<u>Aquatic Assessment EIA phase</u>:

UmSinde Emoyeni Wind Energy Facility – Addendum Report

Prepared for:

Arcus Consulting
Cnr Long Street and Hans Strijdom Road
CAPE TOWN
8001

Prepared by:

Scherman Colloty & Associates
1 Rossini Road
PORT ELIZABETH, 6070

January 2018

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.

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Certified EAP / Member SAEIES & SASAqS

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:…10 January 2018……

Please also refer to Appendix 2 and 3 for additional specialist detail and declaration

1 - Introduction

Scherman Colloty & Associates (SC&A) was been appointed by the Arcus Consulting to conduct an aquatic and Present Ecological State assessment of all water bodies located within the proposed UmSinde Emoyeni Wind Energy Facility footprint as well as within a 500m radius of the proposed site. Where the term site is referred to, this includes the Wind Energy Facility (WEF) and the grid connection study area boundary (Figure 1).

This included delineating any natural waterbodies remaining on the properties in question, as well as the potential consequences of the layout on the surrounding water courses. This was based on information collected during a site visits in July 2012 (winter) and October 2015 (spring), while adhering to the assessment criteria contained in the DWAF 2005 / 2007 delineation manuals and the National Wetland Classification System found in the Appendix 1.

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 facilities on the aquatic environment.

1.1 Scope

It is our understanding that the proposed project, has triggered the preparation of environmental impact assessments and potential applications under the National Water Act (Act 36 of 1998), where required. The potential impacts on the surrounding water bodies therefore need evaluation, with specific attention drawn to the likelihood of any changes to the regional hydrology and how this could impact on these systems. SC&A understands the study area well and has worked on a number of projects within the region and therefore possess a high level of information.

The following potential issue will be assessed:

- Potential loss of riverine and wetland habitat (road and services crossings)
- Increase in stormwater runoff and the potential to increase the amount of erosion in the catchment

All aspects of the SC&A study could then form part of the Water Use Licence process should this become a requirement

1.2 Terms of reference

SC&A endeavours to provide a report which would include the following aspects related to potential wetlands and rivers for the site:

- Maps depicting demarcated waterbodies delineated to a scale of 1:10 000 after a site visit was conducted.
- The determination of the ecological state of any aquatic systems, estimating their biodiversity, conservation and ecosystem function importance with regard ecosystem services.
- Recommend buffer zones and No-go areas around any delineated wetland areas based on the relevant legislation, e.g. Conservation Plan guidelines or best practice.
- Assess the potential impacts, based on the supplied methodology
- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated aquatic areas.
- Provide the relevant aspects with regard compiling the Environmental Management / Monitoring Plans.
- Supply the client with geo-referenced GIS shape files of the aquatic areas.

The following checklist as per the NEMA specialist assessment requirements was also provided by Arcus Consulting:

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Aquatic Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	**Page 3 and Appendix 2 of this report**
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Appendix 3 of this report**
(c) an indication of the scope of, and the purpose for which, the report was prepared;	**Section 1 of this report**
(cA) an indication of the quality and age of base data used for the specialist report;	**Yes – data included ranged from 2012 to September 2015**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Yes Section 3**
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Yes Section 1**
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Yes – Also see EIA**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	**Yes – See Figure 2 & 4**
(g) an identification of any areas to be avoided, including buffers;	**Yes - Figure 2 & 4**
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Yes - Figure 2 & 4**
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	**Yes – Section 2.1 of this report**
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	**Yes – Section 3, 4, 5 and 6 of this report**

(k) any mitigation measures for inclusion in the EMPr;	**Yes – Section 7 of this report**
(l) any conditions for inclusion in the environmental authorisation;	**Yes – Section 8 of this report**
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**Yes – Section 7 and 8 of this report**
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; ii. Regarding the acceptability of the proposed activity or activities; and iii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	**Yes – Section 8 of this report**
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**Yes – Refer to EIA**
(p) any other information requested by the competent authority	**Yes – Refer to EIA**
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**Yes – This report also meets the DWS requirements in terms of GN 40713 of March 2017**

2 – Baseline Survey Methods

The water body delineation and classification were conducted using the standards and guidelines produced by the DWA (DWAF, 2005 & 2007), the South African National Biodiversity Institute (SANBI, 2009) and the National Wetland Classification Systems (Ollis *et al.,* 2013). 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 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 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.

2.1 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 provides 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 associated transmission lines can avoid or span the observed water courses. 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.

3 – Baseline environment

The study site is located approximately 35km north west of the Murraysburg, with the WEF site falling within three quaternary catchments of the Gamtoos Water Management area (Quaternary catchments, L21C, L21D & L21E) (Figure 1a). The Grid site boundary extends over three quaternary catchments, namely L21A, L21b & L21C (Figure 1b). Several main stem rivers are found within these catchments which form part of the Brak River. These tributaries include:

- Skietkuilspruit
- Brak River
- Snynderskraal River
- Buffels River and
- Several unknown tributaries

The proposed development from an aquatic vegetation point of view is dominated by species associated with the Nama Karoo vegetation ecosystem. These systems are thus usually devoid of any trees with strict riparian or wetland affiliations and this is due to the largely ephemeral nature of the rivers / water courses within the region. However, the larger systems, such as those listed above have a higher Mean Annual Runoff and thus contain a woody layer component within the riparian floodplain areas which are dominated by *Vachellia karroo*, *Searsia lanceolata* and *Combretum* species.

A large number of these systems are also Alluvial systems, i.e. dry sandy river beds, that can have extensive floodplains (Figure 2). For the purposes of this project, these areas have been avoided by any infrastructure required for the development of the WEF.

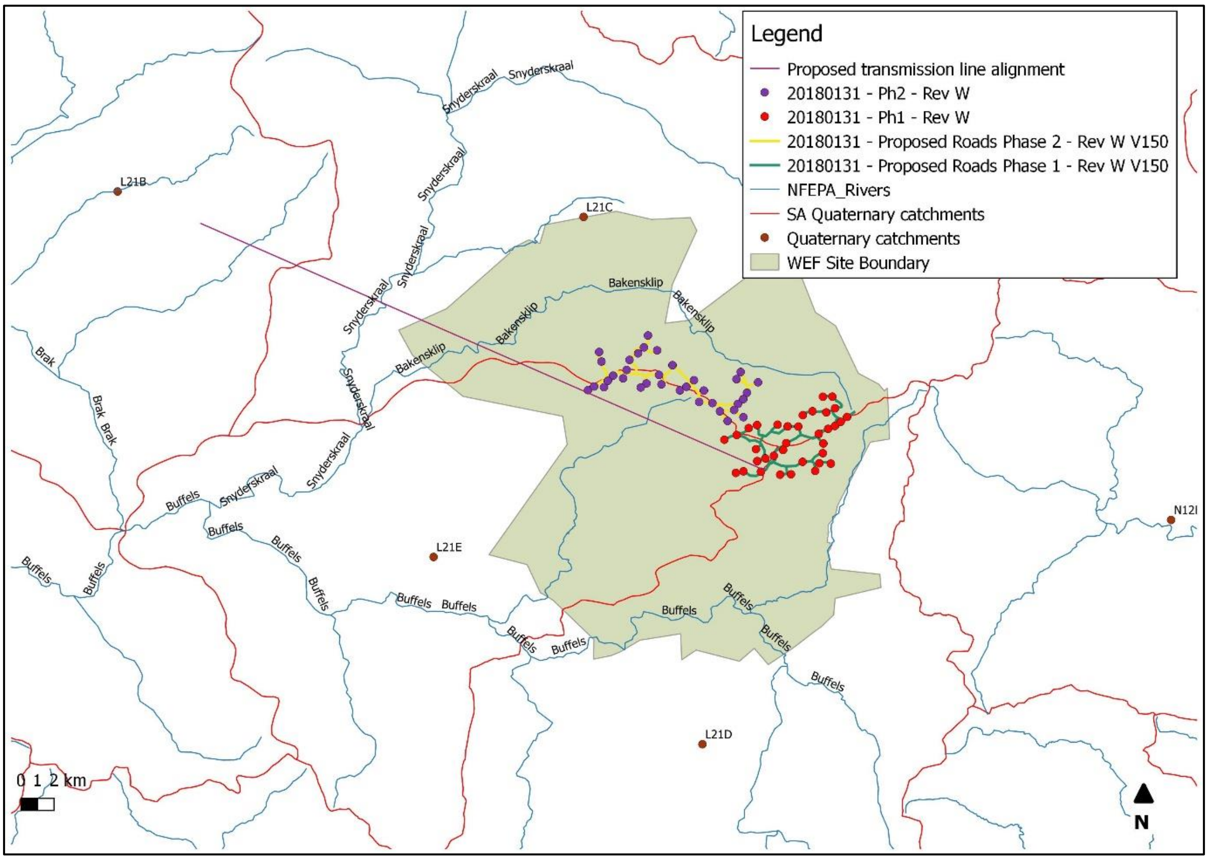

Figure 1: Project study area indicating various quaternary catchments and major rivers (NFEPA & DWS)

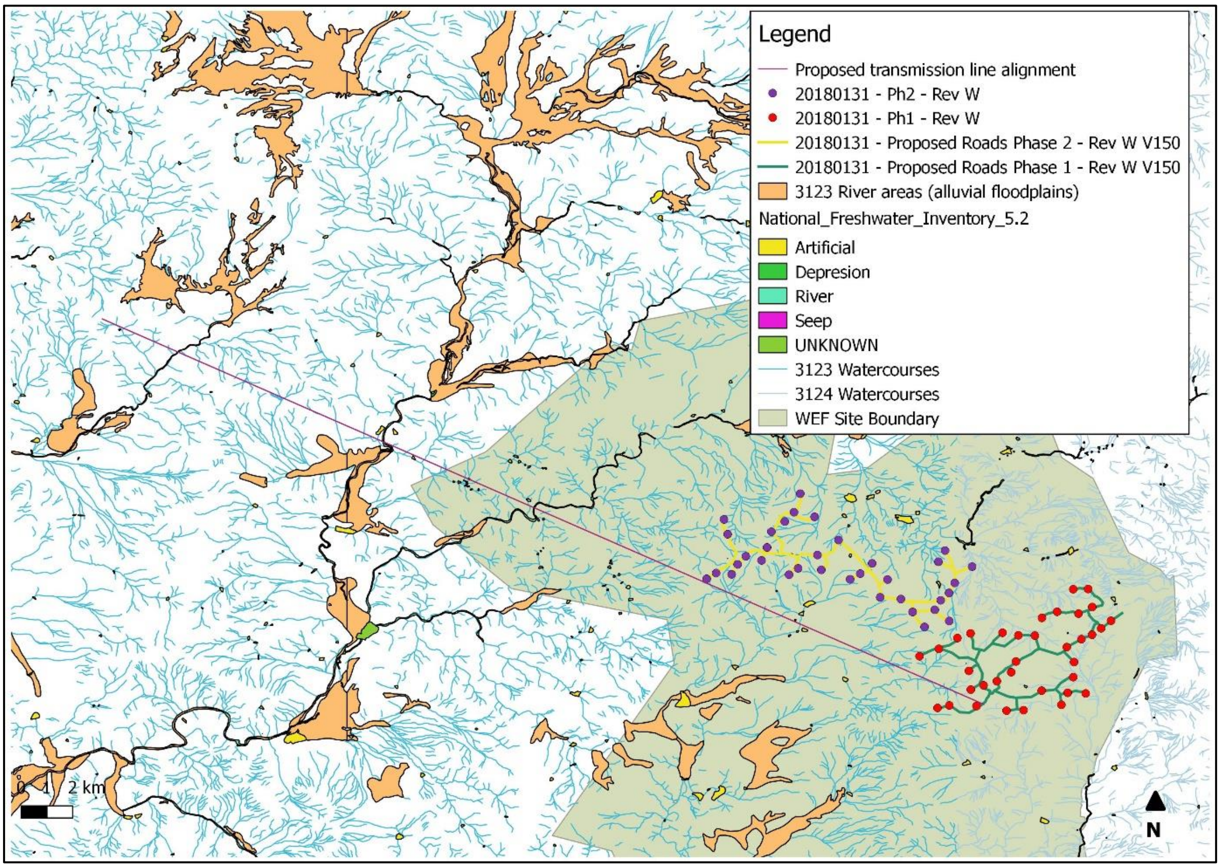

Figure 2: The study area in relation to the various surrounding river (including alluvial fans and water courses) and identified wetland areas.

4 – Baseline Environment

Several water bodies and aquatic systems are indicated in Figure 2 and 3. Based on the 6 levels of the National Wetland Classification System, these systems are typical of Inland Systems (Level 1), within the Drought Corridor Ecoregion (Level 2).

Wetland landscape units (Level 3) were thus valley floors (riparian / palustrine) or un-channelled valley bottom hydrogeomorphic units (Level 4). Several of these have been indicated in the National Wetland Inventory, however upon closer inspection during the site visit (Plate 1), and the National Freshwater Priority Ecosystems Areas (NFEPA) database (Nel *et al*., 2011) most of the indicated wetlands are man-made systems. Based then on this and field observations no natural wetlands would be affected by the proposed WEF or transmission line alignment.

Within the remaining waterbodies, the low annual rainfall within the region the water courses infrequently contain any surface runoff or open water (Level 5), but would remain important habitat or refugia within a landscape when flowing or inundated. These were thus classified as riverine drainage lines (Plate 2), alluvial river beds and small to medium sized water courses (Figure 2). The majority of the water course crossings will occur on the smaller drainage lines and water courses and will not impact on the large alluvial systems shown in Figure 2.

Of interest is the National Freshwater Ecosystems Priority Areas project (Nel *et al*., 2011), several important catchments (sub-quaternaries or SQ) have been earmarked, based either on the presence of important biota (e.g. rare or endemic fish species) or the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas or FEPAs.

The study area contains several of these FEPAs, which are based on either their role in containing fish species of special concern or their potential as support habitats, associated with main stem rivers (Figure 3). These habitats include lower and upper mountain foothills, important for the Chubbyhead barb (*Barbus anoplus*) and *Pseudobarbus asper* (Smallscale redfin) fish species. The later species is Endemic to South Africa and is listed as Endangered.

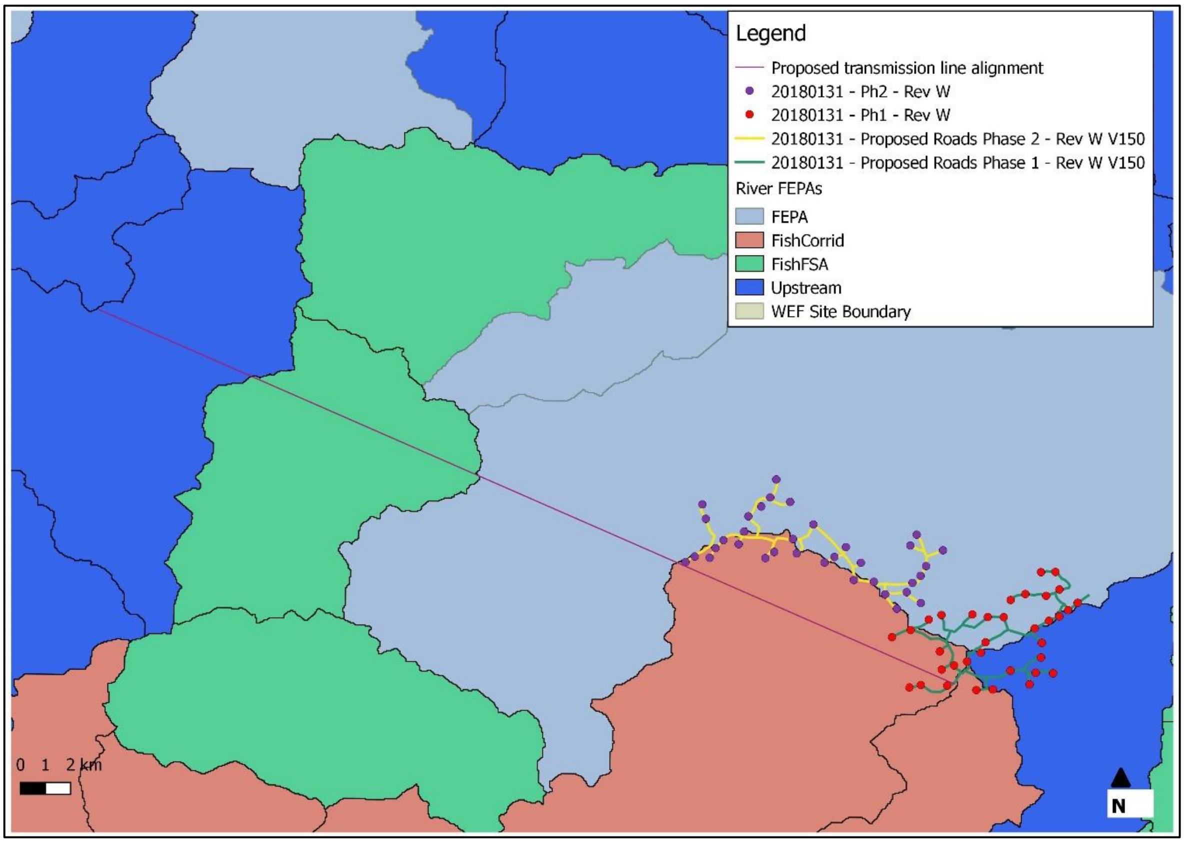

Figure 3: The project locality in relation the Freshwater Ecosystems Priority Areas (Nel *et al*., 2011).

5 - Present Ecological State and conservation importance

The Present Ecological State (PES) of the Rivers

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 habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). 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 centered 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 then overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where C = Moderately Modified & B = Largely Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
6621	C	Moderate	Moderate
6748	D	Moderate	Moderate
6756	C	Moderate	Moderate
6810	C	High	Moderate

It is thus evident that the study area systems are largely functional, however significant impacts as a result of current land use practices and alien trees (e.g. *Salix babylonica*) do occur. This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout shown in Figure 3. In other words, the systems observed are natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

The present day impacts have affected the Ecological Importance (EI) and Ecological Sensitivity (ES) of these systems, with most being rated as Moderate (EI & ES).

The only exception being Sub-Quaternary Catchment, 6810 (L21D), where EI was rated as High. This was due to the importance of this catchment in being a Fish Corridor and containing downstream habitat for the various listed fish species discussed above, i.e. high scores for fish rarity metrics for this catchment.

6 - Recommended buffers

Presently there are no prescribed aquatic buffers other than those proposed in this portion of the Western Cape, thus the, recommendations by Desmet and Berliner (2007) will be applied as these 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, lay down areas and construction camps should avoid these buffer areas i.e. 32m for this development (Figure 4).

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

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	▪ 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 i.e. rivers mapped at this scale by DWS	▪ 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 scale streams, i.e. all systems that appear on the topo-cadastral maps	▪ 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.

Plate 1: Small borrow pit area associated with past road works that was identified as a natural wetland by NFEPA (Nel *et al*. 2011) and was classified as an artificial or man-made dam in this study and the updated National Wetland Inventory (ver 5.2)

Plate 2: A typical water course observed within the study area, where the potential exists to improve the current state of flows and erosion protection

7 – Potential impacts

During the impact assessment study a number of potential key issues / impacts were identified and these were assessed based on the methodology supplied by Arcus Consulting.

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

- Loss of aquatic species of special concern, and
- Wetland loss as no natural wetlands were observed in close proximity to any of the proposed infrastructure (i.e. within 500m of the roads layout).

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

- Impact 1: Loss of riparian systems and water courses
- 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: Overall cumulative impact

The impacts were assessed as follows:

<table>
<tr><td colspan="8">Nature: Impact 1 - Loss of riparian systems and water courses

The physical removal of the riparian zones and disturbance of any alluvial watercourses by 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. This coupled to the fact that the majority of the crossings will occur over small or minor drainage lines, while 31 crossings (Phase 1 & 2) will be upgraded.

The proposed grid connection between Phase 1 and 2 and the National grid, will have no impact on the aquatic environment, firstly due to the size of disturbance of the pylons and it has been assumed that these towers can span any rivers / water courses incl of alluvial areas.</td></tr>
<tr><td colspan="3">▪ Reversibility</td><td colspan="3">▪ Yes (High)</td><td colspan="2">▪ Yes (High)</td></tr>
<tr><td colspan="3">▪ Irreplaceable loss of resources</td><td colspan="3">▪ No</td><td colspan="2">▪ No</td></tr>
<tr><td colspan="3">▪ Can impacts be mitigated</td><td colspan="3">▪ Yes</td><td colspan="2"></td></tr>
<tr><td colspan="8">▪ Mitigation:
• Where water course 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 minimise the loss of riparian vegetation (small footprint).
• 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 if 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.</td></tr>
<tr><td colspan="8">▪ 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.</td></tr>
<tr><td colspan="8">▪ Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.</td></tr>
<tr><th></th><th>Extent</th><th>Duration</th><th>Intensity</th><th>Status</th><th>Significance</th><th>Probability</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>Local (L)</td><td>Long term (L)</td><td>L-</td><td>Negative</td><td>Medium (-)</td><td>High</td><td>High</td></tr>
</table>

With Mitigation	Local (L)	Short term (S)	L-	Negative	Low (-)	High	High

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or roads on riparian form and function		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ Yes (High)	▪ Yes (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.		

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Long term (L)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (S)	L-	Negative	Low (-)	High	High

Nature: Impact 3 - Increase in sedimentation and erosion within the development footprint		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ Yes (High)	▪ Yes (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) 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.		

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Long term (L)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (S)	L-	Negative	Low (-)	High	High

Nature: Impact 4 – Impact on localized surface water quality During both preconstruction, 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.		
	Without mitigation	**With mitigation**
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.
- Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

Cumulative 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.

Residual impacts:
Residual impacts will be negligible after appropriate mitigation.

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Long term (L)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (S)	L-	Negative	Low (-)	High	High

Nature: Impact 5 – Overall cumulative impact during the construction and operational phases. In the assessment of this project, the surrounding projects within a 35km radius of the site were assessed. All of the projects have indicated that this is also their intention with regard mitigation, i.e. selecting the best possible routes to minimise the local and regional impacts, and improving the drainage or hydrological conditions with these rivers so that the cumulative impact would be negligible. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects, noting only a small number of projects ever reach the construction phase and that flows within these systems are sporadic.		
	Without mitigation	**With mitigation**
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:

- Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region

» Install properly sized culverts with erosion protection measures at the present road / track crossings							
Residual impacts: Residual impacts will be negligible after appropriate mitigation.							
	Extent	**Duration**	**Severity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Grid Connection and substation alternatives

It is anticipated the no impacts on the aquatic environment will occur based on the proposed alignment. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

It is however recommended that a walk down of the final tower positions is conducted by an aquatic specialist prior to construction. This will allow for critical comment on the tower positions and allow for any adjustments to avoid any impacts by shifting tower positions where required.

8 – Conclusion and recommendations

The proposed layouts for the facility would seem to have limited impact on the aquatic environment as many of the proposed structures will avoid the delineated watercourses with the exception of the 31 water course crossings. Based on the condition of some of the present crossings, the project thus presents an opportunity to improve the flow and erosion protection were existing culverts / crossings do exist.

No aquatic protected or species of special concern (flora) were observed during the site visit, as well as any natural wetlands. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW. This is based on the assumption that the projects will have a limited impact on the aquatic environment and with monitoring of flows, erosion and sedimentation, although unlikely, downstream fish populations will not be impacted upon. This is also coupled to the fact that all of the project components have avoided the alluvial systems.

Figure 4, below further indicates the affected water courses crossing points and those that would trigger the need for a Water Use License application (a potential GA) in terms of Section 21 c and i of the National Water Act, should any construction take place within these areas. **However, during the micro-siting process several of the 31 crossings could be reduced by moving some of the roads just outside of the buffer, i.e. these are not actual river crossing, and the proposed the road is only within the buffer (Figure 4). This would also apply to the transmission line, once the positions of the towers are known (Figure 5).**

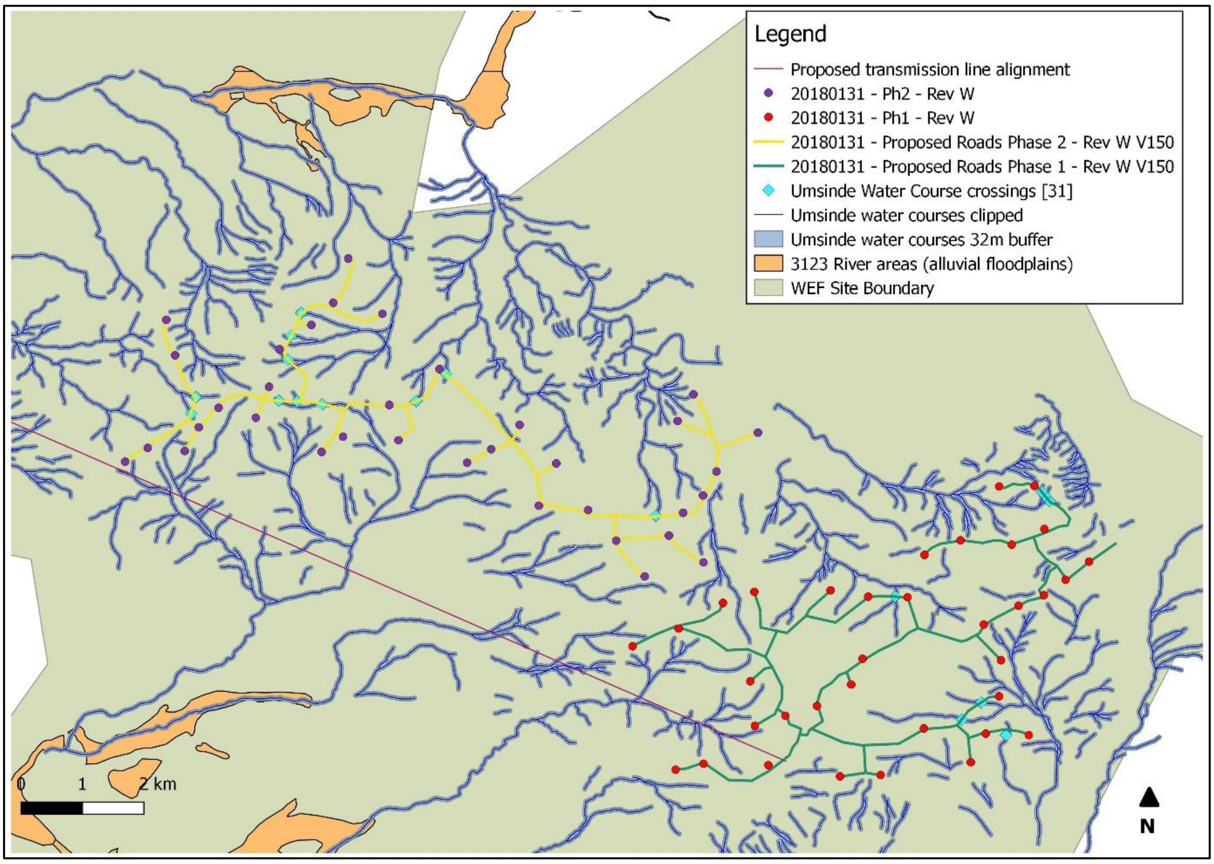

Figure 4: Map indicating the various water courses and the 32m buffer, which has resulted in 31 crossings for both phases.

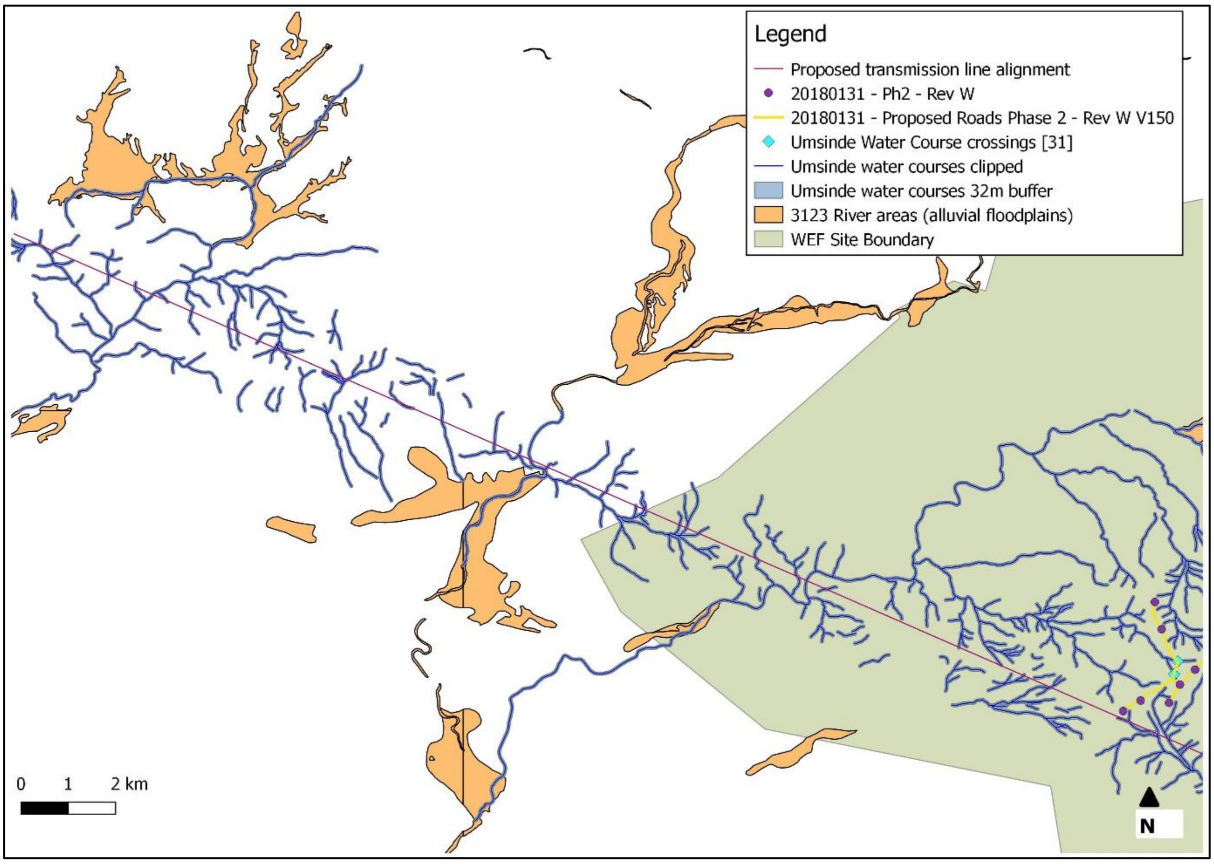

Figure 5: The proposed transmission line will span several water courses should all towers be placed outside of these aquatic areas (incl of the 32m buffer) as shown

9 – References

Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.

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10 – 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 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 2010)

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 (NWCS 2010). 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

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;

[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.

- 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.

<table>
<tr><td rowspan="15">Ecosystem services supplied by wetlands</td><td rowspan="9">Indirect benefits</td><td rowspan="8">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">▪ Stream flow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancem ▪</td><td>▪ Sediment trapping</td></tr>
<tr><td>▪ Phosphate assimilation</td></tr>
<tr><td>▪ Nitrate assimilation</td></tr>
<tr><td>▪ Toxicant assimilation</td></tr>
<tr><td>▪ Erosion control</td></tr>
<tr><td colspan="2">▪ Carbon storage</td></tr>
<tr><td colspan="3">▪ Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits ▪</td><td colspan="3">▪ Provision of water for human use</td></tr>
<tr><td colspan="3">▪ Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">▪ Provision of cultivated foods</td></tr>
<tr><td colspan="3">▪ Cultural significance</td></tr>
<tr><td colspan="3">▪ Tourism and recreation</td></tr>
<tr><td colspan="3">▪ Education and research</td></tr>
</table>

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 land owner. A number of Category 1 & 2 plants were found at all of the sites investigated, thus the contractors must take extreme care further spread of these plants doesn't occur. This should be done through proper stockpile management (topsoil) and suitable rehabilitation of disturbed areas after construction.

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, lay down 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 buffer be set for all 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 4). 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.

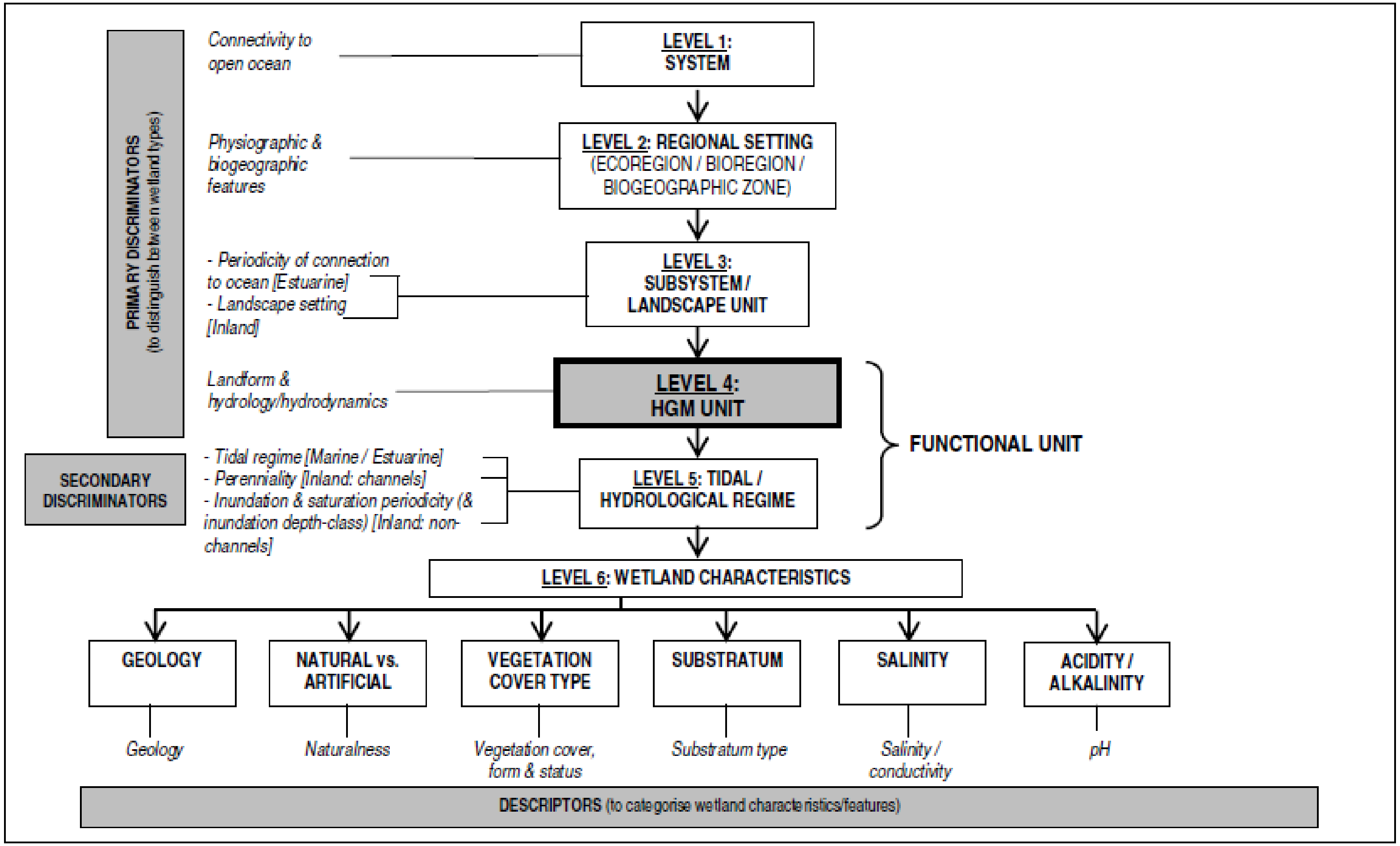
Level 6 uses of six descriptors to characterise the wetland types on the basis of biophysical features. As with Level 5, these are non hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

(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 5 – 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.



PRIMARY DISCRIMINATORS (to distinguish between wetland types)
Connectivity to open ocean
LEVEL 1: SYSTEM
Physiographic & biogeographic features
LEVEL 2: REGIONAL SETTING (ECOREGION / BIOREGION / BIOGEOGRAPHIC ZONE)
- Periodicity of connection to ocean [Estuarine]
- Landscape setting [Inland]
LEVEL 3: SUBSYSTEM / LANDSCAPE UNIT
Landform & hydrology/hydrodynamics
LEVEL 4: HGM UNIT
FUNCTIONAL UNIT
SECONDARY DISCRIMINATORS
- Tidal regime [Marine / Estuarine]
- Perenniality [Inland: channels]
- Inundation & saturation periodicity (& inundation depth-class) [Inland: non-channels]
LEVEL 5: TIDAL / HYDROLOGICAL REGIME
LEVEL 6: WETLAND CHARACTERISTICS
GEOLOGY
NATURAL vs. ARTIFICIAL
VEGETATION COVER TYPE
SUBSTRATUM
SALINITY
ACIDITY / ALKALINITY
Geology
Naturalness
Vegetation cover, form & status
Substratum type
Salinity / conductivity
pH
DESCRIPTORS (to categorise wetland characteristics/features)

Figure 4: 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).

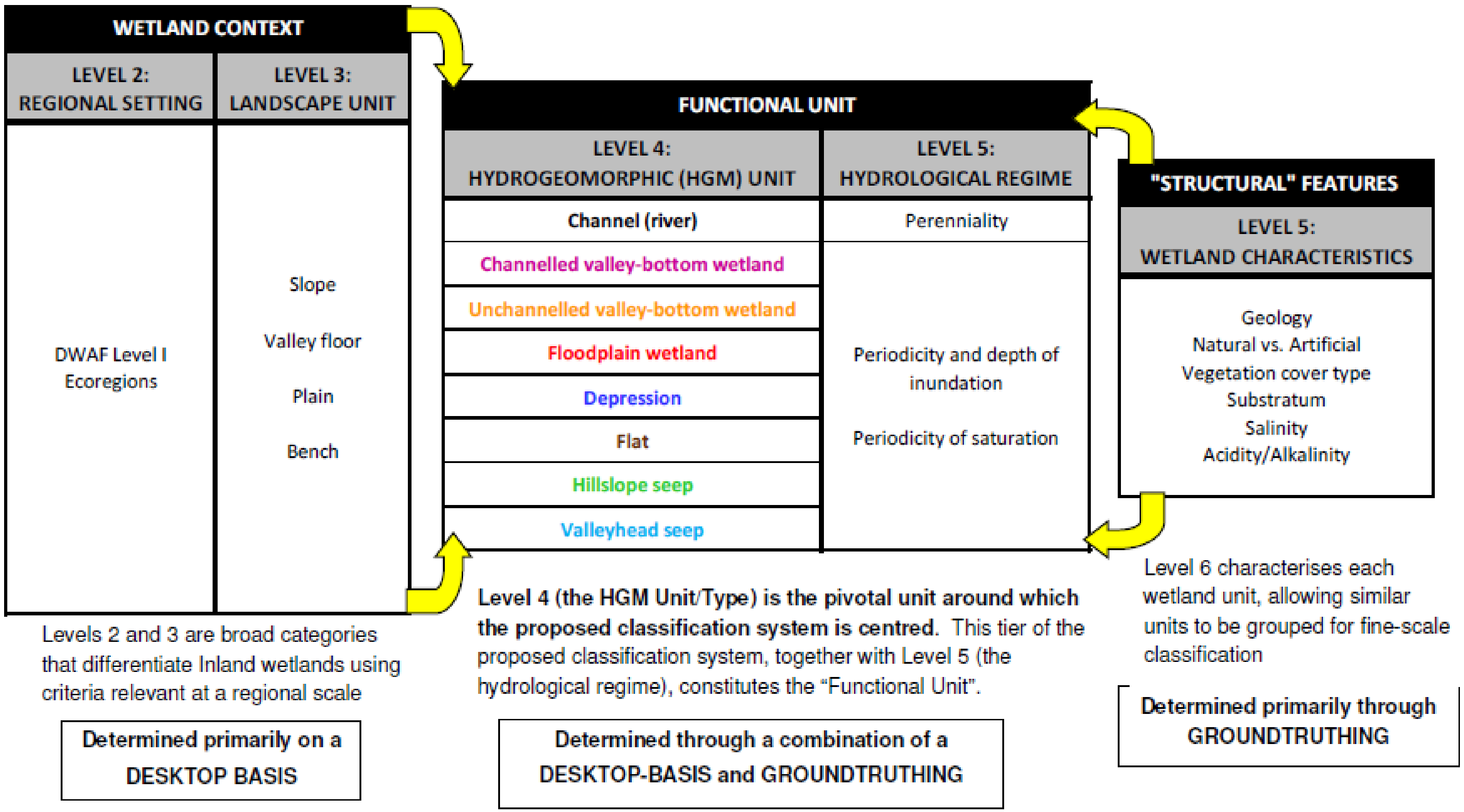


Figure 5 Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from SANBI, 2009).

Wetland condition and conservation importance assessment

To assess the Present Ecological State (PES) or condition of the observed wetlands, 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
- 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.

11 Appendix 2: Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
7212215031083

1 Rossini Rd
Pari Park
Port Elizabeth, 6070
brian@itsnet.co.za
083 498 3299

Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07 & EAPSA certified). Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 21 years

SKILLS BASE AND CORE COMPETENCIES

- 21 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 12 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMMU
- 1995: B Sc Hon (Zoology) - NMMU
- 1996: M Sc (Botany - Rivers) - NMMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela Metropolitan University – SAB institute for Coastal Research & Management. Funded by the WRC.
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – present Owner / Ecologist of Scherman Colloty & Associates cc

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Kenmare Mining Pilivilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.

Dr Brian Colloty 1

- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – current.
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan for the Indwe 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 85 renewable projects in the past four years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farm), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the N2, PE to Cape Town, 2012 on behalf of SRK (2013).

12 - Appendix 3: Signed declaration