Wetland Offset Strategy for the Bombay Road Project

Kwazulu-Natal

August 2017

CLIENT

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DECLARATION

I, Wayne Jackson declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Wayne Jackson

Wetland Specialist

The Biodiversity Company

10 August 2017

1 Introduction

The Biodiversity Company was commissioned to complete a Wetland Offset Strategy for the proposed Bombay Road extension project in Pietermaritzburg, KwaZulu-Natal.

This study aims to:

- Calculate an appropriate target wetland offset for the development;
- Identify potential areas for this offset;
- Provide a conceptual restoration strategy for the preferred candidate site; and
- Recommend measures to achieve the stated ecological objectives off the offset.

2 Background Information

The Bombay Road extension project has been identified as a medium-term roads improvement scheme in the Msunduzi Municipal Transportation Plan. The project entails the extension of Bombay Road from Chota Motala Road to Bhambatha Road and linking into Ohrtmann Road to ease congestion within the surrounding vicinity.

The Bombay Road extension is located in Pietermaritzburg, KwaZulu-Natal, within the industrial area of Rosedale (Figure 1). The project area is located in the upper catchment area which flows into the uMnsunduze River system.

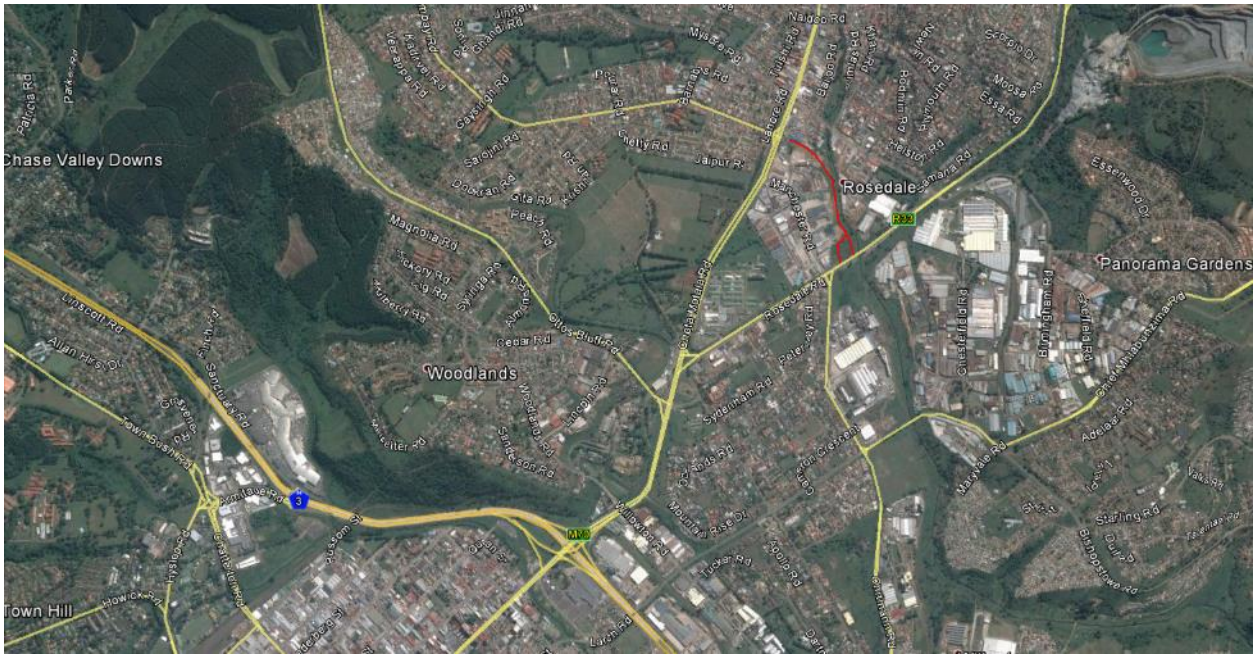

Figure 1: The location of the proposed road extension (red) in relation to the general settings

3 Wetland Offset Rational

3.1 Offset objectives

According to Macfarlane *et al* (2014) key goals are vital in order to inform the wetland offset plan and the implementation thereof. The specific objectives of a wetland offset are the following:

- Provide appropriate and adequate compensation for residual impacts on key water ecosystem services and contribute to achieving water resource objectives by:
    - Ensuring no net loss in the overall wetland functional area by providing gains in wetland area and/or condition equal to or greater than the losses due residual impacts;
    - Directing offset activities that will improve key regulating and supporting services towards those wetlands where these specific services can best be enhanced;
    - Providing 'in kind' services through offset activities, or substitute services acceptable to affected communities;
- Secure formal protection of wetland systems in a good condition so as to contribute to meeting national biodiversity and protection targets for the representation and persistence of different wetland types; and
- Adequately compensate for residual impacts on threatened or otherwise important species through appropriate offset activities that support and improve the survival and persistence of these species.

3.2 Offset categories

Should a wetland offset be deemed appropriate, various actions may be used to deliver the required outcomes, as provided by Macfarlane *et al* (2014).

- **Protection:** This refers to the implementation of legal mechanisms (e.g. declaration of a Protected Environment or Nature Reserve under the National Environmental Management: Protected Areas Act, a legally binding conservation servitude, or a long term Biodiversity Agreement under National Environmental Management Act) and putting in place appropriate management structures and actions (this may include setting appropriate water reserve determinations and specifying protection measures within DWA planning instruments, as well as inclusion of offset sites into appropriate land use zones and land use plans including provincial and local conservation plans) to ensure that conservation outcomes are secured and maintained in the long-term.
- **Averted loss:** This refers to physical activities which prevent the loss or degradation of an existing wetland system, its ecosystem services and its biodiversity, where there is a clearly demonstrated threat of decline in the system's condition, ability to provide ecosystem services or support overall Water Resource Objectives (both quality and quantity).
- **Rehabilitation:** Rehabilitation results in an improvement in wetland condition, function, and associated biodiversity. Rehabilitation involves the manipulation of the physical, chemical, or biological characteristics of a degraded wetland system in order to repair or improve wetland integrity and associated ecosystem services.

- **Establishment:** This involves the development (i.e. creation) of a new wetland system where none existed before by manipulating the physical, chemical, or biological characteristics of a specific site.
- **Direct compensation:** Direct compensation involves directly compensating affected parties for the ecosystem services lost as a result of development activities. This is ideally done by providing an equivalent substitute form of asset or in some cases may take the form of monetary compensation.

3.3 Wetland offsets requirements

A wetland offset plan should be considered in an event that wetland areas will be lost due to a proposed development, resulting in the unavoidable loss of the wetland area, or part thereof, it must be noted, the offset of wetland loss is considered to be the last resort with regards to the mitigation hierarchy (DEA et al., 2013) (Figure 2). The mitigation hierarchy as discussed by the Department of Environmental Affairs et al. (2013) will be considered for this component of the study. In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts.

The objective of this phase of the project is to identify opportunities for improving the overall integrity of the selected wetland offset area to ensure that ecological functioning, which is to be enhanced by effective management, will compensate for the loss of identified ecological services associated with the lost wetland unit.

The wetland offset planning process is outlined in Figure 3. Step 1 has been completed and involves the initial wetland assessment. Steps 2, 3, and 4 are also addressed by the current study to inform the final phase of offset work. This is where the required offset areas are calculated, potential sites are identified and prioritised and possible institutional and governance arrangements for offset implementation are investigated. The current phase of work provides an incomplete picture of the required offset activities. To implement the plan at the current level of definition (without securing the area, defined budgets for the final rehabilitation of sites and detailed designs) would not be possible.

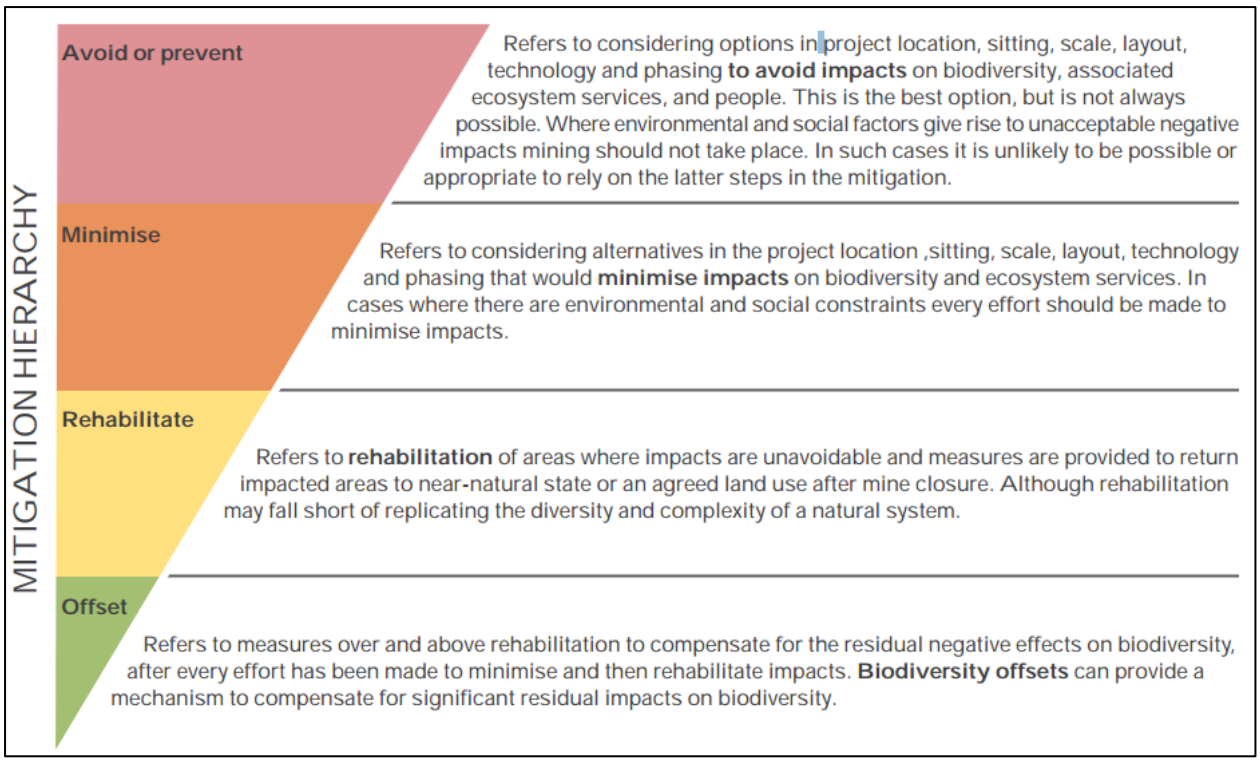

Figure 2: The mitigation hierarchy as described by the DEA (2013)

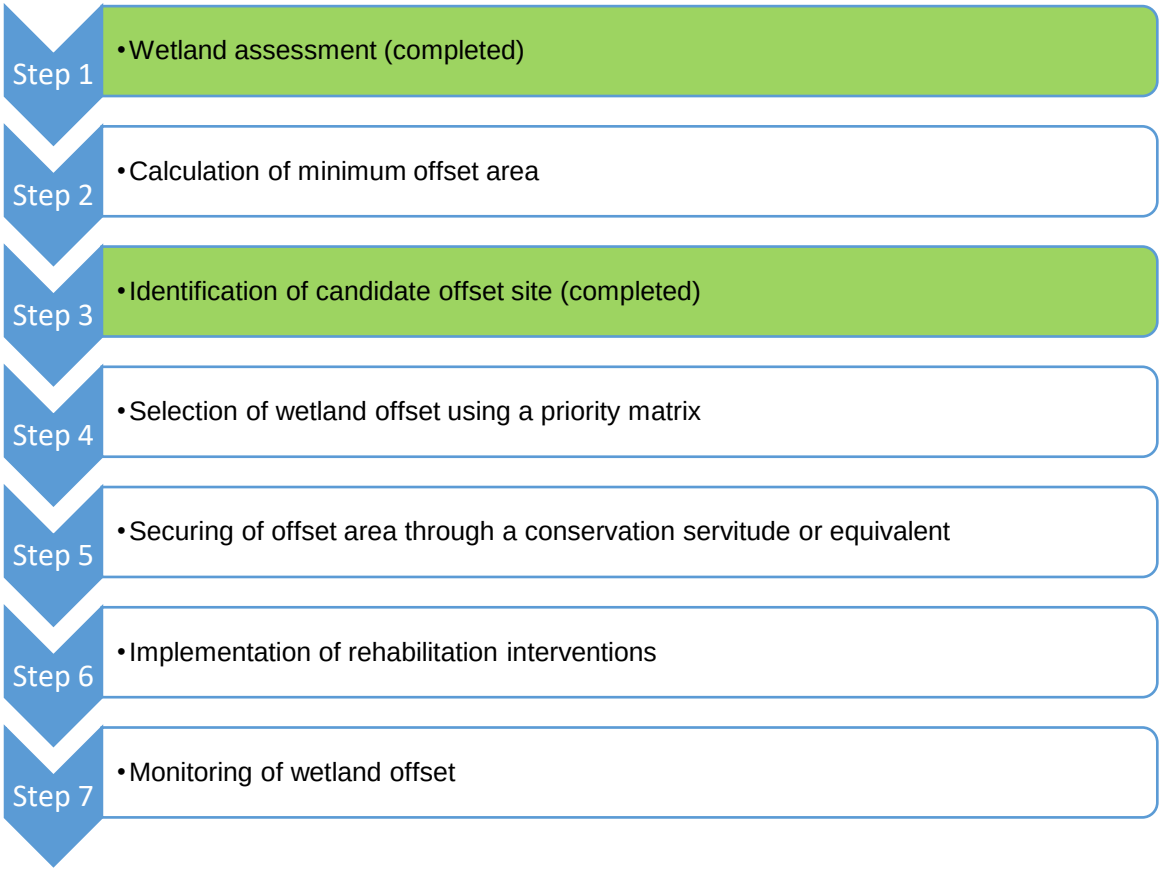

Figure 3: The wetland offset planning process

3.4 Wetland Offset Calculator

The South African National Biodiversity Institute (SANBI), in collaboration with the DWS, has developed a guideline for wetland offsets in South Africa (DWA, 2013). The guideline was produced to provide guidance on wetland offsetting, with particular reference to loss of wetlands, primarily due to mining-related activities. The guideline for wetland offsets in South Africa defines 'biodiversity offsets' as "measurable conservation outcomes resulting from actions to compensate for residual negative impacts on biodiversity".

3.5 Hectare Equivalents

To allow for the quantification of a suitable offset, it is important to establish a common unit or currency that will allow residual losses (due to the proposed impacts) and gains (due to the proposed offset) to be consistently measured and compared. The wetland hectare equivalent concept uses a refined currency that incorporates a measure of ecological function, quality and/or integrity. The basic hectare equivalents of intact wetlands are a combination of extent of the wetland impacted, and the change in condition or functionality They are used as a substitute for measuring lasting loss and have been adopted here as the primary currency for evaluating impacts of proposed development on wetland ecosystems.

Wetland hectare equivalents are determined using three wetland calculators as represented in Figure 4. The hectare equivalents for the wetland functionality and ecosystem

conservation targets were calculated for this study. Since no Red Data species were recorded during field investigations, the species conservation targets calculated was not deemed as necessary.

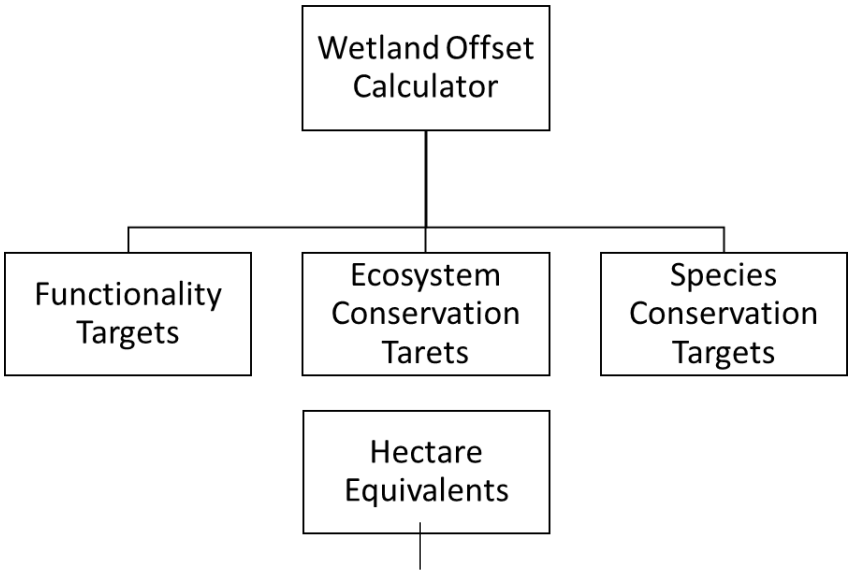

Figure 4: Wetland calculator components

This wetland offset strategy report is intended to motivate for the candidate offset wetland areas to compensate for the impact to the wetland caused by the proposed access route.

4 Methodology

4.1 Wetland Assessment

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification (Ollis, et al. 2013).

4.1.1 Desktop assessment

The following information sources were considered for the desktop assessment;

- Information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org);
- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff 1972 - 2006)
- The National Freshwater Ecosystem Priority Areas (Nel, et al. 2011);
- Contour data (5m).

4.1.2 Wetland Delineation

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 5. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

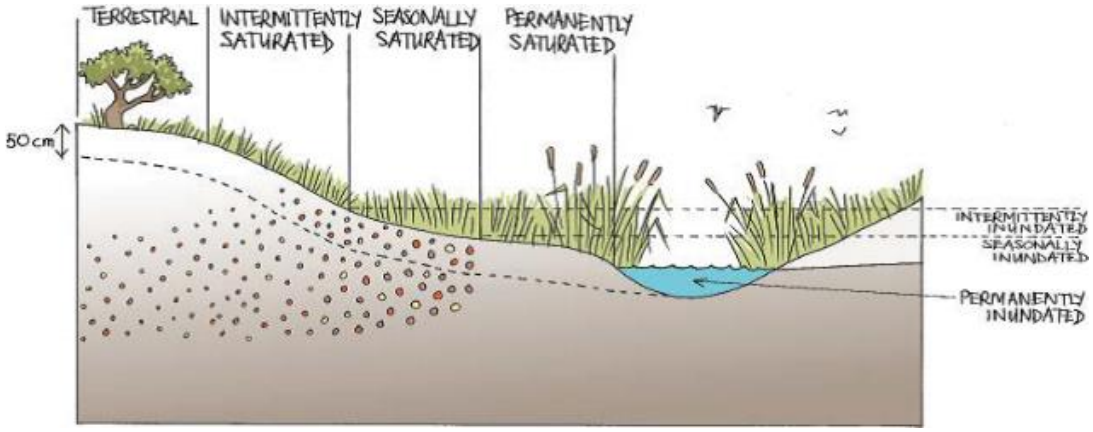

Figure 5: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis, et al. 2013)

4.1.3 Wetland Present Ecological Status (PES)

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 1.

Table 1: The PES categories (Macfarlane, et al. 2009)

Impact Category	Description	Impact Score Range	Present State Category
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

4.1.4 Wetland Ecosystem Services

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze, et al. 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2).

Table 2: Classes for determining the likely extent to which a benefit is being supplied (Kotze, et al. 2009)

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

4.1.5 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no

importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3.

Table 3: Description of EIS categories.

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

4.2 Determination of Targets

The technique described in DWA & SANBI (2013) was used as the technical basis on which to calculate the recommended offset target. The fundamentals of this approach have been developed and used to good effect by the national Working for Wetlands wetland rehabilitation programme. Although not perfect, the technique does offer a way to audit both the setting of quantitative rehabilitation objectives independently and objectively, and the effectiveness of rehabilitation/ restoration in achieving these objectives. The ecological rationale behind this document is sound, and it will serve as an appropriate foundation from which a more site-specific offset goal may be calculated.

In conforming to these guidelines, the wetland hectare-equivalent value of the wetland within the pre-development scenario was calculated. A hectare equivalent is a quantitative expression of the ecological integrity of a wetland HGM unit under a given land-use. It represents the common currency that enables the wetland functional area restored to the landscape by restoration, rehabilitation and artificial creation to be compared to that removed from the landscape by a development. Most environmental authorities advocate a no-net-loss of resources approach, be it to biodiversity or wetland functioning, and the hectare equivalent provides the conceptual means of judging whether these rehabilitation objectives have been satisfied.

The various mitigation ratios recommended in the reference document will be interrogated, and where appropriate adjusted and rationalised based on the particular environmental conditions associated with the site. It is envisaged that the offset target will have two components, namely the functional component (the amount of functional wetland habitat to be secured or restored to the landscape by rehabilitation/ restoration activities) and a conservation component (the biodiversity value to be represented by the candidate offset wetland). These targets will be expressed in hectare-equivalents and/or hectares, and may encompass a range of potential options for the client's consideration.

5 Assumptions and Limitations

The following aspects were considered as limitations;

- The water resource assessment was based on the results of a single low flow/dry season survey only, and information provided should be interpreted accordingly;
- The GPS used for water resource delineations was accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side;
- The MSc. Study being done by Adwoa Awuah from University of KwaZulu-Natal has not been published as yet, and there for the information that was given to TBC has been used as a guideline;
- The lack of information regarding the activities to be completed on the site, only allowed us to do a general assessment on the impacts and the buffer requirement; and
- Wetland systems identified at desktop level within 500 m of the project area were considered for the identification and desktop delineation, with wetland areas within the project area being the focus for ground truthing.

According to the wetland definition used in the National Water Act (NWA), four wetland indicators are used to delineate wetland boundaries. The general area has been disturbed due to the development of the area, this has resulted in the encroachment of industrial areas into the catchment areas, the placement of roads in close proximity to the watercourses, the diversion and management of stormwater and illegal dumping in the area. These disturbances have inhibited the application of the recognised wetland indices, which may affect the accuracy of the delineated areas. Where possible, wetland indicators were implemented for the study, supported by desktop information. Some of the identified disturbances are presented in Figure 6.

Figure 6: Photographs of local disturbances. Left: Access and service roads. Right: Encroachment of yards

6 Results and Discussion

6.1 Impacted Wetland

6.1.1 Wetland Delineation

The desktop delineation attempted to identify the location of wetland areas associated with the project area. Two NFEPA wetland units were identified to be within 500m of the project area (Figure 7), namely channelled and unchannelled valley bottom wetlands. The NFEPA dataset suggests the proposed road alignment will traverse the wetland areas. It is worth noting that the NFEPA wetlands that are directly associated with the road route are not classified as ecological priority areas.

Contour data and Google Earth imagery indicate the presence of numerous watercourses within the general area, these include both perennial and non-perennial systems (Figure 7). The project area is associated with the Bayne's Spruit, a perennial watercourse. A topographical wetness index was also generated for the project to determine the likelihood of wetlands in the area (Figure 8).

Figure 7: The project area and the NFEPA wetlands, watercourses and imagery considered for the study

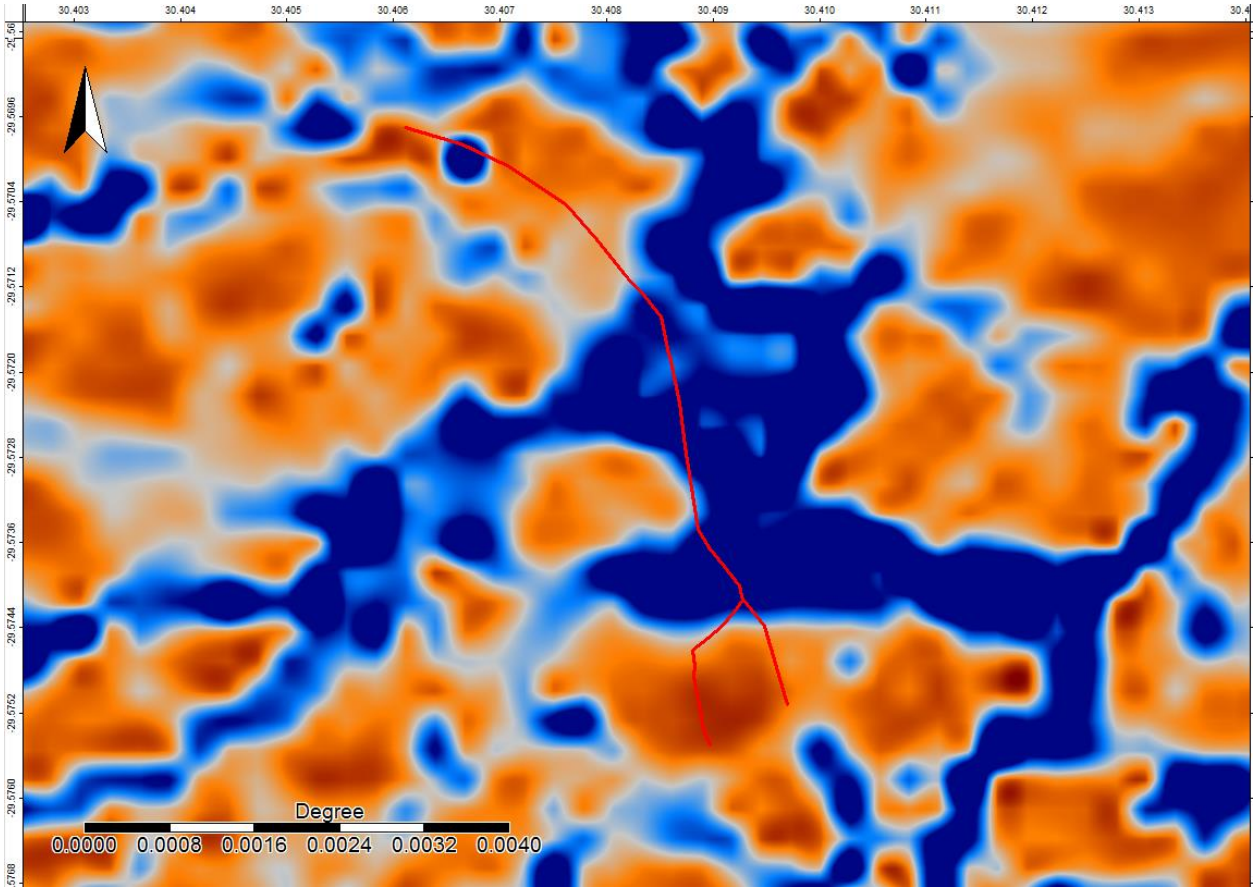

Figure 8: The topographical wetness index processed for the project area showing likely wet areas

The desktop findings were ground truthed, implementing the DWAF (2005) wetland guidelines. Wetland boundaries were ground truthed making use of soil forms, soil wetness, and vegetation to delineate wetland areas. Wetland vegetation that was identified during the study and used to identify and delineate boundaries included *Typha capensis, Phragmites sp, Cyperus sp* and *Juncus sp*. Photographs of areas that were inspected for potential signs of wetness are presented in Figure 9. The delineated areas showing signs of wetness in relation to the project area is presented in Figure 10. The delineated wetland areas have been classified as hillslope seepage wetlands.

Figure 9: Photographs of areas inspected for signs of wetness

Figure 10: The delineated wetland areas and riparian boundary

6.1.2 Present Ecological State (PES)

The Present Ecological Status (PES) for the assessed wetland system, the channelled valley bottom wetland is presented in Table 4. Numerous aspects expected to impact on the status of the wetlands were identified during the study, some of these include (Figure 11):

- Services and access routes transect wetland areas, impeding flow and altering the hydro-dynamics of the systems;
- The general area has been developed, with yards and structures encroaching into wetland areas resulting in the loss of vegetation and altered catchment areas;
- The development of the area has also resulted in increased hardened surface areas, reducing infiltration for the catchment, resulting in increased run-off volumes and velocities down the catchment;
- Local disturbances have resulted in the encroachment of alien vegetation into the area, dominating endemic and wetland plant species;
- Attempts to manage and divert stormwater and run-off have also altered the hydro-dynamics of the catchment, resulting in altered flows and flow velocities;
- The development of the area and the associated landscaping have also altered the structure and geomorphology of the catchment; and
- Dumping and solid waste storage and disposal have also altered the status of the wetland systems, this is as a result of introduced pollutants.

Table 4: Summary of the scores for the wetland PES

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	E: Seriously Modified	7.5	E: Seriously Modified	6.5	E: Seriously Modified	7.6
Overall PES Score	7.2		Overall PES Class		E: Seriously Modified	

The wetland system is in a seriously modified (Category E) state, suggesting the change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable. A summary for the respective modules is as follows:

- The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.
- The change in geomorphic processes is great but some features are still recognizable.
- Vegetation composition has been substantially altered but some characteristic species remain, although the vegetation consists mainly of introduced, alien and/or ruderal species.

Figure 11: Photographs of aspects impacting on the status of the wetlands

6.1.3 Ecosystem Services Assessment

The Ecosystem services provided by the HGM unit present at the site were assessed and rated using the WET-EcoServices method (Kotze, et al. 2009). The summarised results for the HGM units are shown in

Table 5.

The HGM unit had overall Intermediate level of service. The following shows services with moderately high levels or higher;

- Flood attenuation;
- Nitrate assimilation; and
- Toxicant assimilation.

The remaining services were scored as intermediate or lower.

Table 5: The Eco-Services being provided by the wetlands associated with the Bombay Road

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		2.4
			Streamflow regulation		1.7
			Water Quality enhancement benefits	Sediment trapping	1.9
				Phosphate assimilation	2.0
				Nitrate assimilation	2.2
				Toxicant assimilation	2.1
				Erosion control	1.9
			Carbon storage		1.0
	Direct Benefits	Biodiversity maintenance			1.1
		Provisioning benefits	Provisioning of water for human use		0.6
			Provisioning of harvestable resources		1.0
			Provisioning of cultivated foods		1.0
		Cultural benefits	Cultural heritage		1.0
			Tourism and recreation		0.3
			Education and research		0.8
Overall					20.8
Average					1.4

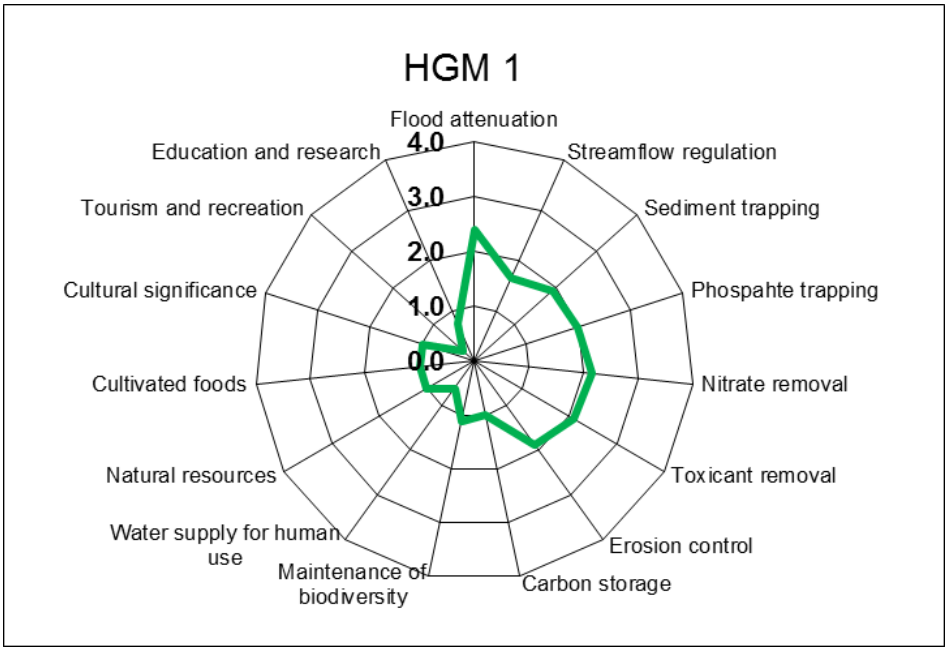

Figure 12: The spider diagram for Eco-Services rendered by the HGM unit

6.1.4 Ecological Importance & Sensitivity (EIS)

The EIS assessment was applied to the HGM unit described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 6.

The Ecological and Hydrological Importance for the impacted wetland was rated to be Moderately important (C), with the direct human benefits being rated as a having a Low Importance (D).

Table 6: The EIS results for the Bombay road Impacted wetland

WETLAND IMPORTANCE AND SENSITIVITY	
HGM 1	
	Importance
ECOLOGICAL IMPORTANCE & SENSITIVITY	**1.4**
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	**1.9**
DIRECT HUMAN BENEFITS	**0.8**

6.2 Identification of Wetland Offset Area

The wetland offset calculator is used to determine the minimum hectare equivalents required for the offset area. Table 7 and Table 8 show the results of the wetland offset calculator for functionality and ecosystem conservation. The species conservation calculator was not used in this assessment, since no Red Data or protected plants were recorded within the lost wetland on site and suitable habitat was not identified.

Although only 0.07 ha are required to be offset as part of the functional target, this does not necessarily imply that rehabilitation should be limited to this area. Since wetlands are complex, interlinking systems, it is advisable that a greater area is rehabilitated in order to show improved functionality. The recommended mitigation measures would also support the improvement of the wetland functionality.

Table 7: Offset Calculator - Wetland Functionality Targets

Wetland Functionality Targets				
Impact Assessment	Prior to development	Wetland size (ha)	0.16	
		Functional value (%)	30	
	Post development	Functional value (%)	0	
		Change in functional value (%)	30	
	Key Regulating and Supporting Services Identified		Flood Attenuation, Nitrate and Toxicant Assimilation	
	Development Impact (Functional hectare equivalents)		0.05	
Offset calculation	Offset Ratios	Triggers for potential adjustment in exceptional circumstances	Wetlands providing critical flood attenuation, water quality enhancement or carbon sequestration functions	
		Functional Importance Ratio	1.5	
	Functional Offset Target (Functional hectare equivalents)		0.07	

Table 8: Offset Calculator – Ecosystem Conservation Targets

Ecosystem Conservation Targets				
Impact Assessment	Prior to development	Wetland size (ha)	0.16	
		Habitat intactness (%)	50	
	Post development	Habitat intactness (%)	0	
		Change in habitat intactness (%)	50	
	Development Impact (Habitat hectare equivalents)		0.08	
Determining offset ratios	Ecosystem Status	Wetland Vegetation Group (or type based on local classification)		
		Threat status of wetland	Threat status	VU
			Threat status Score	3
		Protection level of wetland	Protection level	Moderately Protected
			Protection level Score	0.75
		Ecosystem Status Multiplier		2.25
	Regional and National Conservation context	Priority of wetland as defined in Regional and National Conservation Plans	Moderate Importance	0.75
		Regional & National Context Multiplier		0.8
	Local site attributes	Uniqueness and importance of biota present in the wetland	Low biodiversity value	0.5
		Buffer zone integrity (within 500m of wetland)	Buffer compatibility score	0.5
		Local connectivity	Moderate connectivity	0.75
		Local Context Multiplier		0.5
	Ecosystem Conservation Ratio			0.89
Offset Calculation	Development Impact (Habitat hectare equivalents)		0.08	
	Ecosystem Conservation Ratio		0.89	
	Ecosystem Conservation Target (Habitat hectare equivalents)		0.07	

6.3 Candidate Wetland Offset Area

6.3.1 Wetland Delineation

The wetland selection was made with the consultation of the Department of Environmental affairs and discussions with Esmeralda Ramburran at Msunduzi Municipality. The Sobantu wetland site is currently being studied by a Masters student (Adwoa Awuah at University of KwaZulu-Natal), with particular reference to “An assessment of the rehabilitation potential of wetlands in the Baynespruit catchment, Pietermaritzburg, KwaZulu-Natal. (MSc Thesis)”. The PES values for this wetland was calculated by the MSc. Student, however the study has not been published as yet and this is a limitation in this report.

The wetland delineation (Figure 13) for the Sobantu area consists of 3 HGM types, namely;

- Channelled Valley Bottom;
- Floodplain; and
- Hillslope Seep.

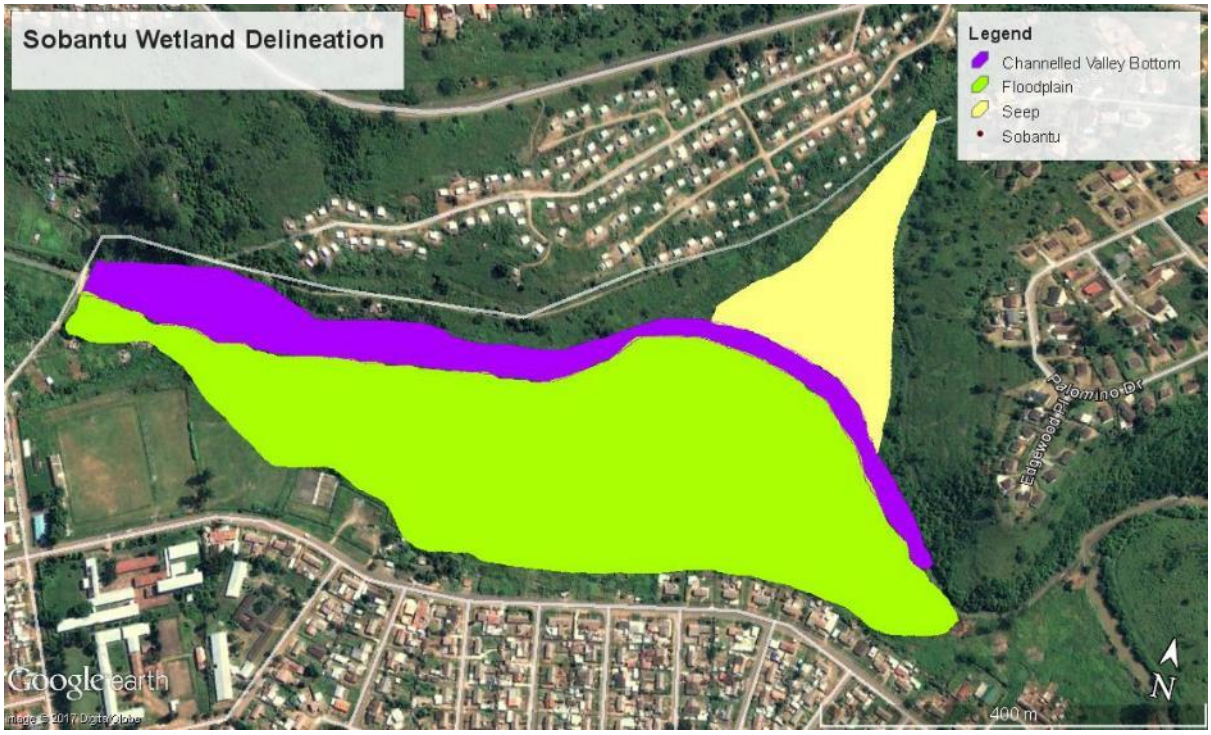

Figure 13: The Sobantu wetland delineation

6.3.2 PES

The Present Ecological Status (PES) for the assessed Sobantu wetland system, the wetlands are presented in Table 9. The aspects that impact on the status of the wetlands were identified during the study;

- Stormwater drains from the development that drain into wetland areas;
- Dumping of domestic and industrial waste;
- Excavation of drainage channels;

- Low level bridges impeding flow;
- Weir structures changing the hydrological regime;
- Proliferation of alien vegetation across entire site;
- Bare areas from excavated and compacted soils (Infrastructure installation); and
- Subsistence Farming.

Table 9: Summary of the scores for the Sobantu wetland PES

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	E: Seriously Modified	7.5	D: Largely Modified	5.1	E: Seriously Modified	7.6
Overall PES Score	6.8		Overall PES Class		E: Seriously Modified	

The wetland system is in a seriously modified (Category E) state, suggesting the change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.

6.3.3 Ecosystem Services Assessment

The Ecosystem services provided by the HGM unit present at the site were assessed using the WET-EcoServices method (Kotze, et al. 2009). The summarised results for the HGM units are shown in Table 10.

The HGM unit had overall Intermediate level of service. The following shows services with moderately high levels or higher;

- Nitrate assimilation; and
- Toxicant assimilation.

The remaining services were scored as intermediate or lower. The Bombay Road wetland had an added benefit of attenuating floods. This benefit will be addressed and improved in the offset planning.

Table 10: The Eco-Services being provided by the wetlands associated with the Sobantu Offset wetland site

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.6
			Streamflow regulation		2.0
			Water Quality enhancement benefits	Sediment trapping	1.9
				Phosphate assimilation	1.9
				Nitrate assimilation	2.1
				Toxicant assimilation	1.8
				Erosion control	2.2
			Carbon storage		1.7
	Direct Benefits	Biodiversity maintenance			1.3
		Provisioning benefits	Provisioning of water for human use		0.8
			Provisioning of harvestable resources		0.4
			Provisioning of cultivated foods		0.4
		Cultural benefits	Cultural heritage		0.0
			Tourism and recreation		0.0
			Education and research		1.3
Overall					19.4
Average					1.3

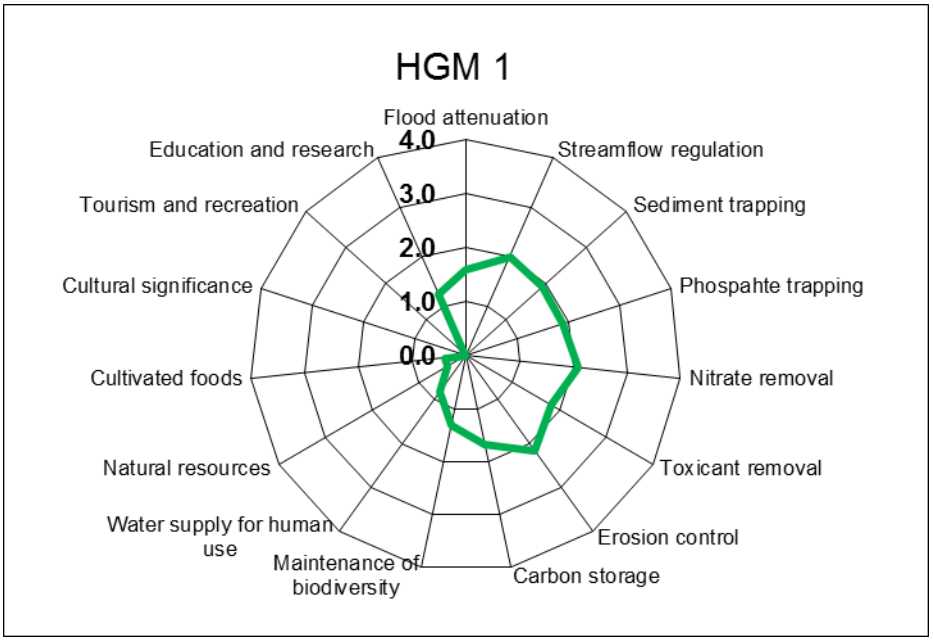

Figure 14: The spider diagram for Eco-Services rendered by the HGM unit

6.3.4 Ecological Importance & Sensitivity (EIS)

The EIS assessment was applied to the HGM unit described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 6.

The Ecological and Hydrological Importance for the impacted wetland was rate to be Moderately important (C), with the direct human benefits being rated as a having a Low Importance (D).

Table 11: The EIS results for the Bombay road Impacted wetland

WETLAND IMPORTANCE AND SENSITIVITY	
HGM 1	
	Importance
ECOLOGICAL IMPORTANCE & SENSITIVITY	**2.0**
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	**1.9**
DIRECT HUMAN BENEFITS	**0.5**

6.4 Wetland Offset Assessment

The wetland that will be lost during the Bombay Road expansion project will be 0.16ha, and the selected site for offset was the Sobantu wetland system downstream of the impacted wetland. It was chosen based on the intactness of the wetland and the size which will be most beneficial. The Sobantu wetland has existing impacts which are described below.

The impacted wetland was 0.16 ha in size and the functional rating was that of 30 % (E – Seriously Modified). Therefor based on the on-site information the hectare equivalent was calculated to be 0.07 ha. The selected portion of the Sobantu wetland is approximately 14 ha with a functional value of 36% (E- Seriously Modified).

It is envisioned that the overall functionality of the Sobantu floodplain wetland could be improved to a Largely Modified State (D) (47%). This equates to an 11% increase in functionality of the Sobantu wetland. With all other factors considered the final hectare equivalent will be 1.02 ha. This is a 1:14 improvement in functionality of the wetland.

The contributions to ecosystem targets over the 14 ha Sobantu area has been calculated to be 4.90 ha, the hectare equivalent requirement was 0.07 ha. This is a significant gain in wetland ecosystem status.

These improvements are at a relatively low cost and a significant gain to the overall wetland integrity.

Table 12: Summary of Floodplain wetland area offset

Contribution Towards Wetland Functionality Targets				
Attributes	Bombay Road			
Alignment with site selection guidelines	**Criterion**	**Relevance**	**Site attributes**	**Acceptability Guidelines**
	Wetland type	Targeted wetlands should typically be of the same type to ensure that similar services to those impacted are improved through offset activities.	Wetland is of the same type as the impacted wetland.	Ideal
	Key services targeted	Targeted wetlands should be prioritised and selected based on their ability to compensate for key regulating and supporting services impacted by the proposed development.	Selected wetland is well placed to contribute meaningfully towards improving key regulating and supporting services identified.	Ideal
	Offset site location relative to impacted wetland	Targeted wetlands should ideally be located as close to the impacted site as possible.	Selected wetland is located within the same local catchment as the impacted wetland.	Ideal
	Overall comment on alignment with site selection guidelines	The Sobantu Wetland was selected as it formed a large intact HGM unit downstream of the Impacted wetland. It also showed similar Eco-Services values which can be improved upon. The Overall health of the Sobantu wetland is also similar		
Preliminary Offset Calculation	**Prior to offset activities**	Wetland size (ha)	14	
		Functional value (%)	36	
	Following successful offset implementation	Functional value (%)	47	
		Change in functional value (%)	11	
	Preliminary Offset Contribution (Functional hectare equivalents)		**1.54**	
Final Offset Calculation	**Criterion**	**Relevance**	**Offset activity**	**Adjustment factor**
	Types of offset activities proposed	The risk of offset failure is linked to the type of offset activity planned with wetland establishment considered less preferable and riskier than rehabilitation or averted loss activities.	Rehabilitation & Protection	0.66
	Final Offset Contribution (Functional hectare equivalents)		**1.02**	

Contribution Towards Ecosystem Conservation Targets				
Wetland attributes	Wetland Reference		Sobantu	
	Wetland Vegetation Group (or type based on local classification)			
	Threat status of wetland		Threat status	**VU**
Alignment with site selection guidelines	**Criterion**	**Relevance**	**Site attributes**	**Acceptability Guidelines**
	Like for Like	Targeted wetlands should be aligned with "like-for-like" criteria to ensure that gains associated with wetland protection are commensurate with losses.	Wetland is of the same wetland type within the same wetland vegetation group	Ideal
	Landscape planning	To what degree is wetland selection aligned with Regional and National Conservation Plans	Wetlands have been identified as moderately important in landscape planning	Acceptable
	Wetland condition	The habitat condition of the wetland should ideally be as good / better that that of the impacted site prior to development (or at least B PES Category in the case of largely un-impacted wetlands)	Final habitat condition is likely to be better than that of the impacted wetland.	Ideal
	Local biodiversity value	Wetlands that are unique or that are recognised as having a high local biodiversity value should be prioritised for wetland protection.	The wetland is characterised by habitat and / species of moderate biodiversity value.	Acceptable
	Viability of maintaining conservation values	Connectivity and consolidation with other intact ecosystems together with the potential for linkage between existing protected areas is preferable.	The wetland is well connected to other intact natural areas	Acceptable
Preliminary Offset Calculation	Wetland areas to be secured	Wetland size (ha)	**14.0**	
		Habitat intactness (%)	**35**	
		Wetland habitat contribution (hectare equivalents)	**4.9**	
	Buffer zones to be secured	Area of wetland buffer zone included in the wetland offset site	**0**	
		Integrity of buffer zone	**0.5**	
		Buffer zone hectare equivalents	**0.00**	
		Buffer zone contribution (hectare equivalents)	**0.00**	
Final Offset Calculation	**Criterion**	**Relevance**	**Site attributes**	**Adjustment factor**
	Security of tenure	Offset activities that formally secure offset sites for longer than the minimum requirement are more likely to be maintained in the long-term and are therefore preferred.	Minimum acceptable security of tenure for shortest acceptable period	1
	Offset Contributions	Wetland habitat contribution (hectare equivalents)	4.90	
		Buffer zone contribution (hectare equivalents)	0.00	
		Functional Offset Contribution (hectare equivalents)	**4.90**	

The Sobantu wetland rehabilitation will require 4 main aspects to improve the functional and ecological state of the wetland. The aspects are;

- Landscaping (the removal of overburden from the floodplain);
- Removal of domestic and solid waste from the wetlands;
- Alien vegetation control; and
- Reconnection of floodplain to main channel.

These are described and shown in Table 13 and Table 14 below.

Table 13: The proposed offset actions

Photograph	Description	Photograph	Description
	<u>Landscaping</u> • Removal of all over burden from the floodplain area, the overburden can be used as a berm to protect the housing development to the south. • Compaction must be avoided during this process and the final landscaped area must be ripped and reseeded with a suitable wetland plants composition.		<u>Removal of Waste</u> • All domestic and solid waste to be removed and disposed of at a licensed disposal site
	<u>Alien Vegetation</u> • All alien vegetation must be removed and disposed of. • Once removed the area is to be reseeded with a wetland plant mix. • All domestic and urban waste to be removed.		<u>Hydrology</u> • The floodplain must be reconnected or opened to allow for water to re-enter the system at the western edge of the floodplain.

The following recommendations have been made for the rehabilitation of the candidate offset wetland area (Table 14).

Table 14: Recommended rehabilitation measures

Aspect	Measures
Landscaping (Figure 15)	• Removal of all over burden from the floodplain area, the overburden can be used as a berm to protect the housing development to the south. • Compaction must be avoided during this process and the final landscaped area must be ripped and reseeded with a suitable wetland plants composition.
Waste Disposal	• All domestic and solid waste to be removed and disposed of at a licensed disposal site
Alien vegetation management (Figure 16)	• All alien vegetation must be removed and disposed of. • Once removed the area is to be reseeded with a wetland plant mix. • All domestic and urban waste to be removed.
Reconnection of floodplain to main channel (Figure 17)	• The floodplain must be reconnected or opened to allow for water to re-enter the system at the western edge of the floodplain.

Figure 15: The area where overburden must be removed

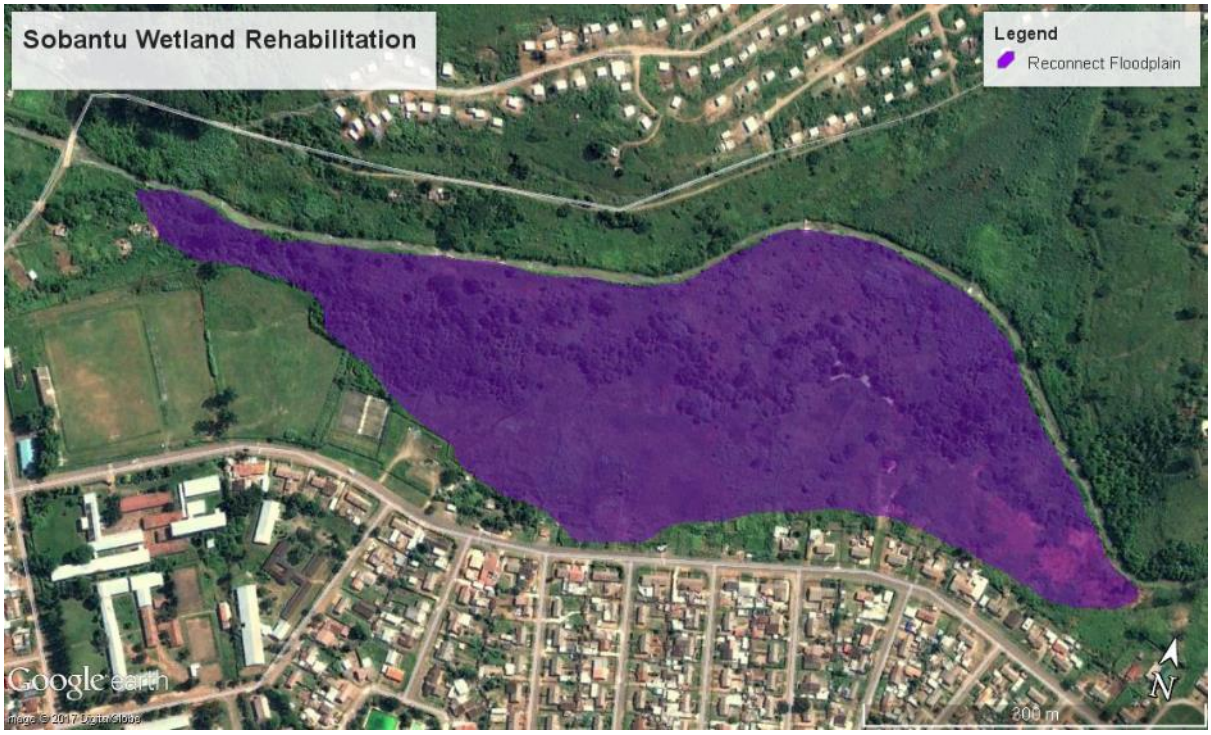

Figure 16: The area that would benefit from the floodplain reconnection to the channelled valley bottom

Figure 17: The removal of alien vegetation area

7 Conclusion

The Bombay Road expansion project will impact on a channelled valley bottom wetland where 0.16 ha will be lost as a result of the development.

The Bombay Road wetland had an overall PES rating of E (Seriously Modified). The Eco-Services provided included flood attenuation, nitrate, and toxicant assimilation. The EIS assessment showed that Ecological and Hydrological importance was rated to be C (Moderate), with the Direct human benefits being rated as D (Marginal).

The site that was selected for the offset is downstream and the wetland type was the Floodplain wetland (14 ha). This wetland was also rated as having an overall PES rating of E (Seriously Modified). The Eco-Services provided included nitrate, and toxicant assimilation. The EIS assessment showed that Ecological and Hydrological importance was rated to be C (Moderate), with the Direct human benefits being rated as D (Marginal).

The Offset requirement for hectare equivalent indicated that the impacted wetland was 0.16 ha in size and the functional rating was that of 30 % (E – Seriously Modified). Therefor based on the on-site information the hectare equivalent was calculated to be 0.07 ha. The selected portion of the Sobantu wetland is approximately 14 ha with a functional value of 36% (E- Seriously Modified).

It is envisioned that the overall functionality of the Sobantu wetland could be improved to a Largely Modified state (D) (47%). This equates to an 11% increase in functionality of the Sobantu wetland. With all other factors considered the final hectare equivalent will be 1.02 ha. This is a 1:14 improvement in functionality of the wetland.

The contributions to ecosystem targets over the 14 ha Sobantu area has been calculated to be 4.90 ha, the hectare equivalent requirement was 0.07 ha. This is a significant gain in wetland ecosystem status.

The Sobantu wetland rehabilitation will require 3 main aspects to improve the functional and ecological state of the wetland. The aspects are;

- Landscaping (The removal of overburden from the floodplain);
- Removal of domestic and solid waste from the wetlands;
- Alien vegetation control; and
- Reconnection of floodplain to main channel.

These improvements are at a relatively low cost and a significant gain to the overall wetland integrity.

8 References

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