Soil and Freshwater Scoping Report for the Phakwe Richards Bay Gas Power 3 Facility

Richards Bay, KwaZulu-Natal

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CLIENT

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1 Introduction

The Biodiversity Company was commissioned to compile a soil and freshwater resources (aquatics and wetlands) scoping report for the proposed up to 2000 MW combined cycle (CC) gas to power plant facility and associated infrastructure, located in Richards Bay, KwaZulu-Natal. Phakwe Richards Bay Gas Power 3Phakwe Richards Bay Gas Power 3 (Pty) Ltd intend on developing an up to 2000 MW combined gas to power plant located on various erven within the Richards Bay Industrial Development Zone (RBIDZ) phase 1F, Richards Bay, KwaZulu Natal.

The development is proposed on erven 16820, 16819,1/16674 and a subdivision of erf 17442 , and will occupy approximately 11ha, situated within Phase 1F of the RBIDZ located approximately 5km north east of Richards Bay and 1km north of the suburb of Alton.

The project site is situated in the City of uMhlathuze Local Municipality which falls within jurisdiction of the King Cetshwayo District Municipality, KwaZulu-Natal Province. The site has been zoned for IDZ Industrial development as part of the planning for this IDZ area.

The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation”. The National Web based Environmental Screening Tool has characterised the aquatic and agricultural biodiversity for the project area as “very high sensitivity”.

The intent of the scoping report is to provide desktop environmental sensitivity information for the Environmental Impact Assessment (EIA) and Water Use License Application (WULA) processes.

1.1 Project Description

The power plant will operate at mid-merit or baseload duty and will include the following main infrastructure:

- A number of gas turbines for the generation of electricity through the use of natural gas (liquid or gas forms), or a mixture of Natural gas and Hydrogen (in a proportion scaling up from 30% H2) as fuel source, operating all turbines at mid-merit or baseload (estimated 16 to 24 hours daily operation).
- Exhaust stacks associated with each gas turbine.
- A number of Heat Recovery Steam Generator (HRSG to generate steam by capturing the heat from the turbine exhaust.
- A number of steam turbines to generate additional electricity by means of the steam generated by the HRSG.
- The water treatment plant will demineralise incoming water from municipal or similar supply, to the gas turbine and steam cycle requirements. The water treatment plant will produce two parts demineralised water and reject one-part brine, which will be discharged to the R IDZ stormwater system.

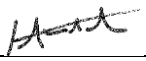
- Steam turbine water system will be a closed cycle with air cooled condensers. Make-up water will be required to replace blow down.
- Air cooled condensers to condensate used steam from the steam turbine.
- Compressed air station to supply service and process air.
- Water pipelines and water tanks for storage and distributing of process water. (Potential sourcing of alternative water outside RB IDZ supply (Municipality))
- Water retention pond
- Closed Fin-fan coolers to cool lubrication oil for the gas turbines
- Gas generator Lubrication Oil System.
- Gas pipeline supply conditioning process facility. Please note, gas supply will be via dedicated pipeline from the proposed Transnet supply pipeline network of Richards Bay (the location of this network has not yet been confirmed) or, alternatively directly from the Regasification facilities at RB Harbour. The gas pipeline will be separately authorized.
- Site water facilities including potable water, storm water, waste water
- Fire water (FW) storage and FW system
- Diesel emergency generator for start-up operation.
- Onsite fuel conditioning including heating system.
- All underground services: This includes stormwater and wastewater.
- Ancillary infrastructure including:
    - Roads (access and internal);
    - Warehousing and buildings;
    - Workshop building;
    - Fire water pump building;
    - Administration and Control Building;
    - Ablution facilities;
    - Storage facilities;
    - Guard House;
    - Fencing;
    - Maintenance and cleaning area;
    - Operational and maintenance control centre;
- Electrical facilities including:
    - Power evacuation including GCBs, GSU transformers, MV busbar, HV cabling and 1x275kV or 400kV GIS Power Plant substation.
    - Generators and auxiliaries;
    - Subject to a separate environmental authorisation application:
        - Eskom 275 or 400kV GIS interface Substation

- Underground 275 or 400kV power cabling connecting Power Plant GIS substation and Eskom GIS Interface substation.
- an overhead 275kV or 400kV power line connecting the ESKOM interface substation to the selected Eskom grid connection point;

- Service infrastructure including:
  - Stormwater channels;
  - Water pipelines
  - Temporary work areas during the construction phase (laydown areas)

- Fuel supply
  - A dedicated pipeline to connect into an on-site gas receiving and conditioning station will provide the natural gas or the mixture of natural gas and Hydrogen. The pipeline will be connected to the proposed Transnet supply pipeline network of Richards Bay (the location of this network has not yet been confirmed), or it will extend directly to the Regasification facilities in the RB Harbour
  - The dedicated pipeline will be separately environmentally authorized.

2 Specialist Details

Report Name	**Soil and Freshwater Scoping Report for the Phakwe Richards Bay Gas Power 3 Facility**
Submitted to	savannah environmental
Report Writer (Soils & Wetlands)	**Andrew Husted**  Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Report Writer (Aquatics)	**Dale Kindler**  Dale Kindler is Pr. Sci. Nat. registered (114743) in aquatic science and completed his M. Sc. in Aquatic Health at the University of Johannesburg. He has six (6) years' experience in conducting Aquatic Specialist Assessments and is SASS 5 Accredited with the Department of Water and Sanitation (DWS). Dale has completed numerous specialist studies locally and internationally, ranging from basic assessments to Environmental Impact Assessments (EIAs) following IFC standards.
Report Reviewer	**Andrew Husted**  Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than

to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

3 Terms of Reference

The Terms of Reference (ToR) included the following:

- Description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (soils, aquatics and wetland) that occur in the project area, and the manner in which these sensitive receptors may be affected by the activity;
- Identification of conservation significant habitats around the project area which might be impacted;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application;
- Provide a map to identify sensitive receptors in the project area, based on available maps and database information;
- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct high-level impact assessments relevant to the proposed activity;
- Impact assessment and mitigation measures to prevent or reduce the possible impacts as per the study.

4 Project Description

The dominant land uses surrounding the project area includes industry, forestry and open veld. A locality map of the project area is shown in Figure 4-1. The proposed development footprint and associated infrastructure is presented in Figure *4-2*.

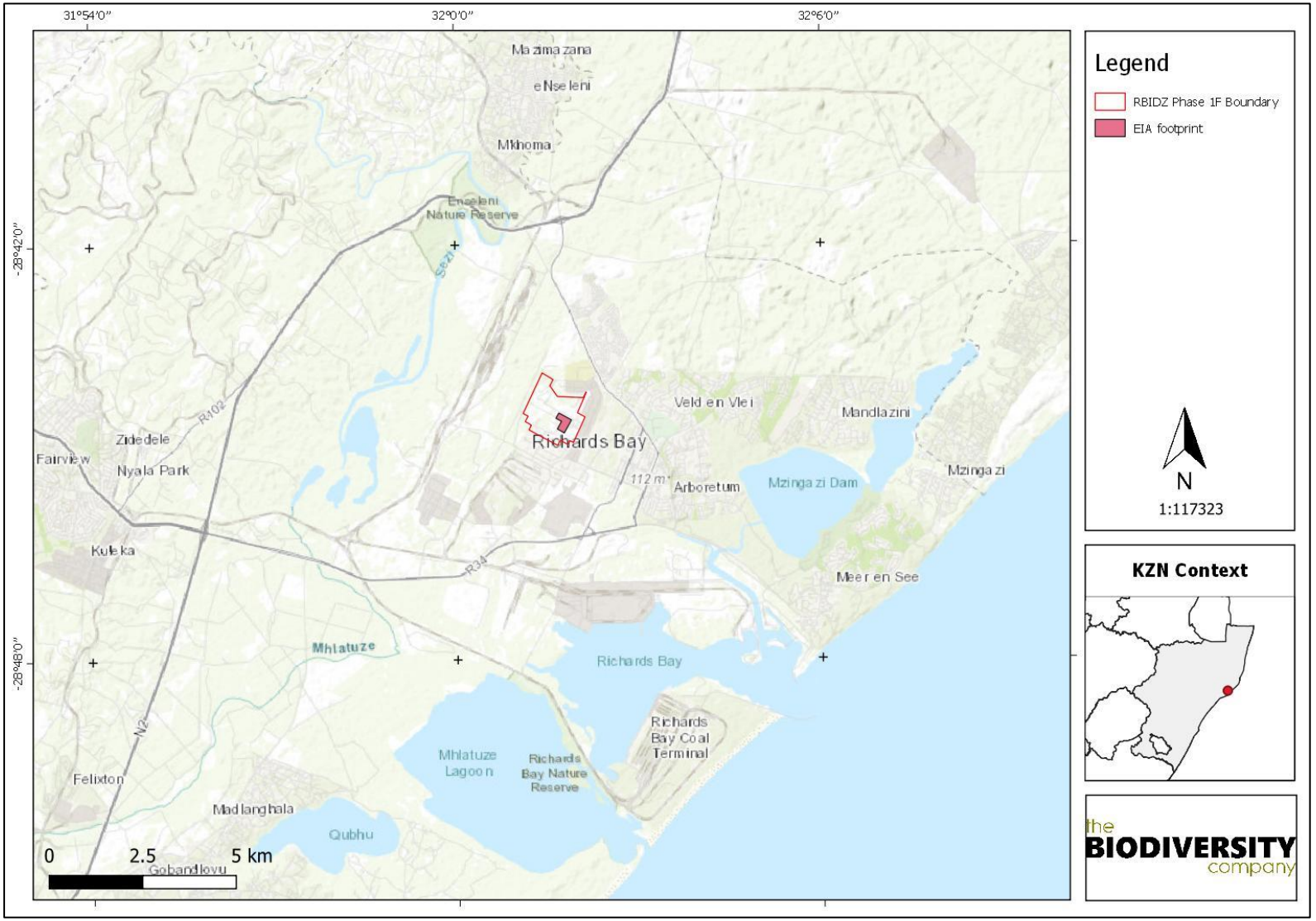


Figure 4-1 Locality of the project area

Figure 4-2 Proposed development footprint

5 Key Legislative Requirements

In terms of Sections 24 and 24D of the National Environmental Management Act (No 107 of 1998), as read with the EIA Regulations (2014), as amended on 07 April 2017, of GN R324 to GN R327, a Scoping and EIA is required to be undertaken for the proposed project in order to authorise, amongst others, the following triggered activities:

GNR 325 (Listing Notice 2):

- No. 2: Non-renewable resource energy generation in excess of 20MW; and
- No. 6: Development of a facility requiring and Atmospheric Emissions Licence.

GNR 327 (Listing Notice 1):

- No. 9: Facilities for the bulk transportation of;
- No. 10: Facilities or the bulk transportation of process water of 0.36m or greater internal diameter;
- No. 12: Infrastructure of 100m2 or greater in or within 32m of a watercourse;
- No. 14: Development and handling of dangerous goods of 80m3 or more (pending layout finalisation);
- No. 16: Development of desalination infrastructure with production capacity of more than 100m3 per day;
- No. 19: Infilling or deposition of 10m3 within a watercourse;
- No. 26: Commercial developments of more than 1 000m2 on land used for heavy industry;
- No. 27: Clearance of less than 20 ha of indigenous vegetation; and
- No. 28: Industrial developments on land used for agriculture, greater than 1ha

GNR 324 (Listing Notice 3):

- No. 2: Development of reservoirs in excess of 250m^3 within a CBA or ESA area;
- No. 4: Development of a road wider than 4 metres with a reserve less than 13,5 metres within a CBA or ESA area;
- No. 10: Storage and handling of a dangerous good of up to 80m^3;
- No. 12: Clearance of an area of 300 square metres or more of indigenous vegetation within a CBA or ESA area;
- No. 14: Infrastructure greater than 10m2 within a watercourse or 32m thereof where the watercourse is located within a CBA or ESA area; and
- No. 15: Industrial developments on land zoned open space or conservation after 2010.

6 Limitations

The following limitations should be noted for the assessment:

- This report was written based on desktop data;
- A basic layout and description of associated infrastructure were provided, assumptions were made on likely associated infrastructure;
- The aquatic assessment only considered freshwater ecosystems and did not consider the estuarine habitats; and
- The available aquatic macroinvertebrate data for the ecoregion in which the project area is located was poor. Therefore, interpretations of the results are of low confidence.

7 Receiving Environment

7.1 Desktop Soil Assessment

According to the land type database (Land Type Survey Staff, 1972-2006) the project area is located within the Hb69 land type. The land type is described in the table below (Table 7-1).

Table 7-1 The expected soil features for the land type present

Land Type	Expected Soil Features
Hb69	Grey Regic Sands; Regic sands and other soils

7.2 Desktop Vegetation

The project area is situated within the following KZN vegetation biomes and vegetation types, namely Freshwater Wetlands and Maputaland Wooded Grassland. The Subtropical Freshwater Wetlands ordinarily occur in low lying areas and are expected to be dominated by reeds, sedges, rushes and water-logged meadows dominated by grasses. The dominant vegetation type is the Maputaland Wooded Grassland. This vegetation type is typically supported coastal sandy grasslands rich in geoxylic suffritices, dwarf shrubs, small trees and very rich herbaceous flora.

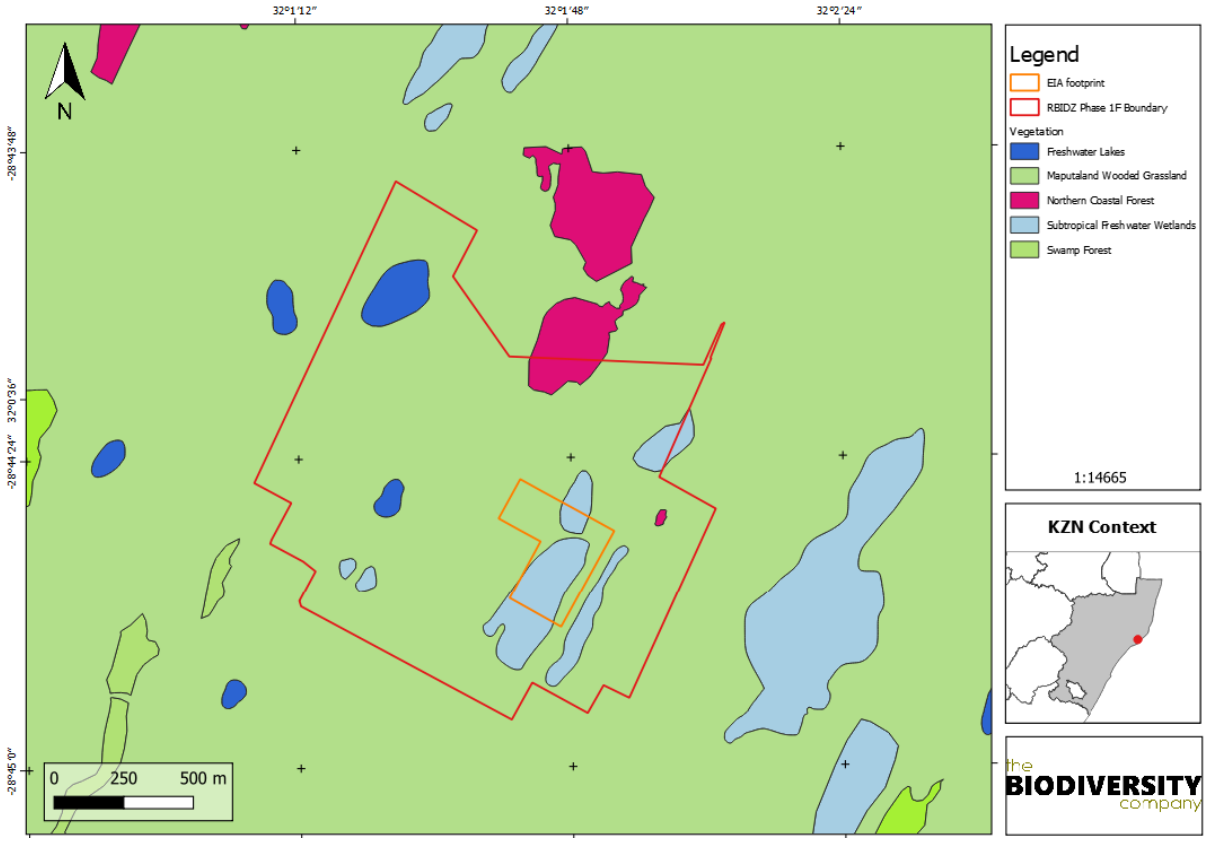


Figure 7-1 Vegetation types on the project area

7.3 Hydrological Setting

The project area is located within the Pongola - Mtamvuna Water Management Area (WMA 4) and predominantly falls within the W12F quaternary catchment (Figure 7-2). Two Sub Quaternary Reaches (SQRs) are associated with the Phase 1F boundary, namely the classified Nseleni River SQR W12H-3459 SQR and an unnamed SQR which serves as the Mhlatuze estuarine catchment which includes the Richards Bay Harbour. Several wetland areas are located within and around the development footprint area. The Nseleni River is a major tributary of the Mhlatuze River and contributes to the ecological functioning of the Mhlatuze lagoon and Richards Bay Harbour. The desktop ecological status and composition of the classified SQRs is shown in Table 7-2 (DWS, 2021).

Table 7-2 Desktop data pertaining to the ecological condition of the associated SQRs (DWS, 2021)

SQR	Nseleni W12H-3459	Nundwane W12J-3450
Present Ecological Status	Largely Modified (class D)	Moderately Modified (class C)
Ecological Importance	High	High
Ecological Sensitivity	Very High	Very High
Contributing Factors	Enseleni Nature Reserve, extensive cultivation (dryland sugarcane), Lake Nsezi - artificially raised, water supply to Richards Bay, back flooding entire reach, estuary in lower reach	Extensive forestry, swamp forest in Riparian Zone, Alien Invasive Plants, roads, urban in lower reach (Richard Bay), lower reach in Lake Mzingazi
Default Ecological Category	Natural (class A)	Natural (class A)

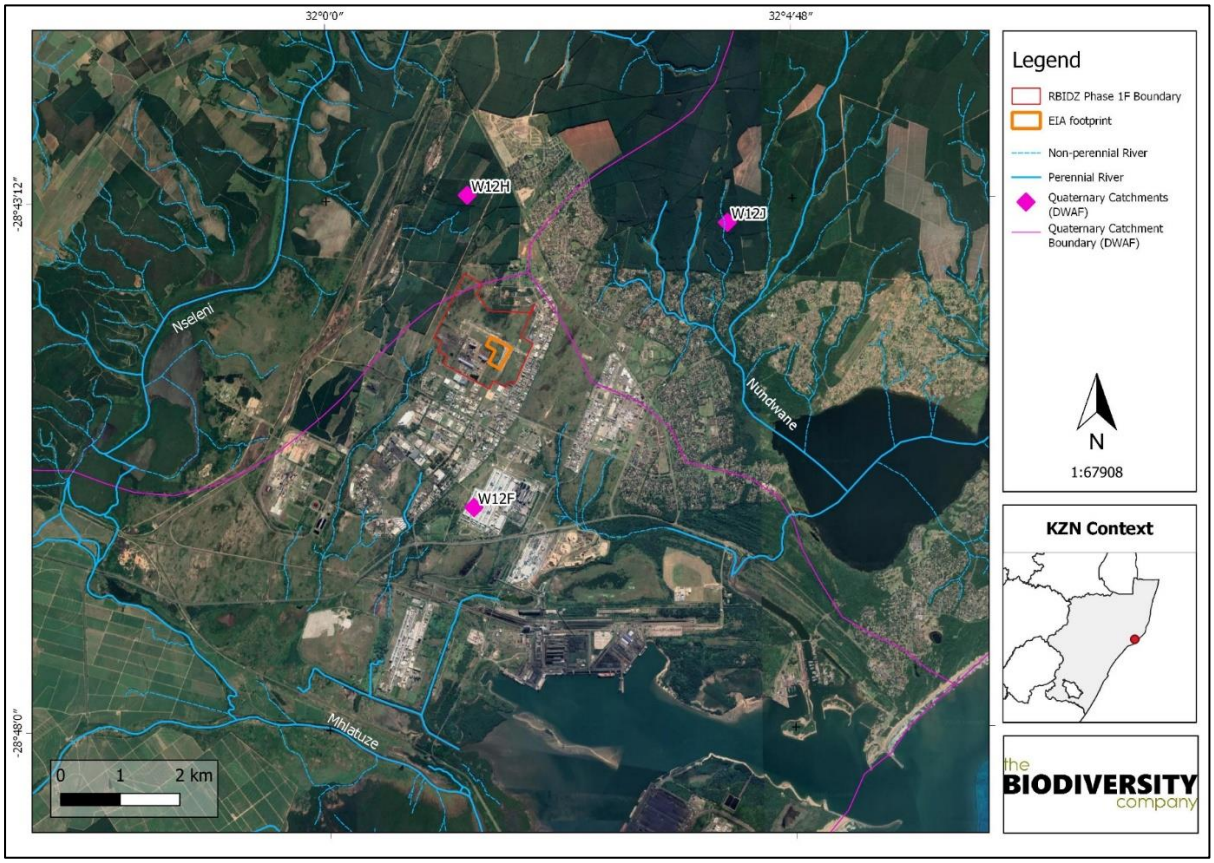


Figure 7-2 The project area in relation to the sub quaternary reach catchments

7.4 National Freshwater Priority Areas

7.4.1 Wetland National Freshwater Priority Areas

According to Nel *et al.* (2011), no wetland FEPAs are listed for the Phase 1F boundary. According to Figure 7-3, numerous non-priority wetland areas are located within the general project area catchments. When assessing wetland systems directly within the Phase 1F boundary and associated EIA footprint, a number of systems are located within the development footprint. Majority of the EIA footprint directly overlaps with a valleyhead seep wetland. Other wetland systems within this boundary include depressions, flats and a valley bottom system.

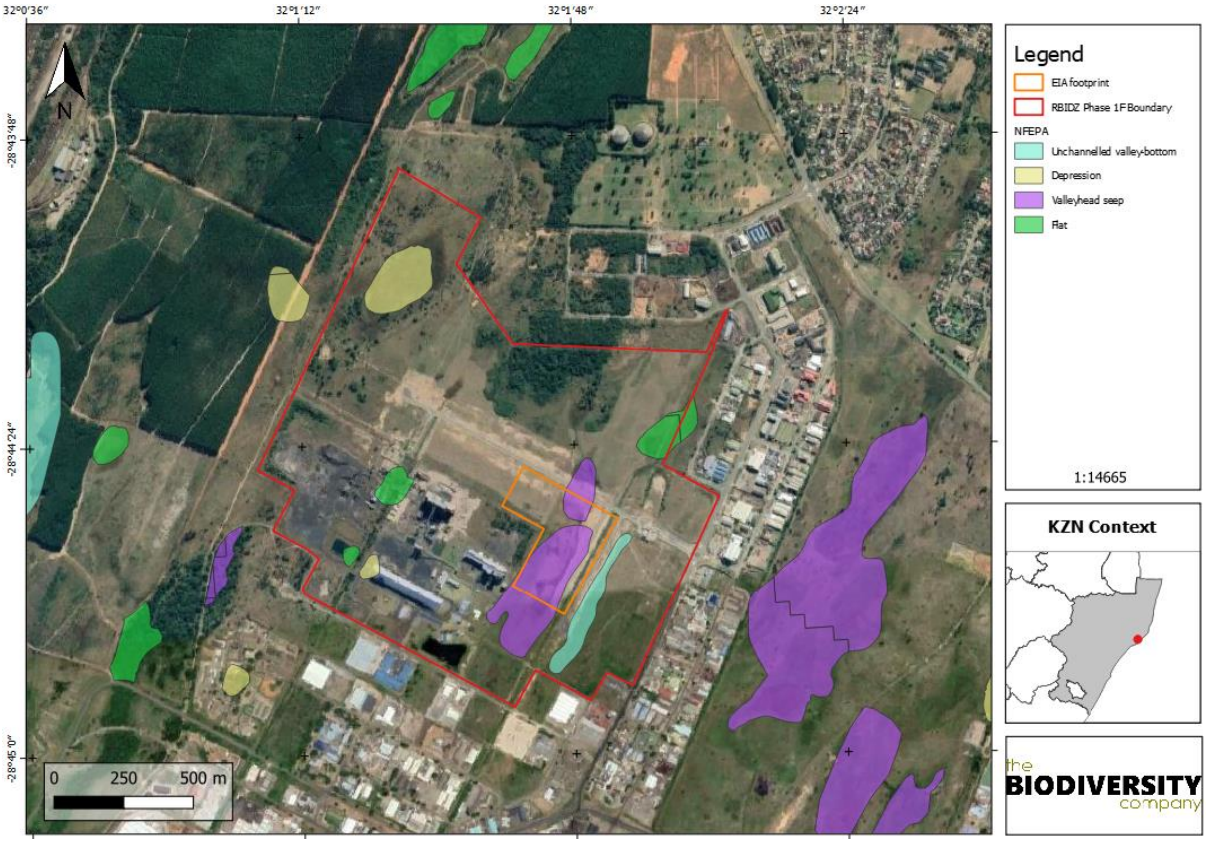


Figure 7-3 Layout of the proposed development area in relation to the wetland NFEPAs

7.4.2 River National Freshwater Priority Areas

The layout of the proposed development area and the National Freshwater Priority Area (NFEPA) layouts are provided in Figure 7-4. As indicated in the figure the development footprint is located outside of River FEPA's. Despite this, the development footprint is located in close proximity to two River FEPA's (Nseleni River to the west and the Nundwane River to the east) and the Richards Bay estuarine FEPA area, with unnamed non-perennial river systems draining the associated SQRs into the aforementioned FEPAs. A map illustrating the national estuarine delineation for the project area as per the South African National Biodiversity Institute (SANBI, 2012) GIS metadata for South African estuaries is presented in Figure 7-5.

Conserving the ecological functioning within the project related SQRs will aid in the protection of riverine, wetland and estuarine habitat supporting fish species occurring within the entire catchment and water quality for the downstream aquatic and terrestrial biota which includes coastal and marine biota in the downstream systems. The SQRs in which human activities occur need to be managed to maintain water quality and prevent further degradation of downstream water resources in order to contribute to national biodiversity goals and support sustainable use of water resources.

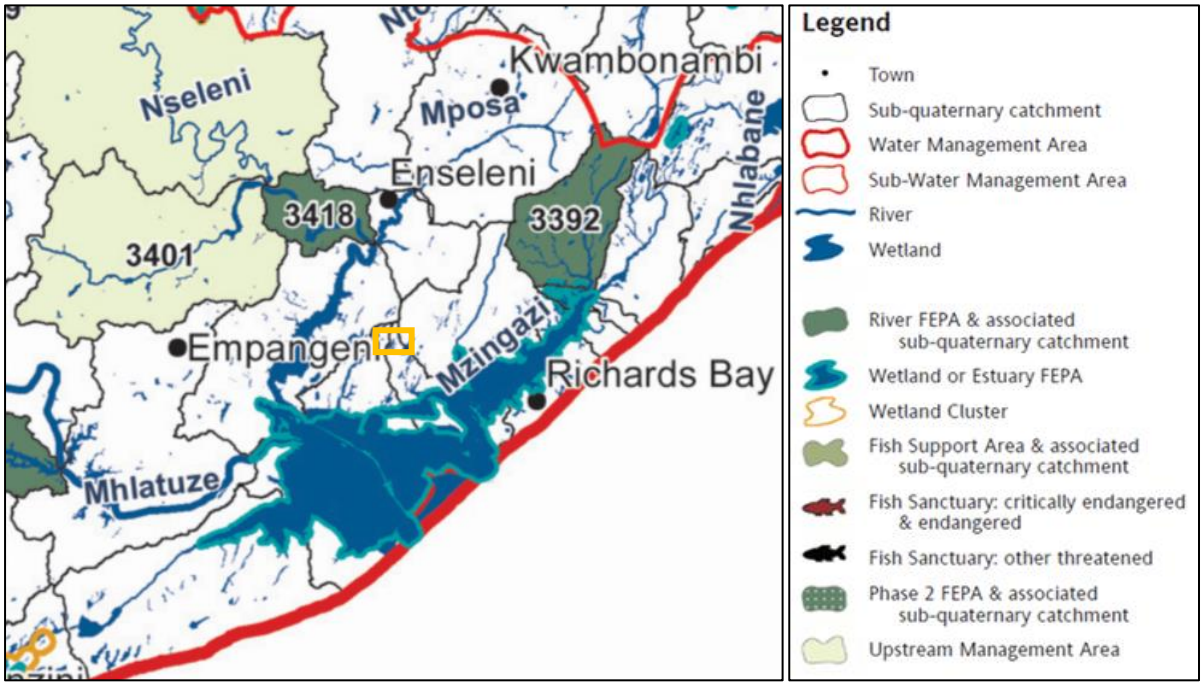


Figure 7-4 Illustration of NFEPAs associated with the project area (indicated by orange square) (Nel et al., 2011)

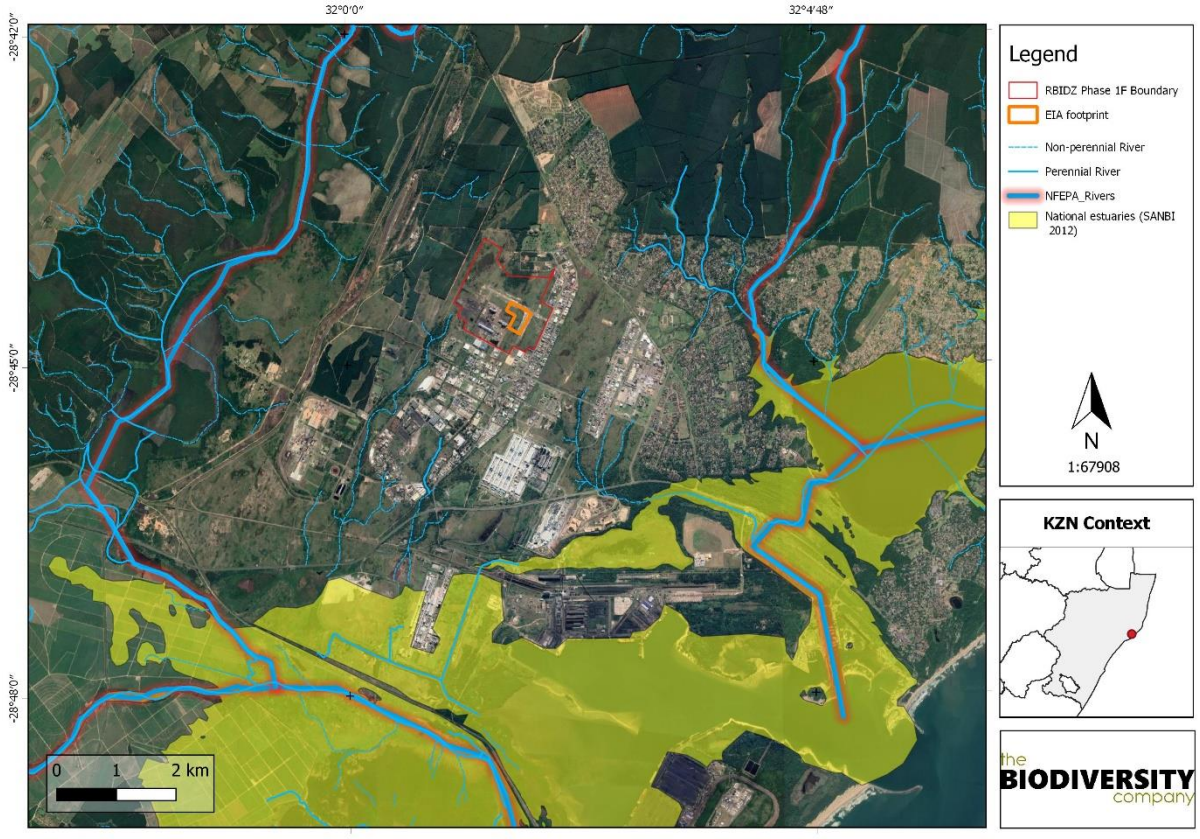


Figure 7-5 Layout of the proposed development area in relation to the riverine National Freshwater Priority Areas and National estuaries

7.5 National Wetland Map 5

The National Wetland Map 5 (NWM 5) spatial data was published in October 2019 (Deventer *et al*. 2019) in collaboration with SANBI with the specific aim of spatially representing the location, type and extent of wetlands in South Africa. The data represents a synthesis of a wide number of official watercourse data including rivers, inland wetlands and estuaries. This database recognises the presence of depression wetland within the project area belonging to Indian Ocean Coastal Belt Group 1 (Figure 7-6).

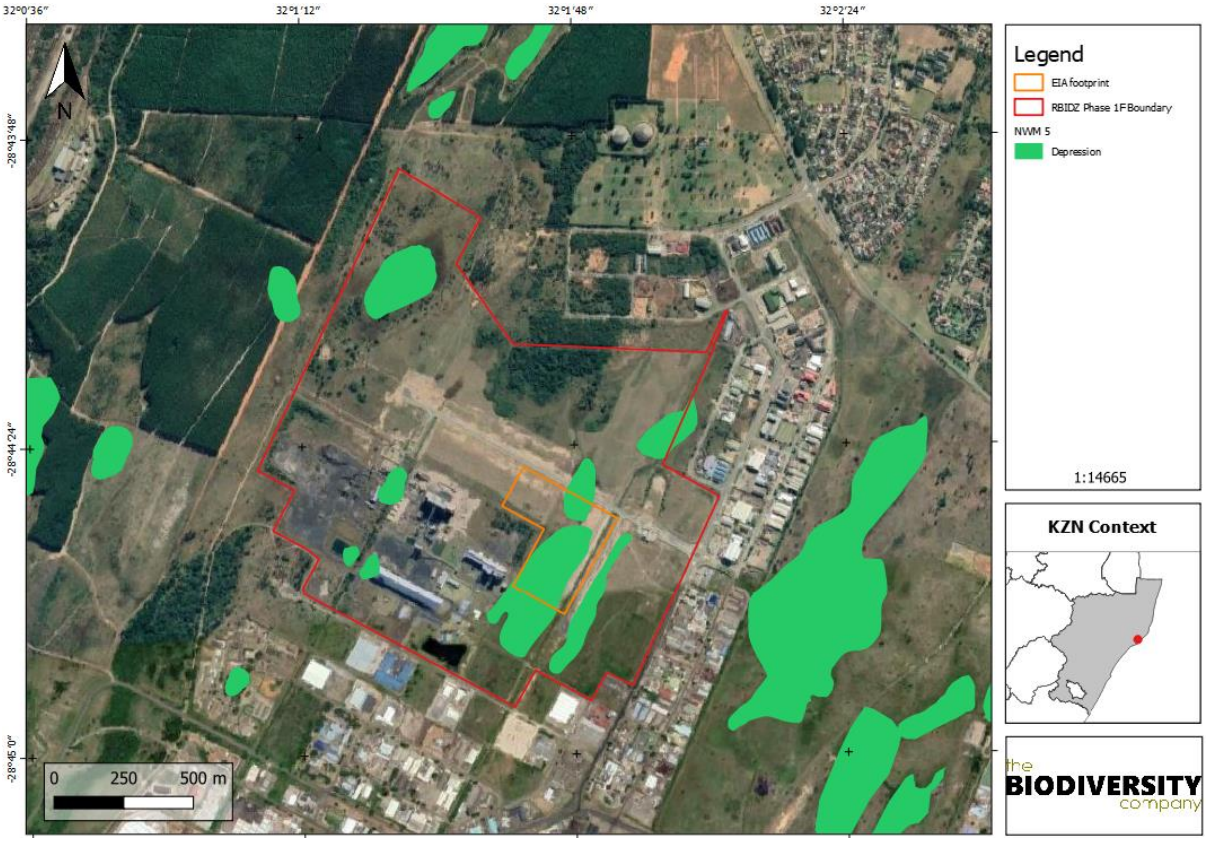


Figure 7-6 National wetland areas located within the development footprint

7.6 Watercourse, Catchment and Land-use Characteristics

In line with the minimum requirements the aquatic ecosystem types must be described and to achieve this the watercourses, catchments and land use characteristics are presented for the report.

As indicated in the hydrological setting section (section 7.3) of this report the watercourses considered in this assessment were located in the watershed of 3 SQRs which feed into the ecologically sensitive Richards Bay water resources. The watercourses are presented in Figure 7-7 below in relation to the proposed Phase 1F boundary. The dominant land uses surrounding the project area includes industry (urban built up), plantations, degraded and natural areas (Figure 7-8). The aquatic ecology status is largely influenced by land use and associated modification of the catchment, thus land cover provides an indication into the ecological status of the watercourses within the catchment.

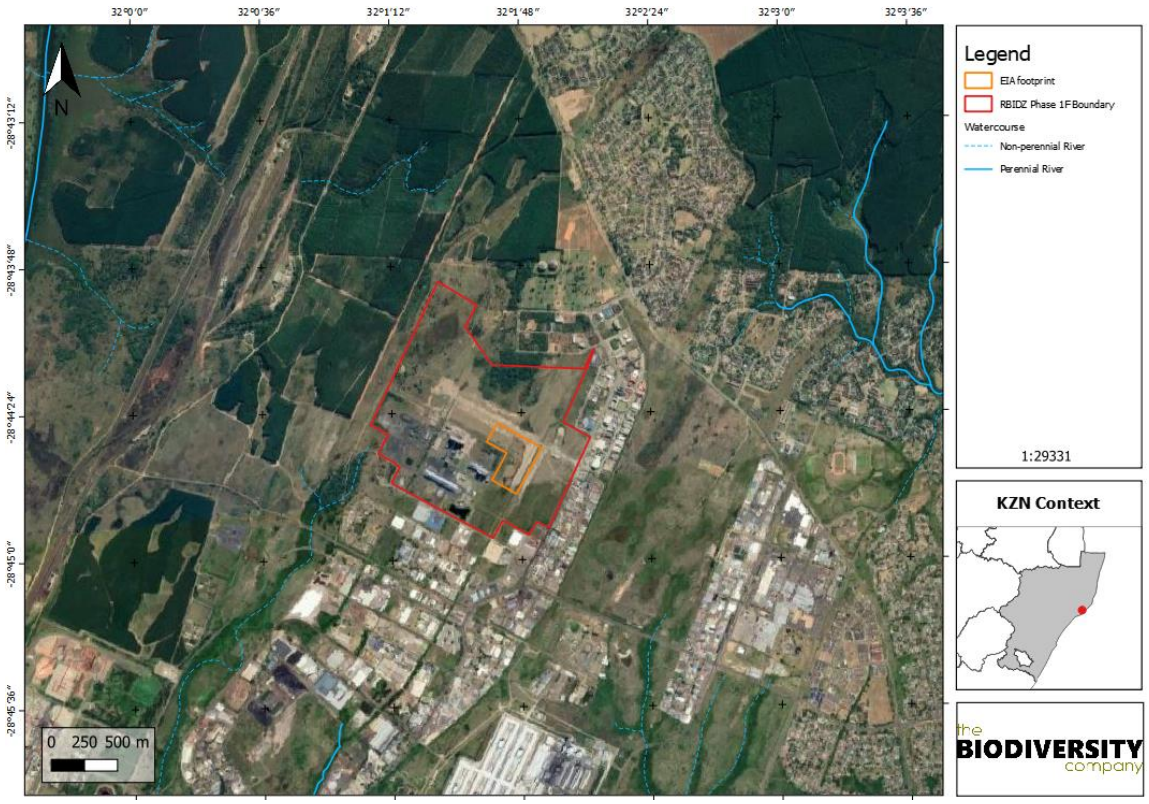


Figure 7-7 Watercourses associated with the Phase 1F boundary

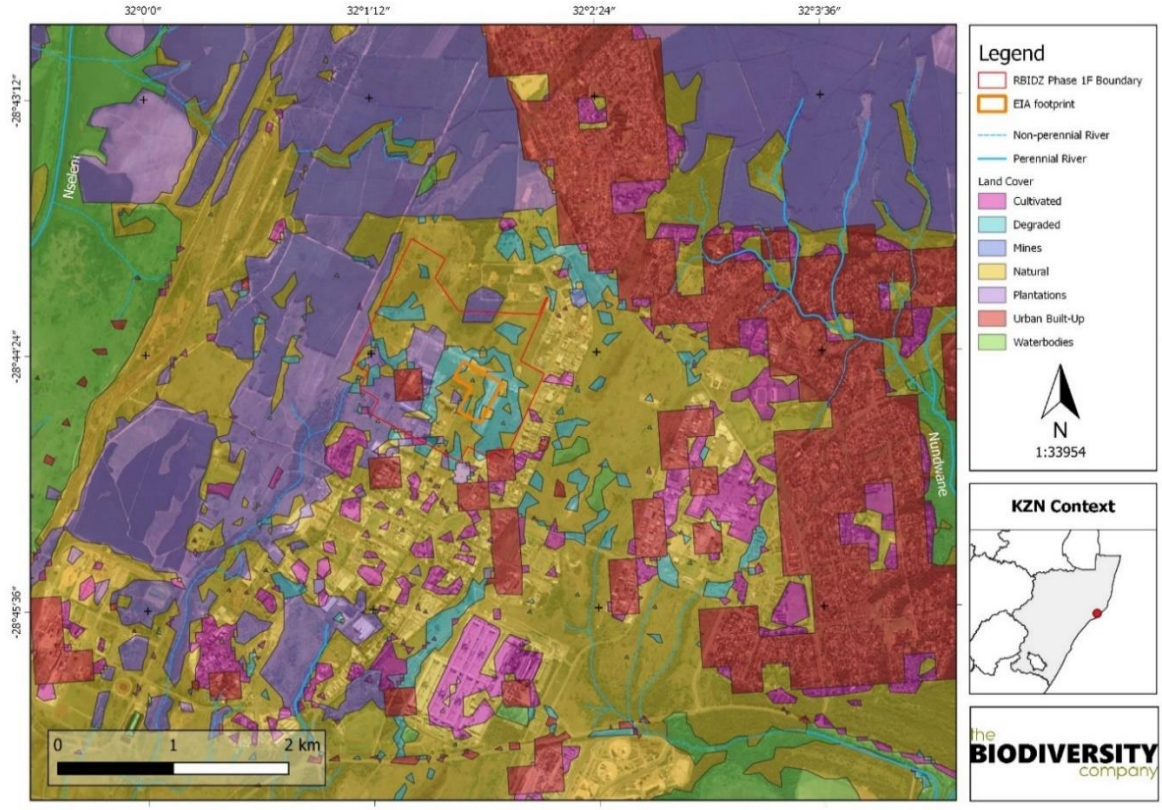


Figure 7-8 Land Use within the catchment area

7.6.1 Fish Assessment

An expected fish species list for the project area is provided below (Table 7-3).

Table 7-3 Expected freshwater fish species in the W12H-3459 Sub Quaternary Reach

Expected fish species	Observed	IUCN status (IUCN, 2020)
Micropanchax johnstoni	No	LC
Micropanchax katangae	No	LC
Micropanchax myaposae	No	NT
Enteromius gurneyi	No	VU
Enteromius paludinosus	No	LC
Enteromius trimaculatus	No	LC
Enteromius viviparus	Yes	LC
Clarias gariepinus	No	LC
Ctenopoma multispine	No	LC
Clarias theodorae	No	LC
Marcusenius macrolepidotus	No	LC
Oreochromis mossambicus	No	NT
Pseudocrenilabrus philander	No	LC
Coptodon rendalli	No	LC
Tilapia sparrmanii	No	LC
Total species	**1**	**15**

Enteromius brevipinnis (Shortfin barb) is currently listed as Vulnerable (VU). The species face threat from varied impacts within the catchments which include loss of habitat extent and quality associated with commercial and residential development, agriculture, pollution (notably effluent from waste water treatment works) and predation by alien invasive species (IUCN, 2020).

Micropanchax myaposae (Natal Topminnow) is currently listed as Near Threatened (NT). The species face threat from varied impacts within the catchments which include widespread agricultural activities affecting habitat condition (coastal wetlands, lakes and rivers), water quality and flows within the entire region of this species range. Further impacts include drought, predation by alien invasive species, dune mining and commercial, tourist, harbour and residential coastal development (IUCN, 2020).

There are currently no conservation plans in place for *Enteromius brevipinnis* and *Micropanchax myaposae* or their habitat, therefore conservation of aquatic habitats and species need to be considered when coastal developments are planned. Maintaining and increasing riparian buffer zones may help alleviate threats. The proposed project presents potential risk to the threatened species as the suitable habitat for the threatened species potentially occurs within the project area, requiring an updated fish assessment with focus on determining their presence.

8 Sensitivities

8.1 Wetland Sensitivity

Several wetland systems are expected to be located within the development footprint area. Furthermore, several IDZ wetland offset areas are located within the development footprint as presented in Figure 8-1. A wetland assessment as part of the RBIDZ feasibility (SIVEST, 2010) noted that the loss of the wetland areas must be looked at holistically in the context of the conservation needs of all the IDZ sites assessed. In response to this, two sites were of distinctly higher quality, namely, IDZ 1C and the western portion of IDZ 1D as they have very high conservation significance and it was felt that these areas should be excluded from any development planning for the area and development should rather be focused on IDZ 1A, 1B, 1F and the eastern portion of 1D. The IDZ 1C and 1D are referred to as potential offset areas.

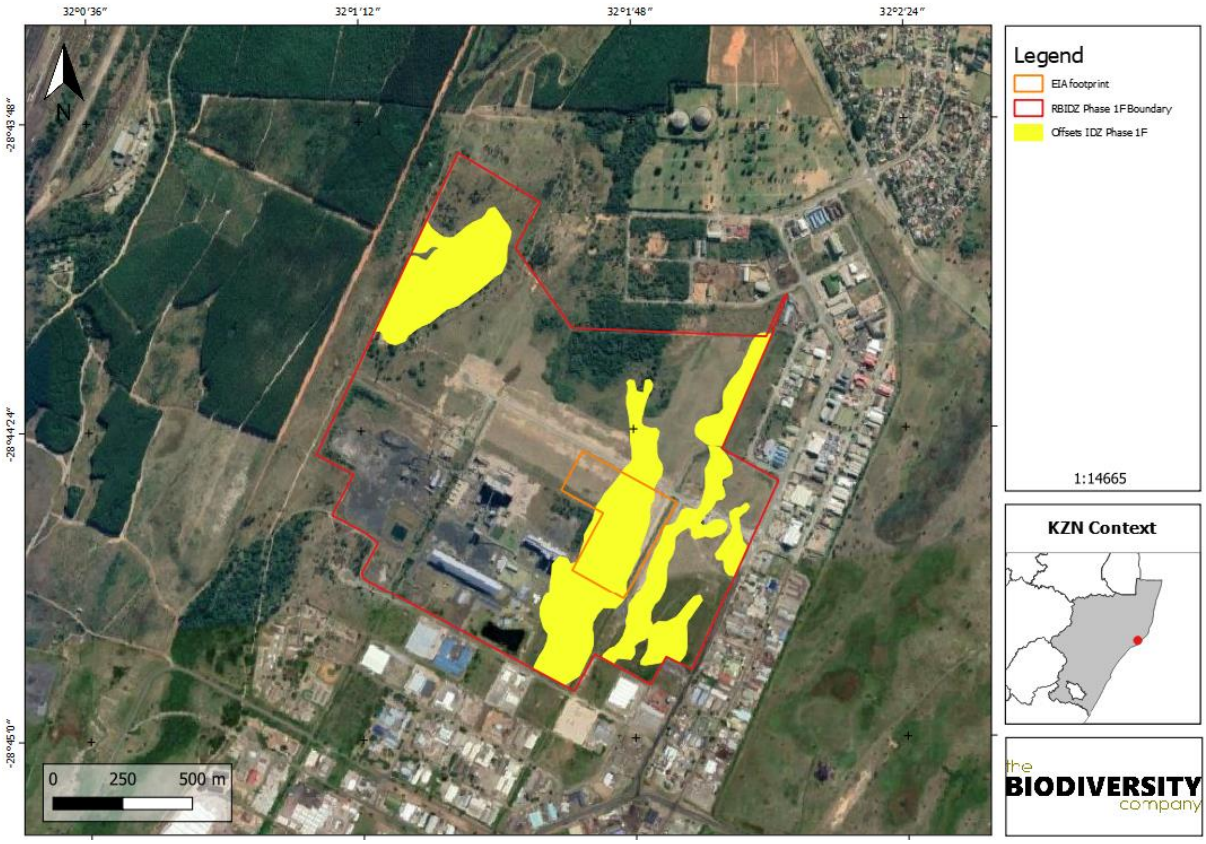


Figure 8-1 Wetland offsets located within the development footprint

8.2 Aquatic Theme Sensitivity

According to the National Web based Environmental Screening Tool the combined aquatic biodiversity for the area is classified as Very High sensitivity (Figure 8-2 and Table 8-1).

Figure 8-2 Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)

Table 8-1 Sensitivity features associated with Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)

Sensitivity	Features
High	Strategic water source area
Very High	Wetlands and Estuaries

Given the extent of wetlands within the project footprint, it is recommended that the wetland sensitivities be considered jointly with the aquatic sensitivities as these systems are interconnected in a hydrological sense. The freshwater ecology of the immediate project area and further downstream is sensitive to disturbance from a hydrological and biological perspective.

8.3 Agricultural Theme Sensitivity

According to the National Web based Environmental Screening Tool the combined agricultural sensitivity for the area is classified as Very High sensitivity (Figure 8-3 and Table 8-2).

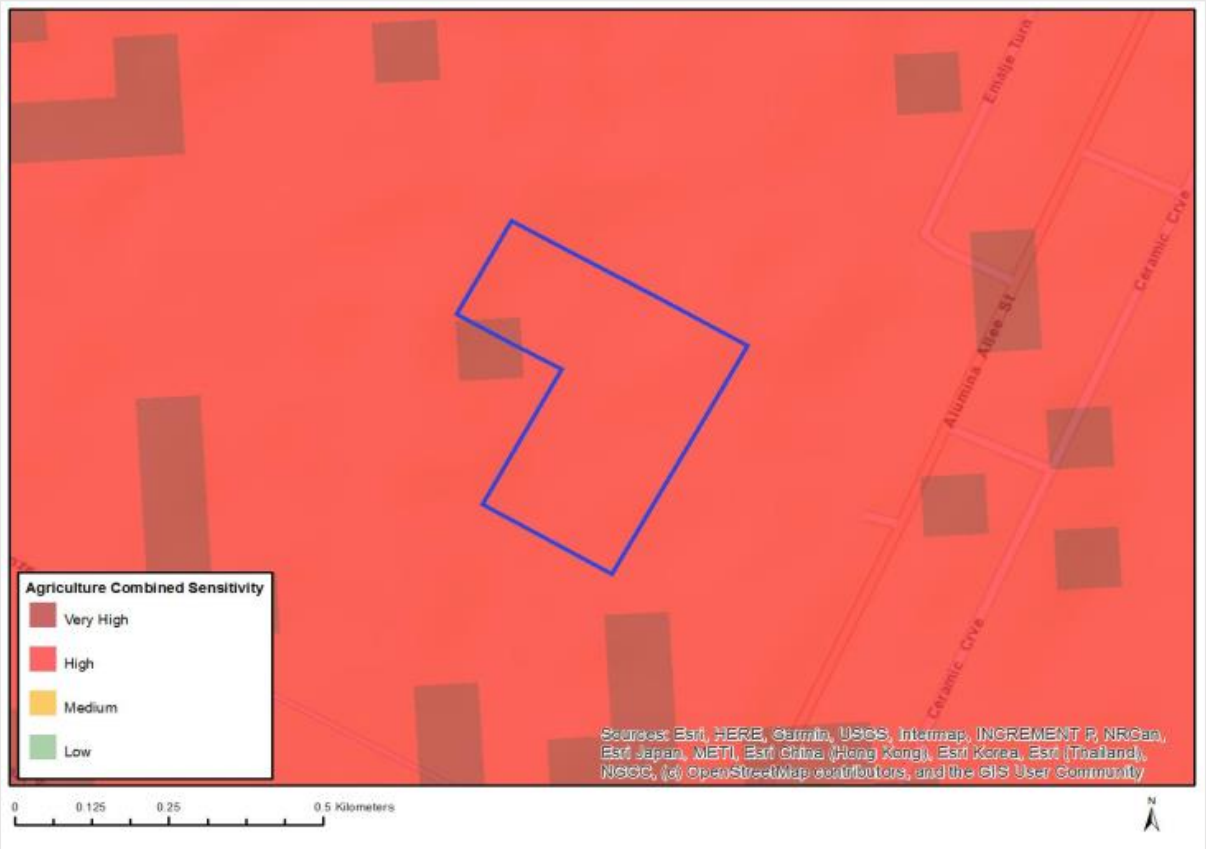


Figure 8-3 Agricultural Combined Sensitivity (National Web based Environmental Screening Tool)

Table 8-2 Sensitivity features associated with Agricultural Combined Sensitivity (National Web based Environmental Screening Tool)

Sensitivity	Features
High	Land capability;09. Moderate-High/10. Moderate-High
Very High	Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high

9 Impact Assessment

Potential impacts were evaluated for the proposed development footprint area. The relevant impacts were then subjected to a prescribed impact assessment methodology. The details of this methodology can be provided on request.

9.1 Current Impacts

The following existing impacts were observed in the Phase 1F project area:

- The existing development within the area has altered the surface flow dynamics through construction of the plant and ancillary infrastructure, creating directional surface run-off across the project area and artificial pooling in some localities (Figure 9-1). Water typically exits a wetland flat through evapotranspiration and infiltration (Ollis *et al.* 2013), which has been inhibited due to the changes in topography and slope for the catchment area (Figure 9-2);

- The removal of vegetation due to historical clearing in sections of the project area, and current development for service infrastructure. Large areas of disturbance and associated erosion scarring is present;
- Historical disturbances and current land uses have likely resulted in the onset and establishment of alien vegetation across the project and offset areas; and
- Industrial activities in the upper reaches of the Eastern unnamed tributary have resulted in the modification of the aquatic environment (class D). Cumulative impacts in the form of a large impoundment have further altered the natural hydrology of the system.

Figure 9-1 Photograph of the EIA footprint area and associated impacts (Savannah, 2020)

Figure 9-2 Satellite imagery of Phase 1F development area and associated impacts A) 7/2016 and B) 7/2020 (Google Earth)

9.2 Potential Impacts and Significance

This section discusses the anticipated impacts associated with the proposed project. While the facility will be connected to a dedicated fuel pipeline, and will have grid connection infrastructure towards connecting with the Eskom substation and the national grid, these

infrastructure components do not form part of this application and are subject to separate authorisation processes.

Table 9-1 Freshwater resource loss / degradation

Impact Freshwater resource disturbance / loss			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Disturbance / degradation / loss to wetland soils or vegetation due to the construction of the facility and associated infrastructure.	Direct impacts: » Disturbance / degradation / loss to wetland soils or vegetation Indirect impacts: » Loss of ecosystem services	Regional	Water resources and buffer area
Increased erosion and sedimentation & contamination of resources	Direct impacts: » Erosion and structural changes to the systems Indirect impacts: » Sedimentation & contamination of wetlands	Regional	None identified at this stage
Spread and/or establishment of alien and/or invasive species	Direct impacts: » Removal of vegetation and establishment of alien vegetation Indirect impacts: » Infestation and establishment of alien vegetation	Local	None identified at this stage
Impaired water quality	Direct impacts: » Contamination of water quality Indirect impacts: » Contamination of water quality	Regional	Water resources and buffer area
Environmental pollution due to increased sedimentation and erosion of watercourses	Direct impacts: » Erosion and structural changes to the systems Indirect impacts: » Sedimentation & contamination of wetlands	Regional	None identified at this stage
Description of expected significance of impact The most notable impact is the expectant loss of some water resources, the desktop wetlands in particular. The loss of wetland is unavoidable with the proposed layout. The proposed layout will also alter the hydro-dynamics of the immediate catchment area. Environmental Authorisation was issued on 27/09/2016 for the construction of the RBIDZ phase 1F for the installation of bulk infrastructure services. A conceptual wetland offset plan was compiled in support of the EA.. The wetland offset strategy must identify and quantify the wetland offset target. The types of offsets available must be described, and options for due consideration in determining the offset provided. A key component of this strategy would be to ensure the securing of the proposed offsite areas by means of proclamation. Approval of the wetland offset strategy is required before construction can be initiated. Additionally, the proclamation is required prior to construction. The destruction of the wetland plants from the proposed wetlands to be removed is irresponsible and senseless. The wetland vegetation and biota must be safely relocated to wetlands earmarked for offsets for the rehabilitation and improvement of the latter systems to promote biodiversity in in offset areas. The primary sources of water for valleyhead seeps and wetland flats is typically precipitation, with the exception of a seep or flat situated on a coastal plain where groundwater may rise to or near the ground surface (Ollis *et al.* 2013). The development of the area will result in a loss of catchment area, thus reducing the amount of run-off sustaining the local systems. It is expected that run-off will be diverted around the working area to separate clean and dirty water, by-passing some wetland systems. The extent of compaction of the area will also reduce the infiltration potential of the area, resulting in a reduction of the shallow recharge area. The expected excavations, shaping and contours will also alter the topography		

of the project area, resulting in changes to the surface flow dynamics across the catchment. The removal of vegetation compounded by the hardening of surfaces will also result in an increase in run-off volumes and velocities for the area.

Water quality alterations are expected during the construction and operational phases of the project. During the construction phase water quality is at risk due to erosion of the area, resulting in sedimentation of the water resources. There is a continuous risk of malfunctioning equipment and machinery, or poorly maintained vehicles that will leak or spill contaminants into the systems. The management and disposal of all forms of waste will be a risk for the duration of the project. During the operational phase of the project, impacts to the water quality due to leaks /spillages, discharge of brine and increased temperatures would need to be managed. According to Böhme (2011), brine discharge has an elevated water temperature with higher salinity than oceanic water. Troublesome chemicals associated with brine discharge are copper and chlorine with the potential for chronic toxicity to aquatic biota for several km's around discharge points. Dirty water may not be permitted for release into the environment.

During the construction phase ideal opportunities are plentiful and conditions optimal for the establishment of alien vegetation in the area. The spread of alien invasive vegetation within the water resources (directly within the project footprint and those nearby) can be exacerbated if not properly managed and may even introduce new alien species to sensitive areas as a result of disturbance.

Construction activities will temporarily denude the vegetation on the site and expose the soils to the erosive elements. Changes in the topography (more slopes) due to the placement of infrastructure and clearing / shaping of areas is also likely to increase the run-off volumes and velocities across the site. Currently the project area is largely flat which could change drastically during and post- construction. This could be exacerbated by the increase in the extent of hardened surfaces (roads, paving, roof tops, etc.). These aspects will all contribute to soil erosion, resulting in the loss of topsoil and formation of erosion gullies. Water resources may become laden with sediment, resulting the loss of habitat and impaired water quality. Sedimentation of these systems will also reduce the holding volume of the systems, possibly reducing the ephemeral lifespan on the wetland systems.

Gaps in knowledge & recommendations for further study

- This is completed at a desktop level only.
- Identification, delineation and characterisation of water resources.
- Undertake a functional assessment of systems where applicable.
- Determine a suitable buffer width for the resources.

Recommendations with regards to general field surveys

- Field surveys to prioritise the development areas, but also consider the 500 m regulation area.
- Beneficial to undertake fieldwork during the wet season period.

Table 9-2 Loss of land capability

Impact Loss of land capability			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Compaction/soil stripping/transformation of land use which leads to loss of land capability	Direct impacts: » Loss of soil / land capability Indirect impacts: » Loss of land capability	Regional	None identified at this stage
Description of expected significance of impact The stripping of topsoil will result in a loss of soil. The extent of the footprint area is to be developed, and the agricultural potential of the area will be permanently altered. The land use will also be permanently altered to represent a transformed or developed land use classification.			

The removal of soils and development of the area will result in soils being replaced, with constructed areas concrete (compacted) for the footprint area. This will result in a loss of infiltration, and a n increase on surface stormwater to be managed for the area.
Gaps in knowledge & recommendations for further study » This is completed at a desktop level only. » Identification and delineation of soil forms. » Determine of soil sensitivity. **Recommendations with regards to general field surveys** » Field surveys to prioritise the development areas.

10 Plan of Study

10.1 Wetland Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- South African Inventory of Inland Aquatic Ecosystems (Van Deventer *et al*., 2019);
- The National Freshwater Ecosystem Priority Areas (Nel *et al*., 2011);
- Contour data (5m); and
- NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data.

10.1.1 Wetland Identification and Mapping

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

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in *Figure 10-1*. The outer edges of the wetland areas were identified by considering the following four specific indicators:

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

- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

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

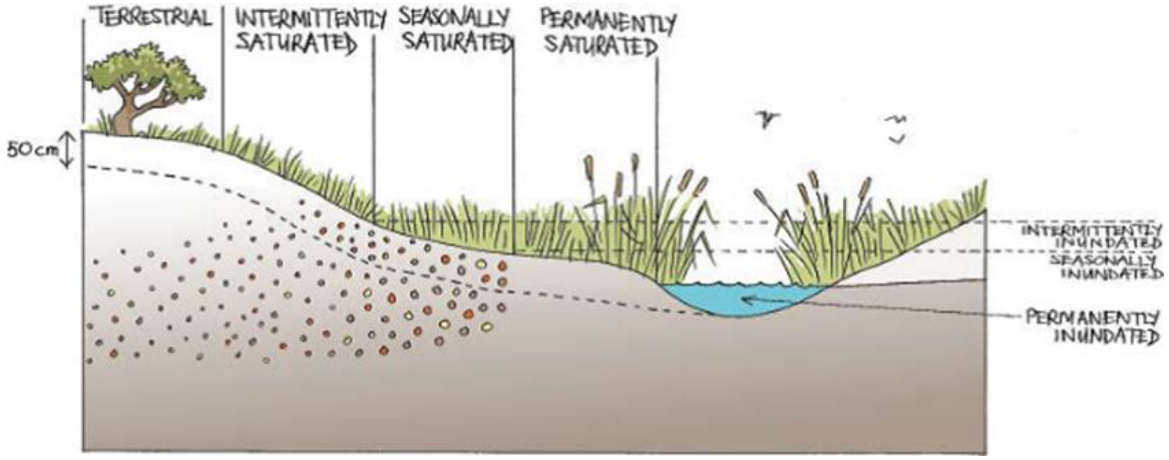


Figure 10-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al., 2013).

10.1.2 Present Ecological Status

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 10-1.

Table 10-1 The Present Ecological Status categories (Macfarlane et al., 2009)

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

10.1.3 Importance and Sensitivity

The importance and sensitivity of water resources is determined to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category, as listed in Table 10-2 (Rountree and Kotze, 2013).

Table 10-2 Description of Ecological Importance and Sensitivity categories

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

10.2 Aquatic Assessment

Methodologies applied for the proposed study were selected in accordance to the aquatic system type. Therefore, freshwater wetland and riverine assessment were utilised. The downstream areas were determined to be within the functional estuary zone and therefore was not considered in this assessment.

10.2.1 Permanent Freshwater Wetlands

10.2.1.1 Water Quality

Water quality was measured *in situ* using a handheld calibrated Extech ExStik II meter. The constituents considered that were measured included: conductivity (µS/cm), temperature (°C) and Dissolved Oxygen (DO) in mg/l.

10.2.1.2 Aquatic Invertebrates

Live sampling was performed as adapted from Ferreira et al. (2012). The sampling for macroinvertebrates was performed using a standard sweep net of 500 µm mesh. Sweeps were performed for each of the type of substrate found in each waterbody which can include stones, gravel, sand and mud. The length of time the kick and sweep method was applied per substrate type was dependent on the size of substrate per waterbody. The size and diversity of the various substrates was rated and ranked in order to provide an indication of its suitability to support aquatic macroinvertebrate life. Sweeps of vegetation was performed for both marginal and submerged vegetation; the length of vegetation sampled was determined by the amount of vegetation present in each waterbody, and the vegetation was ranked and rated in order to give an indication of the suitability of vegetation biotopes for aquatic macroinvertebrates.

10.2.1.3 Fish Assessment

A basic qualitative fish assessment in the freshwater wetland systems was conducted utilising a Haltech Electoshocker. Fish species were identified and released at the point of capture.

10.2.2 River Systems

10.2.2.1 Water Quality

Water quality was measured *in situ* using a handheld calibrated Extech ExStik II meter. The constituents considered that were measured included: conductivity (µS/cm), temperature (°C) and Dissolved Oxygen (DO) in mg/l.

10.2.2.2 Aquatic Habitat Integrity

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 were used to define the ecological status of the river reach.

The IHIA model was used to assess the integrity of the habitats from a riparian and instream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996). The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 10-3 and Table 10-4 respectively.

Table 10-3 Criteria used in the assessment of habitat integrity (from Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of high flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al*., 1993 in: DWS, 1999). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993 in: DWS, 1999) is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al*., 1992 in DWS, 1999).
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.

Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

The assessment of the severity of impact of modifications is based on six descriptive categories which are described in Table 10-4.

Table 10-4 Descriptive classes for the assessment of modifications to habitat integrity (from Kleynhans, 1996)

Impact Category	Description	Score
None	No discernible impact, or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	**0**
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	**1 - 5**
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	**6 - 10**
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	**11 - 15**
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	**16 - 20**
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	**21 - 25**

10.2.2.3 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al*., 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al*., 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

10.2.2.3.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al*. 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Natal Coastal Plain (Figure 10-2).

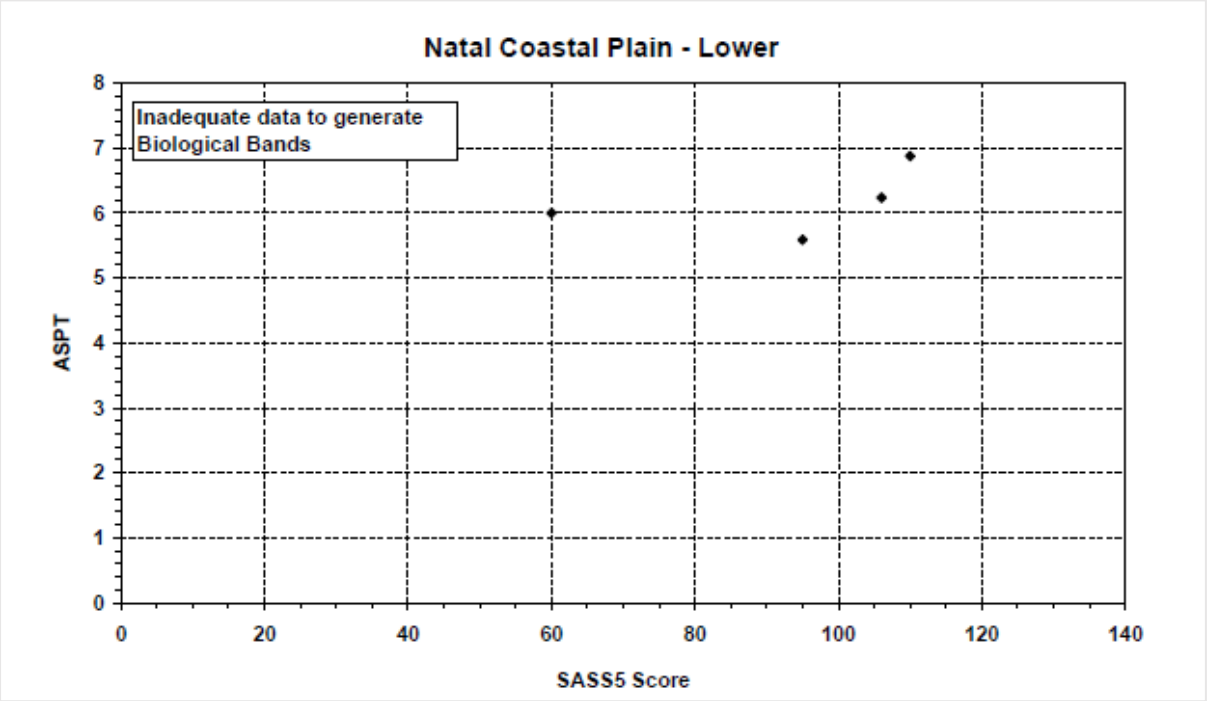


Figure 10-2 Guidelines used for the interpretation and classification of the SASS5 scores (Dallas, 2007)

10.2.2.3.2 Macroinvertebrate Response Assessment Index

The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the SQR. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and
- Energy inputs from the watershed Riparian vegetation assessment.

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the PES.

10.2.2.4 Fish Assessment

A basic fish community assessment was conducted at the freshwater sites. The estuary was not considered in this assessment. A qualitative fish survey was conducted whereby the timed sampling of a river reach was conducted using a Haltech Electroshocker.

10.2.2.5 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For the purpose of this study

ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river ecoclassification manual by Kleynhans and Louw (2007).

10.3 Determining Buffer Requirements

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane *et al*., 2014) was used to determine the appropriate buffer zone for the proposed activity.

10.4 Soil

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types.

10.4.1 Agricultural Potential Assessment

Land capability and agricultural potential is determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes (Smith B. , 2006)

Land capability is divided into eight classes and these may be divided into three capability groups. shows how the land classes and groups are arranged in order of decreasing capability and ranges of use Table 10-5. The risk of use increases from class I to class VIII (Smith, 2006).

Table 10-5 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing Land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife

W - Wildlife	MG - Moderate Grazing	MC - Moderate Cultivation
F- Forestry	IG - Intensive Grazing	IC - Intensive Cultivation
LG - Light Grazing	LC - Light Cultivation	VIC - Very Intensive Cultivation

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 10-6. The final land potential results are then described in Table 10-7.

Table 10-6 The combination table for land potential classification

Land capability class	Climate capability class							
	C1	C2	C3	C4	C5	C6	C7	C8
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 10-7 The Land Potential Classes.

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable

10.4.2 Current Land Use

Land use was identified using aerial imagery and then ground-truthed while out in the field. The possible land use categories are:

- Mining;
- Bare areas;
- Agriculture crops;
- Natural veld;
- Grazing lands;
- Forest;
- Plantation;
- Urban;
- Built-up;
- Waterbodies; and
- Wetlands.

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12 Appendices

12.1 Appendix A - Specialist declarations

DECLARATION

I, Dale Kindler, declare that:

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

Dale Kindler

Aquatic Ecologist

The Biodiversity Company

March 2021

DECLARATION

I, Andrew Husted, declare that:

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

Andrew Husted

Freshwater Ecologist

The Biodiversity Company

March 2021