with focus on aquatic fish community analysis.
- Musami Dam assessment with focus on the FRAI and MIRAI aquatic community assessment indices.

Wetland delineation and wetland function assessment

- Wetland biodiversity studies for three copper mines on the copper belt in the Democratic Republic of the Congo.
- Wetland biodiversity studies for proposed mining projects in Guinea Bissau, Liberia and Angola in West Africa.
- Terrestrial and wetland biodiversity studies for developments in the mining industry.
- Terrestrial and wetland biodiversity studies for developments in the residential commercial and industrial sectors.
- Development of wetland riparian resource protection measures for the Hartbeespoort Dam as part of the Harties Metsi A Me integrated biological remediation program.
- Priority wetland mammal species studies for numerous residential, commercial, industrial and mining developments throughout South Africa.

Terrestrial ecological studies and biodiversity studies

- Development of a biodiversity offset plan for Xstrata Alloys Rustenburg Operations.
- Biodiversity Action plans for numerous mining operations of Anglo Platinum throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plans for numerous mining operations of Assmang Chrome throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plans for numerous mining operations of Xstrata Alloys and Mining throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plan for the Nkomati Nickel and Chrome Mine Joint Venture.



- Terrestrial and wetland biodiversity studies for three copper mines on the copper belt in the Democratic Republic of the Congo.
- Terrestrial and wetland biodiversity studies for proposed mining projects in Guinea Bissau, Liberia and Angola in West Africa.
- Numerous terrestrial ecological assessments for proposed platinum and coal mining projects.
- Numerous terrestrial ecological assessments for proposed residential and commercial property developments throughout most of South Africa.
- Specialist Giant bullfrog (*Pyxicephalus adspersus*) studies for several proposed residential and commercial development projects in Gauteng, South Africa.
- Specialist Marsh sylph (*Metisella meninx*) studies for several proposed residential and commercial development projects in Gauteng, South Africa.
- Project management of several Red Data Listed (RDL) bird studies with special mention of African grass owl (*Tyto capensis*).
- Project management of several studies for RDL Scorpions, spiders and beetles for proposed residential and commercial development projects in Gauteng, South Africa.
- Specialist assessments of terrestrial ecosystems for the potential occurrence of RDL spiders and owls.
- Project management and site specific assessment on numerous terrestrial ecological surveys including numerous studies in the Johannesburg-Pretoria area, Witbank area, and the Vredefort dome complex.
- Biodiversity assessments of estuarine areas in the Kwa-Zulu Natal and Eastern Cape provinces.
- Impact assessment of a spill event on a commercial maize farm including soil impact assessments.

Fisheries management studies

- Tamryn Manor (Pty.) Ltd. still water fishery initiation, enhancement and management.
- Verlorenkloof Estate fishery management strategising, fishery enhancement, financial planning and stocking strategy.
- Mooifontein fishery management strategising, fishery enhancement and stocking programs.
- Wickams retreat management strategising.
- Gregg Brackenridge management strategising and stream recalibration design and stocking strategy.
- Eljira Farm baseline fishery study compared against DWAF 1996 aquaculture and aquatic ecosystem guidelines.





SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **MMAMPE APHANE**

PERSONAL DETAILS

Position in Company	Junior Wetland Ecologist
Date of Birth	16 May 1980
Nationality	South African
Languages	Sepedi, English
Joined SAS	2014

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society

EDUCATION

Qualifications

BSC honours (Ecology)

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Kwa-Zulu Natal

SELECTED PROJECT EXAMPLES

Wetland Assessments

- Wetland delineation and assessment for the Clearwater sports field development in Gauteng province
- Wetland delineation and assessment as part of the authorisation for the Hammanskraal road development in Gauteng province
- Wetland delineation and assessment for the Kriel pipeline development in Mpumalanga province
- Wetland delineation and assessment as part of the authorisation process for the Isibonelo mining expansion in Mpumalanga province
- Wetland delineation and river crossing assessment as part of the Water Use License application for the Rustenburg Platinum Mine in North West province
- Wetland delineation and assessment as part of the WUL application for the construction of a powerline in North West province
- Wetland delineation and assessment as part of the WUL application for the construction of a powerline in Kwa-Zulu Natal province

Risk Assessments

- Risk assessment for the development of a Medical waste facility in Rustenburg
- Risk assessment as part of the General Authorisation for the prospecting activities in Postmasburg

Rehabilitation

- Wetland Rehabilitation and Management Plan as part of S24 rectification process of unauthorised activities in Benoni Gauteng province

