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WETLAND FUNCTIONALITY & HABITAT IMPACT ASSESSMENT

PROPOSED MSIMBAZI RIVER ESTATE DEVELOPMENT, ETHEKWINI METROPOLITAN, KWAZULU-NATAL PROVINCE

30 September 2021 (Revision 2)

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Specialist Declaration (Lead Author)

I, **Brian Mafela,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014 (as amended in 2017);
- I performed the work relating to the application in an objective manner, even if it results in views and findings that are not favourable to the applicant;
- I declare that there were no circumstances that compromised my objectivity in performing such work;
- I have expertise in conducting the specialist assessment relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I comply with the NEMA Act, regulations and all other applicable legislation; and
- I disclosed 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 report are true and correct.
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B (1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist
Date: 30 September 2021

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Specialist Declaration (Co-Author)

I, **Andrew Briggs,** declare that –

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014 (as amended in 2017);
- I performed the work relating to the application in an objective manner, even if it results in views and findings that are not favourable to the applicant;
- I declare that there were no circumstances that compromised my objectivity in performing such work;
- I have expertise in conducting the specialist assessment relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
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- I disclosed 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 report are true and correct.
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Signature of the specialist
Date: 10 March 2021

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Executive Summary

Afzelia Environmental Consultants (Pty) Ltd was appointed by IDM Environmental (Pty) Ltd to undertake a Wetland Functionality and Impact Assessment for proposed Msimbazi River Estate within the eThekwini Metropolitan Municipality, KwaZulu-Natal. The development site is situated between Illovo Beach and Umgababa residential areas in the southern coastal area of the eThekwini Metro. The proposed development comprises 720 two-bedroom flats within 48 blocks and a community centre. The development is intended to function as a 'stand-alone' eco-estate that will utilise solar energy, recycled water and energy efficient utilities. A small solar farm and package plant are also planned for the development which will allow for independent electricity production, recycling of water for consumption and effluent treatment.

Following completion of the desktop delineation exercise the specialist undertook a ground truthing exercise on the 1st March 2021 (Mid-Summer). Infield watercourse delineation confirmed the presence of three wetlands, a single riparian habitat and an estuary (Msimbazi Estuary) within the 500m DWS regulated area (Figure 3.8). Only the estuary (ES1) and two wetlands (DP1 and S1) were confirmed as highly likely to be impacted by the construction and operational phase of the proposed Msimbazi River Estate. Wetland units DP1 and S1 were therefore assessed further and form the basis of this report. The Msimbazi Estuary was not assessed as it does not form the scope of this assessment. A marine specialist must be appointed to assess the Msimbazi Estuary.

The results of the present ecological state (PES) assessment indicated that Wetland Unit DP1 was moderately modified (C PES Class) and of moderate ecological importance and sensitivity (EIS) whilst Wetland Unit S1 was also moderately modified (C PES Class) but of low EIS. In terms of ecosystem service provision, the depression wetland (DP1) was particularly good at providing regulating and supporting benefits along with maintenance of biodiversity as well as tourism and recreational services. It excelled particularly at providing flood attenuation (owing to its closed contours and robust vegetation), water quality enhancing services (owing to high soil saturation, presence of bulrush vegetation, low longitudinal gradient and closed contours), carbon storage (linked with high soil saturation) and maintenance of biodiversity. The seep wetland (S1) was also efficient at providing similar services to depression wetland DP1 but it excelled particularly at providing flood attenuation (owing to the presence of robust vegetation), water quality enhancing services (owing to high soil saturation, presence of bulrush vegetation, being dominated by subsurface flows), carbon storage (linked with high soil saturation) and maintenance of biodiversity.

Overall anticipated adverse impacts linked with the construction phase of the project are expected to be of medium significance whilst operational impacts were expected to be higher as indicated by a high impact significance rating (Table A). The key driver of the impact significance rating for the operational phase is the use of a packaging plant to treat sewage. Implementation of recommended standard best practice mitigation measures (listed in Section 4.2 – 4.6 of this report) will lower the impact significance ratings. Construction impacts will likely be reduced to a negligible to low impact significance whilst operational impacts will be reduced to a low to medium impact significance.

Table A: Summarised impact significance results.

Impact	Construction Phase		Operational Phase	
	Poor / No Mitigation	Good Mitigation	Poor / No Mitigation	Good Mitigation
a) Transformation of watercourse habitat	N/A	N/A	N/A	N/A
b) Direct disturbance of watercourse habitat	N/A	N/A	N/A	N/A
c) Increased sediment input in watercourses	Medium	Low	Low	Low
d) Increased flood peaks in watercourses	Medium	Low	Medium	Low
e) Increased nutrient input in watercourses	Low	Negligible	High	Medium
f) Increased input of toxic contaminants in watercourses	Medium	Negligible	High	Medium
g) Weeds and invasive alien plant proliferation in watercourses	Medium	Low	Medium	Low

Key standard best practice mitigation measures provided in this report include the following:

i. A development setback of 29m from the depression wetland DP1 and 25m from the seep wetland S1.
ii. Treating sewage effluent to conform to special wastewater limit values set by DWS.
iii. Developing a stormwater management plan that (i) encourages infiltration of stormwater, (ii) storage of stormwater for recycling (rainwater harvesting), and (iii) releasing stormwater in a manner that does not cause erosion or increase runoff.

In terms of the DWS Risk Assessment and in accordance with the definitions contained in the National Water Act, No. 36 of 1998 (NWA), discharge of treated effluent constitutes a water use in terms of Section 21(f) of the NWA, which need to be authorised through an application for a Water Use Licence. As per exclusion 'C' from exclusions of the GA, the handling of wastewater does not qualify for a GA because an application must be made for a Water Use License for the authorisation of a water use in terms of Section 21(f) of the NWA. Therefore, an application for a Water Use Licence must be submitted to the DWS for the proposed Msimbazi River Estate.

Special conditions listed below are recommended for inclusion in the Water Use Licence to be issued by the Department of Water and Sanitation.

a) The water user must ensure that stormwater from buildings and the road infrastructure:
    i. is not discharged directly into any watercourse;
    ii. does not induce erosion, sedimentation or flooding; and
    iii. does not cause a detrimental change in the quality of water in downstream watercourses.
b) Prior to the carrying out of any works, the water user must ensure that all persons entering the construction site, including contractors and casual labourers, are made fully aware of the conditions and related management measures specified in the WUL, Environmental Authorisation (EA) and Environmental Management Programme (EMPr).
c) The water user must ensure that no vegetation is cleared or damaged outside the construction footprint.
d) The construction area must be clearly demarcated using a safety net, danger tape, white pegs, etc.
e) The water user must ensure that any construction camp, storage, washing and maintenance of equipment, storage of construction materials, or chemicals, as well as any sanitation and waste management facilities:
    i. are located outside the 1 in 100-year flood line or 30m from any delineated watercourses; and
    ii. are removed within 30 days after the completion of any works.
f) The water user must ensure that measures are taken to prevent increased turbidity, sedimentation and detrimental chemical changes to the composition of the water resource as a result of carrying out the works, including for emergency alterations or the rectification of reportable incidents.
g) The water user must ensure that adequate erosion control measures (bund, berms, sand bags etc.) are installed on all areas susceptible to erosion or runoff.
h) During the construction phase of the project, the water user must appoint an Environmental Control Officer to undertake weekly site visits and an audit once a month. The environmental audit report must discuss non-compliances of the WUL, EA and the approved EMPr.
i) During the construction phase of the project, the appointed Environmental Control Officer (ECO) must take weekly fixed-point photographs of depression wetland DP1. These must be included in the monthly audit report.
j) All environmental audit reports must be made available to the responsible authority upon written request.

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1. INTRODUCTION

1.1 Project Background & Locality

Afzelia Environmental Consultants (Pty) Ltd was appointed by IDM Environmental (Pty) Ltd to undertake a Wetland Functionality and Impact Assessment for proposed Msimbazi River Estate within the eThekwini Metropolitan Municipality, KwaZulu-Natal (Figure 1.1). The development site is situated between Illovo Beach and Umgababa residential areas in the southern coastal area of the eThekwini Metro. It is bordered by a residential estate in the north, a low-density residential area in the east, the Msimbazi Estuary in the south and the National Route 2 (N2) in the west (Figure 1.2).

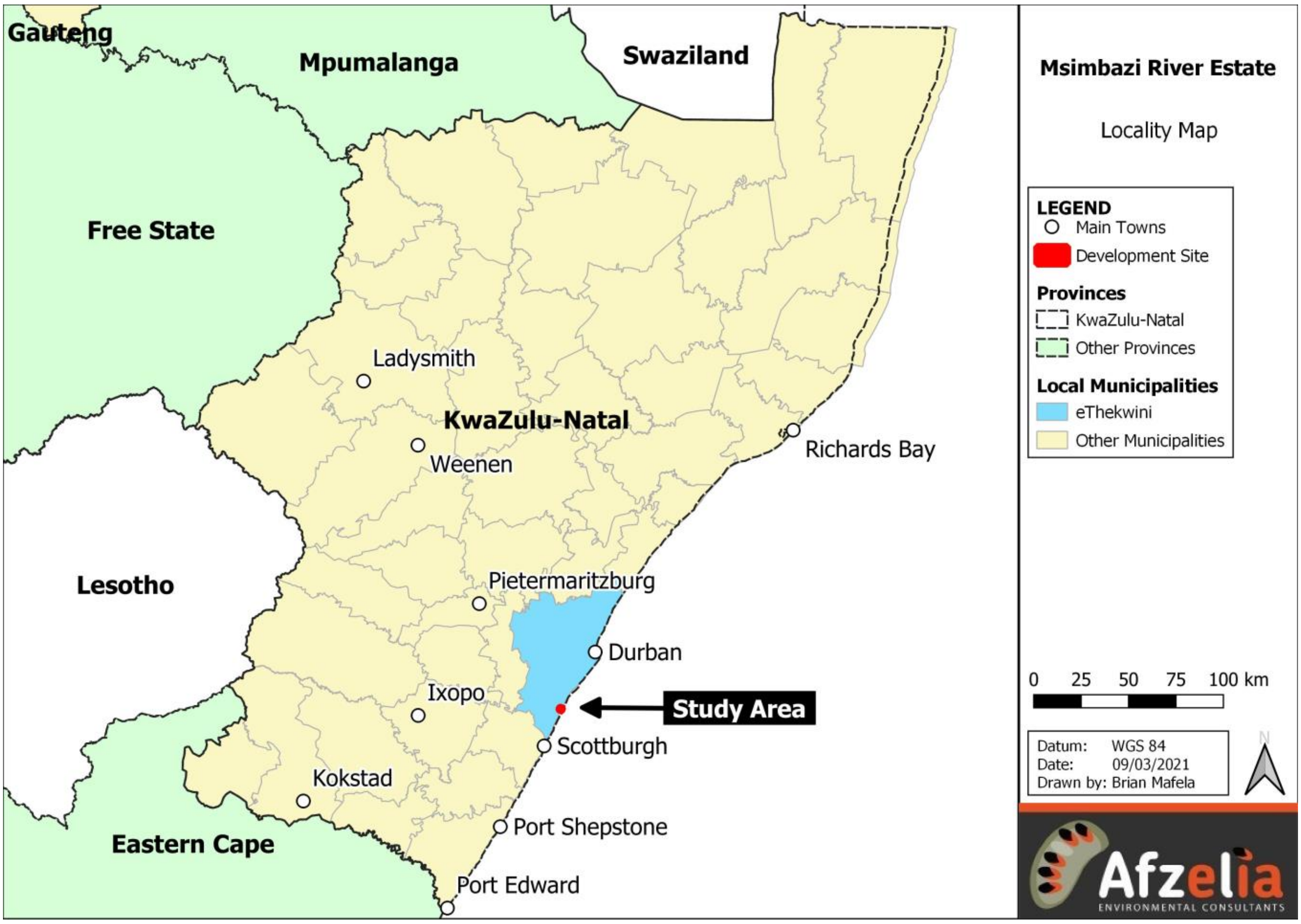

Figure 1.1: Locality of the study area within the eThekwini Metropolitan in the KwaZulu-Natal Province.

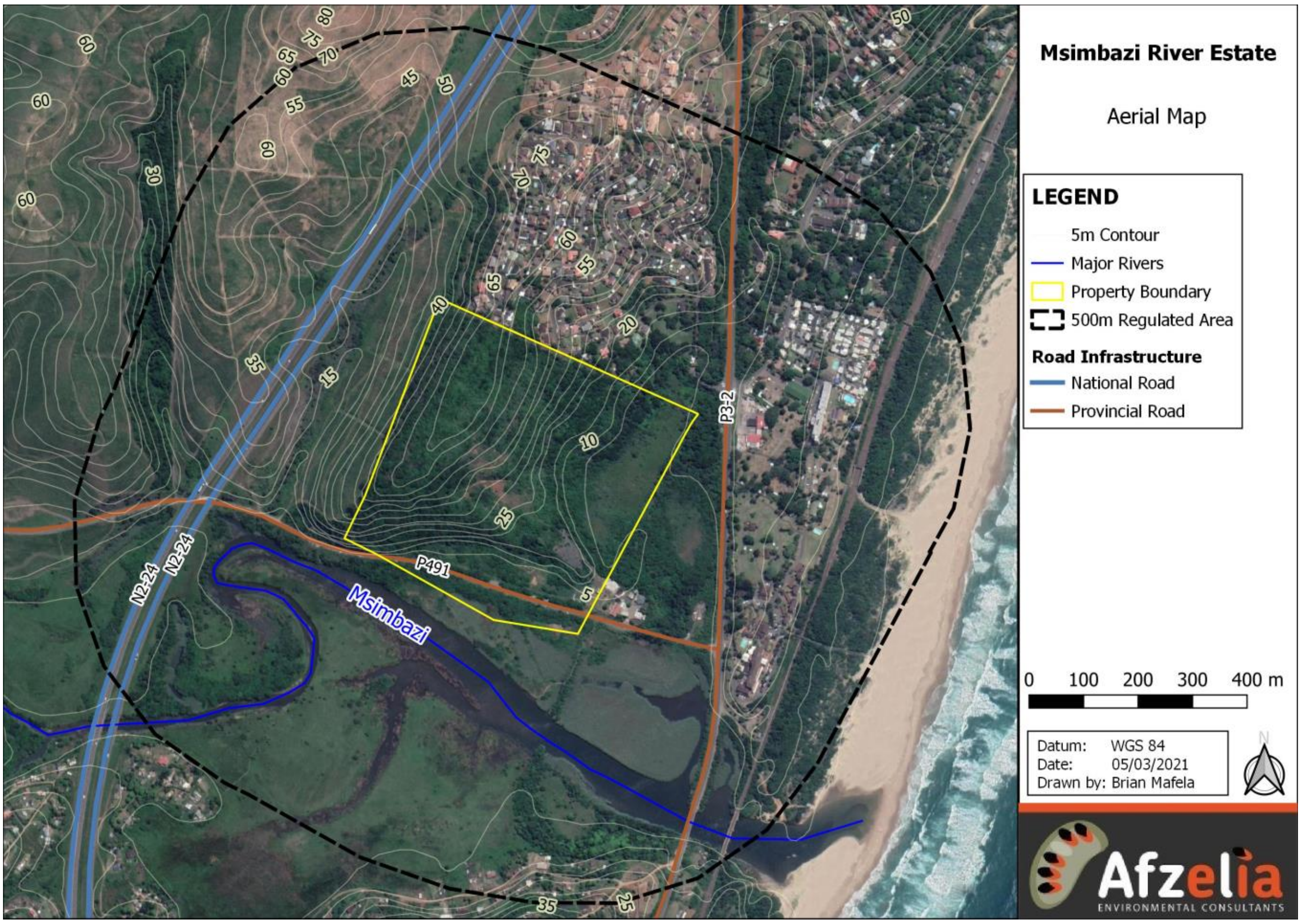

Figure 1.2: Aerial map of the study area.

1.2 Project Description

The proposed development comprises 720 two-bedroom flats within 48 blocks and a community centre. The development is intended to function as a 'stand-alone' eco-estate that will utilise solar energy, recycled water and energy efficient utilities. A small solar farm and package plant are also planned for the development which will allow for independent electricity production, recycling of water for consumption and effluent treatment. The estate will be fully fenced and will have a guarded entrance. Residential units will be situated on elevated areas of the property whilst the community centre will occupy the low-lying area of the property. An engineering services infrastructure master layout designed by MDC Architects is provided in Figure 1.3 on the next page.

Figure 1.3: Msimbazi River Estate Engineering Services Infrastructure Master Layout (MDC, 2021).

1.3 Terms of Reference

This assessment was undertaken as per the following terms of reference:

i. Undertake a desktop review of the site's biophysical attributes using available literature and GIS information.
ii. Review conservation planning tools such as NFEPA datasets, KwaZulu-Natal Systematic Conservation Assessment, municipal spatial datasets and provide a discussion on how they impact the project.
iii. Undertake infield delineation of wetlands within the study area using techniques detailed in the delineated guideline: A practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1 (DWAF, 2005).
iv. Undertake an assessment of the present ecological state (PES) of wetlands using a WET-Health Level 1 Assessment (Macfarlane *et al*. 2007).
v. Undertake an assessment of the functions and ecosystem services provided by wetlands using the WET-EcoServices Level 2 Assessment (Kotze et al. 2007).
vi. Undertake an assessment of the ecological importance and sensitivity (EIS) of wetlands using the EIS Assessment tool (Rountree & Kotze, 2013).
vii. Identify potential construction and operational phase impacts to delineated watercourses.
viii. Recommend development setbacks from all watercourses.
ix. Provide construction-phase and operational-phase mitigation measures.
x. Undertake an impact significance assessment.
xi. Undertake a Department of Water and Sanitation (DWS) Risk Assessment in order to determine the risk level of the proposed development and whether the proposed development requires General Authorisation (GA) or a Water Use Licence (WUL).

2. METHODOLOGY

2.1 Desktop Review

The specialist undertook a desktop review of the site and associated watercourses (wetlands, streams and rivers) prior to undertaking fieldwork. This entailed reviewing available literature and GIS data on water resource conservation, reviewing site details and undertaking desktop mapping of all watercourses within and around the study area. All desktop mapped watercourses were revised following fieldwork on site. The following information was used in completing the desktop assessment:

i. The latest Google Earth imagery was used to identify likely wetland and riparian vegetation and delineate the approximate wetland and riparian boundary at a desktop level.
ii. The NFEPA GIS dataset and the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was used to identify the prioritised catchment, rivers, wetlands and estuaries.
iii. KZN Biodiversity Spatial Planning and eThekwini GIS datasets were used to identify biodiversity conservation areas.
iv. The Threatened Ecosystem GIS dataset was used to identify conservation important vegetation types.
v. KZN Geological GIS dataset was used to identify the underlying geology at the site.
vi. Sub-Quaternary Reach (SQR) specific data from the River Eco-status Monitoring Programme regarding aquatic macroinvertebrate assemblages, fish assemblages, Present Ecological State, Ecological Importance and Ecological Sensitivity (DWS, 2014).

2.2 Wetland Assessments

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act 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 typically adapted to life in saturated soil."*

Below is a list of assessments undertaken as well as assessment tools, methodologies and protocols that were used to assess wetland habitats:

i. **Wetland Delineation:** A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005a). Additional information is provided in Appendix 8.1.1.
ii. **Wetland Classification:** Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.* 2013). Additional information is provided in Appendix 8.1.2.
iii. **Present Ecological State (PES):** WET-Health Level 1 Assessment tool (Macfarlane *et al.* 2008). Additional information is provided in Appendix 8.1.3.
iv. **Wetland Functional Assessment:** WET-EcoServices Level 2 Assessment tool (Kotze *et al.* 2007). Additional information is provided in Appendix 8.1.4.
v. **Ecological Importance and Sensitivity (EIS):** DWAF EIS tool (Rountree & Kotze, 2013). Additional information is provided in Appendix 8.1.5.
vi. **Buffer Zone Determination:** Buffer Zone Guideline for Wetlands, Rivers and Estuaries tool (Macfarlane *et al.* 2014).

2.3 Impact Significance Assessment

The significance (quantification) of potential environmental impacts identified during the assessment have been assessed as per the “Guideline Documentation on EIA Regulation” (Department of Environmental Affairs and Tourism, 2014). To determine the significance of impacts identified for a project, there are several parameters that need to be assessed. These include four factors, which, when plugged into a formula, will give a significance score. The four parameters are described as follows:

i. **Duration**, which is the relationship of the impact to temporal scale. This parameter determines the timespan of the impact and can range from very short term (less than a year) to permanent.
ii. **Extent**, which is the relationship of the impact to spatial scales. Each impact can be defined as occurring in minor extent (limited to the footprint of very small projects) to International, where an impact has global repercussions (an example could be the destruction of habitat for an IUCN Critically Endangered listed species).
iii. **Magnitude**, which is used to rate the severity of impacts. This is done with and without mitigation, so that the residual impact (with mitigation) can be rated. The Magnitude, although usually rated as negative, can also be positive.
iv. **Probability**; which is the likelihood of impacts taking place. These include unlikely impacts (such as the rate of roadkill of frogs, for example) or definite (such as the loss of vegetation within the direct construction footprint of a development).

Each of the abovementioned aspects are rated according to Table 2.12.1 below.

Table 2.1: Table of evaluation criteria ranking.

	Score	Label	Criteria
Duration	1	Very short term	0 -1 years
	2	Short term	2 – 5 years
	3	Medium term	5 – 15 years
	4	Long term	>15 years
	5	Permanent	Permanent
Extent	1	Minor	Limited to the immediate site of the development
	2	Local	Within the general area of the town, or study area, or a defined Area of Impact
	3	Regional	Affecting the region, municipality, or province
	4	National	Country level
	5	International	International level
Magnitude	0	Negligible	Very small to no effect on the environment
	2	Minor	Slight impact on the environment
	4	Low	Small impact on the environment
	6	Moderate	A moderate impact on the environment
	8	High	The impacts on the environment are large
	10	Very high	The impacts are extremely high and could constitute a fatal flaw
Probability	1	Very improbable	Probably will not happen
	2	Improbable	Some possibility, but low likelihood
	3	Probable	Distinct possibility
	4	Highly probable	Most likely
	5	Definite	The impact will occur

Once each of these aspects is rated, the overall significance can be scored (based on the score for effect). The significance is calculated as per the following formula:

Significance Points = (Magnitude + Duration + Extent) x Probability

The results of the assessment are then interpreted using the below rating system which categorises the scores into 5 categories ranging from low to high impact significance. A description of each category is provided in Table 2.2 2.2. with the layout of all possible scores and their overall significance presented in Table 2.3.

Table 2.2: Significance weighting.

Score	Label	Motivation
<10	Negligible	The impact is very small to absent
10-19	Low	where this impact would not have a direct influence on the decision to develop in the area
20-49	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
50 -69	High	where the impact must have an influence on the decision process to develop in the area
≥70	Very high	Where the impact may constitute a fatal flaw for the project

Table 2.3: Possible significance scores based on Effect and Likelihood ratings.

Likelihood	Effect																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very improbable (1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Improbable (2)	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Probable (3)	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
Highly probable (4)	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
Definite (5)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Each impact was assessed based on the methodology above, and a table produced, indicating the scores and the overall significance rating both without and with mitigation. Where relevant, mitigation measures are recommended.

2.4 Assumptions and limitations

The following assumptions and limitation are applicable to this study:

i. Desktop delineation was undertaken using 2m contours and the latest Google Earth Imagery. Any vegetation changes may have influenced the accuracy of the delineation.
ii. The slope gradient was calculated using 5m contour lines which might not be very accurate.
iii. The handheld GPS device used has an accuracy of 3m.
iv. All literature and datasets used were accurate at the time of compiling this report.
v. Vegetation descriptions provided for each wetland unit are not comprehensive but serve to provide a general description of the wetland habitat.
vi. The estuarine habitat was excluded from this assessment as it is not part of the scope of this assessment.

3. RESULTS AND DISCUSSION

3.1 Results of Desktop Investigations

3.1.1 Biophysical Attributes

The biophysical attributes of the study area are summarised in Table 3.1 below.

Table 3.1: Summary of the biophysical attributes of the study area.

Ecoregion (DWA, 2007)	17.01 (Indian Ocean Coastal Belt Group 2)
MAP (Schulze, 1997)	991.0 mm
MAT (DWA, 2007)	16 – 22 °C
Rainfall intensity	88.1 (Zone 4)
PET (Schulze, 1997)	1226.2 mm
Median Annual Simulated Run-off (Schulze, 1997)	258.7 mm
Geology (Department of Agriculture Land Types Database)	Berea Formation and Shale
Soil	Sand, Sandy clay, Sandy loam
Soil Erodibility Score (K-factor) (Schulze, 2007)	0.3 – 0.46 (moderately high erodibility)

3.2 Quaternary Catchment and Drainage Setting

The development site falls within quaternary catchment U70E which forms part of the Greater Pongola-Mtamvuna water management area (WMA). The Msimbazi River is one of three main collecting rivers within the catchment which include uMgababa and Ngane Rivers (Figure 3.1). All three rivers discharge directly into the Indian Ocean. The development site is situated immediately north of the Msimbazi Estuary but the two are separated by the Provincial Road P491 (Figure 3.2). A small watercourse runs through the eastern section of the development site and then discharges into the Msimbazi Estuary.

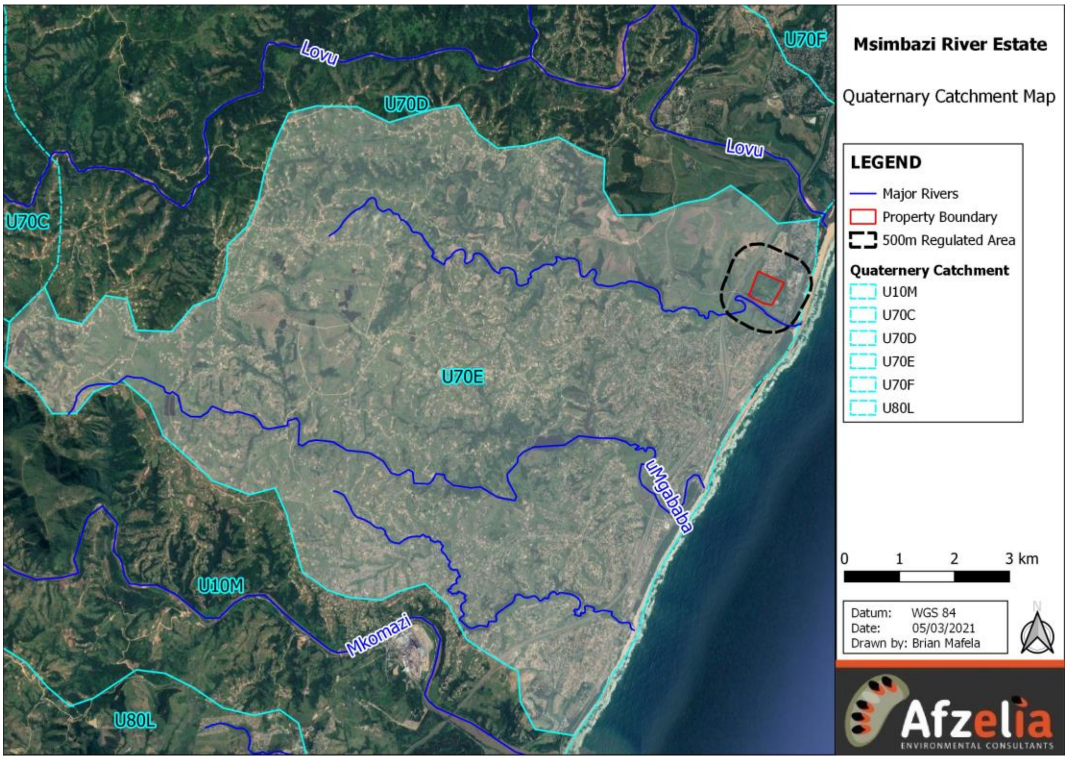

Figure 3.1: Quaternary catchment of the study area.

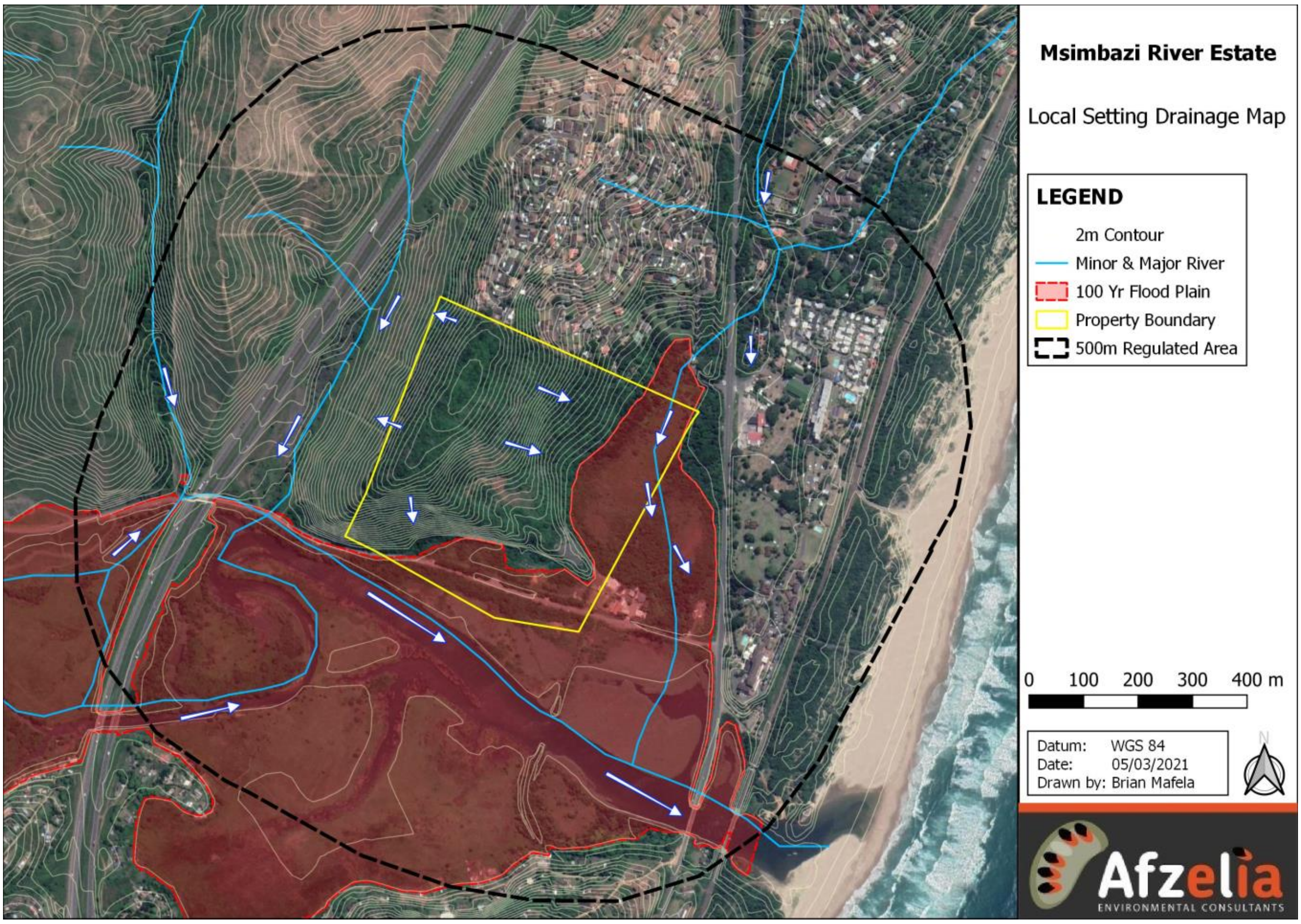

Figure 3.2: Drainage setting of the study area.

3.3 National Freshwater Ecosystem Priority Area

The National Freshwater Ecosystem Priority Areas (NFEPA) project aims to:

i. Identify Freshwater Ecosystem Priority Areas (FEPAs) to meet national biodiversity goals for freshwater ecosystems; and
ii. Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers (Nel *et al.* 2011).

The project was developed to respond to the threats to water resources in South Africa including river, wetland and estuarine ecosystems and provides strategic spatial priorities for conserving freshwater ecosystems as well as supporting sustainable use of water resources. The strategic spatial priorities are known as Freshwater Ecosystem Priority Areas (FEPAs) (Nel *et al*. 2011).

According to the NFEPA GIS dataset the study area is situated within a sub-quaternary catchment (No. 4942) identified as a non-prioritised catchment owing to high levels of transformation resulting from urbanisation. This means the catchment is not critical for the maintenance of aquatic biodiversity (Nel and Driver, 2012). In addition, the NFEPA GIS dataset highlighted the presence of a non-prioritised estuary (Msimbazi Estuary) within the development site and its 500m radius. A FEPA map is provided as Figure 3.3 below.

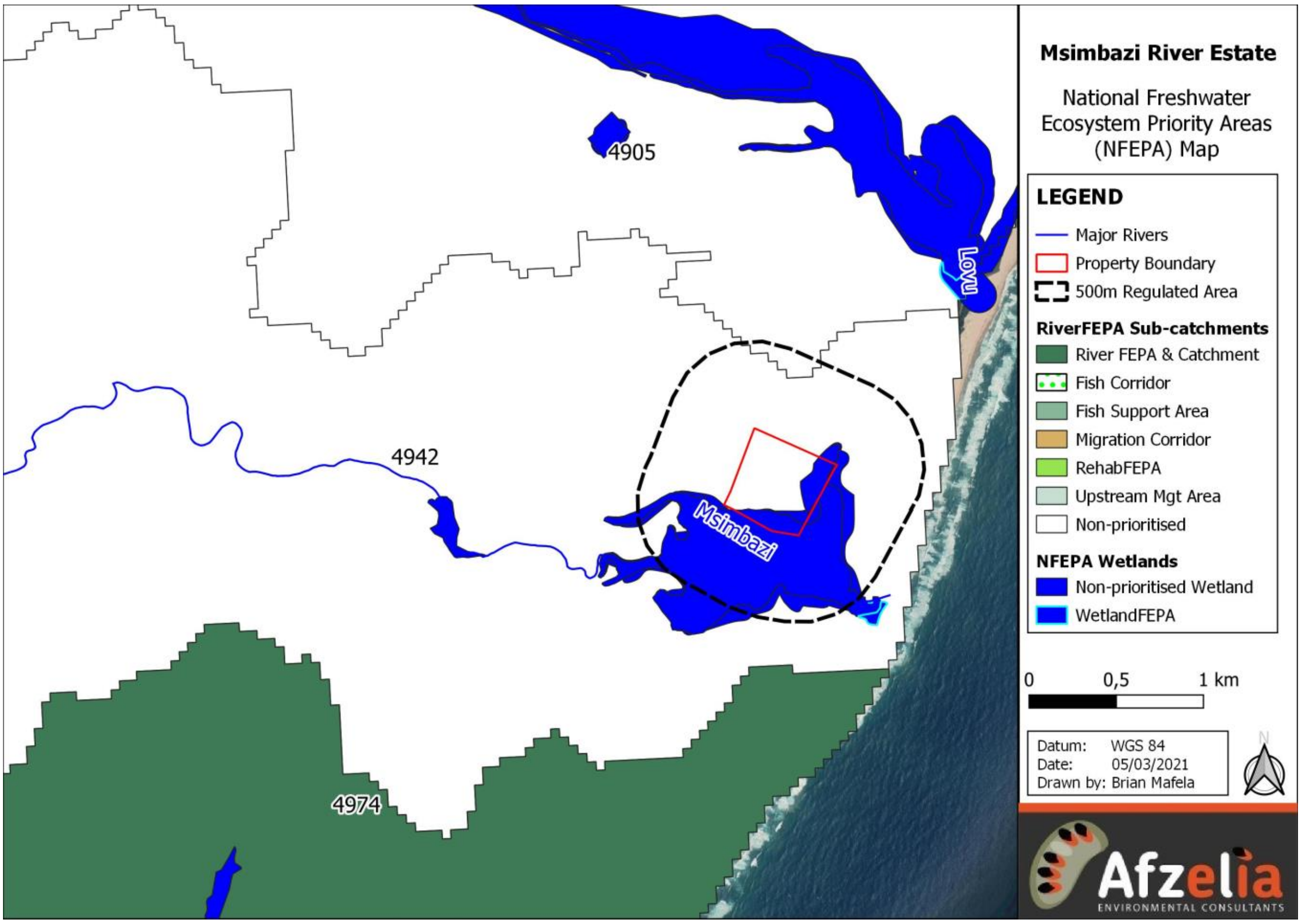

Figure 3.3: Freshwater Ecosystem Priority Area map, showing the sub-quaternary catchment, wetlands and estuaries.

3.4 Threatened Ecosystems: Vegetation Types

The provincial vegetation type map indicated that the development is characterised by two terrestrial vegetation types, the KwaZulu-Natal Coastal Belt Grassland (CB3) and the Eastern Scarp Forest: Southern Coastal Scarp Forest (FOz5) as well as one azonal vegetation type, the Marine Saline Wetlands (AZm). The spatial distribution of abovementioned vegetation types within the study area is shown in Figure 3.4. Provincially, the three vegetation types are listed as **Critically Endangered**, **Least Threatened** and **Endangered**, respectively (Jewitt, 2018). Nationally, KwaZulu-Natal Coastal Belt Grassland is listed as **Endangered**. Southern Coastal Scarp Forest is listed as **Least Concern** whilst Marine Saline Wetlands were not specifically evaluated (Skowno *et al.* 2019).

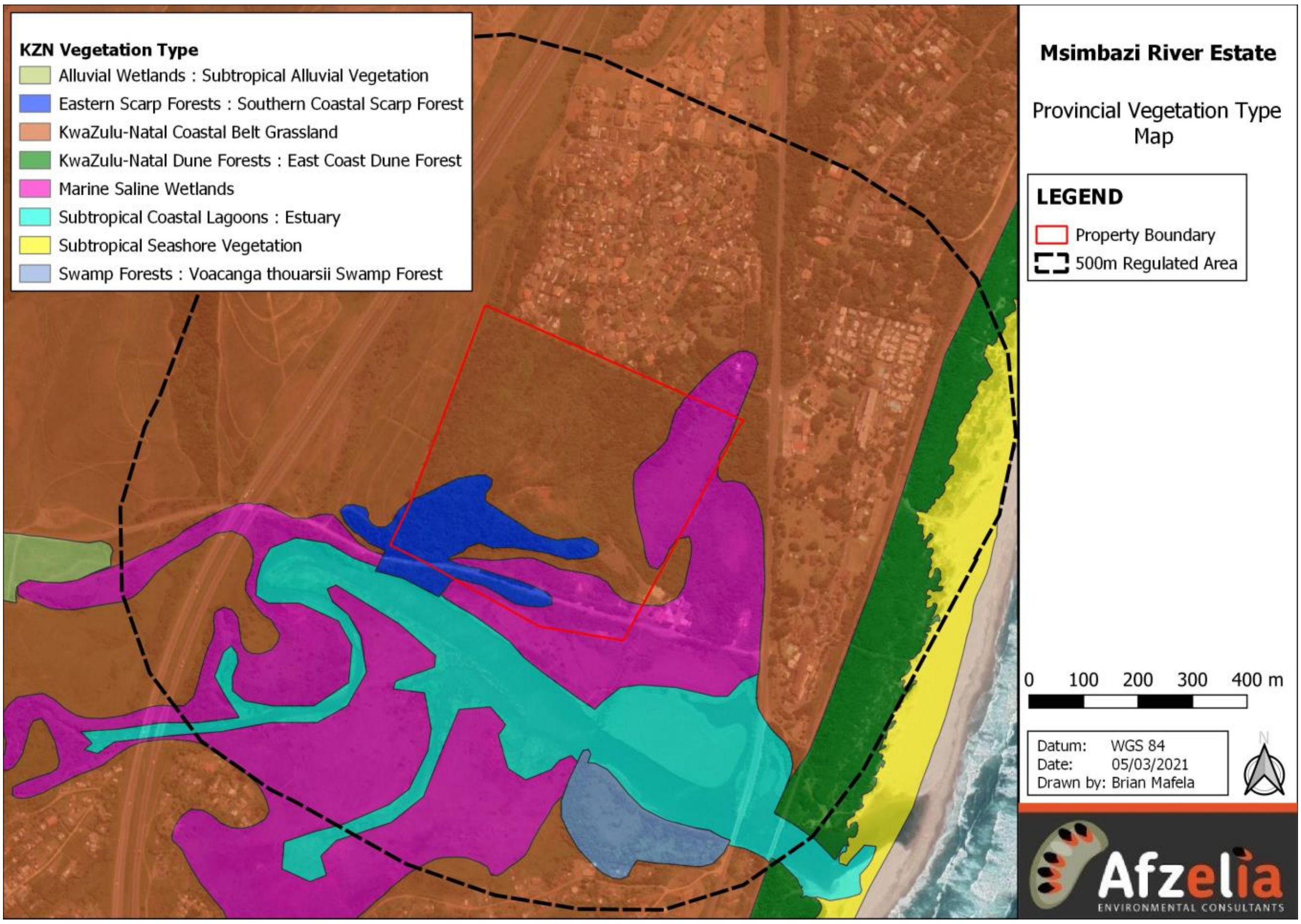

Figure 3.4: Spatial distribution of provincial vegetation types within the study area.

3.5 Provincial Conservation Guidelines

3.5.1 KwaZulu-Natal Biodiversity Spatial Planning

The KwaZulu-Natal Biodiversity Spatial Planning (KZN BSP) defines the areas of land in the form of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) required to ensure the persistence and conservation of biodiversity within the province (EKZNW, 2016). The spatial plan then provides a tool to guide conservation and protected area expansion as well as informing economic sectors involved in alien plant control, conservation officer priorities and guiding the nature of development (EKZNW, 2016).

The spatial guidelines provided by the plan outline two main categories of areas that are required to meet conservation targets for the province (EKZNW, 2016). These two main categories include CBAs and ESAs, including corridors. These are further divided into smaller categories, which are outlined in Table 3.2.

Table 3.2: Description of subcategories of CBAs and ESAs.

Critical Biodiversity Areas (CBAs) – Crucial for supporting biodiversity features and ecosystem functioning and are required to meet biodiversity and/or process targets	
Critical Biodiversity Areas: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Areas: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible (Category driven primarily by

	process, but is informed by expert input).
Ecological Support Areas (ESAs) – Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within Critical Biodiversity Areas.	
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of Ecosystem Services.
Ecological Support Areas: Species Specific	Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites.
Ecological Support Areas: Buffers	Terrestrial areas identified as requiring land-use management guidance not necessarily due to biodiversity prioritisation, but in order to address other legislation/ agreements which the biodiversity sector is mandated to address, e.g. WHS Convention, Triggers Listing Notice criteria, etc.

Upon interrogation of the KZN BSP, it was determined that the entire development site is classified as an irreplaceable critical biodiversity area (CBA: Irreplaceable) (Figure 3.5). Review of the 2010 Minset dataset (EKZNW, 2010) confirmed that the classification is driven by the following biodiversity features contained in the development site: **Vegetation types**: South Coast Grassland, KwaZulu-Natal Dune Forests and the Eastern Scarp Forests: Southern Coastal Scarp Forest; **Plant species**: *Dahlgrenodendron natalense, Diaphananthe millarii, Gerrardanthus tomentosus, Streptocarpus molweniensis* and *Pseudoscolopia polyantha*; **Millepedes**: *Doratogonus montanus* and *D. rubipodus*; **Molluscs**: *Cochlitoma semidecussata* and *Edouardia conulus*. This means the proposed development site is critical for the conservation of abovementioned biodiversity features and meeting biodiversity targets and thresholds which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.

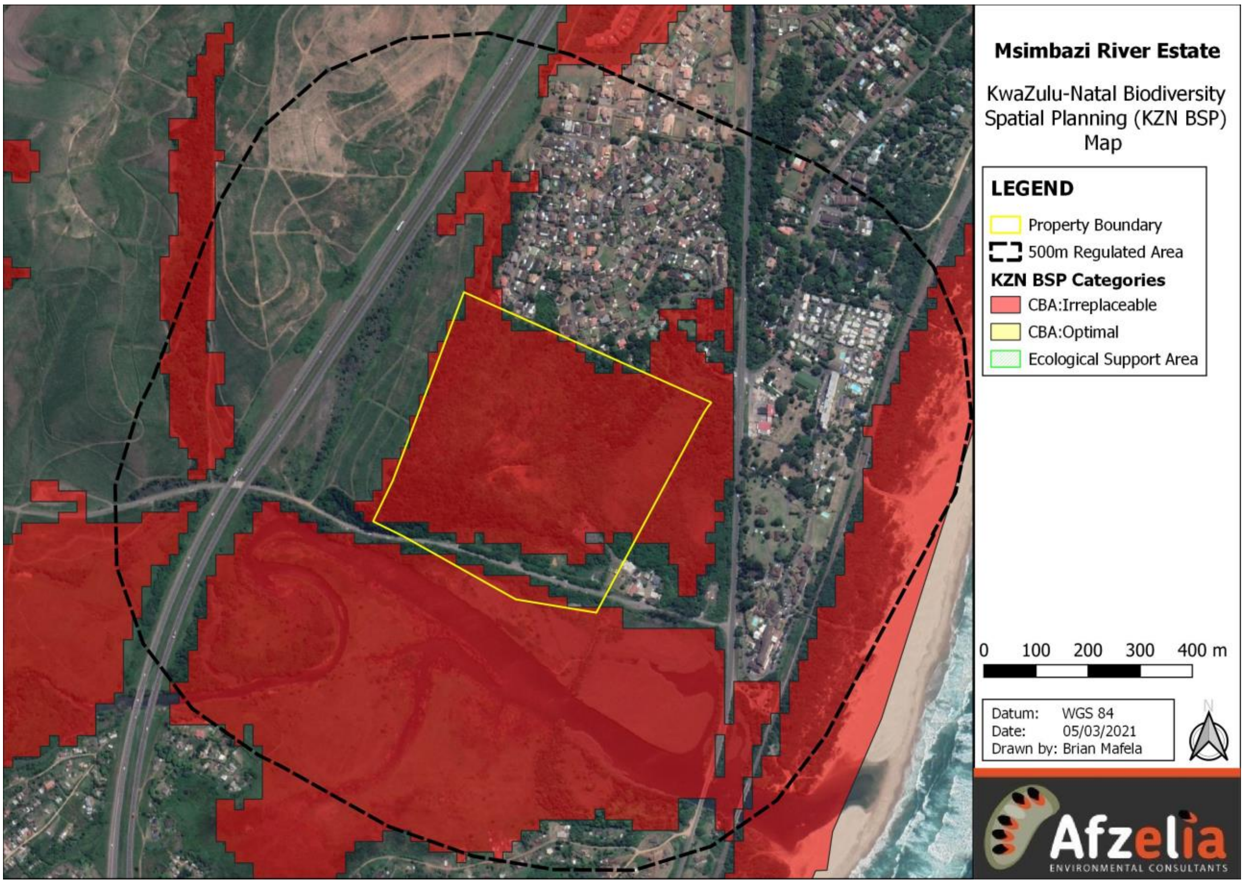

Figure 3.5: KZN BSP map for the study area.

3.5.2 Durban's Systematic Conservation Assessment (SCA)

Durban's Systematic Conservation Assessment (SCA) was compiled by Maclean *et al.* (2016) as a means of identifying priority areas, within the eThekwini Municipal Area, for conservation in order to create and secure a conservation area network before these priority areas become completely transformed. The Durban SCA has two primary categories, namely; Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA). CBAs, as detailed in the Durban SCA, are natural or near-natural habitats or landscapes that include terrestrial and aquatic areas that are critical for meeting national and provincial biodiversity targets and thresholds, safeguarding species and ecosystem functioning as well as conserving key locations for biodiversity features or rare species. ESAs are functional, but not necessarily entirely natural areas that are required to maintain biodiversity features and ecological functioning within the CBAs (Maclean *et al*. 2016).

According to the Durban SCA, three CBAs were identified within the 500m regulated area (Figure 3.6). These include the estuary (Msimbazi Estuary), forest (Eastern Scarp Forest: Southern Coastal Scarp Forest) and a freshwater wetland. It should be noted that the delineation of the forest is not accurate and will require refinement.

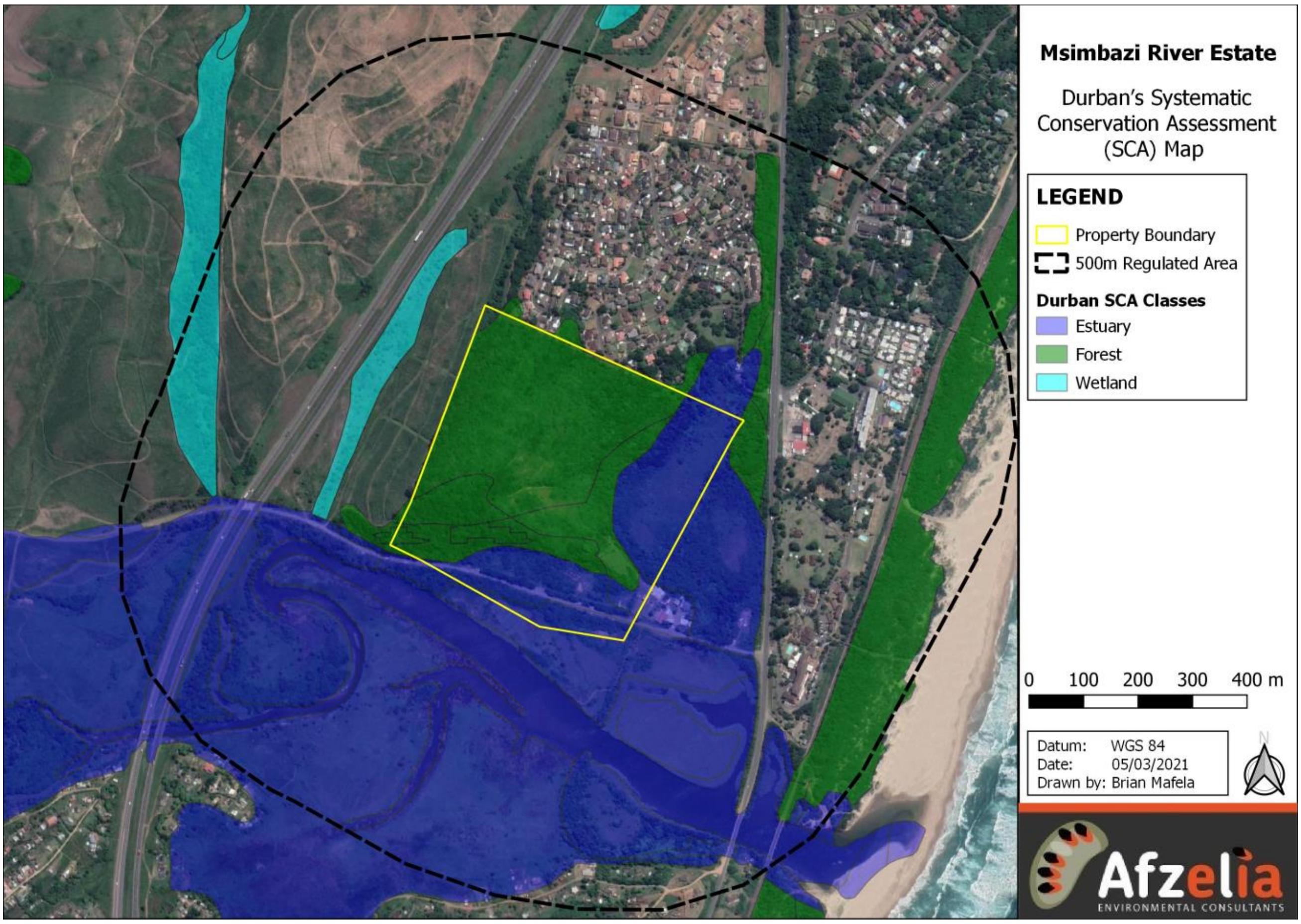

Figure 3.6: Durban SCA map showing the spatial distribution of CBAs and ESAs.

3.5.3 Durban Metropolitan Open Space System (D'MOSS)

The Durban Metropolitan Open Space System (D'MOSS) is a spatial layer of interconnecting open spaces in public, private and traditional authority ownership that seeks to protect the biodiversity and associated ecosystem services of Durban for future generations. D'MOSS thus provides a unique opportunity to conserve many of South Africa's threatened ecosystems and species such as the **Endangered** KZN Sandstone Sourveld grasslands; the **Critically Endangered** *Brachystelma natalense* (a small herbaceous plant); and the **Endangered** Oribi, Spotted Ground Thrush, and Pickersgill Reed Frog. If protected and managed, D'MOSS will assist the province and the country in meeting biodiversity conservation targets. Apart from contributing to the attainment of provincial and national biodiversity conservation targets, D'MOSS provides a range of services to all residents of Durban, including the formation of soil, erosion control, water supply and regulation, climate regulation, cultural and recreational opportunities, raw materials for craft and building, food production, pollination, nutrient cycling and waste treatment.

Interrogation of the D'MOSS dataset highlighted the presence of three ecosystems of conservation importance within the 500m regulated area (Figure 3.7). These include the estuary (Msimbazi Estuary), forest (Eastern Scarp Forest: Southern Coastal Scarp Forest) and a freshwater wetland. Where feasible, these ecosystems will need to be preserved when developing the Msimbazi River Estate. Development will therefore need to be done outside these ecosystems.

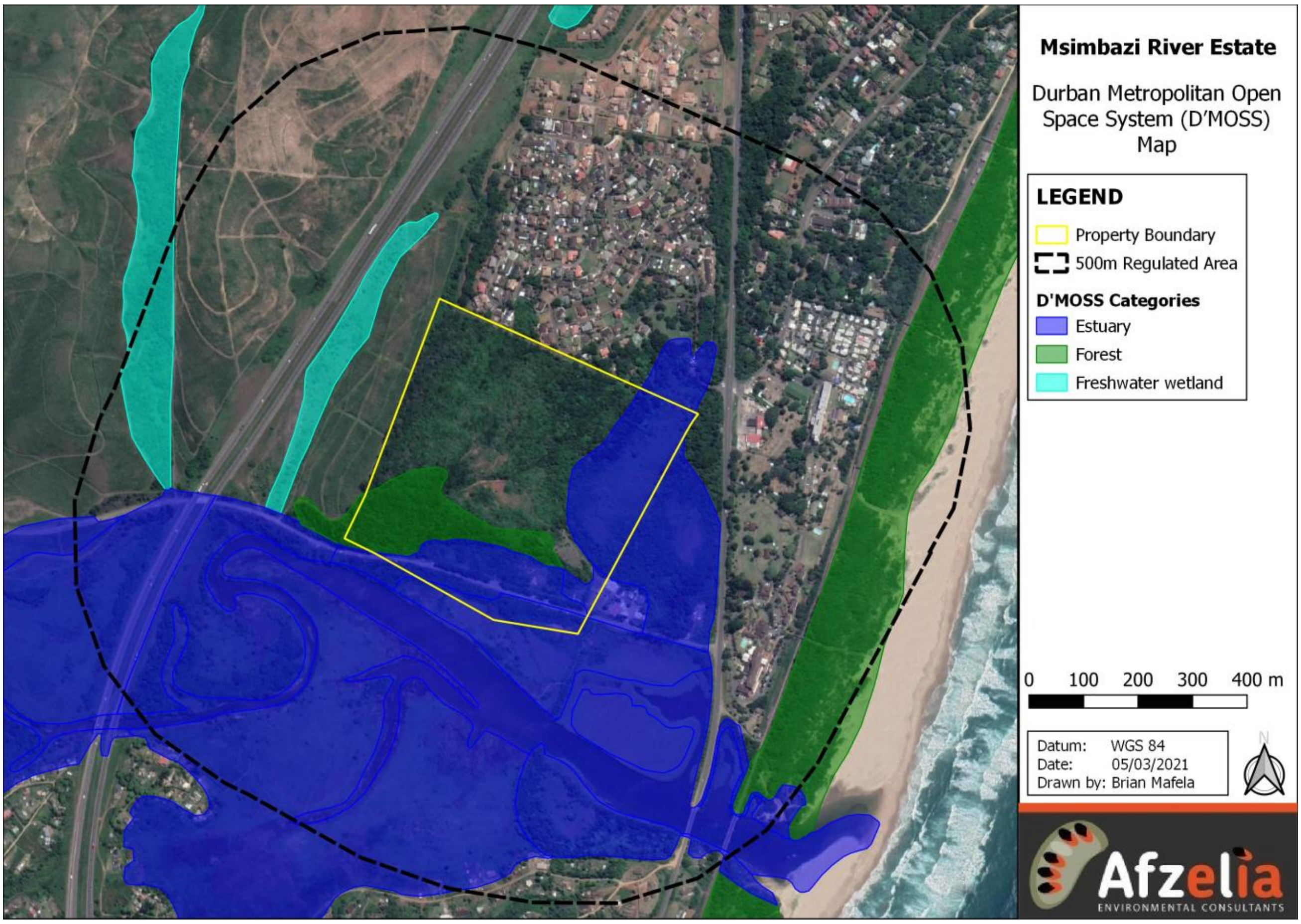

Figure 3.7: Map showing the different D'MOSS areas within the study area.

3.6 Wetland Habitat Delineation

Following completion of the desktop delineation exercise the specialist undertook a ground truthing exercise on the 1st March 2021 (Mid-Summer). This entailed infield wetland delineation using soil and vegetation sampling techniques as well as recording of diagnostic topographic features such as breaks in slope, river banks, bedrock outcrops, etc. Numerous soil samples and topographic features were recorded using a handheld GPS device and used to delineate watercourses and develop a map of onsite watercourses. Delineated watercourses were then sub-divided and classified into hydrogeomorphic (HGM) units as per Ollis *et al*. (2013).

Infield watercourse delineation confirmed the presence of three wetlands, a single riparian habitat and an estuary (Msimbazi Estuary) within the 500m DWS regulated area (Figure 3.8). Only the estuary (ES1) and two wetlands (DP1 and S1) were confirmed as highly likely to be impacted by the construction and operational phase of the proposed Msimbazi River Estate. Wetland units DP1 and S1 were therefore assessed further and form the basis of this report. The Msimbazi Estuary was not assessed as it does not form the scope of this assessment. A marine specialist must be appointed to assess the Msimbazi Estuary.

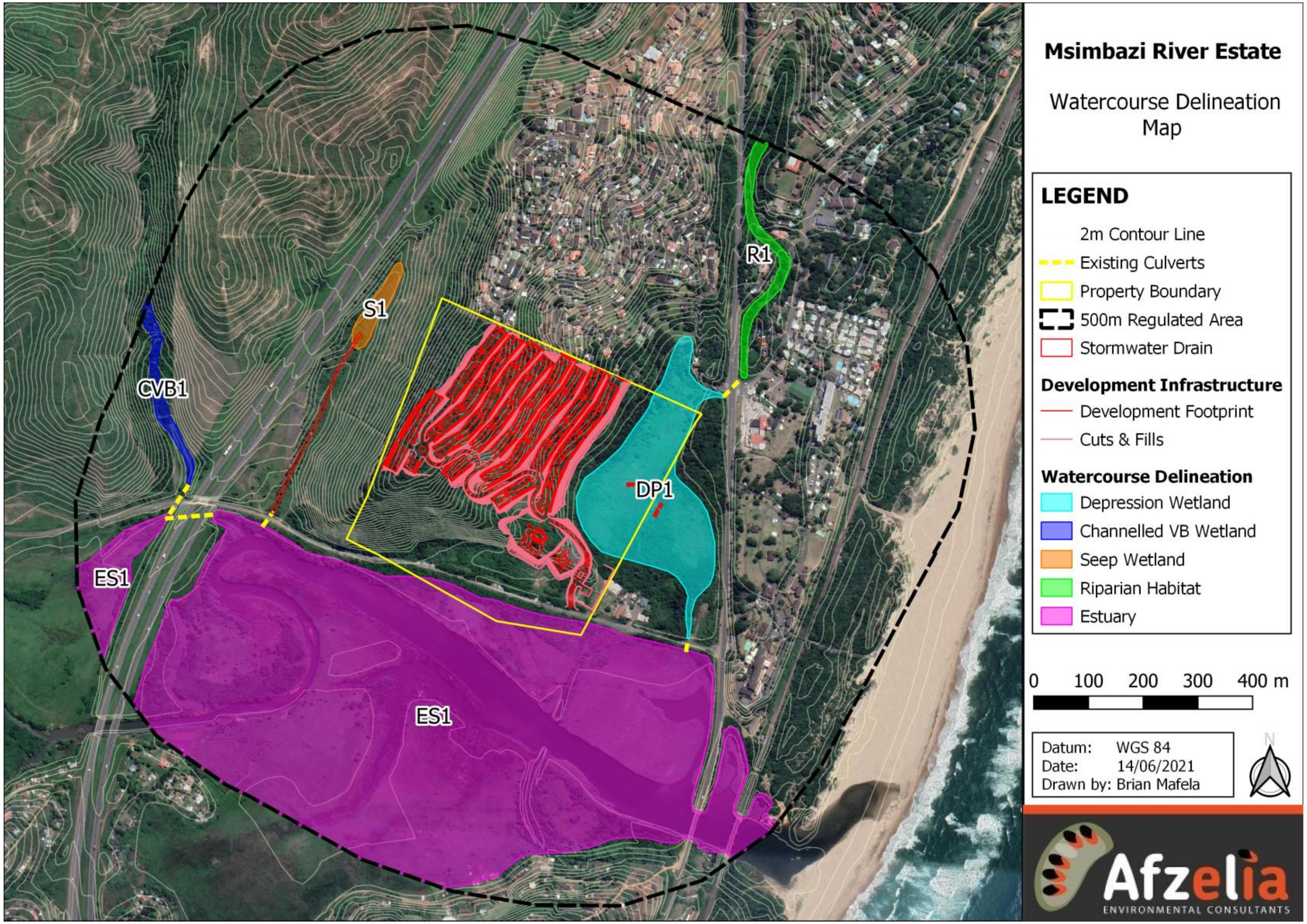

Figure 3.8: Watercourse delineation and classification map.

3.7 Watercourse Description and Classification

The general characteristics and classification of the two infield delineated wetlands is described in Tables 3.3 and 3.4 below.

Table 3.3: General characteristics of infield delineated depression wetland (DP1).

<table>
<tr><th>Level 1</th><th colspan="2">Level 2</th><th>Level 3</th><th colspan="3">Level 4: HGM Unit</th></tr>
<tr><th>System</th><th>DWA Ecoregion</th><th>NFEPA Wet/Veg Group</th><th>Landscape Unit</th><th>4A</th><th>4B</th><th>4C</th></tr>
<tr><td>Inland</td><td>17.01 (North Eastern Coastal Belt)</td><td>Indian Ocean Coastal Belt Group 2</td><td>Plain</td><td>Depression</td><td>Exorheic (outward-draining)</td><td>With channelled inflow</td></tr>
<tr><th>Aspect</th><th colspan="6">Description</th></tr>
<tr><td>General Description</td><td colspan="6">Historically this wetland unit was part of the Msimbazi Estuary and therefore characterised by estuarine processes. It was however cut off from the Msimbazi Estuary by the construction of the provincial road P491. The road embankment through the wetland resulted in the accumulation of sediment upstream of the road thus creating a watercourse with closed contours. Due to having closed contour, the watercourse now functions as a depression wetland hence it has been classified as a depression wetland (Unit DP1).</td></tr>
<tr><td rowspan="3">Hydrology</td><th colspan="2">5A: Inundation</th><th colspan="2">5B: Saturation</th><th colspan="2">5C: Depth of Inundation</th></tr>
<tr><td colspan="2">Seasonally inundated</td><td colspan="2">Permanently saturated</td><td colspan="2">N/A</td></tr>
<tr><td colspan="6">Inflow drainage characteristics: Groundwater supplemented by concentrated flows from upstream.
Movement of water through the wetland: Overland unidirectional flows.
Outflow drainage characteristics: Evapotranspiration and concentrated flows via a channel.</td></tr>
<tr><td rowspan="4">Soil</td><th colspan="4">Upper layer Substratum type</th><th colspan="2">Lower layer Substratum type</th></tr>
<tr><th colspan="2">6A: Primary categories</th><th colspan="2">6B: Secondary categories</th><th colspan="2">6A: Primary categories</th></tr>
<tr><td colspan="2">Clayey soil</td><td colspan="2">Sandy clay</td><td colspan="2">Sandy soil</td></tr>
<tr><td colspan="6">Soil samples extracted from the edge of the wetland that could be accessed exhibited a gleyed soil matrix with no identifiable soil mottles. The soil also exhibited high levels of silt and organic matter.</td></tr>
<tr><td rowspan="4">Vegetation</td><th colspan="4">Vegetation Form</th><th colspan="2" rowspan="2">6E: Vegetation Status</th></tr>
<tr><th colspan="2">6B: Primary veg form</th><th>6C</th><th>6D</th></tr>
<tr><td colspan="2">Thicket</td><td>N/A</td><td>N/A</td><td colspan="2">Largely Alien</td></tr>
<tr><td colspan="6">The vegetation community in the boundary of the wetland can be described as a thicket dominated by woody invasive alien plants particularly Schinus terebinthifolius. The thicket is largely impenetrable and blocks sunlight from the wetland floor. The core of the wetland is characterised by a monotypic stand of Typha capensis.</td></tr>
</table>

Photographs of the depression wetland (DP1) are presented below:

Photo 1: Overview of the wetland habitat.

Photo 2: Edge of the wetland overrun by an alien woody plant, *S. terebinthifolius*.

Photo 3: Wetland section that extends into the adjoining residential estate.

Photo 4: Soil sample extracted from the edge of the wetland. The soil exhibited a gleyed soil matrix and high silt content.

Photo 5: View of the culvert at the toe of the wetland. The culvert conveys outflow from the wetland into the Msimbazi Estuary.

Table 3.4: General characteristics of infield delineated seep wetland (S1).

<table>
<tr><th>Level 1</th><th colspan="2">Level 2</th><th>Level 3</th><th colspan="3">Level 4: HGM Unit</th></tr>
<tr><th>System</th><th>DWA Ecoregion</th><th>NFEPA Wet/Veg Group</th><th>Landscape Unit</th><th>4A</th><th>4B</th><th>4C</th></tr>
<tr><td>Inland</td><td>17.01 (North Eastern Coastal Belt)</td><td>Indian Ocean Coastal Belt Group 2</td><td>Valley Head</td><td>Seep</td><td>With channelled outflow</td><td>N/A</td></tr>
<tr><th>Aspect</th><th colspan="6">Description</th></tr>
<tr><td>General Description</td><td colspan="6">Wetland Unit S1 was classified as a Seep wetland due to location on a modified landscape that resembles a valley head setting. The wetland likely existed prior to the landscape modifications associated with the National Route N2 hence it was considered natural.</td></tr>
<tr><td rowspan="3">Hydrology</td><th colspan="2">5A: Inundation</th><th colspan="2">5B: Saturation</th><th colspan="2">5C: Depth of Inundation</th></tr>
<tr><td colspan="2">Never inundated</td><td colspan="2">Seasonally saturated</td><td colspan="2">N/A</td></tr>
<tr><td colspan="6">Inflow drainage characteristics: Groundwater.
Movement of water through the wetland: Overland and subsurface unidirectional flows.
Outflow drainage characteristics: Concentrated flows via a channel.</td></tr>
<tr><td rowspan="4">Soil</td><th colspan="4">Upper layer Substratum type</th><th colspan="2">Lower layer Substratum type</th></tr>
<tr><th colspan="2">6A: Primary categories</th><th colspan="2">6B: Secondary categories</th><th colspan="2">6A: Primary categories</th></tr>
<tr><td colspan="2">Sandy soil</td><td colspan="2">Sand</td><td colspan="2">Sandy soil</td></tr>
<tr><td colspan="6">Soil samples extracted from the wetland habitat were sandy and exhibited a grey soil matrix with low chroma mottles. Mottles were also recorded in root zones.</td></tr>
<tr><td rowspan="4">Vegetation</td><th colspan="4">Vegetation Form</th><th colspan="2" rowspan="2">6E: Vegetation Status</th></tr>
<tr><th colspan="2">6B: Primary veg form</th><th>6C</th><th>6D</th></tr>
<tr><td colspan="2">Herbaceous</td><td>Sedges/Bulrushes</td><td>Bulrushes</td><td colspan="2">Largely indigenous</td></tr>
<tr><td colspan="6">Monotypic stand of bulrushes (T. capensis) mixed with a few other wetland species namely Cyperus latifolius, Commelina erecta and Ludwigia octovalis.</td></tr>
</table>

Photographs of the seep wetland (S1) are presented below:

Photo 6: General view looking upslope of the seep wetland. Note the monotypic bulrush (*T. capensis*) vegetation.

Photo 7: Soil sample extracted from the wetland habitat. Note the grey matrix and low chroma soil mottles which indicate prolonged soil saturation.

3.8 Wetland Habitat Assessments

3.8.1 Present Ecological State Assessment

The present ecological state (PES) of a wetland / wetland health is defined as a measure of the similarity of a wetland to a natural or reference condition and is determined through use of the WET-Health Assessment tool (Macfarlane *et al*. 2007). The tool examines deviation from the natural reference condition for three components of health; hydrology, geomorphology and vegetation separately.

The results of the PES assessment indicated that both the depression wetland DP1 and the seep wetland S1 were moderately modified (C PES Class). A summary of the assessment results and impact descriptions is provided in Table 3.5 below.

Table 3.5: PES assessment results for all wetland units.

HGM Unit	PES Components			PES Score & Category	Impact Description
	Hydro	Geo	Veg		
DP1	3.2	1.2	5.5	**3.3 C Class**	**PES: Moderately Modified** The hydrological processes of the wetland have significantly altered by (i) catchment hardening of at least 75% of wetland's catchment and (ii) infilling associated with provincial road P491 which effectively cut-off the wetland from the Msimbazi Estuary. Now water dams in the wetland and slowly trickles out via a culvert under the P491 Road. The geomorphological processes have also been affected. As it stands the wetland only accumulates sediment as opposed to its natural dynamic process of sediment accumulation and loss linked with fluctuations of flows. As for the vegetation component, about 50% of the delineated wetland boundary is invaded by an alien woody plant, *S. terebinthifolius*, which has formed impenetrable stands restricting access to the core of the wetland.
S1	3.2	1.3	3.0	**2.6 C Class**	**PES: Moderately Modified** Whilst the catchment of this wetland is largely untransformed, the National Route N2 discharges road stormwater into the wetland habitat. Furthermore, cultivation of the wetland's catchment generated sediment which was washed into the wetland habitat affecting both the hydrological and geomorphological integrity of the wetland. The vegetation community was noted to be low in diversity and dominated by *T. capensis*. The low diversity is likely attributed to historic impacts linked with cultivation and construction of the national route N2. On the whole, identified impacts were of low intensity.

3.8.2 Functional / EcoServices Assessment

The functionality of the wetland in terms of providing ecosystem services was assessed using the WET-EcoServices Level 2 Assessment tool (Kotze *et al.* 2007). The tool accounts wetland attributes and observed impacts to provide an estimation of the level of ecosystem service supply.

The depression wetland (DP1) was particularly good at providing regulating and supporting benefits along with maintenance of biodiversity as well as tourism and recreational services (Table 3.6). It excelled particularly at providing flood attenuation (owing to its closed contours and robust vegetation), water quality enhancing services (owing to high soil saturation, presence of bulrush vegetation, low longitudinal gradient and closed contours), carbon storage (linked with high soil saturation) and maintenance of biodiversity.

The seep wetland (S1) was also efficient at providing similar services to depression wetland DP1 but it excelled particularly at providing flood attenuation (owing to the presence of robust vegetation), water quality enhancing services (owing to high soil saturation, presence of bulrush vegetation, being dominated by subsurface flows), carbon storage (linked with high soil saturation) and maintenance of biodiversity. A summary of the assessment results is provided in Table 3.6 below.

Table 3.6: Functional / EcoServices assessment results for all wetland units.

Ecosystem Services			Functional / EcoServices Scores & Ratings	
			DP1	**S1**
Regulating & Supporting Benefits	Flood attenuation		2,8 Moderately High	2,6 Moderately High
	Streamflow regulation		2,2 Moderate	1.5 Moderately-Low
	Water Quality Enhancement Benefits	Sediment trapping	2,0 Moderate	2,7 Moderately High
		Phosphate trapping	2.6 Moderately-High	3,0 High
		Nitrate removal	3,6 Very High	2,8 Moderately High
		Toxicant removal	3,0 High	3,0 High
		Erosion control	3,4 Very High	3,0 High
	Carbon storage		2,7 Moderately High	1,7 Moderate
Maintenance of biodiversity			1.6 Moderate	1,6 Moderate
Provisioning Benefits	Water supply for human use		1,1 Moderately Low	0,4 Very Low
	Natural resources		0,0 Very Low	0,0 Very Low
	Cultivated foods		0,8 Low	0,4 Very Low
Cultural Benefits	Cultural significance		0,0 Very Low	0,0 Very Low
	Tourism and recreation		1,6 Moderate	0,7 Low
	Education and research		1,0 Low	1,3 Moderately Low

3.8.3 Ecological Importance and Sensitivity Assessment

Ecological importance (EI) of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scale whilst ecological sensitivity (ES) (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.* 1988; Milner 1994).

The depression wetland DP1 was found to be of moderate EIS whilst the seep wetland S1 was of low EIS. A summary of the assessment results and impact descriptions are provided in Table 3.7 below.

Table 3.7: EIS assessment results for all wetland units.

HGM Unit	EIS Components		EIS Rating & Category	Impact Description
	EI	ES		
DP1	1.7	1.7	**1.7** **Moderate EIS**	**EIS: Moderate** The depression wetland (DP1) attained a score of 1.7 which indicates that was of moderate EIS. When one takes into consideration that the wetland is significantly degraded it becomes clear that its EIS has declined significantly. The degradation of the vegetation community and habitat has reduced species diversity and the wetland's sensitivity to water quality impacts. The loss of indigenous vegetation has reduced the wetland's ecological importance as it no longer represents a conservation important ecosystem.
S1	1.4	1.0	**1.4** **Low EIS**	**EIS: Low** The seep wetland was evaluated as being of low EIS (1.4 points). This is largely owing to its inherently low sensitivity to floods, changes in flow patterns and water quality impacts. The wetland is characterised by hardy species.

4. IMPACT ASSESSMENT & MITIGATION

4.1 Impact Identification, Description & Significance Assessment

All impacts linked with the construction and operation of the Msimbazi River Estate are discussed in Table 4.1 below.

Table 4.1: Description of all impacts and a summary of the impact significance results.

Impact	Project Phase & Impact Description	Impact Significance[1]	
		Poor / No Mitigation	Good Mitigation
a) Transformation of watercourse habitat	**Construction & Operational Phase**: Review of the conceptual development layout indicates that no wetland will be transformed during the construction and operational phase of the development. As such this impact was not assessed any further.	**N/A**	**N/A**
b) Direct disturbance of watercourse habitat	**Construction & Operational Phase**: No work will be undertaken within any watercourse habitat; therefore, this impact was not assessed further.	**N/A**	**N/A**
c) Increased sediment input in watercourses	**Construction Phase**: Construction of the Msimbazi River Estate will require removal of vegetation, excavation and infilling of the terrestrial environment adjacent to the depression wetland DP1. Removal of vegetation will reduce water infiltration and increase the risk of erosion during rainfall events whilst earth moving activities will render the soil susceptible to erosion. If construction activities are poorly managed, a significant amount of sediment will be eroded from the terrestrial environment and deposited into the depression wetland. This risk is also increased by the generally steep development area. Sediment deposition will bury smaller vegetation and also alter the micro topography of the wetland. In turn this will alter water distribution and retention patterns within the wetland. Areas under sedimentation will become drier whilst those unaffected will experience increased water concentrations which could increase the risk of soil erosion within the wetland.	**Medium**	**Low**
	Operational Phase: The operational phase will likely experience similar impacts to those discussed above, albeit at a lower intensity given that vegetation cover should be reinstated where necessary. The reader is therefore referred to the above description for details.	**Low**	**Low**
d) Increased flood peaks in watercourses	**Construction Phase**: The removal of vegetation and the construction of hardened surfaces during construction will reduce infiltration and increase runoff during rainfall events. This will lead to large volumes of water entering the wetland often at high flow rates within a short space of time (increased flood peaks). Changes in water input patterns will lead to the following impacts: reduced infiltration and groundwater recharge (which reduces water inputs to groundwater dependent watercourses), increased risk of catchment and wetland	**Medium**	**Low**

[1] *Detailed results of the impact assessment are provided in Appendix 8.2.*

	erosion, sedimentation of the wetland habitat, and increased inundation within the wetland.		
	Operational Phase: Impacts experienced during the operational phase will be similar to those of the operational phase however stormwater will likely be generated by more hardened surfaces such as building, walkways, driveways, arterial roads and the formal stormwater infrastructure.	**Medium**	**Low**
e) Increased nutrient input in watercourses	**Construction Phase**: Key sources of nutrients (nitrogen, phosphorus etc.) during the construction phase of the Msimbazi River Estate include: (i) mis-handling of sewage from chemical toilets, and (ii) use fertilisers during landscaping. Once nutrients are released into the environment they will be carried into downstream watercourses (particularly depression wetland D1) via the following means (i) those attached to sediment will moved with sediment when soil erosion occurs, (ii) and those dissolved in water will be carried by stormwater or groundwater. Once in the wetland, they'll increase the nutrient load thus increasing the risk of algal blooms and infestation by nutrient loving plants (which could be indigenous or alien). Algal blooms will reduce the amount of dissolved oxygen in stagnant pools of water which in turn will result in increased mortality of water dependent aquatic plants. Increased infestation of nutrient loving plants will negatively impact the vegetation integrity and habitat diversity of the wetland.	**Low**	**Negligible**
	Operational Phase: Key sources of nutrients during the operational phase include (i) discharges of treated wastewater from the onsite sewage package plant, and (ii) fertilisers used in landscaping and gardening. Although there is a proposal to recycle treated wastewater from the packaging plants, some of the treated water will be discharged into the adjacent watercourses. Although wastewater will be treated to DWS specification, there will be some nutrients left in treated wastewater which will impact the aquatic environment. It should be noted that the proposed sewage packaging plant poses the biggest threat to downstream watercourses. Please review the above description (Construction phase impacts) of the effects of increased nutrient inputs on wetlands.	**High**	**Medium**
f) Increased input of toxic contaminants in watercourses	**Construction Phase**: During the construction phase it is expected that the following toxic contaminants will be released intentionally or by accident into the environment: heavy metals and hydrocarbons (from motor vehicle brake linings, emissions from construction vehicles) as well as pesticides from the control of alien plants and landscaping. Once released into the terrestrial environment, precipitation will wash toxic contaminants into watercourses. Once in the watercourse they will increase the toxicity level of water which will lead to the mortality of aquatic biota (plants, microorganisms and small animals) sensitive to water quality changes.	**Medium**	**Negligible**
	Operational Phase: Key sources of toxic contaminants and their effect on watercourses during the operational phase of the Msimbazi	**High**	**Medium**

	River Estate are likely to be similar to those of the construction phase. An additional source of toxic contaminants during the operational phase of the development will be effluent from the package plant. For more details please read the above description for the construction phase.		
g) Weeds and invasive alien plant proliferation in watercourses	**Construction Phase**: At the time of undertaking fieldwork, the development area and wetland were overrun by invasive alien plants, the most notable being *Schinus terebinthifolius*. Any temporary removal of vegetation during the construction phase will increase the likelihood of IAP invasion. The colonization of areas by weeds and IAPs poses a risk to indigenous plant communities and habitat characteristics. IAPs can have far reaching detrimental effects on native biota and has been widely accepted as being a leading cause of biodiversity loss. Overtime IAPs will spread into watercourses and degrade the habitat.	**Medium**	**Low**
	Operational Phase: If disturbed areas are not adequately rehabilitated IAPs could spread during the operational phase and compromise the vegetation integrity of the wetland. Details on the impact are provided in the description above.	**Medium**	**Low**

4.2 Wetland Buffer Recommendations

A buffer zone is a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another (Macfarlane *et al.* 2014). According to Macfarlane *et al*. (2014), buffers surrounding water resources serve the following functions:

i. Maintaining basic aquatic process;
ii. Reducing impacts on water resources from upstream activities and adjoining land uses.
iii. Providing habitat for aquatic and semi-aquatic species.
iv. Providing habitat for terrestrial species.
v. Providing a range of ancillary societal benefits.

According to the Wetland Buffer tool (Macfarlane *et al*. 2014), residential developments of medium impact pose a high threat to the aquatic environment during the construction phase and a medium threat during the operational phase. However, these threat ratings are based on the assumption that sewage, during the operational phase of the development, will be conveyed into the municipal system for treatment. As for the Msimbazi River Estate, sewage will be treated on site using a package plant hence the operational impact threat ratings were revised to account for the onsite treatment of sewage. The revised ratings suggest the Msimbazi River Estate development will pose a high threat on receiving water resources. Threats posed by residential developments of medium impact are listed in Table 4.2.

Table 4.2: Threats posed by residential developments of medium impact.

Impact Description	Construction Impact Threat Ratings	Operational Impact Threat Ratings	
		Desktop Ratings	Revised Ratings
1. Alteration to flow volumes	Very Low	Medium	Medium
2. Alteration of patterns of flows (increased flood peaks)	Very Low	Medium	Medium

3. Increase in sediment inputs & turbidity	High	Low	Low
4. Increased nutrient inputs	Very Low	Low	Medium
5. Inputs of toxic organic contaminants	Very Low	Low	Medium
6. Inputs of toxic heavy metal contaminants	Low	Low	Low
7. Alteration of acidity (pH)	Very Low	Very Low	Medium
8. Increased inputs of salts (salinization)	N/A	Very Low	Medium
9. Change (elevation) of water temperature	Very Low	Very Low	Very Low
10. Pathogen inputs (i.e. disease-causing organisms)	Very Low	Low	High

The Wetland Buffer tool (Macfarlane *et al*. 2014) was used to establish the required buffer width for delineated wetlands. The results of the tool which takes into account wetland properties (e.g. buffer slope, soil properties, groundcover within the buffer, sensitivity of receiving watercourses etc.) recommended a final buffer width of 29m for the depression wetland DP1 and a final buffer width of 25m for the seep wetland (Table 4.3 and Figure 4.1).

Table 4.3: Recommended wetland buffer width.

HGM Unit	Construction Phase Buffer Width	Operational Phase Buffer Width	Final Buffer Width
Unit DP1	17m	29m	**29m**
Unit S1	15m	25m	**25m**

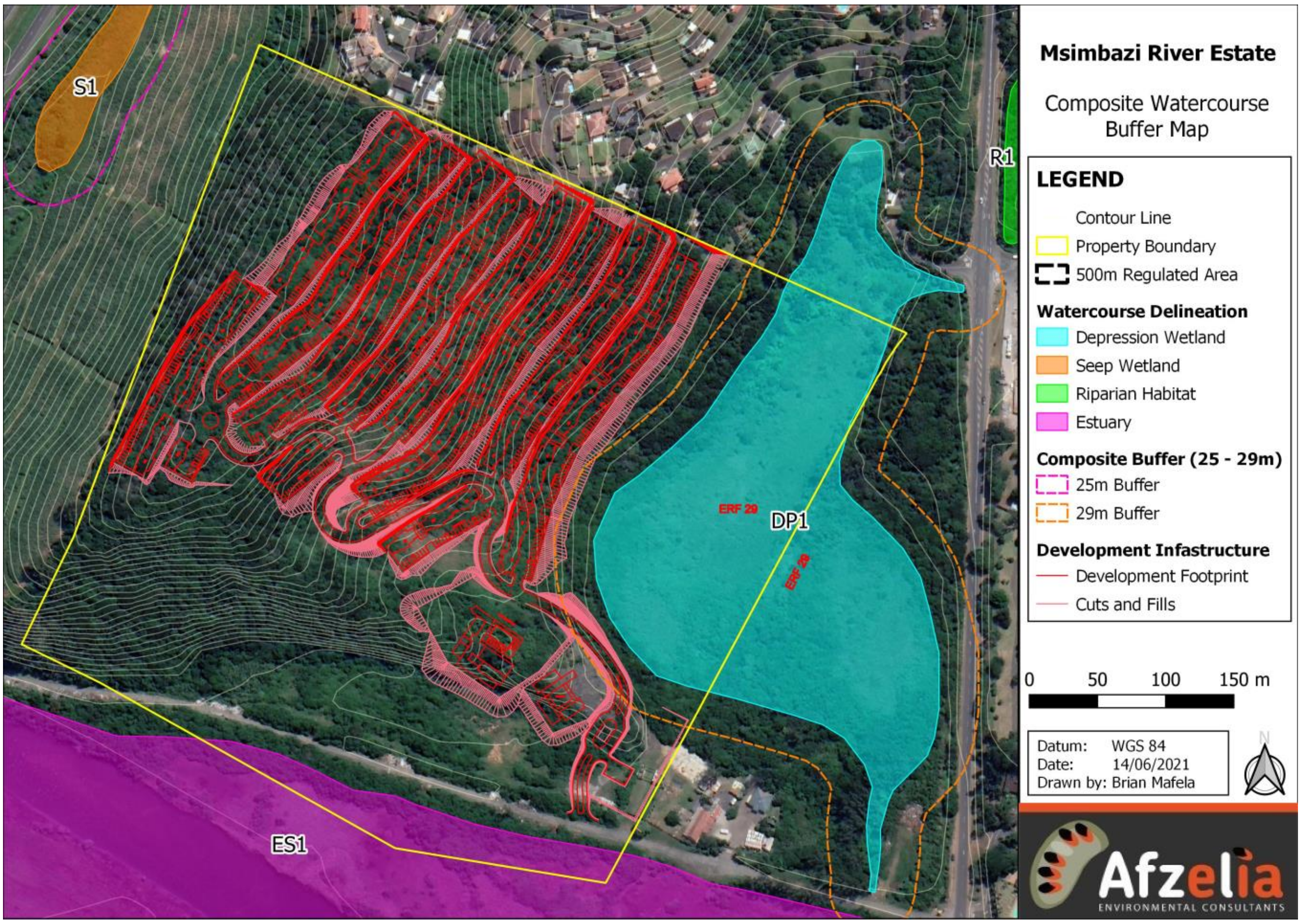

Figure 4.1: Map showing the extent of the recommended 25 - 29m wetland buffer width.

Limitation of Buffer Zones
It is worth noting that buffers do little to address impacts such as hydrological changes caused by stream flow reduction activities or changes in flow brought about by abstractions or upstream impoundments. Buffer zones are also not appropriate for militating against point-source discharges (such as sewage outflows), which can be managed more effectively by targeting these areas through specific source-directed controls. Contamination or use of groundwater is also not well addressed by buffer zones (Macfarlane et al. 2014).

Despite clear limitations, buffer zones are well-suited for performing functions such as sediment trapping and nutrient retention that can significantly reduce the impact of activities taking place adjacent to water resources. Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts linked with land preparation activities, use of fertilisers and use of chemicals to combat insects, pests, fungi, weeds and invasive plants (Macfarlane et al. 2014).

4.3 Estuary Buffer Recommendations

A buffer zone for the estuary has not been determined as it does not form the scope of this assessment. An estuary specialist must be consulted for a buffer zone recommendation.

4.4 Stormwater Management

Stormwater is generally a major problem in urban developments due to increased hardened surfaces which restrict infiltration but promote increased runoff. It is therefore of paramount importance that sustainable stormwater management methods are implemented for developments with hardened surfaces. The general principle for stormwater management is to reduce the rate of runoff to a predevelopment state and ensure that runoff is not concentrated onto adjacent neighbouring sites or other infrastructure. This principle is in line with the eThekwini Municipality's stance on management of stormwater within the municipality. In this regard, the following mitigation measures are recommended:

Point-Source Mitigation Measures

i. Hardened surfaces such as driveways, paved walkways, paved yards etc. must be kept to a minimum. If required, porous paving such as block paving must be used in favour (Figure 4.2).
ii. All units must have rainwater harvesting infrastructure. A common and acceptable technology is diverting stormwater from the gutter into JoJo tanks for storage. Harvested water can then be used for gardening purposes as an example. The acceptable storage ratio for rainwater tanks is 60% of the volume of the tank. In other words, when calculating the volume of storage required (on the 1 m^3 to 40 m^2 area) then 60% of the rainwater tank volume may be claimed on the assumption that the tank is 40% full at any given time.
iii. Runoff generated by arterial roads must be handled through use of grassed swales (Figure 4.3). Where required, grassed swales can be reinforced with gabion mattresses to prevent erosion. Short runner grasses are preferred for this technology.
iv. Grassed swales must be designed to divert runoff away from the road and into the veld at regular intervals. This reduces discharge quantities at each discharge point and thus minimising the risk of erosion.
v. Stormwater must never be discharged into the sewer infrastructure. The two must always be kept separate.

Figure 4.2: Permeable paving options that could be implemented for the roads and/or the parking bays onsite. Left image was extracted from Ecology Matters (2017), whilst the right image was extracted from Salmon Falls Nursery (2016).

Figure 4.3: Examples of grass swales which can be implemented on low gradient areas within the site. Left image was extracted from Jaxshells (2019), whilst the right image was extracted from WBDG (2016).

End-point Mitigation Measures

In the event that point-source mitigation measures are not adequate to handle stormwater end-point mitigation measures will need to be implemented, which include:

vi. Stormwater over flows from rainwater harvesting infrastructure, and any other infrastructure, must be discharged into a water retaining structure such as a soakpit if the soil and geological profiles allow.
vii. Soakpits must be constructed at least 3m away from buildings to avoid any water damage to infrastructure.
viii. All soakpits must be designed to allow for removal of accumulated silt, organic material and any other wind-blown material from the soakpit in order to ensure continued effective functioning.
ix. All stormwater collection, detention, attenuation, conveyance and outlet structures must be established outside delineated watercourses and their buffer zones. This is necessary to allow the buffer zone to dissipate and filter stormwater before it reaches downslope watercourses.
x. A series of smaller stormwater outlets should be considered over a few large outlets. For example, a stormwater discharge point can be constructed for each unit rather than one outlet serving many units.
xi. All stormwater generated by the development must be attenuated onsite and within the property boundary.
xii. Where feasible, all grey water must be reused.

4.5 General Restrictions for a Package Plant

i. Treated wastewater must never be discharged directly into the estuary or adjacent wetland habitat.
ii. Use of the package plant must be limited to 40 units per hectare.

iii. Use of the package plant must be limited to an area without municipal sewer connection or an area where the existing municipal wastewater treatment works does not have adequate capacity.
iv. The package plant must be situated outside the 100-year flood zone.
v. The package plant must be situated at least 100m away from the edge of a water resource (wetland, estuaries and riparian habitats).
vi. Treated sewage effluent must conform to special wastewater limit values[2] set by DWS.

4.6 Additional Mitigation Measures

4.6.1 General Housing Development Guidelines

i. For the project to be an eco-estate development, it needs to include the following environmentally friendly elements:
   a. Keep vegetation removal / clearance to a minimum. Existing large indigenous trees must be incorporated into the design and landscaping of each unit.
   b. Use environmentally friendly designs and construction materials.
   c. Design units that 'blend' with the surrounding environment.
   d. Re-introduce native indigenous trees and remove all alien vegetation.
ii. Major cut and fill earthworks must be kept to an absolute minimum.
iii. Steep slopes, water resources and their associated buffers must be utilised as public open spaces. This should be reflected in the design layout of the project.

4.6.2 Construction Footprint Limit & Demarcation

i. All construction activities must be limited to permitted areas and outside of the approved buffer zones.
ii. Prior to commencement of construction, the buffer zone of the depression wetland DP1 must be demarcated using wooden pegs and an orange safety net.
iii. The demarcation fence must be signed off by an Environmental Control Officer (ECO).
iv. The demarcation fence must be maintained throughout the construction phase.

4.6.3 Vegetation Protection Mitigation Measures

i. Vegetation clearing must be undertaken as and when necessary.
ii. The entire construction area must not be stripped of vegetation prior to commencing construction activities.
iii. Disturbed sites must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.

4.6.4 Soil Management

i. Prior to commencing with earthworks, the topsoil must be stripped and stockpiled separately from subsoil.
ii. Topsoil must be kept for use during rehabilitation of landscaped areas.
iii. Topsoil must be stockpiled in stockpiles not exceeding 2m in height.
iv. All stockpiles must be kept free of weeds and invasive alien plants.

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[2] *According to the National Water Act, "wastewater limit value" means the mass expressed in terms of the concentration and / or level of a substance which may not be exceeded at any time. Wastewater Limit Values shall apply at the last point where the discharge of wastewater enters into a water resource, dilution being disregarded when determining compliance with the wastewater limit values. Where discharge of wastewater does not directly enter a water resource, the wastewater limit values shall apply at the last point where the wastewater leaves the premises of collection and treatment.*

v. If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile.
vi. All stockpiles must be established outside the 30m buffer of all watercourses and on flat ground.
vii. Prior to commencement of construction, a silt fence / curtain must be installed downslope of the construction footprint to retain any sediment (Figure 4.4).
viii. The silt fence / curtain must be maintained regularly to ensure effective functioning.
ix. After every rainfall event, the contractor must check the site for erosion damage and immediately repair any damage recorded.

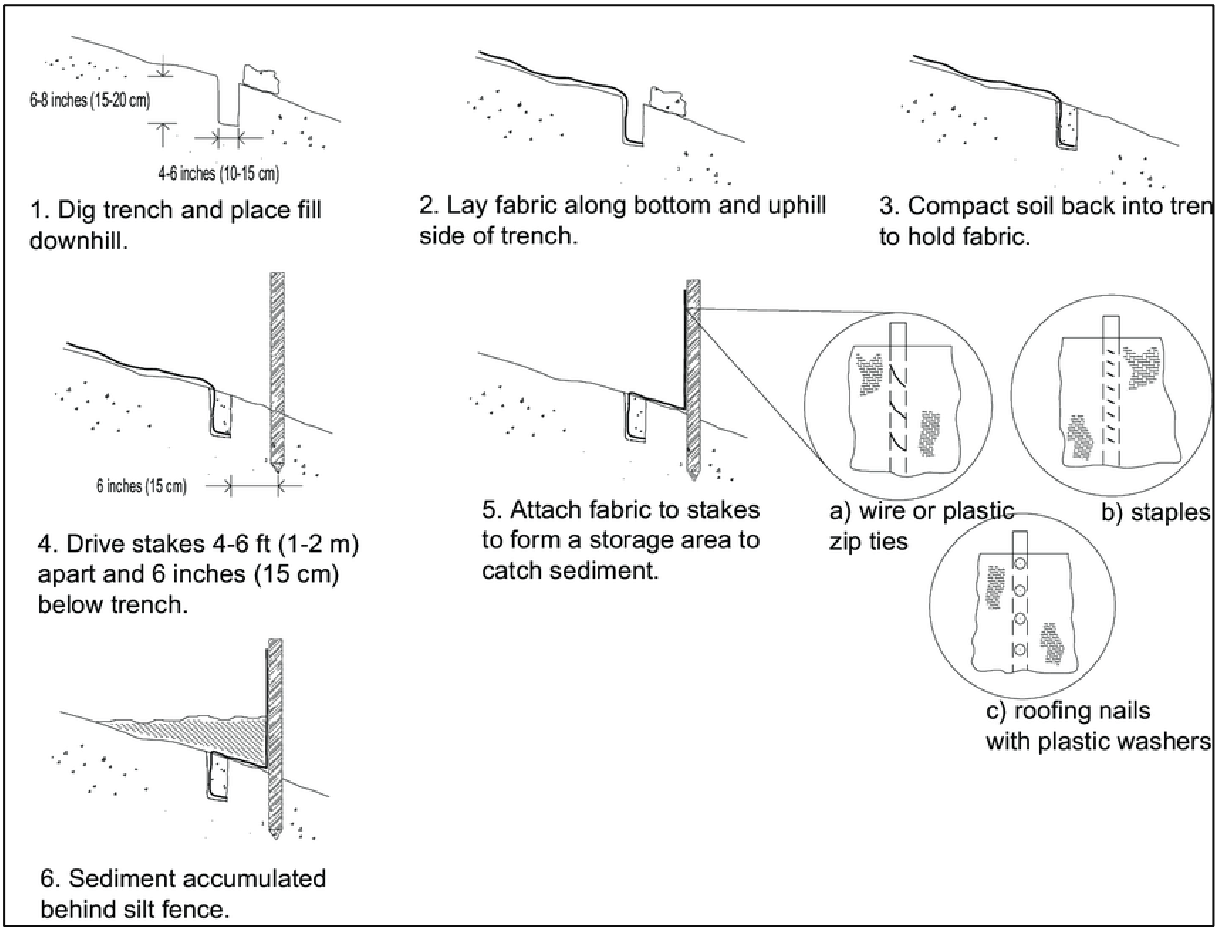

Figure 4.4: Technique of laying sediment / silt fence.

4.6.5 Pollution Prevention Measures

i. Any soil contaminated by hydrocarbons (fuel and oils) must be removed and the affected area rehabilitated immediately.
ii. Chemical toilets must be provided to workers during the construction phase. A single chemical toilet must be provided for every 10 employees.
iii. All chemical toilets must be placed at least 30m away from any watercourse.
iv. Chemical toilets must be serviced regularly by a registered service provider and waybills must be retained as proof of servicing.
v. Fuel must be stored in a bunded structure with a roof. The bund must be able to contain at least 110% of the volumes of fuel.
vi. Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface.

vii. Drip trays should be utilised at all dispensing areas.

viii. A chemical spill kit must be present onsite at all times and once used it must be disposed of at a registered hazardous landfill site.

ix. All solid waste must be collected and placed in bins.

x. All waste generated during construction is to be disposed of at an appropriate registered landfill.

4.6.6 Invasive Alien Plant Control

i. The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs in.

ii. All invasive alien plants must be removed from the construction area.

iii. Mechanical control methods such as digging, hoeing, pulling out of weeds and invasive plants are recommended.

iv. Use of chemical treatment methods must be kept to a minimum.

v. Where chemical treatment methods are used, the contractor must ensure that he uses watercourse friendly herbicides.

vi. The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

5. DWS RISK ASSESSMENT

5.1 Applicable Water Use Authorisation

The General Authorisation (GA) for the impeding or diverting the flow of water in a watercourse (Section 21 c) or altering the bed, banks, course or characteristics of a watercourse (Section 21 i) as contemplated in the National Water Act (Act No. 36 of 1998) was implemented to replace the need for a water user to apply for a licence provided that the water use is within the limits and conditions of this GA. However, according to the Government Notice 509 of 2016, *"the GA does not apply:*

a) to the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009;
b) to the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the Risk Matrix;
c) in instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;
d) where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse; and
e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works."

In accordance with the definitions contained in the National Water Act, No. 36 of 1998 (NWA), a sewage packaging plant is not an exempted activity and it constitutes a water use in terms of Section 21(f) of the NWA, which need to be authorised through an application of a Water Use Licence. As per exclusion "c" and "e" from above-mentioned exclusions from the GA, the Msimbazi River Estate does not qualify for a GA because it is not an exempted activity and an application must be made for a Water Use License for the authorisation of a water use in terms of Section 21(f) of the NWA. Therefore, an application for a Water Use Licence must be submitted to the DWS.

5.2 Special Conditions for the Water Use Licence

Special conditions listed below are recommended and must be included in the Water Use Licence to be issued by the Department of Water and Sanitation.

a) The water user must ensure that stormwater from buildings and the road infrastructure:
    i. is not discharged directly into any watercourse;
    ii. does not induce erosion, sedimentation or flooding; and
    iii. does not cause a detrimental change in the quality of water in downstream watercourses.
b) Prior to the carrying out of any works, the water user must ensure that all persons entering the construction site, including contractors and casual labourers, are made fully aware of the conditions and related management measures specified in the WUL, Environmental Authorisation (EA) and Environmental Management Programme (EMPr).
c) The water user must ensure that no vegetation is cleared or damaged outside the construction footprint.
d) The construction area must be clearly demarcated using a safety net, danger tape, white pegs, etc.
e) The water user must ensure that any construction camp, storage, washing and maintenance of equipment, storage of construction materials, or chemicals, as well as any sanitation and waste management facilities:
    i. are located outside the 1 in 100-year flood line or 30m from any delineated watercourses; and
    ii. are removed within 30 days after the completion of any works.
f) The water user must ensure that measures are taken to prevent increased turbidity, sedimentation and detrimental

chemical changes to the composition of the water resource as a result of carrying out the works, including for emergency alterations or the rectification of reportable incidents.

g) The water user must ensure that adequate erosion control measures (bund, berms, sand bags etc.) are installed on all areas susceptible to erosion or runoff.

h) During the construction phase of the project, the water user must appoint an Environmental Control Officer to undertake weekly site visits and an audit once a month. The environmental audit report must discuss non-compliances of the WUL, EA and the approved EMPr.

i) During the construction phase of the project, the appointed Environmental Control Officer (ECO) must take weekly fixed-point photographs of depression wetland DP1. These must be included in the monthly audit report.

j) All environmental audit reports must be made available to the responsible authority upon written request.

6. CONCLUSION

This investigation confirmed that the proposed Msimbazi River Estate will impact three watercourses, a depression wetland (DP1) that was evaluated as moderately modified (C PES Class) and of moderate EIS, a seep wetland (S1) that was assessed as moderately modified (C PES Class) and of low EIS and an estuary (Msimbazi Estuary – ES1) which was not assessed as it was not part of the scope of this assessment. The depression wetland was the only watercourse that is located very close to the development and will likely receive the most impacts from the proposed development. Both the depression wetland DP1 and seep wetland S1 were particularly good at providing regulating and supporting benefits along with maintenance of biodiversity.

Overall anticipated adverse impacts linked with the construction phase of the project are expected to be of medium significance whilst operational impacts were expected to be higher as indicated by a high impact significance rating (Table 6.1). The key driver of the impact significance rating for the operational phase is the use of a packaging plant to treat sewage. Implementation of recommended standard best practice mitigation measures (listed in Section 4.2 – 4.6 of this report) will lower the impact significance ratings. Construction impacts will likely be reduced to a negligible to low impact significance whilst operational impacts will be reduced to a low to medium impact significance. Detailed results are presented in the Appendix 8.2.

Table 6.1: Summarised impact significance results.

Impact	Construction Phase		Operational Phase	
	Poor / No Mitigation	Good Mitigation	Poor / No Mitigation	Good Mitigation
a) Transformation of watercourse habitat	N/A	N/A	N/A	N/A
b) Direct disturbance of watercourse habitat	N/A	N/A	N/A	N/A
c) Increased sediment input in watercourses	Medium	Low	Low	Low
d) Increased flood peaks in watercourses	Medium	Low	Medium	Low
e) Increased nutrient input in watercourses	Low	Negligible	High	Medium
f) Increased input of toxic contaminants in watercourses	Medium	Negligible	High	Medium
g) Weeds and invasive alien plant proliferation in watercourses	Medium	Low	Medium	Low

Key standard best practice mitigation measures provided in this report include the following:

i. A development setback of 29m from the depression wetland DP1 and 25m from the seep wetland S1.
ii. Treating sewage effluent to conform to special wastewater limit values set by DWS.
iii. Developing a stormwater management plan that (i) encourages infiltration of stormwater, (ii) storage of stormwater for recycling (rainwater harvesting), and (iii) releasing stormwater in a manner that does not cause erosion or increase runoff.

In terms of the DWS Risk Assessment and in accordance with the definitions contained in the National Water Act, No. 36 of 1998 (NWA), discharge of treated effluent constitutes a water use in terms of Section 21(f) of the NWA, which need to be authorised through an application for a Water Use Licence. As per exclusion 'C' from exclusions of the GA, the handling of wastewater does not qualify for a GA because an application must be made for a Water Use License for the authorisation of a water use in terms of Section 21(f) of the NWA. Therefore, an application for a Water Use Licence must be submitted to the DWS for the proposed Msimbazi River Estate. Special conditions listed in Section 5.2 are recommended for inclusion in the Water Use Licence to be issued by DWS.

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8. APPENDICES

8.1 Wetland Assessments

8.1.1 Wetland Delineation

Onsite wetland delineation was undertaken as per procedures described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005a). This document requires the delineator to give consideration to the following 4 indicators in order to find the outer edge of the wetland zone:

i. The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur.
ii. 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.
iii. The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. Signs of wetness are characterised by a variety of aspects. These include marked variations in the colours of various soil components, known as mottling; a gleyed soil matrix or the presence of Fe/Mg concretions. It should be noted that the presence of signs of wetness within a soil profile is sufficient to classify an area as a wetland area despite the lack of other indicators.
iv. The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

8.1.2 Wetland Classification

All natural-occurring wetland units were classified according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013) which categorise wetlands into 6 distinct hydrogeomorphic (HGM) units. See Table 8.1 for a description of each HGM Unit.

Table 8.1: Description of wetland HGM units.

HGM Type	Description
Channelled valley bottom wetland	A mostly flat wetland area with a river channel running through it located along a valley floor, often connected to an upstream or adjoining river channel.
Unchanneled valley bottom wetland	A mostly flat wetland area without a river channel running through it located along a valley floor, often connected to an upstream or adjoining river channel.
Floodplain	A wetland area on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by overtopping of the channel bank.
Seep	a wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend onto a valley floor.
Flat	A level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.
Depression	a wetland or aquatic ecosystem with closed (or near-closed1) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.

Illustrations of the different wetland HGM types is provided in Figure 8.1.

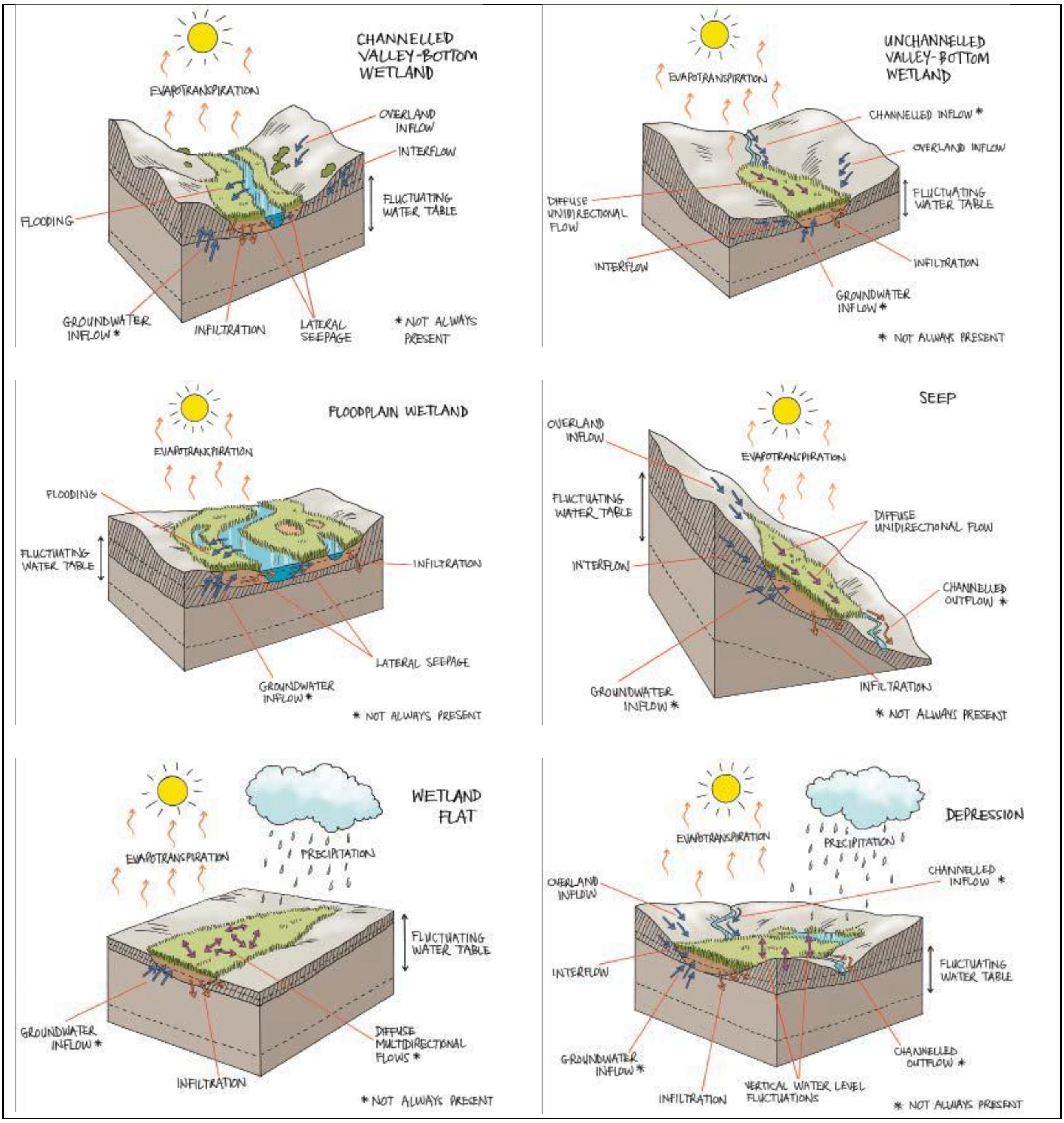

Figure 8.1: Illustrations of the different wetland HGM types.

8.1.3 Wetland Present Ecological State Assessment

The health or integrity of wetlands was assessed using WET-Health Level 1 Assessment tool. The tool attempts to assess the deviation of 3 key wetland components from their reference state prior to human induced degradation (Macfarlane *et al.* 2008). These components namely hydrological, geomorphological and vegetation are assessed separately and the results are integrated to obtain and overall score (Macfarlane *et al.* 2008). An overall wetland health score is calculated by weighting the scores obtained for each component using the following formula:

$$\textbf{Overal Health Score} = \frac{(\text{Hydrology X 3}) + (\text{Geomophology X 2}) + (\text{Vegetation X 2})}{7}$$

The overall health score is then interpreted using a categorised system ranging from A to F with "Category A" signifying that the wetland is in a natural / unmodified state whilst the other end of the gradient "F" signifying that the wetland is critically modified. Details of the scoring system are presented in Table 8.2 below.

Table 8.2: Impact scores and categories of Present State used in WET-Health for describing the integrity of wetlands.

Impact Category	Description	Range	PES Category
None	Unmodified, natural.	0 – 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 – 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 – 3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Critical	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 – 10	F

8.1.4 Wetland Functional Assessment

The functionality of the wetland in terms of providing ecosystem services was assessed using the WET-EcoServices Level 2 Assessment tool (Kotze *et al.*, 2007). The tool accounts wetland attributes and observed impacts to provide an estimation of the level of ecosystem service supply. Table 8.3 lists all ecosystem services assessed and also provide a description of each service.

Table 8.3: Description of each ecosystem service assessed.

<table>
<tr><td rowspan="7">Indirect Benefits</td><td colspan="2">Flood Attenuation</td><td>Refers to the effectiveness of wetlands at spreading out and slowing down storm flows and thereby reducing the severity of floods and associated impacts.</td></tr>
<tr><td rowspan="4">Regulating and Supporting Services</td><td>Stream Flow Regulation</td><td>Refers to the effectiveness of wetlands in sustaining flows in downstream areas during low-flow periods.</td></tr>
<tr><td>Sediment Trapping</td><td>Refers to the effectiveness of wetlands in trapping and retaining sediments from sources in the catchment.</td></tr>
<tr><td>Nutrient & Toxicant Retention and Removal</td><td>Refers to the effectiveness of wetlands in retaining, removing or destroying nutrients and toxicants such as nitrates, phosphates, salts, biocides and bacteria from inflowing sources, essentially providing a water purification benefit.</td></tr>
<tr><td>Erosion Control</td><td>Refers to the effectiveness of wetlands in controlling the loss of soil through erosion.</td></tr>
<tr><td colspan="2">Carbon Storage</td><td>Refers to the ability of wetlands to act as carbon sinks by actively trapping and retaining carbon as soil organic matter.</td></tr>
<tr><td colspan="2">Biodiversity Maintenance</td><td>Refers to the contribution of wetlands to maintaining biodiversity through providing natural habitat and maintaining natural ecological processes.</td></tr>
<tr><td rowspan="3">Direct Benefits</td><td rowspan="3">Provisioning Benefits</td><td>Water Supply</td><td>Refers to the ability of wetlands to provide a relatively clean supply of water for local people as well as animals.</td></tr>
<tr><td>Harvestable Natural Resources</td><td>Refers to the effectiveness of wetlands in providing a range of harvestable natural resources including firewood, material for construction, medicinal plants and grazing material for livestock.</td></tr>
<tr><td>Cultivated Foods</td><td>Refers to the ability of wetlands to provide suitable areas for cultivating crops and plants for use as food, fuel or building materials.</td></tr>
</table>

		Food for Livestock	*Refers to the ability of wetlands to provide suitable vegetation as food for livestock.*
	Cultural Benefits	Cultural significance	*Refers to the special cultural significance of wetlands for local communities.*
		Tourism & Recreation	*Refers to the value placed on wetlands in terms of the tourism-related and recreational benefits provided.*
		Education & Research	*Refers to the value of wetlands in terms of education and research opportunities, particularly concerning their strategic location in terms of catchment hydrology.*

Table 8.4: Classes for determining the likely extent to which a benefit is being supplied based on the overall score for that benefit.

Score	Supply/Demand/Importance Scores
0.0 – 0.5	Very Low
0.6 – 1.0	Low
1.1 – 1.5	Moderately-Low
1.6 – 2.4	Moderate
2.5 – 2.9	Moderately-High
3.0 – 3.4	High
3.5 – 4.0	Very High

8.1.5 Wetland Ecological Importance and Sensitivity Assessment

The ecological importance and sensitivity (EIS) of wetlands was assessed using an unpublished revision of the DWAF EIS tool by Rountree & Kotze, 2013. The tool assesses 3 aspects of the wetland including:

i. The Importance of the wetland in providing habitat to biodiversity,
ii. Landscape importance, and
iii. The sensitivity of the wetland to changes in flow regime and water quality.

The results of the assessment are interpreted as per the following guideline presented in Table 8.5.

Table 8.5: Ecological importance and sensitivity scores, ratings and description.

EIS Score	EIS Rating	EIS Category Description
0 - 0.5	Very Low	Wetlands that are not ecologically important and sensitive at any scale due to high degradation levels.
0.6 - 1.5	Low	Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers
1.6 - 2.7	Moderate	Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers
2.8 - 3.5	High	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers
<3.5	Very High	Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and

		habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers

8.2 Detailed Impact Significance Assessment Results

Detailed impact significance assessment results are provided in Table 8.6 below.

Table 8.6: Detailed impact significance assessment results.

Construction Impact	Without Mitigation					With Mitigation				
	Magnitude	Duration	Extent	Probability	Significance	Magnitude	Duration	Extent	Probability	Significance
a) Transformation of watercourse habitat					N/A					N/A
b) Direct disturbance of watercourse habitat					N/A					N/A
c) Increased sediment input in watercourses	4	2	1	3	21 Medium	2	2	1	2	10 Low
d) Increased flood peaks in watercourses	4	2	1	3,5	24,5 Medium	2	2	1	2	10 Low
e) Increased nutrient input in watercourses	2	2	1	3	15 Low	0	2	1	2	6 Negligible
f) Increased input of toxic contaminants in watercourses	4	2	2	3	24 Medium	0	2	2	2	8 Negligible
g) Weeds and invasive alien plant proliferation in watercourses	4	2	1	4	28 Medium	2	2	1	2	10 Low

Operational Impact	Without Mitigation					With Mitigation				
	Magnitude	Duration	Extent	Probability	Significance	Magnitude	Duration	Extent	Probability	Significance
a) Transformation of watercourse habitat					N/A					N/A
b) Direct disturbance of watercourse habitat					N/A					N/A
c) Increased sediment input in watercourses	2	3	1	2	12 Low	1	3	1	2	10 Low
d) Increased flood peaks in watercourses	4	3	1	4	32 Medium	2	3	1	2	12 Low
e) Increased nutrient input in watercourses	6	4	2	5	60 High	2	4	2	3	24 Medium
f) Increased input of toxic contaminants in watercourses	6	3	2	5	55 High	2	3	2	3	21 Medium

g)	Weeds and invasive alien plant proliferation in watercourses	4	4	1	3	**27 Medium**	2	4	1	2	**14 Low**