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CLARITY PERTAINING TO THE WETLAND ASSESSMENT REPORTS.

The Wetland Assessment Report compiled by Lyndle Naidoo of SRK dated September 2023 was considered in this assessment. This report pertains to the presence and delineation of wetlands. It has been made available as Appendix D5.

The Wetland Assessment by Dr. James Dabrowski was used to inform the assessment as this also included historical analysis and assessed the impact of stormwater and mitigations for stormwater management. This report is attached to the Draft BAR as Appendix D1.

GOEDGELOOF STORAGE FACILITY, ST FRANCIS BAY, EASTERN CAPE PROVINCE

WETLAND IMPACT ASSESSMENT

Report Prepared for

Goedgeloof Properties (Pty) Ltd

Report Number 597323/1/rev1_Draft

Report Prepared by

srk consulting

September 2023

GOEDGELOOF STORAGE FACILITY, ST FRANCIS BAY, EASTERN CAPE PROVINCE

WETLAND IMPACT ASSESSMENT

Report Prepared for

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd. (SRK) by Goedgeloof Properties (Pty) Ltd. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

BLMC	Biodiversity Land Management Classes
CBA	Critical Biodiversity Area
C.A.P.E.	Cape Action for People and the Environment
CESA	Critical Ecological Support Areas
CMA	Catchment Management Agencies
DAEA	Department of Agriculture and Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAPSA	Environmental Assessment Practitioners of South Africa
EC	Electrical Conductivity
ECBCP	Eastern Cape Biodiversity Conservation Plan
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
FEPA	Freshwater Ecosystem Priority Area
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GIS	Geographical Information Systems
GPS	Global Positioning System
HDPE	High Density Polyethylene
HGM	Hydrogeomorphic
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Area
OESA	Other Ecological Support Areas
PE	Potential Evaporation
PES	Present Ecological State
pH	Potential Hydrogen
PPT	Parts Per Thousand
RD	Rural Division
REC	Recommended Ecological Category
SANBI	South African National Biodiversity Institute
WMA	Water Management Area

Definitions

Artificial Wetland	Produced by human beings, not naturally occurring.
Brackish Water	Water which has a salinity level of between 0.5 – 30 parts per thousand (PPT).
Catchment	The land area from which water runs off into a specified wetland or aquatic ecosystem; a drainage basin.
Concentrated Flow	A flow of water contained within a distinct channel. Rivers are characterised by concentrated flow, either permanently or periodically.
Delineation (of a wetland)	The determination of the boundary of a wetland based on soil, vegetation, and/or hydrological factors.
Depression	An inland aquatic ecosystem with closed (or near closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
Diffuse Flow	When water flow is not concentrated within a distinct channel, but is rather spread as sheet-flow on the ground surface, or as seepage below the ground surface.
Ecoregions	Geographic regions delineated on the basis of physical/abiotic factors.
Endorheic	As relates to a depression, inward-draining with no transport of water into downstream systems via subsurface or surface flow. Water leaves via evapotranspiration and infiltration only.
Evapotranspiration	The movement of water from the Earth's surface into the atmosphere through the combined process of evaporation and transpiration.
Exorheic	As relates to a depression, outward-draining with water transported to downstream systems via concentrated or diffuse surface flow, or as subsurface flow.
Facultative (FAC)	As relates to wetland indicator status, equally likely to occur in wetlands (estimated probability 34% - 66%) or non-wetlands.
Facultative Upland (FACU)	As relates to wetland indicator status, usually occur in non-wetlands (estimated probability 67% - 99%) but occasionally found in wetlands (estimated probability 1% - 33%).
Facultative Wetland (FACW)	As relates to wetland indicator status, usually occurs in wetlands (estimated probability 67% - 99%) but occasionally found in non-wetlands.
Forb	A herbaceous flowering plant that is not a graminoid (see Graminoid and Herbaceous Plant).
Graminoid	A herbaceous plant with a grass-like morphology, i.e. elongated culms with long, blade-like leaves (see Herbaceous Plant).
Groundwater	Subsurface water in the saturated zone below the water table.
Herbaceous Plant	Plants that have no persistent woody stem above ground (includes forbs and graminoids).
Infiltration	Downward permeation of water below the ground surface, either into the soil or into the groundwater.
Inundated	Covered by water (water is observably present at the surface).

Mottles	As relates to wetland soils, spots of colour in the soil that contrast with the background (matrix) soil colour. Mottles occur where minerals in the soil that have been reduced under anaerobic conditions are re-oxidised.
Natural Wetland	Existing in, or produced by, nature; not manmade or caused by humankind.
Non-perennial	a) Does not flow continuously throughout the year, although pools may persist.
Obligate (OBL)	As relates to wetland indicator status, almost always occurs in wetlands (estimated probability > 99%) under natural conditions.
Perennial	Flows continuously throughout the year, in most years.
DWS Regulated Area	b) The outer edge of the 1:100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; c) In the absence of a determined 1:100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or A 500 m radius from the delineated boundary (extent) of any wetland or pan.
Seepage	Percolation of water through a soil layer, as subsurface flow.
Terrestrial	Of or on dry land; outside the boundaries of a wetland or other aquatic ecosystem.
Water Table	The upper surface of groundwater or that level below which the soil is completely saturated with water.
Wetland	As defined in the National Water Act (Act No. 36 0f 1998), “a wetland is land that 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.
Wetland Indicator Status	Denotes the probability of individual species of vascular plants occurring in freshwater, brackish and saltwater wetlands.

1 Introduction

SRK Consulting (SRK) has been appointed by Goedgeloof Properties (Pty) Ltd to conduct an Aquatic Wetland Impact Assessment for the construction of a warehouse and storage facility on portion 250 of Farm Goedgeloof No. 745 located in St Francis Bay, Eastern Cape. This report assesses the impacts to the wetlands within the study area prior to development.

According to the DFFE screening report, the site for the proposed development was found to have a very low sensitivity for the aquatic biodiversity theme. However, the assessment has found several wetlands within and surrounding the development area, specifically two wetlands occurring within the proposed development footprint. The occurrence of wetlands has been identified within 500 m of the site and therefore an assessment is required to assess the wetland features and any potential impacts from the proposed activities to these systems. This report will form part of the Environmental Impact Assessment.

2 Terms of reference

The scope of works to conduct this aquatic impact assessment included the following activities:

- Conduct a desktop research study regarding the wetlands within 500 m of the proposed development as well as watercourses within 100 m of the site or that could potentially be affected;
- Site visit to ground truth the information obtained in the desktop study. This will include delineation of wetlands;
- Classify the delineated watercourses;
- Compile the relevant maps indicating wetlands, watercourses and buffers (if required);
- Determine the Present Ecological State (PES) and the Ecological Importance and Sensitivity (EIS) and comment on the conservation status and ecosystem function and services of wetlands and watercourses;
- Review existing databases;
- Compile a report that will include a description and condition of identified wetlands and watercourses which complies with the aquatic biodiversity protocols.
- Undertake an assessment of impacts on aquatic biodiversity and features of the site;
- Methodology used for the assessment; and
- Provide mitigation measures.

3 Aquatic Biodiversity Assessment Specialist Report Requirements

The DFFE screening tool had identified the site as having a very low sensitivity of the aquatic biodiversity theme. However, site verification confirmed the presence of wetlands within the proposed development and surroundings and therefore the site has a very high sensitivity rating. Consequently, this assessment must be compiled in accordance with the requirements of the *"Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity"* (GN R320 of 2020). The requirements, and the sections of this specialist report in which they are addressed, are detailed in Table 3-1 below.

Table 3-1: Content of specialist report as per the NEMA aquatic biodiversity protocol (GN 320, 2020)

GN No. 320, 2020	Item	Report Section:
2.1	The assessment must be prepared by a SACNASP registered specialist with expertise in the field of aquatic sciences	Section 6
2.2	The assessment must be undertake on the preferred site and within the proposed development footprint	Section 5
2.3.1	A description of a) aquatic ecosystem types; b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 5
2.3.2	Threat status of the ecosystem and species as identified by the screening tool;	Section 1
2.3.3	Indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status	Not applicable– The screening tool identified the current site footprint as low sensitivity
2.3.4	A description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 9.8
2.4	The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	Not applicable- The screening tool identified the current site footprint as low sensitivity. No alternative sites were assessed or identified. Areas where wetlands do not occur should be looked at as alternative sites
2.5.1	Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Not applicable -The screening tool identified the current site footprint as low sensitivity
2.5.2	Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	Not applicable – the development will not be impacting the water resources in the catchments
2.5.3	How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);	Section 9.9

GN No. 320, 2020	Item	Report Section:
	(b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);	Not applicable – not a flowing system
	(c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and	Section 9,9
	(d) to what extent will the risks associated with water uses and related activities change;	Section 9.9
2.5.4	ow will the proposed development impact on the functioning of the aquatic feature? This must include: (a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);	Section 9.9.3
	(b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river);	Section 9.3.3
	(c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland);	Section 9.3
	(d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);	Not applicable – water quality was not tested
	(e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and	Section 9.9
	(f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	Section 9.9
2.5.5	How will the proposed development impact on key ecosystems regulating and supporting services especially: (a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage?	Section 11
2.5.6	How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 9.9
2.6	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: (a) size of the estuary; (b) availability of sediment; (c) wave action in the mouth; (d) protection of the mouth; (e) beach slope; (f) volume of mean annual runoff; and (g) extent of saline intrusion (especially relevant to permanently open systems).	Not applicable – estuarine system was not assessed during this assessment

GN No. 320, 2020	Item	Report Section:
2.7.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	Section 6 and Appendix C
2.7.2	A signed statement of independence by the specialist	Appendix C
2.7.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	Section 8.2
2.7.4	Methodology used to undertake the site inspection	Section 8
2.7.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data	Section 4
2.7.6	The location of areas not suitable for development, which are to be avoided during construction and operation where relevant	Section
2.7.7	Additional environmental impacts expected from the proposed development	Section 9.9
2.7.8	Any direct, indirect and cumulative impacts of the proposed development on site	Section 9.9
2.7.9	The degree to which impacts and risks can be mitigated;	Section 9.9
2.7.10	The degree to which the impacts and risks can be reversed;	Section 9.9
2.7.11	The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 9.9
2.7.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	Section 10
2.7.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	Section 9.9
2.7.14	Motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a “low” aquatic biodiversity sensitivity and that were not considered appropriate	Section 11 – no alternative sites were assessed as part of this assessment
2.7.15	Statement on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not	Section 11
2.7.16	Conditions to which the statement is subjected	Section 11

4 Knowledge gaps

There are no known knowledge gaps that could have influenced the findings in this study. Please note that the following assumptions and limitations have been considered in the preparation of the assessment:

- The site visit was conducted during the winter period prior to the flowering period of some plant species. This could therefore have resulted in certain plant species being overlooked while on site;
- Some inaccuracy (margin of error) in the hand-held Global Positioning System (GPS) is expected. The GPS used is accurate to within approximately 5 m; and
- Groundwater and surface water contributions are not known;
- It is unknown to what extent the current impacts on these wetlands would persist as a result of the no-go option.

Notwithstanding these limitations, it is our view that this report provides a good description of aquatic systems in the vicinity of the proposed site as well as the potential impacts associated with the activity.

5 Study area

The study area is located on portion 250 of Farm Goedgeloof No. 745 located in St Francis Bay, Eastern Cape. Access to the property is accessed via direct roads within St Francis Bay.

The study area is defined as the area within a 500 m radius of the proposed development area (refer to Figure 5-1).

Figure 5-1: Study area assessed (500m study area radius around development footprint)

Climate

According to Mucina & Rutherford (2006) the study area receives a nonseasonal precipitation regime. The area receives a mean annual precipitation (MAP) of approximately 680 mm. Of this MAP, 300 mm falls in summer (October–March) and 350 mm in winter (April–September). For the months February and July, the mean daily maximum and minimum temperatures are 25.1°C and 8.3°C.

Vegetation

The most recent National South African Vegetation Map (VEGMAP, 2018) categorises the historical vegetation habitat across the development area comprises mainly of *St Francis Dune Thicket (AT57)*

St Francis Dune Thicket (AT57) is distributed coastal region of the eastern cape from Tsitsikamma River Mouth and stretches eastwards towards the Sundays River Mouth. The landscape is flat with undulating coastal dunes. The vegetation comprises of a mosaic of low growing thicket with small bush clumps and a mosaic of asteraceous fynbos. Dominant taxa within this vegetation type includes small trees such as *Pterocelastrus tricuspidatus, Sideroxylon inerme, Tarchonanthus littoralis* ; the succulent Aloe Africana; low shrub *Morella cordifolia, Muraltia spinosa*, *Phylica ericoides, Syncarpha sordescens*; Graminoids: *Restio eleocharis, Stenotaphrum secundatum,, Themeda triandra, Tristachya leucothrix, Imperata cylindrica* ; and Tall shrubs: *Azima tetracantha, Carissa bispinosa, Cussonia thyrsiflora, Euclea racemosa, Grewia occidentalis, Gymnosporia buxifolia, Metalasia*

muricata, Olea exasperata, Osteospermum moniliferum, Passerina rigida, Putterlickia pyracantha (VEGMAP, 2018).

Land Uses

According to the 2020 National Land Cover and verification based on aerial imagery and field data, the area surrounding the proposed site mostly comprises of natural vegetation with areas which are classified as urban industrial, urban township, urban built up, urban sports and golf.

Figure 5-2: Regional vegetation map of the development site (VEGMAP, 2018)

The site falls within the Fish to Tsitsikamma Proto-CMA, specifically within the Tsitsikamma Sub-Water Management Area. The quaternary catchment applicable to the development is K80F.

According to the National Wetlands Map 5 (2018) there are no wetlands located within the study area (see Figure 5-3). The 1:50 000 topographical data indicates that there are no perennial and non-perennial rivers within the immediate surrounding area.

Ecoregional classification or typing allows for the grouping of rivers according to similarities based on a top-down nested hierarchical approach. It is based on physical/ abiotic attributes such as physiography, climate, rainfall, geology and potential natural vegetation (Kleynhans, *et al*., 2005). The ecoregional classification approach is specifically useful for the purposes of the determination of the Ecological Reserve, but also for managing inland aquatic ecosystems more generally. Thirty one Level I Ecoregions were identified throughout South Africa, Lesotho and Swaziland (Kleynhans, *et al*., 2005).

The study area falls within the *South Eastern Coastal Belt ecoregion (ID – 20)*. This information is useful for the purposes of the wetland classification system as the Level I Ecoregions for South Africa, Lesotho and Swaziland are applied at Level 2 of the classification system.

Figure 5-3: Hydrology map of the development site

Figure 5-4: Locality Plan

6 Expertise of the specialist

Lyndle Naidoo, from the SRK Gqeberha office, was appointed as the specialist to undertake the Assessment in terms of applicable legislation and guidelines. The study and report have been reviewed by Dr Brian Colloty.

SRK Consulting	Contact person: Ms Lyndle Naidoo
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6000	Email: LNaidoo@srk.co.za
Aquatic Impact assessor: Ms Lyndle Naidoo, MSc	
Lyndle Naidoo (MSc) is an Environmental Scientist at SRK's Port Elizabeth office. Lyndle has been involved in Environmental Management for the past 5 years. Her expertise included, Basic Assessments, Environmental Scoping and Impact reports, Environmental Management Programmes (EMPrs), Water Use License Applications (WULA) and Environmental auditing.	
Aquatic Impact assessor: Dr Brian Colloty, PhD, Pr Sci Nat	
Brian Colloty is a qualified and experienced expert in the field of wetland ecology and has a PhD in aquatic ecology and importance rating. He has conducted wetland and riverine / estuarine assessments for projects throughout Africa over the past 27 years. Brian is also a registered with SACNASP (Ecological – 400268/07) and a standing member of the International Wetland Society, South African Wetland Society and South African Society of Aquatic Scientists	

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report.

7 Aims and objectives

The aims and objectives of the study is to:

- Identify and classify all watercourses within 500m of the study footprint;
- Assess the identified watercourses which will be directly impacted by the development;
- Identify the potential impacts on the identified watercourses; and
- Provided mitigation measures to reduce or prevent impacts on the identified water courses.

8 Methodology

8.1 Wetland Identification and mapping

The wetland assessment commenced in June 2023 with a desktop study during which data was collected and studied using existing literature, maps and aerial photography of the study area and Geographical Information Systems (GIS). In a desktop exercise, all potentially affected watercourses, associated riparian zones and wetlands were identified and delineated at a scale of 1:1,250 before field verification.

The following datasets were used for the desktop study:

- NFEPA;

- 2018 National Vegetation Map;
- Council of GeoSciences Geological Information;
- Eastern Cape Biodiversity Conservation Plan;
- National Soil Classes; and
- 2020 South African National Land Cover Data.

8.2 Wetland delineation

A site visit was conducted on 8 June 2023 (winter) to verify the desktop data and collect the required field data for watercourse delineation and classification of the HGM based on the environment, hydrogeomorphic and hydrological features of the wetlands. During the site visit, only Wetland 1, 2 and 3 were assessed. Existing data of the study area based on previous studies conducted by SRK Consulting for Wetlands 4-9 had previously been conducted in June and July 2020 has been used in this study. Special attention was given to observations with regard to characteristics of the environment, existing land uses and impacts in and around the site, potential sources of pollution, as well as potential wetland uses/ functions. An additional site visit was conducted on 14 September 2023 (spring) to verify the extent of Wetland 1.

The study wetlands were delineated considering the methods and indicators described in DWS's practical field procedure for identification and delineation of wetlands and riparian areas (DWAF, 2008). The key indicators considered for delineation include the terrain or position in the landscape, soil wetness, and vegetation (typical wetland species adapted to wet conditions). Plant species were mainly categorised as terrestrial, facultative, or obligate wetland/ riparian species. The height and density of vegetation in the wetlands was also noted as this influences roughness.

The accepted wetlands classification system, namely the '*Classification System for Wetlands and other Aquatic Ecosystems in South Africa'* (Ollis, *et al*., 2013), published by the South African National Biodiversity Institute (SANBI) was used. The hydrogeomorphic (HGM) approach to the classification system is based on the premise that hydrology and geomorphology are the two fundamental features that determine the way in which an inland aquatic system functions regardless of climate, soils, vegetation, and origin. Therefore, these characteristics are used to distinguish between wetland units (Ollis, *et al*., 2013). This system uses hydrological and geomorphological characteristics to distinguish between primary wetland units. A six-tiered structure is given which progresses from Systems (Marine vs. Estuarine vs. Inland) (Level I), through Regional Setting (Level 2) and Landscape Units (Level 3), to Hydrogeomorphic (HGM) Units at the finest spatial scale (Level 4). At Level 5, the hydrological regime is used as distinguishing factor and at Level 6, six descriptors have been included to differentiate between aquatic systems based on structural, chemical and/ or biological characteristics (Ollis, *et al*., 2013).

8.3 Wetland functional assessment

The assessment of ecosystem services and functions delivered by wetlands, that is the benefits provided to people by the relevant ecosystems, was conducted by applying the relevant tool (WET-EcoServices Version 2.0 as described in Kotze, *et al* (2020)). The tool provides a mechanism to flag important ecosystem services that need to be considered during future planning processes in the wetland catchment and downstream, and when managing the wetland. Desktop data, as well as data collected during the site investigation, was used in this assessment.

Kotze, *et al* (2020) describes a number of different functions and services that could potentially be provided by wetlands. These include flood attenuation; streamflow regulation; sediment trapping; phosphate trapping; nitrate removal; toxicant removal; erosion control; carbon storage; maintenance

of biodiversity; water supply for human use; natural resources; cultivated foods; cultural significance; tourism and recreation; and education and research. A summary of the hydrological benefits typically derived from the different wetland hydro-geomorphic units, as provided in Kotze *et al*., 2008, are indicated in Table 9-5. Even if wetland systems have been modified through human intervention, the systems can still fulfil a variety of ecosystem services and functions.

8.4 Determining the ecological integrity of wetlands

The ecological integrity of wetlands are determined by a combination of the outcome of the WET EcoServices and Health tool for the wetland. Wetlands which have both allow PES score and a low hydraulic ecosystem service contribution would in turn have a low ecological integrity.

8.5 Determining the Present Ecological State of wetlands

Present Ecological State (PES) assessments are generally not conducted for artificial wetlands since there is no reference state to which the current state can be compared. However, ecological importance and ecological sensitivity are determined for all wetland habitats (artificial or natural), since, over time an artificially created wetland could potentially become an integral part of a new hydrological scheme while providing some valuable ecosystem services.

The health or integrity of the wetlands was assessed using the Wet-Health Version 2 tool as described by Macfarlane, *et al*. (2020).

8.6 Ecological classification and description

Similarly, the health or integrity of the wetland was assessed using the tool described by Macfarlane, *et al*. (2020) known as Wet-Health Version 2.0. This assessment uses indicators based on geomorphology, hydrology, water-quality and vegetation, and generates a score for the Present Ecological State (PES) of the wetland according to the DWS categories.

The Ecological Importance and Sensitivity (EIS) of each wetland was assessed according to the method as adapted from DWAF (1999), which describes a technique to determine EIS and Ecological Management Class (EMC). The method takes into consideration PES scores and scores for ecosystem service provision as well as a range of other determinants to enable the assessor to determine an EIS Category for the wetland feature or group that will reflect its importance to the maintenance of ecological diversity and functioning. The determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category. A confidence score is also given on a scale of 0 to 4, where 0 indicates low confidence and 4 very high confidence.

8.7 Impact assessment

Finally, considering the outcome of the above-mentioned assessments, the potential impacts that the proposed development could have during the construction and operational phases of the activity were investigated. Where possible, mitigation and/ or management measures were proposed to limit the impact of the proposed development on wetland and other aquatic ecosystems. Rehabilitation or enhancements measures were also recommended where necessary.

Comment is made on the different aspects of the impacts that could affect a rating. These are the following:

- Extent– the area over which the impact will be experienced;
- Intensity– the magnitude of the impact in relation to the sensitivity of the receiving environment;
- Duration– the time frame for which the impact will be experienced;

- Probability– the likelihood of the impact occurring;
- Status – positive or negative impact;
- Reversibility - ability of the impacted environment to return to its pre-impacted state;
- Significance - Each rating is based on observations made during the site visits and on professional judgement. Based on a synthesis of the above criteria, significance of an impact is rated as follows:
    - High significance: where the impact would influence the decision to authorise proposed development regardless of any mitigation measures;
    - Moderate significance: where the impact should influence the decision to authorise the proposed development, and where mitigation measures can, and must, be specified to reduce the overall impact;
    - Low significance: where the impact would not have any influence on the decision to authorise the proposed development;
    - Very Low significance: the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed development; and
    - Insignificant: the potential impact is negligible and will not have an influence on the decision regarding the proposed development.

The different levels under each of the above aspects that were used in the impact descriptions is given in Appendix B

In the case of the “No-Go” alternative, no additional construction or clearing of vegetation would occur and the site would remain in its current condition until/ unless any other development is approved.

In most cases, the “No-Go” alternative approximates the baseline situation. In the sections assessing specific impacts below, the “No-Go” alternative is only assessed where the baseline descriptions do not fully capture current impacts.

9 Results

9.1 Wetland identification and delineation

The proposed development falls within the DWS regulated area of nine wetlands (see Figure 9-1 and Figure 9-2).

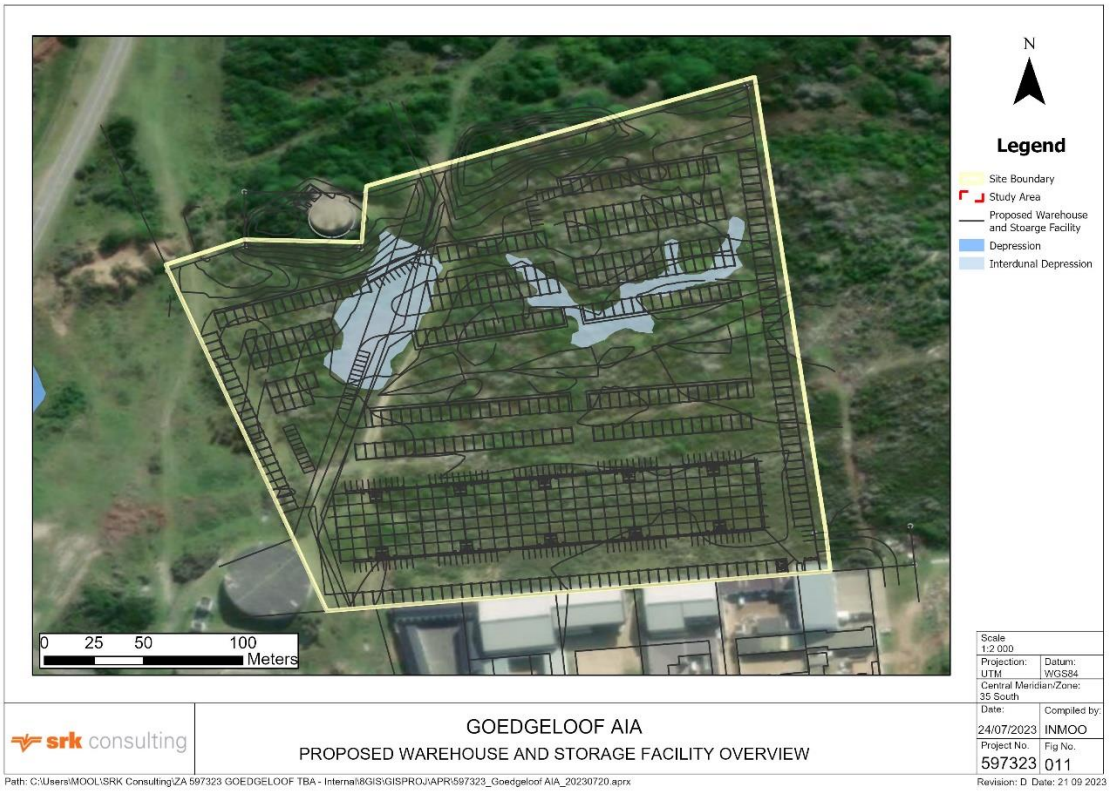

Figure 9-1: Overview development footprint

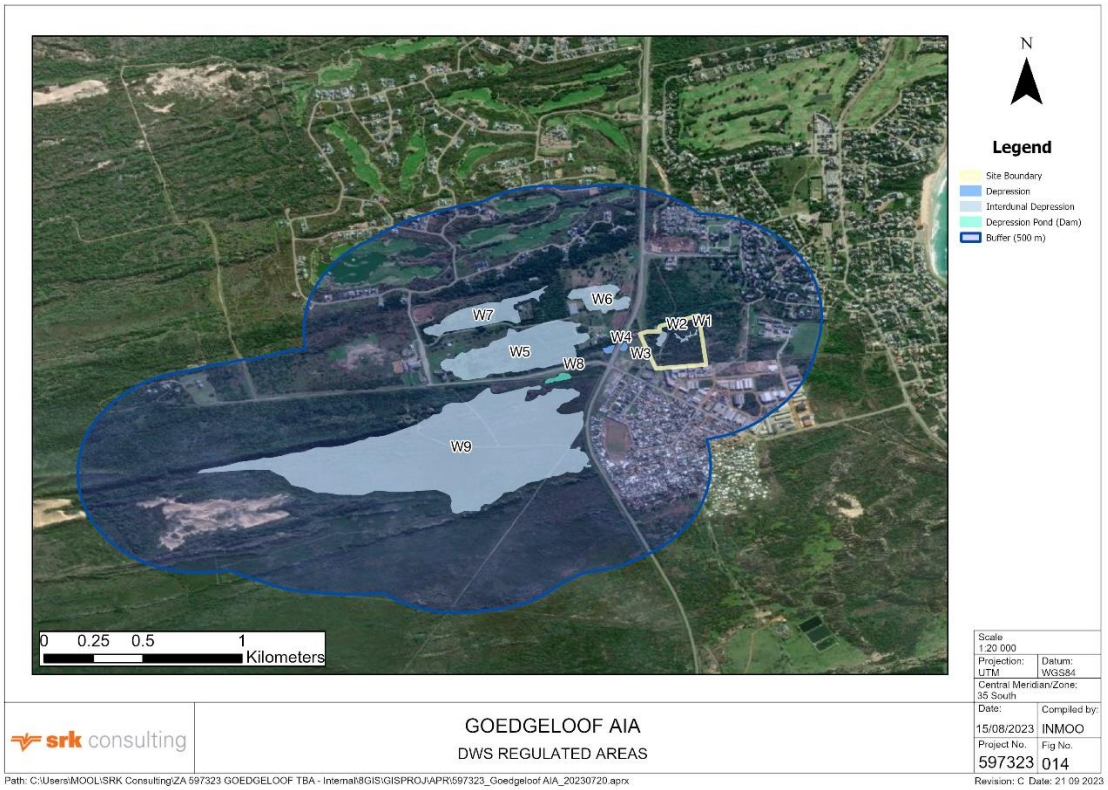

Figure 9-2: DWS regulated areas of the wetlands

Wetlands 1 (W1) and 2 (W2) are interdunal depressions and the delineated boundaries are depicted in Figure 8-3. These wetlands are modified and the presence of anthropogenic impacts were observed during the site visit. Surface water was observed during the second site visit, the soil was well saturated throughout the wetlands. The impacts to these systems include informal access roads, infestation of alien invasives and illegal dumping. The vegetation of **W1** comprised of coastal shrubs mainly *Acacia cyclops, Morella cordifolia, Searsia crenata with the presence of wetland sedge species Cyperus polystachyos, Elegia tectorum* and *Ficinia lateralis*. Areas of **W1** comprised of areas of standing water and moist areas. Some areas were patchy with*Typha capensis* and moist areas were dominated by *Centella asiatica.* **W2** was dominated by *Phragmites australis* and *Typha capensis*. Invasive alien species within these wetlands included *Acacia cyclops*, *Acacia saligna*, *Cestrum laevigatum, Cenchrus clandestinus* and *Ricinus communis*. These wetlands were delineated based on vegetation and/or the presence of moist sediment and standing water.

Figure 9-3: Wetland 1-2 delineated boundaries

Wetlands 3 (W3) and 4 (W4) are depression ponds which are likely to originally have been interdunal depressions but have been modified as a result of the presence of the adjacent road. A culvert was present close to W13 which is used to drain the wetland during periods of flooding. The wetlands are mainly dominated by *Cyperus polystachyos*, *Phragmites australis*, *Typha capensis*, *Senecio glutinosus* and *Stenotaphrum secundatum*. Patches of alien *Cestrum laevigatum* and *Acacia cyclops* are present within both wetlands. Refer to Figure 8-4 for the delineated wetland boundaries.

Wetlands 5 (W5), 6 (W6), 7 (W7) and 9 (W9) are interdunal wetland depressions. The delineated boundaries are depicted in Figure 8-4. A drain is present in the area adjacent to W7. It is highly likely that the water input is generated from both groundwater and precipitation. The area received rain a few days prior to the site visit. The vegetation within the wetlands (**W5, W6 and W7**) comprised mainly of *Cynodon dactylon*, *Sporobolus africanus* and *Stenotaphrum secundatum* with patches of *Cyperus polystachyos* and *Imperata cylindrica.* Clumps of shrubs were observed which included *Searsia crenata*, *Rapanea melonophloeos*, *Morella cordifolia*, etc. The vegetation of **W9** comprised of several

dune associated species which included *Erica chloroloma, Ficinia lateralis, Ficinia bulbosa, Ehrharta villosa, Rapanea gilliana, Plecostachys serpyllifolia, Psoralea repens, Romulea rosea and Schoenus arenicola.*

Wetland 8 (W8) is an artificial depression wetland. It is highly likely that this wetland is an old borrow pit which has been rehabilitated. Based on historic imagery, it appears to be permanently inundated with water. Vegetation comprised mainly of *Centella asiatica*, *Grammatotheca bergiana*, *Juncus punctorius, Phragmites australis* and *Typha capensis.* The latter species are typical indicators of permanent water inundation and or water flow, which is atypical of the natural wetland types observed. Refer to Figure 9-4 for the delineated wetland boundary.

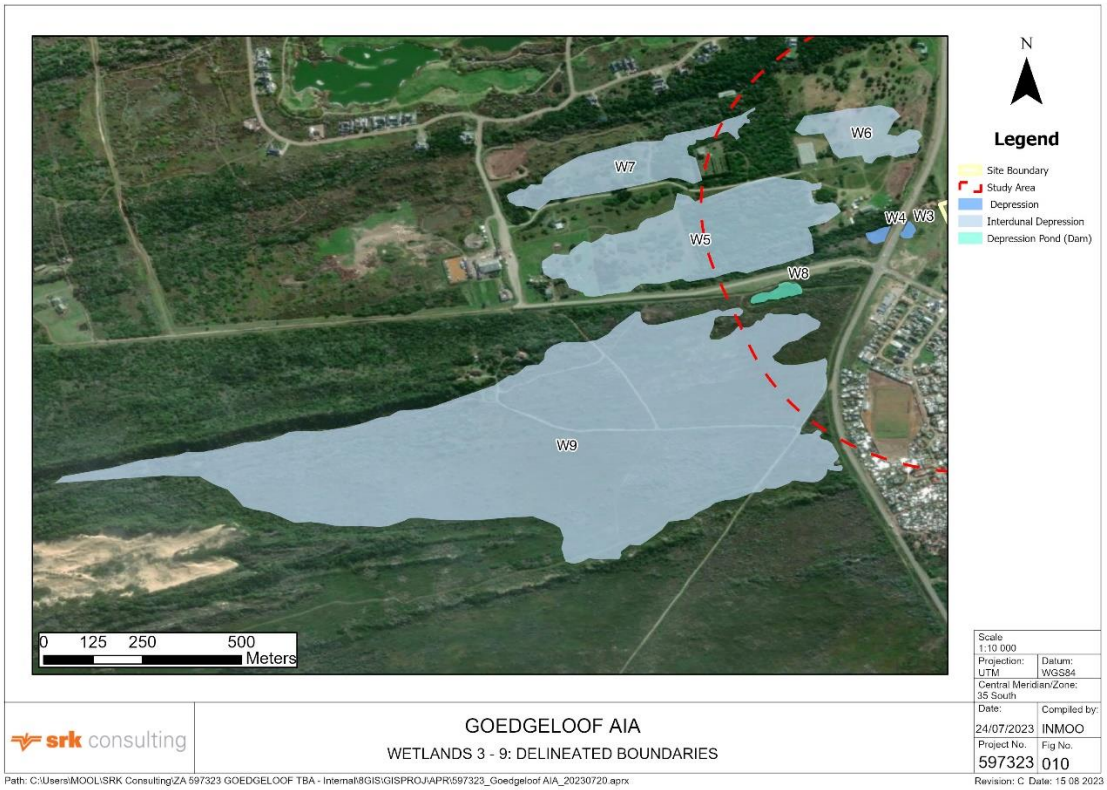

Figure 9-4: Wetland 3-9 delineated boundaries

Soil samples were not used to define wetland boundaries in this area as these are interdunal depressions. Wetland soil indicators such as a grey colour and mottling are usually easily recognisable in wetland soils but seasonally saturated (to inundated) interdunal depressions do not readily exhibit these characteristics. In this case vegetation and the presence of moist/standing water was used for delineation.

Figure 9-5: Auger points

Table 9-1: Main plant species observed

WETLAND No.	FAMILY	SPECIES	INDIGENOUS / ALIEN	INDICATOR STATUS	STATUS
Wetlands 1-2	ANACARDIACEAE	*Searsia crenata*	Indigenous	Facultative	Endemic
	APIACEAE	*Centella asiatica*	Indigenous	Facultative	-
	APOCYNACEAE	*Gomphocarpus fruticosus*	Indigenous	Facultative	-
	ASTERACAEAE	*Cirsium vulgare*	Alien	Facultative	-
	ASTERACEAE	*Nidorella ivifolia*	Indigenous	Facultative	-
	CYPERACEAE	*Cyperus laevigatus*	Indigenous	Obligate	Endemic
	CYPERACEAE	*Cyperus polystachyos*	Indigenous	Facultative	-
	CYPERACEAE	*Ficinia lateralis*	Indigenous	Facultative	Endemic
	EUPHORBIACEAE	*Ricinus communis*	Alien	Facultative	-
	JUNCACEAE	*Juncus krausii*	Indigenous	Facultative	-
	MYRICACEAE	*Morella quercifolia*	Indigenous	Facultative	Endemic
	MYRICACEAE	*Morella cordifolia*	Indigenous	Facultative	Endemic
	MYRSINACEAE	*Rapanea gilliana*	Indigenous	Facultative	Endemic, ENCO, IUCN (EN)
	POACEAE	*Cynondon dactylon*	Indigenous	Facultative	-
	POACEAE	*Cenchrus clandestinus*	Alien	Facultative	-
	POACEAE	*Sporobolus africanus*	Indigenous	Facultative	-
	POACEAE	*Phramites australis*	Indigenous	Obligate	-
	RESTIONACEAE	*Thamnochortus insignis*	Alien	Facultative	-

WETLAND No.	FAMILY	SPECIES	INDIGENOUS / ALIEN	INDICATOR STATUS	STATUS
	RESTIONACEAE	*Elegia tectorum*	Indigenous	Facultative	-
	SOLANACEAE	*Cestrum laevigatum*	Alien	Facultative	-
	TYPHACEAE	*Typha capensis*	Indigenous	Obligate	-
Wetlands 3 and 4	APIACEAE	*Centella asiatica*	Indigenous	Facultative	-
	ARALIACEAE	*Hydrocotyle bonariensis*	Indigenous	Obligate	-
	ASTERACEAE	*Senecio lanceus*	Indigenous	Facultative	-
	ASTERACEAE	*Plecostachys serpyllifolia*	Indigenous	Facultative	Endemic
	ASTERACEAE	*Senecio glutinosus*	Indigenous	Facultative	-
	ASTERACEAE	*Helichrysum cymosum*	Indigenous	Facultative	Endemic
	ASTERACEAE	*Nidorella ivifolia*	Indigenous	Facultative	-
	CYPERACEAE	*Cyperus polystachyos*	Indigenous	Facultative	--
	FABACEAE	*Acacia cyclops*	Alien	Terrestrial	-
	IRIDACEAE	*Dietes iridiodes*	Indigenous	Facultative	-
	LOBELIACEAE	*Grammatotheca bergiana*	Indigenous	Obligate	Endemic
	POACEAE	*Phragmites australis*	Indigenous	Obligate	-
	POACEAE	*Stenotaphrum secundatum*	Indigenous	Facultative	-
	POLYGONACEAE	*Persicaria decipiens*	Indigenous	Obligate	-
	SOLANACEAE	*Cestrum laevigatum*	Alien	Facultative	-
	TYPHACEAE	*Typha capensis*	Indigenous	Obligate	-
Wetlands 5, 6 and 7	ANACARDIACEAE	*Searsia crenata*	Indigenous	Facultative	Endemic
	APIACEAE	*Centella asiatica*	Indigenous	Facultative	-
	ASTERACEAE	*Senecio glutinosus*	Indigenous	Facultative	-
	CYPERACEAE	*Cyperus polystachyos*	Indigenous	Facultative	-
	CYPERACEAE	*Ficinia lateralis*	Indigenous	Facultative	Endemic
	FABACEAE	*Acacia cyclops*	Alien	Terrestrial	-
	MYRICACEAE	*Morella quercifolia*	Indigenous	Facultative	Endemic
	MYRICACEAE	*Morella cordifolia*	Indigenous	Facultative	Endemic
	POACEAE	*Stenotaphrum secundatum*	Indigenous	Facultative	-
	POACEAE	*Sporobolus africanus*	Indigenous	Facultative	-
	POACEAE	*Cynodon dactylon*	Indigenous	Facultative	-
	POACEAE	*Pennisetum clandestina*	Alien	Facultative	Listed Invasive in Wetlands
	POACEAE	*Imperata cylindrica*	Indigenous	Obligate	-
Wetland 8	APIACEAE	*Centella asiatica*	Indigenous	Facultative	-
	FABACEAE	*Psolarea repens*	Indigenous	Facultative	Endemic, IUCN (NT)
	JUNCACEAE	*Juncus punctorius*	Indigenous	Obligate	-
	LOBELIACEAE	*Grammatotheca bergiana*	Indigenous	Obligate	Endemic

WETLAND No.	FAMILY	SPECIES	INDIGENOUS / ALIEN	INDICATOR STATUS	STATUS
	POACEAE	*Stenotaphrum secundatum*	Indigenous	Facultative	-
	POLYGONACEAE	*Persicaria decipiens*	Indigenous	Obligate	-
	POTAMOGETONACEAE	*Potamogeton pectinatus*	Indigenous	Obligate	-
	TYPHACEAE	*Typha capensis*	Indigenous	Obligate	-
Wetland 9	ACANTHACEAE	*Thunbergia capensis*	Indigenous	Facultative	Endemic
	APIACEAE	*Centella asiatica*	Indigenous	Facultative	-
	ARALIACEAE	*Hydrocotyle bonariensis*	Indigenous	Obligate	-
	ASTERACEAE	*Plecostachys serpyllifolia*	Indigenous	Facultative	Endemic
	ASTERACEAE	*Pseudognaphalium luteo-album*	Indigenous	Facultative	-
	ASTERACEAE	*Athanasia dentata*	Indigenous	Facultative	-
	CYPERACEAE	*Cyperus thunbergii*	Indigenous	Obligate	Endemic
	CYPERACEAE	*Ficinia lateralis*	Indigenous	Facultative	Endemic
	CYPERACEAE	*Ficinia bulbosa*	Indigenous	Facultative	Endemic
	CYPERACEAE	*Ficinia nodosa*	Indigenous	Facultative	-
	CYPERACEAE	*Cyperus polystachyos*	Indigenous	Obligate	-
	CYPERACEAE	*Fuirena hirsuta*	Indigenous	Obligate	Endemic
	CYPERACEAE	*Schoenus nigricans*	Alien	Obligate	-
	CYPERACEAE	*Schoenus arenicola*	Indigenous	Obligate	Endemic
	ERICACEAE	*Erica chloroloma*	Indigenous	Facultative	Endemic, IUCN (VU), ENCO
	FABACEAE	*Acacia cyclops*	Alien	Facultative	Listed Invasive
	FABACEAE	*Psolarea repens*	Indigenous	Facultative	Endemic, IUCN (NT)
	IRIDIACEAE	*Aristea ecklonii*	Indigenous	Facultative	-
	IRIDIACEAE	*Romulea rosea*	Indigenous	Facultative	Endemic
	JUNCACEAE	*Juncus kraussii*	Indigenous	Obligate	-
	MYRICACEAE	*Morella quercifolia*	Indigenous	Facultative	Endemic
	MYRICACEAE	*Morella cordifolia*	Indigenous	Facultative	Endemic
	MYRSINACEAE	*Rapanea gilliana*	Indigenous	Facultative	Endemic, ENCO, IUCN (EN)
	POACEAE	*Miscanthus ecklonii*	Indigenous	Obligate	Endemic
	POACEAE	*Imperata cylindrica*	Indigenous	Obligate	-
	POACEAE	*Ehrharta villosa*	Indigenous	Facultative	Endemic
	POACEAE	*Cenchrus clandestinus*	Alien	Facultative	Listed Invasive in Wetlands
	POACEAE	*Sporobolus africanus*	Indigenous	Facultative	-
	RESTIONACEAE	*Restio leptoclados*	Indigenous	Facultative	Endemic

9.2 Wetland unit setting

Depressions are wetlands with closed, or near-closed elevation contours, which increase in depth from the perimeter to a central area of greatest depth and within which water typically accumulates. Although they may at times have a river/ drainage line flowing into or out of them, depressions are specifically characterised by their contour shape. Dominant water sources are precipitation, groundwater discharge, interflow and (diffuse or concentrated) overland flow (Ollis, et al., 2013).

The hydrological regime of the watercourses and other descriptors are indicated in the table below. Under Level 6 of SANBI's Classification System, aquatic ecosystems are classified as either natural or artificial bodies. According to this system, the Wetlands 1 - 7 and 9 are all classified as natural. Wetland 8 is classified as artificial.

The natural wetlands are all seasonally inundated and primarily consist of seasonal hydrological zones as shown in the map below. The artificial system would seem to have permanent inundation, due to modifications to hydrological inputs from stormwater.

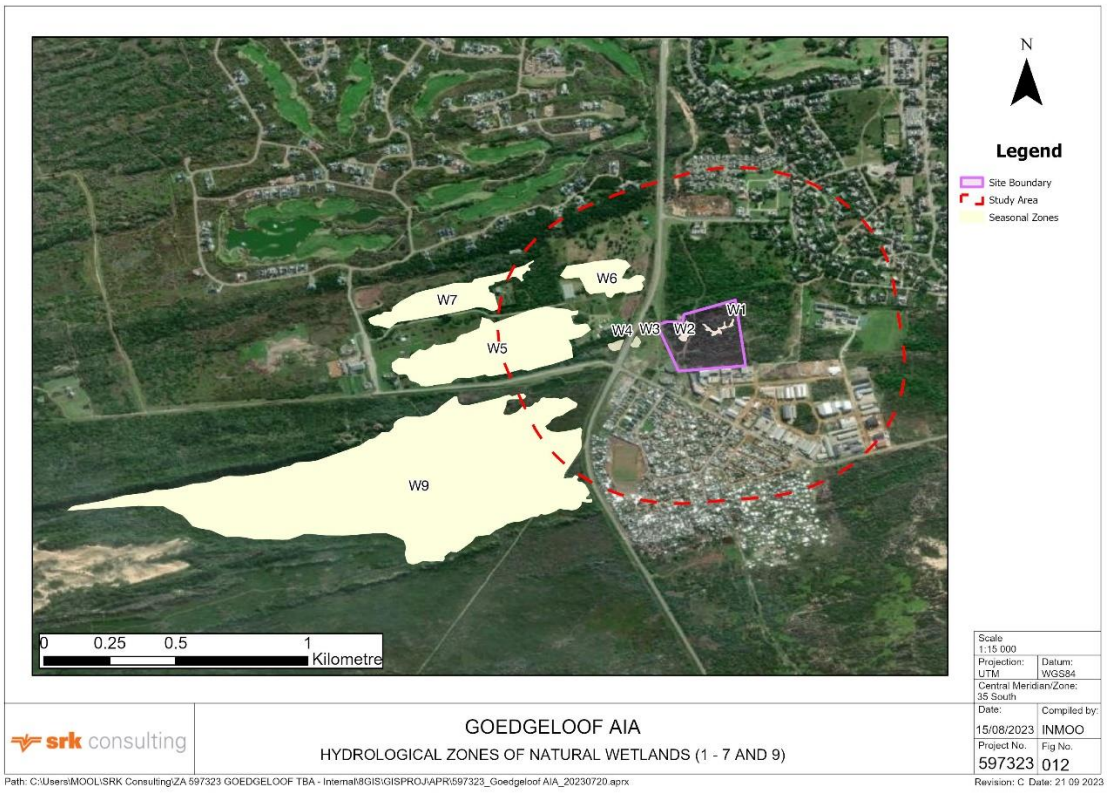

Figure 9-7: Hydrological zones

Table 9-3 includes the outcome of the six levels of the classification system for the identified aquatic systems.

All of the wetlands assessed are classified as Depressions (HGM-Type), in this case due to the nature and location, some of the wetlands have been further classified into interdunal depressions and depression pond (dam).

The study area mainly comprises of Calcareous sandstone, clastic limestone, conglomerate and conquinite (Council of GeoSciences). A portion of the study area comprises of quartzitic sandstone and minor shale.

According to the National Soil Classes data (as accessed on SANBI's BGIS interactive maps), the soils within this area are classified as imperfectly drained soils.

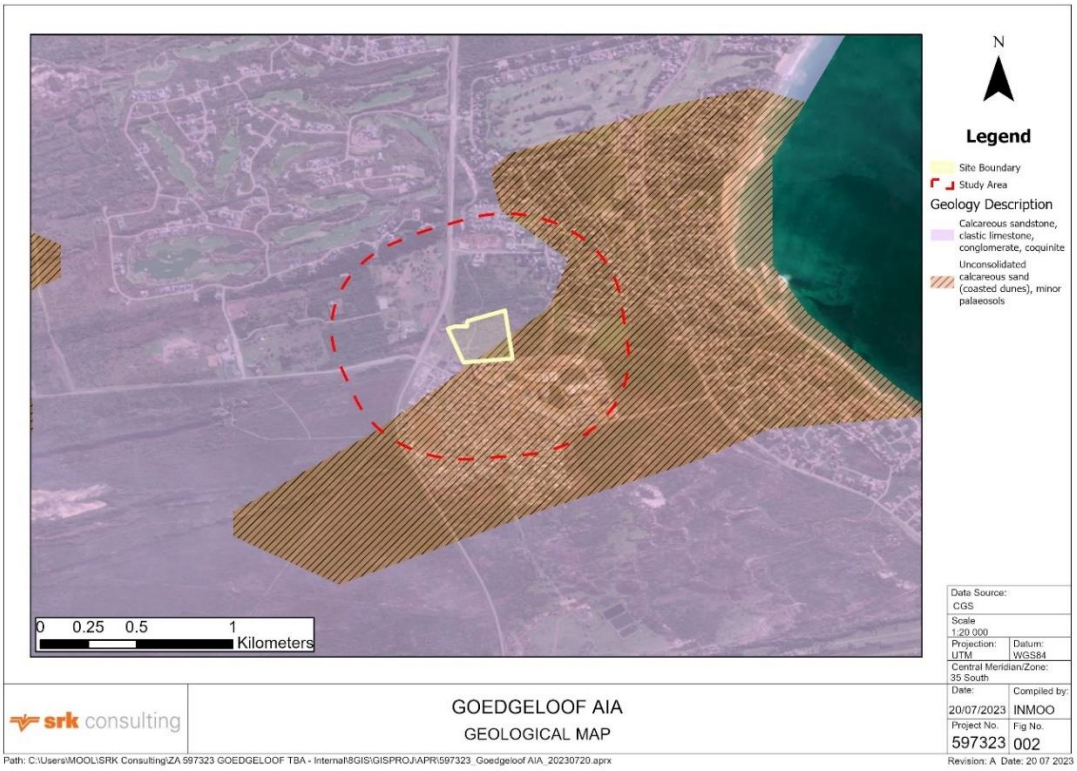

Figure 9-6: Geological map of the development site (Council of GeoSciences)

9.3 Description of wetland type

A number of wetlands were observed within the assessment area during the site visit, contradicting the findings of available NFEPA database information (National Wetlands Map 4 and Map 5). Only those watercourses which fall within approximately 500 m of study area (the DWS Regulated Area) are discussed and assessed in detail in this section of the report (refer to Figure 6-1).

As per *Pers comm*. Philippa Hill, there have been two water leaks on site from the municipal water mains. Based on investigation of the earliest available Google Earth satellite imagery, dating back to 2003, it looks like wetland 2 has existed on the site since then. Information on when the leak might have started is not available. Phillipa Hill has also mentioned that approximately 50 years ago, calcrete mining had taken place in the area in and around where Wetland 1 had been delineated. The mining was done in patches and not the entire area had been mined at once. Evidence of these mined areas were noted on site which included exposed calcrete areas and depressed sections see Photo 1 to Photo 6).

It is expected that if the proposed development goes ahead, the hydrogeomorphic type of the remaining wetlands would not change and therefore remain depressions. The wetland type and extent of the nine identified wetlands are recorded in Table 9-2.

Table 9-2: Wetland Extents

Wetlands	Wetland Type	Extent (Ha)
W1	Interdunal Depression	0.15
W2	Interdunal Depression	0.21
W3	Depression	0.10
W4	Depression	0.13
W5	Interdunal depression	9.98
W6	Interdunal depression	2.30
W7	Interdunal depression	4
W8	Depression pond (Dam)	0.28
W9	Interdunal depression	47.3

9.4 General functional description of wetland types

Depressions are wetlands with closed, or near-closed elevation contours, which increase in depth from the perimeter to a central area of greatest depth and within which water typically accumulates. Although they may at times have a river/ drainage line flowing into or out of them, depressions are specifically characterised by their contour shape. Dominant water sources are precipitation, groundwater discharge, interflow and (diffuse or concentrated) overland flow (Ollis, *et al*., 2013).

The hydrological regime[1] of the watercourses and other descriptors are indicated in the table below. Under Level 6 of SANBI's Classification System, aquatic ecosystems are classified as either natural or artificial bodies. According to this system, the Wetlands 1 - 7 and 9 are all classified as natural. Wetland 8 is classified as artificial.

The natural wetlands are all seasonally inundated and primarily consist of seasonal hydrological zones as shown in the map below. The artificial system would seem to have permanent inundation, due to modifications to hydrological inputs from stormwater.

[1] The hydrological regime described the behaviour of the water within the system and, for wetlands, in the underlying soil (Ollis, *et al*., 2013).

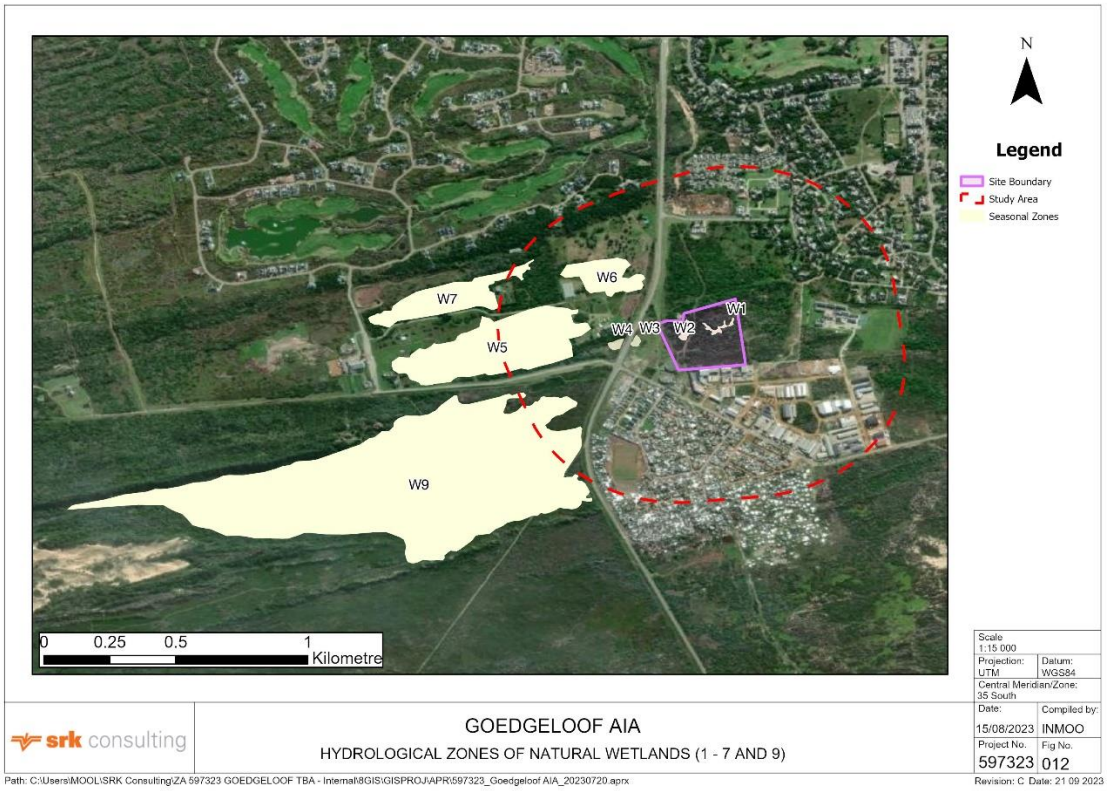

Figure 9-7: Hydrological zones

Table 9-3: Wetland classification according to Ollis, *et al*., 2013

WETLAND ID	LEVEL 1 - SYSTEM	LEVEL 2 - REGIONAL SETTING	LEVEL 3 - LANDSCAPE SETTING	LEVEL 4 - HYDROGEOMORPHIC UNIT			LEVEL 5 - HYDROLOGICAL REGIME (& DEPTH OF INUNDATION)			LEVEL 6 - WETLAND CHARACTERISTICS (DESCRIPTORS)
				HGM Type	Longitudinal Zonation/ Landform/ Outflow drainage	Landform/ Inflow drainage	5A: Inundation periodicity	5B: Saturation periodicity	5C: Inundation Depth	Natural vs Artificial; Salinity; pH; Substratum; Vegetation; Geology
Wetlands 1 and 2	Inland wetland	Ecoregion – South Eastern Coastal Belt	Valley floor	**Depression**	Exorheic	Without channelled inflow	Intermittently inundated (irregular periods - less than ~3 months) (Medium confidence)	Seasonally saturated (Medium Confidence)	Not applicable	Natural[2] Salinity – No test conducted pH – No test conducted Vegetation - Herbaceous dune vegetation Geology – refer to section
Wetland 3 and 4	Inland wetland	Ecoregion – South Eastern Coastal Belt	Valley floor	**Depression**	Endorheic	Without channelled inflow	Seasonally inundated (extended flow between seasons 3-9 months) (Medium confidence)	Seasonally saturated (Medium Confidence)	Not applicable	Natural Salinity – No water during site visit pH – No water during site visit Vegetation - Herbaceous dune vegetation Geology – refer to section
Wetlands 5, 6 and 7	Inland wetland	Ecoregion – South Eastern Coastal Belt	Valley floor	**Depression**	Exorheic	Without channelled inflow	Intermittently inundated (irregular periods - less than ~3 months)	Seasonally saturated (Medium Confidence)	Not applicable	Natural Salinity – No water during site visit pH – No water during site visit Vegetation -

[2] * Wetland could be considered artificial as a result of leaks from reservoir pipeline.

WETLAND ID	LEVEL 1 - SYSTEM	LEVEL 2 - REGIONAL SETTING	LEVEL 3 - LANDSCAPE SETTING	LEVEL 4 - HYDROGEOMORPHIC UNIT			LEVEL 5 - HYDROLOGICAL REGIME (& DEPTH OF INUNDATION)			LEVEL 6 - WETLAND CHARACTERISTICS (DESCRIPTORS)
				HGM Type	Longitudinal Zonation/ Landform/ Outflow drainage	Landform/ Inflow drainage	5A: Inundation periodicity	5B: Saturation periodicity	5C: Inundation Depth	Natural vs Artificial; Salinity; pH; Substratum; Vegetation; Geology
							(Medium confidence)			Herbaceous dune vegetation Geology – refer to section
Wetland 8	Inland wetland	Ecoregion – South Eastern Coastal Belt	Valley floor	**Depression**	Endorheic	Without channelled inflow	Permanently inundated (Medium confidence)	Not applicable	Littoral (<2 m)	Artificial Vegetation - Herbaceous and aquatic vegetation Geology – refer to section
Wetlands 9	Inland wetland	Ecoregion – South Eastern Coastal Belt	Valley floor	**Depression**	Exorheic	Without channelled inflow	Intermittently inundated (irregular periods - less than ~3 months) (Medium confidence)	Seasonally saturated (Medium Confidence)	Not applicable	Natural Salinity – No water during site visit pH – No water during site visit Vegetation - Herbaceous vegetation Geology – refer to section

9.5 Wetland ecological functional assessment

Wetlands 1-9 are considered depressions. Only **Wetland 8** is an artificial depression which is likely to have been established due to an abandoned borrow pit. The remainder are considered natural. The majority of the ecosystem services within these wetlands have been rated as very low.

Table 9-4: Summary of the importance of the ecosystem services provided by the assessed wetlands based on WET-EcoServices Tool (version 2) (Kotze *et al*., 2020)

ECOSYSTEM SERVICE		W1-2	W3-4	W5-7 and 9	W8
REGULATING AND SUPPORTING SERVICES	Flood attenuation	Very Low	Very Low	Very Low	Very Low
	Stream flow regulation	Very Low	Very Low	Very Low	Very Low
	Sediment trapping	Very Low	Very Low	Very Low	Very Low
	Erosion control	Very Low	Very Low	Very Low	Very Low
	Phosphate assimilation	Very Low	Very Low	Very Low	Very Low
	Nitrate assimilation	Very Low	Very Low	Very Low	Very Low
	Toxicant assimilation	Very Low	Very Low	Very Low	Very Low
	Carbon storage	Very Low	Very Low	Low	Very Low
	Biodiversity maintenance	Low	Moderate	Moderately Low	Moderate
PROVISIONING SERVICES	Water for human use	Very Low	Very Low	Very Low	Very Low
	Harvestable resources	Very Low	Moderately Low	Moderately Low	Low
	Food for livestock	Very Low	Very Low	Very Low	Very Low
	Cultivated foods	Very Low	Very Low	Very Low	Very Low
CULTURAL SERVICES	Tourism and Recreation	Very Low	Very Low	Very Low	Very Low
	Education and Research	Very Low	Very Low	Very Low	Very Low
	Cultural and Spiritual	Very Low	Very Low	Very Low	Very Low

Table 9-5: Preliminary rating of the hydrological benefits likely to be provided by a wetland based on its hydro-geomorphic type (Kotze *et al*., 2008)

Wetland Hydro-Geomorphic Type	Hydrological Benefits Potentially Provided by Wetland Types							
	Flood attenuation		Stream flow regulation	Enhancement of Water Quality				
	Early wet season	Late wet season		Erosion control	Sediment trapping	Phos-phates	Nitr ates	Toxi-cants[3]
Floodplain	++	+	0	++	++	++	+	+
Valley-bottom – channeled	+	0	0	++	+	+	+	+
Valley-bottom – un-channeled	+	+	+	++	++	+	+	++
Hillslope seepage connected to a stream channel	+	0	+	++	0	0	++	++

[3] Toxicants are taken to include heavy metals and biocides (Kotze, *et al*., 2008)

Wetland Hydro-Geomorphic Type	Hydrological Benefits Potentially Provided by Wetland Types							
	Flood attenuation		Stream flow regulation	Enhancement of Water Quality				
	Early wet season	Late wet season		Erosion control	Sediment trapping	Phos-phates	Nitr ates	Toxi-cants[3]
Isolated hillslope seepage	+	0	0	++	0	0	++	+
Pan/ Depression	+	+	0	0	0	0	+	+

Rating:

0 Benefit unlikely to be provided to any significant extent

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

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

9.6 The ecological health assessment of the project area

A general impression of the condition of the watercourses observed on site as well as the existing impacts or level of degradation/ transformation was noted during the site investigation. Wetlands 1-4 were all in a natural state. Existing impacts are listed below, and the impacted wetlands are indicated in Table 9-6.

The wetlands to the east of the R330 have a high degree of modification due to presence of industrial areas, grazing, tracks, illegal dumping.

Table 9-6: Existing impacts in the immediate catchment and wetlands

Existing impacts in immediate catchment and wetlands	W1-W2	W3-W4	W5-W7	W8	W9
Vegetation clearing/brushcutting					
Historical calcrete mining					
Grazing					
Earthworks					
Stormwater infrastructure					
Drains					
Alien invasive vegetation					
Erosion					
Illegal dumping/litter					
Roads, tracks and paths					

9.7 The PES assessment of remaining wetland areas

The results for the hydrology, geomorphology, water quality and vegetation assessments done for the different wetland units are given below. The overall health score is calculated by subtracting this number (overall impact score) from 10 (not shown below). All wetlands were assessed using a Level 1-B (desktop with refinement).

Wetland 1 and 2 is rated as *Class C* which indicates that there has been a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. The vegetation condition has been largely modified which is significantly due to the anthropogenic impacts, dumping, clearing of vegetation/brushcutting, paths and urban and industrial development which has led to the degradation of the vegetation condition of **Wetland 1 and Wetland 2**. The development is expected to significantly affect the health and/or functioning of the wetlands within the development footprint.

Table 9-7: Wetland 1 and 2 – Wet-Health Level 1B PES Summary

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.6	1.6	1.2	4.0
PES Score (%)	84%	84%	88%	60%
Ecological Category	**B**	**B**	**B**	**D**
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Medium	Medium	Medium	Medium
Combined Impact Score	2.0			
Combined PES Score (%)	80%			
Combined Ecological Category	**C**			
Hectare Equivalents	0.3 Ha			

Wetland 3 and 4 is also rated as *Class C* which indicates that there has been a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. These wetlands have been transformed due the various anthropogenic activities such construction of roads, infrastructure, dumping, clearing of vegetation development of urban and industrial areas. Category C has been assigned to these wetlands as they still maintain their ecological functions despite having been transformed.

Table 9-8: Wetland 3 and 4 – Wet-Health Level 1B PES Summary

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.6	3.8	1.0	3.5
PES Score (%)	64%	62%	90%	65%
Ecological Category	**C**	**C**	**B**	**C**
Trajectory of change	↓↓	↓	↓↓	↓↓
Confidence (revised results)	High	High	High	High
Combined Impact Score	3.1			
Combined PES Score (%)	69%			
Combined Ecological Category	**C**			
Hectare Equivalents	0.2 Ha			

Wetland 5, 6, 7 and 9 have been rates as *Class A*. Overall, the conditions of these wetlands are natural and unmodified with minimal transformation. Altered score are as a result of vegetation and hydrological functions which have been transformed. The impacts to these wetlands are mainly due to access tracks.

Table 9-9: Wetland 5, 6, 7 and 9 – Wet-Health Level 1B PES Summary (Current Condition)

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.2	0.5	0.6	1.0
PES Score (%)	88%	95%	94%	90%
Ecological Category	**B**	**A**	**A**	**B**
Trajectory of change	↓	→		→
Confidence (revised results)	Medium	Medium	Not rated	Medium
Combined Impact Score	0.9			
Combined PES Score (%)	91%			
Combined Ecological Category	**A**			
Hectare Equivalents	66.1 Ha			

Table 9-10: Ecological categories and descriptions according to the PES impact/ percentage score (modified from Macfarlane, et al., 2009, Kleynhans, 1996 & Kleynhans, et al. 1998)

Description	Pes Impact Score	Score (% of total)	Ecological Category
Unmodified, natural.	0-0.9	90-100	A
Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	1-1.9	80-89	B
Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2-3.9	60-79	C
Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	4-5.9	40-59	D
Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	6-7.9	20-39	E
Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	8-10	0-19	F

Table 9-11: Trajectory class, change scores and symbols used to represent trajectory of change to wetland condition (Macfarlane, *et al*., 2020)

Trajectory Class	Description	Change Score	Class Range	Symbol
Improve markedly	Condition is likely to improve substantially over the next 5 years	2	1.1 to 2.0	↑↑
Improve slightly	Condition is likely to improve slightly over the next 5 years	1	0.3 to 1.0	↑

Trajectory Class	Description	Change Score	Class Range	Symbol
Remain stable	Condition is likely to remain stable over the next 5 years	0	-0.2 to +0.2	→
Deteriorate slightly	Condition is likely to deteriorate slightly over the next 5 years	-1	-0.3 to -1.0	↓
Deteriorate greatly	Condition is likely to deteriorate greatly over the next 5 years	-2	-1.1 to -2.0	↓↓

9.8 The EIS assessment of the remaining wetland areas

According to Kleynhans (1999), ecological importance of a watercourse is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience). Both abiotic and biotic components of the system are taken into consideration in this assessment of ecological importance and sensitivity described by Kleynhans (1999). Generally, a four point (1 to 4) scoring system is used to assess the various aspects of ecological importance and sensitivity. In some cases a five point (0 to 4) scoring system is used (Table 9-13). The following ecological aspects have been considered as the basis for the assessment of ecological importance and sensitivity:

- The presence of rare and endangered species, unique species (i.e. endemic or isolated populations) and communities, intolerant species and species diversity are taken into account for both the instream and riparian components of the watercourse;
- Habitat diversity is considered. This can include specific habitat types such as reaches with a high diversity of habitat types, i.e. pools, riffles, runs, rapids, waterfalls, riparian forests, etc.;
- With reference to points 1 and 2, biodiversity in its general form is taken into account as far as the available information allows;
- The importance of the particular watercourse in providing connectivity between different sections of the system, i.e. whether it provides a migration route or corridor for species;
- The presence of conservation or relatively natural areas along the watercourse section also serve as an indication of ecological importance and sensitivity;
- The sensitivity (or fragility) of the system and its resilience (i.e. the ability to recover following disturbance) of the system to environmental changes is also considered. Consideration of both the biotic and abiotic components is included here.

The EIS of the wetlands in the area ranges between Class B (High) to Class D (Low / Marginal). The high level of endemic and/ or rare and protected species present within **W1-2** and **W9** contribute to the high EIS scores within these wetlands.

Table 9-12: Summary of findings and overall sensitivity

Wetland ID	EIS Score (Median)	Overall EIS Category
W1 – W2	1.5	C - Moderate
W3 – W4	1.5	C - Moderate
W5 – W7	0.5	D – Low / Marginal
W8	1.5	C - Moderate
W9	2.5	B - High

Table 9-13: Ecological importance and sensitivity categories – interpretation of median scores for biotic and habitat determinants (Kleynhans, 1999)

EIS Category	Range of Median
Very high Quaternaries/delineations that are considered unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3 and ≤4
High Quaternaries/delineations that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but may have a substantial capacity for use.	>2 and ≤3
Moderate Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually not very sensitive to flow modifications and often have a substantial capacity for use.	>1 and ≤2
Low/ Marginal Quaternaries/delineations that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have a substantial capacity for use.	>0 and ≤1

9.9 Impact assessment discussions

The impacts of the proposed development have been identified considering the surrounding environment, the HGM-type, PES and EIS of the identified wetlands.

Potential impacts which may occur during the construction phase of the development are described under three main headings:

- Impact 1: Destruction of wetland habitat;
- Impact 2: Increased sedimentation of wetlands and watercourses during construction; and
- Impact 3: Impact to hydrology of the wetland system during construction and operation.

9.9.1 Impact 1: Destruction of wetland habitat

Construction activities such as vegetation clearance, excavations, stockpiling and establishment of associated infrastructure can either directly (loss of vegetation and habitat, impoundment of lateral flow, etc.) or indirectly (introduction and spread of invasive alien plants, sedimentation, erosion) impact wetlands in close proximity or within the construction footprint. The loss of habitat for dependent wetland biota will result in a loss of biodiversity and survival of dependent wetland biota. Construction vehicles impact will soil properties by compressing and damaging soils within the work area . Loss of habitat also decreases wetland functioning and thus impacts the level of ecosystem services which are provided by the wetland.

There will be a complete loss of **Wetland 1** and **Wetland 2** as a direct consequence of construction activities occurring in the delineated wetland boundaries within the development footprint. The removal

of vegetation cover for development could lead to erosion in the surrounding environment as well as the establishment and spread of invasives.

Table 9-14: Significance rating and recommended mitigation measures for destruction of wetland habitat

	Extent	Intensity	Duration	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	Local	High	Long term	High	Definite	**HIGH**	-ve	High
Management Measures: • The development footprint should be amended to exclude the footprint of the wetlands 1 and 2, including a 32 m buffer; • Areas disturbed during construction should be adequately rehabilitated immediately after construction using indigenous vegetation or top soil; • Rehabilitated areas should be regularly monitored, and measures must be implemented to ensure that the reinstated topsoil does not wash away; • No construction activities, or impacts on vegetation, within wetlands 1 and 2, and within the 32 m buffer, may occur; • The wetlands and associated buffers must be demarcated prior to construction and no activities or vehicle movement should be allowed inside of these demarcated areas; • All invasive alien plants propagating within the disturbed areas must be removed and disposed of as waste. All disturbed areas must be regularly monitored for the emergence of alien invasive species; and • Any erosion gullies/ channels which form must be filled immediately and consolidated to prevent the probability of erosion. If necessary, geo-textile material must be installed to stablish the soils.								
After Management	Local	Low	Long term	Low	Improbable	**VERY LOW**	-ve	High

9.9.2 Impact 2: Increased sedimentation of wetlands during construction

This impact assumes the implementation of the management measure recommended in Table 9-14, to exclude the exclude the footprint of the wetlands 1 and 2, including a 32 m buffer.

Vegetation in the wetland or watercourse catchment area not only stabilises soils, but also reduces surface water runoff velocities when rainfall occurs. Attenuation of surface water encourages permeation of the soils and reduces surface water runoff. During the construction phase when vegetation is cleared, large quantities of loose earth may easily be washed from the construction zone or be transported down slope during high rainfall events, resulting in increased sedimentation downstream.

Table 9-15: Significance rating and recommended mitigation measures for increased sedimentation of wetlands

	Extent	Intensity	Duration	Consequence	Probability	SIGNIFICANCE	+ /-	Confidence
Before Management	Local	Medium	Long term	Medium	Probable	**MEDIUM**	-ve	High
Management Measures: • All measures detailed in Table 9-14 apply here.								
After Management	Local	Low	Long term	Low	Possible	**VERY LOW**	-ve	High

9.9.3 Impact 3: Impact to hydrology of the wetland system during construction and operation

This impact assumes the implementation of the management measure recommended in Table 9-14, to exclude the exclude the footprint of the wetlands 1 and 2, including a 32 m buffer.

The natural hydrology of wetland systems may be influenced if proposed development does not allow for flows (particularly subsurface flows) to be similar to the pre-development scenario. The development footprint completely intersects wetlands 1 and 2 and may therefore impact lateral flow of water into the surrounding environment.

Table 9-16: Significance rating and recommended mitigation measures for impacts to hydrology of the wetland system during construction and operation

	Extent	Intensity	Duration	Consequence	Probability	SIGNIFICANCE	+/-	Confidence
Before Management	Local	Medium	Long term	Medium	Probable	**MEDIUM**	-ve	Medium
Management Measures: • All measures detailed in Table 9-14 apply here.								
After Management	Local	Medium	Long term	Medium	Probable	**MEDIUM**	-ve	Medium

10 Buffer determination

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted in order to reduce the impact of adjacent land uses on the wetland or riparian area (DWAF, 2005). Buffer zones have been shown to have a variety of functions and have been proposed as a standard mitigation measure to protect or limit potential impacts on wetlands and other watercourses. Some generic functions of buffer zones are the following:

- Sediment trapping;
- Erosion control;
- Nutrient retention;
- Maintaining basic hydrological processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses; and
- Providing habitat for various aspects of biodiversity.

Available local government policies require that wetland buffer zones be determined from the outer edge of the temporary zone of a wetland and river buffer zones be calculated from the outer edge of the riparian zone (DAEA, 2002; CoCT, 2009; GDACE, 2008). However, no formal guidelines for riverine and wetland buffer zones have been established applicable to this study area in the Eastern Cape Province. Recommendations in the available policies and guidelines are listed in Table 10-1.

Table 10-1: Recommended buffer zones for wetlands and other aquatic systems in available local government policies and guidelines

Policy/ Guideline	Recommended Buffer
Kwa-Zulu Natal Department of Agriculture and Environmental Affairs (DAEA) Interim Guidelines for Development Activities That May Affect Wetlands (2002)	*15 m* – hardened surfaces should be located at least 15 m outside of the outer boundary of the seasonal/ permanent wetland zone; and *20 m* – a predominantly vegetated buffer area at least 20 m wide should be included between the stormwater outflow and the outer boundary of the wetland, with mechanisms for dissipating water energy and spreading and slowing water flow and preventing erosion.
Gauteng Department of Agriculture, Conservation and Environment (GDACE) Requirements for Biodiversity Assessments: Version 2 (2008)	*30 m* – from the outer edge of the wetland temporary zone, for wetlands occurring inside the urban edge; *50 m* – from the outer edge of the wetland temporary zone, for wetlands occurring outside the urban edge; Larger buffer zones may be required for wetlands supporting sensitive species (Red list of plant species – *200 m* buffer and Giant Bullfrog – *60 m* buffer)
	32 m – from the edge of the riparian zone, for rivers and streams within the urban edge; and

Policy/ Guideline	Recommended Buffer
	100 m – from the edge of the riparian zone for rivers and streams outside the urban edge.
City of Cape Town (CoCT) Prioritisation of City Wetlands Report (2009).	Minimum of *32 m* buffer for wetlands ranging up to *75 m*; *32 m* – artificial wetlands given the status of Critical Ecological Support Area (CESA) should be protected by a buffer of at least 32 m, but which can be wider, if deemed necessary by a wetland ecologist; and *10 m* – artificial wetlands given the status of an Other Ecological Support Area (OESA) should be protected by a buffer of at least 10 m, but these wetlands must still be assessed and ground-truthed by a wetland ecologist.
Eastern Cape Biodiversity Conservation Plan (ECBCP) (Berliner, *et al*., 2007)	*50 m* – for all wetlands until a provincial priority ranking system for wetlands is developed.
	50 m – mountain streams and upper foothills of all 1:500,000 rivers; *100 m* – lower foothills and lowland rivers of all 1:500,000 rivers; and *32 m* – all remaining 1:500,000 rivers.
Department of Water Affairs and Forestry (DWAF) Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas (2008).	*20 m* – watercourses in afforested areas Specific (defensible) objectives should be identified for buffers
Water Research Commission Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries (Macfarlane, *et al.,* 2014)	A buffer zone tool for determination of aquatic impact buffers was developed in 2014 for use a guideline tool to determine appropriate buffer zones for aquatic resources on a case by case basis. Each resource is assessed (using the buffer tool and the associated guideline document) in order to determine appropriate aquatic resource specific buffers, taking the following into consideration: • Site-based delineation and classification of aquatic resource; • Management objectives as per the determined PES and EIS; • Threats posed by the proposed land use / activity; • Sensitivity of aquatic resource to threats posed by lateral land-use impacts; • Sensitivity of important biodiversity elements to threats posed by lateral land-use impacts; • Site based investigations (topographical, ecological and geological characteristics); and • Identification of additional mitigation measures which could refine the impact buffer width.

The recommended buffer zone guideline (as listed above) are selected for use according to the sensitivity of the aquatic resources (and its surrounding habitat) as well as the nature of the proposed land-use/ activity.

It is recommended that a buffer of 32 m be implemented for wetlands in the study area. This recommendation is mainly based on the detailed guidelines by the ECBCP and the GDACE Requirements for Biodiversity Assessments: Version 2 (2008)

11 Conclusions and recommendations

According to the DFFE screening report, the site for the proposed development was found to have a very low sensitivity for the aquatic biodiversity theme. Existing databases of published data did not show the presence of any wetlands within the study area of the proposed development. During the study nine wetlands were identified within and surrounding the development area, specifically two wetlands occurring within the proposed development footprint. The proposed development would result in the loss of wetland habitat of 0.36 ha. Consequently, the sensitivity of the site for aquatic biodiversity is very high.

This assessment has identified three impacts which have high significance ratings before management measures and medium significance ratings after management measures.

The proposed development layout would have an unacceptable impact on the aquatic biodiversity on site as there are wetlands occurring within the proposed layout area (Wetland 1 and Wetland 2). Both wetland 1 and wetland 2 are currently impacted by grazing, alien invasive vegetation, tracks, paths, and illegal dumping and litter. In the no-go option these impacts are likely to continue and also compromise the functioning of these wetlands. According to the results of the WET-Health, the vegetation condition of Wetland 1 and Wetland 2 have been largely modified, a large loss of natural habitat, biota and basic ecosystem functions has occurred.

Assessments conducted for all wetland systems are summarised in Table 11-1. Two large water leaks from the municipal water mains have been said have taken place on site which could have potentially contributed to the presence of water on site.

Table 11-1: Summary of wetland systems identified and their classification, PES, EIS & REC

Watercourse ID	Natural/ Artificial	HGM Type	PES	EIS	REC
Wetland 1	Natural	Interdunal Depression	Class C	Low / Marginal	D
Wetland 2	Natural	Interdunal Depression	Class C	Low / Marginal	D
Wetland 3	Natural	Depression	Class C	Moderate	C
Wetland 4	Natural	Depression	Class C	Moderate	C
Wetland 5	Natural	Interdunal Depression	Class A	Low / Marginal	D
Wetland 6	Natural	Interdunal Depression	Class A	Low / Marginal	D
Wetland 7	Natural	Interdunal Depression	Class A	Low / Marginal	D
Wetland 8	Artificial	Depression Pond (Dam)	Not assessed	Moderate	C
Wetland 9	Natural	Interdunal Depression	Class A	High	B

Due to the compaction of soil during the construction of the R330, flow of groundwater across the R330 may be obstructed and therefore the connectivity between the watercourses may also be compromised. The proposed development would only impact on wetlands 1 and 2, and possibly wetland 3 , i.e. those wetlands to the east of the R330.

Where activities are proposed within the wetland systems (W1 and W2), measures need to be implemented to prevent impacts. The recommendations for the mitigation of potential impacts related to maintenance and general operational activities must be followed. Wetland areas which are not directly impacted by the development footprint should be kept natural as far as possible and invasive alien species should be eradicated on an ongoing basis.

As there would be a complete loss of Wetlands 1 and 2, the main impacts to Wetlands 1 and 2 are related to the loss of wetland habitat which would in turn influence hydrology, geomorphology, vegetation components, and ecosystem services of these wetlands. Consequently, the potential impacts which may occur during the construction and operational phase of the development are described under three main headings:

- Impact 1: Destruction of wetland habitat;

- Impact 2: Increased sedimentation of wetlands and watercourses during construction; and
- Impact 3: Impact to hydrology of the wetland system.

Mitigation measures are recommended below to try and conserve the ecological integrity of the assessed wetlands and the surrounding environment.

- The development footprint should be amended to exclude the footprint of the wetlands 1 and 2, including a 32 m buffer;
- Areas disturbed during construction should be adequately rehabilitated immediately after construction using indigenous vegetation or top soil;
- Rehabilitated areas should be regularly monitored, and measures must be implemented to ensure that the reinstated topsoil does not wash away;
- No construction activities, or impacts on vegetation, within wetlands 1 and 2, and within the 32 m buffer, may occur;
- The wetlands and associated buffers must be demarcated prior to construction and no activities or vehicle movement should be allowed inside of these demarcated areas;
- All invasive alien plants propagating within the disturbed areas must be removed and disposed of as waste. All disturbed areas must be regularly monitored for the emergence of alien invasive species; and
- Any erosion gullies/ channels which form must be filled immediately and consolidated to prevent the probability of erosion. If necessary, geo-textile material must be installed to stablish the soils.

A water use application will be required as the development is within 500 m of wetlands. It is expected that the application would be a licence.

Even though the current layout covers an area which has existing impacts, the current layout is not acceptable for the proposed development in its current form and alternatives need to be looked at which do not impact wetland areas. No other alternatives were assessed during this assessment.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

12 References

Batten, A., Bokelman, H. & Manning, J. 2001. Wild Flower Guide 11: Eastern Cape. Botanical Society of South Africa, Cape Town.

Berliner, D., Desmet, P. & Hayes, R. 2007. Eastern Cape Biodiversity Conservation Plan Handbook. Department of Water Affairs and Forestry Project No. 2005-012, King Williams Town.

Birkhead, A., Uys, A., Scherman, P.A., Bok, A., Colloty, B. and Chalmers R. 2013. Review and update of the 1999 EIS/PES of South African rivers, including expansion to priority tributaries and wetlands, according to quaternary catchments for the Water Management Areas 12 & 15. Prepared for the Department of Water Affairs and the Water Research Commission, South Africa. WRC Project No. K5/2045.

Bromilow, C. 2001. Problem Plants of South Africa: A guide to the identification and control of more than 300 invasive plants and other weeds. Briza Publications, Pretoria.

Council of GeoScience. 1:1,000,000 Metallogenic map of South Africa, Lesotho, and Swaziland - Map layers.

Day, J., Day, E., Ross-Gillepsie, V., Ketley, A. Malan, H. 2010. *The Assessment of Temporary Wetlands During Dry Conditions*. Water Research Commission, Cape Town.

Department of Water Affairs and Forestry (n.d), Groundwater Dictionary: Quaternary Catchment. Accessed from: <https://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_catchment.htm >

Department of Water Affairs and Forestry. 1999. *Resource Directed Measures for Protection of Water Resources: Wetland Ecosystems*. Appendix W5: IER (Floodplain Wetlands) Determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). Version 1.0

Department of Water Affairs and Forestry. 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas.* Prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. Unknown. Stream Flow Reduction Activities, DWAF, Pretoria, South Africa.

Department of Water and Sanitation. 2008. WAR Systems [Online] Available from: <https://www.dwa.gov.za/WAR/systems.html>

Department of Agriculture and Environmental Affairs (DAEA), Kwazulu-Natal. 2002. *Interim Guidelines for Development Activities that may affect Wetlands.* Chief Directorate Environmental Management.

Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetland and riparian areas. Department of Water Affairs and Forestry, Pretoria

Gauteng Department of Agriculture, Conservation and Environment (GDACE) Requirements for Biodiversity Assessments: Version 2. 2008. Available from: <http://www.iaia.co.za/File_Uploads/File/GDACErequirementsforbiodiversityassessments_1.pdf

Henderson, L, 2001. *Alien Weeds and Invasive Plants: A complete guide to declared weeds and invaders in South Africa*. Agricultural Research Council, Cape Town.

Job, N. 2009. *Application of the Department of Water Affairs and Forestry (DWAF) Wetland Delineation Method to Wetland Soils of the Western Cape.* Water Research Commission, Cape Town

Kleynhans, C.J., Bruwer, C.A., Kilian, V., Weston, B., Van Wyk, N. & Sellick, C. 1999. *A procedure for the determination of the flow requirements of the ecological reserve for the purposes of the planning estimate*. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.

Kleynhans, CJ, Thirion, C & Moolman, J. 2005. *A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland.* Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Hill, R.S. 1993. *The Geology of the Graaff-Reinet Area*. Council for Geoscience, Pretoria.

Kotze, D., Macfarlane, D. & Edwards, R. 2020. *WET-Ecoservices (version 2): A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas*. WRC report No K5/2737, Water Research Commission, Pretoria.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. *Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report.* WRC Report No TT 610/14, Water Research Commission, Pretoria

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2020. *Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report.* WRC Report No TT 610/14, Water Research Commission, Pretoria

Middleton, B., & Bailey, A. 2009. *Water Resources of South Africa, 2005 Study*. WRC Report Numbers 380/08, 381/08, 382/08. Pretoria: Water Research Commission.

Mucina, L & Rutherford, M. C. 2006 (updated in 2009 and 2012). *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria

National Soil Classes [SHP] Pretoria: Agricultural Geo-Referenced Information System. Available: <http://www.agis.agric.za> Accessed 16 October 2015

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

Nel, J.L, Colvin, C., Le Maitre, D.C., Smith, J. and Haines, I. 2013. *South Africa's Strategic Water Source Areas.* CSIR Report CSIR/NRE/ECOS/ER/2013/0031/A, CSIR, Stellenbosch, South Africa.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. *Classification system for Wetlands and other Aquatic Ecosystems in South Africa.* User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Pierce, S.M & Mader, A.D. 2006. The STEP Handbook: Integrating the natural environment into land use decisions at the municipal level: towards sustainable development. Centre for African Conservation Ecology (ACE). Report Number 47 (Second Edition). Nelson Mandela Metropolitan University, South Africa.

SA Explorer. 2000-2015. South African maps. Available from: <http://www.saexplorer.co.za/south-africa/climate/addo_climate.asp>

South African National Biodiversity Institute (SANBI). NFEPA Groundwater Recharge [vector geospatial dataset]. 2011a. Available from Biodiversity GIS website: <http://bgis.sanbi.org/NFEPA/NFEPAmap.asp>

South African National Biodiversity Institute (SANBI). NFEPA Wetlands [vector geospatial dataset]. 2011b. Available from Biodiversity GIS website <http://bgis.sanbi.org/NFEPA/NFEPAmap.asp>

South African National Biodiversity Institute (SANBI). National Land Cover [vector geospatial dataset]. 2009. Available from Biodiversity GIS website < http://bgis.sanbi.org/landcover/project.asp>

Appendix A: Photographs

Photo 1: Standing water within Wetland 1

Photo 2: Standing water within Wetland 1

Photo 3: Standing water within Wetland 1

Photo 4: Saturated area within Wetland 1

Photo 5: Evidence of calcrete mining within Wetland 1

Photo 6: Evidence of calcrete mining within Wetland 1

Photo 7: View of Wetland 2

Photo 8: View of Wetland 2

Photo 9: Wetland 3 and 4: View of W3 note road adjacent to the wetland and W4 on the opposite side of the road

Photo 10: Wetland Soil sample

Photo 11: View of Wetland 5

Photo 12: View of wetland 9

Photo 13: View of Wetland 8

Photo 14: View of Wetland 9

Photo 15: *Rapanea gilliana*

Photo 16: Saturated soil sample

Appendix B: Impact assessment methodology descriptions

Impact Rating Methodology

The assessment of impacts will be based on specialists' expertise, SRK's professional judgement, field observations and desktop analysis.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring, including possible irreversibility of impacts and/or loss of irreplaceable resources, and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in Table 12-1 below.

Table 12-1: Criteria used to determine the consequence of the impact

Rating	Definition of Rating	Score
A. *Extent* *– the area over which the impact will be experienced*		
Local	Confined to project or adjacent areas	1
Regional	Affecting the region (e.g. District Municipality or Province)	2
(Inter) national	Affecting areas beyond the Province	3
B. ***Intensity***– *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered and/or irreplaceable resources[4] are lost	3
C. ***Duration***– *the timeframe over which the impact will be reversed*		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years or irreversible	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Table 12-2: Method used to determine the consequence score

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence is derived, the probability of the impact occurring is considered, using the probability classifications presented in Table 12-3 below.

Table 12-3: Probability classification

Probability– *the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

[4] Defined as important cultural or biological resource which occur nowhere else, and for which there are no substitutes.

The overall **significance** of impacts is determined by considering consequence and probability using the rating system prescribed in Table 12-4 below.

Table 12-4: Impact significance ratings

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally the impacts are also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in Table 12-5 below.

Table 12-5: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **Insignificant:** the potential impact is negligible and will not have an influence on the decision regarding the proposed activity.
- **Very Low:** the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity.
- **Low:** the potential impact may not have any meaningful influence on the decision regarding the proposed activity.
- **Medium:** the potential impact should influence the decision regarding the proposed activity.
- **High:** the potential impact will affect the decision regarding the proposed activity.
- **Very High:** The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; and
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Appendix C: Specialists Declarations and CV's

SRK Report Distribution Record

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