Ecological and Aquatic Impact Statement:

IZIDULI EMOYENI WIND FARM, EASTERN CAPE PROVINCE

Prepared for:

Savannah Environmental (Pty) Ltd

Prepared by:

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October 2017

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 biodiversity assessments in mind.

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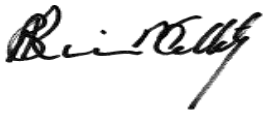
Expertise / **Field of Study**: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs



Signed: …… Date:26 October 2017……

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1 - Introduction

Scherman Colloty & Associates (SC&A) was appointed by Savannah Environmental (Pty) Ltd to conduct an ecological and aquatic impact assessment of the watercourse crossings and access roads for the proposed Iziduli Emoyeni Wind Farm near Cookhouse.

This also included delineating any natural waterbodies remaining on the properties in question, as well as the potential consequences of the alignment on the surrounding watercourses. This was based on information collected during a site visit in June 2014, while adhering to the assessment criteria contained in the DWAF 2005 delineation manual and the National Wetland Classification System found in the Appendix 1. Several additional site visits for other projects and Water Use License Applications within in the region have also been conducted since 2014 by the author, with several of these visits occurring in the summer rainfall period. A specific site visit was thus not needed as the site has shown no dramatic change in the past 3 years, while no changes were made to the original layout assessed

This report thus provides the relevant delineations and Present Ecological State status assessment of the observed waterbodies together with an analysis of the potential impact of the proposed watercourse crossings on the aquatic environment. This report was also compiled to assess the impacts of the development within/ within 32 metres of water course in terms of NEMA as well as assess the potential impacts on the terrestrial environment within these areas.

1.1 Scope

Terrestrial Ecology

A desktop and literature review of the area under investigation was conducted to collate as much information as possible prior to any detailed fieldwork. The purpose of the desktop assessment was to rank relevant areas according to their ecological sensitivity and to identify areas of least ecological risk.

Other relevant literature for e.g. South African Biodiversity Information Facility (SABIF, which includes the PRECIS plant distribution database), South African Bird & Herpetological Atlas Projects, relevant Red Data books, provincial ordinances and all systematic bioregional / conservation plans, were also be consulted. Particular attention was paid to the CBA 1 & 2 areas shown in the Eastern Cape Biodiversity Conservation Plan (ECBCP).

Fieldwork was limited to visual sightings by means of transect walks and plot-based sampling, while particular attention will also be paid to the occurrence Red Data species or Protected species.

Vegetation units was sampled by means of the following techniques as per each site:

- Data collection will be plot-based and in the form of vegetation samples within selected reference areas to categorise the various vegetation units.
- Results from the data analysis will provide a description of the dominant and typical species occurring on the site(s), and will include:
    - Threatened, endemic or rare species, with an indication of the relative functionality and conservation importance of the specific community in the area under investigation
    - Invasive or exotic species present in the area

- The functional and conservation importance of all vegetation communities in the area of investigation

Additional information of faunal community residing on the area of investigation was sourced from distributional data/records (both recent and historical), relevant literature, the private sector and other atlas projects.

Habitat areas (based on the species compositions of the vegetation analysis, topography and soil study) were ranked into high, medium or low classes in terms of their significance based on the Ecological Sensitivity and Conservation Importance. A sensitivity and habitat map (including buffer zones if applicable) will then be produced based on the above information, if possible or relevant.

Recommendations and mitigation measures, where required, were included in the report with proposed buffers

Aquatic and riparian vegetation assessment (inclusive of any wetlands)

- An aquatic biodiversity assessment of the study area, which included watercourses, riparian zones and wetlands. This covered the study area and a 500m development buffer based on a site visit, while drawing on any other past assessment or investigations.
- Maps depicting demarcated aquatic zones delineated to a scale of 1:10 000, following the methodology described by the DWS, together with a classification of delineated areas, according to the methods contained in the Level 1 WET-Health methodology and the National Wetland Classification System (2013). This would then distinguish riverine from wetland and natural versus man-made habitats.
- Identified and rated potential environmental impacts in terms of an acceptable risk assessment against the aquatic sensitivity of the region, with regard drivers and process related to flow regime, water quality, aquatic habitat and biota.
- Identified mitigation for negative and positive impacts, while proposing suitable buffers if required.
- Recommended specific actions that could enhance any aquatic functioning in the areas, allowing the potential for a positive contribution by the project.
- Supplied the client with geo-referenced GIS shapefiles of the waterbodies as per the required specifications supplied.
- The report provided follows the format prescribed by the revised National Water Act Regulation, 24 March 2017 (Section 6 – Wetland and delineation report format)
- Time and cost was also included to provide a separate Risk Assessment Matrix in the required DWS format, for them to determine if a General Authorisation (GA) versus a full Water License for any Section 21 c & i activities would be acceptable. This is if no other regulated activities such as water abstraction or storage exceed their respective GA volumes per farm/erf per annum (See Appendix 2).
- The functional and conservation importance of all vegetation communities in the area of investigation ranked into high, medium or low classes in terms of their significance based on the Ecological Sensitivity and Conservation Importance. A sensitivity and habitat map (including buffer zones if applicable) was produced based on the above information if required.

The above detail could be required for inclusion in the respective water use license application / GA documents submitted to DWS should these be required

2 - Project description

The proposed Iziduli Emoyeni Wind Farm is located near Cookhouse in the Eastern Cape Province, within the Blue Crane Route Local Municipality. The project will require new roads, while certain will existing roads will require upgrading, i.e. widening from 6-9 m (Figure 1).

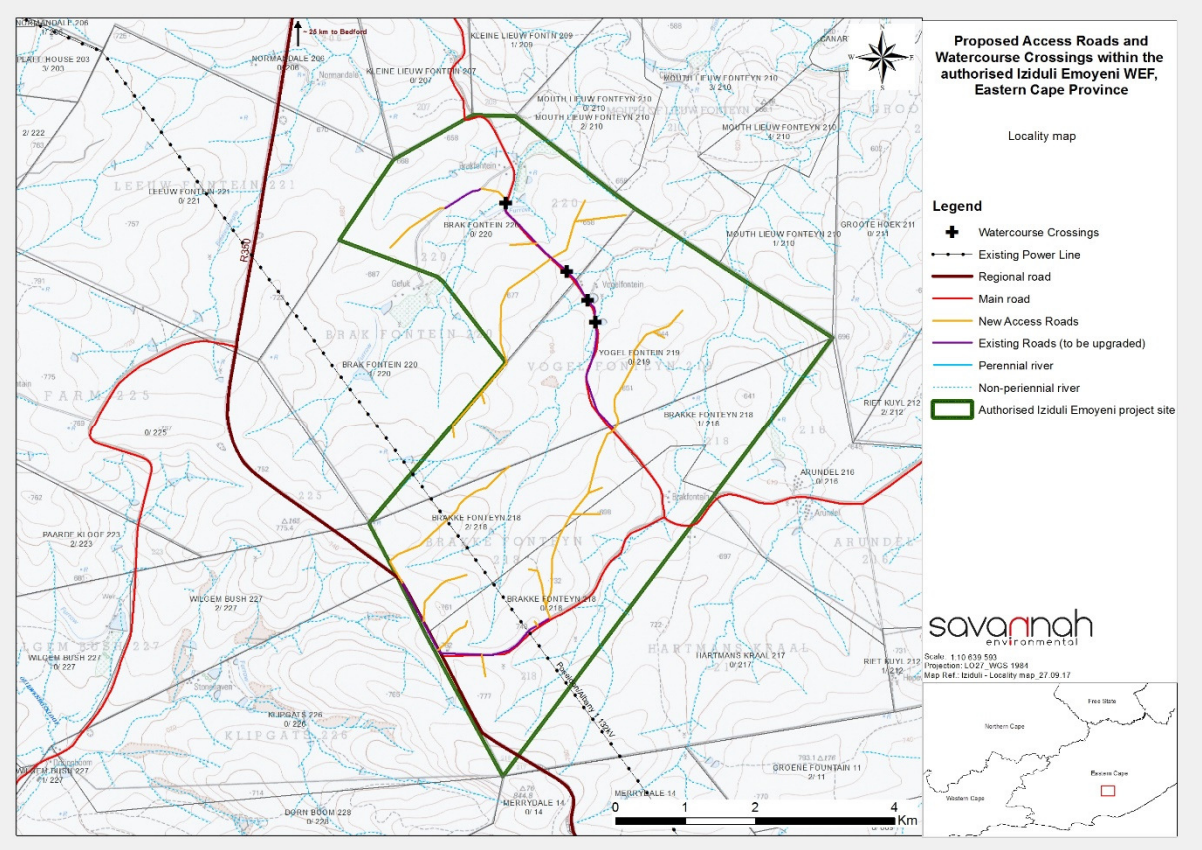

Figure 1: Study area locality with proposed activities associated with road upgrade

3 - Assumptions and limitations

In order to obtain a comprehensive understanding of the dynamics of both the flora and fauna of both the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are mostly based on instantaneous sampling. This site was assessed after a period of spring rainfall, while the adjacent farms have been visited during other years and seasons. This the author of this report as an understanding of the region and the aquatic environment.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

For the purposes of this report it is assumed that any existing roads and tracks within the facility will be upgraded, while the new roads (Figure 3). A further assumption is that water will be sourced from a

licensed resource and not illegally abstracted from any surrounding water courses, particularly if dust suppression is required.

4 – Study area description

4.1 Generalised vegetation description

The study area is located within a region that contains several of the world's biomes and more particularly the Nama-Karoo, Grassland and Thicket Biomes as defined by Mucina & Rutherford (2006).

Plate 1: A photograph taken at the project site, indicating the typical state and uniformity of the grassland vegetation found within the region near Bedford.

On a broad national scale, the study area is covered by two main vegetation types, defined by Mucina & Rutherford (2006) (Figure 2). These are as follows:

1. Bedford Dry Grassland

This vegetation type was the dominate vegetation type within the northern portion of the study area (Figure 2), and is commonly found south of the Winterberg mountain range (i.e. mountain areas behind Somerset East & Bedford towns). This vegetation unit is found mostly on the undulating plains of the Great Fish River valley (Plate 1). Grasses characterise this unit, interspersed with *Acacia karroo* woodland vegetation, usually associated with drainage lines / water courses. According to Mucina & Rutherford (2006) this vegetation type is Least Threatened.

Dominant species observed during the survey included:

Vachellia karroo
Aloe striata
Aloe ferox

Aristida congesta
Atriplex spp.
Commelina africana
Crassula expanse
Cymbopogon caesius
Cynodo dactylon
Digitaria argyropata
Eragrostis obtuse
Erogrostis curvula
Euryops anthemoides
Hermaniia depressa
Heteropogon contortus
Microchloa caffra
Pelargonium althaeifolia
Pentzia globosa
Tephrosia capensis
Themeda triandra
Tragus loeleriodes

2. Great Fish Thicket

As the name implies this vegetation unit occurs within river valleys associated with the Great and Little Fish River catchments, as far north as Cradock. These are usually steep sided slopes colonised by thicket species, were woody trees and shrubs are the most prevalent species (Plate 2). The conservation status of this unit was considered Least Threatened (Mucina & Rutherford, 2006) due to the large areas under conservation. This was the second most dominant vegetation type within the study area (Figure 2).

Species observed during the survey included:

Vachellia karroo
Aloe ferox
Aristida congesta
Carissa bisponsa subsp. bispinosa
Chrysanthemoides monlifera
Crassula obovata
Cussonia spictata
Erogrostis curvula
Euclea undulata
Felicia filifolia
Olea europaea
Plumbago auriclata

Plate 2: A view of a small area of thicket within a river valley in the south western portion of the project site.

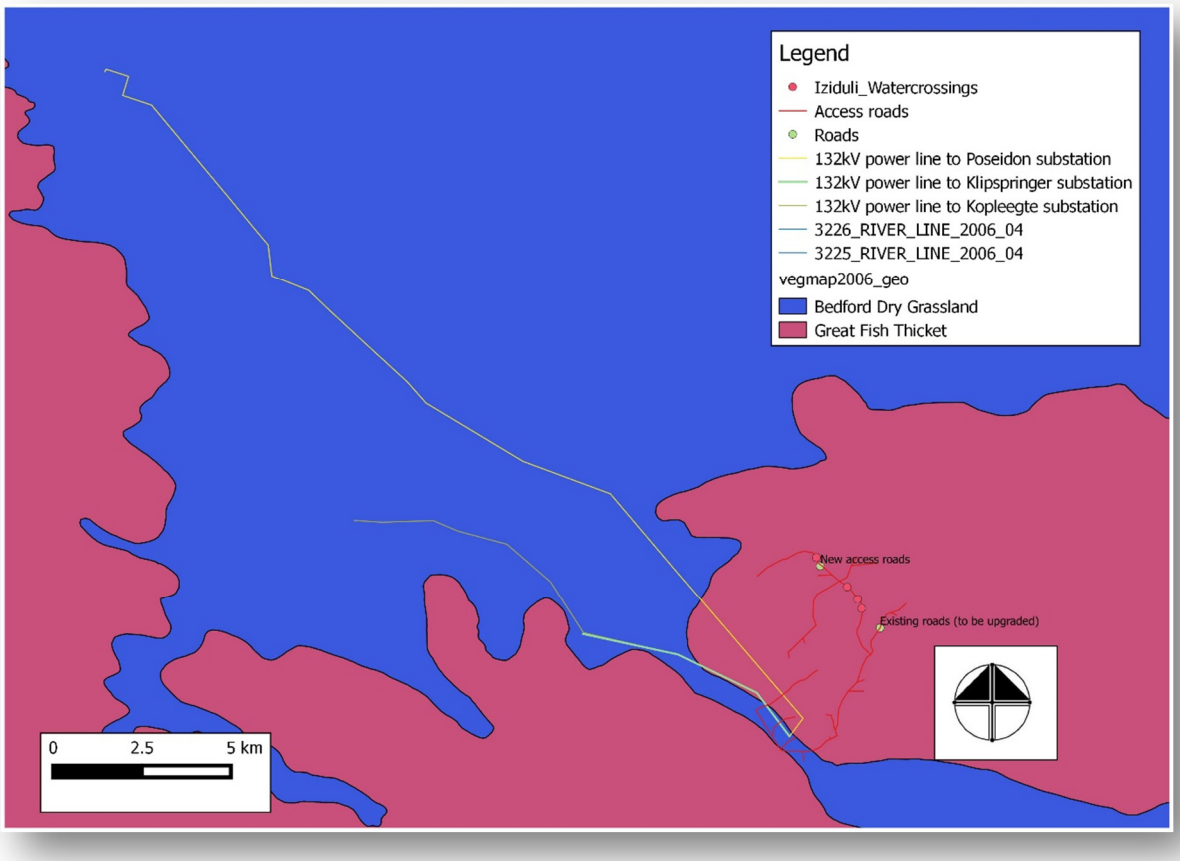

Figure 1: The vegetation units as shown in the Mucina & Rutherford 2006 Vegmap data

The National Environmental Management, Biodiversity Act, promulgated on 9 December 2011 (NEM:BA (Act No 10 of 2004) lists 225 threatened ecosystems based on vegetation type (Vegmap, 2006 as amended). Should a vegetation type or ecosystem be listed, actions in terms of NEM:BA are triggered.

None of these are listed in this Act, however should they have been listed, then the Act requires a minimum of a Basic Assessment for any development, which would result in a loss of any area greater than 300m^2. It is also required that when determining the significance of impact on biodiversity in an EA process, listed as either a Critically endangered or Endangered ecosystem, the impact of the loss of natural habitat should be ranked as **highly significant.**

4.2 Vegetation importance and plant Species of Special concern

Any plant Species of Special Concern were actively searched for and these species are listed in Table 1; together with their respective conservation status and distribution in the site. The status of these plants is dependent on their respective listing in the Provincial Nature Conservation Ordinance (PNCO) of 1974, the National Forest Act (Act No. 84 of 1998) or by the International Union for Conservation of Nature (Red data list) or IUCN.

These species of special concern will require permits from the relevant provincial departments, if any individuals are to be removed, translocated or trimmed according to the relevant legislation including the National Forestry Act (Department of Agriculture, Fisheries and Forestry) and the Provincial Nature Conservation Ordinance (Department of Economic Development, Environmental Affairs and Tourism – Permit Administration).

The majority of the species were observed in the thicket vegetation units and isolate specimens within the grassland units. All of the species are easily translocate or can be used on the rehabilitation within the disturbed areas after construction.

Table 1: Protected plant species observed in the study area

Botanical Name	Family	Status	Regional Distribution/ Endemism	Distribution within the site
Aloe striata	Asphodelaceae	PNCO	EC endemic, widespread	Widespread, within the area
Carpobrotus edulis	Mesembryanthemaceae	PNCO	EC, WC, Widespread	Isolated in small areas between Poseidon and the WEF site
Crassula sp	Crassulaceae	PNCO	EC, WC, KZN	Isolated specimens usually associated with rocky cliffs existing road cuttings
Delosperma sp.	Mesembryanthemaceae	PNCO	Unconfirmed	Isolated in small areas between Poseidon and the WEF site
Sideroxylon inerme	Sapotaceae	NFA	EC, WC	Scattered in thicket clumps in river valleys

4.3 Terrestrial fauna

As per the Terms of Reference, the faunal assessment was largely desktop, based on known distribution records, past assessments and expertise, supported by field observations. Table 2 lists the relevant faunal groups, their likelihood of occurring within the study area, together

with their associated habitat and conservation status. The majority of species listed as well as observed with a conservation status were found in association with rivers, rocky outcrops and the thicket / grassland vegetation types. The majority of these species were listed by the Provincial Nature Conservation Ordinance (PNCO).

The survey occurred during an extend period of high winds, rainfall and cool conditions. This limited to the siting of any species particularly the reptiles and amphibians. This is opposed to previous survey conducted in the region during warm conditions, with an abundance of snakes being observed in the area. These included tortoises (Plate 3), Puff adders, Cape cobras, Rinkhals and Night adders.

Table 2: List of species recorded or likely to occur in the general study area, together with the conservation status.

Key =

x: Y = Observed; U = Unconfirmed, but within the distribution range.

xx: 1. Valley Thicket; 2. Grasslands; 3. Thicket / Karroid; 4. Rocky Outcrops; 5.Transformed/Disturbed; 6 Rivers

Taxon	Common Name	RDB/SSC	Presence [x]	Habitat [xx]
Amphibians				
Amietophrynus pardalis	Eastern Leopard Toad	PNCO, IUCN LC	U	3,4,5,6
Amietophrynus rangeri	Raucous Toad	PNCO, IUCN LC	Y	3,4,5,6
Breviceps adspersus pentheri	Penther's Rain Frog	PNCO, IUCN LC	U	3,6
Cacosternum boettgeri	Common caco	PNCO, IUCN LC	Y	3,5,6
Cacosternum nanum	Bronze Caco	PNCO, IUCN LC	U	3,5,6
Hyperolius marmoratus	Painted Reed Frog	PNCO, IUCN LC	U	1,5,6
Kassina senegalensis	Bubbling Kassina	PNCO, IUCN LC	Y	3,5,6
Semnodactylus wealii	Rattling Frog	PNCO, IUCN LC	U	2,3,4,6
Strongylopus fasciatus	Striped Stream Frog	PNCO, IUCN LC	U	6
Strongylopus grayii	Clicking Stream Frog	PNCO, IUCN LC	U	6
Tomopterna delalandii	Cape Sand Frog	PNCO, IUCN LC	U	3,6
Vandijkophrynus angusticeps	Cape sand Toad	PNCO, IUCN LC	U	3,5,6
Xenopus laevis	Common Platanna	PNCO, IUCN LC	Y	Obligate wetland / riverine species, 6
Reptiles				
Acontias gracilicauda	Thin tailed legless skink	PNCO, IUCN LC	U	1,5,
Acontias meleagris orientalis	Eastern legless skink	PNCO, IUCNLC	U	1,2,3
Agama atra	Southern rock agama	PNCO, IUCN LC	Y	4
Aspidelapse lubricus	Cape coral snake	PNCO, IUCN LC	U	3,4
Bitis arientans	Puff adder	PNCO, IUCN LC	Y	1,3,4,5,6
Bradypodion ventrale	Southern Dwarf Chameleon	PNCO, IUCN LC, CITIES 2	U	1,2,6
Causus rhombeatus	Night adder	PNCO, IUCN LC	U	6
Chersina angulata	Angulate tortoise	PNCO, IUCN LC, CITIES 2	Y	2, 3,5
Cordylus cordylus	Cape girdled lizard	PNCO, IUCN LC, CITIES 2	U	2,3,4,
Cordylus tasmani	Tasman's girdled lizard	CITES 2 ,PNCO, IUCN VU	U	1,2,3,4
Crotaphopeltis hotamboeia	Herald snake	PNCO, IUCN LC	U	3,4,6
Dasypeltis scabra	Rhombic egg eater	PNCO, IUCN LC	U	1,2,3,4,6
Dispholidus typus	Boomslang	PNCO, IUCN LC	U	1,2,4,6
Duberria lutrix	Slug eater	PNCO, IUCN LC	U	1,3,6
Gerrhosaurus flavigularis	Yellow throated plated lizard	PNCO, IUCN LC	U	3,4
Hemachatus haemachatus	Rinkhals	PNCO, IUCN LC	U	3,6
Hemidactylus mabouia	Tropical house gecko	PNCO, IUCN LC	U	2,5,6
Homopus areolatus	Parrot-beaked padloper	PNCO, IUCN LC,	U	3,4

Taxon	Common Name	RDB/SSC	Presence [x]	Habitat [xx]
		CITIES 2		
Homorolapse lacteus	Harlequin snake	PNCO, IUCN LC	U	2,3,4,6
Lamprophis aurora	Aurora house snake	PNCO, IUCN LC	U	3,4,6
Lamprophis capensis	Brown house snake	PNCO, IUCN LC	U	1,2,3,4,5,6
Lamprophis fuscus	Yellow bellied house snake	PNCO, IUCN NT	U	3,6
Lamprophis inornatus	Olive house snake	PNCO, IUCN LC	U	3,6
Leptotyphlops nigricans	Black thread snake	PNCO, IUCN LC	U	1,2,3,6
Lycodonomorphus rufulus	Brown water snake	PNCO, IUCN LC	U	6
Lycophidion capense	Cape wolf snake	PNCO, IUCN LC	U	2,3,4,5,6
Lygodactylus capensis	Cape dwarf gecko	PNCO, IUCN LC	U	1,2,3,4,5,6
Naja nivea	Cape cobra	PNCO, IUCN LC	Y	2,3,4,5,6
Nucras intertexta	Spotted Sandveld Lizard	PNCO	U	3,4
Nucras lalandii	Delalandes sandveld lizard	PNCO, IUCN LC	U	3,4
Pachydactylus maculatus	Spotted thick toed gecko	PNCO, IUCN LC	U	2,3,4,5,6
Pedioplanis pulchella	Pulchell's sand lizard	PNCO, IUCN LC	U	3,4
Pelomedusa subrufa	Marsh terrapin	PNCO, IUCN LC	U	3,5,6
Philothamnus hoplogaster	Green water snake	PNCO, IUCN LC	U	6
Philothamnus natalensis occidentalus	Natal green snake	PNCO, IUCN LC	U	1,2,3,6
Philothamnus semivariegatus	Spotted bush snake	PNCO, IUCN LC	U	1,2,6
Prosymna sundevallii	Sundevalle's shovel snout	PNCO, IUCN LC	U	3,4
Psammophis crucifer	Crossed –marked sand snake	PNCO, IUCN LC	U	3
Psammophis notostictus	Karroo whip snake	PNCO, IUCN LC	U	3,4
Psammophylax rhombeatus	Rhombic skaapsteker	PNCO, IUCN LC	Y	3,4
Pseudaspis cana	Mole snake	PNCO, IUCN LC	U	3
Pseudocordylus m. microlepidotus	Cape crag lizard	PNCO, IUCN LC	U	4
Stigmochelys pardalis	Leopard Tortoise	PNCO, IUCN LC CITIES 2	U	3,6
Tetradactylus fitzsimonsi	FitzSimon's long tailed seps	PNCO, IUCN VU	U	3,6
Tetradactylus seps	Short legged seps	PNCO, IUCN LC	U	3,6
Trachylepis capensis	Cape skink	PNCO, IUCN LC	Y	3,4,5
Trachylepis homalcephala	Red sided skink	PNCO, IUCN LC	U	3,4,5
Trachylepis varia varie	Variable skink	PNCO, IUCN LC	Y	3,4,5
Varanus albigularis	Rock Monitor	PNCO, IUCN LC CITIES 2	Y	2,3,4
Varanus niloticus	Water Monitor	PNCO, IUCN LC CITIES 2	U	3,6
Mammals				
Amblysomus corriae	Fynbos golden mole	PNCO, IUCN NT	U	1,
Amblysomus hittentotus	Hottentot Golden Mole	PNCO, IUCN DD	U	2,3
Aonyx capensis	African clawless otter	PNCO, IUCN LC	U	6
Atilax paludinosus	Marsh mongoose	PNCO, IUCN LC	U	1,2,3,6
Caracal caracal	Caracal	PNCO, IUCN LC	Y	1,2,3,4
Cercopithecus pygerythrus	Vervet monkey	PNCO, IUCN LC	Y	1,2,3,4,5,6
Chlorotalpa duthieae	Duthie's golden mole	PNCO, IUCN LC	U	3
Crocidura cyanea	Reddish-Grey Musk Shrew	PNCO, IUCN DD	U	1,2,3,
Crocidura flavescens	Greater red musk shrew	PNCO, IUCN LC	U	1,2,3,
Cryptomys hottentotus	African mole rat	PNCO, IUCN LC	Y	1,2,3,
Cynictis penicillata	Yellow mongoose	PNCO, IUCN LC	Y	2,3,5
Dendromus melanotis	Grey climbing mouse	PNCO, IUCN LC	U	1,2,3,4
Dendromus mesomelas	Brant's climbing mouse	PNCO, IUCN LC	U	1,2,3,
Felis cattus	Domestic cat	Alien	Y (on farmsteads near road)	1,2,3,4,5,6
Felis silvestris	African wild cat	PNCO, IUCN LC	U	1,2,3,4,6
Galerella pulverulenta	Cape grey mongoose	PNCO, IUCN LC	Y	1,2,3,5,6
Genetta genetta	Small spotted genet	PNCO, IUCN LC	U	1,2,3,5,6
Genetta tigrina	Large spotted genet	PNCO, IUCN LC	Y	1,2,3,5,6
Georychus capensis	Cape mole rat	PNCO, IUCN LC	Y	2,3,
Graphiurus murinus	Woodland dormouse	PNCO, IUCN LC	U	1,2,3,6

Taxon	Common Name	RDB/SSC	Presence [x]	Habitat [xx]
Graphiurus ocularis	Spectacled dormouse	PNCO, IUCN LC	U	1,2,3,6
Herpestes ichneumon	Large grey mongoose	PNCO, IUCN LC	U	1,2,3,5,6
Hystrix africaeaustralis	Cape porcupine	PNCO, IUCN LC	Y	2,3,5,6
Ictonyx striatus	Striped pole cat	PNCO, IUCN LC	U	1,2,3,6
Lepus saxatilis	Scrub hare	PNCO, IUCN LC	Y	1,2,3,5,6
Macroscelides proboscideus	Round eared elephant shrew	PNCO, IUCN LC	U	1,2,3,
Mastomys natalensis	Natal multimammate mouse	PNCO, IUCN LC	U	1,2,3,6
Mellivora capensis	Honey badger	PNCO, IUCN CITES 3 NT	U	1,2,3,4,6
Micaelamys namaquensis	Namaqua rock mouse	LC	U	3,4
Mus minutoides	Pygmy mouse	LC	U	3,
Mus musculus	House mouse	Alien	U	1,2,3,5,6
Myosorex varius	Forest Shrew	PNCO, IUCN DD	U	1,2,3,
Neoromicia capensis	Cape serotine bat	PNCO, IUCN LC	U	1,2,3,4,5,6
Nycteris thebaica	Egyptian slit faced bat	PNCO, IUCN LC	U	1,2,3,4,5,6
Orycteropus afer	Aardvark	PNCO, IUCN LC	Y	3
Otocyon megalotis	Bat eared fox	PNCO, IUCN LC	U	3
Otomys irroratus	Vlei rat	PNCO, IUCN LC	Y	6
Otomys unisulcatus	Bush vlei rat	PNCO, IUCN LC	U	1,3,6
Panthera pardus	Leopard	PNCO, IUCN LC	U	1,2,3,4,6
Papio cynocephalus ursinus	Chacma baboon	PNCO, IUCN LC	U	1,2,3,4,5,6
Philantomba monticola	Blue duiker	PNCO, IUCN CITES2 VU	U	1,2,3,
Poecilogale albinucha	African striped weasel	PNCO, IUCN VU	U	1,2,3,6
Potamochoerus larvatus	Bush pig	PNCO, IUCN LC	Y	1,2,3,6
Raphicerus campestris	Steenbok	PNCO, IUCN LC	U	1,2,3,6
Raphicerus melanotis	Grysbok	PNCO, IUCN LC	Y	1,2,3,6
Rattus rattus	House rat	PNCO, IUCN LC	U	1,2,3,4,5,6
Rhabdomys pumilio	Four striped grass mouse	PNCO, IUCN LC	Y	3,6
Saccostomus campestris	Pouched mouse	PNCO, IUCN LC	U	3,6
Suncus infinitesimus	Least dwarf shrew	PNCO, IUCN E	U	3
Sylvicapra grimmia	Common duiker	PNCO, IUCN LC	Y	1,2,3,6
Tragelaphus scriptus	Bush buck	PNCO, IUCN LC	Y	1,2,3,4
Vulpes chama	Cape Fox	PNCO, IUCN LC	U	1, 2,3,

Plate 3: Juvenile Angulate tortoise (*Chersina angulata) commonly found within the region*

Plate 4: Blue Crane (*Anthropoides paradiseus)* commonly observed within the grasslands of the study area.

4.4 Birds

According to the South African Bird Atlas Project (SABAP2), an average of 185 bird species have been recorded from the quarter degree grid cells (QDGC) that overlaps with the study area. (www.sabap2.adu.org.za). Table 3 lists birds common to the region, together with their expected habitats and respective conservation status. The table highlights the potential presence of 48 bird species, of which 32 were confirmed.

Table 3: A list of Red Data species that could occur on the study sites (according to Harrison et al., 1997; Barnes, 2000) and those observed.

Indicated: conservation status, habitat preference, whether the species was observed. Conservation status: **E** = endangered, **V** = vulnerable, **NT** = near-threatened, **P** = protected, **Ra** = raptor or owl, **B** = Listed in Appendix II of the Bonn Convention, **WA** = listed in Annexure 2 of the African-Eurasian Waterbird Agreement, RL = IUCN Red List; SA = South African Red Data Book (Barnes 2000), DEA = Threatened and Protected Species Regulations (DEA 2007).

Scientific name	Common name	Obs. on site	Conservation status	Habitat
Anthropoides paradiseus	Blue Crane	Y	**V** (RL,SA); **E** (DEA); **WA**	Grasslands
Sagittarius serpentarius	Secretarybird	Y	**V** (RL); **NT** (SA); **Ra**	Thickets & Grasslands
Neotis denhami	Denham's Bustard	Y	**V** (SA); **NT** (RL); **P** (DEA)	Grasslands
Polemaetus bellicosus	Martial Eagle	Y	**V** (SA,DEA); **NT** (RL); **Ra**	Thickets & Grasslands
Buteo rufofuscus	Jackal Buzzard	Y	**Ra**	Thickets & Grasslands
Melierax canorus	Southern Pale Chanting Goshawk	Y	**Ra**	Thickets & Grasslands
Elanus caeruleus	Black-shouldered Kite	Y	**Ra**	Thickets & Grasslands
Falco rupicolis	Rock Kestrel		**Ra**	Thickets & Grasslands
Milvus [migrans] parasitus	Yellow-billed Kite	Y	**Ra**	Thickets & Grasslands
Buteo vulpinus	Steppe Buzzard	Y	**Ra**	Thickets & Grasslands
Falco biarmicus	Lanner Falcon		**NT** (SA); **B**; **Ra**	Thickets & Grasslands
Falco peregrinus	Peregrine Falcon	Y	**V** (DEA); **NT** (SA); **B**; **Ra**	Thickets & Grasslands
Bubo africanus	Spotted Eagle-Owl		**Ra**	Thickets & Grasslands
Tyto alba	Barn Owl		**Ra**	Thickets & Grasslands
Threskiornis aethiopicus	African Sacred Ibis	Y	**B**; **WA**	wetland; cultivated
Tadorna cana	South African Shelduck		**WA**	wetland
Alopochen aegyptiaca	Egyptian Goose	Y	**WA**	wetland; cultivated
Plectropterus gambensis	Spur-winged Goose	Y	**WA**	wetland; cultivated
Anas undulate	Yellow-billed Duck	Y	**B**; **WA**	wetland
Vanellus melanopterus	Black-winged Lapwing		**NT** (SA); **WA**	Thickets & Grasslands
Vanellus coronatus	Crowned Lapwing	Y	**WA**	Thickets & Grasslands
Platalea alba	African Spoonbill		**B**; **WA**	wetland
Ciconia ciconia	White Stork	Y	**B**; **WA**	Grasslands
Circus ranivorus	African Marsh-Harrier		**V** (SA); **P** (DEA); **Ra**	wetland
Circus maurus	Black Harrier		**NT** (RL,SA); **Ra**	Thickets & Grasslands
Accipiter melanoleucus	Black Sparrowhawk		**Ra**	thicket

Scientific name	Common name	Obs. on site	Conservation status	Habitat
Anas capensis	Cape Teal		**B**; **WA**	wetland
Anas smithii	Cape Shoveler		**B**	wetland
Anas erythrorhyncha	Red-billed Teal		**B**; **WA**	wetland
Ardea melanocephala	Black-headed Heron	Y	**WA**	Grasslands
Ardea goliath	Goliath Heron	Y		wetland
Bubulcus ibis	Cattle Egret	Y	**WA**	pasture; cultivated
Ardea cinerea	Grey Heron	Y	**WA**	wetland
Campethera notata	Knysna Woodpecker		**NT** (RL,SA)	thicket
Fulica cristata	Red-knobbed Coot	Y	**WA**	wetland
Philomachus pugnax	Ruff		**WA**	wetland
Charadrius tricollaris	Three-banded Plover	Y	**WA**	wetland
Bostrychia hagedash	Hadeda Ibis	Y		pasture; cultivated
Burhinus capensis	Spotted Thick-knee	Y		Thickets & Grasslands
Caprimulgus pectoralis	Fiery-necked Nightjar	Y		thicket
Corvus albicollis	White-necked Raven	Y		all
Mirafra apiata	Cape Clapper Lark	Y		Thickets
Corvus capensis	Cape Crow	Y		all
Corvus albus	Pied Crow	Y		all
Spreo bicolor	Pied Starling	Y		Thickets
Columba guinea	Speckled Pigeon	Y		Farming areas (pivots)
Streptopelia capicola	Cape Turtle-Dove	Y		Thickets
Columba livia	Rock Dove (Racing Pigeon)	Y		all

Several of these bird species observed are considered Vulnerable, namely *Anthropoides paradiseus* (Blue Crane - Plate 4), *Sagittarius serpentarius* (Secretarybird), *Neotis denhami* (Denham's Bustard) and *Falco peregrinus* (Peregrine Falcon). It is thus important that the transmission line within grassland areas in particular, have bird deflectors installed. Any bird kills should also be monitored along these areas as part of the WEF bird monitoring programme.

According to the Eastern Cape Biodiversity Conservation Plan (ECBCP) of Berliner & Desmet (2007), the project roads traverses one small area Critical Biodiversity Areas (CBA), with the remaining areas being considered degraded or transformed (Figure 3).

The affected CBAs area classed as follows (Figure 3):

- **CBA 2 – Corridor 1,**
    - **Ecological corridors as described by vegetation units mapped in the according to the Succulent Thicket Ecosystem Planning project**

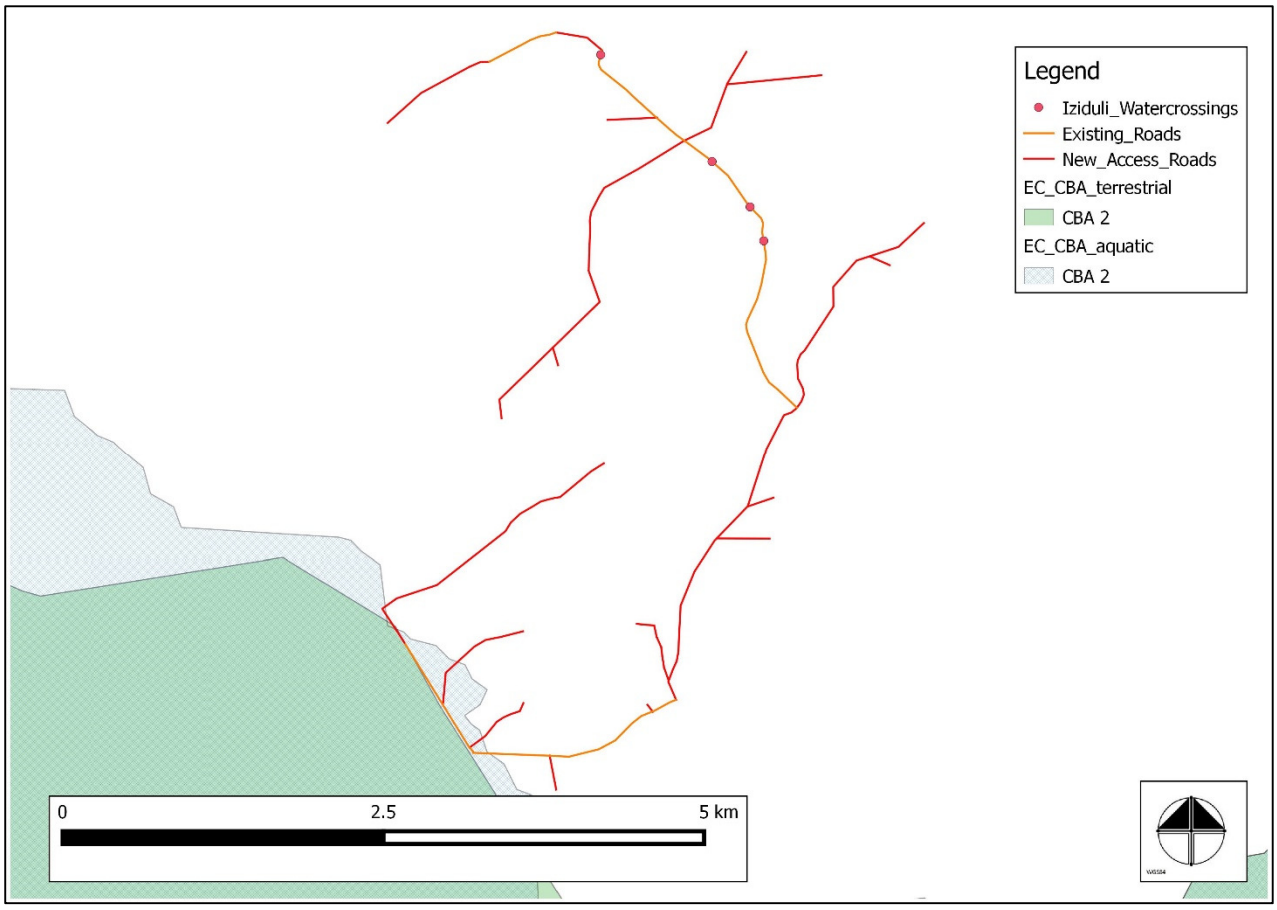

Figure 3: A map illustrating the various CBA's described by Berliner & Desmet (2007), where CBA = Critical Biodiversity Areas

5 - Aquatic environment

There were several minor non- perennial watercourses and drainage lines within the site that will be traversed by roads associated with the project. These include the Goba / eNyara /Biesiesleegta of the Q92F quaternary catchment (Figure 1).

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all watercourses within the study area have been assigned a condition rank of AB (Nel *et al.* 2011), indicating that they largely intact watercourses with biological significance.

According to the Present Ecological State Scores issued by the Department of Water and Sanitation in 1999 (Nel *et al*. 2011), all the mainstem systems were rated as Moderately Modified (PES = C) within the study area.

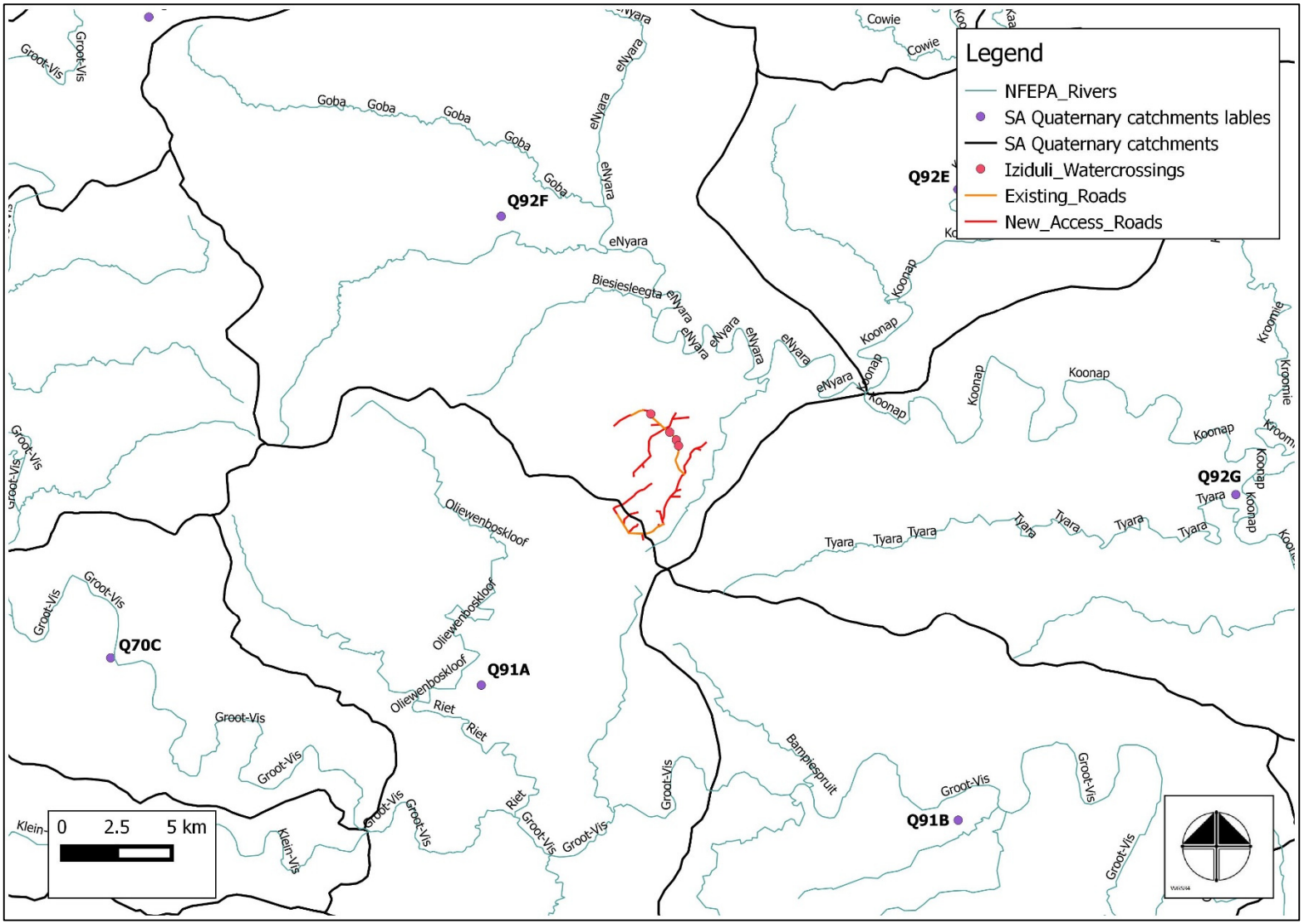

Figure 3: Project locality map indicating various mainstem rivers and streams and the associated quaternary catchments

5.1 Waterbody delineation & classification

The water body delineation and classification was conducted using the standards and guidelines produced by the DWA (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (SANBI, 2009). These methods are contained in the attached Appendix 1, which also includes wetland definitions, wetland conservation importance and Present Ecological State (PES) assessment methods used in this report. Reference is also included with regard to relevant legislation related to the protection of waterbodies and the minimum requirements in terms of prescribed buffers.

For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -

  (a) a river or spring;

  (b) a natural channel in which water flows regularly or intermittently;

  (c) a wetland, lake or dam into which, or from which, water flows; and

  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The study area is dominated by undulating hills, found within the middle portions of the Koonap / Great Fish River catchment. Thus, the number of wetland areas, as well as broad riparian systems would be limited within high lying catchments. Several small drainage lines (Plate 1) were evident within the region (Figure 2).

The streams or small watercourses found within the study area were classified as follows:

1. Upper foothill drainage lines, with no visible channels, with limited inundation, and only contains small amounts of surface run-off during high rainfall events.
2. Lower foot hill streams, with visible channels, narrow riparian zones (Plate 1) and small pools.
3. Depression / pan wetland types (Located more than 2500m from the project boundary) (Figure 3). These natural systems are unique ecosystems within the higher lying areas of the catchment, adding value in terms of habitat for migratory / flying species that move between the riverine areas, i.e. act as refugia.
4. Farm dams – these are considered artificial and in the context of the study area have limited aquatic habitat and function.

However, it is anticipated that the potential impacts will result in minimal changes to the current hydrology if suitable mitigation is incorporated into the design and construction phases. No natural wetlands were observed within the study area boundary (Figure 3).

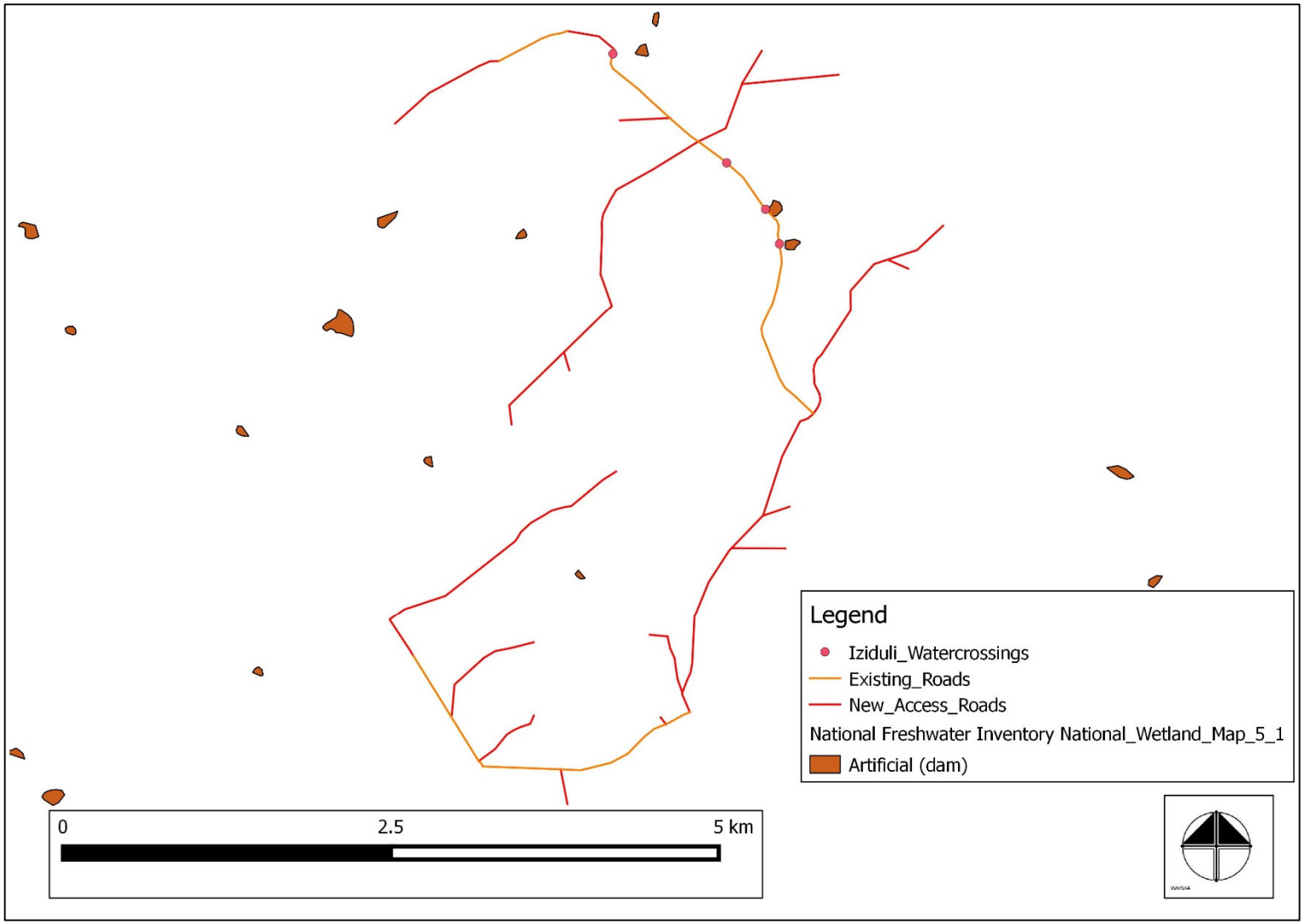

Figure 4: Potential wetlands according to the National Wetland Inventory (SANBI, v.5.1 2017) in relation to the proposed project boundary

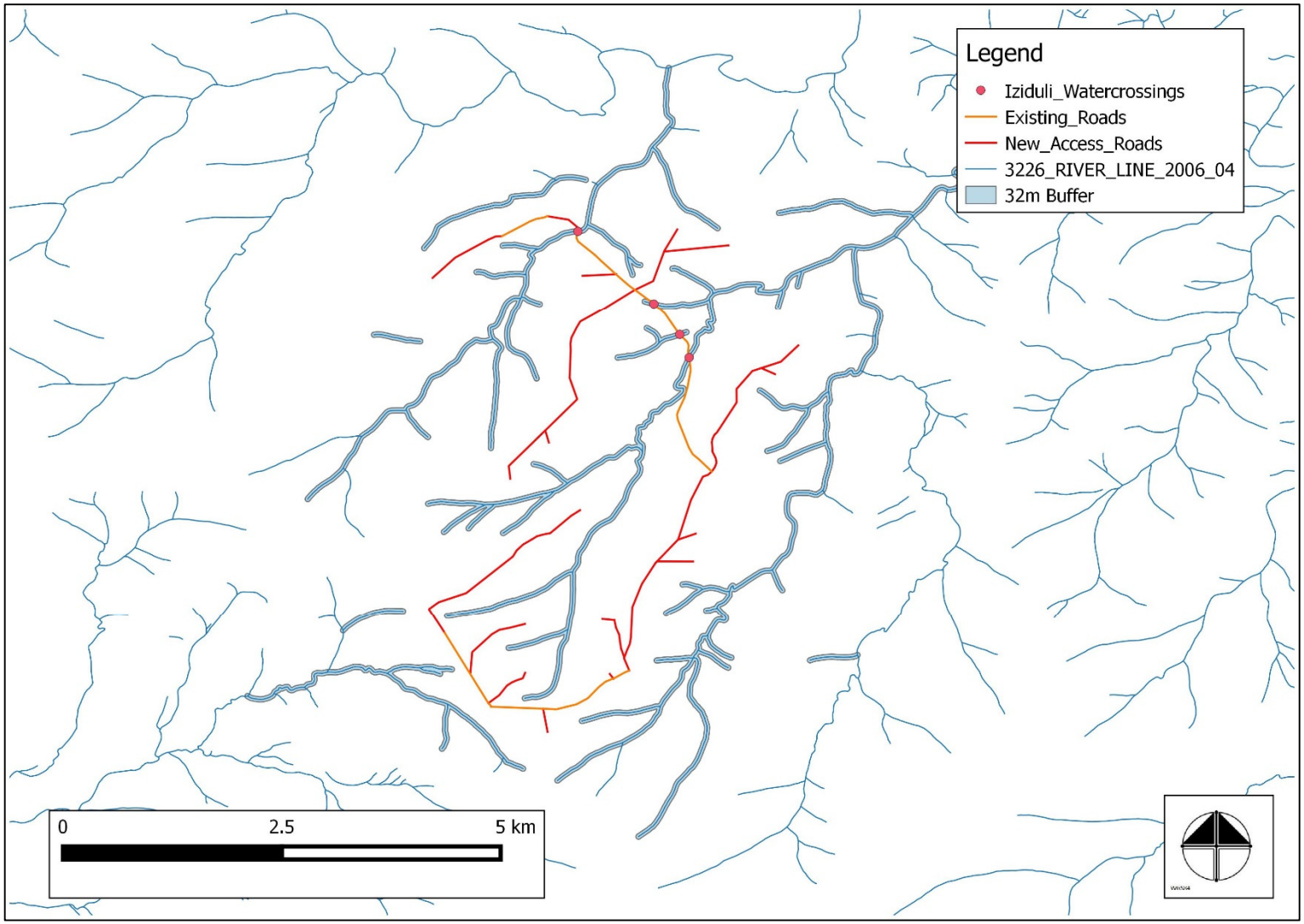

Figure 5: Observed watercourses inclusive of 32m buffer showing the proposed and existing roads, with the new crossings shown

5.2 Present Ecological State and conservation importance

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habitat and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores are currently being revised for the country. This revision is being conducted by SC&A for the Eastern Cape and is based on new models that will incorporate aspects of functional importance as well as direct and indirect impacts. The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed or the overall PES is rated between a C or D.

Previously it was stated in this report that the PES scores for the respective catchments as per the 1999 data were D or Largely Modified and C or Moderately modified. The latest PES scores based on SC&A assessment (See Appendix 2) has shown that the scores for both the study area catchments were rated as C (largely Natural), i.e. an improvement for the Biesiesleegta catchment. This is due to the fact the SC&A assessment is being conducted at a sub-quaternary catchment level, thus at a finer scale. This thus excludes the highly degraded areas associated directly with the banks of the Great Fish system and has assessed the upper catchment areas, which are in a better condition when considered separately.

In summary the PES scores were rated as C (Largely Natural) as impacts are mainly related to localised *Vachellia karroo* encroachment, erosion and sedimentation issues, while the riparian systems and instream habitats remain intact.

The Ecological Importance and Ecological Sensitivity is still being finalised as part of the national project it its understood that the study area systems will be rated as Moderate in this study.

The overall scores for all the systems within the site could have been higher, but scores were reduced due to the presence of a high number of farm dams, erosion, sedimentation and grazing.

It should also be noted that the southernmost portion of the proposed roads are located within an aquatic Critical Biodiversity area (catchment) as indicated in the ECBCP (Berliner & Desmet, 2007) (Figure 8).

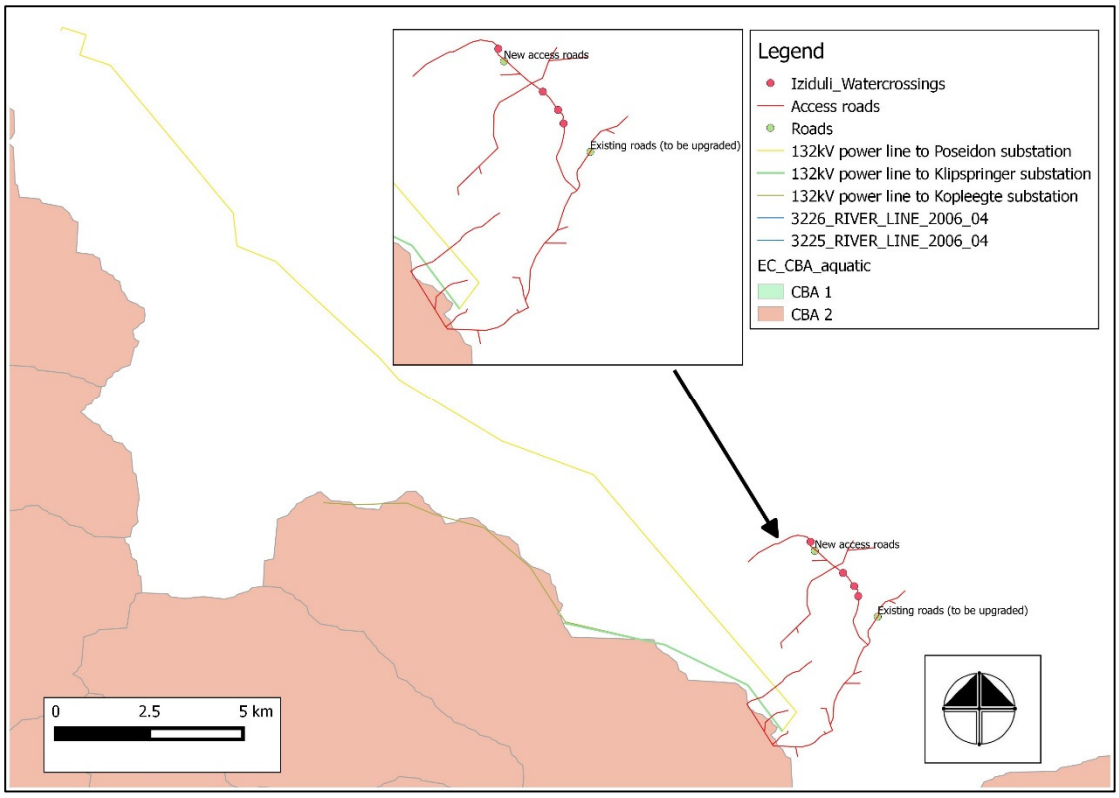

Figure 8: The ECBCP Critical Biodiversity Areas for aquatic systems for the study area

5.3 Recommended buffers

Presently there are no prescribed aquatic buffers other than those proposed in the Eastern Cape Biodiversity Conservation Plan (ECBCP) (Desmet and Berliner, 2007), thus these guidelines will be applied as they are becoming more widely accepted (Table 1). These are shown below, to make the engineers and contractors aware of these buffers during the planning phase, i.e. construction, associated batch plants, stockpiles, laydown areas and construction camps should avoid these buffer areas. Note these buffers are set for the most part as a No-go buffer as these systems have been rated as a Moderate sensitivity. However, it is accepted that some crossings will be required, assuming these are only roads / underground cables with suitable designs, while the remainder of the project activities are located outside of these areas.

Table 1: Recommended buffers for rivers, with those applicable to the Iziduli wind project highlighted in blue

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers	▪ 50	▪ These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.

▪ Lower foothills and lowland rivers of all 1:500 000 rivers	▪ 100	▪ These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
▪ All remaining 1:50 000 streams	▪ 32	▪ Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Currently there is no accepted priority ranking system for wetlands. Until such a system is developed, it is recommended that a **50m no-go buffer be set for natural wetlands**.

Any such systems, if present within the study area would have a high sensitivity and thus no activities would be allowed within the wetlands and the 50m buffer. The artificial dams would have a low sensitivity and could be "developed".

Plate 1: A typical riverine channel within the study area, showing limited aquatic and riparian habitat.

8 – Potential impacts and risk assessment

During the impact assessment study, a number of potential key issues / impacts were identified and these were assessed based on the methodology supplied by Savannah Environmental (Pty) Ltd.

8.1 Ecological Sensitivity and Impact Assessment

The ecological sensitivity of the various habitats (vegetation) is usually ranked in terms of their sensitivity to transformation, using the following criteria, listed in order of importance, i.e. the habitat or vegetation unit:

- Contained Species of Special Concern (SSC);
- Habitat was protected under a form of legislation;
- Exhibited a high degree of biodiversity;
- Exhibited a limited degree of degradation;
- A unique habitat that is not well represented within the region; and
- Provided an important ecosystem role or support system, e.g. ecological corridor:

- Habitats containing SSC are thus rated as **Very High**
- All intact vegetation units, which contained protected flora or sensitive habitat, are rated **High**
- All unimproved vegetation types are rated as **Moderate**, i.e. these have been impacted upon, but are still able to contribute at the landscape level towards ecosystem function and / or assist in the maintenance of ecological corridors
- All modified, transformed or man-made systems were rated as **Low**. These systems have limited restoration / rehabilitation potential, but still provide a form of habitat.

Based then on the results of this assessment it was found that although the majority of the habitat found within the study area is intact, the overall sensitivity of the access roads and watercourse crossings would be Moderate to Low. The sensitivity would have been higher if the survey was conducted during the flowering period, but as the access roads only require a small footprint in relation to the remaining natural habitat, the sensitivity of all the alignments from a terrestrial point of view was rated as Moderate – Low.

With regard the aquatic environment, the importance and sensitivity of these systems is discussed above.

The impact assessment was conducted based on the supplied methodology and considered the following five potential impacts:

- Impact 1: Loss of terrestrial habitat and removal of vegetation.
- Impact 2: Loss of corridors or habitat fragmentation.
- Impact 3 – Loss of rare or protected species (terrestrial).
- Impact 4 – Introduction of alien vegetation.
- Impact 5 – Cumulative impact

It is anticipated that the mammals and reptiles would disperse from the construction areas.

The impacts were assessed as follows:

Nature: Impact 1 – Loss of terrestrial habitat (incl of faunal habitat & species) and removal of vegetation.

This will result due to the clearing of any vegetation within the site. The site is largely covered by natural vegetation which seems intact. The ecological importance of the study area was Moderate - Low, but based on the remaining vegetation within the surrounding areas, the impacts of the road is considered to be minimal.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Probable (3)	Improbable (1)
Significance	**LOW (18)**	**LOW (6)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High

Irreplaceable loss of resources	N/A	N/A
Can impacts be mitigated	Yes	

Mitigation:
Due to the nature of the activities, the vegetation must be cleared prior to construction. The following is this recommended:

- Clearing of the vegetation must be kept to a minimum
- The final development footprint/alignments must be surveyed as part of a search and rescue programme (plants, small mammals and reptiles) before commencement. These species should be translocated to available habitat adjacent to the site.

Cumulative impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be Low, i.e. the areas surround the site are under conservation.

Residual impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be low.

Nature: Impact 2 – Loss of corridors (CBA) or habitat fragmentation

The transformation of the study area could result in the loss of natural corridors, however as the site is surrounded by large natural areas, some under conservation, the loss of any significant corridors would not occur. This is coupled to the fact that the surrounding landscape is largely intact, and the size and scale of the operation is small.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Probable (3)	Improbable (1)
Significance	**LOW (18)**	**LOW (6)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	N/A	N/A
Can impacts be mitigated	Yes	

Mitigation:
Due to the nature of the activities, the vegetation must be cleared prior to construction. The following is this recommended:

- Clearing of the vegetation must be kept to a minimum
- All areas that require rehabilitation after construction has been completed must be done using indigenous vegetation.
- All hard surfaces must be kept to a minimum

Cumulative impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be Low, i.e. the areas surround the site are under conservation.

Residual impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be low.

Nature: Impact 3 – Loss of rare or protected species (terrestrial only as no aquatic species of special concern were observed)

The transformation of the study area could result in the loss of rare or protected species. However, as the site is surrounded by large natural areas, some under conservation, the loss of any significant species would not occur or could be avoided (note Limitations of study due to the time of survey).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Regional (3)	Local (2)
Magnitude	Long-term (4)	Long-term (4)

Probability	Low (1)	Low (1)
Significance	Probable (3)	Improbable (1)
Status (positive or negative)	**LOW (18)**	**LOW (6)**
Reversibility	Negative	Negative
Irreplaceable loss of resources	High	High
Can impacts be mitigated	N/A	N/A

Mitigation:
Due to the nature of the activities, the vegetation must be clear prior to construction. The following is this recommended:

- Clearing of the vegetation must be kept to a minimum
- The final development footprint must be surveyed as part of a search and rescue programme (plants, small mammals and reptiles) before commencement. These species should be translocated to available habitat adjacent to the site.

Cumulative impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be Low, i.e. the areas surround the site are under conservation.

Residual impacts:
Due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be low.

Nature: Impact 4 – Introduction of alien vegetation

Due to the nature of the site (no alien species were observed) and the proposed operations this impact is not expected to occur, and all alien plants will be removed and managed within the site.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Regional (3)	Local (2)
Magnitude	Long-term (4)	Long-term (4)
Probability	Low (1)	Low (1)
Significance	Probable (3)	Improbable (1)
Status (positive or negative)	**LOW (18)**	**LOW (6)**
Reversibility	Negative	Negative
Irreplaceable loss of resources	High	High
Can impacts be mitigated	N/A	N/A

Mitigation:

- Clearing of the vegetation must be kept to a minimum
- Any alien species observed should be removed during the construction and operational phase of the project within the development footprint

Cumulative impacts:
None.

Residual impacts:
None

Nature: Impact 5 – Cumulative impacts Due to the nature of the site and the surrounding renewable energy projects that have already been construction (e.g. Cookhouse, Nojoli, Amakhala WEFs) as well other proposed wind farm farms, the potential exists for cumulative impacts on the surrounding region. However, due to the size and scale of the development, additional cumulative impacts are likely, but when compared to the size / area cover of intact habitat that is located around the site this would be Low, i.e. the areas surround the site are under conservation. The opportunity is also presented to improve aquatic conditions during the upgrade of any existing road crossings that may be required, i.e. improve flow regimes and erosion protection.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Regional (3)	Local (2)
Magnitude	Long-term (4)	Long-term (4)
Probability	Low (1)	Low (1)
Significance	Probable (3)	Improbable (1)
Status (positive or negative)	**LOW (18)**	**LOW (6)**
Reversibility	Negative	Negative
Irreplaceable loss of resources	High	High
Can impacts be mitigated	N/A	N/A
Mitigation: None		
Cumulative impacts: None.		
Residual impacts: None		

8.2 Aquatic Sensitivity and Impact Assessment

The following impacts were not assessed as the factors were not present within the study area aquatic ecosystems:

- Loss of species of special concern,
- Habitat fragmentation, and
- Loss of natural wetlands.

No species of special concern were observed in any of the aquatic systems. Similarly, habitat fragmentation should not occur, as the crossings sites selected within the watercourses are all located within rocky platforms that already act as natural barriers within migration corridors, i.e. small water falls.

The following direct and indirect impacts were assessed with regard to the riparian areas and water courses:

- Impact 1: Loss of riparian systems
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function
- Impact 3: Increase in sedimentation and erosion
- Impact 4: Potential impact on localised surface water quality
- Impact 5: Cumulative impacts

The impacts were assessed as follows:

Nature: Impact 1 - Loss of riparian systems

The physical removal of the narrow strips of riparian zones within the road crossings, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact. Where possible existing tracks and roads have been used and thus only 4 new crossings are proposed. These crossings are high in the catchment areas and are not located within in any major watercourses or riverine channels.

	▪ **Without mitigation**	**With mitigation**
Extent	▪ Local (1)	▪ Local (1)
▪ **Duration**	▪ Long-term (4)	▪ Long-term (4)
▪ **Magnitude**	▪ Moderate (6)	▪ Low (2)
▪ **Probability**	▪ Definite (5)	▪ Probable (3)
▪ **Significance**	▪ **Medium (55)**	▪ **Low (19)**
▪ **Status (positive or negative)**	▪ Negative	▪ Negative
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	

▪ **Mitigation:**

- Where watercourse crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well as to minimise the loss of riparian vegetation (small footprint). This has been proposed by the design team in the prepared design crossings and includes energy dissipation structures such as gabions and reno mattresses.
- No vehicles to refuel within drainage lines/ riparian vegetation.
- During the operational phase, monitor culverts to determine if erosion issues arise and if any erosion control is required.
- Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.

▪ **Cumulative impacts:**

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels and however the annual rainfall figures are low and this impact is not anticipated.

▪ **Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff on riparian form and function.

	▪ **Without mitigation**	**With mitigation**
Extent	▪ Local (1)	▪ Local (1)
▪ **Duration**	▪ Long-term (4)	▪ Long-term (4)
▪ **Magnitude**	▪ Low (2)	▪ Low (2)
▪ **Probability**	▪ Definite (5)	▪ Probable (3)

▪ **Significance**	▪ **Medium (35)**	▪ **Low (21)**
▪ **Status (positive or negative)**	▪ Negative	▪ Negative
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.		
▪ **Cumulative impacts:** Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		
▪ **Residual impacts:** Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		

Nature: Impact 3 - Increase in sedimentation and erosion within the development footprint		
	▪ **Without mitigation**	**With mitigation**
Extent	▪ Local (1)	▪ Local (1)
▪ **Duration**	▪ Long-term (4)	▪ Long-term (4)
▪ **Magnitude**	▪ Low (1)	▪ Low (1)
▪ **Probability**	▪ Definite (5)	▪ Probable (3)
▪ **Significance**	▪ **Medium (30)**	▪ **Low (18)**
▪ **Status (positive or negative)**	▪ Negative	▪ Negative
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.		
▪ **Cumulative impacts:** Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). However due to low mean annual runoff within the region, this is not anticipated due to the nature of the development together with the proposed layout.		
▪ **Residual impacts:** During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) are already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		

Nature: Impact 4 – Impact on localised surface water quality

During construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.

Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

	Without mitigation	**With mitigation**
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:

» Strict use and management of all hazardous materials used on site.
» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).
» Containment of all contaminated water by means of careful run-off management on the development site.
» Strict control over the behaviour of construction workers.
» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

Cumulative impacts:

None.

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 5 – Cumulative impact on aquatic systems due to the addition of crossings.

	Without mitigation	**With mitigation**
Extent	Site (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (5)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**33 (Medium)**	**10 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (Partly)	

Mitigation:

» Where watercourse crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion

(erosion protection) as well as to minimise the loss of riparian vegetation (small footprint). This has been proposed by the design team in the prepared design crossings and includes energy dissipation structures such as gabions and reno mattresses. » No vehicles to refuel within drainage lines/ riparian vegetation. » During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required. » Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.
Residual impacts: Residual impacts will be negligible after appropriate mitigation.

Measures for inclusion into the Draft Environmental Management Plan

OBJECTIVE: Search and Rescue of all Translocatable Indigenous Plants

Prior to any earthworks (including road construction) within areas of natural vegetation, a plant Search and Rescue program should be developed and implemented. The section below provides a guideline for the Search & Rescue Plan on site and will need to be supplemented with the relevant methodology depending on the final placement of infrastructure.

Project Component/s	» Watercourse crossings, i.e. access roads and culverts » All other infrastructure
Potential Impact	» Substantially increased loss of natural vegetation at construction phase and waste of on-site plant resources, and lack of locally sourced material for rehabilitation of disturbed areas. » Increased cost of having to buy in material for rehabilitation.
Activities/Risk Sources	» Construction related loss and damage to remaining natural vegetation via heavy machinery, etc.
Mitigation: Target/Objective	» Rescue, maintenance and subsequent replanting of at least 40% of the natural vegetation in all development footprints within any areas of natural vegetation on site

Mitigation: Action/Control	Responsibility	Timeframe
Search and Rescue (S&R) of certain translocatable, selected plants occurring in long term and permanent, hard surface development footprints should take place. All such development footprints must be surveyed and pegged out as soon as possible, and then suitably qualified specialist with Search and Rescue experience should be appointed to undertake the S&R. All rescued species should be translocate to a suitable habitat or removed to a suitably maintained nursery.	Contractor	Prior to construction
Compile a site rehabilitation plan for implementation.	Contractor	Prior to construction

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation.

	» Limited impacts on areas of identified and demarcated sensitive habitats/vegetation.
Monitoring	» Observation of vegetation clearing activities by ECO throughout construction phase. » Monitoring of vegetation clearing activities in terms of permit conditions. » Supervision of clearing and earthworks as far as possible or practical. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE: Soil erosion control, water quality management

Project component/s	Project components affecting the objective: » Watercourse crossings » All other infrastructure
Potential Impact	» Erosion and soil loss within **watercourses** » Negative impacts on **watercourses** » Disturbance to or loss of **watercourses** » Sedimentation of **watercourse areas** » A loss of indigenous vegetation cover, particularly in **watercourse areas** » Increased runoff into drainage lines can potentially be associated with accelerated erosion in **watercourses**
▪ **Activities/risk sources**	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Storm water run-off from sealed surfaces » Mobile construction equipment movement on site » **Drainage line road crossings** » Roadside drainage ditches » Project related infrastructure, such as culverts and erosion control
▪ **Mitigation: Target/Objective**	» To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines » To minimise damage to vegetation by erosion or deposition » To minimise damage to soil and vegetation by construction activity » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover » No reduction in the surface area of drainage lines as a result of the establishment of infrastructure » Minimal loss of vegetation cover due to construction related activities » No increase in runoff into drainage lines as a result of construction of project related infrastructure » No increase in runoff into drainage lines as a result of road construction

▪ **Mitigation: Action/control**	▪ **Responsibility**	▪ **Timeframe**
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within	▪ ECO/Contractor	▪ Before and during construction

construction areas (prevent over-excavations and double handling)		
▪ Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines. Limit the height of stockpiles as far as possible in order to reduce compaction.	▪ Contractor	▪ During site establishment and any activity related to earthworks as well as the duration of construction
▪ Any excavation, must be supervised by the ECO.	▪ Contractor	▪ Duration of construction
▪ Disturbance of vegetation and topsoil must be kept to a practical minimum.	▪ Contractor	▪ Duration of contract
▪ Rehabilitate disturbance areas as soon as construction in an area is completed.	▪ Contractor	▪ During and after construction
▪ Control depth of excavations and stability of cut faces/sidewalls.	▪ ECO / Contractor	▪ maintenance over duration of contract
▪ Compile a comprehensive storm water management plan as part of the final design of the project and implement during construction and operation.	▪ Construction team, management, environmental control officer	▪ Construction & operation

▪ **Performance Indicator**	» No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of increased siltation in drainage lines, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by Resident Engineer & ECO
▪ **Monitoring**	» Fortnightly inspections of the site by ECO » Fortnightly inspections of sediment control devices by ECO » Fortnightly inspections of surroundings, including drainage lines by ECO » Immediate reporting of ineffective sediment control systems » An incident reporting system must record non-conformances to the EMP/IWWMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Limit Damage to water courses

Construction within drainage lines has been minimised as far as possible. Where impacts are unavoidable, mitigation measures are required to minimise impacts on these systems.

Project component/s	List of project components affecting the objective: » access roads
Potential Impact	» **Damage to watercourse areas** by any means that will result in

	hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material).		
▪ **Activity/risk source**	» Construction of access roads		
▪ **Mitigation: Target/Objective**	» Minimise damage to watercourse areas where crossings are built or upgraded.		
▪ **Mitigation: Action/control**		▪ **Responsibility**	▪ **Timeframe**
Align internal access roads as far as possible along existing infrastructure & disturbances.		▪ Contractor, ECO	▪ Construction & Operation
▪ Rehabilitate any disturbed areas as soon as possible once construction is completed in an area.		▪ Contractor, ECO	▪ Construction & Operation
▪ Control storm water and runoff water through the implementation of a storm water management plan for the site.		▪ Contractor, ECO	▪ Construction & Operation
▪ Obtain a permit as required in terms of the National Water Act from DWA to impact on any water resource.		▪ Project company, Contractor, ECO	▪ Construction & Operation
▪ **Performance Indicator**	» No impacts on water quality, water quantity, natural status of watercourses.		
▪ **Monitoring**	» Habitat loss in watercourses should be monitored before and after construction. » The presence and development of erosion features downstream of any construction must be monitored. » The ECO should be responsible for driving this process. » An incident reporting system must be used to record non-conformances to the EMP/IWWMP. » Public complaints register must be developed and maintained on site.		

OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances and waste
The construction phase of the roads may involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents although in small amounts. The main wastes expected to be generated by the construction of the facility will include **general solid waste, hazardous waste and liquid waste**.

Project component/s	List of project components affecting the objective: » electrical balance of plant activity » civil balance of plant activity
Potential Impact	▪ **The watercourse areas could be impacted via:** » Release of contaminated water from contact with spilled chemicals could impact the » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
▪ **Activity/risk**	» Vehicles associated with site preparation and earthworks

source	» Power line construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
▪ **Mitigation: Target/Objective**	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons » To comply with waste management legislation » To minimise production of waste » To ensure appropriate waste storage and disposal » To avoid environmental harm from waste disposal

▪ **Mitigation: Action/control**	▪ **Responsibility**	▪ **Timeframe**
Storage areas must be located more than 50 m away from the watercourse.	▪ ECO/Contractor	▪ Before and during construction
▪ The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the SHE Representative / ECO.	▪ Contractor	▪ Duration of contract
▪ Any spills must receive the necessary clean-up action. If required, bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan).	▪ Contractor	▪ Duration of contract
▪ Any storage and disposal permits/approvals which may be required will be obtained, and the conditions attached to such permits and approvals must be complied with.	▪ Contractor	▪ Duration of contract
▪ Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	▪ Contractor	▪ Duration of contract
▪ Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	▪ Contractor	▪ Duration of contract
▪ Waste disposal records must be available for review at any time.	▪ Contractor	▪ Duration of contract
▪ Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	▪ Contractor	▪ Duration of contract

▪ Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control.	▪ ECO/Contractor	▪ Duration of contract
▪ Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc).	▪ Contractor	▪ Duration of contract
▪ Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	▪ Contractor	▪ Duration of contract
▪ Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	▪ Contractor	▪ Duration of contract
▪ Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	▪ Contractor	▪ Duration of contract
▪ Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste.	▪ Contractor	▪ Duration of contract
▪ An incident/complaints register must be established and maintained on-site.	▪ Contractor	▪ Duration of contract
▪ Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	▪ Contractors	▪ Erection: during site establishment Maintenance: for duration of Contract within a particular area
▪ All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.	▪ Contractors	▪ Erection: during site establishment Maintenance: for duration of Contract within a particular area
▪ Supply waste collection bins at construction equipment and construction crew camps.	▪ Contractors	▪ Erection: during site establishment

		Maintenance: for duration of Contract within a particular area
▪ Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised.	▪ ECO/Contractor	▪ Duration of contract
▪ All stored fuels to be maintained within a bund and on a sealed surface.	▪ Contractor	▪ Duration of contract
▪ Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	▪ Contractor	▪ Duration of contract
▪ Construction machinery must be stored in an appropriately sealed area.	▪ Contractor	▪ Duration of contract
▪ Oily water from bunds at the substation must be removed from site by licensed contractors.	▪ Contractor	▪ Duration of contract
▪ Spilled cement or concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	▪ Contractor	▪ Duration of contract
▪ Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	▪ Contractor	▪ Duration of contract
▪ In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	▪ Contractor	▪ Duration of contract
▪ Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	▪ Contractor	▪ Duration of contract
▪ Upon the completion of construction, the area will be cleared of potentially polluting materials.	▪ Contractor	▪ Completion of construction
▪ Performance Indicator	» No chemical spills outside of designated storage areas » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams » Designated areas for fires identified on site at the outset of the construction phase » Firefighting equipment and training provided before the construction phase commences	

▪ Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase » A complaints register must be maintained, in which any complaints from the community will be logged. Complaints must be investigated and, if appropriate, acted upon » Observation and supervision of waste management practices throughout construction phase » Waste collection to be monitored on a regular basis » Waste documentation completed » An incident reporting system must be used to record non-conformances to the EMP/IWWMP » An appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » Public complaints register must be developed and maintained on site.

9 – Conclusion and recommendations

The proposed access roads will have limited impact on the ecological and aquatic environment. Similarly, no protected or species of special concern (fauna & flora) were observed within the aquatic areas during the site visit undertaken on September 2014. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW. This would also apply to the cumulative impacts if all the proposed mitigations and the EMP conditions are upheld. Thus, the author would have no objection to this project going ahead. It can only be reiterated that approval can be given if the following conditions are upheld:

- The proposed designs of the crossings must not impede or divert any flows, and natural ground levels should be maintained
- Suitable erosion protection and stormwater management is included in the designs and that their effectiveness is monitored during the construction and first few months of the operational phase.

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11 – Appendix 1: Wetland assessment methods

Survey methods

The assessment was initiated with a survey of the pertinent literature, past reports and the various conservation plans that exist for the study region. Maps and Geographical Information Systems (GIS) were then employed to ascertain, which portions of the proposed development, could have the greatest impact on the wetlands and associated habitats.

A one day site visit was then conducted to ground-truth the above findings, thus allowing critical comment of the development when assessing the possible impacts and delineating the wetland areas.

Wetland and riparian areas were then assessed on the following basis:

- Vegetation type – verification of type and its state or condition based, supported by species identification using Germishuizen and Meyer (2003), Vegmap (Mucina and Rutherford, 2006 as amended) and the South African Biodiversity Information Facility (SABIF) database.
- Plant species were further categorised as follows:
    - Terrestrial: species are not directly related to any surface or groundwater base-flows and persist solely on rainfall.
    - Facultative: species usually found in wetlands (inclusive of riparian systems) (67 – 99% of occurrences), but occasionally found in terrestrial systems (non wetland) (DWAF, 2005).
    - Obligate: species that are only found within wetlands (>99% of occurrences) (DWAF, 2005).
- Assessment of the wetland type based on the NWCS method discussed below and the required buffers.
- Mitigation or recommendations required.

National Wetland Classification System (NWCS 2013)

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

The South African National Biodiversity Institute (SANBI) in collaboration with a number of specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the Hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (SANBI 2009).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM

approach has now been included in wetland classification as the HGM approach has been adopted throughout the water resources management realm with regard the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All of these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water Affairs. The Ecological Reserve of a wetland or river is used by DWA to assess the water resource allocations when assessing water use license applications (WULA).

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This **is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

Wetland definition

Although the National Wetland Classification System (SANBI, 2009) is used to classify wetland types it is still necessary to understand the definition of a wetland. Wetland definitions as with classification systems have changed over the years. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as **"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"** (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised seaward boundary of the shallow photic zone (Lombard *et al*., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (SANBI, 2009):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the later as a water course (SANBI, 2009). The DWA is however reconsidering this position with regard the management of estuaries due to the ecological needs of these systems with regard to water allocation. Table 1 provides a comparison of the various wetlands included within the main sources of wetland definition used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the National Water Act, together with open waterbodies), it is understood that subsequent versions of the Inventory include the

full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (SANBI, 2009).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the National Water Act (Act No. 36 of 1998), and ecosystems are included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	▪ YES	▪ NO	▪ NO
▪ Estuarine	▪ YES	▪ NO	▪ NO
▪ Waterbodies deeper than 2 m (i.e. limnetic habitats often describes as lakes or dams)	▪ YES	▪ NO	▪ NO
▪ Rivers, channels and canals	▪ YES	▪ NO[1]	▪ NO
▪ Inland aquatic ecosystems that are not river channels and are less than 2 m deep	▪ YES	▪ YES	▪ YES
▪ Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	▪ YES	▪ YES	▪ YES[3]
▪ Riparian[2] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	▪ NO	▪ NO	▪ YES[3]

Wetland importance and function

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act.

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods would be considered riparian wetlands, opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water borne diseases.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 2 summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 2: Summary of direct and indirect ecoservices provided by wetlands from Kotze et al., 2008.

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits		Flood attenuation
				▪ Stream flow regulation
			Water quality enhancement	▪ Sediment trapping
				▪ Phosphate assimilation
				▪ Nitrate assimilation
				▪ Toxicant assimilation
				▪ Erosion control
				▪ Carbon storage
		▪ Biodiversity maintenance		
	Direct benefits ▪	▪ *Provision of water for human use*		
		▪ *Provision of harvestable resources*[2]		
		▪ *Provision of cultivated foods*		
		▪ *Cultural significance*		
		▪ *Tourism and recreation*		
		▪ *Education and research*		

Relevant wetland legislation and policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from the destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance (No. 19 of 1974)
- National Forest Act (No. 84 of 1998)
- National Heritage Resources Act (No. 25 of 1999)

Apart from NEMA, the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) will also apply to this project. The CARA has categorised a large number of invasive plants together with associated obligations of the landowner. An amendment of the National Environmental Management was promulgated late December 2011, namely the Biodiversity Act or NEM:BA (Act No 10 of 2004), which lists 225 threatened ecosystems based on vegetation type (Vegmap, 2006 as amended). Should a vegetation type or ecosystem be listed, actions in terms of NEM:BA are triggered.

Provincial legislation and policy

Various provincial guidelines on buffers have been issued within the province. These are stated below so that the engineers and contractors are aware of these buffers during the planning phase. Associated batch plants, stockpiles, laydown areas and construction camps should avoid these buffer areas.

Until national guidelines for riverine and wetland buffers are established, the guidelines set out in the Eastern Cape Biodiversity Conservation Plan documentation should be applied (Berliner & Desmet, 2007). Table 3 recommends buffers for rivers.

Table 3: Recommended buffers for rivers, with the applicable buffer related to this study shaded in grey

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers	▪ 50	▪ These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
▪ Lower foothills and lowland rivers of all 1:500 000 rivers	▪ 100	▪ These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by agricultural practices. These larger buffers are particularly important to lower the amount of crop-spray reaching the river.
▪ All remaining 1:50 000 streams	▪ 32	▪ Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Currently there is no accepted priority ranking system for wetlands. Until such a system is developed, it is recommended that a **50m no-go buffer be set for natural wetlands**.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the sites are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas – CSIR 2011 draft. This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

National Wetland Classification System method

During this study due to the nature of the wetlands and watercourses observed, it was decided that the newly accepted National Wetlands Classification System (NWCS) be adopted. This classification approach has integrated aspects of the HGM approached used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (SANBI, 2009) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (SANBI, 2009).

The classification system used in this study is thus based on SANBI (2009) and is summarised below:

The NWCS has a six tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 1). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular systems has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale. This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

(i) Landform – shape and localised setting of wetland
(ii) Hydrological characteristics – nature of water movement into, through and out of the wetland
(iii) Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for the inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses of six descriptors to characterise the wetland types on the basis of biophysical features. As with Level 5, these are non hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

(i) Geology;
(ii) Natural vs. Artificial;
(iii) Vegetation cover type;
(iv) Substratum;
(v) Salinity; and
(vi) Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, thus are nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 2 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

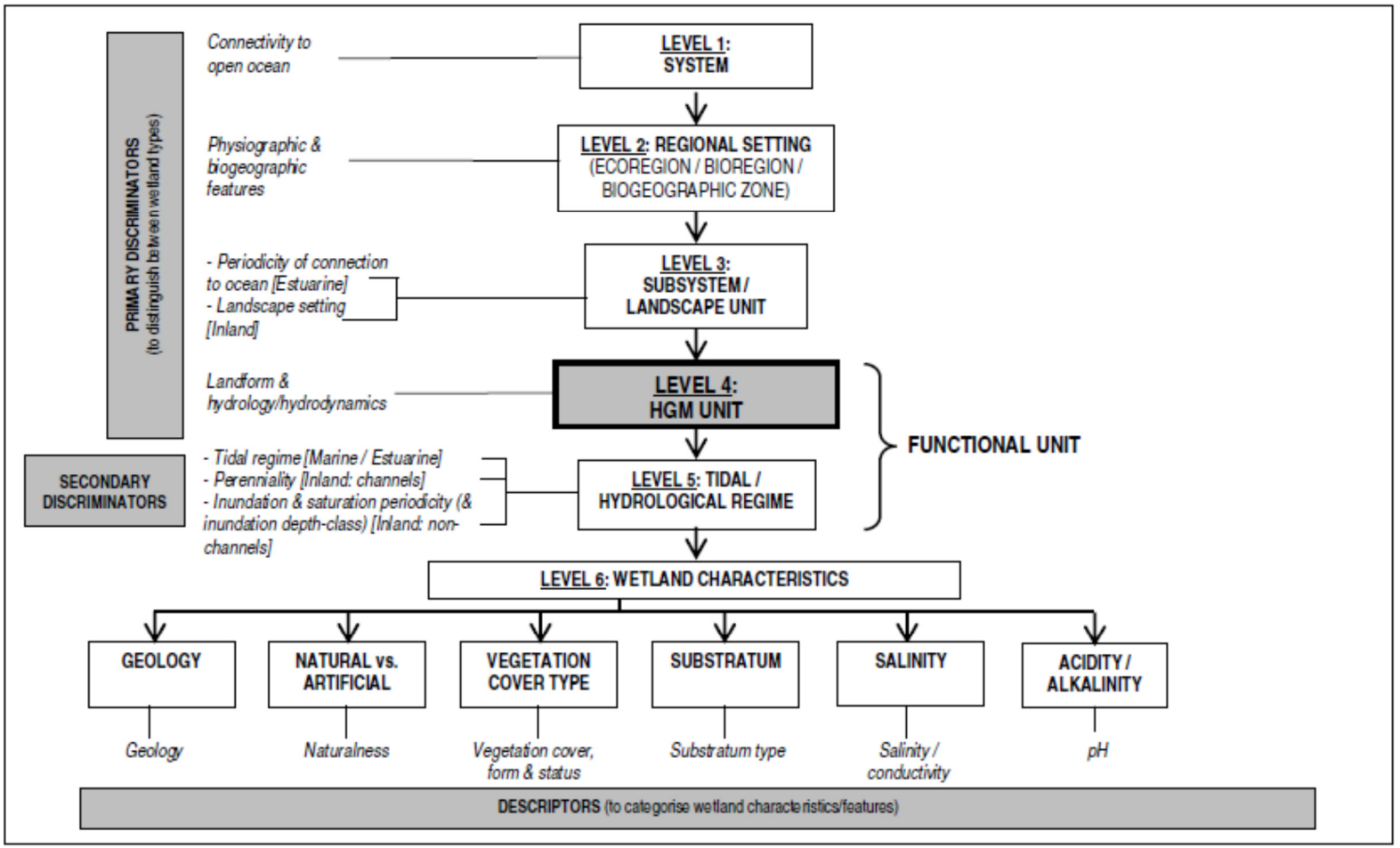


Figure 1: Basic structure of the National Wetland Classification System, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From SANBI, 2009).

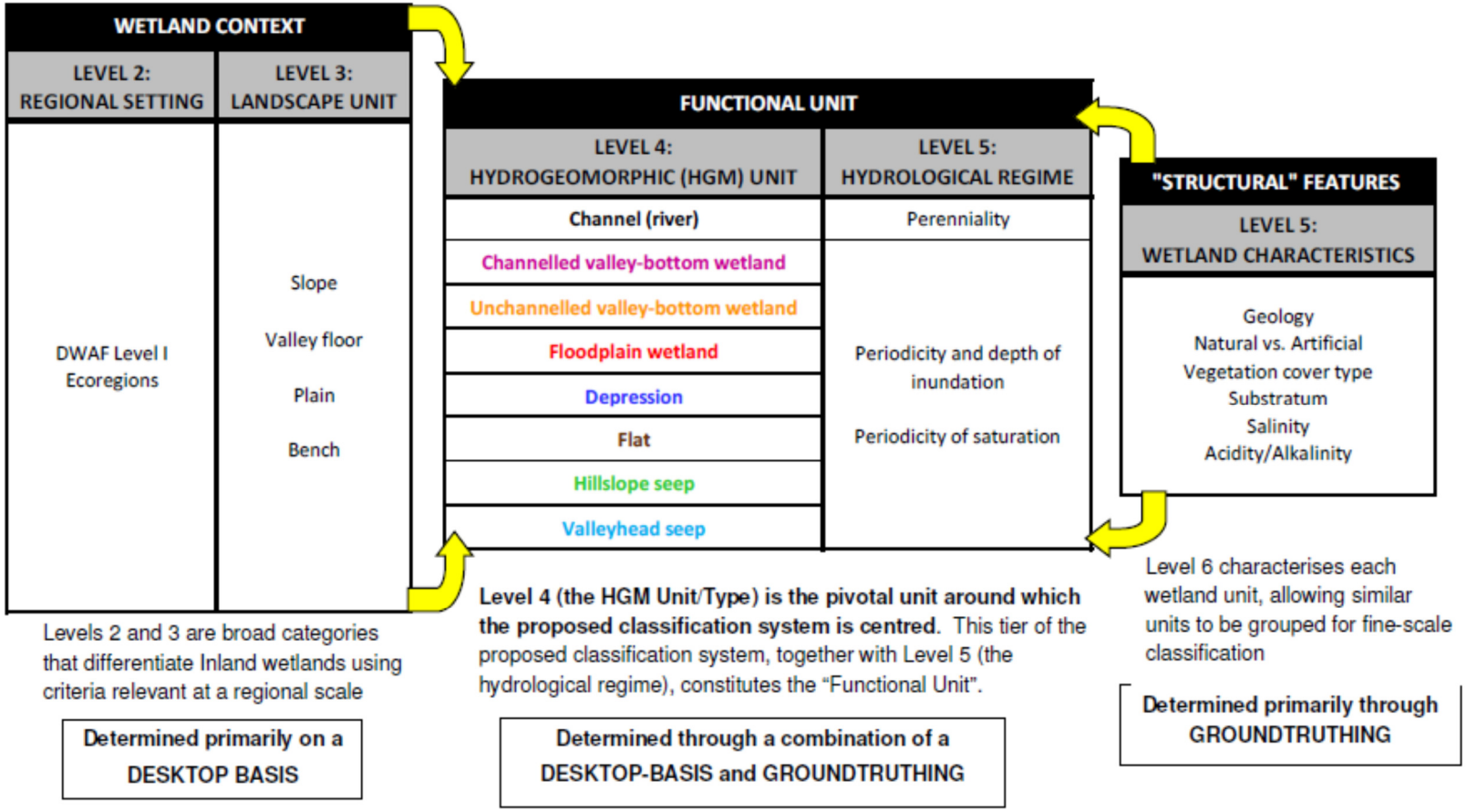


Figure 2 Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from SANBI, 2009).

Wetland condition and conservation importance assessment

To assess the Present Ecological State (PES) or condition of the observed wetlands (i.e. the depression wetland and artificial wetland, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 4), and provide a score of the Present Ecological State of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind, and is not always suitable for impact assessments. This coupled to degraded state of the wetlands in the study area, a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 4: Description of A – F ecological categories based on Kleynhans *et al.*, (2005).

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	▪ Unmodified, natural.	▪ Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	▪ Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	▪ Some human-related disturbance, but mostly of low impact potential
C	▪ Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	▪ **Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	▪ Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	▪ Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	▪ **Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
▪ F	▪ 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.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary ***driving processes*** behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human landuse activities on the wetland surface itself and how these may have ***modified*** the condition of the wetland. The integration of the scores from these 4 modules provides an overall Present Ecological State (PES) score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a rapid site visit.

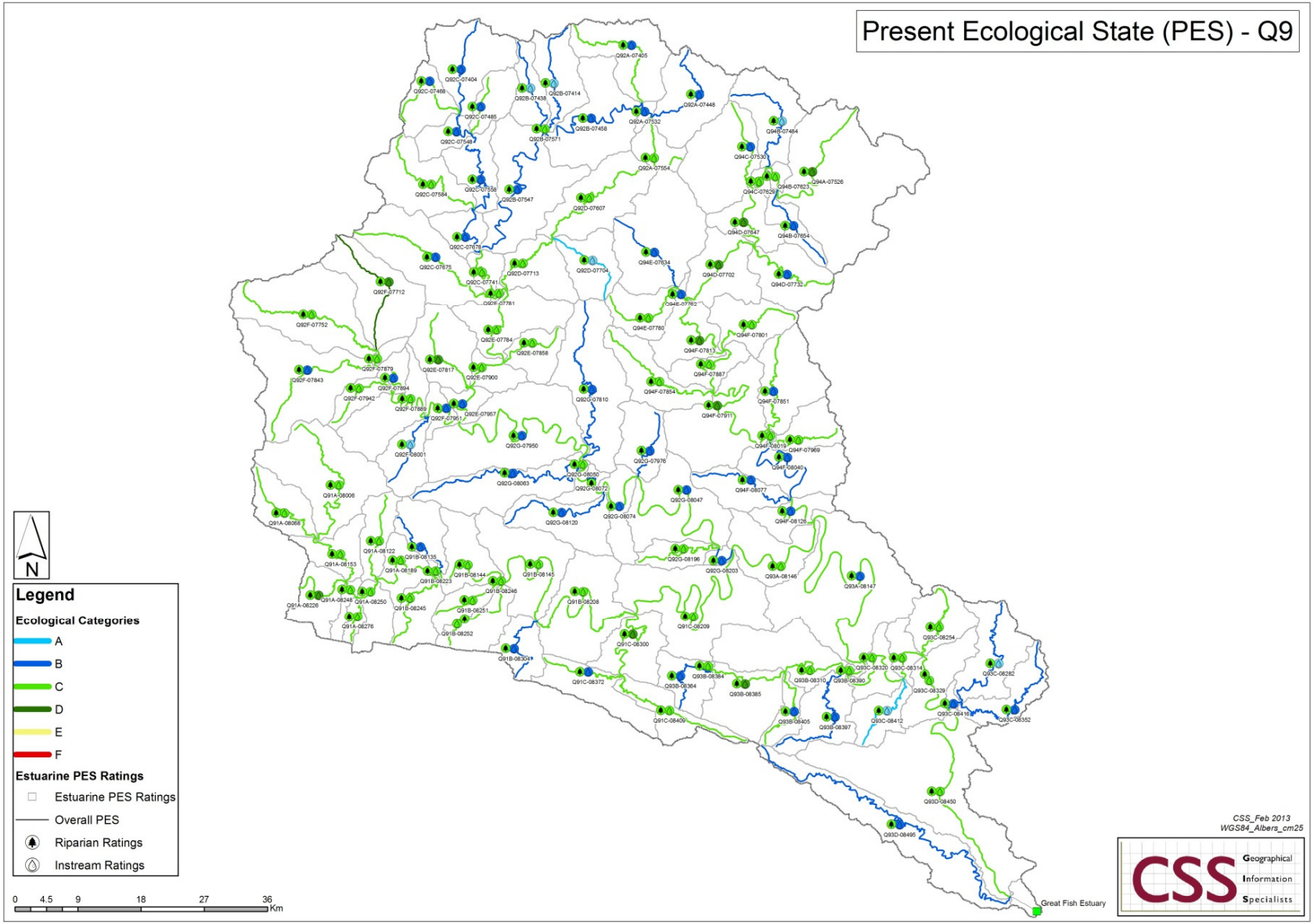
Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWAF's River EcoStatus models which are currently used for the assessment of PES in riverine environments.

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation with regard ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of conservation concern was observed (HIGH). Any systems that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Wetlands which receive a LOW conservation importance rating could be included into stormwater management features, but should not be developed so as to retain the function of any ecological corridors.

12 –Appendix 2 – DWS RISK ASSESSMENT


Present Ecological State (PES) - Q9
N
Legend
Ecological Categories
A
B
C
D
E
F
Estuarine PES Ratings
Estuarine PES Ratings
Overall PES
Riparian Ratings
Instream Ratings
0 4.5 9 18 27 36
Km
Great Fish Estuary
CSS_Feb 2013
WGS84_Albers_cm25
CSS
Geographical
Information
Specialists