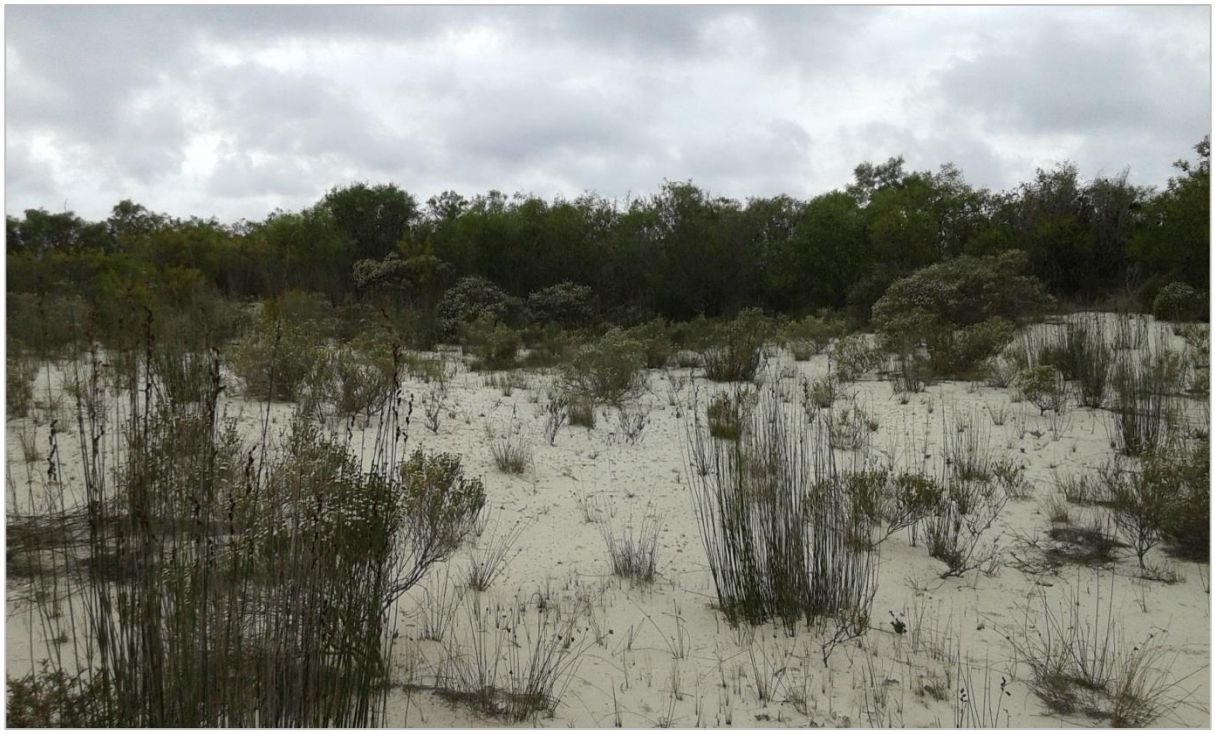
REPORT

PROJECT TYPE: WETLAND SURVEY AND ASSESSMENT

PROJECT TITLE: ESKOM POWERLINE ANKERLIG TO OMEGA (STERREKUS), CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY, WESTERN CAPE



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SPECIALIST STATEMENT DETAIL

This statement has been prepared with the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant other National and / or Provincial Policies related to ecological or biodiversity assessments in mind.

Report Prepared By: Ms Deborah Vromans

Expertise / Field of Study: MSc Botany (Estuaries), BA Environmental & Geographical Science, ND Horticulture, Botanical assessments (terrestrial, wetland and estuarine), Environmental Impact Assessments, Biodiversity and Planning Professional.

I, **Ms Deborah Vromans,** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs.

Curriculum Vitae attached as Addendum 1.

Signed:  Date: 4 September 2015

ACKNOWLEDGEMENTS

Thanks are extended to **Ms Nancy Job**, an independent wetland specialist, for her expert input and review.

Thanks are also extended to **Mr Wanro Hayes**, the Engineer at Sterrkus substation, for his support during the field work.

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EIMS Pty Ltd was appointed by Eskom to manage the final walkdown and implementation of the Construction Environmental Management Plan for the 20 km Eskom powerline route from Ankerlig substation in Atlantis (to the north) and Sterrekus substation in Melkbos area (to the south) (Section 2, Figure 1). This report represents the wetland assessment required to delineate wetlands within 500 m of the proposed powerline, a requisite in terms of section 21c and section 21i of the National Water Act (36 of 1998).

Catchment Hydrology

The powerline falls within the G21B quaternary catchment. Two non-perennial rivers, namely the Donkergat River and the Soutrivier River, are situated along the route, located approximately 5.3 km and 4 km north of the Sterrekus substation respectively. The Donkergat feeds into the Soutrivier, which then drains into the Atlantic Ocean at Melbosstrand.

Wetlands

Thirty-four wetland habitats were recorded along the powerline route and mapped in Quantum GIS (Version 2.4) (Figure 4). Seventeen of these wetlands are natural or semi-natural. The remaining 17 are artificially established, ranging from stormwater retention ponds (7), quarries (2), dams (5), excavations (2) and one water leakage.

Table summary of the mapped wetland findings for this wetland assessment

WETLAND NO.	NATURAL OR ARTIFICIAL	LATITUDE	LONGITUDE	WETLANDS MAPPED BY SNADDON AND DAY (2009) YES/NO
1	Artificial Stormwater Retention Pond	-33.591361	18.466288	Y
2	Artificial Stormwater Retention Pond	-33.593665	18.46464	N
3	Artificial Stormwater Retention Pond	-33.59718	18.457441	Y
4	Natural Depression (isolated)	-33.605516	18.464345	Y
5	Natural Depression (isolated)	-33.60619	18.465817	Y
6	Natural Depression (isolated)	-33.607084	18.46745	Y
7	Artificial Stormwater Retention Pond	-33.614402	18.473369	Y
8	Artificial Water Discharge Pond (water used for sand cleaning operation)	-33.615372	18.473739	Y
9	Artificial Quarry	-33.61615	18.47324	Y
10	Artificial Quarry	-33.61694	18.47332	Y
11	Natural Flat (isolated)	-33.618826	18.468971	Y
12	Natural Depression (isolated)	-33.642758	18.451641	N
13	Natural Depression (isolated)	-33.645536	18.448752	Y
14	Natural Valley Bottom Depression	-33.657296	18.459427	Y

WETLAND NO.	NATURAL OR ARTIFICIAL	LATITUDE	LONGITUDE	WETLANDS MAPPED BY SNADDON AND DAY (2009) YES/NO
15	Artificial Dam	-33.656551	18.460372	N
16	Natural with artificial excavation (isolated)	-33.675219	18.468023	N
17	Artificial Dam	-33.687497	18.478006	Y
18	Artificial Dam	-33.688611	18.477371	Y
19	Natural Floodplain	-33.688529	18.477137	Y
20	Artificial Dam	-33.690491	18.476008	Y
21	Natural Floodplain	-33.693423	18.487384	Y
22	Natural Floodplain	-33.693987	18.486691	Y
23	Natural Floodplain	-33.693406	18.488231	Y
24	Natural Hillslope Seep (isolated)	-33.704926	18.497935	N
25	Artificial Dam	-33.70837	18.51018	Y
26	Artificial leakage	-33.707505	18.513724	Y
27	Natural Hillslope Seep (but modified with dam)	-33.706008	18.517053	Y
28	Artificial Stormwater Retention Pond	-33.702273	18.50906	N
29	Artificial Excavation	-33.704704	18.509461	N
30	Artificial Excavation	-33.706625	18.509056	N
31	Artificial Stormwater Retention Pond	-33.611487	18.465187	Y
32	Natural Depression (isolated)	-33.603038	18.452476	Y
33	Natural Flat (isolated)	-33.604555	18.452311	Y
34	Natural Depression (isolated)	-33.645026	18.449191	Y

Plant Species of Conservation Concern

No rare or threatened plants were recorded in the wetland habitats, although *Hellmuthia membranaceae* which occurred in the wetlands around Atlantis area (Ankerlig end) is the only species of *Hellmuthia* worldwide and in South Africa (van Ginkel et al., 2011).

Faunal Species of Conservation Concern

According to the faunal assessment the Vulnerable frogs, Cape Rain Frog (*Breviceps gibbosus)* and Cape Caco (*Cacosternum capense*) may potentially be present in the Atlantis study area (Mouton, 2008). A number of bird species of conservation concern were observed. Larger dams with large areas of open water, such as the stormwater retention pond (wetland habitat 28), are important habitats for these birds. Species include, for example: the blue crane (Vulnerable), pelican (Near Threatened). Refer to the bird specialist report for detailed information in this regard.

Present Ecological State, Ecological Importance and Ecological Sensitivity

The Present Ecological State of the natural wetlands ranged from seriously modified to largely natural. All the wetlands are important given the cumulative loss of wetlands in the region. The DWAF methodology for determining ecological importance provides a more realistic scoring and indicated that wetland 6 and 28 were assessed as 'high ecological importance', while wetlands 1, 19, 20 to 23 (Soutrivier River floodplain wetlands),

32 and 33 were assigned as 'moderate high importance'. Refer to Section 5.3 and 5.4 for the Present Ecological State of the natural wetlands and the ecological importance and ecological sensitivity of all the wetlands.

No-Go Wetland Buffer Areas

The minimum generic buffer recommendations provided by the City Wetlands Map (Snaddon and Day, 2009) should be followed, namely 32 m (CBA 2) – 10 m (OESA). The only two wetlands that fall within or are proximate to the minimum buffers are wetland 23 and wetland 2, respectively (Figure 5A and 5B). All the other wetlands fall beyond the 32 m and in fact fall far beyond the closest pylon, ranging from **approximately** 58 m to 498 m (in QGIS 2.4).

PYLON NO.	WETLAND NO. & TYPE	CBA MAP CATEGORY	BUFFER	COMMENT AND FURTHER RECOMMENDATIONS
Pylon 1	Wetland No 2. Artificial wetland – stormwater retention pond	Other Ecological Support Area (OESA) (although not mapped by Snaddon and Day (2009), it is assessed as equivalent to OESA in this study i.e. Low importance, Table 13)	10 m	Pylon 1 is outside the 10 m buffer (approximately 25 m from the pylon) but caution needs to be implemented during construction as this area is fenced in (restricting movement). Furthermore, maintaining a buffer as wide as possible is preferable. The pylon should be placed on level ground, beyond the depression of the retention pond.
Pylon 36	Wetland No. 23. Natural floodplain wetland (along the Soutrivier River).	Critical Biodiversity Area 2 (CBA 2)	32 m	A minimum 20 m buffer is acceptable if the 32 m buffer is not a technically feasible option. Technical reasons will need to be submitted. The floodplain wetland ends at the access track running adjacent, parallel and to the north of the Soutrivier River.

The following additional mitigation measures are recommended to reduce the impacts of powerline and pylon construction and operation activities on aquatic resources and hydrological process areas:

1) Prevent contamination of wetlands proximate to the pylons during construction due to the mixing of cement for concrete foundations and vehicular / equipment spillages (oil, fuel and other hazardous substances). This will be especially important for wetland 2 and 23.

2) Buffers to be adhered to during both construction and operational maintenance activities.

3) Use of existing vehicular access tracks to each pylon site during construction and operational activities.

4) Rehabilitation with indigenous species immediately after construction in disturbed areas.

5) Eskom is encouraged to continue removing the alien invasive trees *Acacia saligna* and *A. cyclops* within the servitude, especially where wetlands are being impacted on e.g. wetland 12 and 23.

6) Recommendations in the bird specialist report to be followed. Discussions with the bird specialist on site indicated that bird strikes with powelines occur where large birds are utilizing large wetland areas or dams with large areas of open water. In such instances, a buffer of 100 m – 150 m – 200 m from the powerline is required for birds landing to roost or feed in large open water wetland areas. The stormwater retention pond at Sterrekus substation is utilized by large birds due to the expanse of open water, which lies below the existing powerline. All the other wetlands did not present with large expanses of open water.

7) All measures indicated in the Construction and Operational Environmental Management Programme should be adhered to.

8) Detailed wetland surveys and assessments should form part of the environmental assessment process in order to align the water use authorisation process with the environmental impact assessment process, as is now recommended in the amended National Environmental Management Act (89 of 1998) environmental impact assessment regulations.

Water Use License Application or General Authorisation

9) Eskom will need to determine the need for a general authorisation or water use license application for the powerline in terms of Section 21c and Section 21i of the National Water Act (36 of 1998). In this regard:

- It is the opinion of the author that a general authorisation could be requested given the fact that none of the pylons will be placed within any wetlands mapped for this project.
- Most of the wetlands are at a distance from the pylons ranging from **approximately** 58 m to 498 m (calculated in QGIS 2.4), with only wetlands 2 and 23 within 25 m and 32 m of pylons 1 and 36 respectively.
- Furthermore, if the recommended buffers are adhered to and the potential pollution impacts relating to construction are mitigated through implementation of the Construction Environmental Management Programme then the potential impact on wetlands 1 and 23 should be insignificant or non-existent.
- The powerline is considered to be a low impact land use activity as it relates to the position of the wetland habitats. In other words, the pylons will not remove or destroy any wetland habitat or alter wetland functioning.
- The other important issue for the powerline in relation to wetlands is the utilization of large wetlands, with large expanses of open water, by large birds (e.g. pelicans) and the potential for bird strikes. Refer point 6 above in this regard.
- Furthermore, the urgency of the need for electricity supply to Cape Town cannot be under-estimated, especially as it relates to economic productivity in the region..

1. INTRODUCTION

EIMS Pty Ltd was appointed by Eskom to manage the final walkdown and implementation of the Construction Environmental Management Plan for the 20 km Eskom powerline route from Ankerlig substation in Atlantis (to the north) and Sterrekus substation in Melkbos area (to the south) (Section 2, Figure 1). As part of the final walkdown, prior to construction, a wetland survey and assessment was required. This report represents the wetland assessment required to delineate wetlands within 500 m of the proposed powerline, a requisite in terms of section 21c and section 21i of the National Water Act (36 of 1998).

1.1. TERMS OF REFERENCE

The following terms of reference was provided by EIMS Pty Ltd. The standard scope of work for each specialist includes a 20km walkdown, and the compilation of a draft and final walkdown report. The deliverables will typically include the following:

1. The Specialist will be required to undertake a post Environmental Authorisation (EA) survey of the approved site and alignment route including a walkdown to all proposed towers (particularly the tower foundation positions) in great detail. Provision has been made for 2 days.
2. The Specialist will be required to compile a draft and final walkdown report and provide input towards the finalisation of the preparation of a detailed site specific Environmental Management Programme relating to the specific field of expertise and based on findings during the walkdown.
3. The Specialist shall be required to identify sensitive features in terms of your field of study within the study area and must prepare a GIS sensitivity map of the study area, based on findings of the desktop assessment and the walkdown. To ensure that accurate site selection decisions will take place, the specialist must score sensitivity relative to the site in question (Table 1). Ideally the specialist should only use very high sensitivity in rare cases, where such a score can be justified. Please note that legal licencing requirements or permit requirements should not be factored into the sensitivity score, this should be represented by a separate shape file indicating additional legal requirements.
4. Delineate the wetlands affected by the proposed route as per the provided tower profiles. Wetland boundaries (in shapefiles) and delineation report to be submitted.
5. The delineation methodology must comply with the strict requirements of Department of Water and Sanitation Wetland Delineation Guidelines as well as any relevant Provincial Biodiversity Guidelines and Requirements.
6. Recommendations must be made regarding mitigation and / or management measures to address the unavoidable impacts on identified wetland areas during and after construction.

Table 1. Project sensitivity scoring methodology to be included in the GIS shapefile

Sensitivity Rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1	Preferrable
Low/Poor	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	0	Negotiabl
High	The proposed development will negatively influence the current status of the feature.	+1	
Very High	The proposed development will negatively significantly influence the current status of the feature.	+2	Restricted

2. LOCATION AND BRIEF DESCRIPTION OF THE PROPOSED POWERLINE

The 20 km Eskom powerline route commences from Ankerlig substation in Atlantis (to the north) and terminates at the Sterrekus substation in Melkbosstrand area (to the south) (City of Cape Town Metropolitan Municipality, Western Cape) (Figure 1). The powerline route occurs to the east of the national R27 highway, to the north of the City of Cape Town Central Business District, inland of Melkbos and northwards to Atlantis. For the most part, the powerline is aligned to the east of an existing powerline. Refer to the Construction EMP for more detail with regards to the powerline and pylons.

The Ankerlig substation is sited at approximately 33°35'19.68"S 18°27'53.80"E, and the Sterrekus substation is positioned at approximately 33°42'32.95"S 18°31'3.00"E.

Catchment Hydrology

The powerline falls within the G21B quaternary catchment. Two non-perennial rivers, namely the Donkergat River and the Soutrivier River, are situated along the route, located approximately 5.3 km and 4 km north of the Sterrekus substation respectively. The Donkergat feeds into the Soutrivier, which then drains into the Atlantic Ocean at Melbosstrand.

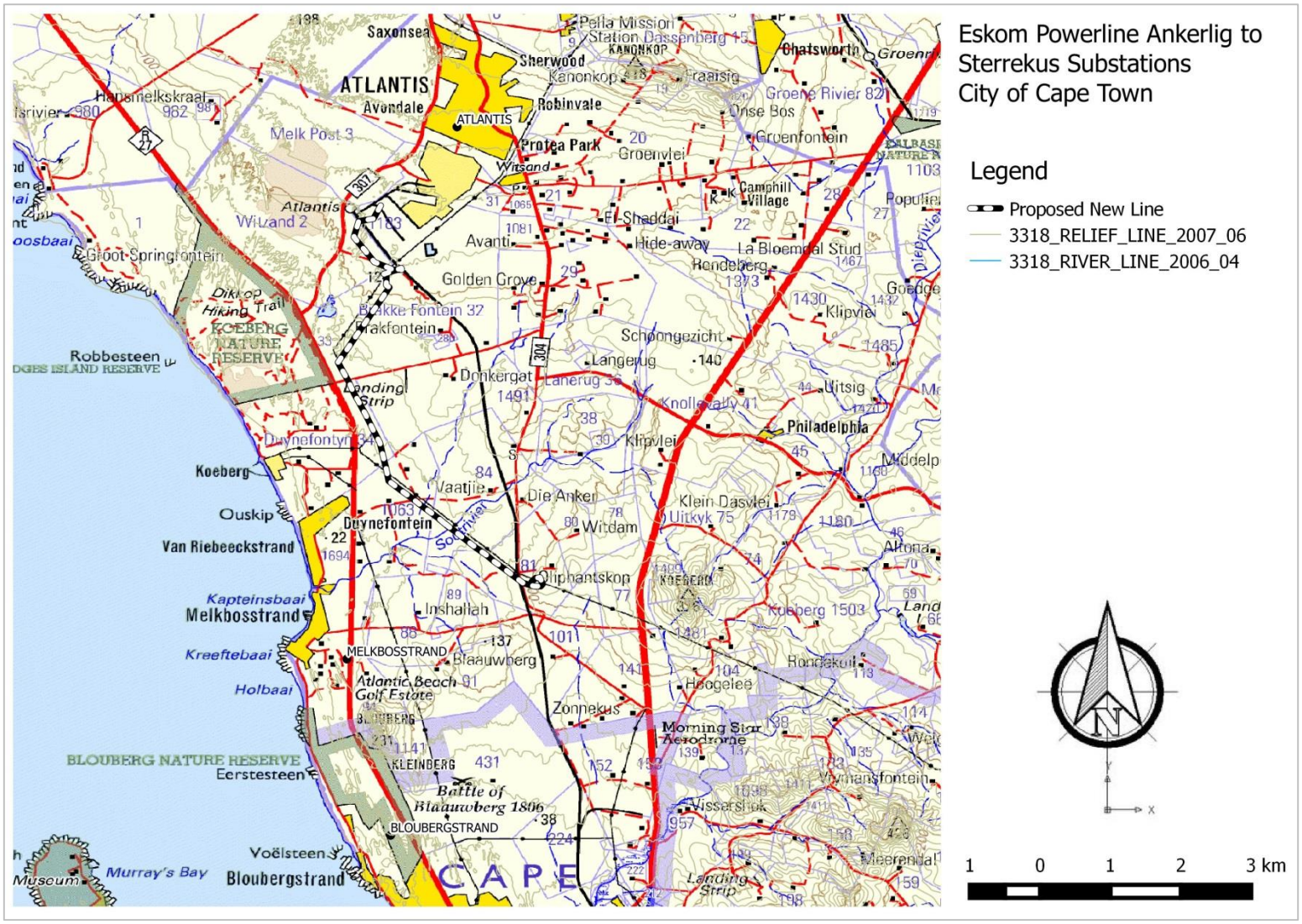


Figure 1. Map indicating the locality of 20 km Eskom powerline route from Ankerlig substation in Atlantis (to the north) and Sterrekus substation in Melkblos area (to the south) (City of Cape Town Metropolitan Municipality, Western Cape) .

3. STUDY METHODOLOGY

A field survey and assessment was conducted from 12 – 17 August 2015 in order to assess the wetland habitat within 500 m of the powerline route and pylons.

Task 1: Literature Review

Available wetland data included the City of Cape Town Wetlands Map (Snaddon and Day, 2009) and the National Freshwater Ecosystems Priority Areas (NFEPA) Map (Nel et al., 2011). The data was consulted to determine the presence of wetlands within the 500 m radius of the powerline and pylons. The 1:50 000 South African topographical data was also used to map drainage lines (rivers and streams) along the route; as well as historical dams and/or inland waterbodies prior to the site visit to ground-truth the wetland data and to identify any additional wetlands, if present. Google Earth imagery and aerial imagery was also consulted to determine the presence of wetlands along the route.

Task 2: Field Survey

The field survey and assessment was undertaken to verify (ground-truth) the available wetland data, to record the presence of other wetlands not mapped and to map (digitize) the wetland habitats and watercourses along the route more accurately.

Wetland delineation was directed by the occurrence of typical wetland species adapted to wet conditions (i.e. hydrophytes and obligates[1]), including the identification of typical wetland soils (i.e. hydromorphic soils) and the presence of surface water or high saturation levels. Generally, a grey or low chroma soil matrix (which, in certain circumstances, may indicate seasonally anoxic conditions), anoxic conditions and/or mottles must be present in the soil horizon to qualify as temporary, seasonal and/or permanent (anoxic) wetlands. However, due to the sandy soils along this portion of the Western Cape coastline, mottling or visible signs of fluctations between periods of reduced oxygen / high water table and oxygenated periods / low water table was absent and/or very vague.

The methodology described by 'A practical field procedure for identification and delineation of wetlands and riparian areas' (DWAF, 2005) guided the assessment. Specific attention was given to the Department of Water Affairs delineation guideline regarding sandy coastal aquifers, which states that aeolian derived, sandy soils associated with sandy coastal aquifers often have grey profile colours, which are not necessarily associated with hydromorphic soil forming processes. Specific soil properties (and thus indicators), terrain indicator and vegetation indicator on sandy coastal aquifers have been recognized which distinguish wetland habitats from drier sites. The very sandy, white soils did not contain a high organic matter layer; and in fact none of the wetlands had this layer, apart from areas along the Soutrivier River.

While the delineation process therefore applied these indicators were not applicable to the soils of the study area. Detailed soil sampling within each individual wetland was not undertaken due to the extent of the 500 m radius; and because (1) obligate wetlands occurred; (2) surface water was evident; (3) saturation was evident; (4) mottling was evident; (5) anoxic conditions were evident; and/or (5) indicative contour or landscape features were present. Furthermore, Ms Nancy Job, a regional wetland expert who was involved in the ground-truthing of the City of Cape Town wetlands data, reviewed this report.

[1] *Grow in wetland or water saturated areas for more than 99 % of the time.*

Each individual wetland was also assessed according to the level of impact in and around the wetland. The vegetation survey was conducted to identify the presence of key wetland and/or riparian plant species, and species of conservation concern (i.e. protected or threatened species), if any.

GPS coordinates of the wetlands and watercourses (Soutrivier and Donkergat) were recorded in the field, coupled with consultation of aerial (2009), Google Earth imagery (2015) and the 1:50 000 South African Topographical Data.

Task 3: Draft Report Compilation – Wetland Mapping and Assessment

A description of the aquatic features is presented in Section 5.

The City of Cape Town systematic biodiversity plan was consulted to determine the presence of important areas for conservation and/or biodiversity management (Section 4.2). Buffer areas were based on the general buffer recommendations and project type (i.e. potential impact of the pylons or powerlines).

GIS software (Quantum GIS version 2.4) was used to delineate waterbodies (wetland habitat) and the Soutrivier and Donkergat rivers.

The National Wetland Classification System (SANBI, 2009) methodology was followed, in order to classify the waterbodies. The national system has a six-tiered structure, namely Level 1 to Level 6 (Section 5.2).

The ecological importance and ecological sensitivity of all the wetlands, as well as Present Ecological State (PES) for natural wetlands, was determined using the 'Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types' (DWAF, 2005). The Present Ecological State (PES) of the habitat integrity of the wetlands was classified according to the standard Department of Water Affairs' A-F ecological categories (Table 2). The WET-Health series 'A technique for rapidly assessing wetland health'' by Macfarlane *et al.* (2008) was also consulted for additional support, however the detailed methodology was not applied for this extensive study. Although both methodologies have been developed for floodplain and channelled valley bottom wetlands, the methodologies can be adapted to the wetlands assessed in this study using general characteristics such as vegetation condition, land-use impacts and general wetland function. Professional opinion and experience therefore also assisted with the PES assessment.

The ecological importance and ecological sensitivity of all the wetlands was also based on an adaptation of the methodology for determined ecological importance and sensitivity for rivers (Kleynhans, 1999) and the criteria determined in the DWAF methodology for determining ecological importance and ecological sensitivity, including hydro-functional importance (Refer Section 5.4, Tables 10 & 11). The assessment however was largely based on vegetation rather than invertebrates, and included the potential presence of frog and bird species of conservation concern. The WET-EcoServices technique for rapidly assessing ecosystem services supplied by wetlands (Kotze et al., 2005) was also followed to determine the ecological importance of wetlands by determining ecosystem service benefits. Furthermore, the prioritization of the wetlands by Snaddon and Day (1999) contributed to the classification.

The Department of Water Affairs and Sanitation desktop Present Ecological State data was also consulted for PES of the Soutrivier River, as well as ecological importance and ecological sensitivity (DWS, 2014).

Table 2. Descriptions of the A-F ecological categories (after Kleynhans, 1996, 1999 cited in SANBI, 2009).

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.

Ecological Category	PES % Score	Description
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.
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.

As per the terms of reference, an aquatic sensitivity map was generated to indicate buffer areas (no-go areas) in order to safeguard aquatic features. Included in the mapping is the sensitivity scores according to the position of the wetlands in relation to the pylon positions.

Limitations of the Study:

(1) One baseline assessment or field visit was conducted during winter (12 – 17 August 2015), which limits the amount of biota identified on site and in the herbarium due to limited fertile specimens.
(2) One baseline assessment or field visit was conducted during winter (12 – 17 August 2015), subsequent to rainfall which assisted with likely inundation/saturation during such periods. Ideally, however, assessments should be done in both the dry period and wettest period.
(3) Although the survey was detailed, the assessment was largely guided by the City of Cape Town wetlands map (Snaddon and Day, 2009), drainage areas, landscape form, Google Earth imagery and tower position.
(4) The use of existing available information that is out-dated (2009 aerial images, 1:50 000 topographical map) to map wetlands areas, although ground-truthed, may result in slight boundary inaccuracies.
(5) Some inaccuracy in the hand-held Global Positioning System and Geographical Information System is expected.
(6) Soil types according to the South African Soil Classification system, which are indicative of wetland soils in sandy coastal aquifers, would need to be determined by a soil expert. However, it should be noted that according to personal communications with the Institute for Soil, Climate and Water, soil types associated with wetlands is in dispute, and therefore mottling, gleying (blue/green), grey, and anoxic conditions are the most important criteria in determining hydrophitic wetland soils. This makes identifying wetland soils challenging as the wetlands fall within sandy coastal areas, which often do not exhibit these characteristics (mottles and gley colours). The Department of Water and Sanitation delineation guideline in sandy coastal aquifers was consulted (DWAF, 2005, 2008).
(7) This report does not include a geo-hydrological component.

4. AVAILABLE WETLAND AND SYSTEMATIC PLANNING DATA

4.1. NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA) WETLANDS MAP (2011)

Wetlands in South Africa have been mapped on a broad-scale by various stakeholders and have been included in the National Freshwater Ecosystem Priority Areas (NFEPA) Map (Nel et al., 2011). Due to the broad-scale nature of the NFEPA map, ground-truthing is required to verify the data (Nel et al., 2011; Driver et al., 2011).

The location of NFEPA wetlands was derived from the National Land Cover 2000 (Van Den Berg et al., 2008 cited in Nel et al., 2011) and inland water features from the Department of Land Affairs' Chief Directorate: Surveys and Mapping (DLA-CDSM). All wetlands are classified as either 'natural' or 'artificial' waterbodies. The FEPA Wetland Map identifies important or sensitive wetlands, called Freshwater Ecosystem Priority Area (FEPA) wetlands.

National Freshwater Ecosystem Priority Areas (NFEPA) Map relative to the powerline:

Although the NFEPA map was consulted, it was found to be significantly less accurate than the City of Cape Town wetlands map (Snaddon and Day, 2009). Refer below Section 4.2.

4.2. THE CITY OF CAPE TOWN WETLANDS MAP (2009)

The Freshwater Consulting Group and Jeffares and Green (Pty) Ltd completed a desktop spatial wetlands map for the City of Cape Town (Ewart-Smith et al., 2008 cited in Snaddon and Day, 2009), referred to as the City Wetlands Map (Snaddon and Day, 2009). The City Wetlands Map was produced from a largely desktop assessment of aerial photography, with field verification of a subset of the mapped wetlands, including those areas where existing field work had already been undertaken by the Freshwater Consulting Group and other consultants for separate studies. Where field verification was undertaken, the confidence with which the wetlands were mapped was high, while a low confidence was associated with the mapping of many of the wetlands. The complete wetlands GIS shapefile comprises 7677 polygons classified as wetlands, some of which lie outside the City of Cape Town jurisdiction. A total of 3503 wetlands are classified as known anthropogenic features (e.g. stormwater retention ponds, quarries), while the remaining 4174 wetlands are considered to be natural or semi-natural (Snaddon and Day, 2009).

Figure 2 and 3 below presents the wetlands that were mapped by Snaddon and Day (2009) within the 500 m radius of the powerline and pylons, indicating anthropogenic wetland type and biodiversity importance respectively. **These mapped wetlands represent all the potential wetland areas that were ground-truthed during this wetland survey and assessment**.

A total of 34 wetlands were mapped. Table 3 presents the classification of the wetlands into anthropogenic wetland types (natural or artificial), hydro-geomorphhic wetland types and the aquatic biodiversity category assigned. The aquatic biodiversity category represents the prioritization or importance of each wetland. In the case of the wetlands along the powerline, the wetlands were classified into the following biodiversity priority categories:

- **Critical Biodiversity Areas 2 (CBA 2).** These are high ranking "natural or semi-natural" wetlands within each wetland type (second quarter = CBA 2 (rank 2). (CBA 2 comprise of critically endangered vegetation of restorable condition. Needed for national targets but not for management consolidation, connectivity or viability of priority biodiversity network sites).
- **Critical Ecological Support Areas (CESA).** These are high ranking artificial wetlands (top quarter of artificial wetlands) (rank 1) and middle ranking natural or semi-natural wetlands (third quarter of total scores) (rank 3). (CESA 1a are transformed by agriculture or other activities. Essential for management consolidation, connectivity & viability of biodiversity elements in CBA 1a, CBA 1b & protected sites).
- **Other Ecological Support Areas (OESA).** These are lower ranking artificial wetlands (ranks 2, 3 and 4) and lowest ranking natural or semi-natural wetlands (rank 4).

Figure 3 presents the aquatic biodiversity categories assigned to each wetland within 500 m of the powerline.

Table 3. The anthropogenic wetland types, hydro-geomorphic wetland types and biodiversity categories assigned

ANTHROPOGENIC WETLAND TYPE	No.	WETLAND TYPE	No.	AQUATIC BIODIVERSITY CATEGORIES	No.
Natural or semi-natural wetlands	18	Dune strandveld isolated depression	10	Critical Biodiversity Areas 2 (CBA 2).	18
Dams	6	Sand fynbos depression	2	Critical Ecological Support Areas (CESA).	10
Irrigation pond	1	Sand fynbos isolated depression	10	Other Ecological Support Areas (OESA).	15
Stormwater ponds	4	Sand fynbos isolated seep	3	The irrigation pond was classified as 'need to find out more'.	1
Stormwater depression	1	Sand fynbos seep	7		
Quarries were identified	4	Shale renosterveld isolated depression	1		
		Shale renosterveld seep	1		

The shale renosterveld wetlands are critically endangered, the Atlantis Sand Fynbos wetlands are vulnerable and the dune strandveld wetlands are critically endangered according to the CBA 2 category definition above (According to the national wetland assessment (Nel and Driver, 2011), western strandveld NFEPA wetlands are endangered. However, the fine scale ecosystem status of the City of Cape Town Wetlands was used in this assessment).

The following management and buffer recommendations are provided by Snaddon and Day (2009):

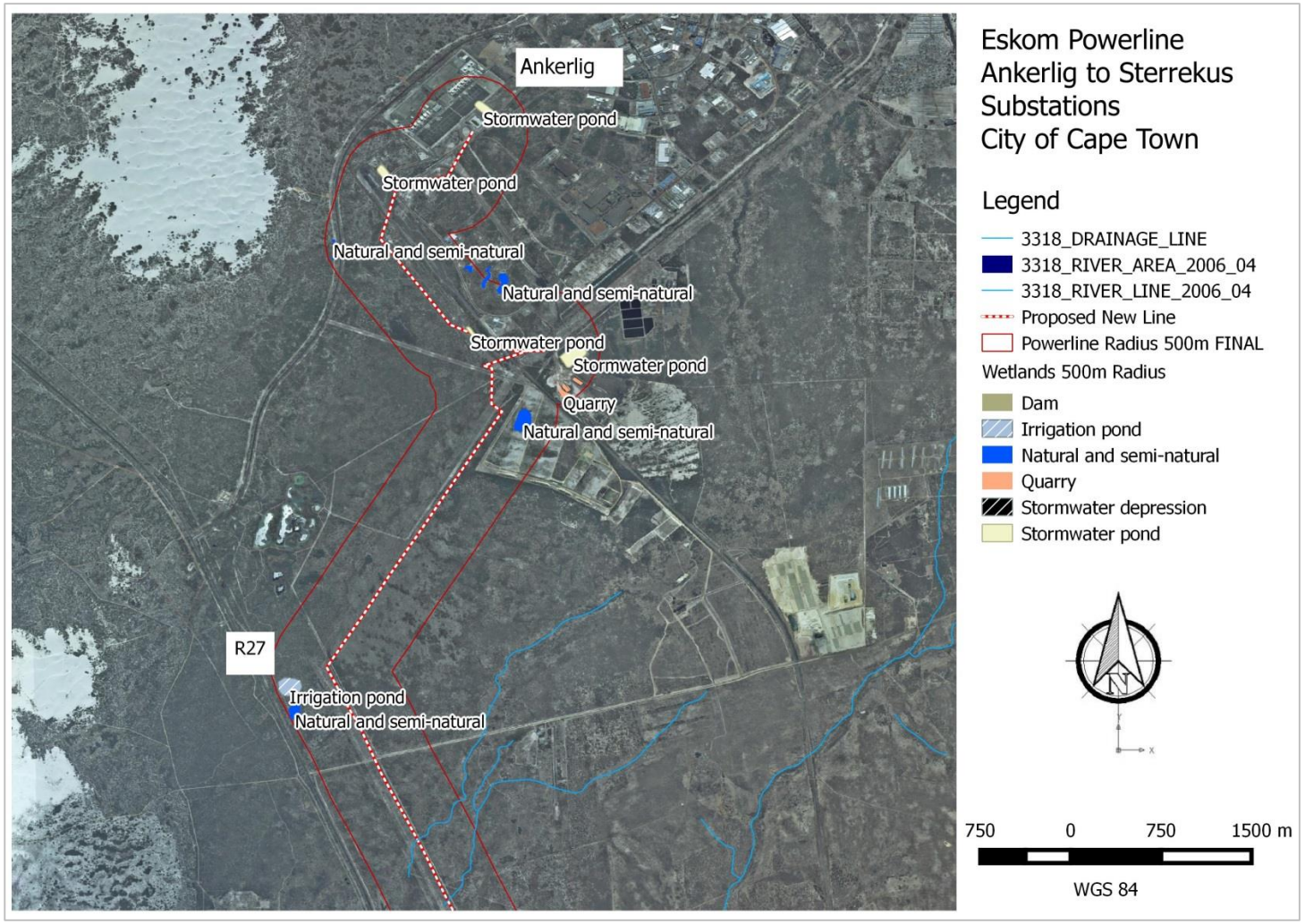
- Wetlands should be protected by a development setback, or buffer, of at least 32 m (as stipulated in the National Environmental Management Act Environmental Impact Assessment regulations), ranging up to 75 m, as suggested in the City of Cape Town's Floodplain Management Policy (2009). Reasons should be provided to the relevant authorities during the application process (i.e. during the basic or Environmental Impact Assessment study) where this minimum buffer width is to be reduced.
- The guidelines below shall also be applied to the buffers around wetlands. In other words, the CBA guidelines should apply to CBA buffers.

- Wetlands classified as CBAs should be protected and, where necessary, rehabilitated. Where CBA wetlands have been placed in a condition class that is unacceptable (i.e. lower than a Class C), then these wetlands should be rehabilitated.
- Artificial wetlands should be accorded a level of protection that is in line with their biodiversity value and the ecosystem service provided by the wetland. Artificial wetlands given the status of CESA should be protected by a buffer of at least 32 m, but which can be wider, if deemed necessary by a wetland ecologist.
- Buffers around CESA artificial wetlands can be used for stormwater detention and other activities and services, to the satisfaction of a wetland ecologist.
- Artificial wetlands given the status of an OESA should be protected by a buffer of at least 10 m, but these wetlands must still be assessed and ground-truthed by a wetland ecologist.

Refer to Section 5 for the results of the wetland ground-truthing exercise.

Figure 2. Map series below showing the City of Cape Town Wetlands Map (Snaddon and Day, 2009) within the 500 m radius of the Eskom powerline, indicating anthropogenic wetland type.

2A: ANKERLIG SUBSTATION (NORTH END)



2B: STERREKUS SUBSTATION (SOUTH END)

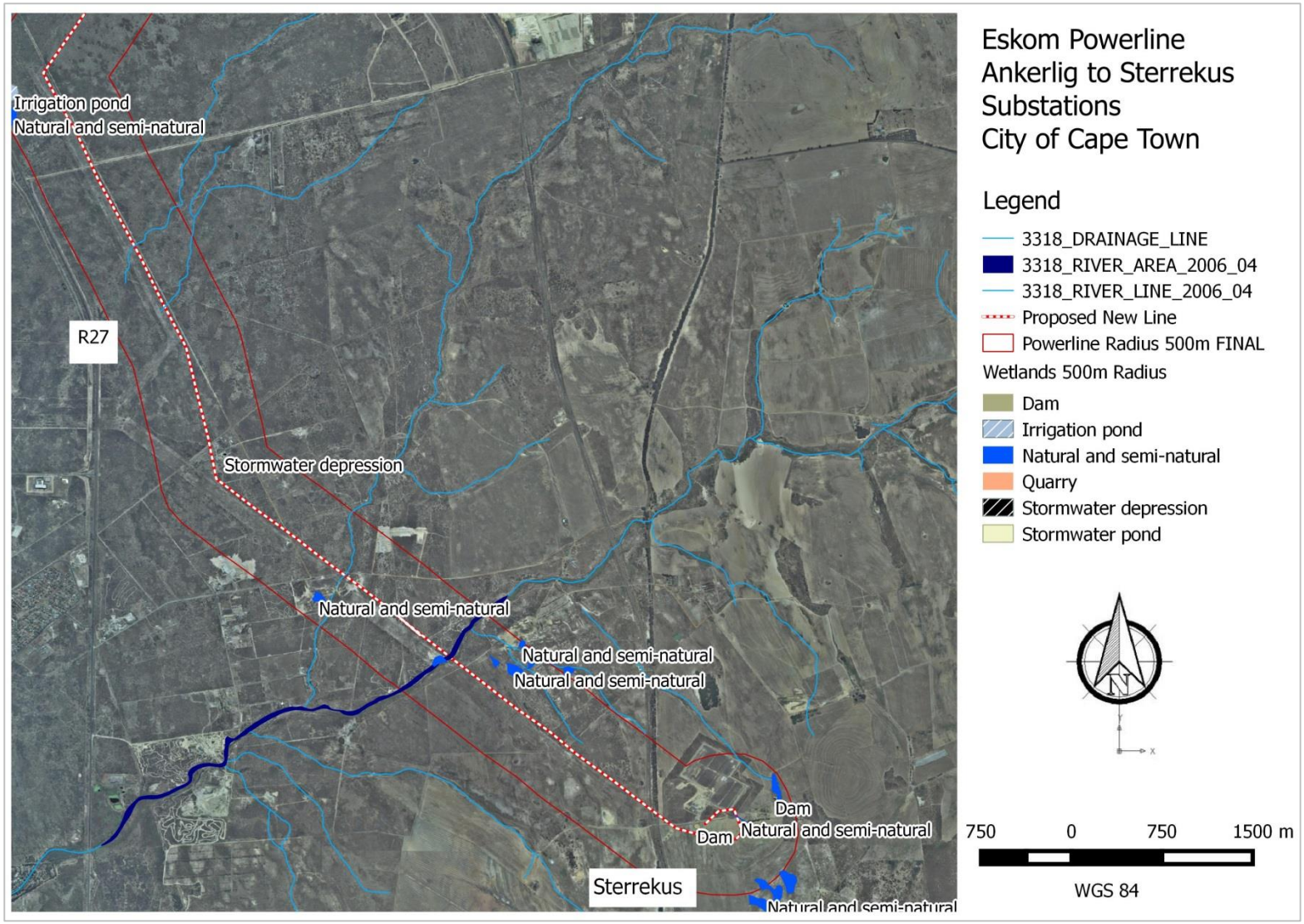
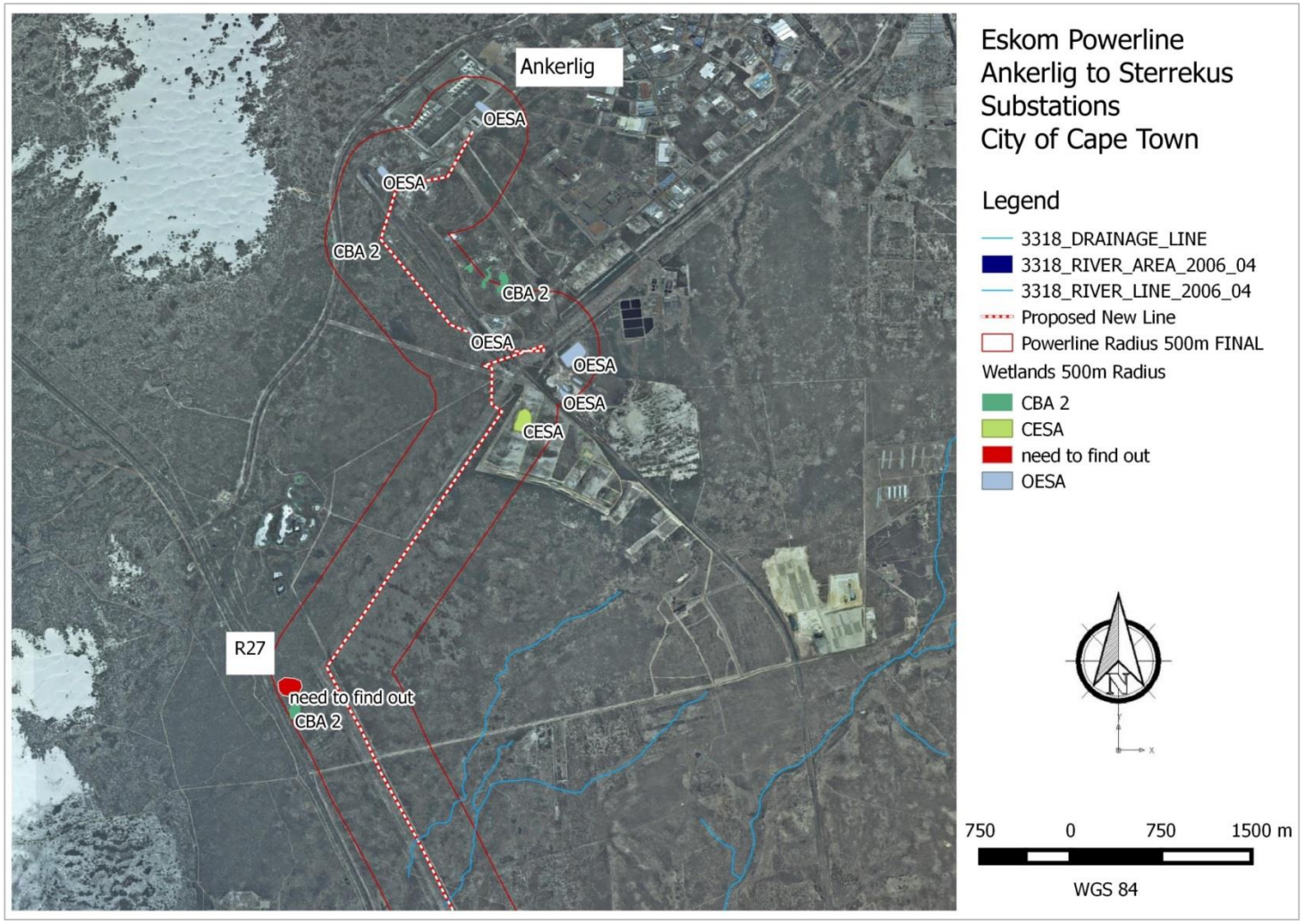
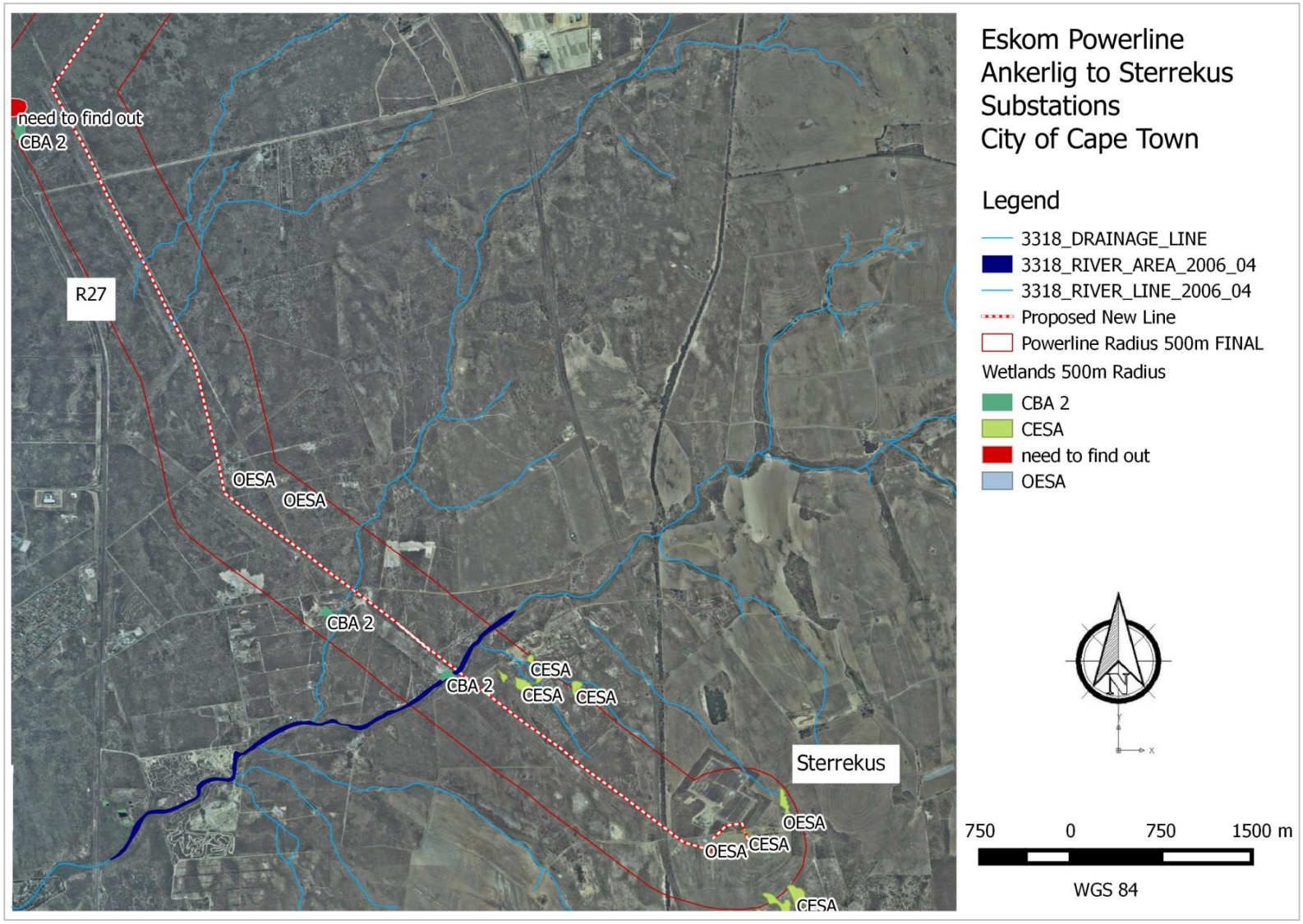


Figure 3. Map series below showing the City of Cape Town Wetlands Map (Snaddon and Day, 2009) within the 500 m radius of the Eskom powerline, indicating the aquatic biodiversity category assigned.

3A. ANKERLIG SUBSTATION (NORTH END)



3B: STERREKUS SUBSTATION (SOUTH END)



5. GROUND-TRUTHING RESULTS: WETLAND SURVEY AND ASSESSMENT

As indicated in Section 2, the powerline falls within the G21B quaternary catchment. Two non-perennial rivers, namely the Donkergat River and the Soutrivier River, are situated along the route, located approximately 5.3 km and 4 km north of the Sterrekus substation respectively. The Donkergat feeds into the Soutrivier, which then drains into the Atlantic Ocean at Melbosstrand.

5.1. WETLAND DELINEATION

Wetlands mapped for this assessment

Thirty-four wetland habitats were recorded along the powerline route and mapped in Quantum GIS (Version 2.4) (Table 4, Figure 4). Seventeen of these wetlands are natural or semi-natural. The remaining 17 are artificially established, ranging from stormwater retention ponds (7), quarries (2), dams (5), excavations (2) and one water leakage. The artificial stormwater retention ponds around Ankerlig (Atlantis area) form part of the Atlantis Water Source Management Scheme, which includes artificial groundwater recharge (DWA, 2010).

Wetlands 4 and 5 (Figure 4A) were mapped in this study despite the absence of mottling, gleying saturation and/or anoxic conditions and wetland plants. These wetlands were mapped by the City Wetlands Map (Snaddon and Day, 2009) and do not appear to be functioning as wetlands but appear to be terrestrial due to intensive invasion by *Acacia saligna* and *A. cyclops*. Google Earth imagery shows that this invasion has occurred since 2009.

Table 4. Table summary of the mapped wetland findings for this wetland assessment

WETLAND NO.	NATURAL OR ARTIFICIAL	LATITUDE	LONGITUDE	WETLANDS MAPPED BY SNADDON AND DAY (2009) YES/NO
1	Artificial Stormwater Retention Pond	-33.591361	18.466288	Y
2	Artificial Stormwater Retention Pond	-33.593665	18.46464	N
3	Artificial Stormwater Retention Pond	-33.59718	18.457441	Y
4	Natural Depression (isolated)	-33.605516	18.464345	Y
5	Natural Depression (isolated)	-33.60619	18.465817	Y
6	Natural Depression (isolated)	-33.607084	18.46745	Y
7	Artificial Stormwater Retention Pond	-33.614402	18.473369	Y
8	Artificial Water Discharge Pond (water used for sand cleaning operation)	-33.615372	18.473739	Y
9	Artificial Quarry	-33.61615	18.47324	Y
10	Artificial Quarry	-33.61694	18.47332	Y
11	Natural Flat (isolated)	-33.618826	18.468971	Y
12	Natural Depression (isolated)	-33.642758	18.451641	N
13	Natural Depression (isolated)	-33.645536	18.448752	Y
14	Natural Valley Bottom Depression	-33.657296	18.459427	Y

WETLAND NO.	NATURAL OR ARTIFICIAL	LATITUDE	LONGITUDE	WETLANDS MAPPED BY SNADDON AND DAY (2009) YES/NO
15	Artificial Dam	-33.656551	18.460372	N
16	Natural with artificial excavation (isolated)	-33.675219	18.468023	N
17	Artificial Dam	-33.687497	18.478006	Y
18	Artificial Dam	-33.688611	18.477371	Y
19	Natural Floodplain	-33.688529	18.477137	Y
20	Artificial Dam	-33.690491	18.476008	Y
21	Natural Floodplain	-33.693423	18.487384	Y
22	Natural Floodplain	-33.693987	18.486691	Y
23	Natural Floodplain	-33.693406	18.488231	Y
24	Natural Hillslope Seep (isolated)	-33.704926	18.497935	N
25	Artificial Dam	-33.70837	18.51018	Y
26	Artificial leakage	-33.707505	18.513724	Y
27	Natural Hillslope Seep (but modified with dam)	-33.706008	18.517053	Y
28	Artificial Stormwater Retention Pond	-33.702273	18.50906	N
29	Artificial Excavation	-33.704704	18.509461	N
30	Artificial Excavation	-33.706625	18.509056	N
31	Artificial Stormwater Retention Pond	-33.611487	18.465187	Y
32	Natural Depression (isolated)	-33.603038	18.452476	Y
33	Natural Flat (isolated)	-33.604555	18.452311	Y
34	Natural Depression (isolated)	-33.645026	18.449191	Y

Deviations from the City of Cape Town Wetlands Map

Eight additional wetlands were mapped, namely 2, 12, 14, 16, 24, 28, 29 and 30 (Table 4).

Eight wetlands mapped by City of Cape Town wetlands map (Snaddon and Day, 2009) were not mapped for this assessment. The following City of Cape Town wetlands were not included in the mapped findings of the study for the following reasons:

Six wetlands based on the City of Cape Town wetlands map (Snaddon and Day, 2009), south of the Soutrivier (Figure 3B), were not included in the mapped findings of this study. If these wetlands existed they have been modified (transformed) by current intensive cultivation (rye and wheat), quarrying, as well as past intensive cultivation and intensive encroachment by the alien invasive plant, *Acacia saligna*. Another City of Cape Town mapped wetland, situated north of the Donkergat River, was found to be an underground sewage soak-away that was dominated by *Pennisetum clandestinum* (kikuyu grass). It was not considered to be a wetland area. Wetland plants were not observed in these areas and wetland soils could not be determined due to the high sand content of the soils and absence of mottling, gleying saturation and/or anoxic conditions. The terrain indicator unit 5 (depression) and high organic content in the upper soil layer were also absent (as highlighted by the DWAF guidelines), although this is not necessarily a viable indicator for these systems, apart from where the sewerage soak-away occurred given the density of the kikuyu grass.

The 'irrigation pond' along the R27, mapped by Snaddon and Day (2009), just south of the Atlantis turn-off (Figure 3A), was also not mapped for this study. This area was terrestrial in character. Species included, for example: *Chrysanthemoides monolifera, Euphorbia mauritanica, Pelargonium sp., Cynancum africanum, Asparagus sp., Ficinia indica, Lampranthus sp., Gymnosporia buxifolia, Metalasia muricata, Muraltia spinosa, Searsia laevigata, Salvia Africana-lutea, Thamnocortus spicigerus* and *Zygophyllum morgsana*. Several soil samples were taken. Mottling, gleying and/or anoxic conditions were absent, although situated in a dune slack area.

The wetland mapped by Snaddon and Day (2009) to the south of the 'irrigation pond' (Figure 3A) was in fact two separate wetlands that were smaller in extent (as indicated in Figure 4A). Several soil samples were also taken in the mapped area. The one wetland area (no. 13), mapped in this study, was dominated by *Typha capensis* and the other smaller wetland area proximate to it (no. 34), also mapped in this study, supported *Ficinia nodosa* and had grey, saturated soils at approximately 35 cm - 50 cm depth (Figure 4A). This entire area was previously a horse camp, and therefore must be the reason for the large grassy area dominated by *Ehrharta villosa*, and patches of *Pennisetum clandestinum* (kikuyu), *Cynondon dactylon*, *Chrysanthemoides monolifera*, *Carpobrotus deliciosus* and *Acacia saligna*.

Vegetation cover

The majority of the artificial wetlands were dominated by *Typha capensis*. The natural wetlands on the other hand were dominated by *Hellmuthia membranaceae*, *Elegia tectorum, Isolepis* species*, Juncus* species and *Ficinia nodosa.* Along the Soutrivier River, salt marsh occurred, which supported *Sarcocornia natalensis, Sporobolus virginicus, Bolboschoenus maritimus, Juncus kraussii, Restio confusus* and *Phragmites australis.* The following key plants were recorded in the wetland habitats (Figure 4):

OBLIGATE WETLAND PLANTS
Bolboschoenus maritimus
Chenolea diffusa
Cyperus esculentus
Cyperus textilis
Elegia tectorum
Ficinia nodosa
Hellmuthia membranaceae
Isolepis cernua
Isolepis prolifera
Juncus capensis
Juncus dregeanus
Juncus kraussii
Juncus lomatophyllus
Paspalum vaginatum
Persicaria lapathifolia (weed)
Phragmites australis
Pycreus polystachyus
Restio confusus
Sarcocornia natalensis
Sporobolus virginicus
Typha capensis
COMMON WETLAND PLANTS

Imperata cylindrica
SUBMERGED AQUATIC
Potagometon pectinatus (weed)
COMMON NON WETLAND PLANTS FOUND IN SOME OF THE WETLANDS
Atriplex semibaccata
Cotula filifolia
Crassula strigosa
Cynodon dactylon
Exomis microphylla
Ficinia indica
Ficinia lateralis
Mesembryanthemum pugioniforme
Metalasia muricata
Rumex lanceolata
Thamnocortus spicigerus. This restio species was present in wetland 1 and 6, which both supported *Hellmuthia membranaceae.* It was also present in wetland 4.

Plant Species of Conservation Concern

No rare or threatened plants were recorded in the wetland habitats, although *Hellmuthia membranaceae* which occurred in the wetlands around Atlantis area (Ankerlig end) is the only species of *Hellmuthia* worldwide and in South Africa (van Ginkel et al., 2011).

Faunal Species of Conservation Concern

According to the faunal assessment the Vulnerable frogs, Cape Rain Frog (*Breviceps gibbosus)* and Cape Caco (*Cacosternum capense*) may potentially be present in the Atlantis study area (Mouton, 2008; Du Preex and Carruthers, 2009). The Cape Rain Frog may be present within patches of Malmesbury Shale Renosterveld, and the Cape Caco in fynbos areas where it breeds in temporary wetland areas or rain-filled depressions in cultivated land in the winter months. The Cape Rain Frog however is not reliant on wetlands.

The presence of these frogs could not be verified, but the likelihood of the presence is higher in the fynbos and renosterveld wetlands where modification to natural plant cover in the surrounding areas is lower.

A number of bird species of conservation concern were observed in the study area, and are known to inhabit and utilize the area. Larger dams with large areas of open water, such as the stormwater detention pond (wetland habitat 28) at the Sterrekus substation, are important habitat in this respect. Species include, for example: the blue crane (Vulnerable), pelican (Near Threatened). Refer to the bird specialist report for detailed information in this regard.

According to the Blaauwberg District Plan Environmental Management Framework (City Space Planning, 2011), the following bird species of conservation occur in the study area:

- The Vulnerable African marsh harrier (*Circus ranivorus*) is dependent on extensive wetlands.
- Several pairs of the Near Threatened black harrier (*Circus maurus*) are breeding in the Koeberg Nature Reserve and are presumed to breed in the Atlantis area.
- The Near Threatened old world painted snipe (*Rostratula benghalensis*).

- The Near Threatened Secretarybird (*Sagittarius serpentarius*) occurs in agricultural areas and natural open spaces. One of the farmers indicated that these birds used to frequent his farm (near Sterrekus substation) but he has not observed them for a while.
- Vulnerable blue cranes (*Anthropoides paradiseus*) occur in agricultural areas and natural open spaces. A breeding pair was observed a year ago at Sterrekus substation (Pers. Comments: Mr W. Hayes, Sterrekus substation Engineer).
- The Vulnerable martial eagle (*Polemaetus bellicosus*) is occasionally encountered.
- The Near Threatened great white pelican (*Pelecanus onocrotalus*), which was observed in the field.

Discussions with the bird specialist on site indicated that bird strikes with powelines occur where large birds are utilizing large wetland areas or dams with large areas of open water. In such instances, a buffer of 100 m – 150 m – 200 m from the powerline is required for birds landing to roost or feed in large open water wetland areas. The stormwater retention pond at Sterrekus substation is utilized by large birds due to the expanse of open water, which lies below the existing powerline. All the other wetlands did not present with large expanses of open water. Refer to the bird specialist report for detailed information in this regard.

Figure 4. Map indicating the wetland habitat within a 500 m radius of the powerline alignment and pylon positions.

4A: ANKERLIG SUBSTATION (NORTH END)

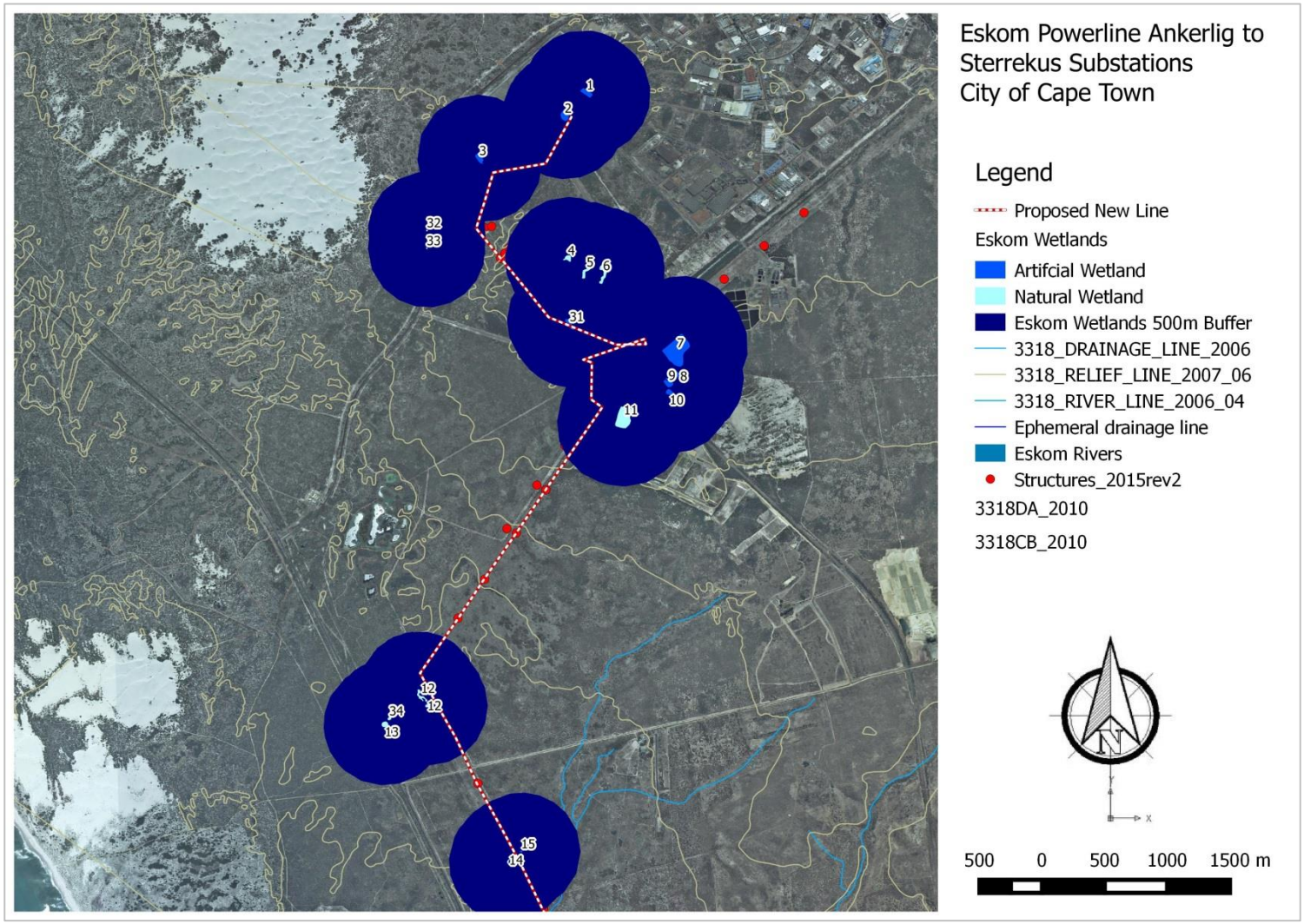


FIGURE 4B: STERREKUS SUBSTATION (SOUTH END)

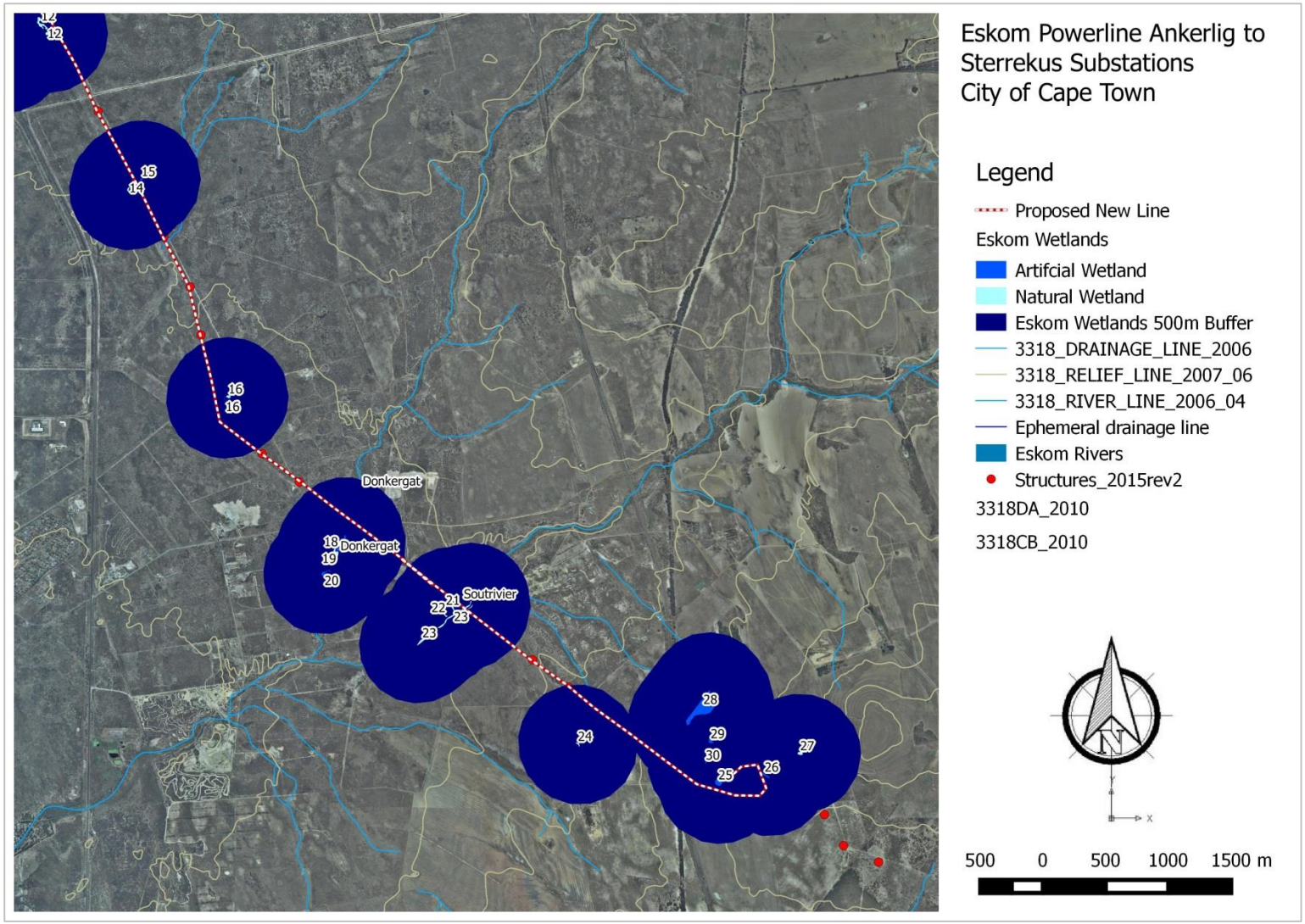


Table 5. Photographic images of the wetland habitat surveyed within 500 m of the powerline

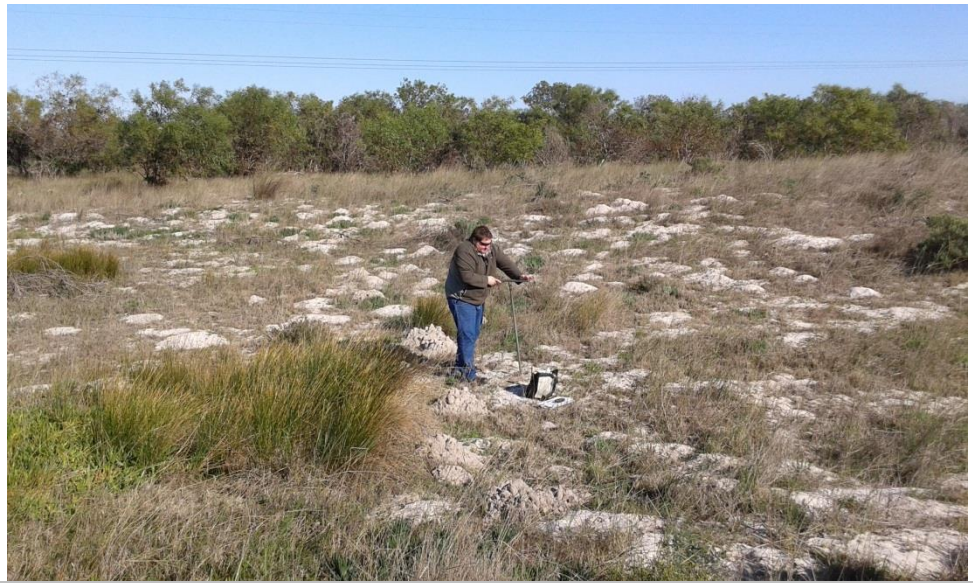
WETLAND NO. (FIGURE 4)	DESCRIPTION
1	A stormwater detention pond has created an isolated depression temporary wetland supporting *Hellmuthia membranaceae*. Terrestrial species included, for example *Ficinia lateralis, Thamnocortus spicigerus, Metalasia muricata, Muraltia spinosa, Searsia laevigata, Gymnosporia buxifolia, Thesium sp., Carpobrotus edulis* and *Lampranthus sp.* 
3	A stormwater retention pond has created an 'isolated' depression wetland, with *Ficinia nodosa* bordering the edge. A drainage ditch was observed which was aligned towards a culvert under the road. *Typha capensis* was present in the drainage ditch (to the left, outside the photograph view). 
4	This wetland was mapped despite the absence of mottling, gleying, greying saturation and/or anoxic conditions and wetland plants. This wetland was mapped by the City Wetlands Map (Snaddon and Day, 2009) and does not appear to be functioning as a wetland but appears to be terrestrial due to intensive invasion by *Acacia saligna* and *A. cyclops*.

WETLAND NO. (FIGURE 4)	DESCRIPTION
	Google Earth imagery shows that this invasion has occurred since 2009. 
6	A natural depression wetland supporting *Hellmuthia membranaceae,* including *Ficinia indica* and *Ficinia lateralis*. Other terrestrial species included, for example *Thamnocortus spicigeru, Muraltia spinosa, Thesium sp.* and *Ehrahrta villosa.* 
33	A flat wetland on a dune slope supporting *Hellmuthia membranacea* and *Ficinia indica*. An *Acacia cylops* stands in the centre, and *Ehrharta villosa* scattered around.

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
31	A stormwater detention pond dominated by *Typha capensis*. The wetland was severely polluted by stormwater wastewater and emitted a foul odour. 
11	This flat wetland has been severely modified due to regular mowing although wetland plants are scattered in the area. *Juncus lomatophyllus* and *Ficinia nodosa* were present, with a few young *Typha capensis* establising in the drainage ditch along the northern boundary (not in view of photograph).

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
19	Floodplain wetland along the Donkergat River, where a large berm separates it from the river. A number of dams have been established along the river (Figure 4), dominated by *Typha capensis*. The floodplain wetland supported *Juncus dregeanus, Juncus capensis* and *Elegia tectorum* amongst other plants. 
23	Floodplain wetland along the Soutriver River, proximate to pylon 36, which supported *Juncus kraussii, Sarcostemma natalensis* and *Phragmites australis* (amongst other wetland plants).

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
12	Natural depression wetland under the existing powerline, which supported *Ficinia nodosa, Pycreus polystachyos, Paspalum vaginatum* and *Cynodon dactylon*. 
14	This natural valley bottom depression wetland is part of an ephemeral drainage line. It supported patches of *Ficinia nodosa* (visible in the photograph).

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
16	This natural depression wetland was likely excavated (deepened) for recreational purposes in the past. It supported the weed *Potagometon pectinatus*. 
24	A natural seep, which has been excavated for water for livestock consumption.

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
26	This artificial wetland has been created due to a leaking water supply pipeline (Pers. Comments: Farmer) and is located in an agricultural wheat field. A trench appears to link this area to the wetland dam no. 25 (downslope). Wheat is not supported in this saturated and pooled area due to high saturation levels which was evident by black soil mottling.

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
27	This is a natural seep that has been modified into a dam. The seepage discharge point lies just above the dam (Pers. Comments: Farmer). The larger area mapped in the City Wetlands Map (Snaddon and Day, 2009) was not mapped in this study. If it existed before it has been modified to agricultural land.

WETLAND NO. (FIGURE 4)	DESCRIPTION
	
28	The stormwater retention pond established to control stormwater run-off from the Sterrekus substation. The pond is relatively big and supports large birds, such as pelican, geese. A pair of blue crane (with one young) were observed in its vicinity last year (Pers. Comments: Mr Wanro Hayes, Engineer on site), where smaller excavations have created small wetland areas supporting *Bolboschoenus maritimus* amongst other wetland plants. The pond is under the existing power line and falls only partially within the 500 m radius. 

Table 6. Photographic images of some of the soil samples taken in the wetland habitat

WETLAND (FIGURE 4)	DESCRIPTION
6	Limited mottling in sandy soils of natural depression wetland supporting *Helmuthia membranaceae*. Munsell value of 8 and chroma of 1 (hue 10 YR). 
12	Vague mottling in natural depression wetland under the existing powerline, which was also saturated and inundated in parts of the depression. Munsell value of 7 and chroma of 1 (hue 7.5 YR). 
11	Flat wetland situated in a shooting range, with vague mottling and saturated grey soils. Munsell value of 6 and chroma of 1 (hue 10 YR).

WETLAND (FIGURE 4)	DESCRIPTION
	
33	Vague mottling in wetland 33, which also supported *Hellmuthia membranaceae*. Munsell value of 8 and chroma of 1 (hue 10 YR). 
19	Saturated, grey soils in the floodplain wetland along the Donkergat River. Soils were saturated (inundated) within 10 cm. Munsell value of 6 and chroma of 1 (hue 10 YR).

WETLAND (FIGURE 4)	DESCRIPTION
	
21-23	Sandy soils along the Soutrivier River with vague mottling and grey soils. Soils were saturated (inundated) beyond 30 cm. Munsell value of 6 and chroma of 1 - 2 (hue 10 YR). 

5.2. WETLAND CLASSIFICATION

The wetland classification is based on the six tiered National Wetland Classification System (SANBI, 2009). The wetland classification has been undertaken for the natural wetlands (Table 7).

Table 7. Wetland classification for the natural wetlands (Figure 4)

NO.	LEVEL 1. ECO-REGION	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT	LEVEL 4: HYDROGEOMORPHIC UNIT				LEVEL 5: HYDROLOGICAL REGIME (& DEPTH OF INUNDATION)		LEVEL 6: WETLAND CHARACTERISTICS (DESCRIPTORS)		
				4A. HGM TYPE	4B. LONGI-TUDINAL ZONATION/ LAND-FORM	4C. DRAINAGE - OUTFLOW	4D. DRAINAGE INFLOW	5A: Depth of inundation	5B: Saturation periodicity			
4	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal/ Intermittent	Temporary	Restio, Sedge, Acacia	Sandy	**Geology and salinity** The geology of the route ranges from unconsolidated white sand (Qw) and light grey to pale red sandy soil (Qs) to greywacke, phyllite and quartzitic sandstone (Nt) at the southern end. The salinity was not measured, however, it is likely that these wetlands are brackish, especially given the presence of salt marsh and *Bolboschoenus martimus*, and the name of the Soutrivier River. According to the Atlantis Water Source Management Scheme (DWA, 2010), the salinity of the groundwater varies with some areas more saline than others. The groundwater around Atlantis has an electrical conductivity of 70-300 milli Siemens per meter (mS/m), (which is fresh <300 – 1 800 mS/m).
5	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal/ Intermittent	Temporary	Restio, Sedge, Acacia	Sandy	
6	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal/ Intermittent	Temporary	Restio, Sedge	Sandy	
11	South-western coastal belt	inland	Plain	Flat	NA	NA	without channelled inflow	Seasonal	Seasonal + permanent (possible)	Typha, Sedge	Sandy	
12	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal	Seasonal + permanent (possible)	Sedge, Rush, Typha	Sandy	
13	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal	Permanent	Typha	Sandy	

NO.	LEVEL 1. ECO-REGION	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT	LEVEL 4: HYDROGEOMORPHIC UNIT				LEVEL 5: HYDROLOGICAL REGIME (& DEPTH OF INUNDATION)		LEVEL 6: WETLAND CHARACTERISTICS (DESCRIPTORS)		
				4A. HGM TYPE	4B. LONGI-TUDINAL ZONATION/ LAND-FORM	4C. DRAINAGE - OUTFLOW	4D. DRAINAGE INFLOW	5A: Depth of inundation	5B: Saturation periodicity			
14	South-western coastal belt	inland	Valley floor	Channelled valley-bottom	Valley-bottom depression	Channelled	Channelled	Seasonal	Seasonal + permanent (possible)	Sedge, Rush, Typha	Sandy	Groundwater in the central coastal region has higher conductivities of 300-1000 mS/m (or brackish = 300 – 1 800 mS/m) (CoCT, 1999 cited in City Space Planning, 2011). The low-lying areas of the West Coast are characterised by deeper, sandy, calcareous soils that are less acidic and have a marginally higher nutrient content than the soils associated with the Table Mountain Group sandstone close to or on mountain slopes. As these soils are occurring in low-lying areas close to the ocean, they frequently become waterlogged due to high local water tables.
16	South-western coastal belt	inland	Plain	Depression	NA	endorheic	without channelled inflow	Seasonal	Seasonal + permanent (possible)	Potagometon, Sedge	Sandy	
19	South-western coastal belt	inland	Plain	Floodplain	floodplain flats	NA	NA	Seasonal	Seasonal + permanent (possible)	Typha, Sedge, Restio, Rushes	Sandy	
21	South-western coastal belt	inland	Plain	Floodplain	floodplain flats	NA	NA	Seasonal	Seasonal	Juncus, grass	Silty sand	
22	South-western coastal belt	inland	Plain	Floodplain	floodplain flats	NA	NA	Seasonal	Seasonal	Juncus, grass	Silty sand	
23	South-western coastal belt	inland	Plain	Floodplain	floodplain flats	NA	NA	Seasonal	Seasonal + permanent (possible)	Phragmites, Sedge, Restio, Juncus, Sarcocornia, grass	Silty sand	
24	South-western coastal belt	inland	Plain	Seep	Hillslope seep	without channelled outflow		Seasonal	Seasonal	Isolepis, grass	Sandy	

NO.	LEVEL 1. ECO-REGION	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT	LEVEL 4: HYDROGEOMORPHIC UNIT				LEVEL 5: HYDROLOGICAL REGIME (& DEPTH OF INUNDATION)		LEVEL 6: WETLAND CHARACTERISTICS (DESCRIPTORS)		
				4A. HGM TYPE	4B. LONGI-TUDINAL ZONATION/ LAND-FORM	4C. DRAINAGE - OUTFLOW	4D. DRAINAGE INFLOW	5A: Depth of inundation	5B: Saturation periodicity			
27	South-western coastal belt	inland	Slope	Seep	Hillslope seep	without channelled outflow	without channelled inflow	Seasonal	Seasonal + permanent (possible)	Grass, sedge	Clayey	
32	South-western coastal belt	inland	Slope	Depression	NA	endorheic	without channelled inflow	Seasonal/ Intermittent	Temporary	Sedge	Sandy	
33	South-western coastal belt	inland	Slope	Flat	NA	without channelled outflow	without channelled inflow	Seasonal/ Intermittent	Temporary	Sedge	Sandy	
34	South-western coastal belt	inland	Plain	Depression	NA	without channelled outflow	without channelled inflow	Seasonal	Seasonal	Sedge	Sandy	

5.3. PRESENT ECOLOGICAL STATE OF NATURAL WETLANDS

The Present Ecological State (PES) was determined for the natural wetlands indicated in Figure 4 and was based on the DWAF methodology (DWAF, 2005) and professional opinion. Water use licensing or authorisation processes usually only require the determination of PES for natural wetlands, whereas ecological importance and sensitivity are important for all wetland habitats (artificial or natural). The DWAF (2005) methodology is for valley bottom and floodplain wetlands, and therefore the methodology does not apply wholly to other wetland types, e.g. depression and seeps. Therefore the criteria used in this methodology along with professional opinion and experience were important in assessing PES. Land use impacts, such as vegetation clearing, alien plant infestation, and excavation (berming) were key impacts on the natural wetlands. Livestock grazing, agriculture and livestock manure were impacts associated with natural wetlands to the south of the Soutrivier River. Refer Table 8.

Table 8. Present Ecological State of the natural wetlands indicated on Figure 4

WETLAND NO.	PRESENT ECOLOGICAL STATE (PES)	EXPLANATION
4	Class F. Critically / Extremely modified.	Intensive encroachment by the alien invasive plant, *Acacia saligna,* with fewer *Acacia cyclops*; and excavations. This wetland, mapped by the City Wetlands Map (Snaddon and Day, 2009), is not functioning as a wetland and appears to be terrestrial given the dense cover of *A. saligna*.
5	Class F. Critically / Extremely modified.	Intensive encroachment by the alien invasive plant, *Acacia saligna,* with fewer *Acacia cyclops*. This wetland, mapped by the City Wetlands Map (Snaddon and Day, 2009), is not functioning as a wetland and appears to be terrestrial given the dense cover of *A. saligna*.
6	Class B. Largely natural.	The wetland had no alien vegetation encroaching in the basin of the wetland but was surrounded by an *Acacia saligna* 'forested' landscape. This is likely to impact on flow dynamics by reducing infiltration into the depression wetland.
11	Class D. Seriously modified.	This wetland falls within a shooting range. The area is regularly mowed, and has a drainage ditch along its northern boundary. Despite this, a few *Typha capensis* were establishing in the drainage ditch, including *Pycreus polystachyos, Juncus lomatophyllus* and *Ficinia nodosa. P. polystachyos* was scattered throughout the larger area with some *F. nodosa*.
12	Class C. Moderately modified.	*Acacia saligna* has been recently removed from parts of the depression area, but is likely to be an ongoing problem due to high encroachment in the surrounding landscape. The surrounding land is also impacted on due to maintenance clearing by Eskom as this wetland is sited below the existing powerline. This wetland is in a Protected Area and therefore land-use impacts associated with hydrology, geomorphology and water quality are non-existent.
13 & 34	Class C. Moderately modified.	Wetland 13 and 34 lie next to each other, near to the R27 highway. No. 13 is a *Typha capensis* dominated wetland, which has potentially replaced other natural wetland species. This area was previously a camp for a horse and it is likely that the wetland area was excavated (deepened) to form the dam. No. 34 is smaller in extent and dominated by *Ficina nodosa*, but *Pennisetum clandestinum*, *Cynodon dactylon* and *Acacia* trees are encroaching upon this wetland. It appears that there may have been some excavations in the area. These wetlands fall within the same Protected Area as wetland 12; and therefore land-use impacts associated

WETLAND NO.	PRESENT ECOLOGICAL STATE (PES)	EXPLANATION
		with hydrology, geomorphology and water quality are non-existent, although changes due to excavation would play a role in changing the PES from the reference state.
14	Class C. Moderately modified.	The wetland impacts were very similar to wetland no. 12. This wetland falls along an ephemeral drainage line; and dam wetland 15 is not situated on the drainage line but offset from it. Land use impacts are evident higher up in the catchment, e.g. homestead, *Acacia saligna* 'forested' landscape, at a great distance from the wetland.
16	Class C. Moderately modified.	This depression wetland is likely to have been deepened and it appears that a circular like excavation has been added to the depression area (to its west), to create an island, which would also result in increased flow (volume and velocity) into the wetland depression. The system was infested with the aquatic weed *Potagometon pectinatus* and contained algae. The surrounding land has been impacted on by *Acacia saligna* and *A. cyclops,* and minor earth moving activities. It appears to be an old motorbike recreational site with tyres lining old paths.
19	Class C. Moderately modified.	This floodplain wetland has been encroached upon by *Acacia saligna*, an access track and *Typha capensis* is increasing in cover extent. A large berm has also been established along the northern boundary of the Donkergat River, while access tracks traverse the river resulting in a change in hydrodynamics and geomorphology. The Donkergat River is a tributary of the Soutrivier River. According to the Department of Water and Sanitation desktop PES study, the Soutrivier is in an E Class: Seriously modified (DWS, 2014). The land use impacts in the Donkergat River catchment, particularly upstream are not as extensive, although *A. saligna* is a serious problem.
21 - 23	Class C. Moderately modified.	These wetlands occur along the Soutrivier River. Agricultural practices (pervious clearing of natural vegetation cover in the catchment to the south-east, as well as intensive encroachment by *Acacia saligna* in areas), 4X4 access tracks and upstream quarrying are likely to have impacted on hydrodynamics, sedimentation and erosion. However, the vegetation component appears to be in a relatively good condition despite the presence *of Acacia saligna* along the boundaries and further. According to the Department of Water and Sanitation desktop PES study, the Soutrivier is in an E Class: Seriously modified (DWS, 2014). However the vegetation of the wetland areas is considered to be in a fairly good state.
24	Class D. Largely modified.	The seep has been excavated (deepened) and is utilized by livestock.
27	Class D. Seriously modified.	Agricultural lands have destroyed the area and a dam has been established below the seep discharge point (Pers. Comments: Farmer). Furthermore, the dam is surrounded by kikuyu grass within a farm homestead where livestock are grazing, kraals and access tracks occur. Nutrient input is therefore likely to be higher than the reference state, while changes in vegetation cover are evident. If the larger area mapped by the City Wetlands Map (Figure 2B and 3B) existed it has been irreversibly modified (transformed) by agriculture; and wetland habitat was not observed.

WETLAND NO.	PRESENT ECOLOGICAL STATE (PES)	EXPLANATION
32, 33	Class B. Largely natural.	Wetland No. 33 had one large *Acacia cyclops* in the wetland area. *Acacia saligna* and *A. cyclops* were present in the surrounding landscape, but largely on lower ground and to the east. A sandy access track and fence border the western boundaries, downslope. The wetlands however are sited on higher ground and impacts are not considered significant to warranty a lower PES.

5.4. ECOLOGICAL IMPORTANCE AND ECOLOGICAL SENSITIVITY OF WETLANDS

Ecological importance and ecological sensitivity determinations are usually a standard requirement for water use authorisations in terms of Section 21c and Section 21i of the National Water Act (36 of 1998).

A summary of the hydrological benefits usually derived from the various wetland hydro-geomorphic units (Kotze et al., 2005), are indicated in Table 9, which assist with guiding the importance of the wetlands on site. The wetlands are isolated depressions, channelled depressions (i.e. stormwater retention ponds, dams on the Donkergat River), seeps and floodplain wetlands (where sited on the Donkergat and Soutrivier rivers). Stream flow regulation only applies to wetlands sited along the Donkergat and Soutrivier rivers. Table 10 indicates the functional or ecological importance of a wetland relative to its size (Kotze et al., 2005). The wetlands are comparatively small in extent (m^2) relative to their respective catchment areas.

Table 9. Preliminary rating of the hydrological benefits likely to be provided by a wetland given its particular hydro-geomorphic type

WETLAND HYDRO-GEOMORPHIC TYPE	HYDROLOGICAL BENEFITS OTENTIALLY PROVIDED BY WETLAND TYPES							
	Flood attenuation		Stream flow regulation	Erosion control	Enhancement of water quality			
	Early wet season	Late wet season			Sediment trapping	Phos-phates	Nitrates	Toxicants
1. Floodplain	++	+	0	++	++	++	+	+
2. Valley bottom - channelled	+	0	0	++	+	+	+	+
3. Valley bottom - unchannelled	+	+	+?	++	++	+	+	++
4. Hillslope seepage feeding a stream channel	+	0	+	++	0	0	++	++
5. Hillslope seepage not feeding a stream	+	0	0	++	0	0	++	+
7. Pan/Depression	+	+	0	0	0	0	+	+

Rating:

0 Benefit unlikely to be provided to any significant extent.

\+ Benefit likely to be present at least to some degree.

++ Benefit very likely to be present (and often supplied to a high level).

Table 10. Importance of wetland size in contributing to the provision of particular benefits

Ecosystem services	Importance of size		Ecosystem services	Importance of size
Flood attenuation	****		Biodiversity maintenance	**
Streamflow regulation	**		Carbon storage	***
Sediment trapping	****		Water supply	**
Phosphate assimilation	****		Harvestable resources	**
Nitrate assimilation	***		Cultural significance	*
Toxicant assimilation	***		Tourism & recreation	**
Erosion control	***		Education & research	*

Size is seldom important*; Size is usually very important***; Size is usually moderately important **; Size is always very important****

The following biodiversity features provides a summary of the key criteria used to determine high ecological importance, as adapted from Kleynhans (1999), and were utilized in the DWAF (2005) and Kotze et al. (2005) assessments for determining ecological importance and ecological sensitivity presented below in Tables 13 and 15.

BIODIVERSITY FEATURE / CRITERIA
1. Presence of red data or Threatened species, namely: the threatened frogs or birds.
2. High species diversity.
3. Presence of unique populations, namely: *Helmuthia membraneaceae.*
4. An important site for breeding, feeding or migration, namely sites for blue crane, pelican etc.
5. Identified as a Ramsar wetland (no such wetlands in this instance).
6. A rare or unique system, namely: Fynbos systems (irrespective of catchment modification).
7. High conservation status of surrounding vegetation, namely Critically Endangered, Endangered and Vulnerable (i.e. all wetland types).
8. Sited in an area of near-natural and untransformed vegetation cover that is threatened.
9. Identified as a Critical Biodiversity Area or Critical Ecological Support Area wetland i.e. regional importance of the wetland as prioritized by Snaddon and Day (2009).

The DWAF (2005) criteria scoring tables for determining ecological importance, ecological sensitivity and hydro-functional importance are provided below in Table 11 and Table 12.

Table 11. DWAF criteria methodology for determining ecological importance and ecological sensitivity

ECOLOGICAL IMPORTANCE AND SENSITIVITY CRITERIA	SCORE (0-4)	CONFIDENCE (1-5)	SCORING GUIDELINE
BIODIVERSITY SUPPORT			
Presence of Red Data species			*Endangered or rare Red Data species presence*
Populations of unique species			*Uncommonly large populations of wetland species*
Migration/breeding/feeding sites			*Importance of the unit for migration, breeding site and/or a feeding.*
LANDSCAPE SCALE			
Protection status of the wetland			*National (4), Provincial, private (3), municipal (1 or 2), public area (0-1).This was equated to CBA, CESA, OESA status.*
Protection status of the vegetation type			*SANBI guidance on the protection status of the surrounding vegetation.*

ECOLOGICAL IMPORTANCE AND SENSITIVITY CRITERIA	SCORE (0-4)	CONFIDENCE (1-5)	SCORING GUIDELINE
Regional context of the ecological integrity			*Assessment of the PES (habitat integrity), especially in light of regional utilization.*
Size and rarity of the wetland type/s present			*Identification and rarity assessment of the wetland types.*
Diversity of habitat types			*Assessment of the variety of wetland types present within a site.*
SENSITIVITY OF THE WETLAND			
Sensitivity to changes in floods			*Floodplains at 4; valley bottoms 2 or 3; pans and seeps 0 or 1.*
Sensitivity to changes in low flows/dry season			*Un-channelled valley bottoms probably most sensitive.*
Sensitivity to changes in water quality			*Especially naturally low nutrient waters - lower nutrients likely to be more sensitive.*
ECOLOGICAL IMPORTANCE & SENSITIVITY			

Table 12. DWAF criteria methodology for determining hydro-functional importance

HYDRO-FUNCTIONAL IMPORTANCE CRITERIA		SCORE (0-4)	CONFIDENCE (1-5)	SCORING GUIDELINE
Flood attenuation				*The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream.*
Streamflow regulation				*Sustaining streamflow during low flow periods.*
Water Quality Enhancement	*Sediment trapping*			*The trapping and retention in the wetland of sediment carried by runoff waters.*
	Phosphate assimilation			*Removal by the wetland of phosphates carried by runoff waters, thereby enhancing water quality.*
	Nitrate assimilation			*Removal by the wetland of nitrates carried by runoff waters, thereby enhancing water quality.*
	Toxicant assimilation			*Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters, thereby enhancing water quality.*
	Erosion control			*Controlling of erosion at the wetland site, principally through the protection provided by vegetation.*
Carbon storage				*The trapping of carbon by the wetland, principally as soil organic matter.*
	OVERALL SCORE			

The results associated with the DWAF methodology (2005) for determining ecological importance, ecological sensitivity and hydro-functional importance (as indicated in the above tables 12 & 13) are presented in Table 13 below. Separate results for ecological importance and ecological sensitivity are indicated rather than the overall ecological importance and sensitivity score. Wetlands of similar character, land use impacts and classification were grouped and assessed together e.g. natural depression wetlands, natural floodplain wetlands. Wetlands of moderately high and high ranking are highlighted in orange and red, respectively.

Wetland 6 and 28 were assessed as 'high ecological importance', while wetlands 1, 19, 20 to 23 (Soutrivier River floodplain wetlands), 32 and 33 were assigned as 'moderate high importance'. The presence of *Hellmuthia membranaceae*, the potential presence of the Vulnerable frogs, Cape Rain Frog (*Breviceps gibbosus*) and Cape Caco (*Cacosternum capense*), or threatened birds and the fact that these are fynbos or dune strandveld wetlands were key criteria for assigning the scores. Wetland 28, which is the stormwater retention pond at Sterrekus substation, supports numerous birds including pelican; and the Vulnerable blue crane have been observed. The temporary natural wetland 6 on the other hand supports *H. membranaceae* and potentially the Vulnerable frogs. Wetlands assessed as high ecological sensitivity include wetland 19 (along the Donkergat River), 21 to 23 (along the Soutrivier River) and 28 (stormwater retention pond). Those of moderate high hydro-functional importance include wetlands 2, 3, 21 to 23, 28 and 31. Many of the latter include stormwater retention ponds which are serving a hydrological (stormwater) function, and recharging groundwater.

According to the Department of Water Affairs desktop PES study, the Soutrivier River is assigned a moderate ecological importance scoring and a high ecological sensitivity (DWS, 2014). The Donkergat River is a tributary of the Soutrivier River.

Table 13. DWAF methodology results for determining ecological importance, ecological sensitivity and hydro-functional importance

WETLAND NO.	ECOLOGICAL IMPORTANCE	SCORE	ECOLOGICAL SENSITIVITY	SCORE	HYDRO-FUNCTIONAL IMPORTANCE	SCORE
1	Moderate High	2.6	Low	1.6	Low	1.75
2,3	Low	1.7	Moderate	2	Moderate High	2.5
4,5	Low	1	Moderate	2	Low	1
6	High	3	Low	1.67	Low	1.6
7 to 10	Low	1.2	Moderate	2	Moderate	2.5
11	Low	1.16	Moderate	2	Low	1
12, 13, 15, 16, 34	Moderate	2.23	Moderate High	2.67	Low	1
14	Moderate	2.4	Moderate High	2.67	Low	1.8
17-20	Moderate	2.4	Moderate High	2.67	Moderate	2
19	Moderate High	2.5	High	3	Moderate	2
21-23	Moderate High	2.9	High	3	Moderate High	2.9
24	Moderate	2.1	Low	1	Low	1.1
25	Low	1	Low	1	Low	1.3
26	Low	0.78	Low	1	Low	0.6
27	Low	1.6	Low	1.67	Low	0.8
28	High	3.1	High	3	Moderate High	2.5
29,30	Low	1.8	Low	1.67	Low	1.3
31	Low	1.13	Moderate	2	Moderate High	2.5
32,33	Moderate High	2.9	Low	1.67	Low	0.8

The guideline for rapidly assessing wetland ecosystem services was also used to determine ecological importance of the wetlands (Kotze et al., 2005), especially in relation to biodiversity maintenance. Wetlands of similar character, land use impacts and classification were grouped and assessed together e.g. natural

depression wetlands, natural floodplain wetlands. Table 14 below indicates the scoring system for each ecosystem service and Table 15 indicates the results. The benefits relating to socio-cultural aspects, tourism, harvestable goods, food source, tourism education and research were not included in the assessment. In other words, this assessment focused on ecological importance in terms of biodiversity maintenance, flood attenuation, stream flow regulation, sediment, phosphate, nitrate and toxicant removal; and carbon storage. Ecosystem service benefits that obtained a moderately high and high ranking are highlighted in orange and red, respectively.

According to the ecosystem service benefits derived via WET-Services (Kotze et al., 2005) all the wetlands are either of moderate high or high importance for the maintenance of biodiversity (Table 15). The presence of *H. membranaceae*, the potential presence of the Vulnerable frogs, Cape Rain Frog (*Breviceps gibbosus)* and Cape Caco (*Cacosternum capense*), or threatened birds (e.g. blue crane, pelican), the fact that these are fynbos or dune strandveld wetlands, as well as the cumulative loss of wetlands in the region, were key criteria for assigning the biodiversity scores.

Table 14. Classes for determining the likely extent to which a benefit is being supplied based on the overall score for that benefit (Kotze et al., 2005)

SCORE	< 0.5	0.5 - 1.2	1.3 - 2.0	2.1 - 2.8	> 2.8
Rating of the likely extent to which an ecosystem service is being supplied	Low	Moderately low	Intermediate	Moderately high	High

Table 15. Ecological importance in terms of ecosystem service benefits derived from each wetland (Kotze et al, 2005)

WETLAND NO.	MAINTENANCE OF BIODIVERSITY	FLOOD ATTENUATION	STREAMFLOW REGULATION	SEDIMENT TRAPPING	PHOSPAHTE TRAPPING	NITRATE REMOVAL	TOXICANT REMOVAL	EROSION CONTROL	CARBON STORAGE
1	4.0	2.4	0.0	1.9	2.0	1.7	2.0	3.2	1.3
2 to 3	3.3	2.3	0.0	1.9	1.9	1.7	2.0	3.2	1.3
4 to 5	2.9	2.4	0.0	1.7	1.8	1.7	1.8	2.8	0.7
6	4.0	2.4	0.0	1.5	1.3	1.3	1.7	3.2	1.3
7	3.3	1.6	0.7	1.7	2.2	2.7	2.8	2.7	1.3
8,9,10	2.5	1.4	0.7	2.4	2.3	2.3	2.9	2.3	1.3
31	2.2	1.5	0.7	2.4	2.3	2.3	2.9	2.3	1.3
11	3.5	1.6	0.3	1.7	1.6	1.8	2.0	2.3	0.7
12	3.0	1.4	0.3	1.7	1.7	2.0	2.3	3.4	2.0
13, 34	3.1	1.1	0.7	1.1	1.5	2.3	2.4	3.2	2.3
14	3.3	1.5	0.8	1.2	1.0	1.3	1.6	2.6	1.0
15, 16	3.1	1.1	0.7	1.1	1.5	2.3	2.4	3.0	2.0
17 to 20	2.8	1.9	2.0	2.1	1.5	2.3	2.4	3.5	2.7
21 to 23	4.0	1.9	2.0	2.1	1.7	2.5	2.4	3.4	2.3
24	3.2	2.0	1.2	2.1	2.5	3.2	2.7	3.0	1.3

WETLAND NO.	MAINTENANCE OF BIODIVERSITY	FLOOD ATTENUATION	STREAMFLOW REGULATION	SEDIMENT TRAPPING	PHOSPAHTE TRAPPING	NITRATE REMOVAL	TOXICANT REMOVAL	EROSION CONTROL	CARBON STORAGE
25	2.8	2.8	0.2	1.7	1.9	1.8	1.7	2.4	1.3
26	2.7	2.1	1.3	2.3	2.1	3.0	2.4	1.8	2.0
27	2.3	2.6	1.3	2.4	2.7	3.2	2.9	2.0	1.3
28	4.0	2.6	1.3	2.3	2.1	2.7	2.5	2.6	1.7
29, 30	2.3	2.5	1.3	2.3	2.1	2.7	2.5	2.8	2.0
32, 33	4.0	1.8	0.0	1.2	1.0	1.2	1.4	2.2	1.3

Concluding Remarks

In conclusion, all the wetlands are important given the cumulative loss of wetlands in the region. The DWAF methodology however, provides a more realistic scoring in terms of ecological importance, particularly when comparing the various wetlands in terms of size, species composition and species diversity, as well as current impacts. The methodology also indicates ecological sensitivity.

6. WETLAND BUFFER RECOMMENDATIONS

The minimum generic buffer recommendations provided by the City Wetlands Map (Snaddon and Day, 2009) should be followed, namely 32 m (CBA 2) – 10 m (OESA).

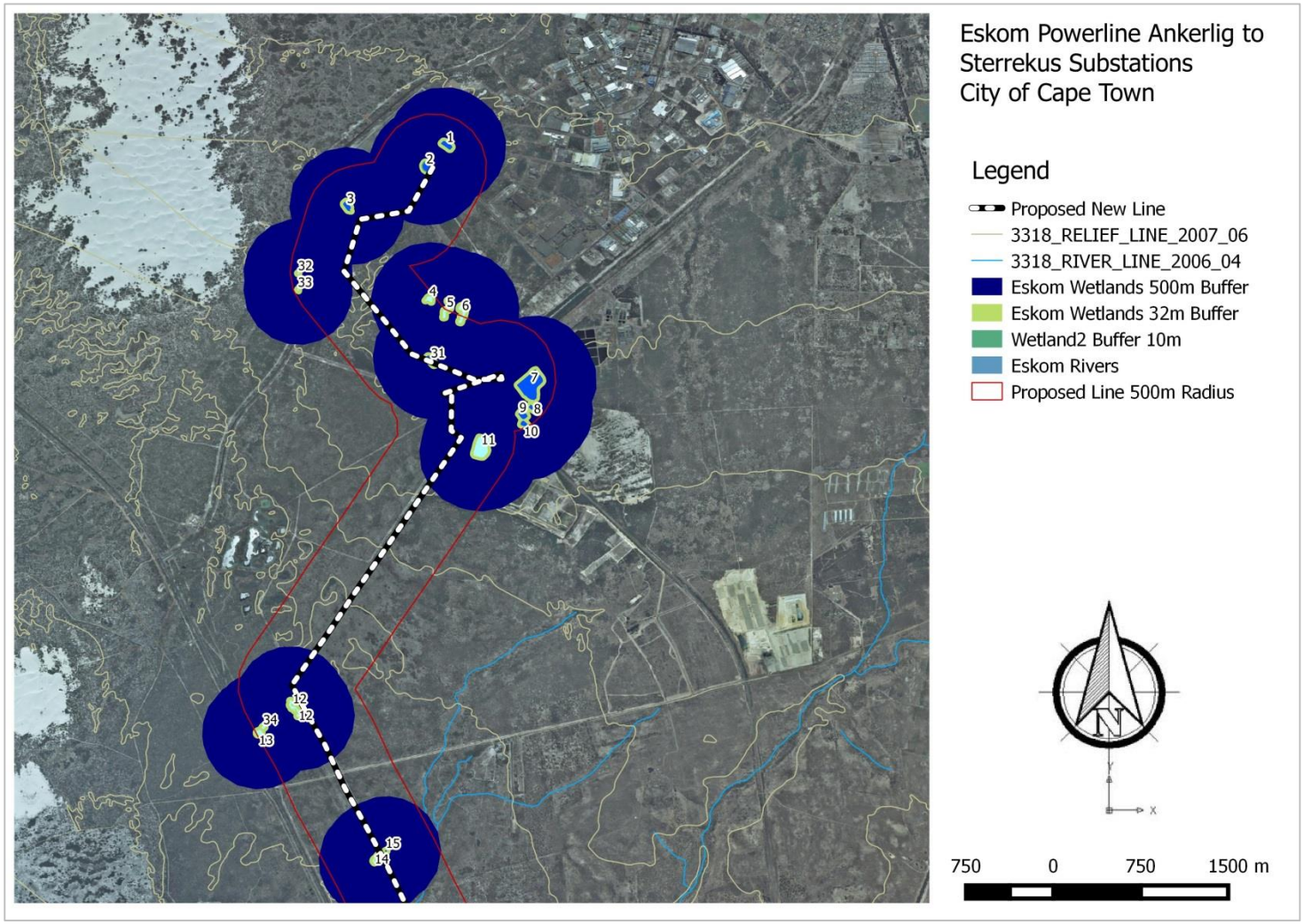
The only two wetlands that fall within or are proximate to the minimum buffers are wetland 23 and wetland 2, respectively (Table 17, Figure 5A and 5B). All the other wetlands fall beyond the 32 m and in fact fall far beyond the closest pylon, ranging from **approximately** 58 m to 498 m (in QGIS 2.4).

Table 16. Buffer recommendation for pylons with in close proximity to the mapped wetlands

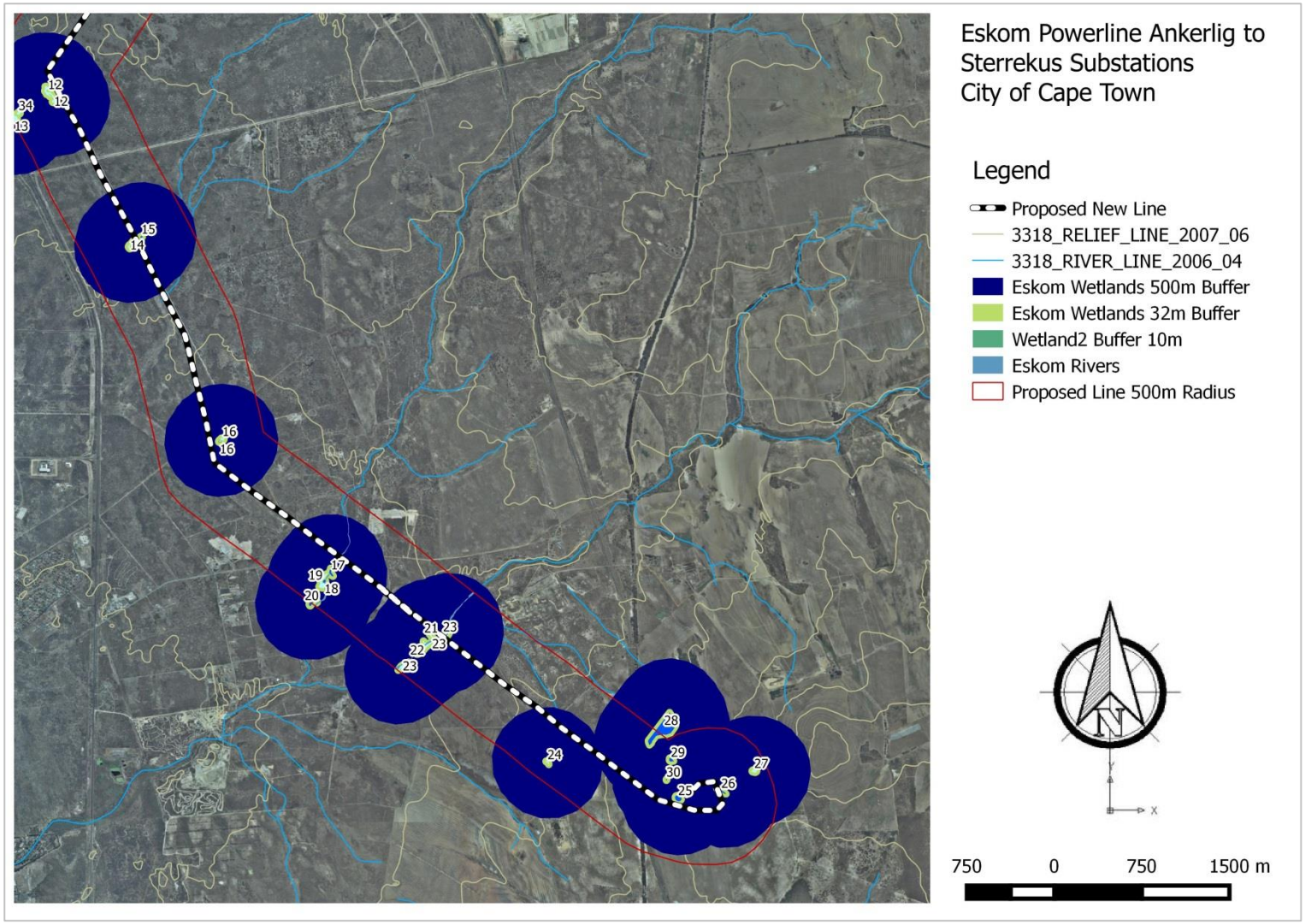
PYLON NO.	WETLAND NO. & TYPE	CBA MAP CATEGORY	BUFFER	COMMENT AND FURTHER RECOMMENDATIONS
Pylon 1	Wetland No 2. Artificial wetland – stormwater retention pond	Other Ecological Support Area (OESA) (although not mapped by Snaddon and Day (2009), it is assessed as equivalent to OESA in this study i.e. Low importance, Table 13)	10 m	Pylon 1 is outside the 10 m buffer (approximately 25 m from the pylon) but caution needs to be implemented during construction as this area is fenced in (restricting movement). Furthermore, maintaining a buffer as wide as possible is preferable. The pylon should be placed on level ground, beyond the depression of the retention pond.
Pylon 36	Wetland No. 23. Natural floodplain wetland (along the Soutrivier River).	Critical Biodiversity Area 2 (CBA 2)	32 m	A minimum 20 m buffer is acceptable if the 32 m buffer is not a technically feasible option. Technical reasons will need to be submitted. The floodplain wetland ends at the access track running adjacent, parallel and to the north of the Soutrivier River.

Figure 5. Map series indicating the wetland habitat within the 32 m buffer and 10 m buffer relative to the powerline alignment and pylon positions.

5A: ANKERLIG SUBSTATION (NORTH END)



5B: STERREKUS SUBSTATION (SOUTH END)



7. PROJECT SENSITIVITY SCORING

For the purposes of the terms of reference, Table 16 below indicates the project sensitivity scoringAccording to the project sensitivity scoring, the stormwater retention pond (wetland no. 2) and the floodplain wetland along the Soutrivier River (wetland no. 23) are in close proximity to pylon 1 and pylon 36 respectively. Figure 5 and 6 presents project sensitivity maps for these two pylons. Refer to Section 6 indicating recommended buffers and cautionary measures in this regard.

Table 17. Project sensitivity scoring for each wetland relative to the powerline

WETLAND NO.	NATURAL OR ARTIFICIAL	PROJECT SENSITIVITY
1	Artificial Stormwater Retention	-1
2	Artificial Stormwater Retention	0
3	Artificial Stormwater Retention	-1
4	Natural Depression	-1
5	Natural Depression	-1
6	Natural Depression	-1
7	Artificial Stormwater retention Pond	-1
8	Artificial Water Discharge	-1
9	Artificial Quarry	-1
10	Artificial Quarry	-1
11	Natural Flat	-1
12	Natural Depression	-1
13	Natural Depression	-1
14	Natural Valley Bottom Depression	-1
15	Artificial Dam	-1
16	Natural with artificial excavation	-1
17	Artificial Dam	-1
18	Artificial Dam	-1
19	Natural Floodplain	-1
20	Artificial Dam	-1
21	Natural Floodplain	-1
22	Natural Floodplain	-1
23	Natural Floodplain	1
24	Natural Hillslope Seep	-1
25	Artificial Dam	-1
26	Artificial leakage	-1
27	Natural Hillslope Seep (but modified with dam)	-1
28	Artificial Stormwater	-1
29	Artificial Excavation	-1
30	Artificial Excavation	-1
31	Artificial Stormwater retention pond	-1
32	Natural Depression	-1
33	Natural Flat	-1

WETLAND NO.	NATURAL OR ARTIFICIAL	PROJECT SENSITIVITY
34	Natural Depression	-1

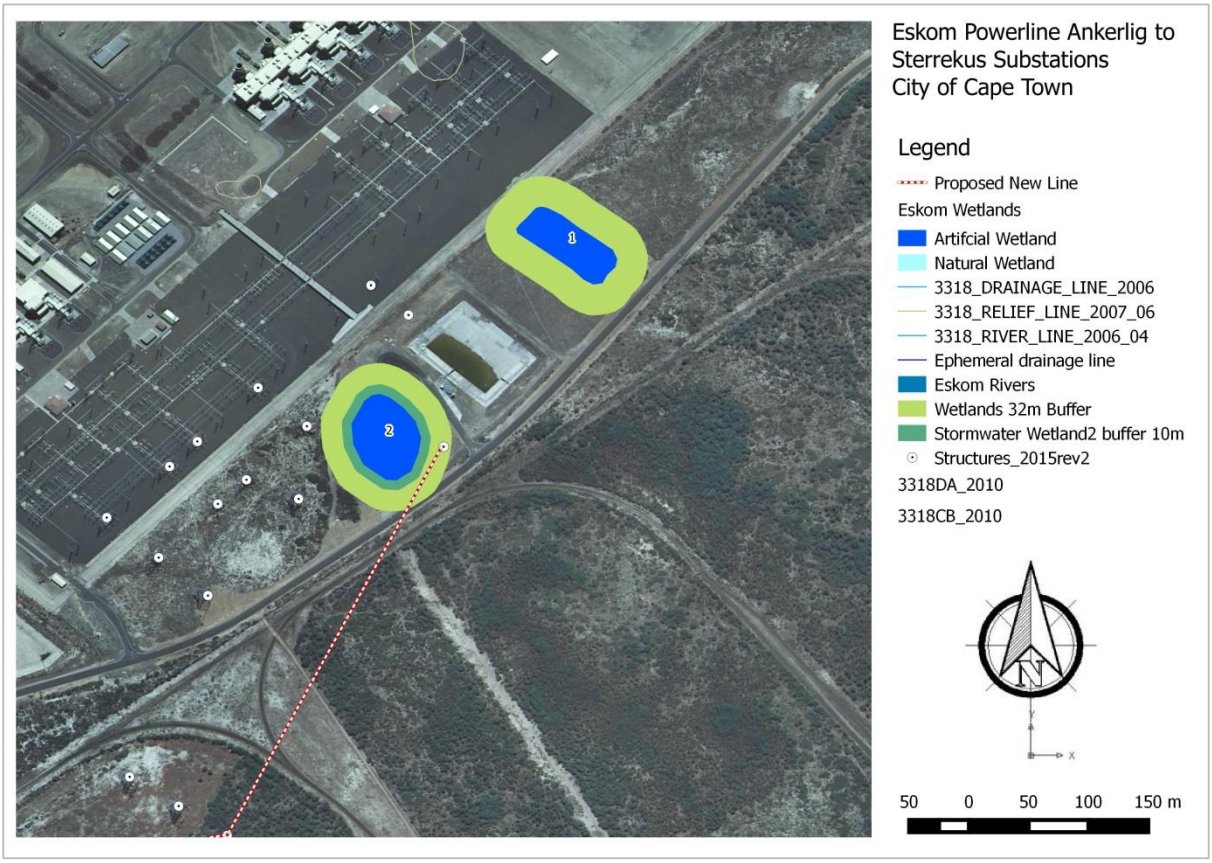


Figure 6. Project sensitivity map for wetland 2 at pylon 1.

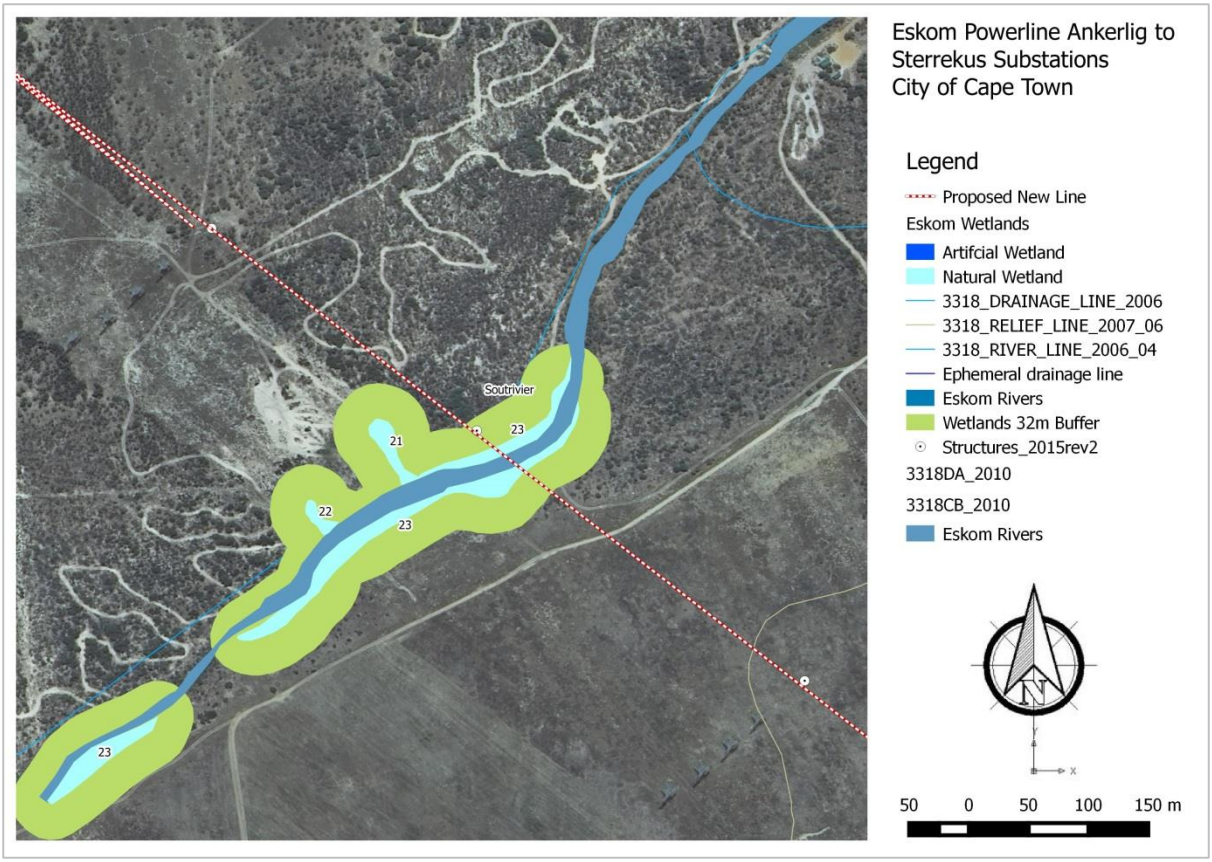


Figure 7. Project sensitivity map for wetland 23 at pylon 36.

8. OTHER MITIGATION MEASURES

The following additional mitigation measures are recommended to reduce the impacts of powerline and pylon construction and operation activities on aquatic resources and hydrological process areas:

1) Prevent contamination of wetlands proximate to the pylons during construction due to the mixing of cement for concrete foundations and vehicular / equipment spillages (oil, fuel and other hazardous substances). This will be especially important for wetland 2 and 23.

2) Buffers to be adhered to during both construction and operational maintenance activities.

3) Use of existing vehicular access tracks to each pylon site during construction and operational activities.

4) Rehabilitation with indigenous species immediately after construction in disturbed areas.

5) Eskom is encouraged to continue removing the alien invasive trees *Acacia saligna* and *A. cyclops* within the servitude, especially where wetlands are being impacted on e.g. wetland 12 and 23.

6) Recommendations in the bird specialist report to be followed. Discussions with the bird specialist on site indicated that bird strikes with powelines occur where large birds are utilizing large wetland areas or dams with large areas of open water. In such instances, a buffer of 100 m – 150 m – 200 m from the powerline is required for birds landing to roost or feed in large open water wetland areas. The stormwater retention pond at Sterrekus substation is utilized by large birds due to the expanse of open water, which lies below the existing powerline. All the other wetlands did not present with large expanses of open water.

7) All measures indicated in the Construction and Operational Environmental Management Programme should be adhered to.

8) Detailed wetland surveys and assessments should form part of the environmental assessment process in order to align the water use authorisation process with the environmental impact assessment process, as is now recommended in the amended National Environmental Management Act (89 of 1998) environmental impact assessment regulations.

Water Use License Application or General Authorisation

9) Eskom will need to determine the need for a general authorisation or water use license application for the powerline in terms of Section 21c and Section 21i of the National Water Act (36 of 1998). In this regard:

- It is the opinion of the author that a general authorisation could be requested given the fact that none of the pylons will be placed within any wetlands mapped for this project.
- Most of the wetlands are at a distance from the pylons ranging from **approximately** 58 m to 498 m (calculated in QGIS 2.4), with only wetlands 2 and 23 within 25 m and 32 m of pylons 1 and 36 respectively.
- Furthermore, if the recommended buffers are adhered to and the potential pollution impacts relating to construction are mitigated through implementation of the Construction Environmental Management Programme then the potential impact on wetlands 1 and 23 should be insignificant or non-existent.
- The powerline is considered to be a low impact land use activity as it relates to the position of the wetland habitats. In other words, the pylons will not remove or destroy any wetland habitat or alter wetland functioning.
- The other important issue for the powerline in relation to wetlands is the utilization of large wetlands, with large expanses of open water, by large birds (e.g. pelicans) and the potential for bird strikes. Refer point 6 above in this regard.
- Furthermore, the urgency of the need for electricity supply to Cape Town cannot be under-estimated, especially as it relates to economic productivity in the region.

9. REFERENCES

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Kleynhans, C.J. 1999. Assessment of Ecological Importance and Sensitivity. Institute for Water Quality Studies, Department of Water Affairs and Forestry.

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Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. And Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. Report to the Water Research Commission. WRC Report No. K5/1801.

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10. ADDENDUM 1: CURRICULUM VITAE

MS DEBORAH CLAIRE VROMANS

ENVIRONMENTAL SCIENTIST : BIODIVERSITY SERVICES PROFESSIONAL

BOTANICAL, RIPARIAN, ESTUARINE AND WETLAND SURVEYS, ECOLOGICAL ASSESSMENTS, GIS MAPPING

720815 0189 084

Services and Skills Offered

- Botanical and horticultural
- Terrestrial and estuarine botanical surveys and assessments
- Wetland surveys and assessments
- Riparian delineation and assessments
- Basic ecological assessments
- Basic GIS mapping and digitizing
- Managing and conducting Basic Assessments and Water Use License Applications.
- General Environmental Support – Completing Basic Assessment questionnaires and Water Use License applications, edit & review, assisting with the Public Participation Process, Strategic Environmental Assessments, compiling Environmental Management Programmes etc.

Ms Deborah Vromans holds an MSc degree in Botany (Estuaries) (NMMU) and a BA degree in Environmental and Geographical Sciences (UCT), including a National Diploma in Horticulture (Botany) (Cape Technikon). Her MSc permitted publication and poster presentation in the international and national domain. She has 15 years of experience in the environment and biodiversity sector. Her focus is botanical (terrestrial and aquatic), wetland, basic ecological assessments, and riparian delineation & assessments, coupled with basic GIS mapping and digitizing. Deborah has river and estuary research experience. She can also process Water Use License Applications. Deborah has conducted numerous Environmental Impact Assessments, Environmental Management Plans, Basic Assessments, wetland surveys and specialist botanical surveys. Deborah has also performed several environmental risk assessments for abalone, as well as freshwater and marine fish species, in association with Enviro-Fish Africa (Department of Ichthyology and Fisheries Science, Rhodes University). She also assisted with the development of one of the first Municipal Coastal Management Programmes, required in terms of the Integrated Coastal Management Act. Deborah has a good understanding of environmental and planning legislation. She was employed by South African National Parks on two Global Environmental Facility (GEF) funded projects, aimed at mainstreaming biodiversity data and policy guidelines into land use planning and decision-making at the local, provincial and national level. Activities encompassed stakeholder consultation, the development of municipal biodiversity sector plan handbooks and compiling a legislative guide, as well as leading local and provincial capacity building workshops. She provided biodiversity input into the development of draft rural land use management guidelines for the Department of Environmental Affairs and Development Planning (Western Cape). She has undertaken a review of 30 key municipal planning documents in the Olifants Catchment (Limpopo, Mpumalanga and Gauteng Provinces), as part of the Resilim-O Project supported by the United States Agency for International Development (USAID). She is also assisting as a biodiversity mainstreaming advisor on this project, which shall be extended to include Mozambique. Deborah is involved in the compilation of the Waterberg District Municipality Bioregional Plan (Limpopo Province) for the Department of Economic Development, Environmental and Tourism, in association with Ecosol GIS (the leading conservation planners in South Africa). She is currently involved in generating a Biodiversity Sector Plan and developing land use guidelines for the North West Province, also in association with Ecosol GIS.

QUALIFICATIONS

Nelson Mandela Metropolitan University (2011)

- MSc Botany (Estuaries): The Phenology of Macrophytes in a Temporarily Open/Closed Estuary compared with a Permanently Open Estuary, South Africa.

University of Cape Town – Bachelor of Arts Degree (1997)

- Major Subject - Environmental & Geographical Sciences
- Relevant Subjects - Integrated Environmental Management (IEM), Environmental Impact Assessment (EIA), Conflict Management, Ecological Issues in Africa, Geo-Science, Statistics, Research Methodologies and Report Writing.

Cape Technikon – National Horticultural Diploma (1994)

- Relevant Subjects - IEM, EIA, Environmental Studies, Soil Science, Botany, Plant Identification and Landscape Design, Soil Science, Horticultural Science, Propagation and Re-vegetation Practices.

Additional Courses

- Estuary Management Course (2009) - Nelson Mandela Metropolitan University.
- Landscape Function Analysis (2005) – Potchefstroom University.
- Rehabilitation Course (2004) – Rhodes University (Prof R Lubke).
- Environmental Impact Assessment (2003) – Coastal & Environmental Services, Rhodes University.
- Class 4 Commercial Diver (2002). University of Cape Town.

PROFESSIONAL EXPERIENCE

Independent Biodiversity Services Professional: Integrating Biodiversity and Planning (2011 -2015)
Botanical, Wetland, Riparian and Estuarine Surveys, Basic Ecological Assessments, Basic GIS Mapping
Projects -

- North West Province Biodiversity Sector Plan (BSP). BSP handbook for the Department of Rural, Environment and Agricultural Development (Contracted by: ECOSOL GIS) (Current).
- Waterberg District Bioregional Plan. Limpopo Province. Department of Economic Development and Environmental Affairs (Contracted by: ECOSOL GIS) (Current).
- Advisor to RESILIM/AWARD - Integrating Biodiversity into Municipal Planning Documents in the Limpopo Catchment of South Africa and Mozambique. (Contracted by: RESILIM/AWARD – USAID Funded Project) (Current).
- Umgcabo Farm Vegetation and Aquatic Assessment. Rapid Environmental Risk Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (June – July 2015).
- Gafney Farm Vegetation and Aquatic Assessment: Sensitive Areas Mapping. Rapid Environmental Risk Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (June – July 2015).
- Aquatic Assessment. Citrus Cultivation of Farm Hitgeist. Sundays River Valley Municipality. Instomi Citrus Cultivation. (Contracted by: Engineering Advise and Services) (Current).
- Aquatic Assessment and Water Use License Application. Sundays River Valley Municipality. Instomi Citrus Cultivation. (Contracted by: Public Process Consultants) (Ongoing).
- Ecological Assessment: Citrus Cultivation Scheepers Vlakte Farm. Sundays River Valley Municipality. (Contracted by: I.W. Terblanche and Associates) (Current).
- Buffelspruit Nature Reserve Ecological Assessment: Lodge Development, Maletswai Local Municipality, Eastern Cape (Contracted by: NS Environmental Consulting) (Current).
- Municipal review of the socio-ecological content of spatial and non-spatial planning documents in the Limpopo Catchment. (Contracted by: RESILIM/AWARD – USAID Funded Project) (October 2014 – March 2015).

- Wetland Aquatic Assessment. Rosedale Water Works. Mthatha. (Contracted by: Scherman Colloty and Associates) (October 2014).
- Ecological Assessment: Loerie Heights Mixed Use Development, Buffalo City Metropolitan Municipality, Eastern Cape (Contracted by USK Consulting Engineers) (July - October 2014).
- Aquatic Assessment. Sabelele Road Upgrade, Cofimvaba, Eastern Cape. (Contracted by: SRK Consultants) (August – September 2014).
- Specialist Review: Construction activities within buffers recommended in the Sunny South Housing Development, Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (August 2014).
- Wetland Survey and Assessment. Gonubie. Buffalo City Metropolitan Municipality (Contracted by: Tshani Consulting) (December 2014).
- Ecological Assessment: Citrus Cultivation Scheepers Vlakte Farm. Sundays River Valley Municipality. (Contracted by: I.W. Terblanche and Associates) (August - September 2014).
- Ecological Assessment: Thina Lodge Development, Thina Falls, Mhontlo Municipality, Eastern Cape (Contracted by: Ikamva Consulting) (September – October 2014).
- Aquatic Assessment. Summerstrand Stormwater Upgrade. Nelson Mandela Bay Metropolitan Municipality (Contracted by: Public Process Consultants) (August 2014).
- Hintsabe Ecological Assessment: Mixed Use Development, Nqgushwa Local Municipality, Eastern Cape (Contracted by: Indwe Environmental Consulting) (August 2014).
- Gonubie Ecological Assessment: Residential Development, Buffalo City Metropolitan Municipality, Eastern Cape (Contracted by: NS Environmental Consulting) (Current).
- Mkuze Wetland Survey and Water Use License Application (Contracted by: Scherman Colloty and Associates) (April - September 2014).
- Specialist Botanical Assessment: Vegetation and Floristics. Thornhill Bulk Water Supply Scheme, Greater Mthatha Area, Eastern Cape (Contracted by: Gibb Africa) (Current).
- Ecological Assessment: Cofimvaba Mixed Use Human Settlement. Cofimvaba, Intsika Yethu Local Municipality, Eastern Cape. (Contracted by USK Consulting) (February 2014).
- R72 Main Road Biodiversity Assessment. Ndlambe and Ngqushwa local municipalities, Eastern Cape (Contracted by: Scherman Colloty and Associates) (January – March 2014).
- Specialist Botanical Assessment: Vegetation and Floristics. Rosedale Water Treatment Works and Associated Pipeline, Mthatha, Eastern Cape (Contracted by: Gibb Africa) (Current).
- Specialist Ecologist and Wetland Assessment. Coega Tankatara Road Upgrade. Coega Industrial development Zone. Nelson Mandela Bay Municipality. Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (2014).
- Msenge Emoyeni Wind Farm Water Use Licensing Application, Bedford (Phase II) – Report Compilation in collaboration with Dr Patsy Scherman (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- Mvoti – Mzimkulu Water Management Area (WMA 12) – Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- Inkomati Water Management Area– Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- R72 Main Road Biodiversity Assessment. Ndlambe and Ngqushwa local municipalities, Eastern Cape (Contracted by: Scherman Colloty and Associates) (October 2013).
- Swaziland Scoping Study. Biodiversity Data and Mapping Report (Contracted by: Scherman Colloty and Associates) (October 2013).
- Ingquza Wetland Study. Eastern Cape (Contracted by: Scherman Colloty and Associates for AURECON) (September 2013).
- Specialist Ecologist and Wetland Assessment. Proposed Residential Development within 100 m of the High-Water Mark, Kariega Estuary, Kenton-On-Sea. Ndlambe Municipality (Contracted by Conservation Support Services). (July – September 2013).
- Proposed Dedisa – Grassridge 132 kV Powerline. Protected Species Permit Application - Specialist Botanical Survey. (Contracted by: Scherman Colloty and Associates). (Feb – July 2013).

- Proposed Dedisa – Grassridge 132 kV Powerline Environmental Management Programme and Specialist Botanical Survey. (Contracted by: Scherman Colloty and Associates). (Feb – July 2013).
- Specialist Botanical and Vegetation Assessment. Proposed Upgrade of Storm water Infrastructure. Addo, Sundays River Valley Municipality, Eastern Cape. (Contracted by: Scherman Colloty and Associates). (June – July 2013).
- Specialist Wetland Study. Proposed Port Alfred Central Well Fields. Ndlambe Municipality, Eastern Cape (Contracted by Coastal and Environmental Services) (June 2013).
- Specialist Ecologist Assessment. Proposed Residential Development within 100 m of the High-Water Mark, Bushmans Estuary, Bushmans Mouth, Kenton-On-Sea. Ndlambe Municipality (Contracted by Conservation Support Services). (March – May 2013).
- Specialist Ecologist and Wetland Assessment. Proposed Access Road and Culvert Crossing over the Salt Vlei Wetland, Port Alfred. Ndlambe Municipality (Contracted by Conservation Support Services). (January – April 2013)
- Specialist Ecologist and Wetland Assessment. Proposed Slipway on the Mthatha River, Mthatha. King Sabata Dalinyendebo Municipality (Contracted by Conservation Support Services) (February – April 2013).
- Specialist Ecological and Wetland Study for the proposed Sunny South Housing Development, Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (May 2013).
- Specialist Botanical Report for the Kwanobuhle Housing Development, Port Elizabeth, Nelson Mandela Bay Municipality (Contracted by: Scherman Colloty and Associates) (May 2013).
- Swanepoel Kraals Wetland Study. (Contracted by: Scherman Colloty and Associates) (April 2013).
- Watercourse Delineation Study for the formalization of the Mdantsane Townships. East London. Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Scherman Colloty and Associates) (March 2013).
- Letaba Catchment Reserve – Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (October 2012 – June 2013).
- Aquaculture Scoping Study for South Africa Environmental Risk Analysis of current species farmed and associated farming methods in South Africa (Contracted by: Enviro-Fish Africa, Department of Ichthyology and Fisheries Science, Rhodes University) (2012).
- Addo Elephant National Park Mainstreaming Biodiversity Project: Ndlambe, Sundays River Valley, Blue Crane Route and Ikwezi Municipalities, Eastern Cape (Contracted by: South African National Park Parks, French GEF funded project) – Biodiversity and Planning Advisor, capacity building at the local and provincial level on the uptake of biodiversity information, production of user friendly products (four handbooks, four posters, a mapbook and DVD), managing the design component of user friendly products. The production of four Biodiversity Sector Plans (main author) (July 2011 – December 2012).
- Eden District Municipality Coastal Management Programme – Assistance with report compilation: Sensitive environments, legislative review, and management action plans (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Ndlambe Wetland Delineation Study – Present Ecological State Assessment and GIS Mapping (Contracted by: Coastal and Environmental Services) (2012).
- Amakhala Emoyeni Wind Farm Water Use Licensing Application (Phase I), Bedford – Assistance with report compilation (Contracted by: Scherman Colloty and Associates) (2012).
- Tsitsikamma Wind Farm Water Use Licensing Application, Kouga Local Municipality – Assistance with report compilation, including an Integrated Water and Waste Management Plan. Technical assistance with wetlands and wetland GIS mapping, including Wetland Delineation and Sensitivity Assessment Report (Contracted by: Scherman Colloty and Associates). (2012).
- Tombo Access Roads: Water Use Licensing Application, Port St Johns Local Municipality – Assistance with report compilation (Contracted by: Scherman Colloty and Associates) (2012).
- Mthatha Corana Bridge Crossings: Water Use Licensing Application, King Sabata Dalinyendebo Municipality, Eastern Cape - Assistance with report compilation (Contracted by: Scherman Colloty and Associates). (2012).

- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project EC1: Schoemakerskop (Sardinia Bay) Marine Protected Area to Cape Recife, Eastern Cape, Nelson Mandela Bay Municipality. Including Environmental Management Plan.Report Compilation in collaboration with Aquaculture Specialist Prof P. Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project EC2: Hamburg to East London Harbour, Eastern Cape. Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P. Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area EC3: Chintsa to Mazeppa Bay, Eastern Cape Great Kei Municipality. Including Environmental Management Plan.Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P. Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area EC3: Chintsa to Mazeppa Bay, Eastern Cape Great Kei Municipality. Including Environmental Management Plan.Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P. Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area NC1: Boegoeberg Noord to Beach North of North Point, Richtersveld Local Municipality, Northern Cape. Including Environmental Management Plan.Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area NC4: Skulpfontein to Two Small Rocks 200m From Shore, Kamiesberg Local Municipality, Northern Cape Including Environmental Management Plan.Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P. Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Ecological Risk Assessment. Proposed Aquaculture Development: The Development of a Pilot Land-Based Dusky Kob (Argyrosomus japonicus) Mariculture Facility at Hamburg, Ngqushwa Municipality, Eastern Cape. Including Environmental Management Plan. Report Compilation in collaboration with Aquaculture Specialist Dr T. Shipton (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Basic Assessment Report. Proposed Trout Aquaculture Facility, Reedsdell Farm, north of Barkley East, Senqu Local Municipality, Eastern Cape. Including Environmental Management Plan (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).

Addo Elephant National Park Biodiversity Mainstreaming Project Global Environmental Facility Funded project (2011-2012)

- Duties: Main author of four biodiversity sector plan handbooks for 4 local municipalities (Ndlambe, Ikwezi, Sundays River Valley, Blue Crane Route), Production of user friendly products and input into the design process, Leading local municipal capacity building workshops, Assisting with incorporating biodiversity into IDP and SDF documents.

Biodiversity Liaison Officer for South African National Parks, Global Environmental Facility Funded project (2007 – 2010) – Garden Route Initiative

- Duties – Mainstreaming biodiversity into land use planning and decision making through government stakeholder workshops, main author of two biodiversity sector plan handbooks for 5 local municipalities, capacity building at the local and provincial level on the uptake of biodiversity information, the review of municipal Integrated Development Plans and Spatial
- Development Frameworks, the review of biodiversity policy documents e.g. biodiversity offset guidelines and rural land use guidelines developed by the Department of Environmental Affairs and Development Planning.

- Vromans, D.C., Maree, K.S., Holness, S., Job, N. and Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the George, Knysna and Bitou Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Garden Route Initiative. South African National Parks. Knysna. ISBN 978-0-9869776-1-9.
- Vromans, D.C., Maree, K.S., Holness, S., Job, N. and Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the Southern Regions of the Kouga and Koukamma Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Garden Route Initiative. South African National Parks. Knysna. ISBN 978-0-9869776-2-6.

Environmental Consultant for 'Coastal and Environmental Services' (May 2003 – December 2006)

- Duties – Quotation and Proposal Compilation, Report Writing, Environmental Impact Assessment and Scoping Studies/Reports, Basic Assessments, Botanical Sampling, Vegetation Surveys and Assessments & Herbarium Work (Plant Identification), Sensitivity Assessments, Rehabilitation Specifications, Environmental Management Plans. Environmental Control Officer. Project Management.

Projects –

- Environmental Control Officer – Environmental Auditing Reports for the proposed "Upgrade of Kenton-on-Sea/Bushmansrivermouth - Bulk Water Supply". Prepared for the Albany Coast Water Board, Eastern Cape (2005).
- The proposed establishment of an 'Eco-Residential' Development at Seafield (Kleinemonde) in the Eastern Cape: Environmental Scoping Report (2006).
- The proposed Rosehill Mixed Use Development at Port Alfred: Environmental Impact Assessment (2006).
- The proposed Trailees Wetland Access Road at Port Alfred: Environmental Scoping Report (2006).
- Vegetation Survey, River Sands, Ndlambe Local Municipality (2006)
- Cola Beach Guide Plan Amendment: Vegetation Survey, Knysna Local Municipality (2006)
- Upgrade and extension of the Mpekweni Resort, Ndlambe Local Municipality (2006)
- KZN Vegetation Mapping, Durban, Kwazulu Natal (2006)
- ACSA EL Airport Upgrade: Basic Assessment Report, Buffalo City Municipality, Eastern Cape (2006)
- CSL Vegetation Monitoring, Proposed Mining Project, Mozambique (2006)
- Vegetation Survey and Environmental Scoping Report: Proposed Eco-Lodge Development and Nature Reserve, as an Extension to Lalibela Game Reserve, Eastern Cape (2006)
- Vegetation Survey and Sensitivity Assessment, Proposed Mixed Use Development, Gonubie, Buffalo City Municipality (2006).
- Environmental Scoping study: Proposed Shopping Development, Beacon Bay, Buffalo City Municipality (2006).
- Lima Massacre Heritage Site, Environmental Scoping Study and Vegetation Survey, Queenstown (2006).
- Review and editing of several Scoping Studies, EIAs and Vegetation Surveys (2005 – 2006).
- The proposed upgrading and construction of two tented campsites with jetties along the Kariega River and the reparation of the watercourse bank, Kenton-On-Sea, Eastern Cape. Environmental Scoping Report. Prepared for Foxlaw investments - Private Developer (2004 – 2005).
- Preparation of a Construction and Operational Environmental Management Plan for the proposed "Upgrade of Kenton-on-Sea/Bushmansrivermouth - Bulk Water Supply". Prepared for the Albany Coast Water Board, Eastern Cape (2005).
- Upgrade of Main Road 435, Coega Industrial Development Zone, Nelson Mandela Metropolitan Municipality, Eastern Cape. Includes Vegetation Survey (2005).
- Environmental Control Officer – Coega Port Rehabilitation (2005).

- The proposed construction of an 'eco-lodge camp' on a ridge located on Salem farm # 498 above the Bushmans River, Eastern Cape – Environmental Scoping Report. Prepared for Mr J Kritzinger (2003 – 2004).
- The proposed construction of a lodge resort within the Ntlangano Community Reserve adjacent to the Tsitsa Falls and Chipoka Mineral Sands, Salima Bay, Malawi: Volume 1: Scoping and Terms of Reference. Compiled this report. Allied Procurement Agency, Lilongwe, Malawi (2003).
- Establishment of a Community Nature Reserve on the south bank of the Umtamvuna River, Eastern Cape - Environmental Scoping Report. Preparing for PondoCrop, Port Edward. (2003 – 2004).
- The proposed establishment of a Marine and Wildlife Rehabilitation Centre, St Francis Bay, Eastern Cape: Environmental Scoping Report. Prepared for Ajubatis Marine and Wildlife Rescue. (2004 – 2005).
- Construction of a 66kv Power Line, 22Kv Feeder Bays and Substation St Francis Bay, Eastern Cape: Environmental Scoping Report. Prepared for Eskom, Southern Region, East London (2004 – 2005).
- Long term Rehabilitation Plan for the Port of Ngqura. Prepared for the National Ports Authority (NPA), Coega. Port Elizabeth (2004 – 2005).
- Construction of the proposed refurbishment and rebuilding requirements for the Melkhout/Gamtoos 22kvFeeder Powerline and Gamtoos/Melkhout 22kv Feeder Powerline, Eastern Cape. Environmental Scoping Report. Prepared for Eskom, Southern Region, East London (2004 - 2005).
- The assessment of an Existing Environmental Scoping Study with additional adaptation to the previously proposed layout design for: The proposed establishment of an 'Eco-Residential' development adjacent to the coast and including pristine sand dunes at Aston Bay, Portion 2, Eastern Cape. Prepared for Glenny Buchner Trust (Private Developer) (2004 – 2005)
- The proposed establishment of an 'Eco-Residential' Development at Aston Bay on Farm Swanlake in the Eastern Cape Environmental Scoping Report. Prepared for Glenny Buchner Trust - Private Developer (2004 – 2005).
- Letaba Water Quality Reserve: Specialist Trainee – Water Quality Assessment of the Letaba River Catchment - Water quality sampling, statistics and report writing (Dr Scherman & Ms Vromans). Preparing for Department of Water Affairs and Forestry (2003 – 2005).
- Luanda Dredging Pre-feasibility Study: Assistance in writing part of the dredging report for this study. Prepared for PRDW, Cape Town (2003).
- Construction of a 66kv Power Line Linking Fort Beaufort and Adelaide, Eastern Cape: Scoping Report. Prepared for Eskom, Southern Region, East London (2003).
- Corridor Sands Chongoene Export Facility EIA, Volume 2: Specialist Reports: Vegetation & Floristics. Assisted in writing and compiling this specialist report. Prepared for 'Corridor Sands Limitada'. (Prof Lubke & Vromans) (2003).
- N2 Toll Road Bridges EMP: Vegetation & Sensitivity Analysis. Assisted in writing and compiling the specialist report. (Prof Lubke and Vromans) (2003).

**** Note that all scoping studies include a vegetation assessment and project management.***

Environmental Scientist: Projects Assistant at Enviro-fish Africa PTY (LTD) (Jan – April 2003)

- Duties – Preparation of Tender Proposals, Information Sourcing and Gathering, Data Capture (Excel); Report Writing: Assisted with the compilation of the 'Nelson Mandela Municipal
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- Metro: Coastal Management Plan'. General Administration and Co-ordination (New Company established).

Environmental Scientist: Projects Management and Assistant at 'Anchor Environmental' PTY (LTD) (2000-2002)

- Duties – Preparation of Tender Proposals, Project Management of Tuna Longline, Hake Longline and West Coast Rock Lobster Observer Programmes, Information Sourcing and Presentation (Powerpoint), Data Capture (Excel & Access); Report Writing (MSWord); Financial Administration (Pastel 5.2), General Administration, Project Co-ordination & Logistics,

Scientific Sampling (SASS), Estuarine Sampling (Vertebrate & Invertebrate), Coastal Zone (Off-Shore & On-Shore) Sampling (Vertebrate & Invertebrate), Class 4 Scientific Diver.

REFERENCES

1. South African National Parks, Park Planning and Implementation: Conservation Services, Port Elizabeth - Dr Mike Knight (Tel: 041 508 5411; Email: M.Knight@nmmu.ac.za).
2. Coastal and Environmental Services, Grahamstown and East London (Dr Alan Carter, Prof Roy Lubke) www.cesnet.co.za – Dr Alan Carter (Tel: 043 742 3302; Email: a.carter@cesnet.co.za).