DRAFT ENVIRONMENTAL IMPACT ASSESSSMENT

DRAFT ENVIRONENTAL IMPACT ASSESSMENT REPORT:

Proposed Gas to Power via Powership Project at Port of Richards Bay, uMhlathuze Local Municipality, KwaZulu-Natal

DEFF REF NO: 14/12/16/3/3/2/2007

A Project of Karpowership SA (PTY) Ltd

February 2021

KARPOWERSHIP

triplo4 sustainable solutions

DOCUMENT DESCRIPTION

Applicant:	Karpowership SA (Pty) Ltd
Report name:	Draft Environmental Impact Assessment Report for the Proposed Gas to Power via Powership, Port of Richards Bay, KZN
Report type:	Draft Environmental Impact Assessment Report
Project name:	Proposed Gas to Power via Powership, Port of Richards Bay, KZN
Project number:	E-BL01.200446
Authority Reference:	DEFF REF NO: 14/12/16/3/3/2/2007
Version:	Original

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EXECUTIVE SUMMARY

The proposed **Gas to Power Powership Project at the Port of Richards Bay** has been formulated in response to the *Request for Proposals (RFP) for New Generation Capacity under* the *Risk Mitigation IPP Procurement Programme* issued by the Department of Mineral Resources and Energy to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The "*Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National*" has also been designated the status of a Strategic Integrated Project (SIP) under the Infrastructure Development Act, 2014 by the Presidential Infrastructure Coordinating Commission. SIPs are considered to be projects of significant economic or social importance to South Africa as a whole or regionally that give effect to the national infrastructure plan and for this reason, can be expeditiously implemented through the provisions of the enabling Act. At the time of this report, the preferred bidder status had not been confirmed.

The Karpowership project will generate electricity from two floating mobile Powerships moored in the Port of Richards Bay. Three ships will be berthed at any one time, during the project's 20 year lifespan (as per the RMIPPPP requirements) - a Floating Storage Regasification Unit (FSRU) and two Powerships. A Liquefied Natural Gas Carrier will supply the Liquefied Natural Gas (LNG) to the FSRU over a 1-to-2 day period approximately every 20 to 30 days. The LNG is then converted to Natural Gas (NG) and pumped from the FSRU to the Powership via a gas pipeline. The proposed design capacity for the Powerships is 540MW, which comprises 27 gas reciprocating engines having an approximate heat input of over 10MW each. The three steam turbines have a heat input of 15.45MW each. The power that is generated is then converted by the on-board High Voltage substation and the electricity evacuated via a 132kV transmission line over a distance of approximately 3km to the tie in point to the Eskom line, at a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds into the national grid.

In terms of alternatives, two alternative mooring sites for the Powerships were considered. The first option is to position the two Powerships in a closer position to the transmission line on land. The second is to position the two Powerships further away from the land and the connection to the transmission line. The depth of the water in which the ships will be positioned is approximately 14m. The gas pipeline that connects from the FSRU to the Powerships will be routed along the seabed and the length of the pipeline route alternatives is dependent on the positions of the Powership alternatives. From the Powerships, a transmission line will connect to a proposed switching station and into the national grid. Two alternatives were assessed for the transmission line route.

The Project triggers a number of activities listed under the National Environmental Management Act 107 of 1998 (NEMA) which require environmental authorisation prior to commencement. Because these listed activities include activities described in the Environmental Impact Assessment (EIA) Regulations Listing Notice 2 of 2014 (as amended), the process that is required to be applied to the application for environmental authorisation is Scoping and Environmental Impact Reporting (S&EIR). The procedural requirements for S&EIR are set out in the EIA Regulations, 2014 (as amended).

Scoping has already been concluded with the acceptance of the Scoping Report, including the plan of study for the EIA by the competent authority, namely the Department of Environment, Forestry and Fisheries (DEFF) on 6 January 2021. This draft EIA Report is part of the EIR phase and has been distributed for comment for a 30-day period as part of the public participation process.

The objectives of the EIA process is, through a consultative process with Interested and Affected Parties (I&APs), including relevant organs of state, to:

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;
- identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the biophysical, social, economic, heritage and cultural aspects of the environment;
- determine the-
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts can be reversed; may cause irreplaceable loss of resources, and can be avoided, managed or mitigated;
- identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;
- identify suitable measures to avoid, manage or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

The EIA process, including public participation, and findings are reported on in the draft EIA Report, in particular, Sections 7, 8 and 9.

Once the public participation process has been concluded, the draft report will be revised taking into consideration the I&APs' comments. The Final EIA Report will then be submitted to DEFF for consideration, and a decision either to grant or refuse environmental authorisation will be made. All registered I&APs will be notified of this decision and of their opportunity to appeal.

The following issues and potential impacts have been identified and assessed in respect of the various alternatives in the EIA:

- Powerships and FSRU and Liquefied Natural Gas Carrier (LNGC)
  - Disturbance to marine habitat;
  - Disturbance to the sediment from mooring infrastructure;
  - Reduction in ambient air quality from increased atmospheric emissions;
  - Safety risk from potential leakage of LNG;

- Safety risk of storage of NG within the Port;
    - Increase in noise pollution;
    - Change in water temperature
    - Provision of additional electricity;
    - Contributions to climate change;
    - Socio-economic impacts;
    - Marine traffic congestion and accidents;
- Gas Pipeline
    - Disturbance to marine and estuarine habitat;
    - Impact on coastal environment; and
    - Potential leakage of LNG.
- Transmission Line, Switching Station and Temporary laydown area for gas pipeline installation
    - Impacts on indigenous vegetation and species of conservation concern;
    - Disturbance to the terrestrial ecosystem;
    - Impacts on fauna and avifauna;
    - Altered hydrology and geohydrology;
    - Impact on aquatic system;
    - Increase in noise pollution;
    - Change in hydropedological processes;
    - Destruction of wetlands, watercourses, estuarine areas;
    - Destruction of cultural heritage and palaeontological resources;
    - Disturbance to properties and existing services; and
    - Provision of additional electricity.

The assessment was conducted with specialists' input, and includes the identification of mitigation measures and an evaluation of their effectiveness. These assessment findings are used to determine the preferred alternatives and provides the basis for the EAP's opinion as to whether the proposed activity should be authorised or not, and if so, the conditions that should be made in respect of such authorisation. Should authorisation be granted, the applicant will need to comply with the Environmental Management Programme (EMPr) when implementing the project, which contains *inter alia* the proposed impact assessment outcomes and actions (mitigation measures) and monitoring and auditing requirements.

For ease of reference:

- The EIA process, methodology and findings are contained in Chapter 8.
- The specialist reports are contained in Appendix I:
    - Terrestrial Ecology Assessment
    - Heritage and Palaeontology Impact Assessment
    - Wetland Rehabilitation Plan
    - Wetland Delineation and Functional Assessment
    - Geohydrological Assessment
    - Hydrological and 1:100 year Floodline Assessment
    - Aquatic Assessment
    - Hydropedology Assessment
    - Avifaunal Assessment
    - Estuarine and Coastal Assessment

- Marine Ecology Assessment
    - Atmospheric Impact Assessment
    - Climate Change Impact Assessment
    - Major Hazard Installation Risk Assessment
    - Socio-Economic Assessment
    - Noise Impact Assessment
- Further technical reports are contained in Appendix J.
- The EAP's opinion is provided in Chapter 9.2.
- The Environmental Management Programme is contained in Appendix G

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. The preferred positions alternative for the Powerships is supported from the engineering design perspective, as the Powerships are positioned within the dead-end basin adjacent to the break bulk quay /multi-purpose terminal, and thus located closer to the first tower of the transmission line, positioned on the main land 'promontory' adjacent to the large mangrove stand, and positioned further away from the sensitive sand bank (a 200m offset from the water line to the moored vessels maintained). This alternative position was approved by TNPA in Richards Bay for the power barges in the 2015 study, and thus in line with their port planning. This alternative was also assessed by the specialists and no fatal flaws were identified.

A subsea gas pipeline is proposed to be installed along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powerships to ensure gas supply for power generation. The preferred route alternative for the gas pipeline is directly influenced by the preferred position of the Powerships in relation to the position of the FSRU. The route is approx. 1700 meters in length, and is preferred from an engineering perspective, as it is in line with the preferred position of the Powerships and the FSRU within the port, positioning the Powerships in closer proximity to the land and the transmission line. From the marine ecology perspective, both alternatives for the gas pipeline route were assessed to have the same impacts during the operational phase, and no fatal flaws were identified by the other specialists.

The power from the Powership will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powership to the National Grid utilising the existing Impala – Bayside network via a proposed new 132kV on shore switching station. The preferred transmission line route runs from the moored Powerships to the first tower, then towards the existing Harbour arterial road, crossing the road and towards the existing powerline servitude to the west through crossing of an open grassland/scrubland and unchannelled valley bottom wetland, then running along the exiting servitude along Manzamnyama Canal, before heading north and finally in a westerly direction before reaching its end point. The location of the route is in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude. The existing servitude will be used for access for the majority of this route, and an additional access / working servitude will be required between the port and the Manzamynama Canal as well as from the start point to the Harbour arterial road. Relevant specialists' studies, including the terrestrial and wetland assessments, are in support of the preferred transmission line route.

The Powership engine technology provides for dual fuel usage and is capable of utilizing both Liquid Natural Gas (LNG) and Heavy Fuel Oils (HFO) as primary fuel sources. As indicated in the accepted Final Scoping Report, the HFO is not being considered further as an alternative fuel due to the significant advantages of the LNG. The operating fuel for power generation will be from LNG only and will not consume HFO for any part of the generation process. All relevant licenses, permits and approvals are for the consumption and use of LNG only. Relevant Specialists' studies had assessed the fuel alternatives and identified that the use of LNG will have less potential impacts than the HFO, in terms of impacts on air quality and the marine environment.

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country and will not contribute further to the local economy by provide employments opportunities. From the environmental perspective, the specialists hadn't identified any fatal flaws in authorising the proposed project, and mitigation measures were provided to manage identified impacts.

From a socio-economic perspective, when compared with the no-go option – which entails the Powerships and their associated infrastructure not being deployed, and none of the positive or negative impacts identified arising– the proposed project is associated with greater socio-economic benefits and should be authorised, hence the "no-go" alternative is not the preferred alternative.

Based on the findings of the independent specialist studies, the proposed project will not result in significant negative environmental or social impacts provided the mitigation measure recommended by the EAP and specialists, as contained in Section 8 of the draft EIA report and the Environmental Management Programme (EMPr) are implemented. The proposed project will also have significant positive socio-economic impacts. It is thus the reasoned opinion of the EAP that the proposed 540MW Gas to Power Powership Project, should be authorised subject to the conditions proposed in Section 9.2, which include compliance with the EMPr.

The same EIA process meets the requirements for an application for an atmospheric emission licence (AEL) required for a Listed Activity under GN 893 of 22 November 2013 (as amended) in terms of Section 21 of the National Environmental Management: Air Quality Act 39 of 2004: Sub-category 1.5: Reciprocating Engines. The Powerships will have in total 27 gas reciprocating engines each with an approximate heat input of over 10MW. The findings in the EIA Report will be used by the licensing authority, also DEFF, to decide on the application for the AEL. Again, registered I&APs will be notified of DEFF's decision on the AEL and their opportunity to appeal.

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List of Abbreviations

AHT	Anchor Handling Tug
BID	Background Information Document
BOG	Boil Off Gas
CBAs	Critical Biodiversity Areas
CWDP	Coastal Waters Discharge Permit
dB	Decibel
DAFF	Department of Agriculture, Forestry and Fisheries
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DEFF	Department of Environment, Forestry and Fisheries
DFP	Development Framework Plan
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DOT	Department of Transnet
DWAF	Department of Water Affairs and Forestry
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EMS	Environmental Management Systems
G2P	Gas to Power
GG	Government Gazette
GN	Government Notice
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IEP	Integrated Energy Planning
IUCN	International Union for Conservation of Nature
IRT	Issues and Response Trail
MPA	Marine Protected Area
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:ICMA	National Environmental Management: Integrated Coastal Management Act
NERSA	National Energy Regulator South Africa
NGO	Non-Governmental Organisations
NFEPA	National Freshwater Ecosystems Priority Areas
NIRP	National Integrated Resource Planning
NWA	National Water Act
OCIMF	Oil Companies International Marine Forum
PLEM	Pipeline end manifold
PoS	Plan of Study

PPP	Public Participation Process
RMIPPPP	Risk Mitigation Independent Power Producer Procurement Programme
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SIGTTO	Society of International Gas Tanker and Terminal Operator
STS	Ship to Ship
TOR	Terms of Reference
TPNA	Transnet National Ports Authority

THIS REPORT WAS COMPILED BY TRIPLO4 SUSTAINABLE SOLUTIONS (PTY) LTD IN TERMS OF APPENDIX 3 OF THE EIA REGULATIONS, 2014 (GNR 982 (AS AMENDED))

1 INTRODUCTION

1.1 Project Title

The draft Environmental Impact Assessment Report for the Proposed Gas to Power via Powership at Port of Richards Bay, uMhlathuze Local Municipality, King Cetshwayo District Municipality, KwaZulu-Natal.

1.2 Background

Triplo4 Sustainable Solutions (Pty) Ltd has been appointed by Karpowership SA (Pty) Ltd (Karpowership) to undertake the environmental impact assessment (EIA) and manage the application for environmental authorisation for the proposed Gas to Power Powership Project at the Port of Richards Bay located within Ward 2 of the uMhlathuze Local Municipality, KwaZulu-Natal. The competent authority responsible for evaluating and deciding on the application for environmental authorisation is the Department of Environment, Forestry & Fisheries (DEFF). The same EIA will inform Karpowership's application for an atmospheric emission licence (AEL). The licensing authority for the AEL is also DEFF, although a different branch within the Department. The Port is state-owned and managed by Transnet National Ports Authority (TNPA) in a landlord capacity.

The applicant is Karpowership SA Pty Ltd, a South African company with 51% owned by Karpowership, a member of Karadeniz Energy Group, Istanbul, Turkey which owns, operates and builds Powerships (floating power plants). Since 2010, 25 Powerships have been completed with total installed capacity exceeding 4,100 MW globally and an additional 4,400 MW of Powerships either under construction or in the pipeline.

Karpowership proposes to locate a Powership project at the Port of Richards Bay to generate electricity from natural gas and evacuate the electricity through a transmission line to a substation linking to the national grid. Three ships will be berthed at any one time - a Floating Storage Regasification Unit (FSRU) and two Powerships. A Liquefied Natural Gas Carrier will supply the Liquid Natural Gas (LNG) to the FSRU over a one to two day period approximately every 20 to 30 days. The natural gas (NG) will be pumped from the FSRU to the Powership via a gas pipeline.

The proposed design capacity for the Richards Bay Powership project is 540MW, which comprises of 27 gas reciprocating engines having an approximate heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The power that is generated is then converted by the on-board High Voltage substation and the electricity evacuated via a 132kV transmission line over a distance of approximately 3 km from the Richards Bay Port tie in point to the Eskom line, at a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds into the national grid.

The proposed project is situated within the Port of Richards Bay, and in proximity to the Richards Bay Industrial Development Zone (RBIDZ), which was designated Special Economic Zone (SEZ) status in July 2017 in terms of the Special Economic Zones Act 16 of 2014. An SEZ is an economic development tool developed to promote national economic growth and export by using support measures in order to attract targeted foreign and domestic investments and technology, and includes industrial development zones as a category.

The proposed Project has been formulated in response to the Request for Proposals (RFP) for New Generation Capacity under the Risk Mitigation IPP Procurement Programme issued by the Department of Mineral Resources and Energy to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The RFP stipulates stringent environmental, social and economic criteria, for example, the shift from coal and LPG to NG as a cleaner and more cost effective resource, BBBEE criteria and skills development. The "*Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National*" has also been designated the status of a Strategic Integrated Project (SIP) under the Infrastructure Development Act, 2014 by the Presidential Infrastructure Coordinating Commission. SIPs are considered to be projects of significant economic or social importance to South Africa as a whole or regionally that give effect to the national infrastructure plan and for this reason, can be expeditiously implemented through the provisions of the enabling Act. At the time of this report, the preferred bidder status had not been confirmed.

In terms of where Karpowership is in the EIA process, Scoping which was the first phase, has already been concluded with the acceptance of the Scoping Report, including the plan of study for the EIA by DEFF on 6 January 2021. This draft EIA Report is part of the second phase, the EIA and has been distributed for comment as part of the public participation process.

Once the public participation process has been concluded, the draft report will be revised taking into consideration I&APs' comments. The Final EIA Report will then be submitted to DEFF for consideration, and a decision either to grant or refuse environmental authorisation will be made. All registered I&APs will be notified of this decision and their opportunity to appeal.

1.3 Summary of "Environmental Licensing" Requirements

Prior to the commencement of the proposed Gas to Power Project at Port of Richards Bay Project, the following key "environmental licences" are required from the following competent authorities, namely:

- Environmental authorisation from the Department of Environment, Forestry & Fisheries (DEFF) in terms of the National Environmental Management Act 107 of 1998 (NEMA), the EIA Regulations, 2014 (as amended) and the EIA Regulations Listing Notices 1, 2 and 3 (as amended).
- An atmospheric emission licence (AEL) in terms of the National Environmental Management: Air Quality Act 39 of 2004) (NEM:AQA). The licensing authority is also DEFF, but a separate Branch within the same Department.
- A water use licence (WUL) from the Department of Human Settlements, Water and Sanitation (DHSWS) in terms of the National Water Act 36 of 1998 (NWA) and the Water Use Licence Applications and Appeals Regulations, 2017.

The draft EIA Report (this report) supports the applications for environmental authorisation and an AEL. A separate application and reporting process is followed for a WUL in terms of the NWA and the Water Use Licence Applications and Appeals Regulations, 2017.

1.4 Purpose of this Report

2014 NEMA EIA Regulations (as amended), Appendix 3.2: the objective of the environmental impact assessment process is to, "through a consultative process:

a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;
c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
d) determine the –
    i. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    ii. degree to which these impacts—
        aa) can be reversed;
        bb) may cause irreplaceable loss, of resources, and
        cc) can be avoided, managed or mitigated;
e) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;
f) identify assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;
g) identify suitable measures to avoid, manage or mitigate identified impacts; and
h) identify residual risks that need to be managed and monitored.

The draft EIA Report documents the findings of the EIA as per the reporting requirements of the EIA Regulations, 2014 (as amended).

1.5 Independent Environmental Assessment Practitioner

2014 NEMA EIA Regulations (as amended), Appendix 3. 3. (1) (a) An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (a) details of—(i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;

Please see Appendix E for EAP Declaration and full Curriculum Vitae.

EAP	Triplo4 Sustainable Solutions
EAP	Mrs Hantie Plomp
Educational qualifications	Masters in Environmental Management
Professional Registrations	EAPASA; SACNASP; AP with GBCSA

EAP	Triplo4 Sustainable Solutions
Voluntary Memberships	IAIAsa; IWMSA; IODSA, WISA
Experience at environmental assessments (yrs.)	> 20 Years
Postal Address	P.O. Box 6595 Zimbali, 4418
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Email Address	pppRichards Bay.triplo4@gmail.com
Assisted by:	Mrs Chen Read
Educational qualifications	Postgraduate Diploma in Environmental Management
Voluntary Memberships	*EAPASA;* AP with GBCSA
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>9 years
Assisted by:	Ms. Shanice Singh
Educational qualifications	Honours in Environmental Management
Professional Registrations	*EAPASA*
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>5 years
Assisted by:	Mr Zayd Hoosen
Educational qualifications	MSc Environmental Sciences
Professional Registrations	SACNASP (*Pri.Sci.Nat*)
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>6 years

Table 1-1: Independent EAP Details

1.6 Specialist Studies

Specialist studies have been undertaken to inform the EIA process. The specialist studies involved the gathering of baseline data (desktop and site visit, where applicable) relevant to identifying and assessing environmental, socio-economic and heritage impacts that may occur as a result of the proposed project. Specialists have also recommended mitigation measures to minimise potential impacts or optimisation measures to enhance potential benefits as well as monitoring requirements, where necessary. These findings and recommendations have been incorporated into the assessment (Section 8) and the EMPr. The methodologies applied to each specialist study are described in the specialist reports attached as appendices to this EIR and EMPr. The specialists and technical experts who provided input to the EIA process are listed in the Table 1-2.

Specialist Field	Company & Specialist
Wetland Delineation and Functionality	*Triplo4 - Mr. Suheil M Hoosen*
Wetland Rehabilitation Plan	*Triplo4 - Mr. Suheil M Hoosen*
Terrestrial Ecology	*Ms Leigh Anne de Wet Ecologist*
Avifauna	*Ms Leigh Anne de Wet*
Heritage & Palaeontology	*Umlando - Mr. Gavin Anderson*
Estuarine and Coastal	*GroundTruth - Ms Catherine Meyer &* *Coastwise Consulting -Ms Tandi Breetzke*
Climate Change	*Themis - Mr. Luke Moore & Mr. Daniel Winshia*
Geohydrology	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Hydropedology	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Hydrology (incl. 1:100 Year Floodline)	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Aquatic	*GCS Water and Environmental Consultants - Ms Karin Lukes & Mr. Gareth Preen*
Major Hazard Installation Risk Assessment	*Occutech cc - Mr. Harold Gaze*
Marine Ecology	*Lwandle - Dr Robin Carter & Ms Laura Weston*
Air Quality	*uMoya-Nilu - Dr Mark Zunckel*
Socio-Economic	*Urban-Econ - Mr. Eugene de Beer*
Noise	*Safetech - Dr Brett Williams*
Technical expertise	**Company & Expert**
Thermal Plume & Marine Traffic	*PRDW – Mr Warwick Donaldson & Mr Derek Paul*
Power Evacuation Routes	*SIRIS – Dr. Kishoor Pitamber*
Greenhouse Gas Emissions	*Southern Cross Capacitating Corporation (Pty) Ltd*
Geotechnical	*Geosure – Mr A. Ramroop*
Water Balance	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*

Table 1-2: Details of Specialist and Technical Team

1.7 EIAR Requirements as per EIA Regulations 2014 (as amended)

Table 1-2 outlines the reporting requirements of the Environmental Impact Assessment Report as per the NEMA EIA Regulations, 2014 (as amended). Appendix 3 (3) requires that "[a]n environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include…" the information outlined in Table 1-3 below. This includes the information elicited through the Public Participation Process (PPP) prescribed by Regulations 39 to 44 of the EIA Regulations, 2014 (as amended) and described in Chapter 7 of the EIA Report.

Relevant section in GNR. 982	Requirement description	Relevant section in this report

(a) Details of-	(i) The EAP who prepared the report; and	Section 1.5
	(ii) The expertise of the EAP, including a curriculum vitae;	Appendix E
(b) The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including -	(i) The 21 digit Surveyor General code of each cadastral land parcel;	Section 2.3
	(ii) Where available, the physical address and farm name;	
	(iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale	(i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	Section 2.3 & Appendix A and B
	(ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d) A description of the scope of the proposed activity, including	(i) All listed and specified activities triggered and being applied for;	Section 2.2
	(ii) A description of the activities to be undertaken, including associated structures and infrastructure;	Section 2.1
(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 5
(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report	Section 6
(g)	motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	
(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	(i) details of the development footprint alternatives considered;	Section 3
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 7 and Appendix D
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 7 and Appendix D
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 4

	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts— (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 8.4
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 8 2
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8.4
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 8.4 and Appendix G
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Not Applicable
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report	Section 9
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 8 and Appendix I
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	
(j) an assessment of each identified potentially significant impact and risk, including—	(i)cumulative impacts;	Section 8.4 and Appendix I
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	

	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	vii) the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report	Section 8 and Appendix I
(l) an environmental impact statement which contains	(i) a summary of the key findings of the environmental impact assessment	Section 8 and 9
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and	Appendix A – Site Plans
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 8.4
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 8.6
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 9
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 9
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 8.8
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 9
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Not Applicable
(s) An undertaking under oath or	(i) The correctness of the information provided in the report;	Appendix E - Declaration
	(ii) The inclusion of comments and inputs from stakeholders and interested and affected parties; and	

affirmation by the EAP in relation to -	(iii) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	Not applicable
(u) an indication of any deviation from the approved scoping report, including the plan of study, including	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	Section 8.7
	(ii) a motivation for the deviation	
(v)	any specific information that may be required by the competent authority; and	Appendix F - DEFF Correspondence
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable
(2)	Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.	Appendix I – Specialists considered relevant Environmental Themes. Appendix G – Transmission Line EMPr.

Table 1-3: Prescribed contents of the Environmental Impact Assessment Report (Appendix 3 of the EIA Regulations, 2014)

1.8 Report Structure

The EIA Report has been structured as follows –

- Executive summary
- Section 1 – Introduction
- Section 2 – Project Description: Provides a description of the proposed development, the properties on which the development is to be undertaken and the location of the development on the property. The technical details of the project are also provided in this Chapter.
- Section 3 – Alternatives:
- Section 4 – Description of Environment: Provides a brief overview of the bio-physical, Heritage and socio-economic characteristics of the site and its environs that may be affected by the proposed development, compiled largely from published information, but supplemented by information from site visits.
- Section 5 – Policy and Legislative Framework: Identifies all the legislation and guidelines that have been considered in the preparation of the EIR and project compliance.
- Section 6 – Motivation, Need and Desirability.
- Section 7 – Public Participation Process

- Section 8 – Environmental Impact Assessment
- Section 9 – Concluding Statement and Recommendations
- Section 10 - References: Cites any texts referred to during preparation of this report.
- Appendices: Containing all supporting information, including specialist studies, public participation record and EMPr.

2 DESCRIPTION OF THE PROPOSED ACTIVITY

2014 EIA Regulations (as amended), Appendix 3 – 3(d) (ii) a description of the activities to be undertaken, including associated structures and infrastructure.

2.1 Description of the Activities to be Undertaken Including Associated Structure and Infrastructure

The Karpowership project generates electricity from two floating mobile Powerships moored in the Port of Richards Bay. Three ships will be berthed at any one time, during the project's 20 year lifespan (as per the RMIPPPP requirements) - a Floating Storage Regasification Unit (FSRU) and two Powerships. A Liquefied Natural Gas Carrier will supply the Liquefied Natural Gas (LNG) to the FSRU over a 1-to-2 day period approximately every 20 to 30 days. The LNG is then converted to Natural Gas (NG) and pumped from the FSRU to the Powership via a gas pipeline. The proposed design capacity for the Powerships is 540MW, which comprises 27 gas reciprocating engines having an approximate heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The power that is generated is then converted by the on-board High Voltage substation and the electricity evacuated via a 132kV transmission line over a distance of approximately 3km to the tie in point to the Eskom line, at a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds into the national grid.

The project is anticipated to make a notable contribution towards the national and local economy. There will be a significant number of local employees for both the construction and operation period which will exceed the Economic Development criteria that must be reached under the terms of the RMIPPPP. Please refer to Section 8.3.1.6 of this report for further details on the findings from the Socio-Economic study.

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the Port and will utilise their own mooring system. No marine structures are planned, and the mooring system for the vessels will be heavy chain lying on the seabed attached to anchors (anchor piles or vertical load anchors) which will become buried in a very short time. The vertical load anchors are by design buried during the installation and the intention is to install the anchor piles such they are flush or below the surrounding sea bed.

The key criteria for the mooring site are sufficient space for turning the LNG Carrier (LNGC) as well as the approach channel shared with the container terminal to allow the safe passing of other traffic including container vessels, cargo vessels and tugs, and maintain the safety exclusion zone required for the ship-to-ship transfer of the LNG to the FSRU.

In terms of alternatives, two alternative mooring sites for the Powerships were being considered. The first option is to position the two Powerships in a closer position to the transmission line on land. The second is to position the two Powerships further away from the land and the connection to the transmission line. The depth of the water in which the ships will be positioned is approximately 14m. The gas pipeline that connects from the FSRU to the Powerships will be routed along the seabed and the length of the pipeline route alternatives is in direct relations to the positions of the Powerships alternatives. From the Powerships, transmission line will connect to a proposed switching station and into the national grid and two alternatives were assessed for the transmission line route.

As the Powerships, FSRU and LNG carrier arrive in South African waters fully equipped and ready for operation, construction is limited to the transmission and gas supply lines and associated infrastructure.

2.1.1 Powership, FSRU and LNG Carrier (LNGC)

The Powerships are assembled off-site and will be delivered fully equipped and functional to the Port of Richards Bay. They are essentially ships which have been fitted with the necessary equipment, including gas reciprocating engines, steam turbines, and a high voltage substation to generate and transmit electricity using natural gas as a fuel.

The fuel is supplied by a separate vessel, a Floating Storage Regasification Unit (FSRU) which stores the liquefied natural gas (LNG) and converts it to a gaseous state for delivery to the Powerships through a gas pipeline. A LNG carrier shall periodically supply LNG to the FSRU (every 20 to 30 days) and will temporarily stay in the location within the Port (over a 1-to-2 day period) while offloading the LNG cargo.

The proposed design capacity for the Richards Bay Powerships (classes Khan and Shark) are 540MW, which comprises of 27 gas reciprocating engines having an approximate heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The Powerships are equipped with gas reciprocating engines for power generation, allowing reliable supply of electricity with minimal impacts from load profile and number of starts and stops. Powerships, with their modular generation capability, allow for greater technical flexibility for load cycling and shedding.

The Ship to Ship (STS) transfer of LNG will be managed under an international accredited process (i.e. the Ship to Ship Transfer Guide (Liquefied Gases) - 2nd edition, OCIMF / SIGTTO) via trained personnel to ensure compliance with quality, health and safety requirements. The fuel lines between the FSRU and the Powership will be via double walled with annular space being inerted and continuously purged with Nitrogen "N2" gas. A gas detector in circuit will identify a leak, so that the fuel gas can be immediately isolated and shut off, the leak identified, and the necessary repairs or replacements made.

Refer to the images in Table 2-1 below, showing the types of Powerships, FSRU and Project Concept.

	
Image 1: Example of a Powership – Khan Class	Image 2: Example of a Powership – Shark Class

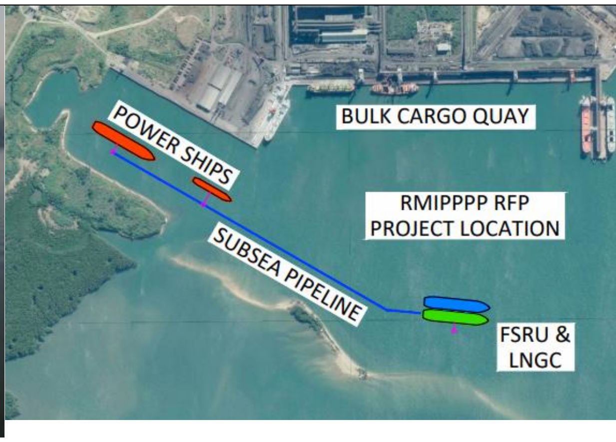
	
Image 3: Floating Storage & Regasification Unit (FSRU)	Image 4: Project Concept

Table 2-1: Images of Various Powerships and Project

The Powership's Charge Air Systems are designed and equipped with both wet and dry filtration systems, so that Powerships can continue to operate in extreme environments, including locations where high levels of organic or inorganic dusts exist. Charge air filtering system day-to-day workmanship or its maintenance intervals may be affected by the pollutant intensity, but operations can continue. The Charge Air Filtering system has proved itself at other locations, for example at Guinea Conakry, where the Applicant is operating next to an iron ore exporting harbour.

The FSRU regasifies the required amount of LNG and sends this to the Powership in gaseous form (NG) continuously through a connecting pipeline. The NG is supplied to the engines. The engines in operation drive the generator shaft to generate electricity, and the heat generated by the engines may be captured and used by additional steam turbines for increased efficiency. The electricity generated is transmitted through the overhead transmission line to the proposed switching station and into the national grid.

The FSRU is specifically designed, constructed and equipped to supply the fuel gas required for the power generator engines installed on the Powerships.

Natural gas boil off of LNG on board the FSRU is not flared or vented. The natural Boil Off Gas (BOG) is used as fuel for the operation of the FSRU and if in excess, is prioritised for export to the Powership for use in the generation of electrical power. In the event that BOG is in excess of the base load demand, then arrangements are provided on-board the FSRU for this excess BOG to be burnt in a specialised internal process. Under normal operations it is anticipated that the demand for gas will be significantly in excess of the natural boil off resulting in liquid LNG being re-gassified for export to the Powership.

The project's marine activities require limited construction facilities. The Contractor's marine (floating) equipment will use the Port's existing infrastructure and operational systems as defined by the Port Authority. A pipe stringing yard is required, which will be established near the installation site. The specialist nature of marine construction means that only large experienced national contractors are able to provide the main works. However, around the Port there is good local industry support and local ready-mix, steel fixing, welding, diving and support subcontractors will be utilised as much as possible.

<u>Operational Processes and Associated Measures</u>

- ***Technology***

The Powerships that will be employed for this project will be equipped with dual-fuel gas reciprocating engines and guarantee electricity at the highest fuel efficiency. Although the technology provides for dual fuel use (i.e. capable of utilizing both Liquid Natural Gas and Heavy Fuel Oils as primary fuel sources), the project proposes the use of LNG only. The choice of modular medium speed, reciprocating engines for power generation enables reliable supply of electricity with minimal impacts from load profile and number of starts and stops. Powerships with their modular generation capability, allow for greater technical flexibility for load cycling and shedding. For all practical purposes, Powerships do not have minimum load limitations and can maintain the same high efficiency even at partial loads due to modularity of design.

In addition to this, Powerships, through the use of gas reciprocating engine technology, provide the shortest response times for load variations, presenting the most suitable technology to be paired with the increasing renewable energy generation capabilities of South Africa.

A key operational advantage of the Powership is that, with the multiple engine technology and built in redundancy systems throughout the balance of the plant, operations can continue at over 98% availability with ongoing maintenance programs without down time for the whole or a significant part of the generation capacity thus not affecting the power output.

This significant advantage over other technologies like Open Cycle Gas Turbine or large coal plants is that the Powerships remain online at all times with live maintenance ongoing delivering output power at the same efficiency whereas large scale plants as described above must shut down operations for maintenance programs to be carried out.

The engine automation system takes care of the following major tasks and functions:

- Local interface to the operator, including a local display which indicates all important engine measurements.
- Engine start/stop management, including start block handling and slow-turning, load reduction, waste-gate control, and the Low Temperature /High Temperature -thermostatic valve control.
- Engine safety (alarms, shutdowns, emergency stops, load reductions) including hard wired safety for engine over speed, lube oil pressure, cooling water temperature, and external shutdowns.
- Electronic speed/load control with various operation modes.

The technology proposed entails the production of electricity through natural gas-fired Combined Cycle Gas Turbine (CCGT) technology.

Table 2-2 and Figure 2-1 below provide the flow diagram for power generation with engines and a bank of engines connected in series, as well as schematic presentation of a Typical CCGT Process.

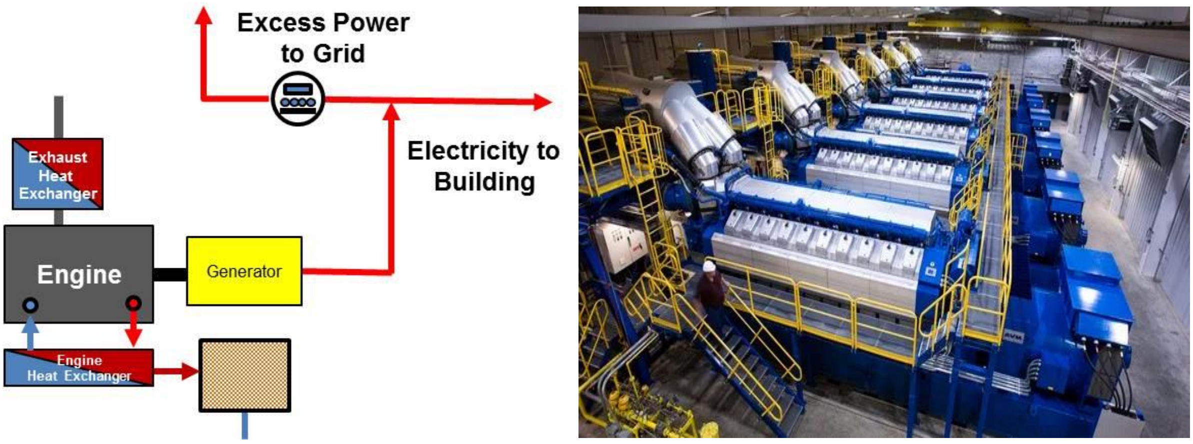


Table 2-2: A flow diagram for power generation with engines (left), and a bank of engines connected in series

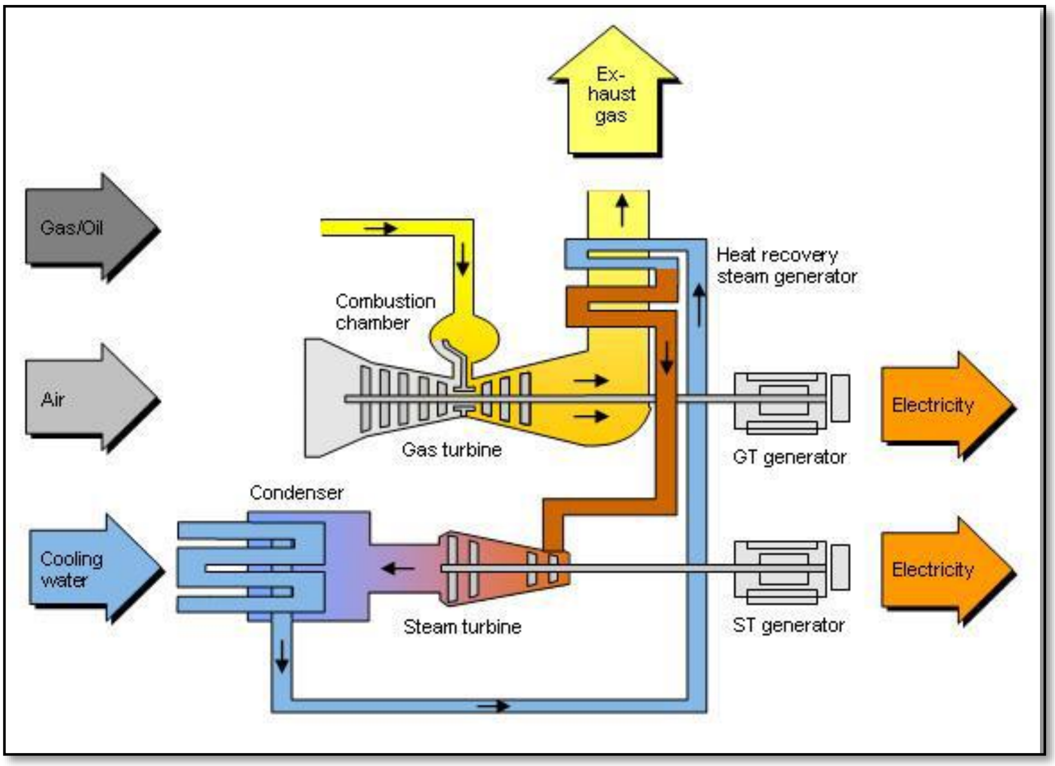


Figure 2-1: **Schematic Presentation of a Typical CCGT Process**

The preferred Gas Reciprocating Engines technology option will ensure higher efficiency and reliability in electricity generation with overall improved environmental performance compared to traditional coal fired technology.

The Powership's Charge Air Systems are designed and equipped with both wet and dry filtration systems, so that Powerships can operate in extreme environments, including locations where high levels of organic or inorganic dusts exists. Charge air filtering system day to day workmanship or its maintenance intervals may affected by the pollutant intensity, but operations can continue. The Charge Air Filtering system has proved itself at Guinea Conakry, where the Applicant is operating next to iron ore exporting harbour.

In terms of construction and footprint, the Powerships are considered to be a complete pre-constructed, purpose-built, offshore power solution, offering several advantages over land-based solutions of similar energy generating capacity, e.g. in terms of development footprint and terrestrial impacts.

Please refer to Appendix J for further technical information.

- ***Water Usage***

Seawater is generally used for the outer cooling systems, while a portion of seawater is treated for distribution into the freshwater supply to be used in the inner cooling systems (i.e. the low-temperature cooling, generator cooling, condensate cooling systems etc.) and for domestic use. Sub-systems are sensitive to saline water. The vessels operate via a continuous sea water feed system, where only a small volume of seawater is used in the generation of electricity (i.e. losses to steam, condensers and treatment). This means that large volumes of seawater are discharged back to the ocean (termed seawater overboard discharge).

Seawater is attained via several sea chest intakes and distributed to the seawater cooling systems [external use on generators (GN), low-temperature (LT) coolers, alternators, turbine stacks]. An excess amount of seawater is flushed through the system, and the water volumes used by the GN and LT coolers are very low. A portion of the seawater intake is treated at onboard water treatment plants (WTPs) including evaporator, seawater reverse osmosis system and distributed to freshwater, collection and technical water tanks, to supplement freshwater supply to the dedicated sub-systems and cooling systems.

Process seawater (i.e. water which has already gone through the cooling system) is either discharged back to the ocean or used to replenish the sea chests via antifouling anode treatment tanks. Wastewater effluent is collected in the onboard dedicated waste storage tanks for temporary storage. The freshwater system is interconnected throughout the vessels, and that recirculation of the water takes place (i.e. water from the engines and steam turbines is redistributed to the mixed cooling units and LT cooling systems) and water is “topped up” as required to ensure adequate pressure and flow in the cooling system. Only evaporation losses and operational losses of fresh are anticipated for the cooling system. As such, there are fresh water close loop circuits for cooling system of engines, water circulates from/to expansion tanks of the engines. The only consumption on this system is evaporation due to heat of Engines.

In terms of domestic water use, both treated seawater (i.e. desalinated) and drinking water will be used for domestic purposes. Potable (drinking water) will further be supplemented by stocking bottled water. All grey and blackwater generated on the vessels will be stored in a waste storage tank to be taken off-site by an accredited service provider. No discharge of grey or blackwater will take place into the ocean.
The conceptual process flow diagram (PFD) for the generation of electricity is shown in Figure 2-2 below. Further details are captured in the Water Balance Report, attached as Appendix J.

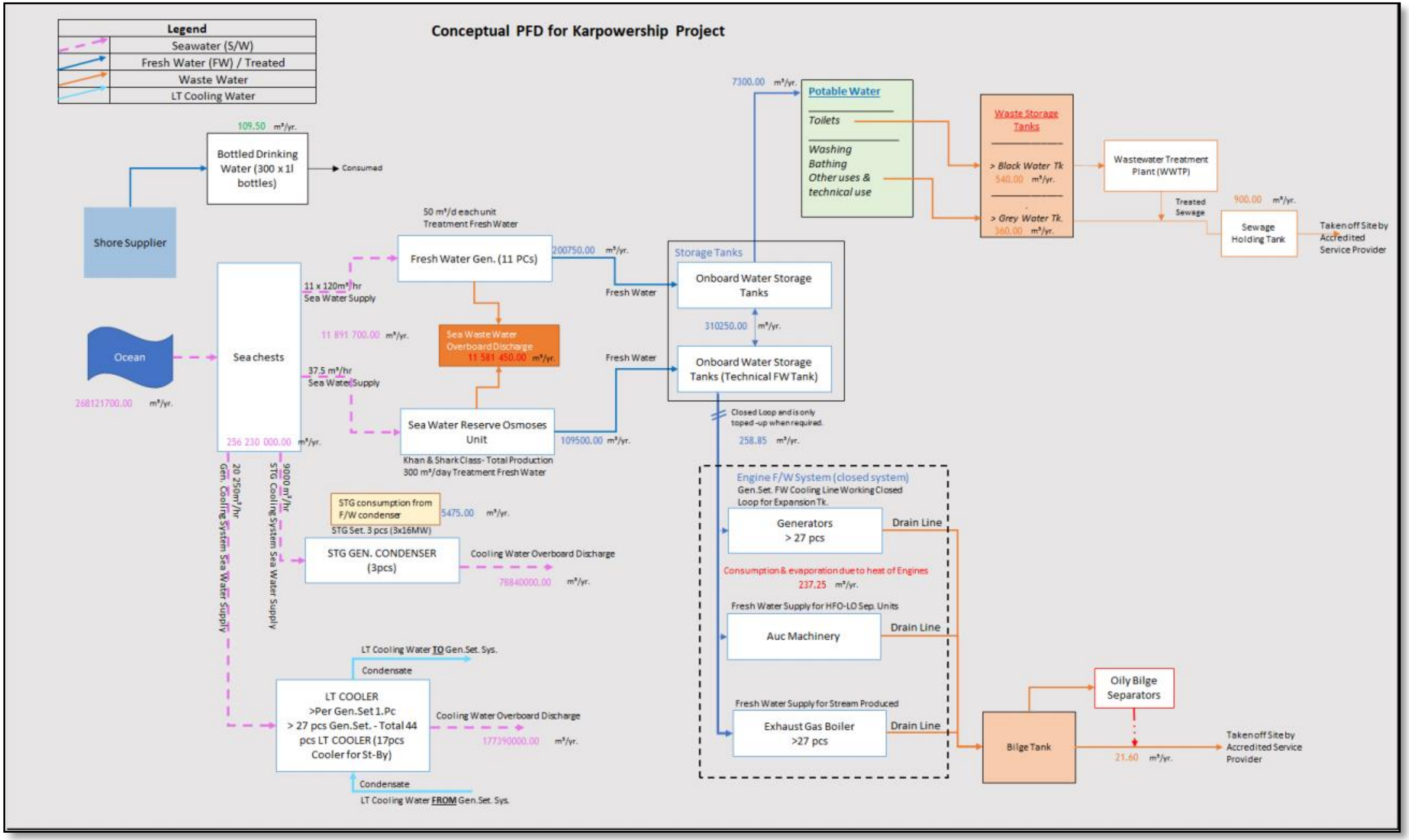


Figure 2-2: Conceptual Process Flow Diagram (PFD) for cooling, technical and potable water

- **Water Temperature**

The Powerships will use seawater for cooling the gen-sets and optionally the steam turbine generators and fresh water generators. The total intake/outlet flow rates range from 2.4 m3/s to 11.4 m3/s and the increase in temperature (ΔT) range from 4°C to 15°C. No chemicals such as chlorine are discharged with the cooling water.

The dispersion of the resulting thermal plume depends on the flow rate, ΔT, discharge geometry, bathymetry, currents, winds and water column stratification. In confined water bodies with low water exchange there can be a build-up of temperature including recirculation from the intake to the outlet.

Typical ecological thresholds include ΔT = 3°C at 100 m from the discharge point (World Bank), ΔT = 1°C at sensitive receptors or the edge of the mixing zone, which for discharges beyond the surf-zone can be assumed as 300 m from the discharge point, according to the South African Marine Water Quality Guidelines (DWAF, 1995).

The results show that a smaller footprint of ΔT is achieved when discharging at a deeper depth below the water surface. Discharging at a deeper depth allows the thermal plume to entrain colder sub-surface ambient water as it rises to the surface, reducing the temperature of the plume. In can be concluded that the thermal plume meets the World Bank guideline and the generic South African Marine Water Quality Guideline when the cooling water is discharged 8 m below the water surface.

A calibrated 3D hydrodynamic model was used to predict the extent of the thermal plume generated by the Powerships considered at Richards Bay running at 100% load. The results show that a smaller footprint of ΔT is achieved when discharging at a deeper depth below the water surface. Discharging at a deeper depth allows the thermal plume to entrain colder subsurface ambient water as it rises to the surface, reducing the temperature of the plume.

It was concluded that when the cooling water is discharged 8 m below the water surface the thermal plume meets the World Bank guideline and the generic South African Marine Water Quality Guideline. To reduce the risk of recirculation of the discharge back to the intakes, it was recommended that the discharge pipeline running down the vessel hull has a second elbow to discharge horizontally away from the vessel, and that the discharge pipes be positioned as far from the intakes as possible. Further details are captured in the Cooling Water Dispersion Modelling Report, attached as Appendix J.

- **Air Emissions**

Although the gas reciprocating engines are designed to run on dual fuels (i.e. Liquid Natural Gas and Heavy Fuel Oils), only Natural Gas (NG) will be the fuel used for the generation of electricity in the proposed Karpowership project. The pollutants that are typically emitted using this type of fuel include oxides of nitrogen ($NO + NO_2 = NOx$), low concentrations of Sulphur dioxide (SO_2) and low concentrations particulate matter (PM_{10}).

Table 2-3 presents the concentrations of these three pollutants predicted to be emitted by the proposed project in relation to the ambient concentrations in the Richards Bay area and the respective South African National Ambient Air Quality Standards (NAAQS).

		SO_2	
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.07	0.34	0.94
NAAQS	50	125	350
		NO_2	
Predicted maximum NO_2	1.34		18.9
NAAQS	40		200
		PM_{10}	
Predicted maximum PM_{10}	0.33	1.72	
NAAQS	40	75	

Table 2-3: SO_2, NO_2 and PM_{10} concentrations predicted to be emitted by the proposed project in relation to the ambient concentrations in the Richards Bay area and the respective South African National Ambient Air Quality Standards (NAAQS).

Please refer to Section 4.1.7 for further details on air emission and ambient air quality.

The international standard is to express greenhouse gases in carbon dioxide equivalents (CO_2e). Emissions of gases other than CO_2 are translated into CO_2e using global warming potentials. Natural gas is an efficient and relatively widely available alternative to other fossil fuels and produces roughly half of the amount of carbon dioxide (CO_2) per unit energy as coal. This scenario makes natural gas attractive as a potential 'bridge' or transitional fuel in the shift toward renewable energy. Nonetheless, natural gas is primarily composed of methane (CH_4), a greenhouse gas with climate change adaptation risks associated 21 times the warming potential of CO_2.

From an emissions perspective, the Powership performs most efficiently when operating at full capacity. The fuel efficiency of the generators will be based on several factors including temperature/cooling, revolutions per minute (RPM), generating capacity, and load capacity. What becomes evident is the increased fuel efficiency of larger generators operating at full load capacity, as opposed to the smaller generators, or operating at lower load. GHG emissions per MW (CO_2e/MWh) at Richards Bay are lowest when operating at 100% contracted capacity (0.504 t/MWh net). At the maximum design capacity, there is a small increase in emission rates at 0.5044 CO_2e/MWh for Richards Bay. This rate is when operating at 114.6% of contracted capacity and delivering 515.9 MW Net.

Given the 540MW generation capacity of the ships located at Richards Bay, the emissions from 100% capacity are 272.16t CO_2e.

The 540MW capacity Powerships at Richards Bay are expected to emit ~857 Gg CO_2e annually, equivalent to ~0.17% of the annual CO_2e emissions of South Africa's gross greenhouse gas emissions in 2017. Over the 20-year project lifespan, emissions will be ~19 000Gg CO_2e, comprised of $C0_2$ (85.9%), followed by CH_4 (13.5%) and N_20 (0.6%).

Refer to Appendix I and J for further details on air quality and GHG emissions / Climate Change Assessment.

- ***Safety and Security***

Safety performance is focused on risk and on the safe operation of the vessel as well as the containment of the LNG within the containment systems, including the pipeline. The main risk contributing part of the operation is the possible rupture of one of the transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting leading to a flash and pool fire, considered as a High impact. According to the Major Hazard Installation (MHI) Risk Assessment (Attached as Appendix I), risks were found to be acceptable for the Gas to Power Operations. Due to the nature of LNG, should there be a minor leakage of LNG it will disperse quickly and rise into the atmosphere very quickly. For an explosion to occur one requires a loss of containment (e.g. a hose rupture) and an ignition source. The calculations uses a 30% possibility of an ignition source being present. Therefore if the risk of a hose rupture is 5.0e-007 then the risk of an explosion is 1.5e-007.' These risks with be further assessed during the MHI application. The MHI application can only be made upon completion of the EIA process, once the EA has been granted. Please refer to the MHI Risk Assessment (Appendix I) for further details.

In the event of a lightning strike, the high conductivity of the large quantities of metal, with hundreds of square yards of hull in direct contact with the water, causes rapid dissipation of the electrical charge. The Powerships, FSRU and LNG carriers are designed to meet stringent lightning protection standards required by the Ship Classification Society. FSRU operations are safeguarded through 100% containment with no LNG interface with the atmosphere. Lightning strikes are easily dissipated by the steel structures without affecting the normal operational aspects of the FSRU, however, in such situations, it is normal practice to cease STS operations and make safe the transfer hoses through inerting and also maintaining the cargo containment without oxygen.

Fire can be extinguished in Powerships by means of various methods which include permanently installed systems in the Powership that are able to fill the affected area with CO^2 or Hot foam and portable extinguishing systems. Each chamber in the Powership is also equipped with fire detection and alarm equipment (fire detectors, manual call points, alarms, sounders, and bells) in order to detect & locate the origin of the fire.

In addition to using the fixed firefighting systems, portable firefighting equipment and personnel protection equipment are to be used throughout Powership to ensure maximum protection from fire related accidents. Approved drawings on firefighting plans are located throughout the Powership in fireboxes and hung in different locations. In the event of fire drills or actual fire these plans are to be carried out.

All maintenance and operation will be managed by the Karpowership in-house Operational & Maintenance team on board 24/7. Highly experienced personnel in the Powerships observe and control all systems remotely. In addition to state-of-the-art automatic supervision and control arrangements, experienced engineers take readings, measurements, and perform other inspection routines. All systems are to be inspected regularly for leaks, and any leak is repaired immediately. The pressure and temperature readings in all systems are to be checked frequently.

The Operation and Maintenance procedures for each system and equipment are defined in manufacturers operating manuals. The quality and efficiency of operation and maintenance tasks onboard are planned and monitored by the enterprise resource planning system (SAP). Each Powership is implemented with a computer-based maintenance, quality, and material resource planning system (SAP PM-QM-MM), including all individual procedures with intervals, job descriptions, Health, Safety and Environment (HSE) precautions, spare parts, tools and manpower.

Karpowership applies predictive and preventive maintenance procedures according to equipment manufacturers' instructions. The preventive maintenance measures ensure high availability, reliability, quality, and increase in equipment lifetime. Maintenance of the engines is performed according to the maintenance schedule. Regular maintenance helps to avoid malfunction of the engine and increases its lifespan.

The operations and maintenance of the FSRU, gas pipeline, the 132 kV distribution line and associated equipment will be managed by an Operations and Maintenance contractor that will be appointed by Karpowership.

In terms of Emergency Plans, the Major Hazard Installation (MHI) Risk Assessor had recommended that an Emergency Plan be developed and sent to the City's Disaster Management for them to comment and formulate action plans during the MHI application. The MHI application will be made to the District Municipality, and be assessed based on their disaster management capacity (refer to the Major Hazard Installation Risk Assessment, Appendix I).

Powerships are equipped with advanced CCTV systems monitoring all areas, inside and out, in addition to surrounding fencing and razor wires to protect against unauthorized entry to the project site from land. Dedicated professional security team personnel are responsible for monitoring and constantly patrolling the vessels to prevent any unauthorized entry or attacks. In addition, prior to deployment of the Powership to its operating location, an independent security risk assessor visits the location, meets local authorities including port authorities and armed security forces, and provides detailed advice on any additional security measures that should be implemented before or during the operation over and above the proposed Security Plan specific to that project site.

The same independent security advisors visit the vessels shortly after their arrival, immediately after mooring arrangements are completed, to follow up and assess actual operation of the security systems and team. Regular follow up visits and assessments continue, and adaptation of systems and protocols would be made if the project site security risk status is deemed by them to have changed in the area over time.

In addition, a Floating Storage Vessel can be moved relatively quickly in the event that South Africa becomes exposed to terrorist activities. Access to these facilities is also more easily controlled than land-based facilities.

- **Extreme Events**

Climate changes that can negatively impact the proposed Powerships at Richards Bay and its associated infrastructure will likely be those associated with extreme events. For permanently-moored infrastructure such as the Powership and FSRU, impacts from events such as extreme storms and coastal surges are of lower significance given their sheltered location within the port. The LNGC vessel, which will transport fuel for the Powerships via the FSRU, will likely be exposed to greater levels of risk from extreme events on the high seas. Mitigation measures that will lower the significance of the above-mentioned impacts for mobile vessels (i.e., the LNGC) include the proactive use of existing early-warning systems and international standard operating procedures for vessels operating in inclement weather, including evasive action where appropriate. The permanently-moored FSRU and Powerships are less exposed to this risk, and consequently mitigation for these project components entails compliance with existing emergency protocols and disaster risk reduction procedures at the Port of Richards Bay. Impacts relating to sea-level rise were not considered significant because most of the floating infrastructure associated with the project is not susceptible to changes in sea-level or coastal erosion and the location of the proposed activities within the heavily defended port will further mute the increasingly dynamic coastal processes expected with elevated sea-levels.

2.1.2 Berthing and Mooring of the Powerships and FSRU

Berthing and mooring will be conducted as per the Ports' approved maintenance plans, procedures and requirements, and ships will be located where adequate depths exist.

No dredging is required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided. The Sand-spit area in the Port has been identified as sensitive and a 200m offset from the water line to the moored vessels maintained.

Key considerations for a feasible position are the size of the turning circle for the LNG Carrier (LNGC) as well as that the approach channel and turning circle which will be shared with the coal terminal and bulk berths. The traffic in the basin (coal vessels, cargo vessels and tugs) cannot be impeded by the Powership project.

Marine conditions derived for all design return periods include an allowance for potential climate change impacts (increases) on wind speeds, water levels and wave heights over the design life of the infrastructure.

2.1.3 Refuelling

The FSRU is refuelled through vessels specially fitted for the purpose of carrying LNG and fuelling the Powership. Refuelling would be required approximately every 20 to 30 days, depending on the power generation capacity and output of the Powerships.

The location of the LNGC, when re-fuelling, will be immediately adjacent to the FSRU. The LNGC will stay in this location within the Port only during the re-fuelling which takes one to two days, and thereafter will leave the Port.

The FSRU can hold enough LNG to allow the Powerships to operate for approximately 40 days; expected arrival dates of the LNG Carriers transporting the LNG from the overseas market will be aligned (taking account of the prevailing weather conditions) with the expected usage profile, whilst ensuring that sufficient reserves are maintained in the FSRU in case of any short notice delays. This is to avoid interrupting the supply of LNG to the Powership and thus, power generation.

2.1.4 Source of LNG

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost effective generation of power, as opposed to coal-fired power stations. In addition, coal-fired power technology is associated with significant air pollution as a result of the coal-fired combustion. Natural gas emits between 45 and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants than coal when used to generate electricity (Shell SA, Media Release, 2020).

According to Shell SA, "*Natural gas is the cleanest-burning hydrocarbon, producing around half the carbon dioxide (CO2) and just one tenth of the air pollutants of coal when burnt to generate electricity.*

If consumption remained at today's levels, there would be enough recoverable gas resources to last around 230 years. It is versatile. A gas-fired power station takes much less time to start and stop than a coal-fired plant. This flexibility makes natural gas a good partner to renewable energy sources like solar and wind power, which are only available when the sun shines and the wind blows." (https://www.shell.co.za/energy-and-innovation/natural-gas.html).

The benefits of running the engine on NG include emission reductions of NOx, SOx, CO_2, particulates, no smoke, reduced waste streams to meet the requirements of local or international legislations.

Global LNG Market

The market for Liquified Natural Gas has existed since 1958 when the first tanker shipment of LNG took place from Lake Charles, USA bound for Canvey Island in the UK aboard the Methane Pioneer.

Today, more than 40 countries import LNG from 21 exporting nations around the world. Imports are dominated by the Asia Pacific region, with Japan, China and South Korea dominating demand, as shown in the diagram below.

On the supply side, Qatar has been the world's largest supplier of LNG for a number of years. However, both Australia and the USA are expected to surpass Qatar as the world's largest LNG suppliers since both nations have rapidly expanded their liquefaction capacity in recent years. Figure 2-3 below provides representation of the Global LNG Supply.

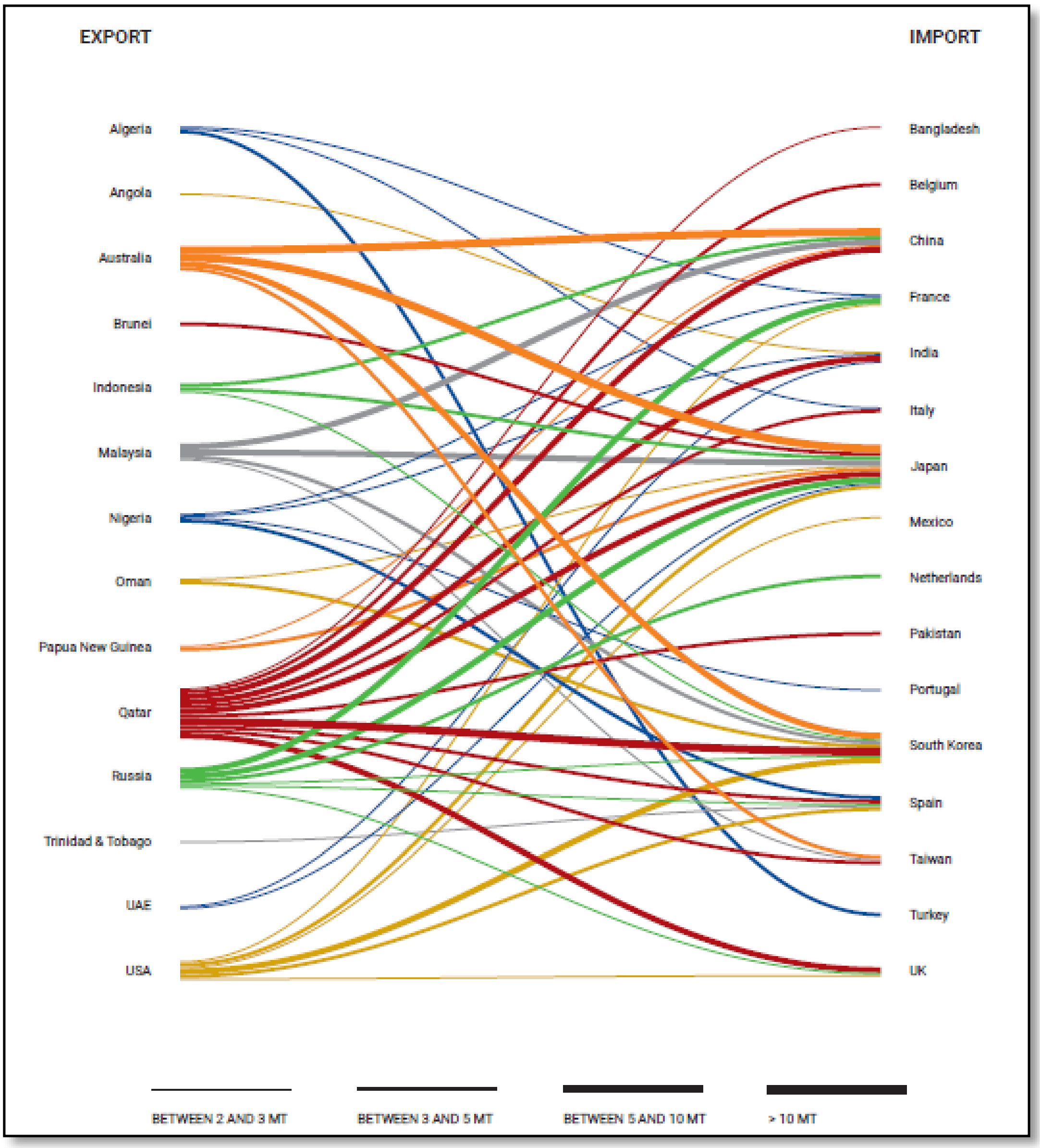


Figure 2-3: Representation of the Global LNG Supply

<u>LNG Supply Sources</u>

Given the complexity of different sources of LNG and different customers for LNG and the fact that demand for LNG in a country can change from year to year as well as within the market, this market is suited to very large companies who can manage the complexity of changing import demand combined with the requirement to serve the customers' demands.

LNG Supply is a mature market with approximately 30 larger companies, capable of supplying LNG to the project. Well–established companies will have to supply LNG from within their total global portfolio. Therefore, the LNG will not be sourced from a dedicated source(s).

The market for the supply of LNG will continue to grow for the next 40 years, and therefore there is no risk associated with the physical supply of this fuel for the term of the project.

<u>LNG Procurement for the Project</u>

Fuel Company started the process for procurement of LNG during September 2020 by running an Expression of Interest ("EOI") for LNG supply to the proposed Project. The EOI was sent to thirty (30) well established LNG suppliers. A robust LNG supply chain was secured.

Upon receiving the Preferred Bidder status, Karpowership will enter into an agreement for 6 years extendable up to a 20-year term with the preferred supplier(s).

2.1.5 Gas Lines

A subsea gas pipeline is proposed to be installed along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powerships to ensure gas supply for power generation and connected to the vessels via a flexible marine hose riser (Figures 2-4 and 2-5 below). It is anticipated that subsea gas pipeline will have a servitude of approximately 10m to allow for mounting and protection, as well as the foundations of the three PLEMs (Pipeline end manifolds). The pipelines will be made of steel, engineered to meet the standards for natural gas pipelines with a diameter of approximately 60cm.

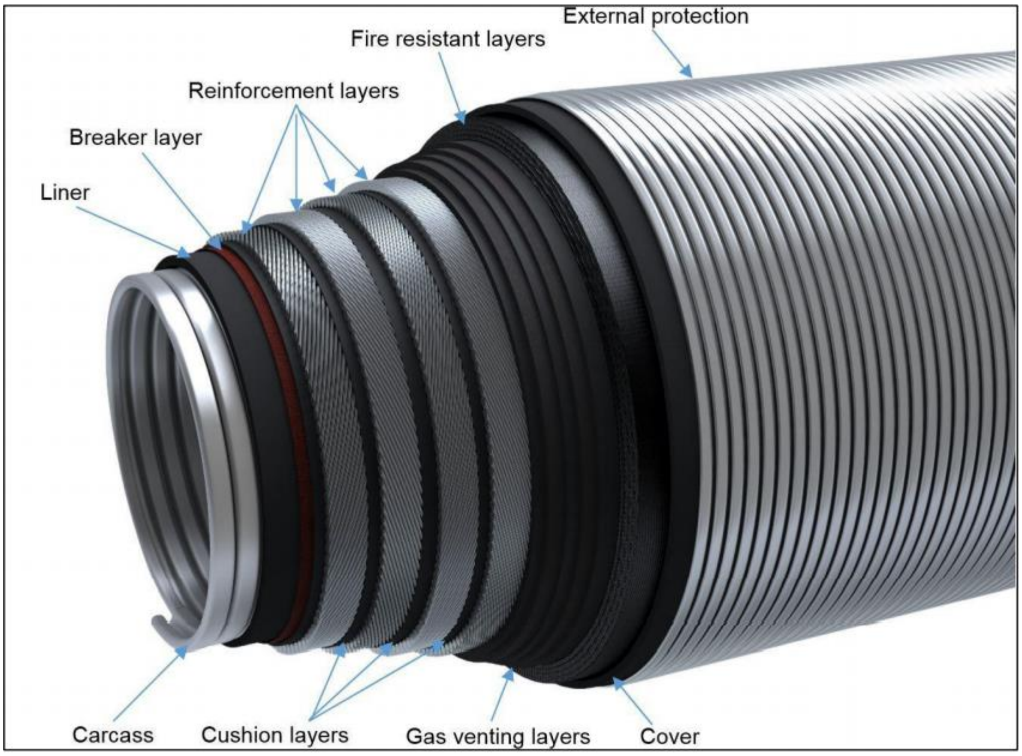


Figure 2-4: Riser / flexible hose

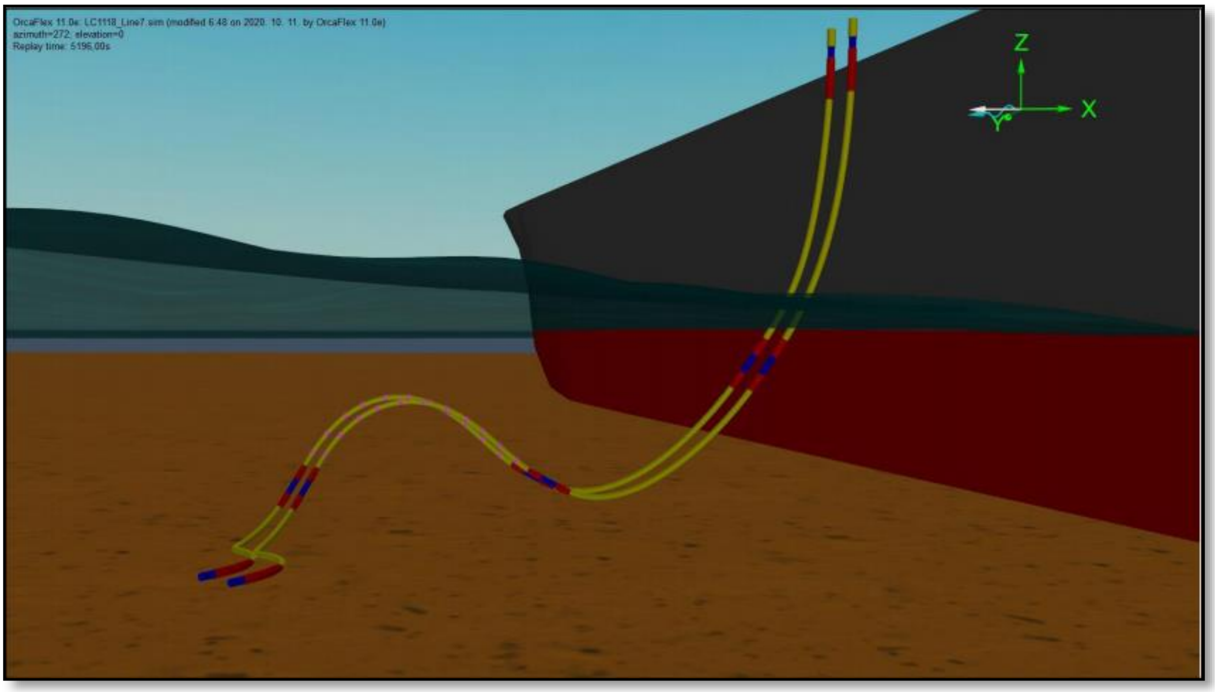


Figure 2-5: Illustration of riser hose application

There are two proposed alternative routes for the gas pipeline, and these are directly influenced by the selected positions of the Powerships in relation to the position of the FSRU.

- Alternative 1 of the gas pipeline route (approx. 1700 meters in length) is preferred from an engineering perspective, as it is in line with the preferred position (from an engineering design perspective) of the Powerships and the FSRU within the Port, positioning the Powerships in closer proximity to the land and the transmission line but further from the FSRU.
- Alternative 2 of the gas pipeline route (approx. 500 meters in length) relates to the second alternative of the Powership positions (further from the shore) and the FSRU.

The preferred route subsequent to the EIA process will also need to be approved by Transnet National Port Authority (TNPA).

The Applicant is currently investigating the procurement of natural gas from global suppliers. As already mentioned, the gas will be shipped into the Port on a specialised carrier and offloaded to the FSRU.

Further description and figures of these alternatives are provided in Section 3.2.2.

<u>Pipeline installation</u>

The methodology used to install the subsea gas pipeline will be dependent on the specific expertise and experience of the Marine Contractor appointed to undertake the construction works. The various possible methods are however all very similar, depending on the site and the marine plant that is available to the marine contractor. The actual detailed methodology that will be used will only become available once the marine contract has been awarded.

The most likely construction methodology associated with the installation of the subsea pipes is as follows:

The submarine pipeline is to be brought onto site in sections, typically 18m long. The pipeline is likely to be delivered to the site by road truck and welded together in a pipe stringing yard near the launch site. The trucks used to deliver the pipeline sections will therefore require road access to the stringing yard within the construction site / laydown area.

Sufficient space for a temporary onshore construction site / laydown area near the launch site will therefore be required to undertake the assembly of the pipeline. An area within the Port previously disturbed and with sufficient space near the launch site will be selected in order to reduce new impacts. Estimated size for the temporary assembly/ laydown area for the installation of the gas pipeline is 9987m² (0.9987 hectares).
The proposed location of the stringing yard and launchway is proposed to be adjacent to the old caisson construction basin and is shown on the drawings. The final selection of the site will only be finalised once a preferred marine contractor has been selected. A launchway will be constructed with rollers to transfer the pipeline from the stringing yard to the sea. It may be necessary to cross the existing caisson construction basin using a piled structure to support the launchway. The launchway typically will consist of concrete or steel pedestals supporting rollers at approximately 10 to 20m centres, over which the pipeline will move, allowing the completed pipeline to be pulled into the sea.

The pipeline is likely to be installed by pulling it from the shore into position using a winch mounted on the deck of an anchor handling tug (AHT), moored offshore. Due to the low pulling forces, no added buoyancy will be required. The AHT will be positioned at the furthest end of the pipeline. A large diameter (approx.76mm dia) pulling wire will be laid from the end of the pipeline on the launchway to the AHT pulling position. A reaction anchor will be laid offshore of the pull position and will be connected to the AHT with a wire mooring pennant. As the pipeline is pulled, additional pipe strings are welded on in the stringing yard. The pipeline is placed on the seabed with minimal disturbance to the seabed and weighted with concrete to ensure the on-bottom stability of the pipeline during operation. Where necessary the pipeline will be covered with crushed rock to protect the pipeline. Although no dredging is required prior to installation of the pipeline, some seabed preparation in the form of levelling of high spots or placing of crushed stone founding material in low spots may be necessary prior to installing the pipeline.

There are 3 PLEMs on this site, connected to the pipeline with in-line spools. For pipe pulling, dummy spools will be inserted at the PLEM locations. Once the pipeline is in position, the spools will be removed for PLEM installation and hook-up of the permanent spools.

<u>Removal of pipe route high spots to pipe span corrections</u>
High spots along the pipeline route are envisaged to be encountered at the shoulders of existing dredged slopes and where sediments have accumulated. These need to be removed or ameliorated by excavation by divers using pumps and hydraulic spades in case the material is stiff mud or clay.
The support vessel will be set up to support the divers with a dive spread, pumps and hydraulic power pack for the spades. A spread mooring will be laid over the high spots for the vessel to moor securely, so that the divers will have a stable platform to work from. The material will be side cast out of the pipeline corridor by the pump discharge pipeline.
For the pipeline span corrections, the field surveyor will identify spans greater than 20m long for treatment. The deck of a barge will be loaded at the quayside with crushed stone. A knuckle boom crane will be fitted with a grab bucket, which will be used to place the stone onto the seabed at the pipeline span points. Divers will ensure that the stone is correctly located under the pipeline at span points. Where grout bags are required to support the pipeline, the grout bags will be installed by divers. The dive barge deck crew will manage the grouting operation. Communications between diver and deck supervisor will ensure that the grout bags are properly placed and filled with grout.

Seabed preparation for PLEM installations

Each of the three Pipeline End Manifold (PLEM) needs to be set down on a stable and level foundation. The seabed surface layer needs to be excavated and levelled to achieve this. Divers will excavate and level a 10m x 10m foundation area on the seabed at the pre-surveyed PLEM position. The excavation will be done using hydraulic spades and 6” pumps, to create a 10m x 10m foundation. The divers will lay out a geotextile and peg it to the bottom of the excavation, followed by placing of the 53mm stone to a depth of about 250mm. The stone will be placed off the deck of the barge using a grab bucket fitted to the knuckle boom crane. Once stone is placed the divers will level it using wash water from the pump discharge hose.

PLEM installation

The PLEMs will be loaded onto the deck of the AHT at the quayside. The same method as described above for the blocks will be applied to the installation of the PLEMs, using the AHT A-frame, observation divers and observation ROV. The PLEMs will be placed on the prepared stone foundation bed. Once it is properly set down on the seabed, the positioning surveyors will fix the PLEM’s positions for the as-built records. Three PLEMs will be installed this way, one for the FSRU and one for each of the two Powerships.

Precast Concrete Ballast Blocks

The installation of ballast blocks in each of the PLEMs is required to ensure the on-bottom stability of the PLEM. The ballast blocks will be loaded onto the deck of the AHT which will be set up in a pre-laid spread mooring over the PLEM. The positioning surveyor will locate the A-frame at the stern of the vessel over the target ballast block receiving brackets, and the blocks will be lifted into position using the A-frame crane. Divers on the seabed will confirm the correct seating of the block in the receiving brackets of the PLEM frame. A light observation ROV could also be used to assist the divers.

Spool installation

The installation of the pipe spool pieces is carried out after pipelay and PLEM installation. The initial activity is diver metrology to measure the in-situ distances and directions between the PLEM and pipeline flanges. This data is then provided to fabricate the spools and apply the corrosion coating and concrete weight coat. The spools are then delivered to the quayside for collection and installation on the seabed. The AHT and her crane or A-frame will be used to lower the spools to the seabed. From there, divers will use lifting bags to manoeuvre the spools into position between PLEM and pipeline. The gaskets and bolts and nuts will be inserted and the divers will use bolt tensioning tools to set the bolt tensions to the correct tension. This activity will be directed by the ASME PCC-1 subcontractor specialists, communicating with the divers via the dive supervisor on deck.

Once the pipeline installation is complete, the laydown site will be rehabilitated to reinstate it to the topographical and environmental condition as was prior to the disturbance during the construction phase of this project.

Pipeline Maintenance

The gas pipeline infrastructure is designed to require little to no maintenance during its design life. Relevant design features include the following:

- the subsea pipeline will be protected with a factory applied external coating as well as sacrificial anodes;
- the external coating will be protected by a concrete weight coating which is designed to provide abrasion resistance, which is especially important during pipeline installation; and

- the pipeline is designed to remain stable on the seabed, thereby mitigating against seabed abrasion and material fatigue.

2.1.6 Transmission Line

The power generated on the ship will be converted by the on-board High Voltage substation and transmitted along 132kV twin conductor transmission line. The approximate 3km transmission line (preferred route) will be installed as part of the project from the Richards Bay Port to the tie in point to the Eskom line, at a connection point (including a new switching station) in proximity to the existing Bayside Substation.

A total of 17 Monopoles towers are proposed for the preferred route, and each tower will cover a maximum footprint of 15m by 15m which will necessitate the clearing of vegetation to allow for the towers to be erected. A proposed servitude, stretching along the transmission line from the Port to the connection point by the substation, will have a width of 30m as per Eskom safety specifications. No transformers will be installed.

Access for construction and maintenance of the transmission line (preferred route) will be via the existing powerline servitude for the majority of the route, and an additional access / working servitude will be required for the portion of the route between the port and the Manzamynama Canal.

The transmission lines traverse watercourses and fall within 32 metres of a watercourse. This may require the infilling or depositing or excavation, removal or moving of more than 10 cubic metres of material into, or from a watercourse and removal of more than 5 cubic metres of sand, from an estuary or a distance of 100 meters of an estuary.

Routes options for the transmission lines are presented in the layout alternatives, Section 3.2.3 of this report.

2.1.7 Storage of Hazardous Goods

The maximum storage capacity of the FSRU for LNG is 175 000m³. The FSRU is made up of a series of pressurised containers. The storage of NG on the Powerships is of such small quantities it can be assumed as zero. The reason for this is because as the gas is produced, it is used to generate electricity. There will also be other hazardous substances stored on board, such as lubricating oil for maintaining equipment, but these will be small quantities.

2.1.8 Waste generation and Management

Due to daily operational activities and the regular repair and maintenance of the Powerships and FSRU, waste will be generated. All effluent and solid (general and hazardous) waste will be removed by authorised service providers in terms of legislation and TNPA and MARPOL requirements.

Sewage from on-board ablution facilities and bilge water will be produced by the Powerships. Approximately 75m³ of sewage (black water) will be generated per month, as well as grey water (washing and kitchen).

Pursuant to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 or "MARPOL Convention" in short) (Annexes I, II and IV), discharge of oil, noxious liquid substances, and sewage from vessels into marine environment is prohibited. All black and grey wastewater generated during operation of Powership facilities will be removed by authorised service providers for appropriate off-site treatment and disposal.

In terms of energy waste, Powerships operate with a lean waste philosophy. Every type of energy generated from the fuel is used in a specific way to reduce waste energy. While engines burn fuel, heat is carried out to atmosphere by exhaust gasses. In order to utilise the waste heat, Powerships use Exhaust Gas Boiler Equipment to convert waste heat to superheated steam and redirect the steam to the Steam Turbine Generators to generate electricity.

2.2 Listed and Specified Activities Triggered in terms of NEMA and NEM: AQA

2014 EIA Regulations (as amended), Appendix 3 - 3(d) (i) all listed and specified activities triggered

Table 2-4 presents the listed activities that are deemed applicable to the proposed project, based on Triplo4's assessment and guidance from DEFF:

NEMA

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* *excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is —* *(a) temporarily required to allow for maintenance of existing infrastructure;* *(b) 2 kilometres or shorter in length;* *(c) within an existing transmission line servitude; and* *will be removed within 18 months of the commencement of development.*	The power generated on the ship will be converted by the on-board High Voltage substation (110kV-170kV) and transmitted along the 132kV twin conductor overhead transmission line. However, the transmission line will be located within an urban area and Port of Richards Bay (Transnet) and its capacity falls below the threshold of 275 kV, therefore, it is excluded from the listed activity as described and therefore does not require environmental authorisation. **DEFF to confirm that this listed activity can be removed.**
Activity 12	*The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse* *Excluding:*	Based on the proposed route of the transmission line, and the locations of the proposed towers, switching station and the temporary laydown area for the gas pipeline installation, the development will take place within a watercourse (wetland)

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(dd) where such development occurs within an urban area.	and within 32 metres of a watercourse. However, if these project components fall within an area considered to be "urban" by the competent authority, they will not trigger this activity. **DEFF to confirm that this listed activity can be removed in so far as it pertains to the potential exclusions of (dd).**
Activity 15	*The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding—* *(i) the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(ii) the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(iii) the development of temporary structures within the beach zone where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or* *(iv)* ***activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.***	Structures in the coastal public property exceeding 50 square meters include: gas pipeline, transmission line and the laydown area for the gas pipeline installation. The development of these structures and infrastructure within the coastal public property will occur within the Port of Richards Bay. Activity 14 in Listing Notice 2 (2014), is applied for in terms of the gas pipeline and mooring structures. **DEFF to confirm the applicability of this listed activity given the potential exclusions of (i) and (iv).**
Activity 17	*Development—* *(i) in the sea* *(ii)in an estuary;* *(iii)* within the littoral active zone; *in respect of—* *(e) infrastructure or structures with a development footprint of 50 square metres or more —*	The Powerships and FSRU are not being developed. However, the mooring system, the gas pipeline, the proposed towers for the transmission line, the switching station and the temporary laydown area for the gas pipeline installation will cumulatively exceed a footprint of

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	but excluding— *(aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(dd) where such development occurs within an urban area.*	50 square meters within the sea, estuary (Port is situated in an estuarine functional zone and described as an estuarine bay) and littoral active zone. As these project components fall within an established Port, DEFF's guidance is sought on whether the activities are included or excluded in terms of (aa). In addition, these structures and infrastructure are proposed within the existing Port of Richards Bay and Transnet property, which could be interpreted as urban, in which case the exclusion (dd) would apply and the activity not triggered. **DEFF to confirm the applicability of this listed activity given the possible exclusions of (aa) and/or (dd).**
Activity 18	*The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square metres, within the littoral active zone, for the purpose of preventing the free movement of sand, erosion or accretion.*	Sections of the gas pipeline and transmission line, where it comes on shore, need to be stabilised to prevent erosion on the substrate where the pipeline and transmission line is established. Furthermore, rehabilitation for the land-based portion will be required. Although the area has already been transformed due to port activity, it will require the planting of vegetation on exposed sand surfaces of more than 10 square meters to ensure environmental management.
Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging,*	Based on the proposed route of the transmission line, and the

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse *but excluding where such infilling, depositing, dredging, excavation, removal or moving—* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour*	location of the temporary laydown area for the gas pipeline installation, the development will take place within a watercourse and will require the infilling or depositing of material of more than 10 cubic meters into, and the excavation, removal or moving of soil or sand of more than 10 cubic meters from a watercourse. It is uncertain whether the infilling, depositing, dredging, excavation, removal or moving are deemed to increase the development footprint of the port. If the exclusion (d) applies, then the activity is not triggered. **DEFF to confirm the applicability of this listed activity given the potential exclusion of (d).**
Activity 19A	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from—* *(i) the seashore;* *(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or* *(iii) the sea; —* *but excluding where such infilling, depositing, dredging, excavation, removal or moving—* *(e) will occur behind a development setback;* *(f) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(g) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(h) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or*	The Powership mooring system, the gas pipeline, the erection of the towers for the transmission line, and the temporary laydown area for the gas pipeline installation will require the removal of more than 5 cubic metres of soil or sand from the littoral active zone, an estuary or a distance of 100 meters of an estuary, and the sea. It is uncertain whether the infilling, depositing, dredging, excavation, removal or moving are deemed to increase the development footprint of the port. **DEFF to confirm the applicability of this listed activity given the potential exclusion of (h).**

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies	
Activity 27	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *maintenance purposes undertaken in accordance with a maintenance management plan.*	The transmission line, its servitude the switching station and the temporary laydown area and the infrastructure maintenance will cumulatively require clearance of more than 1 hectares of indigenous vegetation. DEFF IQ desk has confirmed that the transmission line comprising of towers / pylons and 132kV lines is not triggered by the project. The switching station was not specifically addressed in the enquiry to DEFF IQ. It must be noted that without the transmission line, no switching station will be established. **DEFF (competent authority) to confirm that the switching station is included in linear activity and to confirm applicability and confirm that this listed activity can indeed be removed for the transmission line and associated switching station.**

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
Activity 2	*The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where the electricity output is 20 megawatts or more.*	The two Powerships and FSRU are assembled off-site and will be delivered fully equipped and ready to operate to the Port of Richards Bay where they will be moored and linked via a gas pipeline.

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
		The proposed design capacity for the Richards Bay the two Powership is approximately 540MW, which comprises of 27 gas reciprocating engines having heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The gas pipeline from the FSRU to the Powerships and the transmission line from the Powerships to the Substation trigger separately listed activities as does the need for an AEL which if issued, will regulate the atmospheric emissions during commissioning and operation of the project.
Activity 4	*The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	Storage of LNG on the FSRU will exceed 500 cubic meters, anticipated to be maximum 175000 cubic meters at any given time.
Activity 6	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding—* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies*	The engines used for electricity generation are a Listed Activity under GN 893 of 22 November 2013 (as amended) in terms of Section 21 of the NEM: AQA Sub-category 1.5: Reciprocating Engines. In the case of the proposed project, the Powerships will have a combined sum of 27 engines that each have a heat input capacity of more than 10MW. The three steam turbines have a heat input capacity of less than 50MW, but more than 10MW. These units are therefore declared Controlled Emitters and they will be regulated in terms of GN 831 of 1 November 2013 for Small Boilers.

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
Activity 7	*The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods—* *in gas form, outside an industrial complex, using pipelines, exceeding 1 000 meters in length, with a throughput capacity of more than 700 tons per day;* *in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day; or* *in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.*	A subsea gas pipeline for transportation of gas in gas form is proposed, exceeding 1000 meters, however the proposed location is within industrial complex (harbour land use). **As this activity is within the Port boundaries which potentially is within an industrial complex. DEFF to confirm the applicability of this listed activity.**
Activity 14	*The development and related operation of—* *(i) an anchored platform; or* *(ii) any other structure or infrastructure —* *on, below or along the sea bed;* *excluding —* *(a) development of facilities, infrastructure or structures for aquaculture purposes; or* *the development of temporary structures or infrastructure where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared.*	The ships will be anchored and moored in existing port operational areas utilising the vessel's anchoring system. The transmission of the NG gas will flow via a gas pipeline from the moored ship along the seabed to the main ship for processing. The subsea gas pipeline is proposed to be installed, operate and maintained along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powership to ensure gas supply for power generation.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
Activity 10	*The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.* ***KwaZulu-Natal*** ***i. In an estuarine functional zone;*** *ii. Trans-frontier protected areas managed under international conventions;*	The storage and handling of a dangerous good at the Powerships and FSRU will have a combined capacity of more than 500 cubic meters. The FSRU with a storage capacity not exceeding

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	iii. Community Conservation Areas; *iv. Biodiversity Stewardship Programme Biodiversity Agreement areas;* *v. World Heritage Sites;* ***vi. Within 500 metres of an estuarine functional zone;*** *vii. A protected area identified in terms of NEMPAA, excluding conservancies;* *viii. Sites or areas identified in terms of an international convention;* ***ix. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*** *x. Core areas in biosphere reserves;* *xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;* *xii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *xiii. Outside urban areas:* *(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve;* ***(bb) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or*** *(cc) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland; or*	175 000 cubic metres is located within the estuarine functional zone at Richards Bay.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	xiv. Inside urban areas: *(aa) Areas zoned for use as public open space; or* *(bb)* ***Areas seawards of the development setback line or within 100 metres from the high-water mark of the sea if no such development setback line is determined***	
Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *d. KwaZulu-Natal* *i.Trans-frontier protected areas managed under international conventions;* *ii. Community Conservation Areas;* *iii.Biodiversity Stewardship Programme Biodiversity Agreement areas;* *iv.Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *v.Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *vi.****Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas****;* *vii.On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning;* *viii.A protected area identified in terms of NEMPAA, excluding conservancies;* *ix. World Heritage Sites;*	This activity will be triggered by the transmission line and its servitude, the switching station and the temporary laydown area infrastructure which will cumulatively require clearance of more than 300 square meters of indigenous vegetation.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	x.Sites or areas identified in terms of an international convention; *xi.Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;* *xii.Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; or* *xiii.* ***In an estuarine functional zone****.*	
Activity 14	*The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.* ***KwaZulu-Natal*** *i.* ***In an estuarine functional zone;*** *ii. Community Conservation Areas;* *iii. Biodiversity Stewardship Programme Biodiversity Agreement areas;* *iv. A protected area identified in terms of NEMPAA, excluding conservancies;* *v. World Heritage Sites;* *vi. Sites or areas identified in terms of an international convention;* *vii. Critical biodiversity areas or ecological support areas as identified in systematic*	Based on the proposed route of the transmission line, and the locations of the proposed towers, switching station and the temporary laydown area for the gas pipeline installation, the development will take place within a watercourse (wetland) and within 32 metres of a watercourse, within the littoral active zone and in an estuarine functional zone. It is uncertain whether the development of infrastructure and structure are deemed to increase the development footprint of the port. If the exclusion applies, then the activity is not triggered. ***DEFF decision on the applicability of this listing notice to be confirmed given the potential exclusion.***

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	biodiversity plans adopted by the competent authority or in bioregional plans; *viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *ix. Core areas in biosphere reserves;* *x. Outside urban areas:* *(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; or* *(bb)* ***Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea*** *if no such development setback line is determined; or* *xi. Inside urban areas:* *(aa) Areas zoned for use as public open space;* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority, zoned for a conservation purpose; or* *(cc)* ***Areas seawards of the development setback line or within 100 metres from the high-water mark of the sea*** *if no such development setback line is determined.*	

Table 2-4: Applicable Listed Activities.

<u>NEM:AQA</u>

In terms of Section 21 of the National Environmental Management: Air Quality Act, 2004 (NEM:AQA), the Minister published a 'list of activities which result in atmospheric emissions and which the Minister or MEC reasonably believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage'. The consequences of listing an activity are set out in Section 22:

*'No person may **without a provisional atmospheric emission licence or an atmospheric emission licence** conduct an activity—*

(a) listed on the national list anywhere in the Republic; or

(b) listed on the list applicable in a province anywhere in that province.'

Table 2-5 below indicate the applicable listed activities under NEM:AQA for the proposed project.

Category of Listed Activity	Sub-category of the Listed Activity	Application
Category 1: Combustion Installations	Sub-category 1.5: Liquid and gas fuel stationary engines used for electricity generation	All installations with design capacity equal to or greater than 10 MW heat input per unit, based on the lower calorific value of the fuel use

Table 2-5: Applicable Listed Activities under NEM:AQA for the proposed Gas to Power Powership Project (GN 893 in GG No. 37054 of 22 November 2013, as amended).

The applicability of this listed activity has been investigated by the EAP upon advice of the air quality specialist and will be confirmed in consultation with the licensing authority, also DEFF, but a separate Branch within the Department.

The minimum emission standards prescribed for Activity 1.5 are presented in Table 2-6 below:

Substance or mixture of substances		MES for sub-category 1.5
Common name	**Chemical symbol**	**MES under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa**
Particulate matter	N/A	50
Oxides of nitrogen (Expressed NO_2)	NO_X	400
Sulphur dioxide	SO_2	N/A

Table 2-6: Minimum Emission Standards in mg/Nm3 for Subcategory 1.5: Gas Reciprocating Engines.

2.3 Project Locality

2014 EIA Regulations (as amended), Appendix 3: 3(1) an environmental impact assessment report must include (b) the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties; (c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale

Table 2-7 below presents the location of the proposed activity.

Description	Location of the Activity
District Municipality	King Cetshwayo District Municipality
Local Municipality	uMhlathuze Local Municipality
Municipal Ward	2
Area / Town / Village	Richards Bay
Property Description & 21 Digit SG Code	See Table 2-6 below

Table 2-7: Location of the proposed activity.

Table 2-8 below show the properties description, the 21 SG codes and the central coordinates of the properties. Coordinates points for the proposed development site are indicated in Section 3 under each component of the proposed development.

Properties	21 SG CODES	CENTRAL GPS-COORDINATE	
		Longitude	Latitude
Remaining Extent of Erf 223 UMhlathuze No. 16230 Held by T10589/1994 *Powerships, FSRU & gas pipeline*	N0GV00000001623000000	28°47'39.14"S	32°1'32.46"E
Portion 45 of Erf 5333 Richards Bay Held by T33569/1996 *Transmission line*	N0GV04210000533300045	28°47'22.84"S	32°1'10.78"E
Reminder of Erf 5333 (previously Erf 397) Held by T14568/1979 *Transmission line*	N0GV04210000533300044	28°46'51.22"S	32°00'42.22"E
Portion 21 of Erf 5333 Richards Bay Held by T6562/1992 *Transmission line*	N0GV04210000533300021	28°47'36.35"S	32°1'27.60"E
Portion 8 of Erf 5333 Richards Bay Held by T29471/984	N0GV04210000533300008	28°47'36.35"S	32°1'27.60"E

Properties	21 SG CODES	CENTRAL GPS-COORDINATE	
		Longitude	Latitude
Transmission line			
Reminder of Erf 6363 (previously Erf 6362) Held by T3013/1980 *Bayside substation*	N0GV042100000636300000	28°46'45.4"S	32°00'48.3"E

Table 2-8**: Property Description & 21 Digit SG Code – As per the preferred transmission line route.**

With regards to property Reminder of Erf 6363 – this property will only be relevant if the preferred location of the tie-in points to the Eskom line (via a new switching station) will not be implemented and a direct connection to the Bayside substation is made.

Refer to the locality map in Figures 2-6 and 2-7 below, showing the locations of the proposed Powerships and FSRU within the Port, the alternative routes for the gas pipeline, as well as the alternative transmission line routes – from the Port to the proposed switching station, by the existing Bayside substation.

A detailed Layout Plan, providing further additional information regarding the location of the ships, gas pipeline and the transmission line, as well as existing infrastructure within the study area, is attached as Appendix A1, in addition to alternatives maps, sensitivity map and cumulative map, all attached in Appendix A. Refer to Chapter 3 for detailed description of the alternatives.

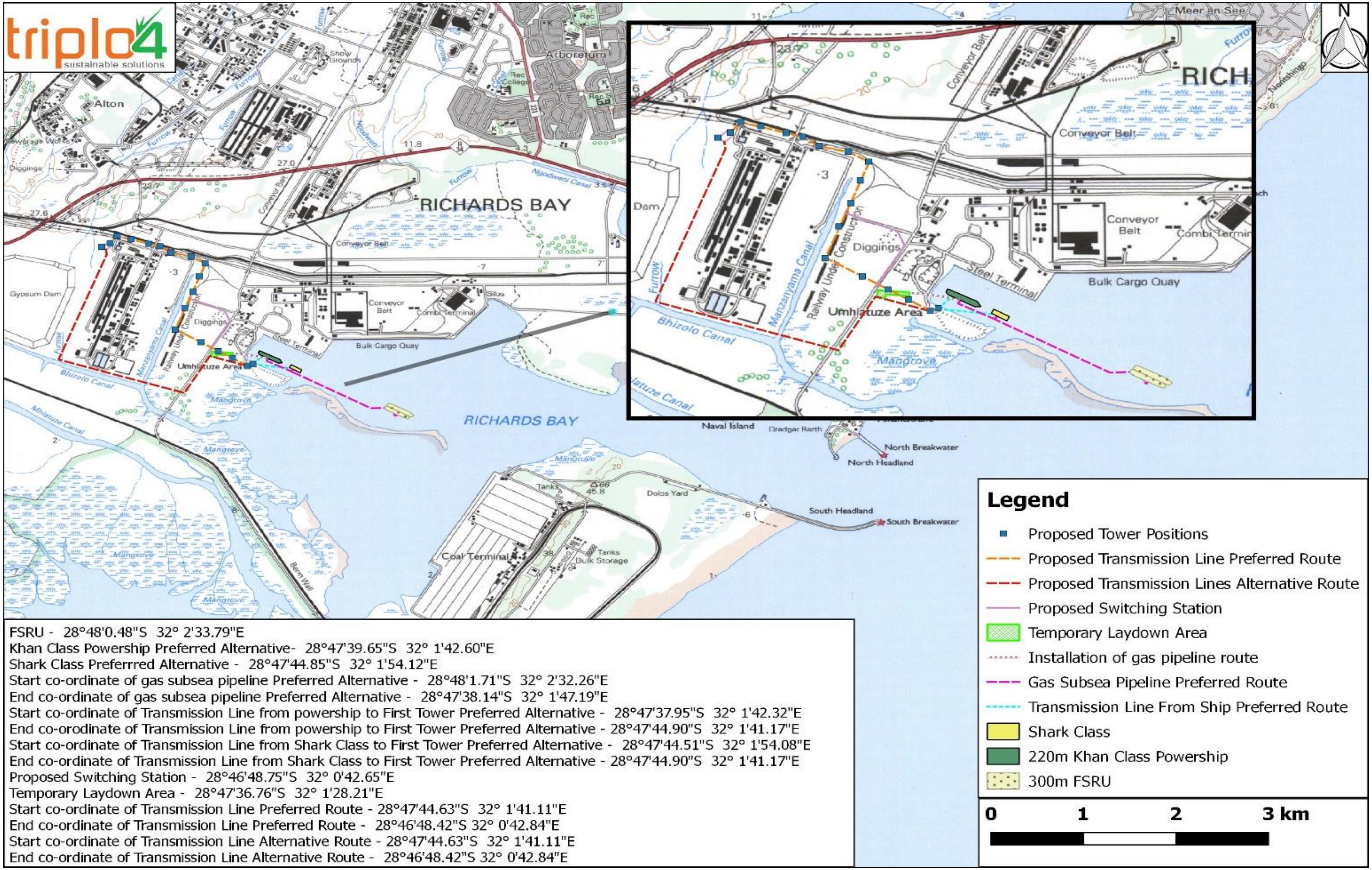


Figure 2-6: **Map showing the proposed Gas to Power Powership Project – Port of Richards Bay (including both transmission line route alternatives).**

Figure 2-7: Google image showing the proposed Gas to Power Project (preferred alternatives) – Port of Richards Bay.

2.3.1 Site Access

The proposed location of the Project is situated within the existing and operational Port of Richards Bay, and therefore the existing access roads network from the N2 and R34 will be used to access the Powership Project site, including the temporary laydown area for the gas pipe assembly, during the construction phase. The position of the access road is indicated in Figure 2-8 below. No additional laydown area is proposed for the construction of the transmission line, as the proposed site for the switching station will be used as a laydown area and storage of construction materials and equipment. The existing harbour arterial, past the entrance to the port, will be used as an access to the gas pipeline temporary laydown area during the construction phase. The existing servitude will be used for access for the majority of the Transmission line route, and an additional access / working servitude will be required for the construction of tower 13 between the port and the Manzamynama Canal (i.e. from the Harbour arterial road to Tower 12), as well as from the start point to the Harbour arterial road (towers 17 to 14) as described in Section 3.2.3.

Figure 2-8: Google map showing existing access roads system to the Port of Richards Bay.

3 ALTERNATIVES

3.1 Approved site and Alternatives assessed in EIA

2014 EIA Regulations (as amended), Appendix 3 - 3(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered;

3.1.1 The approved site

Being a ship-based power generating operation (as opposed to land-based) with transmission of energy to land-based transmission connection points, only locations that provide infrastructure associated with the proposed technology were identified.

The ports of South Africa are hubs of the economy, with the port of Richards Bay situated adjacent to the Richards Bay Industrial Development Zone (RBIDZ) – Special Economic Zones (SEZ) in terms of the SEZ Act 16 of 2014, so called as they are specifically designed to allow for related industries to be based in an Industrial Zone.

The Richards Bay Port was identified as a preferred location in the region, as it meets the specifications for the proposed Powership project and occurs within a close proximity to the Richards Bay Industrial Development Zone (RBIDZ). This site has been approved by DEFF in Scoping.

The following alternatives have been assessed as part of the EIA as per the plan of study for EIA accepted by DEFF at the end of the Scoping phase:

3.2 Development footprint (layout) alternatives assessed in EIA

3.2.1 Powership and FSRU Positioning

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time.

No dredging is required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided. The Sand-spit area has been identified as sensitive and a 200m offset from the water line to the moored vessels maintained.

Key considerations for a feasible position are the size of the turning circle for the LNG carrier as well as that the approach channel and turning circle will be shared with the coal terminal and bulk berths, i.e. traffic in basin from coal vessels, cargo vessels and tugs are not impeded by the Powership project.

The following alternatives, with the preferred position to be also agreed with the Port Authorities, were identified and are being assessed:

- **Alternative 1** is deemed the preferred position from the engineering design perspective, as the Powerships are positioned within the dead-end basin adjacent to the break bulk quay /multi-purpose terminal, and thus located closer to the first tower of the transmission line, positioned on the main land ‘promontory’ adjacent to the large mangrove stand, and positioned further away from the sensitive sand bank. This alternative position was approved by TNPA in Richards Bay for the power barges in the 2015 study, and thus in line with their port planning.

- **Alternative 2** is considered less suitable from an engineering perspective, as the Powerships and the FSRU are located too close together, and the Powerships and the mooring systems are placed closer to the sensitive sand bank. Figures 3-1 and 3-2 below show the alternatives for the positioning of the Powerships.

The two alternatives are illustrated in figures 3-1 and 3-2 below:

Figure 3-1: Alternative 1 – Preferred: Powerships and FSRU position within the port – closer to transmission tower.

Figure 3-2: Alternative 2: Powerships and FSRU position within the port – further from transmission tower.

The FSRU will be mooring against the break-water at geographical co-ordinates 28°48'0.48"S 32° 2'33.79"E (central point).

Alternative 1 (preferred): the two Powerships will be mooring at geographical co-ordinates (central points) 28°47'39.65"S 32° 1'42.60"E (khan Class) and 28°47'44.85"S 32° 1'54.12"E (Shark class).

Alternative 2: the two Powerships will be mooring at geographical co-ordinates (central point) 28°47’59.57”S 32° 2’19.07”E (Khan and Shark class).

The physical size of the Powerships and FSRU (Size of activity):
Power Generation (moored at port, within seawater):
Powerships – 19 000m²
FSRU – 29 300m²

3.2.2 Gas Pipelines Alternatives

A subsea gas pipeline is proposed to be installed along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powerships to ensure gas supply for power generation and connected to the vessels via a flexible marine hose riser. The proposed gas pipeline diameter is 24 inches, equivalent to approx. 60cm (600mm). In terms of the Pipeline End Manifold (PLEM) installation, each of the three PLEMs needs to be set down on a stable and level foundation. The seabed surface layer needs to be excavated and levelled to achieve this. Divers will excavate and level a 10m x 10m foundation area on the seabed at the pre-surveyed PLEM position. The excavation will be done using hydraulic spades and 6” pumps, to create a 10m x 10m foundation.

There are two proposed **alternative routes for the gas pipeline**, and these are directly influenced by the selected positions of the Powership in relation to the position of the FSRU (as discussed in section 3.2.1).

- **Alternative 1 (preferred)** – is approx. 1700 meters in length, and is preferred from an engineering perspective, as it is in line with the preferred position (from an engineering design perspective) of the Powerships and the FSRU within the port, positioning the Powerships in closer proximity to the land and the transmission line.
- **Alternative 2** – is approx. 500 meters in length, and it relates to the second alternative of the Powerships’ positions (further from the shore) and the FSRU. Although this alternative presents a shorter gas pipeline, the position of the Powerships in relation to the shore is not supported from an engineering design perspective, and consequently the associated gas pipeline is not supported from the engineering design perspective, therefore making this alternative less feasible or preferred from a technical perspective.

The preferred route subsequent to the EIA process will also need to be approved by Transnet National Port Authority (TNPA).

Figures 3-3 and 3-4 below present the alternative gas pipelines, based on the alternative for the position of the Powerships and FSRU. An approx. 10 meters servitude will be required for the placement of the subsea gas pipeline.

Figure 3-3: Alternative 1: Gas Pipeline route (Blue Line).

Figure 3-4: Alternative 2: Gas Pipeline route (Pink Line).

Subsea Gas Pipeline Route Alternatives:	**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	1.7km with Approx. 10m servitude = 17 000m²
Alternative A2	0.5km with Approx. 10m servitude = 5 000m²

The estimated size for the temporary laydown area for the installation of the gas pipeline is 9987m² (0.9987 hectares), as indicated in Figure 3-5 below. The selected site is adjacent to the existing harbour arterial and within a historically transformed area due to previous disturbance, as per Figures 3-8 and 3-9.
This area will be rehabilitated after the completion of the installation of the pipeline.

Figure 3-5: Proposed location for the temporary laydown area for the installation of the gas pipeline.

The table below indicates the coordinates of the gas pipeline alternatives and the laydown area.

Subsea Gas pipeline	GPS-COORDINATE	
	Longitude	**Latitude**
Gas pipeline Route Alternative 1 – Start point	28°48'1.71"S	32° 2'32.26"E
Gas pipeline Route Alternative 1 – End point	28°47'38.14"S	32° 1'47.19"E
Gas pipeline Route Alternative 1 – mid way point	28°47'49.87"S	32° 2'6.68"E
Gas pipeline Route Alternative 2 – Start point	28°48'4.70"S	32° 2'29.01"E
Gas pipeline Route Alternative 2 – End point	28°47'59.62"S	32° 2'17.26"E
Gas pipeline Route Alternative 2 – mid way point	28°47'57.46"S	32° 2'20.57"E
Temporary laydown area (central point)	28°47'36.76"S	32° 1'28.21"E

Table 3-1: Coordinates for the gas pipelines' alternatives.

3.2.3 Transmission Line Alternatives

The power from the Powership will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powership to the National Grid utilising the existing Impala – Bayside network via a proposed new 132kV on shore switching station.

The image below (Figure 3-6) shows the proposed location of the Powership and the location of the Bayside substation.

Figure 3-6: 132kV connection near the Bayside Substation in relation to the location of the proposed Powership.

In terms of the **transmission line route**, two alternative routes were proposed, with the same start and end point (Figure 3-6 below).

Start point – the first tower is positioned on the main land 'promontory' adjacent to the large mangrove stand, on a Freshwater Ecosystem Priority Areas (FEPA Estuary) (as per the National Freshwater Ecosystem Priority Areas (NFEPA) dataset; Nel *et al*, 2011). Transmission lines will run from the moored Powerships to the start point (numbered as 17 in figure 3-6).

End point – the proposed new switching station positioned alongside the Bayside substation, located near the north western corner of the former Bayside Aluminium Smelter site, to tie in to the existing Eskom network.

Alternative 1 - preferred (yellow line) - from the start point, the route run towards the existing Harbour arterial road, crossing the road and towards the existing powerline servitude to the west through crossing of an open grassland/scrubland and unchannelled valley bottom wetland, then running along the exiting servitude along Manzamnyama Canal, before heading north and finally in a westerly direction before reaching its end point.

The route is the preferred overhead transmission line from the Powership to the proposed switching station, as it offers a shorter route to the end point (Approx. 3km, 17 towers). The majority of the Alternative 1 route is located in areas of low to moderate ecological sensitivity, and will be traversing high sensitive wetland and swamp forest. The route was further refined following the scoping phase, to reduce the towers within the sensitive area (namely open grassland/scrubland and unchannelled valley bottom wetland) from two towers to one (tower 13 in figure 3-7 below).

The location of the route is in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude.

The existing servitude will be used for access for the majority of this route, and an additional access / working servitude will be required for the construction of tower 13 between the port and the Manzamynama Canal (i.e. from the Harbour arterial road to Tower 12) as well as from the start point to the Harbour arterial road (towers 17 to 14).

Alternative 2 (purple line) begins at the same start point, the route joins into the harbour arterial road, and before the lower Bhizolo Canal, it cuts west across the lower Manzamnyama Canal, passing through the mangroves, traversing the smelter site, before heading north through mixed mangrove and wetland habitat on the western boundary of this site.

The route is approximately 4km long, requiring 19 towers. The alternative route traverses areas that have been historically transformed, however these areas are still considered highly sensitive due to the unique flora and fauna that resides within these environments. Furthermore, this proposed transmission line route is located to a large extent of its length within wetlands, and it traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest. These have extremely high sensitivity and as such, can be considered as a fatal flaw and therefore this alternative route is not supported.

Figure 3-7: Transmission line route alternatives from the Powerships to the proposed switching station – Alternative 1 (yellow) and Alternative 2 (purple).

In terms of the start point of the transmission line (tower 17 in figure 3-8), the area is transformed due to previous disturbance in the area, as per Figures 3-8 and 3-9 below.

Figure 3-8: Imagery from 2004 indicated that the area of the transmission lines has been disturbed.

Figure 3-9: Imagery from 2006 indicated that the area of the transmission lines has been disturbed.

The proposed connection point of the 132kV powerline from the Powership into the existing Eskom electricity grid is a new 132kV switching station situated alongside the Bayside substation on the Reminder of Erf 6363, as illustrated in Figure 3-10 below, and currently engagement with Eskom on the connection to the line is underway. Should this not be possible, the transmission line will need to be connected to the Eskom line at the Bayside substation. Letter of consent from the landowner was obtained and further engagements will be done accordingly.

Figure 3-10: Proposed connection to the Eskom line and placement of the switching station.

The Monopole towers, each with a footprint of 15m x 15m (for stay wires) or 0.6m x 0.6m to a maximum of 2.5m x 2.5m (for monopole bases), are to be positioned within the servitude of 30m for the length of the route.

The preferred evacuation line is in accordance with the proposed 2015 Transnet Evacuation Route.
In terms of the components of the transmission line, single double circuit towers were selected, in order to minimise the environmental footprint of the installation. In addition, the proposed monopoles towers will include bird friendly measures as part of their designs.

Transmission Line Route Alternatives:	**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	3.1km with 30m servitude = 93 000m²
Alternative A2 (not supported)	4km with 30m servitude = 120 000m²

Both alternatives will include the establishment of a switching station, with an approximate footprint of 100m x 70m = 7000m²

The table below show the GPS co-ordinates for the of the start and end points of the transmission lines – from the powerships (as per 2 alternative positions) to the start point, as well as from the start point to the end point (2 alternative routes).

Transmission line	GPS-COORDINATE	
	Longitude	Latitude
From powership (Khan Class) to First Tower Alternative 1 – Start point	28°47'37.95"S	32° 1'42.32"E
From powership (Khan Class) to First Tower Alternative 1 – End point	28°47'44.90"S	32° 1'41.17"E
From powership (Shark Class) to First Tower Alternative 1 – Start point	28°47'44.51"S	32° 1'54.08"E
From powership (Shark Class) to First Tower Alternative 1 – End point	28°47'44.90"S	32° 1'41.17"E
From powerships to First Tower Alternative 2 – Start point	28°47’59.62”S	32° 2’17.26”E
From powerships to First Tower Alternative 2 – End point	28°47’44.90”S	32° 1’41.17”E
Transmission Line Route – Alternatives 1 and 2 – Start point	28°47'44.63"S	32° 1'41.11"E
Transmission Line Route – Alternatives 1 and 2 – End point	28°46'48.42"S	32° 0'42.84"E
Transmission Line Route Alternative 1 – mid-way point	28°47'11.83"S	32° 1'15.87"E
Transmission Line Route Alternative 2 – mid-way point	28°47'44.07"S	32° 0'38.92"E
Transmission Line Route Alternative 1 (bend 1)	28°47'42.19"S	32° 1'38.59"E
Transmission Line Route Alternative 1 (bend 2)	28°47'26.09"S	32° 1'9.85"E
Transmission Line Route Alternative 1 (bend 3)	28°46'56.45"S	32° 1'22.06"E
Transmission Line Route Alternative 1 (bend 4)	28°46'44.22"S	32° 0'46.68"E
Transmission Line Route Alternative 2 (bend 1)	28°47'37.78"S	32° 1'23.59"E
Transmission Line Route Alternative 2 (bend 2)	28°47'54.36"S	32° 1'13.48"E
Transmission Line Route Alternative 2 (bend 3)	28°47'39.11"S	32° 0'23.24"E
Transmission Line Route Alternative 2 (bend 4)	28°46'52.51"S	32° 0'42.61"E

Table 3-2: Coordinates for the Transmission line, including alternatives.

3.2.4 Technology alternatives

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost effective generation of power, as opposed to coal-fired power stations. In addition, coal-fired power technology is associated with significant air pollution as a result of the coal-fired combustion. Natural gas emits between 45% and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants than coal when used to generate electricity (Shell SA, Media Release, 2020).

The Powership engine technology provides for dual fuel usage and is capable of utilizing both Liquid Natural Gas (LNG) and Heavy Fuel Oils (HFO) as primary fuel sources. As indicated in the accepted Final Scoping Report, the HFO is not being considered further as an alternative fuel due to the significant advantages of the LNG. The operating fuel for power generation will be from LNG only and will not consume HFO for any part of the generation process. All relevant licenses, permits and approvals are for the consumption and use of LNG only.

Combustion of HFO results in emissions of oxides of nitrogen (NO and NO_2, referred to as NO_X), carbon monoxide (CO), sulphur dioxide (SO_2) and particulates. Heavy Fuel Oil (HFO) is a refined liquid fuel, consisting primarily of hydrocarbons with smaller amounts of hydrogen, nitrogen, sulphur, and volatile organic compounds. Low-sulphur HFO has a sulphur content of less than 2%.

In a case where HFO is used rather than LNG, the resultant ambient SO_2, NO_2 and PM_{10} concentrations are likely to be low and well below the NAAQS, although they may be somewhat higher than for LNG. The spatial extent on any air quality impact is likely to be somewhat bigger than for LNG. The duration of the impact, the consequence, frequency, probability, and likelihood of impacts using HFO are likely to be the same as for LNG. Therefore, the significance of any impacts associated with HFO is likely to be low to very low.

The benefits of running the engine on NG include emission reductions of Nox, Sox, CO_2, particulates, no smoke, reduced waste streams to meet the requirements of local or international legislations. No emission abatement will be installed for the control of these emissions. Nox emissions are controlled to the required concentration at source using selective catalytic reduction (SCR). LNG has only trace amounts of sulphur, if any. LNG is the cleanest fuel possible, and the combustion of LNG does not result in SO_2 emissions of any significance. Similarly, particulate emissions are very low. The maximum predicted SO_2 concentrations resulting for the proposed project is well below 1 µg/m^3.

LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life.

Impacts on the marine environment arising from an HFO spill would likely be much more significant than those from LNG leakage. HFO can cause major water pollution, soils pollution and is difficult to clean up. A spill of HFO is the same as a spill of bunker oil or even crude oil from ships.

HFOs can be particularly difficult to clean up if spilled in the ocean as HFO doesn’t readily disperse or breakdown in the marine environment, as it has a tendency to stick to surfaces like sea ice or sink and emulsify in sea water (rather than floating on the surface or evaporating off) (Degnarain, 2020). HFO also remains longer in cooler waters before they have had the chance to evaporate off, making their presence felt for longer. HFO becomes more toxic when exposed to Ultra-Violet (UV) light and can be absorbed by organisms, increasing their mortality (Degnarain, 2020).

The use of natural gas to generate electricity, which is what the Powerships technology is designed to do, is the preferred alternative for power generation.

3.2.5 No-go option

The option of not implementing the activity is also referred to as the "No-go" alternative. In respect of the Project, it would mean that the existing status quo would prevail and that no additional power using this particular technology will be generated and transmitted for inclusion into the energy grid in the KwaZulu-Natal and uMhlathuze Local Municipality in particular. Please refer to Section 8 for the assessment of the No-go option.

4 DESCRIPTION OF THE ENVIRONMENT

2014 EIA Regulations (as amended), Appendix 3: 3(1)- (h) (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

4.1 BIOPHYSICAL ENVIRONMENT

4.1.1 Eco-Region

The proposed development falls into the Natal Coastal Plain (13) Level 1 Eco-region (Kleynhans *et al.*, 2005). Level 1 eco-regions are derived primarily from terrain and vegetation, along with altitude, rainfall, runoff variability, air temperature, geology and soil. This region is characterised as follows:

- Mean annual precipitation: Moderate to high.
- Coefficient of variation of annual precipitation: Low to moderate.
- Drainage density: Low.
- Stream frequency: Low to medium.
- Slopes <5%: >80%.
- Median annual simulated runoff: Moderate to high.
- Mean annual temperature: High to very high.

Table 4-1 below present the main attributes of the Natal Coastal Plain Eco-region.

Main Attributes	Description
Terrain Morphology: Broad division (dominant types in bold) (Primary)	**Plains: Low Relief**
Vegetation types (dominant types in bold) (Secondary)	**Coastal Bushveld/Grassland; Subhumid Lowveld Bushveld; Natal Lowveld Bushveld;** **Patches Sand Forest.** **Valley Thicket (limited)**
Altitude (above mean sea level – a.m.s.l)	0 – 300
MAP (mm)	500 to 600 (limited); 600 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 30
Rainfall concentration index	15 to 50
Rainfall seasonality	Mid to late summer
Mean annual temp. (°C)	20 to >22
Mean daily max. temp. (°C): February	26 to 32
Mean daily max. temp. (°C): July	20 to 24
Mean daily min. temp. (°C): February	>20
Mean daily min temp. (°C): July	8 to >10
Median annual simulated runoff (mm) for quaternary catchment	40 to 80; 100 to >250

Table 4-1: Main attributes of the Natal Coastal Plain Eco-region (Kleynhans et al., 2005).

4.1.2 Climatic Conditions

The description of the climate in Richards Bay is derived from the South African Weather Bureau (now Service) long-term climate statistics (SAWB, 1992 and 1998). The Richards Bay region has a warm temperate climate and the temperature range is not extreme, although high temperatures can occur during summer. Averages of daily minimum, maximum and mean temperatures, and average monthly rainfall are presented in Figure 4-1. The average summer maximums exceed 27 °C from December to March, when it is also very humid. Winters are mild with the average minimum temperatures of 14 °C in June and July (SAWS, 1998). The average annual rainfall at Richards Bay is 1 212 mm (SAWB, 1992). The majority of rainfall occurs from late September to March and this period is usually associated with summer storms. Winter rainfall is not uncommon and is associated with the passage of cold fronts.

The predominant winds are associated with the Indian Ocean high pressure system and its seasonal movement relative to Richards Bay, with coastal lows and the passage of frontal systems having some influence. The winds are generally aligned with the coastline and at Richards Bay winds occur predominantly in the sector north to north-northeast and in the sector south to southwest.

Land-based changes in climate

Climate change in South Africa shows projected rainfall variations with a distinct gradient of increasing to decreasing precipitation going east to west over the country. The increase in precipitation over KwaZulu-Natal and the north-eastern parts of the Eastern Cape is caused partially by the enhanced evaporation from the warm Agulhas current and orographic influence of the Drakensberg mountain range. The areas of Northern Cape and Western Cape will experience less rainfall. There is a marked increase in both day and night-time temperatures with the most major change toward the inland regions of the country. Temperature increases are still present in areas closer to the coast but are reduced by the mitigating influence of the large bodies of water.

These synoptic-scale changes will have dramatic influences on varying meteorological parameters. It is projected that there will be an increase in the number of days exhibiting extreme daytime temperatures, as well as the number and duration of heatwave events. Furthermore, a greater number of warm nights will increase general discomfort, reduce overnight frost and morning dew.

The rainfall parameters are more complex but there is general agreement that areas, where either increasing or decreasing rainfall volumes, are expected, rainfall will be focused into a shorter timeframe. Some areas are exhibiting a shifting in the rainfall onset and cession timing. The rain season is decreasing in length; in the frontal areas of the western and southern areas of the country, winter rainfall is compressed, and the dry summer is extended; to the east and north, the convective rainfall is clustered into fewer summer months and the shoulder seasons of autumn and spring exhibit more summer-like temperatures and reduced rainfall. While it is generally expected that there will be a decrease in the number of rainfall days each year, there will likely be an increase in precipitation intensity and the occurrence of more extreme events when it does rain. This is particularly true in the summer convective rainfall areas. There will also be an increase in dry spell duration between rainfall events.

Observed changes (Figure 4-1) at Richards Bay indicate a long-term increase in mean temperature. The diurnal range drops significantly from the 1960s. Further assessment into the night-time temperatures would indicate if this were a reanalysis error or indicative of a larger trend. The precipitation has a slight shallow decreasing trend. The long-term future shows this area may have either increasing, decreasing or stationary precipitation. The areas of more defined increase are further inland of Richards Bay. There is an increase in the vapour pressure as increased warming evaporates more water vapour.

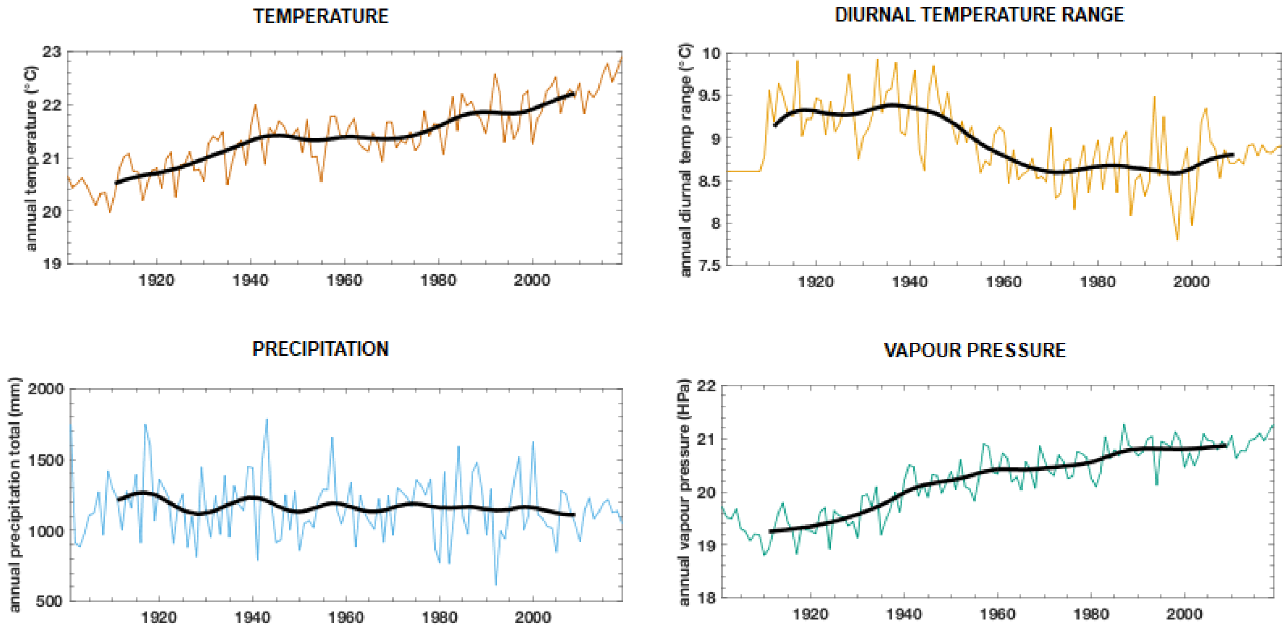
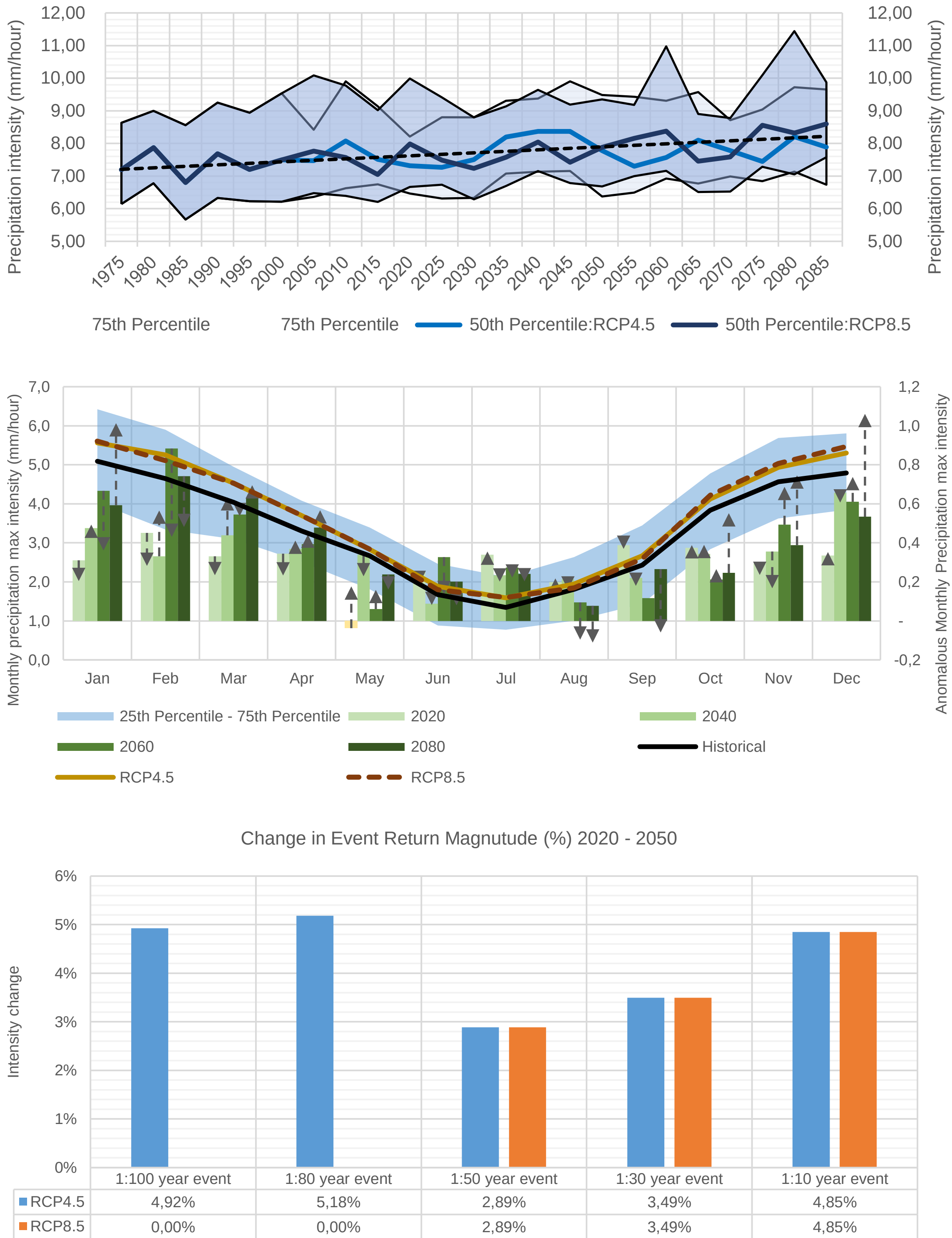


Figure 4-1: Climate variables for Richards Bay.

Precipitation intensity changes over major rivers near Richards Bay

Changes in the precipitation intensity at Richards Bay are noted in the projected scenarios. The convectively forced precipitation has a peak of ~7mm/hour in the historic period but this is increased to ~8.2mm/hour by the end of the century. This results in an increase of ~10-16% intensity in the latter parts of the century. The seasonal signal shows an increase in intensity in all months into the projected future. The largest of this increase is in austral summer with increase of 0.6-0.9mm/hour from December to February. The increase in the event magnitude will result in the increased magnitude of the event return period. These are projected to increase by ~5%, 3.5%, and 2.9% for the 1:10 1:30, and 1:50 year events, respectively (Figure 4-2).



	1:100 year event	1:80 year event	1:50 year event	1:30 year event	1:10 year event
RCP4.5	4,92%	5,18%	2,89%	3,49%	4,85%
RCP8.5	0,00%	0,00%	2,89%	3,49%	4,85%

Figure 4-2: Richards Bay precipitation intensity characteristic changes. Annual average hourly peak (top), monthly peak (middle), and return event magnitude (bottom).

Changes in extreme temperatures

Changes in average maximum temperature will shift the baseline temperature profile meaning there will be an increase in the temperatures of the more extreme events, a decrease in cooler days, and more frequent and severe heatwaves. Climate changes that may have impacts of the infrastructure or the ships will likely be those associated with extreme events. For temperature, the assessment of baseline maximum temperatures and the extreme 90th, -99th percentile changes are selected.

The temperatures in Richards Bay are the highest with an average temperature currently between 25-26°C, this is projected to increase to 26°C and 2.5 by the end of the centaur for RCP4.5 and RCP8.5. The associated temperature extreme will also increase by 2.0-2.5°C and 3.0-4.0°C by the end of the century. These changes will mean heatwaves and extreme temperature days will become that much more severe than they are already currently (Figure 4-3).

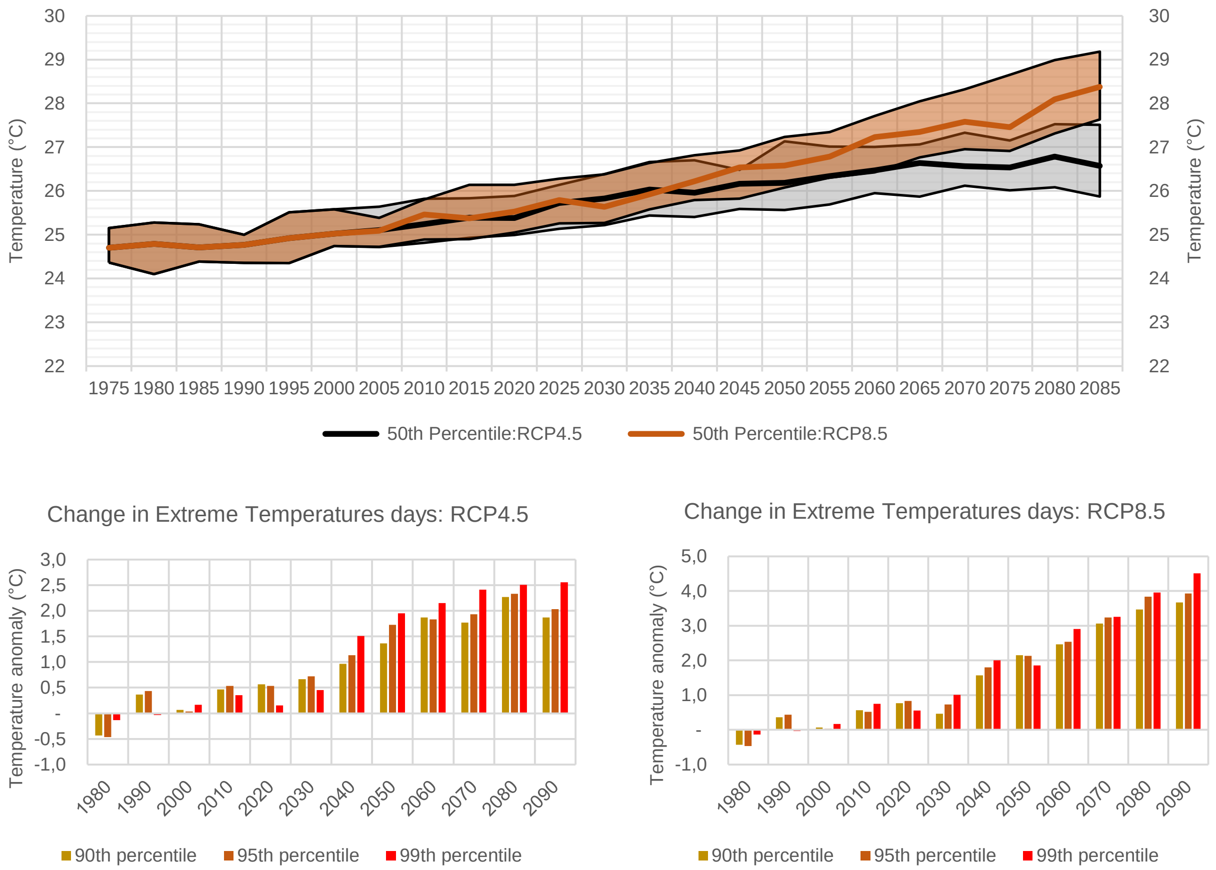


Figure 4-3: Figure 4-3: Richards Bay temperature maximum characteristic changes. Annual average maximum temperature (top), 90th, 95th, 99th percentile daily event changes, RCP4.5 (bottom left), RCP8.5 (bottom right).

Changes in Fire danger index (FDI)

The Fire danger index (FDI) "*is the system that is used to provide a measure of the relative seriousness of burning conditions and the threat of fire by providing an accurate measure as possible of the relative seriousness of burning conditions*. It uses the current day temperatures, relative humidity, and wind speed, and the rainfall volume and how long ago that rainfall fell in the area to assess the seriousness of a potential fire in the area. The FDI Is proportional to the temperature and wind speed, but inversely proportional to the relative humidity and rainfall characteristics. The warmer temperature and fast wind speeds mean higher FDI. Lower Relative humidity and a longer time since rainfall, mean higher FDI.

- Temperature (T = Maximum, expressed in degrees C)
- Relative humidity (RH = Minimum, expressed in percentage %)
- Wind speed (Wind Factor calculation, 4-2)
- Rain (Rainfall Factor calculation, **Error! Reference source not found.**-3)

Wind speed (km/h)	Add to initial FDI value 0
0-2	0
3-8	5
9-16	10
17-25	15
26-32	20
33-36	25
37-41	30
42-45	35
46+	40

Table 4-2: Wind Factor calculation.

		Days since last rainfall											
		1	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**21**
Last Rainfall (mm)	**2.6**	0.70	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	5.2	0.60	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	7.6	0.50	0.70	0.90	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	10.2	0.40	0.60	0.80	0.90	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	12.8	0.40	0.60	0.70	0.80	0.90	0.90	1.00	1.00	1.00	1.00	1.00	1.00
	15.3	0.30	0.50	0.70	0.80	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
	20.5	0.20	0.50	0.60	0.70	0.80	0.80	0.90	1.00	1.00	1.00	1.00	1.00
	25.5	0.20	0.40	0.50	0.70	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00
	38.4	0.10	0.30	0.40	0.60	0.60	0.70	0.80	0.90	1.00	1.00	1.00	1.00
	51.1	0.10	0.20	0.40	0.50	0.50	0.60	0.70	0.80	0.90	1.00	1.00	1.00
	63.8	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.70	0.80	0.90	1.00	1.00
	76.5	0.10	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.80	0.90	1.00
	76.5	0.10	0.10	0.10	0.20	0.10	0.50	0.60	0.60	0.70	0.80	0.90	1.00

Table 4-3: Rainfall Factor Calculation.

FDI is calculated by FDI = [{(Temp-35) - ((35-Temp)/30) + ((100-RH) * 0.37) + 30} + Wind Factor] * Rain Factor.

The potential outputs are as follows:

Alert stage/colour code	FDI	Fire Danger	Ratings
Blue	0-20	Low	Insignificant

Green	21-45	Moderate	Low
Yellow	46-60	Dangerous	Medium
Orange	61-75	Very dangerous	High
Red	76-100+	Extremely dangerous	Extremely high

The assessed FDIs are the average FDIs for a year and the assessment calculates the change in the baseline FDI averages to be expected under future climate conditions. Changes in these baselines may be enough to push a normal day from the Green to the Yellow category. It is likely that fires under future scenarios will be more severe on average, however, the average changes here are contextualized in the changes of extreme temperatures, and potentially more variable rainfall noted earlier. There will certainly be extreme days in the dry seasons where temperatures are hot and the wind is strong, resulting in an extremely high FDI and the future climate changes will increase that likelihood.

Richards Bay sees an increase in the average FDI into the projected future. Generally, the RCP8.5 shows a steeper trend as this is driven by more extreme day time temperatures and more varied precipitation. The change in relative humidity and average wind speed is seemingly negligible, so the changes shown in Figure 4-4 are primarily temperature-driven.

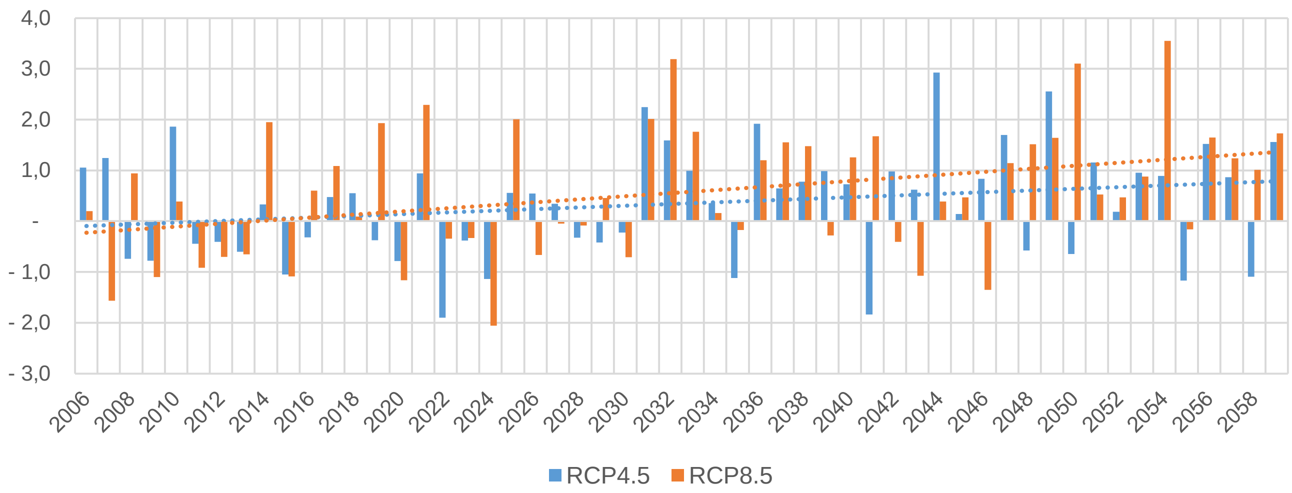


Figure 4-4: Changes in FDI in the projected future at Richards Bay under RCP4.5 and RCP8.5, respectively.

Ocean-based changes in climate

Notable changes in the ocean characteristics occur very slowly. This is due to the long thermal capacity of water and the slow transport and overturning of water in the ocean. However, increases in atmospheric temperatures will filter down to ocean surfaces increasing sea surface temperature (SST). This increased heating leads to thermal expansion and with enhanced freshwater inputs, resulting in a slow rise in baseline sea-level. This long-term sea-level rise (SLR) will enhance the tidal range and the base level of extreme wave heights such as storm surges, or storm tides.

Changes in sea surface temperatures

Changes in sea surface temperature (SSTs) are noted in the Indian Ocean located long the warm Agulhas current near the proposed activity at Richards Bay. The increases between RCP4.5 and RCP8.5 are similar. These depict an increase of ~0.5-0.6°C in mid-century and 0.8-1.5°C at the end century. (Figure 4-5).

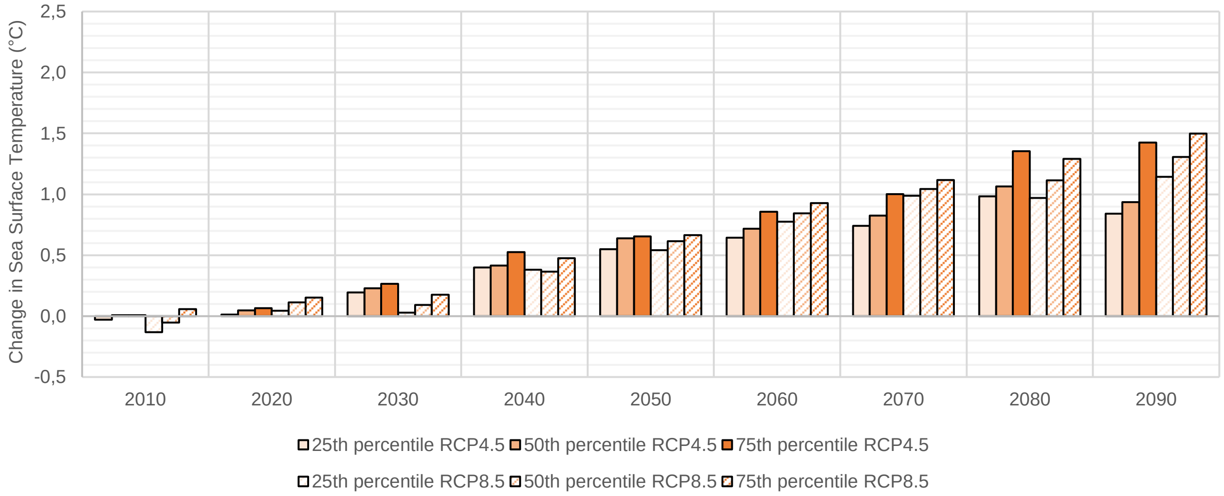


Figure 4-5: Projected changes in sea surface temperature at Richards Bay under RCP4.5 and RCP8.5, respectively.

Changes in sea-level rise

Sea-level rise is forced by several mechanisms, including thermal expansion, glacier and Antarctic and Greenland ice sheet melt, land storage, and ice sheet dynamics. This has occurred in the observational record and it is anticipated that this will continue under the various future climate scenario (Figure 4-6). From 1993–2012, the sea level off the east coast of Africa increased annually by ~1–4 mm. The observed trends in the historical period from stations around South Africa indicate an average SLR trend of 1.71mm/year or 0.9mm/year to 2.52mm/year with a 95% confidence interval. Continuing this trend would lead to ~90-250mm increase by the end of the century (Figure 4-5).

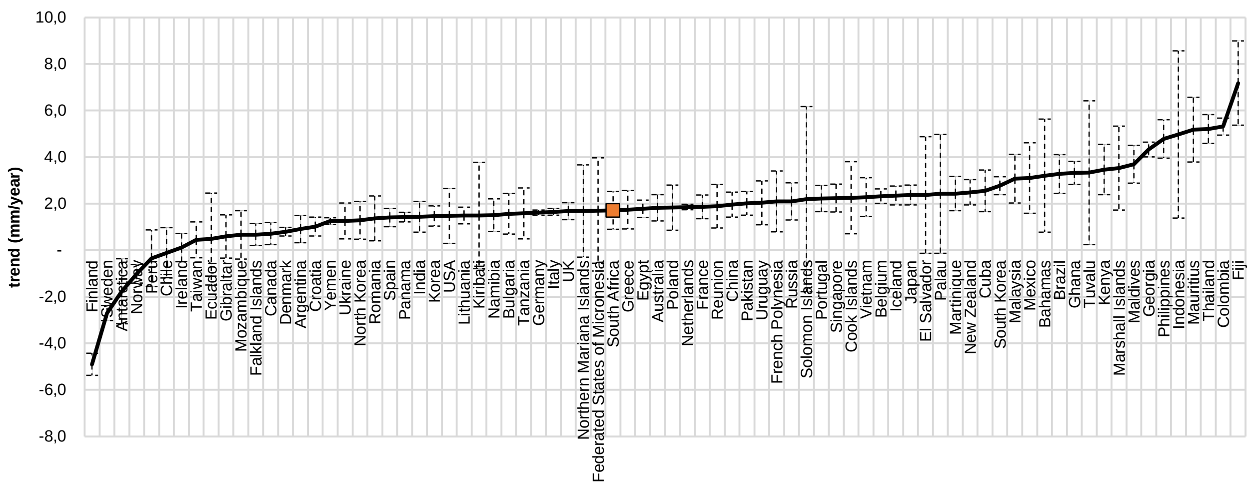


Figure 4-6: Global observed sea-level rise trends.

Anticipated SLR at Richards Bay on the eastern seaboard projects ensemble increases with ~50mm by 2100 for both RCP4.5 and RCP8.5. (Figure 4-7). There is however a wide variation between different SLR models. Nonetheless, most of these models indicate a clear long-term increasing trend. This change in height will alter the baseline of the more extreme storm surge and tide events leading to coastal damage.

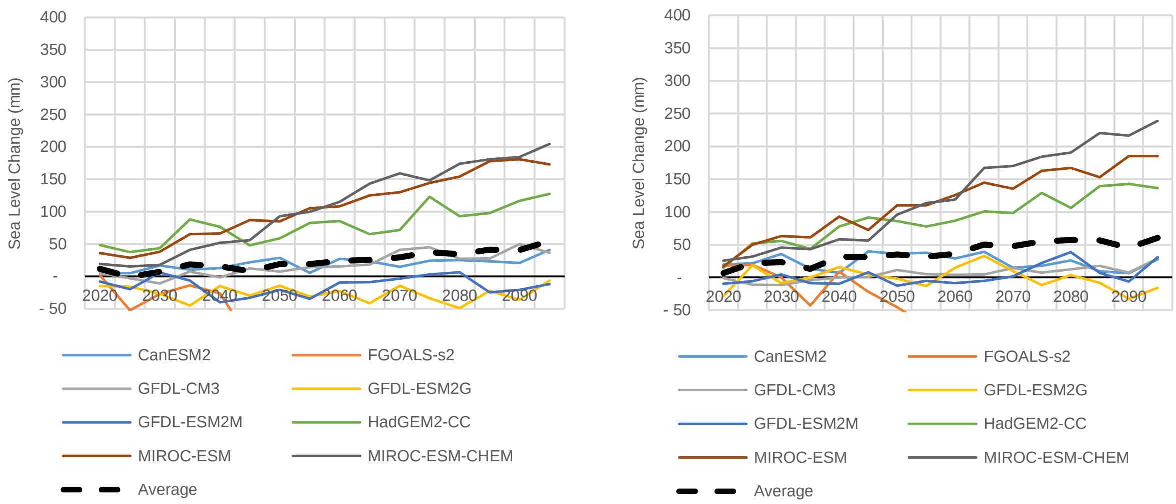


Figure 4-7: Projected changes in SLR under RCP4.5 (left) and RCP8.5 (right) at Richards Bay.

Changes in 850hPa level wind

Wind at 850hPa level is the synoptic level forcing that determines the wind character at the lower elevations. Surface level winds are driven by this synoptic level, but also by local features such as topography and land cover. Projected changes in wind speed and direction at 850hPa would be caused by alterations in synoptic pressure systems. In Richards Bay, there are increased projected from the south-east for both RCP scenarios. There is also a noted decrease in the wind from the north and northeast directions. The easterly and southerly winds are less clear in direction trends (Figure 4-8).

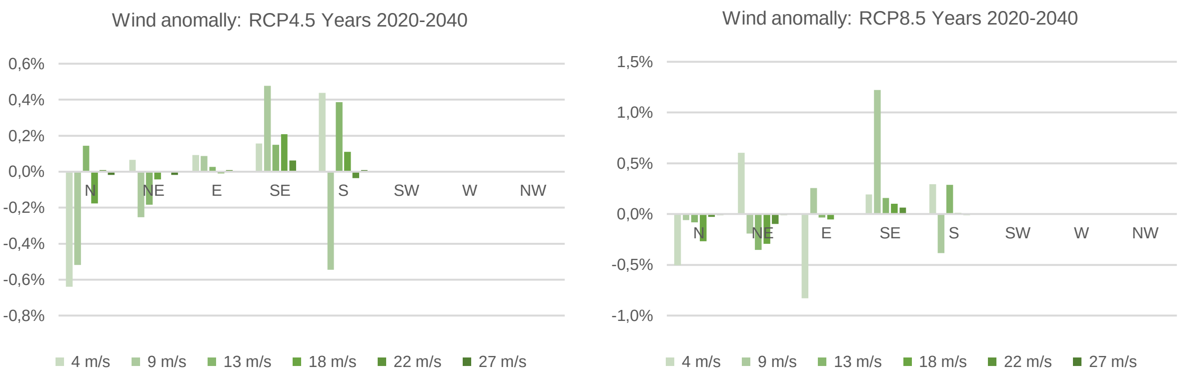


Figure 4-8: Change in wind speed and direction at 850hPa level for Richards Bay under RCP4.5 and RCP8.5.

4.1.3 Geology and Soils

The proposed development site is located over alluvium, sand and calcrete. These are loose unconsolidated deposits which were formed during the Quaternary period. Further explanation is provided in Table 4-2.

Deposits	Description
Alluvium:	Known as loose, unconsolidated (not cemented together into a solid rock) soil or sediment that has been eroded, reshaped by water in some form, and redeposited in a non-marine setting (Geosciences, 2011). Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger

Deposits	Description
	particles of sand and gravel. When this loose alluvial material is deposited or cemented into a lithological unit, or lithified, it is called an alluvial deposit (Geosciences, 2011). The term "alluvium" is not typically used in situations where the formation of the sediment can clearly be attributed to another geologic process that is well described. This includes (but is not limited to): lake sediments (lacustrine), river sediments (fluvial), or glacially-derived sediments (glacial till). Sediments that are formed or deposited in a perennial stream or river are typically not referred to as alluvial (Geosciences, 2011). Most alluvium is geologically Quaternary in age and is often referred to as "cover" because these sediments obscure the underlying bedrock. Most sedimentary material that fills a basin ("basin fill") that is not lithified is typically lumped together as alluvial (Geoscience, 2011).
Sand:	A granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type, therefore, a soil containing more than 85 percent sand-sized particles by mass (Geosciences, 2011). The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO_2) (Geosciences, 2011), usually in the form of quartz. The second most common type of sand is calcium carbonate, for example, aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish (Geosciences, 2011).
Calcrete:	Also known as Hardpan, calcium-rich duricrust, a hardened layer in or on a soil. It is formed on calcareous materials as a result of climatic fluctuations in arid and semi-arid regions (Geociences, 2011). Calcite is dissolved in groundwater and, under drying conditions, is precipitated as the water evaporates at the surface. Rainwater saturated with carbon dioxide acts as an acid and also dissolves calcite and then re-deposits it as a precipitate on the surfaces of the soil particles; as the interstitial soil spaces are filled, an impermeable crust is formed (Geociences, 2011).

Table 4-4: Description of the dominant deposits within the proposed development site.

According to the Land types of South Africa databases (ARC, 2006), the soils in the project area fall within Ia74 (deep alluvial soils comprise >60% of land type) land types. In general, the moisture regime of the Ia74 land types is dominated by surface flows of water with infiltration and subsequent lime and gypsum translocation. As these land types occur more readily in dry to arid environments the dominance of lime in the soil will mask most redox morphology features due to alkaline condition. These conditions lead to the potential development of redox depletions in the form of grey colours but will not readily yield high chroma redox accumulations (in the form of Fe oxides and hydroxides) due to the dominance of white $FeCO_3$ minerals (as the dominant Fe minerals in alkaline soil solution conditions). Additionally, the youthful nature of the soils lead to limited expression of mottling (Der Waals, 2019); (Job, et al., 2019). Different soil types are encountered within shoulder, mid-slope and valley positions of the project area, and is mainly due to sub-surface geology, products of weathering, degree of saturation, soil texture and slope position. Fine to medium-grained sand is expected for the study area.

According to the preliminary Geotechnical Investigation, the site and surrounds are underlain by Quaternary Age Aeolian deposits. The site was observed to be underlain by fill material, alluvium, Aeolian Deposits and Harbour Bed deposits. These geological units are generally described in order of increasing depth:

Fill – Dry to moist, light to dark grey / grey / dark greyish brown / bluish grey / light brown / brown / light to dark yellow, loose to medium dense, fine to medium grained, slightly gravelly SAND to silty SAND / slightly clayey SAND / soft to stiff, intact / pinholed, sandy silty CLAY. The fill was encountered in IP1 through IP6, IP8, IP9 and AH1 through AH5 and was observed to extend to depths in the approximate range 0.07m (AH5 refers) to in excess of 3.05m (IP4 refers) below EGL.

Alluvium – Moist to wet, dark grey / brown / orange brown / light to dark brown / yellowish brown / greyish brown, loose to medium dense, fine to medium grained, slightly clayey silty SAND to silty SAND / very soft to soft, sandy silty CLAY containing occasional decomposed roots, shell fragments and cobbles. The alluvium was encountered in IP5 through IP9, AH4 and AH6 and was observed to extend to depths in the approximate range 0.24m (IP7 refers) to in excess of 2.2m (IP8 refers) below EGL.

Aeolian Deposits – Moist, dark red / light to dark yellow / light brown / grey, fine to medium grained, silty SAND. These soils were encountered in IP2 and were observed to extend to depths of in excess of 3.6m below EGL.

Harbour Bed Deposits – Slightly moist to wet, brown / yellowish brown / light greyish brown / light grey / light yellow / light olive grey / orange brown, loose to medium dense, fine to medium grained, silty SAND with occasional shell fragments. These soils were encountered in IP1, IP7, AH1, AH2 and AH5 and were observed to extend to depths in excess of 3m below EGL.

4.1.4 Water Recourses

4.1.4.1 Groundwater

The project is situated in Quaternary Catchment W21F of the Pongola –Mtamvuna (DWS, 2016) Water Management Area (WMA 4). The delineated sub-catchment is indicated in Figure 4-9 below. The total extent of the sub-catchment area is approximately 22.6 km^2.

Two aquifer systems have been identified – an unconfined aquifer associated with the unconsolidated sands; and a confined and fractured aquifer network associated with deeper and older granite/gneiss rock. Based on available groundwater level data, the water table for the area range from 3 to 15 metres below ground level (mbgl). Literature suggests that the electrical conductivity (EC) for the underlying aquifer generally ranges between 0 – 70 mS/m (milli Siemens/metre) and the pH ranges from 6 to 8. This means that groundwater abstracted from the aquifer can generally be used for domestic and recreational use (DWAF, 1998). The estimated Groundwater Levels and Groundwater Users are shown in Figure 4-9 below.

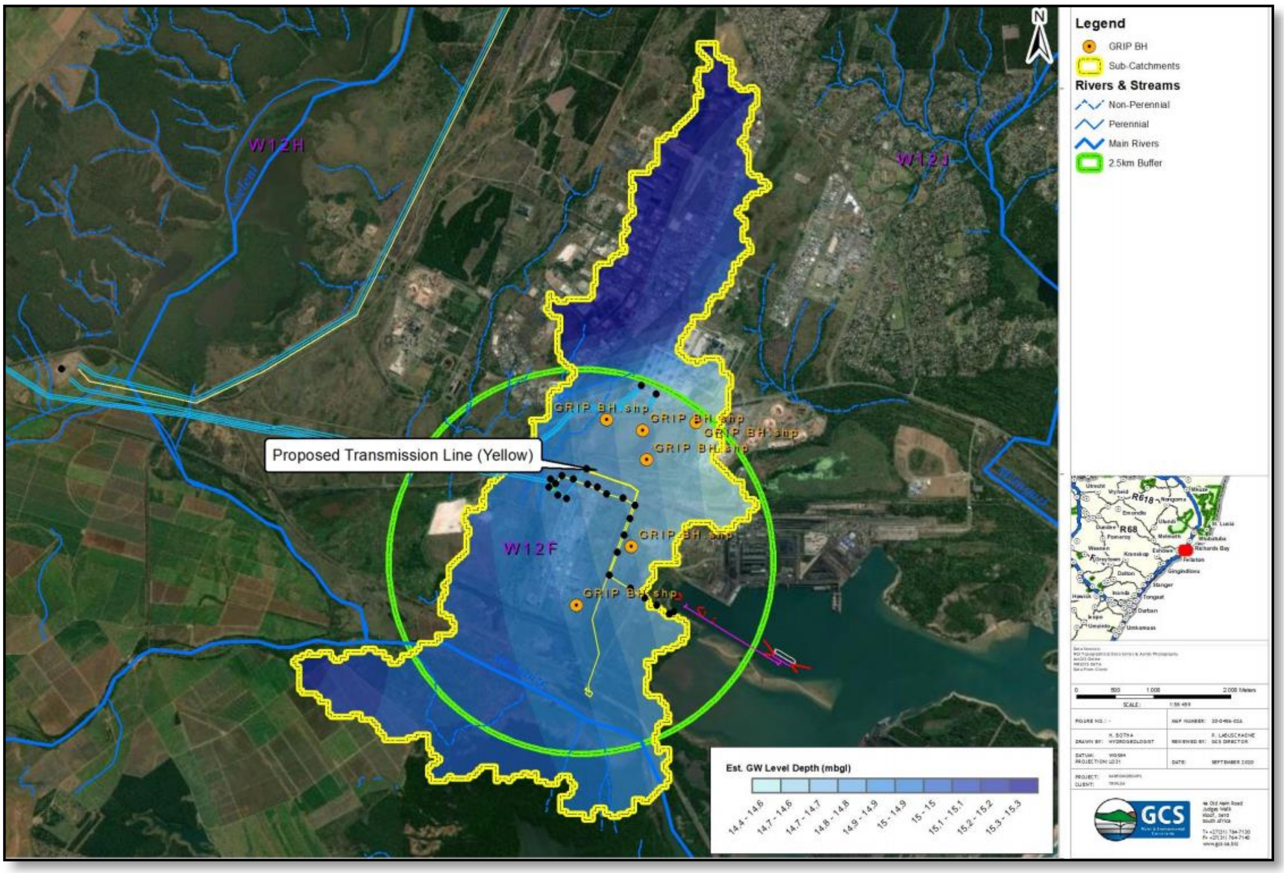


Figure 4-9: Estimated Groundwater Levels & Groundwater Users.

Six Groundwater Resource Information Project (GRIP) boreholes are situated within the boundary of the sub-catchment. Assuming a median aquifer yield of 0.5 l/sec, an existing use in the order of 259.2 m³/day is assumed.

The site conceptual geohydrological model for the site is shown in Figure 4-10 below.

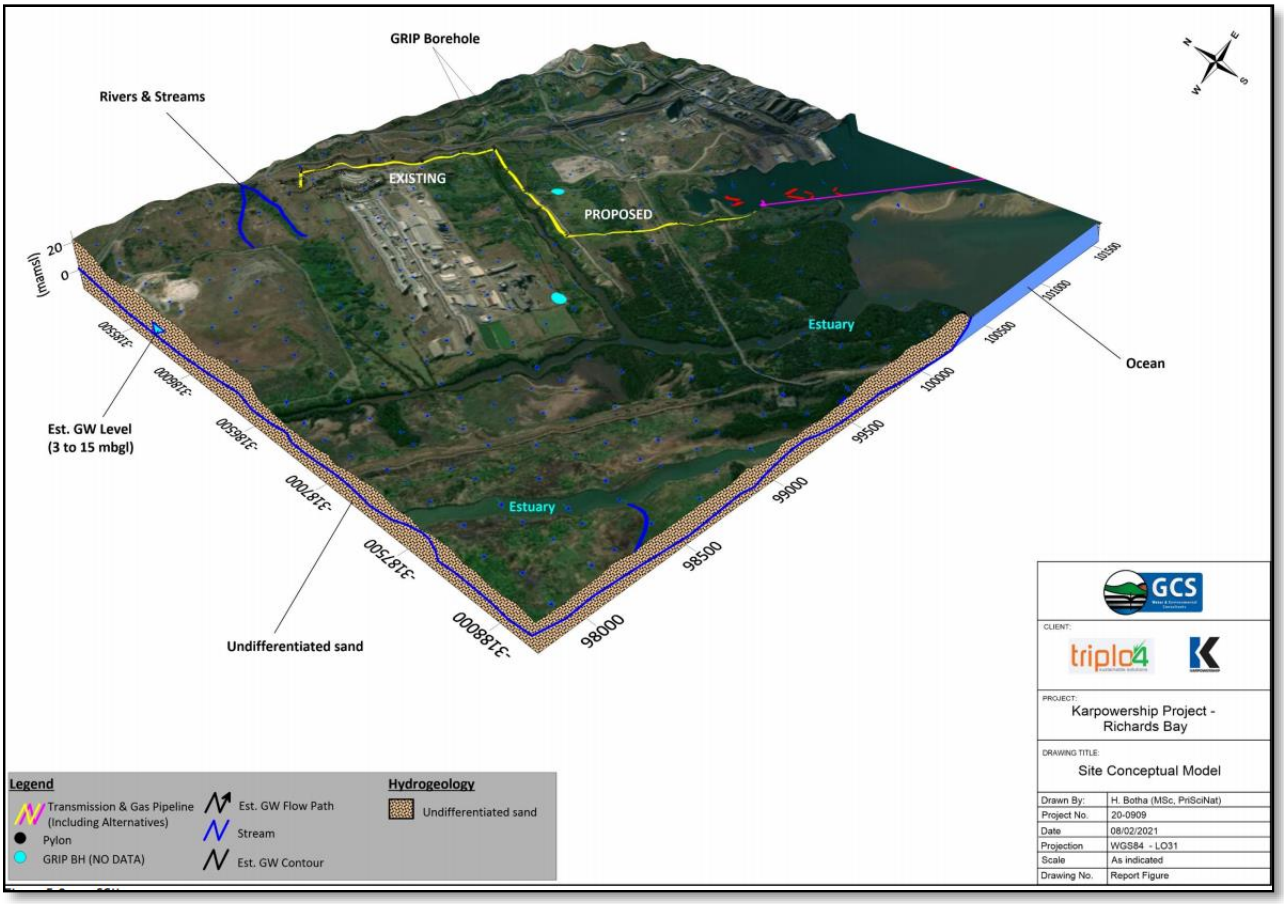


Figure 4-10: The site conceptual geohydrological model for the proposed transmission lines.

4.1.4.2 Water Management Areas

The proposed development falls within the Water Management Area (WMA): Usuthu to Mhlathuze, and the sub-WMAs: Mhlathuze and the quaternary catchment W12F. The WMA is drained by several parallel rivers which flow in a south-easterly direction and eventually discharge into the Indian Ocean. The rivers which contribute to the highest flow within this WMA are the Usuthu, Pongola, Mhlathuze, Mfolozi and Mkuze rivers with several smaller coastal rivers that feed the aforementioned larger rivers ((Nel *et al*., 2011), as shown in Figure 4-11 below.

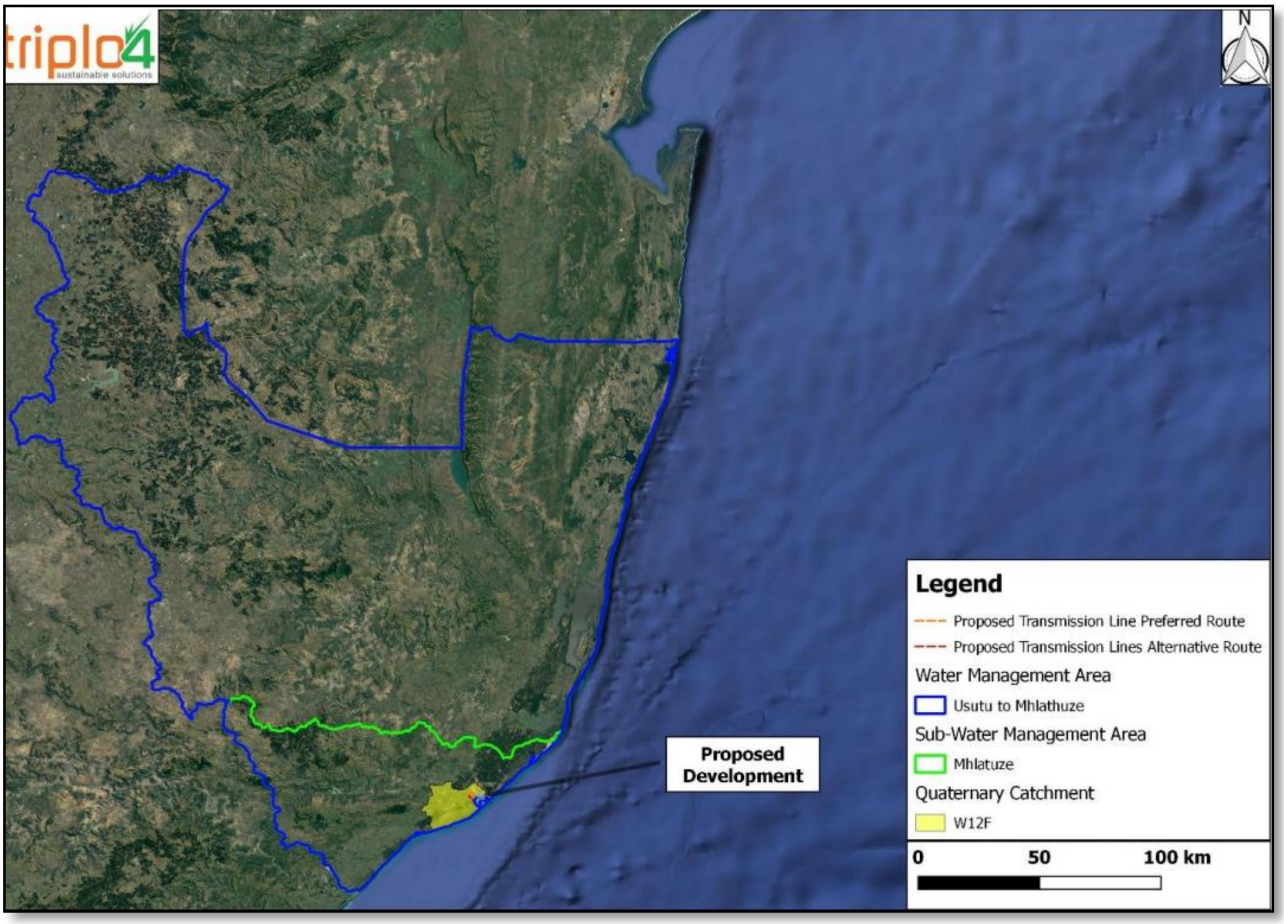


Figure 4-11: Map of the WMA, sub-WMA and Quaternary Catchment that fall within the proposed development.

4.1.4.3 Wetlands and Watercourses

The National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA), are a selection of rivers, wetlands and estuaries which have been identified as systems of strategic importance to the hydrological functioning of South Africa. These systems have been identified using scientific methodologies as well as consensus amongst researchers, government entities and the general public (Nel *et al*., 2011).

According to the NFEPA dataset, a FEPA Estuary will be at risk as a result of the preferred and alternative transmission line routes. Only a small portion of both of these routes do not occur within the FEPA Estuary, as per figure 4-12 below.

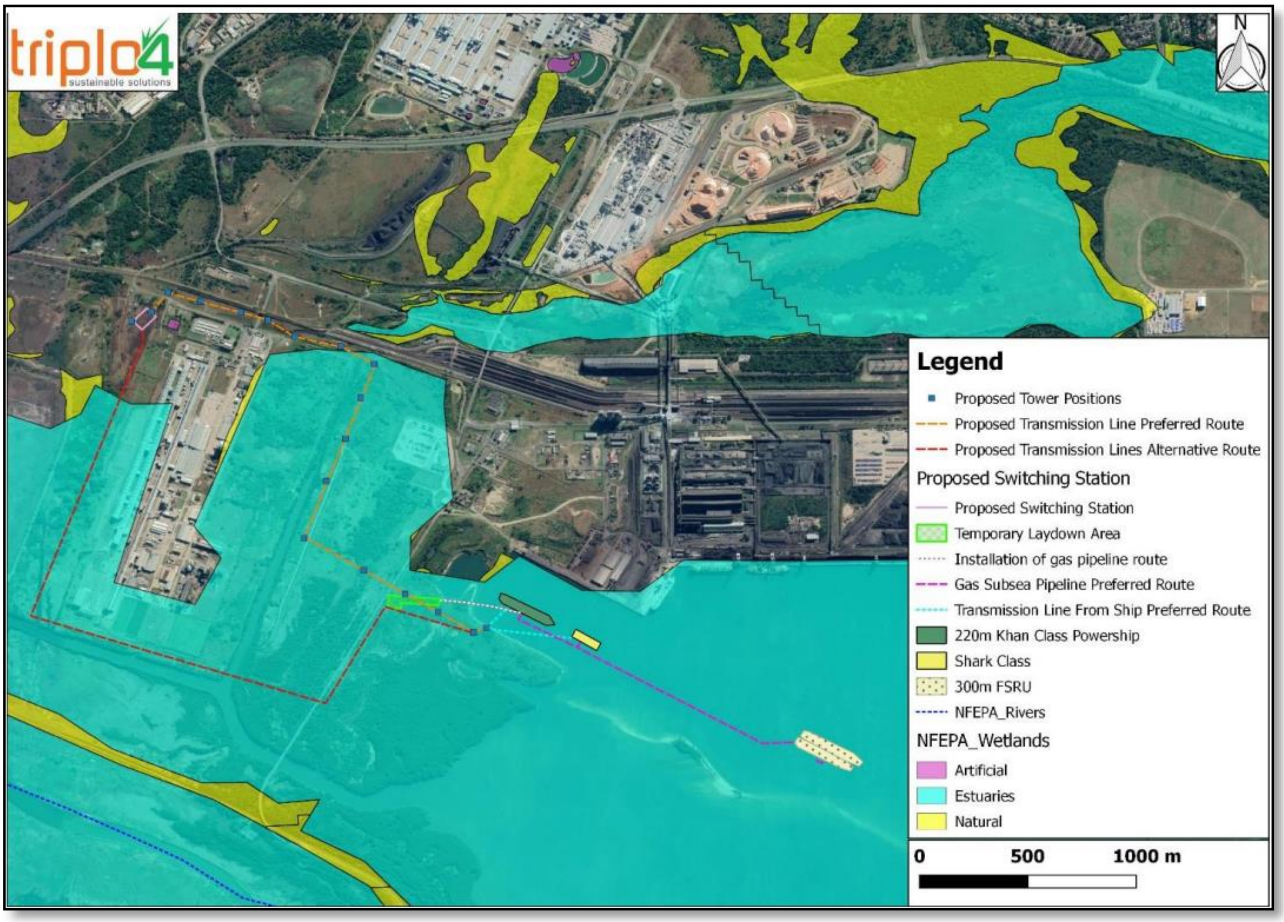


Figure 4-12: Map of the FEPA Rivers and Wetland in relation to the proposed development, from the NFEPA dataset.

Historical Wetlands Delineation

The Richards Bay Port and the surrounding areas have undergone significant changes as a result of developments such as linear infrastructure (dirt and tar roads, overhead powerlines), coal storage areas, ship docking areas, industrial hubs, and yacht clubs which have largely altered and destroyed the natural landscape which featured forest, swamps, grasslands and watercourses.

In order to understand these changes and the current landscape, historical topographical maps dating back to 1943, 1964 and 1983 were interrogated.

From this information, the following watercourse delineation (Figure 4-13) was assumed to be historically present before the Richard Bay Port was established.

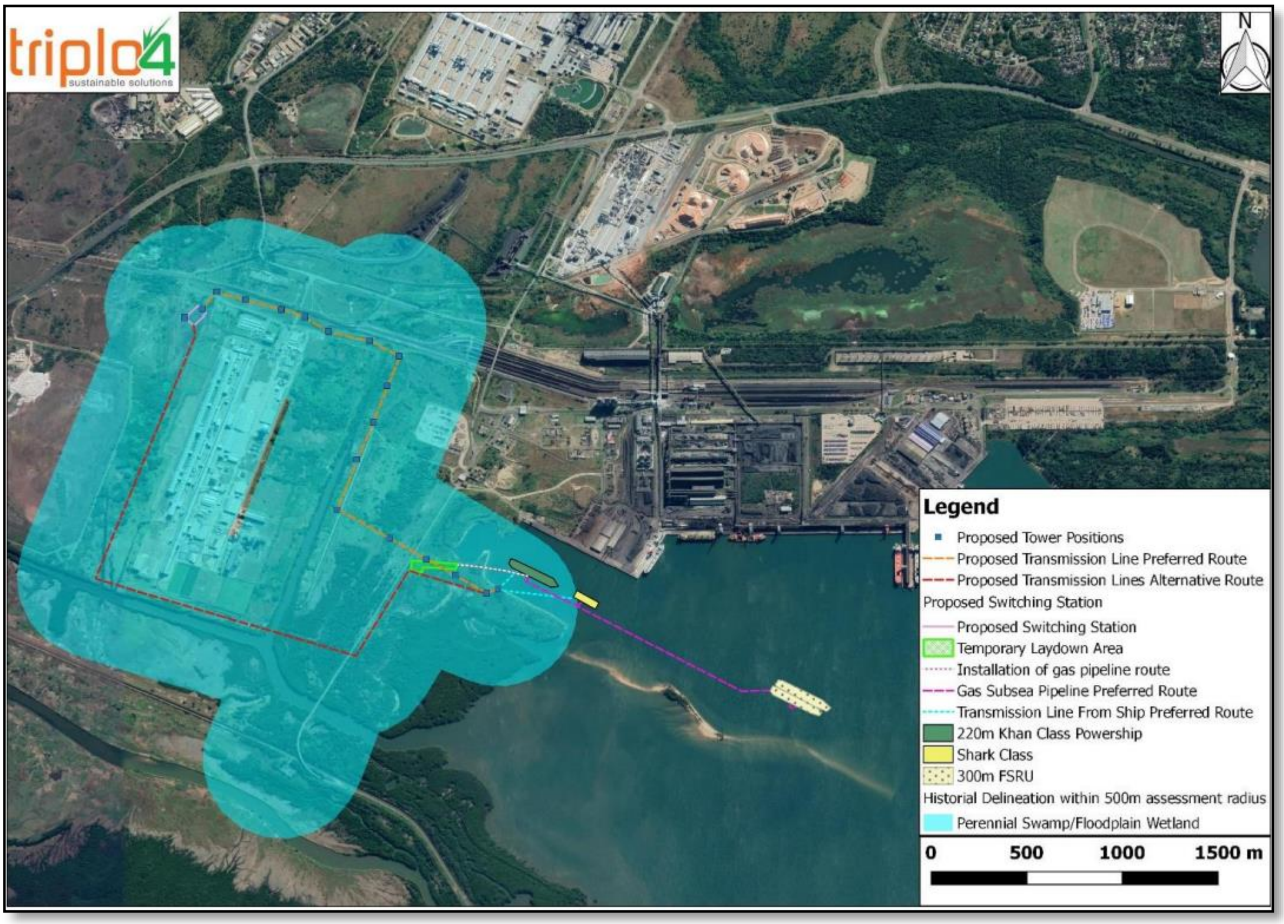


Figure 4-13: Map representing the historical watercourse delineation within the proposed development site and 500m assessment radius.

Wetland Delineation

A total of 25 watercourses were identified within the 500m assessment radius (as per figure 4-6 below). The classification of these watercourses is as follows: one artificial dam, one estuary/port waters, three channelled valley bottom wetlands, one depression wetland, five floodplain wetlands, four unchannelled valley bottom wetlands, six hillslope seepage wetlands and four river riparian systems. The riverine systems were classified as B channel streams i.e. streams that have presumable flow six to nine months of the year and those that sometimes have baseflow.

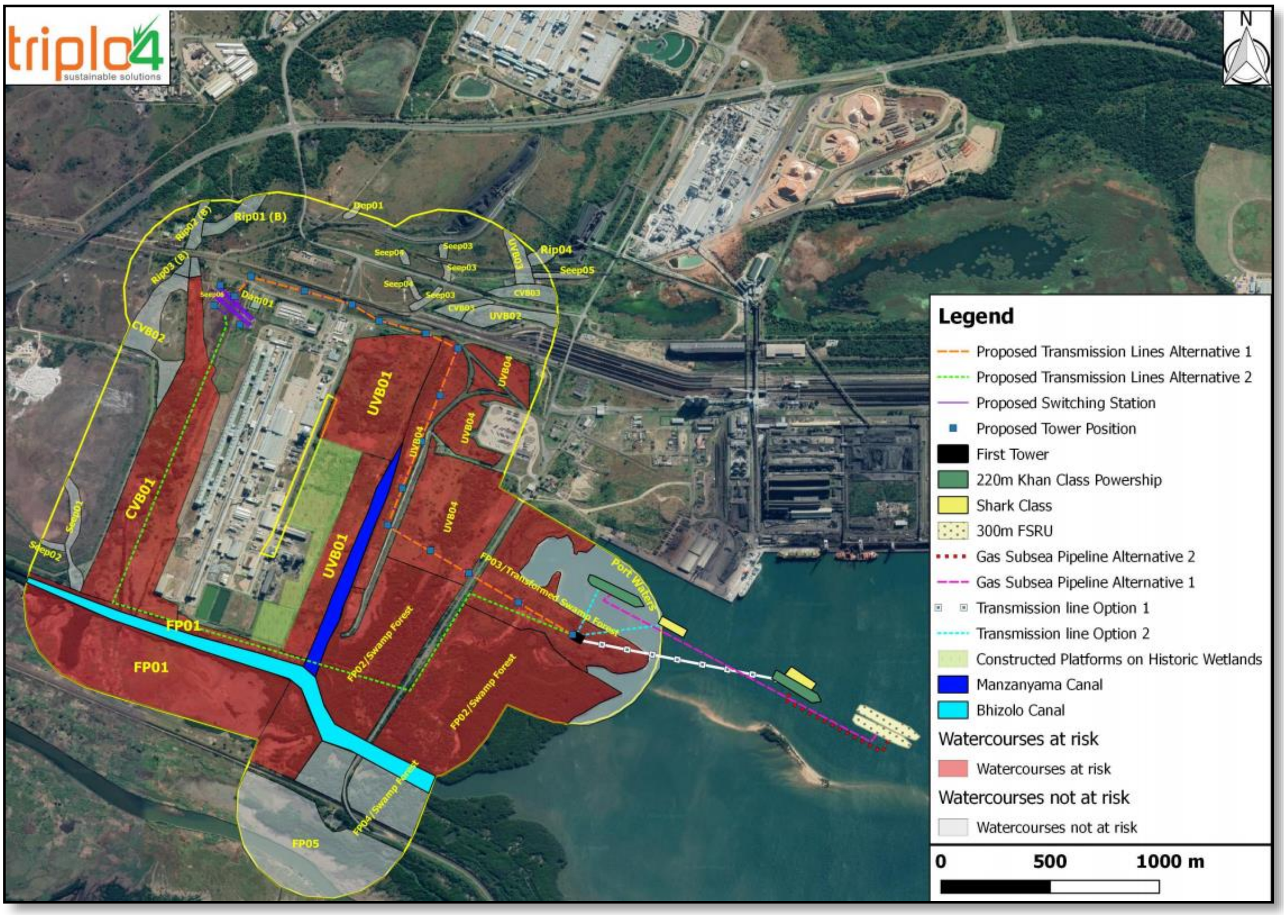


Figure 4-14: Map of the in-field delineations of the watercourses identified at the proposed development site and 500m assessment radius.

Aquatic Assessment

Six assessment sites were investigated (refer to Figure 4-15 below), and only one site on an unnamed non-perennial drainage line (RB4) presented flowing water in which SASS5 sampling could be undertaken, and slightly lower levels of Dissolved Oxygen Saturation (%) were observed. The Macroinvertebrate Response Assessment Index assessment indicated that the macro-invertebrate assemblage was in a largely modified state with an ecological category of D (largely modified).

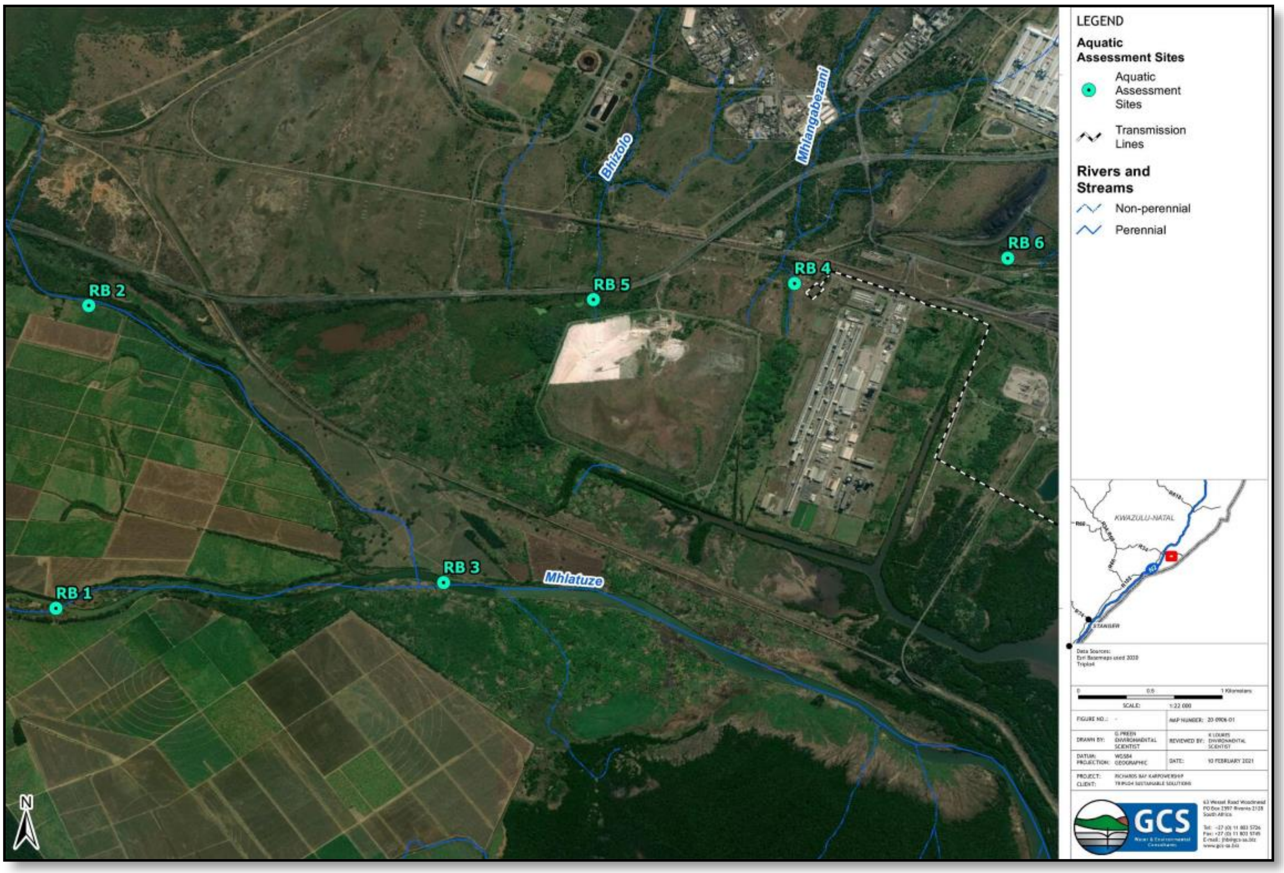


Figure 4-15: Aquatic Assessment Sites for the proposed development.

4.1.5 Fauna and Flora

4.1.5.1 Vegetation Types

The proposed development extends over two vegetation units identified at a desktop level, namely the Maputaland Coastal Belt and Subtropical Freshwater Wetlands (Figures 4-16 and 4-17). Threatened vegetation are shown in Figure 4-18. The conservation status of these vegetation types is vulnerable and least threatened, respectively (SANBI, 2011). The Maputaland Coastal Belt vegetation was intact to approx. 50%, which was noted to be disturbed by industrial development, tar roads and other linear activity. The Subtropical Freshwater Wetlands vegetation was predominantly disturbed along the proposed routes of the preferred and alternative Transmission Line. The disturbance that was noted is from built platforms, industrial development, dirt and tar roads and other linear activities.

Vegetation of the site comprises a mix of all four of these vegetation types, with the routes traversing areas of completely transformed and degraded vegetation, as well as areas of Critically Endangered Swamp Forest and Mangrove Forest. Several protected species were found on site, as well as several alien invasive plant species.

Some Species of Conservation Concern recorded on the site include the Swamp Forest dominant tree *Ficus trichopoda*, as well as mangrove trees (*Rhizophora mangle*), all of which are on the National List of Protected Trees. S*ideroxylon inerme*, also a protected tree, was also recorded on the site. In addition, some geophytic species from the *Iridaceae* family were recorded but could not be identified due to lack of flowers at the time of the site visit.

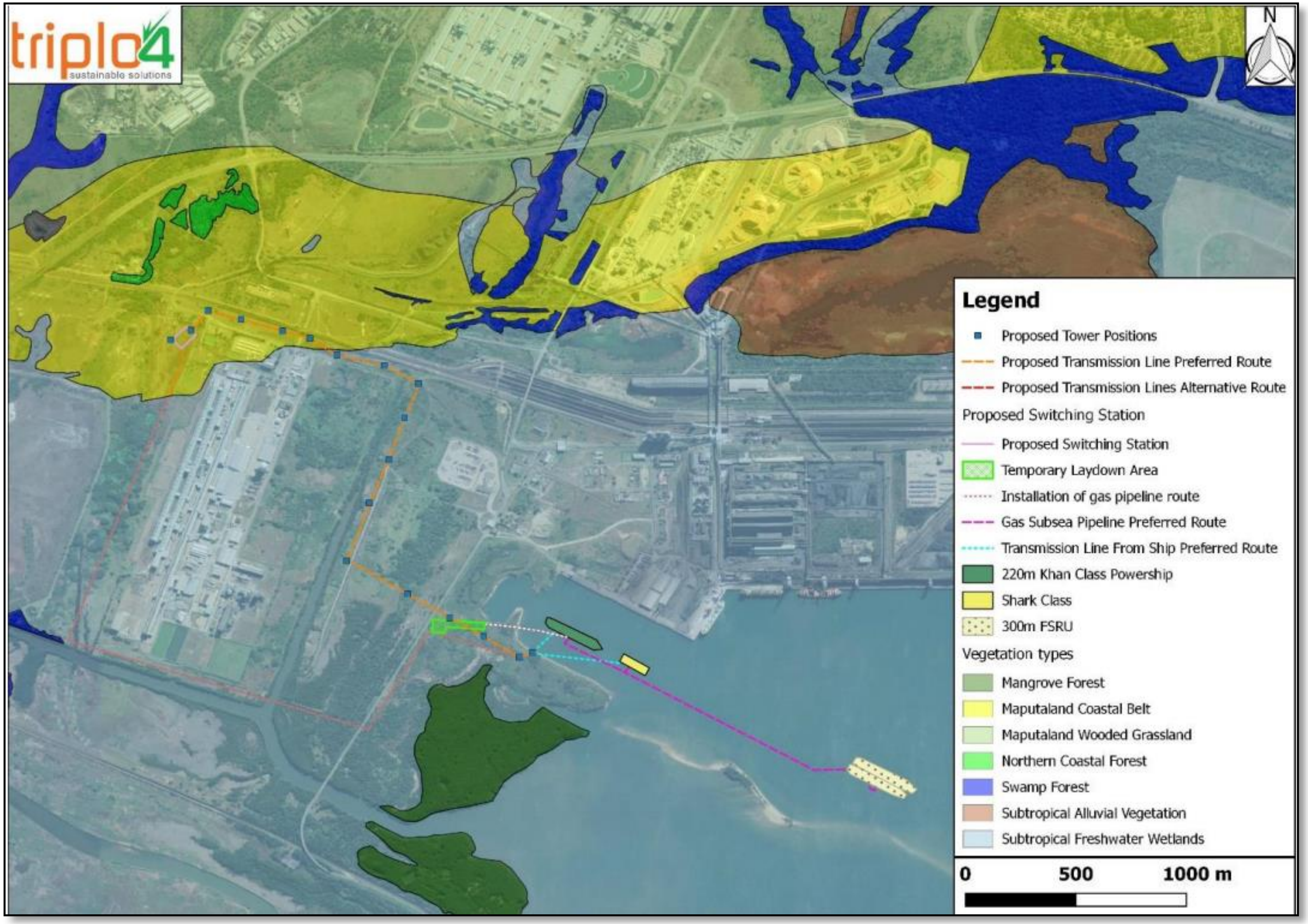


Figure 4-16: Map of the vegetation types within the proposed development.

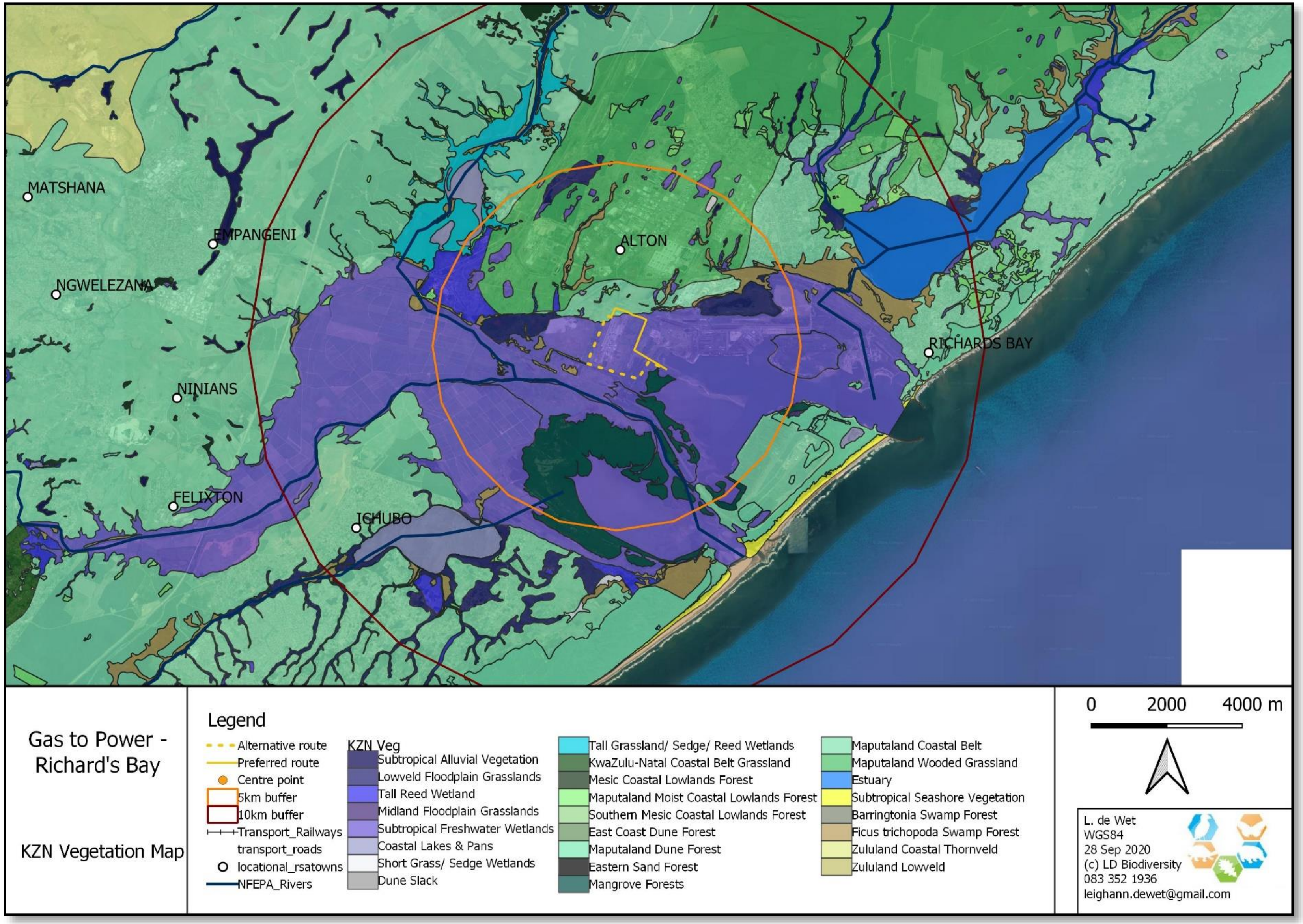


Figure 4-17: Additional map for Vegetation types within the study area.

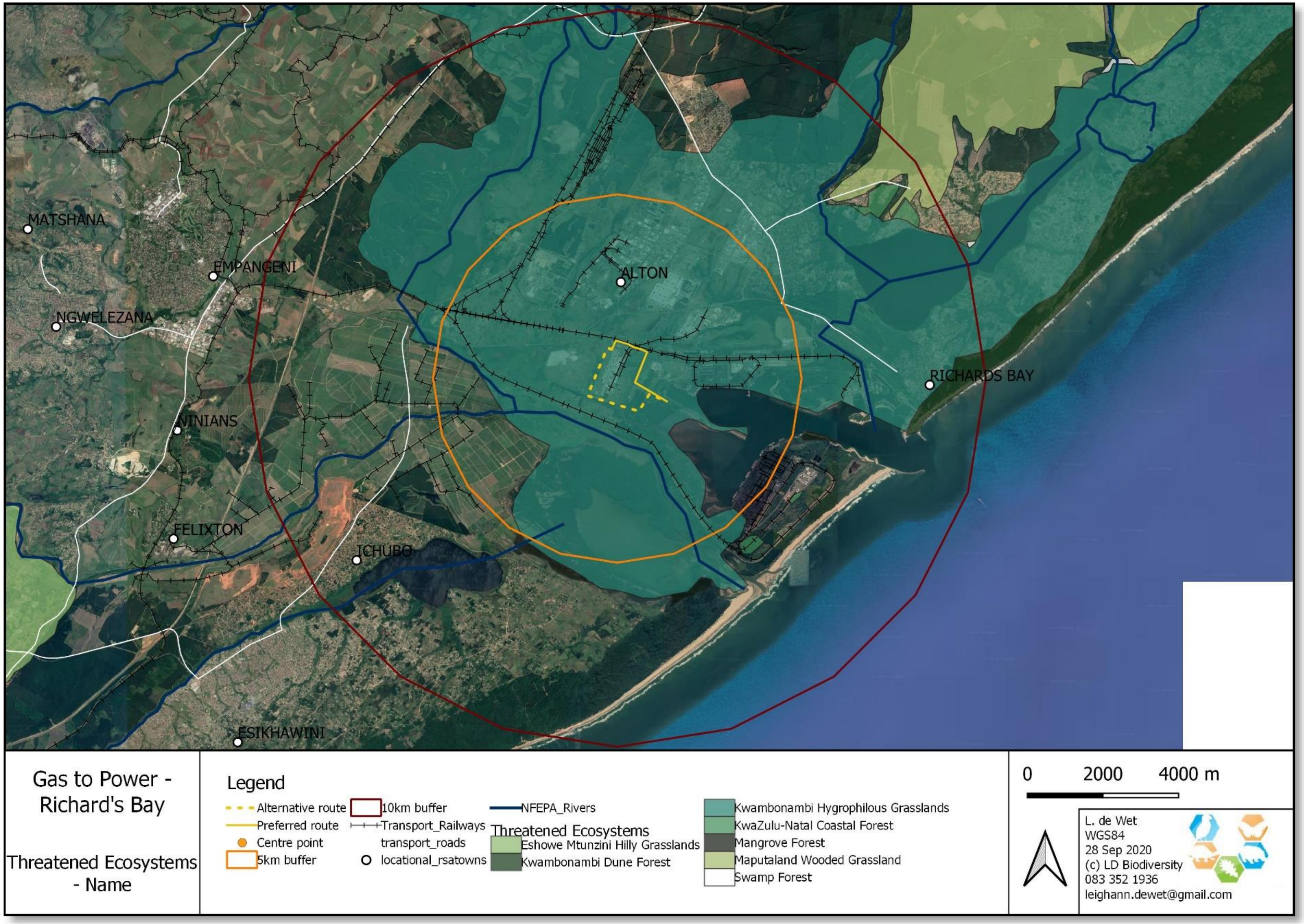


Figure 4-18: Threatened Ecosystems within the study area.

4.1.5.2 Critical Biodiversity Area

Ezemvelo KwaZulu-Natal Wildlife has developed and implemented the KwaZulu-Natal Biodiversity Plan to assist with development, protected areas expansion and conservation with the province (Ezemvelo Wildlife, 2016). The plan identifies areas as Critical Biodiversity Areas (CBAs) which cannot be lost if conservation goals are to be met. Figures 4-19 and 4-20 below present the identified CBA within the study area.

Furthermore, Ecological Support Areas (ESAs) were also established as these areas are required to support the functioning of CBAs and ecosystems. The guidelines of the KwaZulu-Natal Biodiversity Plan for each CBA and ESA category are outlined in table 4-3.

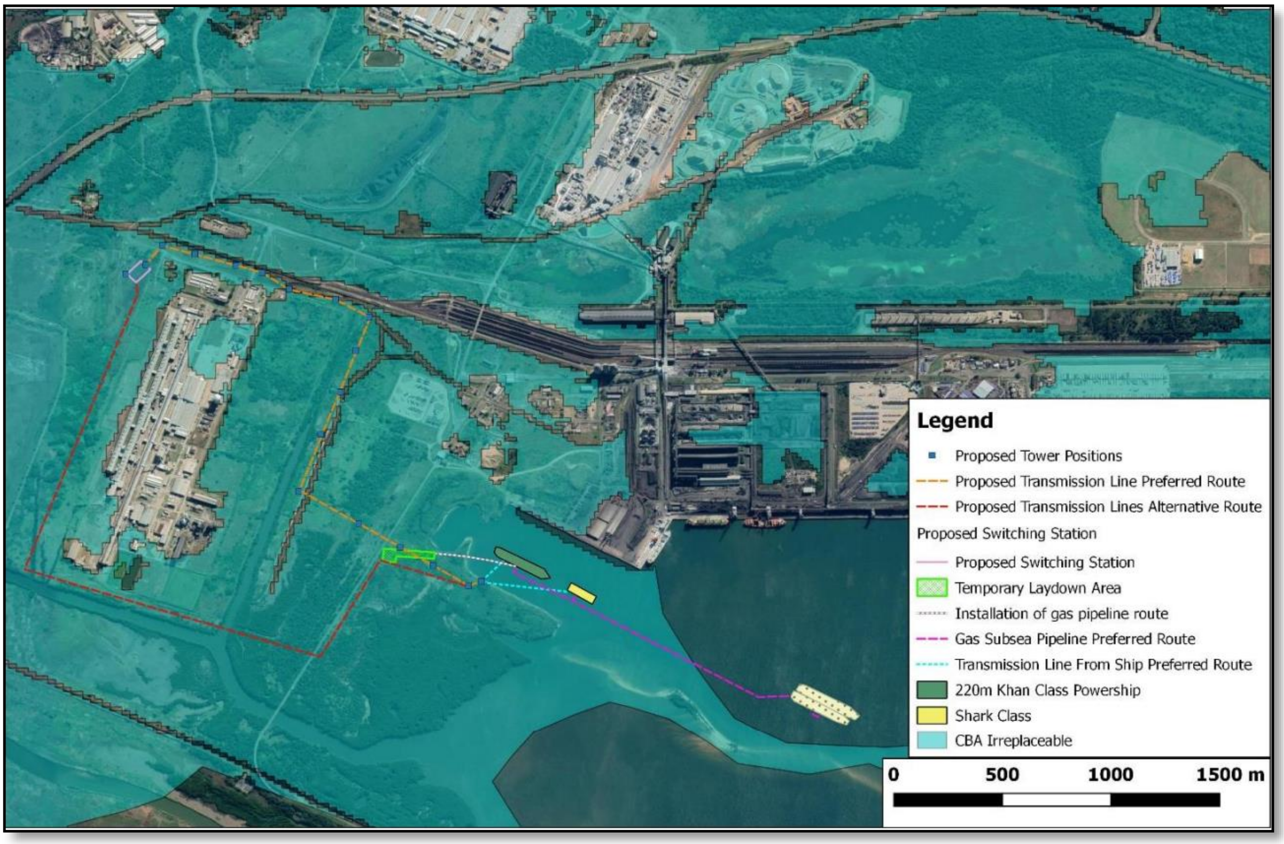


Figure 4-19: Critical Biodiversity Area within the proposed development site.

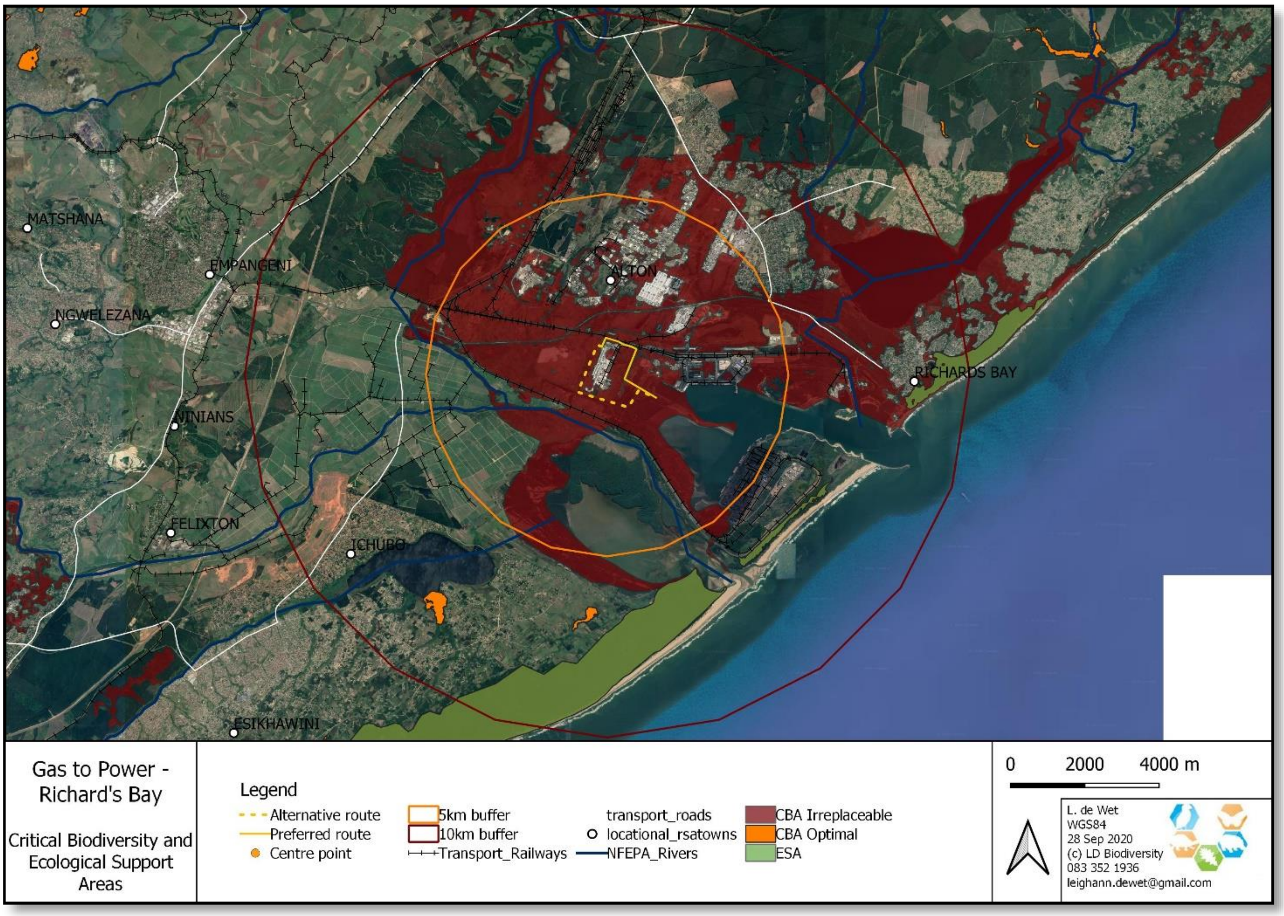


Figure 4-20: Critical Biodiversity Area of the proposed development site and surrounding area.

At a desktop level, the CBA associated with the proposed development is “CBA irreplaceable”. This means that the proposed development occurs in areas considered critical for meeting biodiversity targets and thresholds, which are required to ensure the persistence of viable populations of species and the functionality of ecosystems. During the site visit, it was noted that several sensitive areas along the preferred and alternative transmission line routes are potential habitat for red data species. However, due to the anthropogenic changes in the area, proliferation of alien invasive plants was evident (species: *Ageratum conyzoides, Lantana camara, Ricinius communis* to name a few).

CBA	Description
Critical Biodiversity Area: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Area: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high-cost areas as much as possible (Category driven primarily by process but is informed by expert input).
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of Ecosystem Services.

CBA	Description
Modified Areas	Areas with no significant natural vegetation remaining and therefore regarded as having a low biodiversity value (e.g. sugarcane plantation areas or highly developed areas with no connectivity to natural environment).
Protected Area	A specifically delineated area that is both designated and managed to achieve the conservation of the indigenous state and the maintenance of associated ecosystem services and cultural values, through legal or other effective means.

Table 4-5: CBA Descriptions for KwaZulu-Natal Province.

Proximity to protected areas is also important to consider, as sites close to these areas may be ecologically sensitive, and buffers around protected areas should be maintained to preserve biodiversity and connectivity. Richards Bay Nature Reserve lies less than 1km to the southwest of the site, and the Enseleni Nature Reserve is located approximately 10km to the north of the site, as per figure 4-21 below. Richards Bay Nature Reserve is also considered an Important Bird Area (IBA), internationally recognized for their importance for birds, and thus internationally important for conservation.

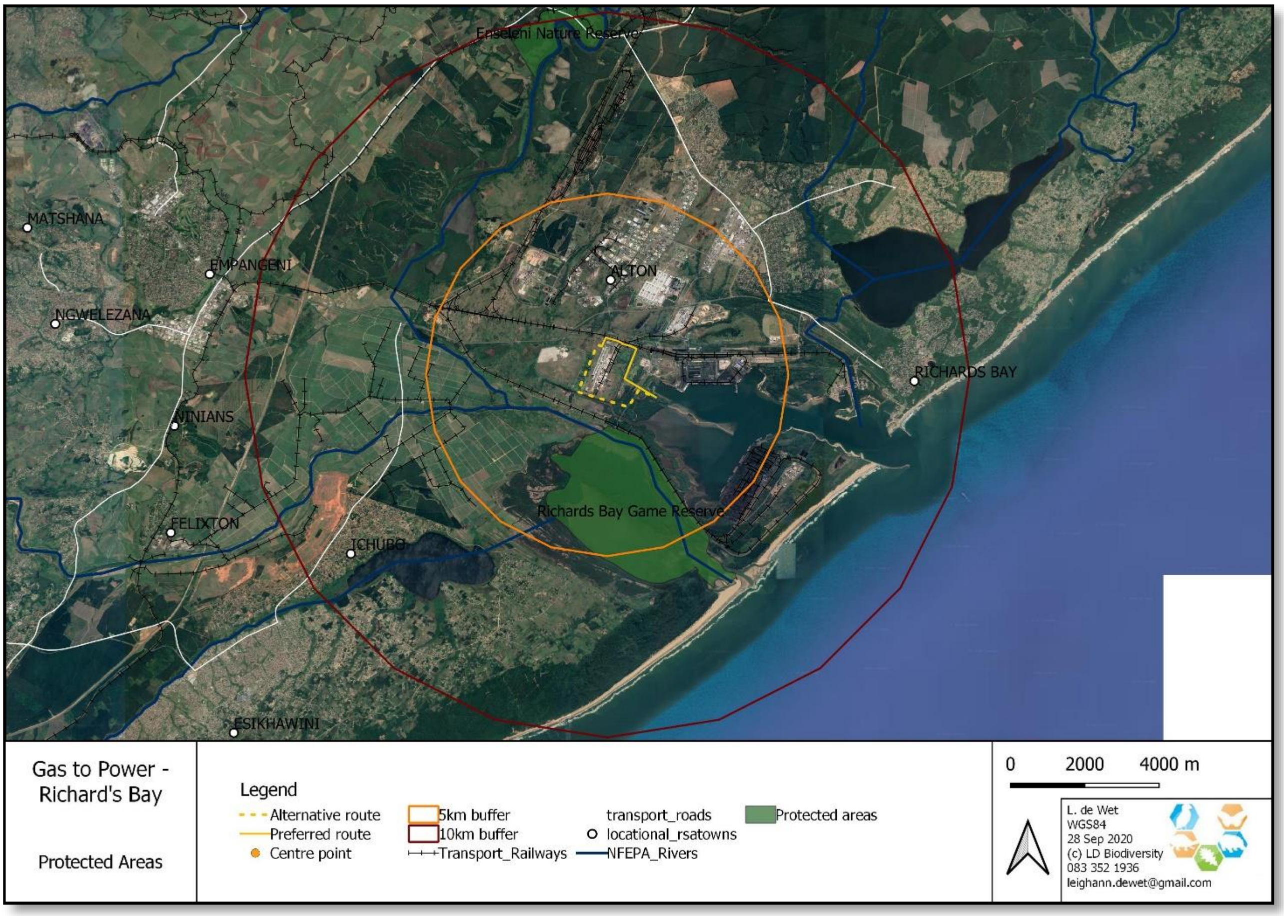


Figure 4-21: Protected areas in proximity to the study area.

4.1.5.3 Fauna

The data for the Quarter Degree Square in which the project area falls for each of the Mammals, Reptiles and Amphibians groups was obtained from the Animal Demography Unit's (ADU) Virtual Museum and are appended to the Terrestrial Ecological Report (Appendix I).

Mammal species recorded from the site (incidental encounters, scat, tracks and signs) include the following:

- Vervet monkey (*Chlorocebus pygerythrus*)
- Hippopotamus (*Hippopotamus amphibius*)
- Slender mongoose (*Herpestes sanguineus*)
- Cape Clawless Otter (*Aonyx capensis ssp. capensis*)

There is habitat available for several mammal species including small mammals. The probability of occurrence of ADU Virtual Museum Species of Conservation Concern can be seen in Figure 4-22 below. One of the SCC species was recorded on site: Hippopotamus (*Hippopotamus amphibius*).

Scientific name	Common name	Red List	TOPS	Provincial	Likelihood of occurrence
Panthera pardus	Leopard	VU	VU	Sch3	Low
Hippopotamus amphibius	Common Hippopotamus	LC		Sch2	Definite (recorded)
Dasymys incomtus	Common Dasymys	NT			Moderate
Aonyx capensis	African Clawless Otter	NT	PR		Low

Figure 4-22: Mammal Species of Conservation Concern and Likelihood of Occurrence.

Reptile species recorded from the site include the common Stiped skink (*Trachylepis striata*), Southern tree agama (*Acanthocercus atricollis*) and Common tropical house gecko (*Hemidactylus mabouia*). Several snake species have been identified as located within the site and are encountered by people who work in the general port area.

There is habitat available for several reptile species the most likely noted when encountered include venomous snakes. The probability of occurrence of ADU Virtual Museum Species of Conservation Concern can be seen in Figure 4-23 below.

Scientific name	Common name	Red list	Tops	KZN	Likelihood of Occurrence
Crocodylus niloticus	Nile Crocodile	VU	PR		Moderate
Lycophidion pygmaeum	Pygmy Wolf Snake	NT			Low
Python natalensis	Southern African Python	LC	PR		High

Figure 4-23: Reptile Species of Conservation Concern and Likelihood of Occurrence.

Two amphibians have been recorded from the site: Painted reed frog (*Hyperolius marmoratus*) and Water Lily Reed Frog (*Hyperolius pusillus*). Only one SCC is listed in the ADU list for the site: African Bullfrog (Pyxicephalus edulis), with a high likelihood of occurrence. Only one SCC is listed in the ADU list for the site: African Bullfrog (Pyxicephalus edulis), with a high likelihood of occurrence.

Further information on the flora and fauna within the study area are detailed in the Terrestrial Ecological Assessment Report, attached as Appendix I.

4.1.5.4 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 354 species have been recorded in the pentad in which the study area falls. The Species of Conservation Concern include Eight that are listed as Endangered (EN), Nine that are listed as Vulnerable (VU) and Seven that are listed as Near Threatened (NT). The full species list for Coordinated Waterbird Counts (CWAC) surveys have been conducted for the site from 1993 to 2012 and includes 101 bird species. These have been recorded from the study area and so are considered confirmed present. SCC on this list include Six that are listed as Endangered (EN), Three that are listed as Vulnerable (VU), and Five that are listed as Near Threatened. Refer to Figure 4-24 Below.

106 bird species were recorded in and around the study area in habitats present within the footprint of the proposed development. Species of Conservation Concern include three listed on the Conservation ordinance Schedule 9: Specially Protected Birds and one, the Pink-backed Pelican (*Pelecanus rufescens*) is listed on the national TOPs list. Four are red-listed for the region and include the Near Threatened European Roller (*Coracias garrulus*) and Greater Flamingo (*Phoenicopterus roseus*) as well as the Vulnerable Great-white Pelican (*Pelecanus onocrotalus*) and Pink-backed Pelican (*Pelecanus rufescens*). Some of these birds, most specifically both pelican species as well as the flamingo are particularly sensitive to fatalities as a result of collision with transmission lines.

Not all species recorded from the study area and surrounds are indigenous, with two species, namely the rock dove (*Columa livia*) and the Indian Myna (*Acridotheres tristis*) listed as invasive and given a score of 3 according to NEM:BA.

Scientific name	Common name	IUCN
Phalacrocorax capensis	Cormorant, Cape	EN
Balearica regulorum	Crane, Grey Crowned	EN
Halcyon senegaloides	Kingfisher, Mangrove	EN
Circus ranivorus	Marsh-harrier, African	EN
Catharacta antarctica	Skua, Subantarctic	EN
Mycteria ibis	Stork, Yellow-billed	EN
Numenius arquata	Curlew, Eurasian	NT
Phoenicopterus ruber	Flamingo, Greater	NT
Phoenicopterus minor	Flamingo, Lesser	NT
Microparra capensis	Jacana, Lesser	NT
Charadrius pallidus	Plover, Chestnut-banded	NT
Pelecanus onocrotalus	Pelican, Great White	VU
Pelecanus rufescens	Pelican, Pink-backed	VU
Sterna caspia	Tern, Caspian	VU

Figure 4-24: The Coordinated Waterbird Counts Species of Conservation Concern recorded from the study area.

Further information on the Avifauna within the study area are detailed in the Avifauna Assessment Report, attached as Appendix I.

4.1.6 Estuarine and Marine Environment

4.1.6.1 Estuarine Environment

Richards Bay is one of only three estuarine bays in the country, along with the Knysna Estuary and Durban Bay, and is thus considered an extremely rare estuarine type among South Africa's 300 or so estuaries. Therefore the system is locally, regionally and nationally significant. Estuarine bays are characterised by their large size and a permanent connection to the sea, which imparts strong marine influences in terms of tidal activity, salinity, and water temperature (Whitfield, 1992; Van Niekerk et al., 2020). The ecology of these systems is thus marine and estuarine dominated, and extensive wetlands and mangrove swamps are typical noteworthy features (Whitfield, 1992).

Drastic transformation of the Richards Bay Estuary and its habitats has occurred through port development activities, including the widening and stabilisation of the mouth for the entry channel; the protection of the mouth with constructed breakwaters; dredging; wharf construction; infilling and the construction of supporting infrastructure and industry (Zwamborn and Cawood, 1974; Campbell, 1976; Begg, 1978; MER, 2013). At the western extent of the harbour, the Bhizolo and Manzamnyama Canals were excavated (ca. 1976) as a means to drain the local wetlands and swamps to facilitate industrial development around the Port, including the then Alusaf (Bayside) Aluminium smelter (Begg, 1978). The Bhizolo /Manzamnyama confluence discharges into the western corner of the Bay into an ecologically sensitive area known as the Kabeljous Flats (MER, 2013).

No dune systems are present in the project area, the transmission line pylons do not lie on the beaches and the gas pipeline lies only on the seafloor so coastal impacts are limited to the seafloor and to the vegetated terrestrial areas within the coastal zone where pylons are to be placed. The proposed mooring sites, transmission lines and gas pipelines that fall within the coastal zone also fall entirely within the estuarine functional zone.

The proposed project site is located within a completely transformed section of the Richards Bay EFZ. The area has undergone drastic historical modifications including infilling, canalisation of rivers, quay wall construction, dredging, and industrial, commercial and transport infrastructure development. Extrapolating from the macrobenthic data from the long-term ecological monitoring of the port, the project footprint on the seabed is likely to support a slightly disturbed macrobenthic community.

In terms of adjacent protected areas, or areas of conservation importance, the uMhlathuze Estuary is a formal protected area (Richards Bay Game Reserve) and an important bird area (SA no: SA079) managed by Ezemvelo KZN Wildlife (Birdlife, 2016; DEA, 2017; CoastKZN, 2019). Further, the eChwebeni Natural Heritage Site, which is a Transnet designated site of conservation significance within the Port of Richards Bay, preserves part of an original mangrove site that existed prior to the development of the Port (Tholet, 2012; DEA, 2017). It is located approximately 4.4 km south-east of the development site. Figure 4-25 below shows the delineation of Richards Bay Estuarine, as well as the neighbouring uMhlathuze Estuary to the south.

Figure 4-25**: Estuarine functional zone of the uMhlathuze/Richards Bay estuarine systems.**

The size of the estuarine functional zone (EFZ) is approximately 5509ha, comprising 3543ha developed/transformed area and 1966 natural habitat, of which approximately 869ha is open water habitat (Van Niekerk et al., 2019). Mixing processes within the system are dominated by tidal action, with tidal amplitude and water levels close to those of the sea due to the unrestricted permanently open inlet (Van Niekerk et al., 2019). Under high wind conditions, strong wind-driven flows occur, especially in the shallow peripheral areas (DEA, 2017). The influence of freshwater on circulation is low, due to low freshwater inflow volumes compared with tidal volume exchanges (DEA, 2017). Freshwater inputs into the system are via the Mzingazi River/Canal (draining from Lake Mzingazi), Manzamnyama and Bhizolo canals (DEA, 2017), thus freshwater mixing processes are mostly confined to these restricted upper areas. Inorganic nutrients (dissolved inorganic nitrogen and dissolved inorganic phosphate) enter the Richards Bay Estuary via the Bhizolo/Manzamnyama Canal complex as a result of activities in the catchments, groundwater seepage, as well as the spillage of industrial products (DEA, 2017). There is significant sediment contamination by metals and hydrocarbons in some parts of the Bay, with cadmium, copper, chromium and zinc being the most important metal contaminants. This is attributed to port associated activities (DEA, 2017).

Very little natural habitat remains in the Port of Richard Bay today, whilst that which is present in the uMhlathuze Estuary, is largely transformed through changes in tidal variation, river inflow and sediment deposition directly as a result of port development. The importance of the transformed Richards Bay in supporting critical ecosystem services, such as habitat provision and feeding grounds for fish and crustaceans, has long been recognised. It still supports habitats of conservation significance, including intertidal salt marsh, reeds and sedges, mangroves, swamp forest, and sand and mud banks and flats. Of particular note is the Kabeljous Flats, which is a 440 ha shallow embayment area in the western corner of the Port at the outlet of the lower Bhizolo Canal, that comprises a variety of habitats including intertidal and subtidal sand- and mud- flats, and mangrove habitat, which in turn support different biotic communities and serve different biological functions (MER, 2013). This area, together with the lower reaches of the Bhizolo and Manzamnyama Canals, performs an important nursery function for a range of marine and estuarine fauna utilising the estuary. The total area covered by mudflats in the western portion of the harbour is approximately 125 ha (AECOM, 2014). An overview of the sensitive habitats of Richards Bay is provided in Figure 4-26 below (CSIR, 1996 in AECOM, 2014). The development site falls within the area marked as Development Areas.

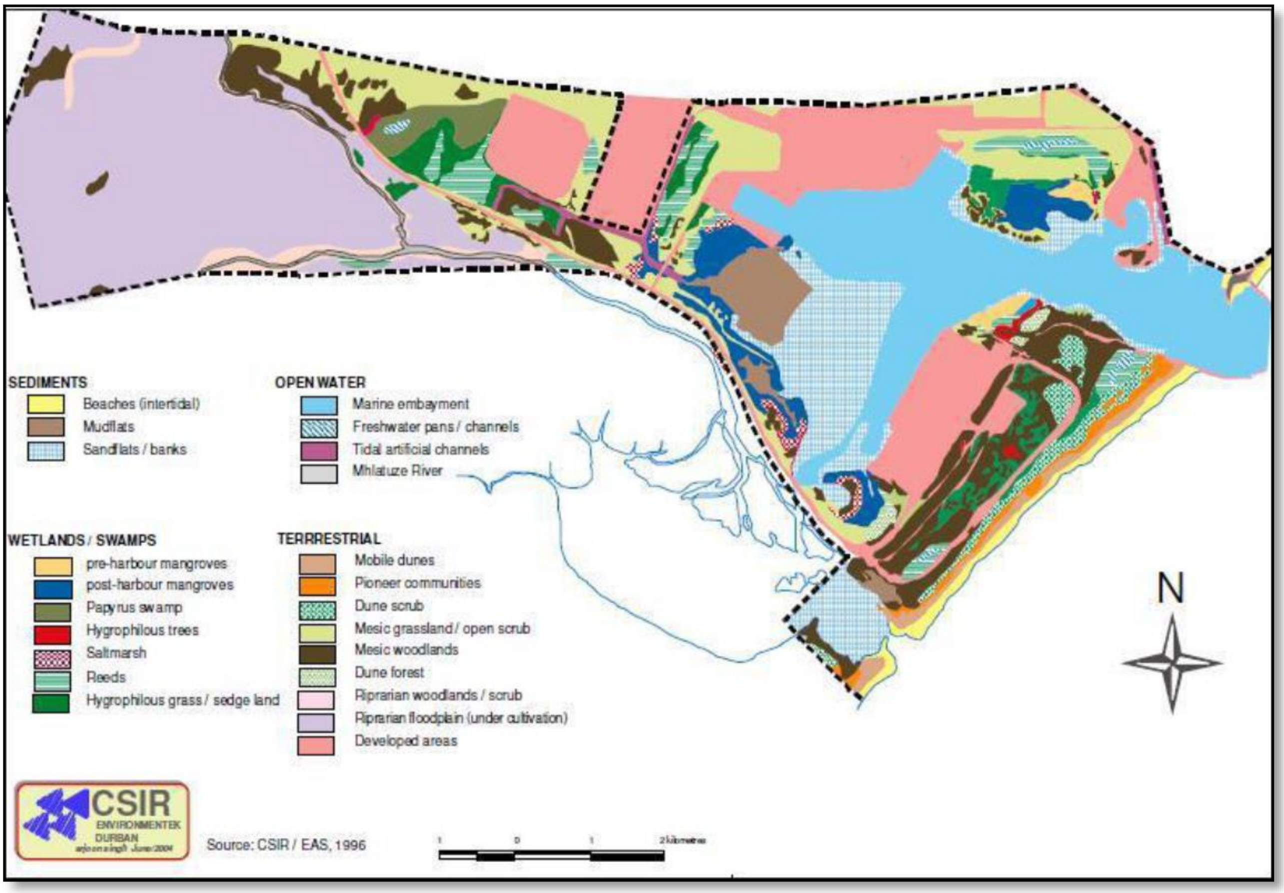


Figure 4-26: **Sensitive habitats of Richards Bay Estuarine.**

The Port of Richards Bay is known to have the oldest area of mangroves in the country, which are preserved in the eChwebeni Natural Heritage Site, covering an area of about 54 ha. Together, the Richards Bay and uMhlathuze estuaries support almost half (47%, 652.1 ha) of South Africa's mangrove habitat. Richards Bay also possesses the highest density of white mangrove, *Avicennia marina* and red mangrove, *Rhizophora mucronata*. Reeds and sedges cover approximately 309 ha and occur mainly to the west of the Port, with some habitat noted on the seaward margin of the *Manzamnyama* Canal (Van Niekerk and Turpie, 2012). Swamp forests dominated by *Barringtonia racemosa*, *Hibiscus tiliaceus* and *Ficus trichopoda* occur in small dense stands along rivers, drainage channels, and the upper portions of the bay (SiVEST, 2018). Remaining swamp forest covers approximately 18 ha (Turpie, Wilson and Van Niekerk, 2012). A fairly large and well-developed swamp forest occurs seaward of the *Manzamnyama* Canal and railway line, comprising *Ficus trichopoda–Syzygium cordatum* swamp forest, and *Phragmites australis–Cyperus* papyrus freshwater wetland (CRUZ, 2014a, 2014c).

The Richards Bay Estuary, and specific habitats within, serve as critically important fish habitat. The macrobenthic invertebrate community of the Kabeljous Flats is highly diverse, supporting a total 113 species (MER, 2013), which is typical of marine-dominated systems. The fauna comprise a mixture of marine and estuarine taxa, including cnidarians, nemerteans, nematodes, sipunculids, predominantly marine polychaete groups, molluscs including gastropods and bivalves, and a wide variety of crustaceans including typical estuarine species (MER, 2013). These fauna are critical food organisms for marine and estuarine fish and coastal bird species, and thus contribute to a complex food web with strong species interdependence (MER, 2013). Richards Bay is also one of the major providers of prawn nursery grounds in the KwaZulu-Natal region. Studies on the macrocrustaceans in the canals and Kabeljous Flats yielded 34 species, comprising 14 prawns, one sand prawn and 20 crab species (MER, 2013). The most abundant species on the Kabeljous Flats were the small pelagic shrimp species, *Acetes erythraeus*, followed by *Metapenaeus monoceros* and *Marsupenaeus japonicas* (CRUZ, 2009). These areas are expected to support significant food resources for the predacious fish populations of the Port (MER, 2013). Richards Bay is ranked as the third most important estuary out of 247 South African systems in terms of its importance for fish populations. Numerous fish surveys have repeatedly shown that different habitats support different numbers and types of species. Fifty-three species alone were recorded from the sheltered mangrove areas on the south-western edge of the Kabeljous Flats (Cyrus and Forbes, 1996 cited in MER, 2013).

The diversity of water-associated bird species present in the Richards Bay Estuary is reportedly unmatched in South Africa. It also supports the highest numbers of birds in South Africa for 18 species of water birds (MER, 2013). Richards Bay estuary is critically important for national and global water bird populations. Many of the recorded species feature in species lists associated with the Ramsar and Bonn Conventions, IBA Programme and Red Data book (MER, 2013; AECOM, 2014). As of 1995, out of 42 South African estuaries, the Richards Bay estuary was ranked as the most important system in terms of the species population sizes it supports, the second most important in terms of species endemism and third for total bird abundance (Turpie, 1995).

The National Biodiversity Assessment (NBA) (Van Niekerk, J. B. Adams, et al., 2019), provides inter alia an updated assessment of the health status of estuaries in South Africa. The health condition of each estuary (also known as the Present Ecological State (PES)) was provisionally determined (or confirmed if updated studies were available, e.g. for the uMhlathuze Estuary) at the desktop level using the Estuarine Health Index, in which the current conditions of various abiotic and biotic components are rated as a percentage of the probable pristine condition. The table 4-6 below present the result for Richards Bay Estuarine (the study area), as well as for the neighbouring uMhlathuze Estuary, which is a formal protected area.

COMPONENT	CATEGORY	
	MHLATHUZE	RICHARDS BAY
Hydrology	B	D
Hydrodynamics and mouth condition	D	D
Water quality	E	D
Physical habitat alteration	E	E
Habitat health score	D	D
Microalgae	C	D
Macrophytes	E	F
Invertebrates	D	E
Fish	F	E
Birds	E	D
Biotic health score	D	E
PRESENT ECOLOGICAL STATE (PES)	D	D
2018 CONDITION STATUS	HEAVILY MODIFIED	HEAVILY MODIFIED

Table 4-6: Desktop Present Ecological Status and preliminary Recommended Ecological Categories allocated to uMhlathuze and Richards Bay estuaries in the 2018 NBA.

As one of only three estuarine bays in the country, the Richards Bay estuarine system is an extremely rare estuarine type and is included in the priority estuaries requiring formal protection in order to conserve South Africa's estuarine biodiversity. The biodiversity plan requires that the uMhlathuze/Richards Bay estuaries be partially protected (e.g. possess a designated no-take fishing zone), have 50% of its estuarine margin left untransformed, and achieves a Recommended Ecological Category (REC) of A (natural) or best attainable state (Turpie, Wilson and Van Niekerk, 2012). However, given the highly transformed state of the estuarine complex, and the operation of the Richards Bay Estuary as an industrial port, the restoration of the uMhlathuze/Richards Bay estuaries to their natural/pristine state is reported to be both impractical and unattainable (as per Estuarine and Coastal Assessment Report – attached as Appendix I).

The current threats to the Richards Bay Estuary are a product of the long history of human interference, habitat modification and destruction through port development, flow modification, poor water quality, resource exploitation (fish and vegetation), urban and industrial development, and catchment related impacts, all coupled with ongoing modern-day impacts associated with port activities (DEA, 2017). The overall cumulative pressure on the system is considered to be High (Van Niekerk, J.B. Adams, *et al.*, 2019).

In a significantly transformed and industrialised system such as the Richards Bay estuary, the extent of human impacts is plentiful. These impacts are categorised into three groups related to land-use and infrastructure, water quality and quantity, and living resources (DEA, 2017).

Among the plethora of impacts associated with port-related activities, the following were noted as key issues from an ecological perspective (DEA, 2017), with relevance to the proposed Gas to Power project:

- Port construction activities (high extent);
- New port infrastructure development (high extent);
- Vessel (ship movement) (medium extent);
- Brine discharge (desalination) (low extent);
- Oil and cargo spills (low extent); and

- Ballast water discharges (low extent).

These impacts contribute to physical habitat alteration/destruction, suspended solids, siltation, alteration of salinity regime, and toxic chemical pollution. The ecological consequences of these threats include, *inter alia* (DEA, 2017):

- Loss of overall biodiversity;
- Smothering of benthic communities;
- Chronic effects on biota;
- Mortality (acute effects) on biota;
- Harmful/nuisance algal blooms;
- Human health and safety risks through recreational activities;
- Human health and safety risks through the consumption of contaminated seafood;
- Loss in quality of seafood products;
- Loss of fisheries resources and revenue; and
- Loss of aesthetic value.

Water quality

Water quality results of the 2017/2018 (winter/summer) survey of the long term ecological monitoring of Richards Bay (CSIR, 2018b) confirm that salinity is uniform throughout the water column at all sites except those sites within the Msingazi Canal, which provides freshwater to the Bay. Water quality monitoring sites, which are applicable to the Gas to Power project, are site 3 at dead-end of the 600 Berth Basin and site 7 within the inner port basin, around 500 m off the sandspit (Figure 4-27 below).

Taking all water quality parameters into account, the overall water quality for sites 3 and 7 was rated as good and excellent, according to the integrated water quality index (CSIR, 2018b).

Figure 4-27**: Water quality index categories for surface water monitoring sites - 2018 survey.**

Sediment Composition and Quality

The long-term monitoring programme illustrates that the sediments throughout the Bay are dominated by mud (CSIR, 2018b). Sediment analyses revealed that the substrate within the project area, comprised approximately 94% mud fraction. Despite this high proportion, the sediment quality was rated as good, and within the expected range in terms of organic content (2.16 – 2.60 % total organic carbon) (CSIR, 2018b).

There is significant sediment contamination by metals and hydrocarbons in some parts of the Bay, with cadmium, copper, chromium and zinc being the most important metal contaminants (DEA, 2017). The presence of sediment contaminants, specifically heavy metals, is common occurrence and expected within ports given the nature of the activities and materials handled. Other significant contaminants sampled as part of the long-term monitoring programme are hydrocarbons, which include a range of compounds originally derived from crude oil, for example, Polycyclic aromatic hydrocarbons (PAH), a subset of total petroleum hydrocarbons. These contaminants are of particular concern because of their toxicity, and/or their potential carcinogenicity, mutagenicity and teratogenicity, respectively (CSIR, 2018b).

Overall the sediment quality at sites 5 and 7 was rated as marginal and good, respectively (CSIR, 2018b) (Figure 4-28 below).

Figure 4-28: Sediment quality index categories for sediment monitoring sites for the winter 2017 survey.

4.1.6.2 Marine Ecology

Marine ecosystems comprise a range of habitats each supporting a characteristic biological community. The important habitats in the Port of Richards Bay include the mangroves, intertidal and shallow subtidal mud and sand flats, the subtidal benthic zone and the water body itself.

<u>Intertidal and Shallow Subtidal Habitats</u>

Mangroves, comprising *Avicennia marina*, *Bruguiera gymnorrhiza* and *Rhizophora mucronata* (MER 2013), are situated in the north, west and south-west portions of the Port and are characterised by high productivity, supporting large numbers of invertebrate and fish species. The western portion of the Port also consists of multiple salt marshes which add to the ecological integrity of the region (Transnet 2014).

Intertidal mudflats occur on the south-western side of the Port, near the outlet of the Bhizolo Canal, to the south-west of the proposed powership and FSRU location. These mudflats cover an area of approximately 125 ha and support a high diversity and abundance of macrobenthos. They are also an important nursery ground for fish.

Sandflats occur primarily on the south-western side of the Port near and on the sand spit which forms a physical boundary between the intertidal habitats (mud- and sandflats) and the main berthing area of the Port and proposed powership and FSRU location. Sandflats are also prevalent on shoreline edges in undeveloped areas of the Port. They cover a large area of approximately 400 ha (Transnet 2014). As with the mudflats, sandflats are considered an important nursery ground for juvenile fish as well as serve as a habitat for birds.

<u>Subtidal Benthic Macrofauna</u>

Benthic macrofauna are often used as indicators of disturbance and biological stress as the majority are relatively sedentary and have long life cycles (Izegaegbe et al. 2020). Generally, sandy habitats, which are characterised by high flows and low organic detritus deposition are dominated by suspension-feeding benthic species. In muddy areas, which are characterised by low flow and high organic detritus deposition rates, deposit feeders dominate.

The benthic macrofauna assemblage within the Port of Richards Bay is typical of permanently open estuaries found on the South African east coast (CSIR 2018). During a 2014 survey, Vivier and Cyrus (2014) recorded an overall mean catch per unit effort of 661 organisms.m-2, however in a recent study by Izegaegbe et al. (2020), much higher mean densities of 90,551 organisms.m-2 were recorded. This discrepancy is likely due to the latter study sampling from within the Bhizolo and Mzingazi canals as well as in the vicinity of where the Mhlatuze estuary joins the Port (Izegaegbe et al. 2020), whilst the former study only sampled within boundaries of the Port and adjacent mudflats. The Bhizolo and Mzingazi canals had especially high densities of the tanaid *Halmyrapseudes digitalis* (140 212 individuals.m-2 and 23 220 individuals.m-2 at each canal site respectively) and this is largely as a result of these sites being less impacted by port activities. Within the port itself, both studies recorded highest macrofaunal densities in the mudflats to the south-west of the proposed powership and FSRU site, with the community being dominated by the bivalve *Dosinia hepatica*, the polychaetes *Mediomastus capensis* and *Aphelchaeta marioni* and the tanaid *H. digitalis* (Vivier and Cyrus 2014; Izegaegbe et al. 2020).

The macrofaunal density in the region of the proposed powerships and FSRU location is relatively low, especially compared to the mudflat habitat (Vivier and Cyrus, 2014, CSIR, 2018, Izegaegbe et al. 2020). The community in the proposed development area is primarily dominated by polychaete worms, mainly *Mediomastus capensis* and *Aphelochaeta marioni* (Vivier and Cyrus, 2014; Izegaegbe et al, 2020). These are indicative of a disturbed region which aligns with the findings of CSIR (2018) where high sediment trace metals concentrations were found in this region of the Port.

Several larger crustacean species occur within the Port of Richards Bay (Weerts et al. 2003). Many of these are associated with the surrounding mangrove habitat (MER 2013). Penaeid prawns that occur are an important component of the bait and commercial fishery and the Port and Mhlatuze Estuary acts as an important nursery ground for these species.

Plankton

In the survey conducted by CSIR (2018), phytoplankton biomass at the 16 sites sampled in the harbour was relatively low. During winter and summer, chlorophyll-a concentrations (indicative of phytoplankton biomass) at most sites were less than 3ug.L -1 and concentrations varied minimally throughout the water column. At site 3 surveyed, located near the proposed powership mooring location, high surface chlorophyll-a concentrations were recorded during the summer survey (approximately 12 µg.L-1) and a pronounced subsurface maximum, in which concentrations exceeded 20 µg.L-1 occurred at 2 m depth, indicating that phytoplankton blooms within the Port do occur.

Fish

Being an estuarine system, the undeveloped, shallower sections of the Richards Bay Port function as an important nursery ground for many fish species. Surveys conducted in the Port since 1996 have emphasised the overall significance of the estuary and particular habitats within the system in the functioning of fish communities in the area (MER 2013).

Studies have reported variable species counts but species richness is generally high. Cyrus and Forbes (1996) recorded 53 species in the sheltered mangrove areas of the Port. Weerts (2002) reported 64 species, with 41 of these occurring on subtidal mudflats, 32 occurring on subtidal sandflats, 24 occurring in mangroves and 26 occurring in the Bhizolo Canal. Nhleko and Cyrus (2008) recorded 80 species while Beckley *et al.* (2008) reported 46 species from recreational anglers' catches. In a study conducted by Vivier and Cyrus (2014) 486 individuals comprising 20 fish species were caught during sampling conducted in the intertidal areas of the Port. In most studies conducted, the majority of fish sampled were juveniles occurring within the intertidal and shallow subtidal areas, demonstrating the importance of this habitat (MER 2013). Based on the classification proposed by Whitfield (1994) most species encountered in the Port are either partially (category II, euryhaline marine species which breed at sea with their juveniles showing varying degrees of dependence on estuaries as part of their life cycle) or wholly (category I, estuarine species which breed in the system) dependent on the estuary.

Common species encountered in the Port include mullet *Valamugil buchanani*, *Liza dummerilii* and *Liza macrolepis* as well as spotted grunter *Pomadasys commersonnii*, slimy *Leiognathas equula*, target fish *Terapon jarbua*, and the bream *Acanthopagrus berda*, (Beckley et al. 2008; Cyrus and Vivier 2014). All fish species present are listed in Table 2.4 of the Marine Ecology Report, attached as Appendix I.

Several shark and ray species have also been recorded to occur in the Port including bull shark *Carcharhinus leucas, blacktip* shark C. *limbatus,* dusky shark C. *obscurus, milkshark Rhizoprionodon acutus*, giant guitarfish *Rhynchobatus djeddensis, sharpnose* stingray *Himantura gerradi* and honeycomb stingray H. *uarnak* (Beckley *et al.* 2008).

Megafauna

The Richards Bay area is a preferred habitat of the Indo-Pacific humpback dolphin, *Sousa plumbea*. The species occurs within the Port and feeds in the entrance channel (Atkins et al. 2004; Johnson 2012). Based on species distributions, several other dolphin species may occur in the vicinity of the Port as well, while whales, including humpback whales and southern right whales generally occur further offshore.

Five turtle species occur on the east coast of South Africa including the green turtle *Chelonia mydas*, olive *ridley Lepidochelys olivacea*, leatherback *Dermochelys coriacea*, hawksbill *Eretmochelys imbricata* and loggerhead *Caretta caretta*. Important loggerhead and leatherback nesting sites occur along the sandy beaches north of the Port of Richards Bay. Satellite tracking of leatherbacks revealed that their home range extended southwards to Richards Bay (CSIR, 2016). The species may therefore occur in the Port on occasion.

Local Conservation and Biodiversity

The available biological records for the Port of Richards Bay, indicate that none of the marine algae, fish and invertebrate species/taxa has either restricted distributions or small population sizes with many of the species being representative of communities on the east coast of South Africa. Consequently, none of the recorded species are classifiable as either rare or endangered in terms of their conservation status.

Several fish and megafauna that are known to occur within or near the Port are listed as being threatened by the IUCN Red List (IUCN, 2020). The dusky kob and dusky shark are Endangered, as is the Indian Ocean humpback dolphin. The perch *Acanthopagrus vagus*, yellowbelly rockcod, Mozambique tilapia, elf and milkshark are Vulnerable and bonefish, catface rockcod, bronze bream, bull shark and blacktip shark are listed as being Near Threatened.

While not within the confines of the Port, Richards Bay Nature Reserve and Important Bird Area encompasses the estuary adjacent to the Port. To the west of the main port entrance channel, and adjacent to the coal terminal the Echwebeni Natural Heritage site has been established, which provides primary plant communities and suitable breeding environments for numerous bird species within the region. Furthermore, this area contains the last remaining stands of the original mangrove communities.

Local Ecosystem Services

The area within the Port itself provides many important ecosystem services. Recreational and subsistence fishing occur within the confines of the Port (Beckley et al. 2008). The mangrove areas in the Port provide raw materials to surrounding communities and the stands play an important role in carbon sequestration, protection from extreme sea conditions and nutrient cycling. The port water body assists in the regulation of water flow and the intertidal and shallow subtidal habitats are important nursery areas for numerous invertebrate and fish species, some of which are commercially important. Most obviously, the Port hosts an area in which commercial transport is significant and so conflict with other shipping activities needs to be considered by the Port authority.

Please refer to Appendix I for a detailed Marine Ecology Study.

4.1.7 Ambient Air Quality

Poor ambient air quality in the Richards Bay area is a longstanding issue with local residents and thus, any proposed development that has the potential to further reduce air quality is likely to cause concern.

The Richards Bay Clean Air Association (RBCAA, http://www.rbcaa.org.za/) has undertaken ambient air quality monitoring in the area since 2004, measuring sulphur dioxide (SO_2) and particulate matter (PM_{10}). Okello et al (2018) used the RBCAA data to describe air quality in Richards Bay area over the period 2004 to 2017. Findings from this comprehensive analysis are highlighted here.

PM_{10} monitoring data indicates a downward trend at 4 stations (Brakenham, CBD, Esikhaleni and Felixton). Mtunzini and St. Lucia, the reference sites, had upward trends. The CBD and Brakenham have higher PM_{10} values compared to the other stations. All measurements were within the stipulated South African National Ambient Air Quality Standards (NAAQS) annual average limit of 50 µg/m3. Esikhaleni is a highly populated area with mostly low income households and fewer industries compared to areas around the CBD. The source of PM_{10} are different and are likely to be indoor compared to outdoor. St. Lucia and Mtunzini were the reference site with PM_{10} levels averaging at 20.8 µg/m3 and 22.3 µg/m3 respectively. This is deemed a good indication of the background PM_{10} concentration of the whole study area as both sites are relative unaffected by local sources. The background in both cases is above the WHO guideline value indicating the potential contribution of other sources such as pollen and sea salts.

SO_2 measurements in all seven monitoring stations where data was available was within the NAAQS of 50 µg/m3. Downward trends were observed in Arboretum, Brakenham, CBD and Felixton. Harbour west had no observable trend. Esikhaleni showed an upward trend although with ambient concentrations well below the annual limit value. Scorpio had the least favourable SO_2 trends attributable to their close vicinity to industry.

Data taken over the long term (1997 to 2017) for SO_2 indicate a slightly upward trend. From 2013 to 2017 however, a significant downward trend is observed. The Scorpio and Harbour West Stations have consistently been above the 20-year average. This can be attributed mostly to emissions from the surrounding industry. The CBD had SO_2 annual average ambient concentration just below the 20-year regional annual average. Measurement from residential areas such as Arboretum, Mtunzini and Esikhaleni showed low concentrations of SO_2.

In relation to the Karpowership project, there are no residential areas at the Port of Richards Bay. The closest residential area is Arboretum, which is located approximately 3.9 km to the north-east of the site. Arboretum is a moderately populated township. It is identified as a sensitive receptor due to the presence of schools, hospitals, crèches, and other similar facilities. Meerensee, also a residential area, is located 5 km to the west of the site, while others are located further away from the project site and source of emissions.

Natural Gas (NG) will be the only fuel used for the generation of electricity in the proposed project. The associated pollutants that will be emitted include oxides of nitrogen (NO_x), sulphur dioxide (SO_2) and particulate matter (PM_{10}).

Table 4-7 presents the concentrations of these three pollutants predicted to be emitted by the proposed project in relation to the ambient concentrations in the Richards Bay area and the respective South African National Ambient Air Quality Standards (NAAQS).

		SO_2	
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.07	0.34	0.94
NAAQS	50	125	350
		NO_2	
Predicted maximum NO_2	1.34		18.9
NAAQS	40		200
		PM_{10}	
Predicted maximum PM_{10}	0.33	1.72	
NAAQS	40	75	

Table 4-7: SO_2, NO_2 and PM_{10} concentrations predicted to be emitted by the proposed project in relation to the ambient concentrations in the Richards Bay area and the respective South African National Ambient Air Quality Standards (NAAQS).

The maximum predicted annual SO_2, NO_2 and PM_{10} concentrations and the 99^{th} percentile concentration of the 24-hour and 1-hour predicted concentrations of pollutants from the proposed project are very low relative to the NAAQS.

Available monitoring has shown ambient SO_2 concentrations to be relatively low in the Richards Bay and below the NAAQS. The cumulative effect of the contribution of SO_2 from the Karpowership Project is predicted to be very small and the potential increase in ambient SO_2 concentrations is highly unlikely to result in exceedences of the NAAQS.

The cumulative effect of the contribution of NO_2 from the Karpowership Project is predicted to be very small and the potential increase in ambient NO_2 concentrations is highly unlikely to result in exceedences of the NAAQS.

Monitoring has shown that ambient PM_{10} concentrations are relatively high because of high regional background concentrations from sources such as biomass burning, industrial activity, terrestrial dust and long-range atmospheric transport. The cumulative effect of the contribution PM_{10} from the Karpowership Project is predicted to be very small and the potential increase in ambient PM_{10} concentrations is highly unlikely to result in further exceedences of the NAAQS.

Please refer to Appendix I for detailed Atmospheric Impact Report.

Greenhouse Gas Emissions

Emissions of greenhouse gases are typically expressed in a common metric, so that their impacts can be directly compared, as some gases are more potent (i.e., they have a higher global warming potential or GWP) than others. The international standard is to express greenhouse gases in carbon dioxide equivalents (CO_2e), which in turn may be expressed, *inter alia*, as gigagrams (Gg), gigatons (GT), metric tons (Mt) or megatons (MT) of $C0_2e$.

Natural gas is an efficient and relatively widely available alternative to other fossil fuels and produces roughly half of the amount of carbon dioxide (CO_2) per unit energy as coal. This scenario makes natural gas attractive as a potential ‘bridge’ or transitional fuel in the shift toward renewable energy. Nonetheless, natural gas is primarily composed of methane (CH_4), a greenhouse gas with climate change adaptation risks associated 21 times the warming potential of CO_2 (Estimates of the GWP of methane vary between 16 and 30 times the GWP of carbon dioxide). Table 4-8 and Figure 4-29 describe the 100-year global warming potential of CO_2, CH_4, N_20, and HFC-134a, in tabular and graphic format, respectively.

Greenhouse gas	Global warming potential (100 years)
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_20)	310
Hydrofluorocarbon (HFC)-134a	1300

Greenhouse gas	Global warming potential (100 years)

Table 4-8: Warming potential of long-lived greenhouse gases.

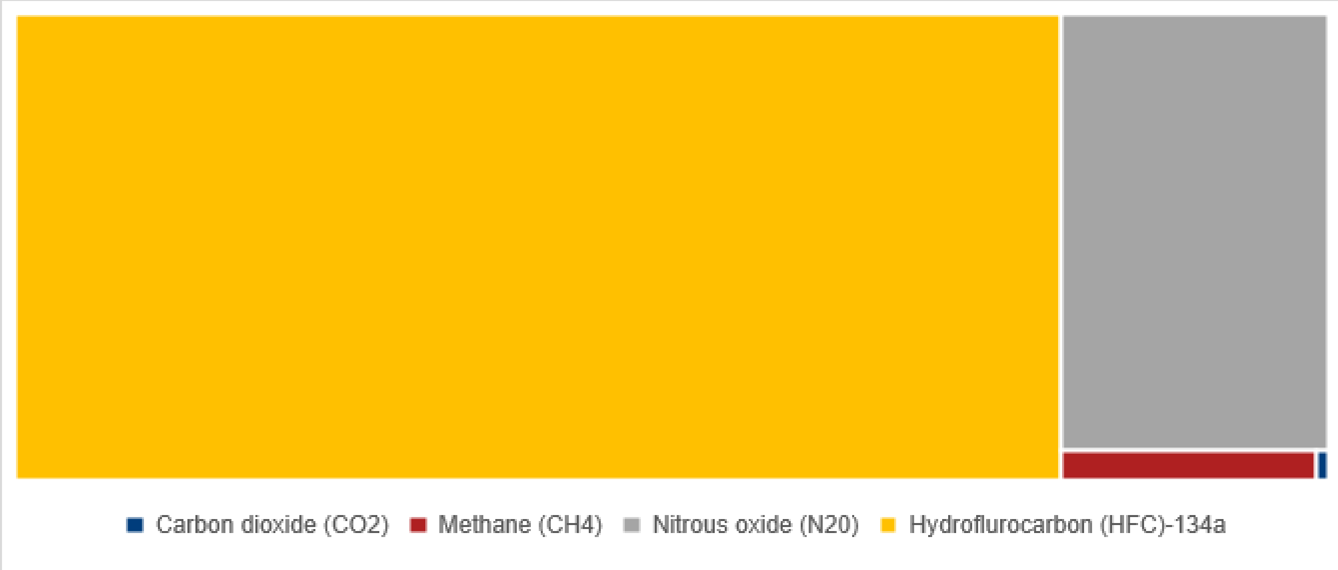


Figure 4-29**: Graphic representation of the ratio of the global warming potential of four long-lived greenhouse gases.**

The energy sector emitted most of South Africa's GHGs between 2000 and 2017, ranging between 77% and 79% of total emissions (**Error! Reference source not found.**). The remaining contributors to the country's GHG emissions are aggregated into: i) industrial process and product use; ii) waste; and iii) agriculture (including livestock), forestry and other land use.

Figure 4-30 disaggregates South Africa's energy sector to show coal's dominance (69%) as well as the relatively small contribution of natural gas (3%) to the sector. Coal is plentiful and cheap in South Africa and is ranked among the lowest energy costs in the world. Other sources of energy include crude oil, biomass (waste), hydropower, nuclear power, solar power, and wind.

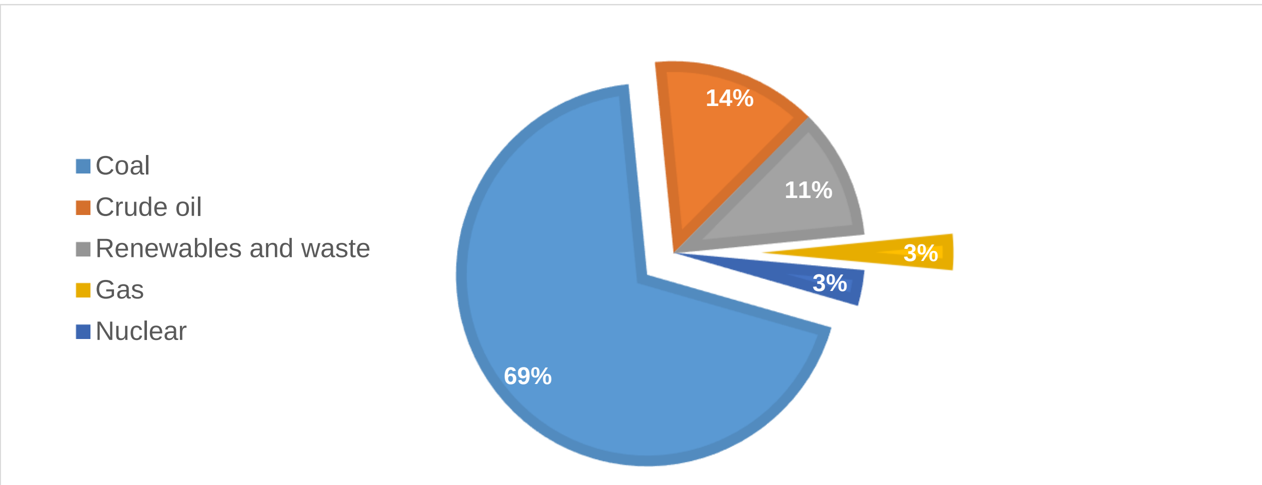


Figure 4-30: Ratio of energy sources in South Africa in 2016.

South Africa's long-term goal in terms of its intended national contribution (INDC) to global GHG emissions is that the country's total annual GHG emissions will be in the range of 212 to 428 Mt CO_2e by 2050 (212,000 – 428,000 Gg CO_2e), having declined in absolute terms from 2036 onwards. South Africa defines a peak, plateau and decline GHG emissions trajectory range, with emissions by 2025 and 2030 in a ranging between 398 and 614 Mt (398,000 – 614,000 Gg CO_2e).

4.1.8 Ambient Noise

Noise sensitive areas (NSA's) within the study area and surrounding area have been identified and illustrated in Figure 4-31 and Figure 4-32 below. The distances are calculated based on the noise source in relation to the noise sensitive area.

#	Description	Latitude	Longitude	Distance to Project Location (m)
NSA 1	Bayside Aluminium	28°47'17.88"S	32° 0'52.59"E	1755
NSA 2	Seafarer's Club	28°47'17.74"S	32° 1'36.65"E	975
NSA 3	SPS Manufacturing	28°46'49.88"S	32° 3'37.62"E	3190
NSA 4	Small Craft Harbour	28°47'43.18"S	32° 4'41.73"E	4440
NSA 5	Meerensee Residential	28°47'25.94"S	32° 5'33.49"E	6005
NSA 6	Gubhethuka Residential	28°50'29.00"S	31°59'41.05"E	6375

Figure 4-31: Location of Noise Sensitive Areas

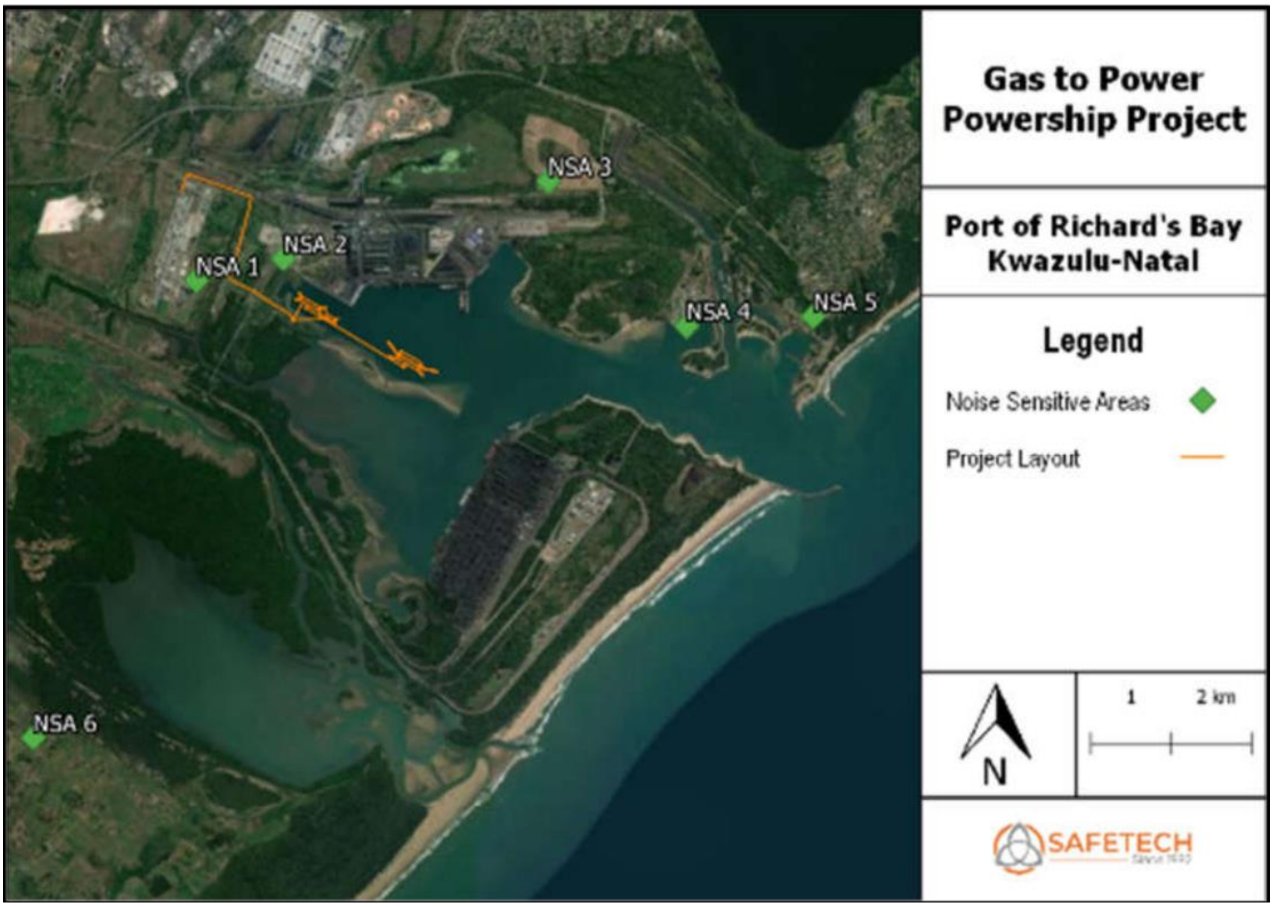


Figure 4-32: Noise Sensitive Areas.

A field study was conducted to determine the current ambient noise in the Port of Richard's Bay. The most sensitive areas from a noise perspective will be the Seafarer's Club and the several facilities in close proximity to the proposed project, such as the Bayside Aluminium facility to the north-east of the site (NSA 1). The other sensitive areas are too far away from the noise source to be of concern as is indicated in the results table. This is due to the attenuation of noise by distance.

Due to access and security issues, setting up a long-term monitoring point was not possible at NSA 1 or NSA 2, therefore long-term measurements were taken in the Meerensee suburb (NSA 5). This location was chosen as a proxy for the residential areas where ambient noise is expected to be lower (and thus more susceptible to disturbing noise) than in the port where noise from trucks, factories and other operational facilities will contribute to a higher ambient noise and thus receptors may not be as heavily impacted as in the suburbs.

The results of the ambient noise monitoring are contained in Figure 4-33 below and illustrates the relationship between wind speed and noise levels. The ambient noise does not appear to vary significantly with low windspeeds. This is most likely due to the protected area of the measurement point. The results of the ambient noise monitoring indicate that, during the monitoring period, a maximum noise level of 52.9 dB(A) was reached. The average noise levels over the course of the study was 45 dB(A).

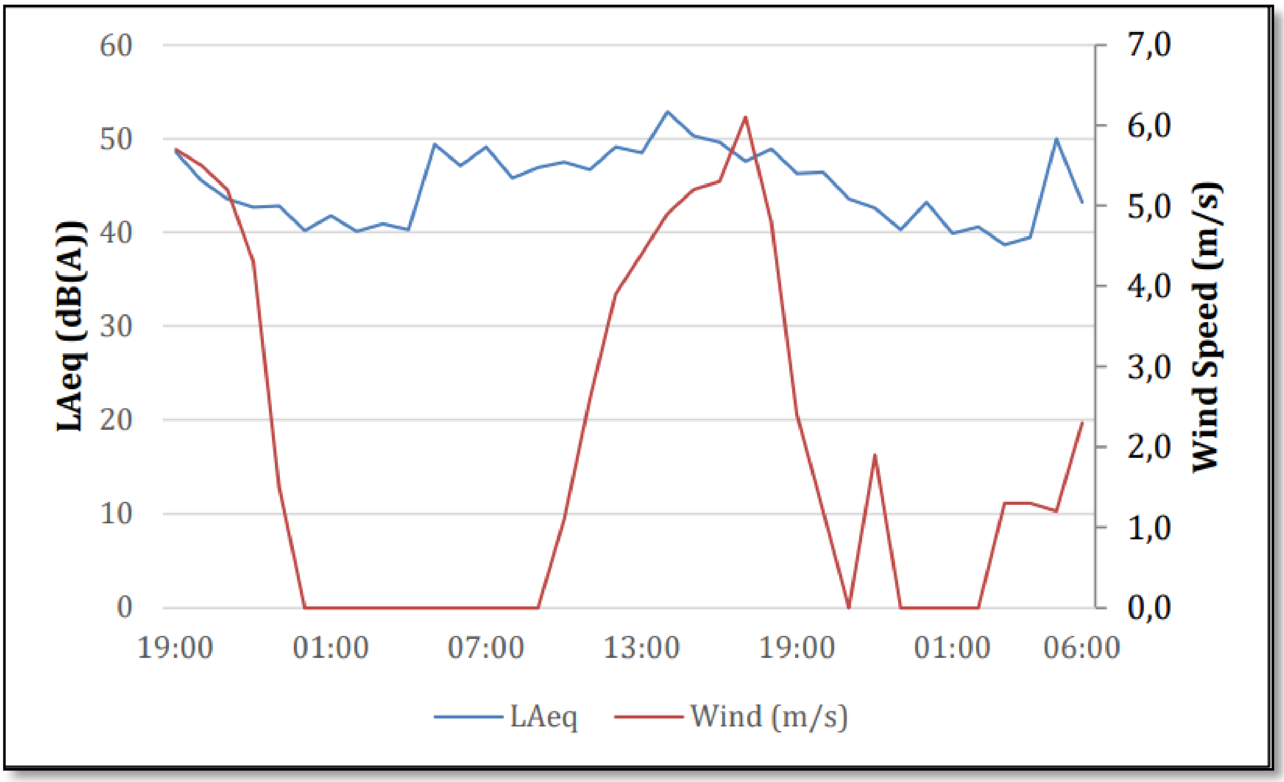


Figure 4-33: Ambient Noise Levels vs Wind Speed.

The noise sources could impact on the local residents outside the study area, as well as persons working within the Port of Richard's Bay. Various ecological receptors have also been identified such as fauna and flora in the Richard's Bay. The noise will include audible, low frequency and infra sound.

SANS 10103:2008 provides typical rating levels for noise in various types of districts, as described in Figure 4-34 below.

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Figure 4-34: Typical rating levels for noise in various types of districts.

The rating levels above indicate that in industrial districts, the noise should not exceed 70 dB(A) during the day and 60 dB(A) at night. There are however no rating levels for protected natural environments. The Richard's Bay Nature Reserve should ideally be free of any anthropogenic noise sources.

These rating levels can thus be seen as the target levels for any noise emissions from a nearby industrial facility. As can be seen from the ambient noise monitoring results, the ambient noise is not exceeding the recommended day/night rating levels of industrial districts or suburban districts with little road traffic.

Furthermore, the South African noise control regulations and the local authority regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7dB. This difference is usually measured at the complainant's location should a noise complaint arise. This will not strictly apply to a protected area that has no permanent human recipients. The noise emissions primary impact will be on the terrestrial animals within the protected area.

4.2 CULTURAL AND NATURAL HERITAGE

4.2.1 Cultural Heritage

A map from 1937 indicates that the study area was previously mostly agricultural fields surrounding wetlands where the current Alusaf facility is located. Further north, settlements and a cattle byre are also visible on this map. A topographical map from 1964 indicates that a settlement near the study area and thus, graves would have also been present. However, and remains would have been destroyed by the railway line that was constructed there. A map from 1984 shows that the area was then developed as an industrial zone. These maps concur that there was a swamp and wetland formed by the Hlangabenzani River. However, by 1964 furrows/canals had drained much of the water. The maps also indicate that much of the landscape has changed with the building of the harbour and extra docking areas. For example, the small peninsula where the Powership will be anchored only occurs post-1983. The historical maps thus indicate that human settlements did exist in the general area and thus there is a possibility of human graves being present. This area has also been one of the many areas regarding forced removals of the Mandlazini people (Griffiths 1996; Ntuli 2019) and there is a pending land claim for the general area. No heritage sites were observed along the proposed transmission line routes during the field survey.

4.2.2 Palaeontology

The project site is located within an area of low to medium paleontological sensitivity (Figure 4-35). The green area refers to the Cretaceous deposits that occur 3m – 5m below the surface. These deposits were noted during the harbour expansion project. The proposed project will not reach those depths and it consists of small impact areas for each pole of the proposed transmission line.

Figure 4-35: Paleontological Sensitivity Map.

4.3 SOCIAL AND ECONOMIC CONDITIONS

4.3.1 Socio-Economic Aspects

The propped project falls within the City of uMhlathuze Local Municipality (uMhlathuze LM) and the King Cetshwayo District on the north-east coast of KwaZulu-Natal. It is the third economic hub in the province after eThekwini and Msunduzi Municipalities respectively.

uMhlthuze boasts South Africa's deepest water port, in Richards Bay, and is home to the Richards Bay Industrial Development Zone (RBIDZ), which drives the inwards investment of the City through foreign direct investments. The Richards Bay IDZ strategy is to cluster smaller, downstream manufacturing businesses around existing major industries in the City, as well as attract small-medium industrial operations that will create employment and economic growth whilst broadening South Africa's export products. The Richards Bay IDZ is centered around five key sectors; agro-processing, ICT and techno-parks, metals beneficiation, marine industry development and renewable energy.

The City of uMhlathuze is strategically placed with Richards Bay considered to be the industrial and tourism hub, eMpangeni the commercial hub, eSikhaleni the largest suburb, and Ntambanana the home of safari tourism. The urban areas are typical of the spatial patterns of towns throughout South Africa, namely that they are segregated by economic classes and reside in clusters.

The surrounding activity around the study area at the port of Richards Bay is primarily industrial and port operations, with light recreational activities including the small craft harbour and Naval Island (a tourist attraction). There are two groups of potentially affected communities: the recreational and livelihood fishing and small crafts community and the tourism node surrounding Alkanstrand beach and Naval Island.

Naval Island, Pelican Island and Alkantstrand beach form a tourism node at the Richards Bay Port Harbour Entrance. The Alkantstrand area specifically is marked for significant tourism development towards a new beachfront precinct that is resilient from coastal erosion, aesthetically appealing, economically stimulating to the area and iconic in status.

The Recreational and Livelihood Fishing and Small Crafts Community

A number of small fishermen fish out of the Richards Bay Port and due to the size of their fishing boats, stay close to shore (within 5 miles of the coastline) to secure their catches. Similarly, there is a small crafts harbour mostly used for smaller fishing vessels and the yachting community. Figure 4-36 below show the location of the tourism precinct and small craft activity in relation to the proposed mooring site of the Powerships and FSRU (a distance of approx. 3km).

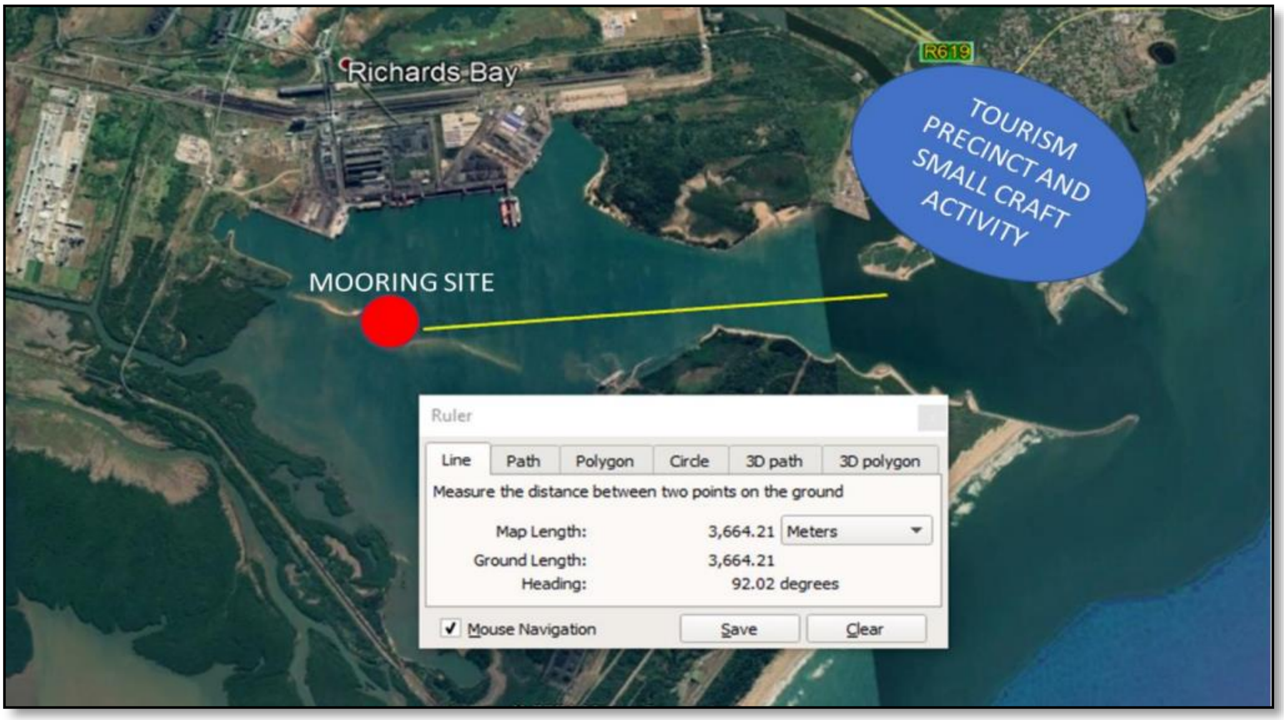


Figure 4-36: The mooring site in relation to the tourism precinct including the small craft harbour, Alkantstrand and Navel Island.

Population, Income and Employment Profile

Over the period 2009 to 2019, uMhlathuze LM experienced household and household density growth of 1.3% per annum, which is above the provincial growth rate of 1.4% and growing considerably faster than its district, King Cetshwayo DM (0.9%). This fast growth is coupled with a higher household density than surrounding areas and the country as a whole, indicating the pull factor of the economic opportunities available within the area.

The disposable average monthly income of households in uMhlathuze LM is R16 725 in 2011 (in current 2020 prices). This was significantly higher than that of KwaZulu-Natal (R11 450; 2020 prices) and South Africa (R14 256; 2020 prices) in the same period.

A review of the employment profile of uMhlathuze LM reveals that a relatively high proportion of the population in the area is formally employed (72.2%), with a correspondingly lower unemployment rate of

27.8%. The unemployment rate is slightly lower than both the provincial and national unemployment (32.5% and 28.8% respectively). The higher employment rate in uMhlathuze LM reflects a higher labour force participation rate compared to provincial and national participation.

Education Profile

The skill level of the population in uMhlathuze LM, as measured by educational attainment, is relatively reflective of the national education profile and significantly better than the provincial education profile. In addition, educational attainment in uMhlathuze LM has showed significant improvement over the past decade with growth rates in the upper education levels reflecting 3.3% for completed matric and 2.9% for a completed tertiary qualification. The educational profile of uMhlathuze LM suggests that there is a relatively skilled population, however, there is a need for interventions that target low and semi-skilled individuals.

Access to Basic Services

In 2019, 95.6% of households in uMhlathuze LM had access to piped water, well above the provincial average of 78.4%. Accordingly, only 846 households in uMhlathuze LM were dependent on either boreholes or natural sources, such as dams, rivers and streams as their primary water source. It should be noted that this figure does not speak to the quality and reliability of this access.

Electricity access is exceptionally high in uMhlathuze LM as most (93.4%) households in the municipality report using electricity as their primary means of lighting. This level of access is higher than both the provincial and national figures.

Flush and chemical toilets are the most widely used sanitation type in the respective area, with just under two-thirds of households in uMhlathuze LM (63.4%), having access to this minimum national sanitation standard in 2019. Over the last ten years, the roll out of sanitation services in the municipality has been positive with the number of households that have access to flush or chemical toilets improving at an average rate of 2.0%. uMhlathuze LM has made positive strides in improving access to sanitation, however, there is still a significant way to go with 29.6% of households using bucket and pit latrines and 6.6% of households having no access.

Economic Profile

Nationally, South Africa's Real Gross Domestic Product (GDP) for the first quarter of 2020 declined by 2.0% quarter-on-quarter (seasonally adjusted and annualised). This was followed by a record 51.0% contraction in the second quarter of 2020 owing to the impact of the hard COVID-19 lockdown restrictions that began in the end of March 2020. However, the third quarter of 2020 saw a rebound of 13.5%, following the gradual easing of lockdown restrictions. A marginal positive quarter-on-quarter GDP growth rate is anticipated in the fourth quarter of 2020; however, the full year estimate is for a contraction of 7.2% which indicates that South Africa is in a technical recession (StatsSA, 2020) (National Treasury, 2020).

The ongoing impacts of COVID-19 and load shedding are likely to further negatively impact the national economy. On a national level, forecasts are that South Africa's GDP will contract by between 4% and 8%, with the country experiencing revenue shortfalls of between R 70 and R 100 billion. The budget deficit is expected to accelerate from an initial forecast of 6.8% of GDP to more than 10% (van Wyk, 2020). Additionally, it is likely that the recession South Africa currently finds itself in will continue for the rest of 2020.

Once this shock to the economic and social system has been dealt with at a national and international level, there will be a need to strengthen and develop the South African economy. One of the necessary components of a functional economy will be the provision of a stable electricity supply. The South African energy provision system is currently and has in the past decade been, notoriously unreliable which has had a major impact on investor confidence and the overall development of the country.

South African Electricity Supply

The supply of electricity in South Africa is currently exceptionally constrained. Load shedding in South Africa began in 2007 as a result of insufficient electricity generating capacity by the government owned national power utility, Eskom. The advent of load shedding has brought numerous direct economic impacts, indirect economic impacts and social impacts to South Africa.

These costs are associated with losses to productivity and limitation of growth for companies and as a result a reduced growth for the country (Goldberg, 2015). The lack of sustainable energy supply also has a direct impact on the ability of the country to attract foreign direct investment. Electricity supply is a critical factor in the profitability of an industrial investment (Goldberg, 2015). The price and the reliability of electricity supply can influence the decisions of investors.

The uncertainty around South Africa's current electricity supply and the inability to resolve the current crisis adds significant risk to any investment made in the South African economy. It should also be noted that the current electricity crisis is not a one-off event, but rather, a continuous challenge that negatively impacts market sentiment and investor confidence in the South African economy (Goldberg, 2015). Load shedding also threatens jobs, economic recovery, and the livelihood of many South Africans around the country.

At a national level any additional energy production which is sustainable and affordable would improve energy security, further South Africa's goals towards international agreements, provide employment and assist in improving investor confidence in the country.

Regional Economic Profile

The GVA (Gross Value Added) of uMhlathuze LM is R24.6 billion as at 2019 (constant prices), which collectively accounts for 69.5% of the district economy's GVA, 5.3% of the provincial economy's GVA, and 0.9% of South Africa's GVA. Per capita GVA in the municipality is R70 727 as at 2019 in constant 2010 prices, which is 73.4% higher than the rest of KwaZulu-Natal (R40 780) and 45.1% higher than South Africa (R48 754). These figures suggest that uMhlathuze LM is an important part of the provincial economy and performs strongly in terms of economic output.

The growth of uMhlathuze LM over the last few years is largely due to the strong performance of the primary and tertiary sectors, particularly the finance and business services sector and trade sector.

Electricity, gas and water only contributes a small margin to the economy of uMhlathuze LM in line with provincial and national norms. Both output and GVA figures over the past decade reveal that the sector is particularly strained with negative growth in the water sector and almost no growth (0.3%) in the electricity and gas sector. The electricity and gas sector is comparatively underdeveloped within uMhlathuze LM and any new development would likely greatly increase the contribution of the utilities and construction sectors to the GVA.

The Wholesale and retail trade, catering and accommodation sector is the largest contributor to employment. Within uMhlathuze LM this sector accounts for 23.8% of employment opportunities which is the highest contributing sector seen between uMhlathuze LM, the district and the province. Other significant employment sectors for uMhlathuze LM include:

- The Finance, insurance, real estate and business services sector accounting for 17.2% of total employment;
- The Community, social and personal services sector accounting for 12.9% of total employment; and
- The Private households sector accounting for 15.1% of total employment.

In total the tertiary sector accounts for 75.7% of total employment within uMhlathuze LM. The tertiary sector also reflects the fastest employment growth with the construction (2.7%), transport and communication (2.6%) and trade (2.4%) sectors all showing significant employment expansion, likely due to the Richards Bay Port Expansion activities and significant activity surrounding the development of the Industrial Development Zone.

Overall Socio-Economic Profile

The socio-economic profile indicates that uMhlathuze LM offers a relatively more developed economy whilst still suffering from common national and provincial problems of poverty, inequality and unemployment. Despite these issues, the uMhlathuze LM seems well positioned to accommodate and implement the construction and operation of the Port of Richards Bay Powerships.

Education levels and, as a consequence, skill levels in uMhlathuze LM are comparably better than the provincial skills profile with almost a third of the population having completed matric or higher. Whilst this is impressive, there is a large divide in the educational and skills profile of uMhlathuze LM as just under two-thirds of the population have not completed secondary schooling or have had no formal education. This suggests that the uMhlathuze LM could benefit significantly from the construction and operation of the Powerships Project through employment opportunities for the skilled and semi-skilled labour force as well as skills transfer from migrant or imported specialists and upskilling programmes planned for the project’s socio-economic spend. Furthermore, the additional employment opportunities within the Municipality could result in a slight increase in the comparably better but still moderate levels of household income.

The economies of both the uMhlathuze LM and KwaZulu-Natal are dominated by the manufacturing and finance and business services sectors in terms of both economic output and employment. The most significant sector in uMhlathuze LM specifically related to employment is the trade sector accounting for 23.5% of employment. The construction sector, whilst small in uMhlathuze LM is showing significant growth in both GVA and employment which suggests that any construction related developments in the respective area is likely to have a strong positive impact on unemployment and skills development within the region.

The strong positive real GVA growth rate of uMhlathuze LM between 2009 and 2019 relative to the province and South Africa suggests that the area is experiencing significant investment and development. As such the electricity supply supporting local big business within the IDZ and the provincial grid as a whole is under strain. Given the skills available and investment in the area, it seems that uMhlathuze LM and more specifically the Port of Richards Bay is well situated to construct and operate the proposed Powerships. In addition, this development will have a subsequent positive impact on household income, economic well-being, poverty and unemployment.

4.3.2 Marine Traffic

The Port of Richards Bay is the largest port in South Africa by tonnage, handling around 100 million tonnes of cargo per year, which equates to 54% of South Africa’s total port demand (TNPA, 2019). Bulk operations in the port currently focus on four major activities: export coal, dry bulk, break-bulk and liquid bulk. The port has a world-class coal export terminal, a general purpose dry bulk and multipurpose terminal and a liquid bulk terminal. Other services include bunkering and minor ship repairs and facilities for service and recreational craft. The short-term (i.e. 7-year) and medium-term (i.e. 7 to 30 year) port development plans consists of three key infrastructure developments to increase the capacity of the port. The infrastructure developments include the provision of two new dry bulk berths located at the finger jetty, a new LNG berth becomes available and the provision of the two additional berths in the Bayvue Precinct (TNPA, 2019).

The Powership vessel classes considered for the Port of Richards Bay are the Khan and Orca S class and are to be moored opposite the 600 berth series within the Port of Richards Bay. As there is currently no LNG infrastructure within the port, the Powership solution will be fuelled by the FSRU on a separate spread-mooring and connected via a gas pipeline to the Powership. The approach channel and vessel manoeuvring areas will therefore be shared with all the terminals in the port, i.e. vessel traffic in the basin from breakbulk (MPT) vessels and dry bulk cargo vessels and tugs.

In the process of identification of the potential sites, the existing cargo facilities and the future short to medium term developments were avoided, i.e. no existing TNPA berthing infrastructure will be used for the proposed project.

The existing and anticipated vessel traffic in the Port of Richards Bay in 2020 is 2019 vessels with approximately 38% of these vessels being export coal vessels and 25% of the vessels for minor bulk cargoes. The current demand for coal export is 81.8 Mtpa and is expected to grow to approximately 102 Mtpa by 2051. The current demand for bulk cargo is 27 Mtpa and is expected to grow to approximately 37 Mtpa by 2051. The liquid bulk terminal in Richards Bay is forecast to increase handling of total liquid bulk products from approximately 2.2 Mtpa in 2021 to approximately 6.1 Mtpa in 2051.

CMR data (port log data) was used to analyse the historic trends of vessel activity at the Port of Richards Bay (LTPF, 2015). The annual percentage growth in demand was used to estimate the future vessel traffic for the various cargo handled within the port for the years 2021 to 2051. Coal export vessel calls are forecasted to increase from 777 in 2021 to 990 in 2051. The number of additional vessels contributable to the Powership operations is 10 vessels per annum initially, increasing to 20 vessels per annum in 2051. This only considers the relatively more frequent LNGC refuelling of the FSRU and excludes the once-off arrival of the Powership and FSRU upon commissioning within the Port of Richards Bay. Minor bulk and general cargo vessel calls are forecasted to increase from 588 and 448 in 2021 to 808 and 830 in 2051 respectively. The latter vessels will have a more significant impact on the navigation and mooring of the Powership and FSRU solution as a result of the proximity to the access channel, turning circle and the shared vessel manoeuvring areas at the 600 and 700 series berths.

All vessel slots, including the LNGC vessels arriving to refuel the Powership, were calculated assuming an appropriate slot duration where the navigation channels, pilotage and tug resources of the port are utilised. The assumed slot durations considered a 2.5 hour duration for both berthing and sailing operations of the existing vessel types in the port (i.e. cargo vessels), while LNGCs will consider a duration of approximately 4 hours to moor and unmoor at the FSRU.

The results of the marine vessel traffic assessment, which considers vessel traffic forecasts up to 2051 and an upper limit of LNGC vessel calls, indicate that the LNG vessels, only representing 1% of the 2051 vessel traffic slot durations, are not expected to significantly add to marine vessel traffic congestion within the Port.

The Port of Richards Bay is forecasted to have approximately 41% and 12% spare slot capacity in 2021 and 2051 respectively. Due to the marine vessel traffic congestion that may occur in 2051, vessel traffic easing measures such as slot systems may need to be considered in the port. Figure 4-37 below illustrates the proposed LNGC vessel track.

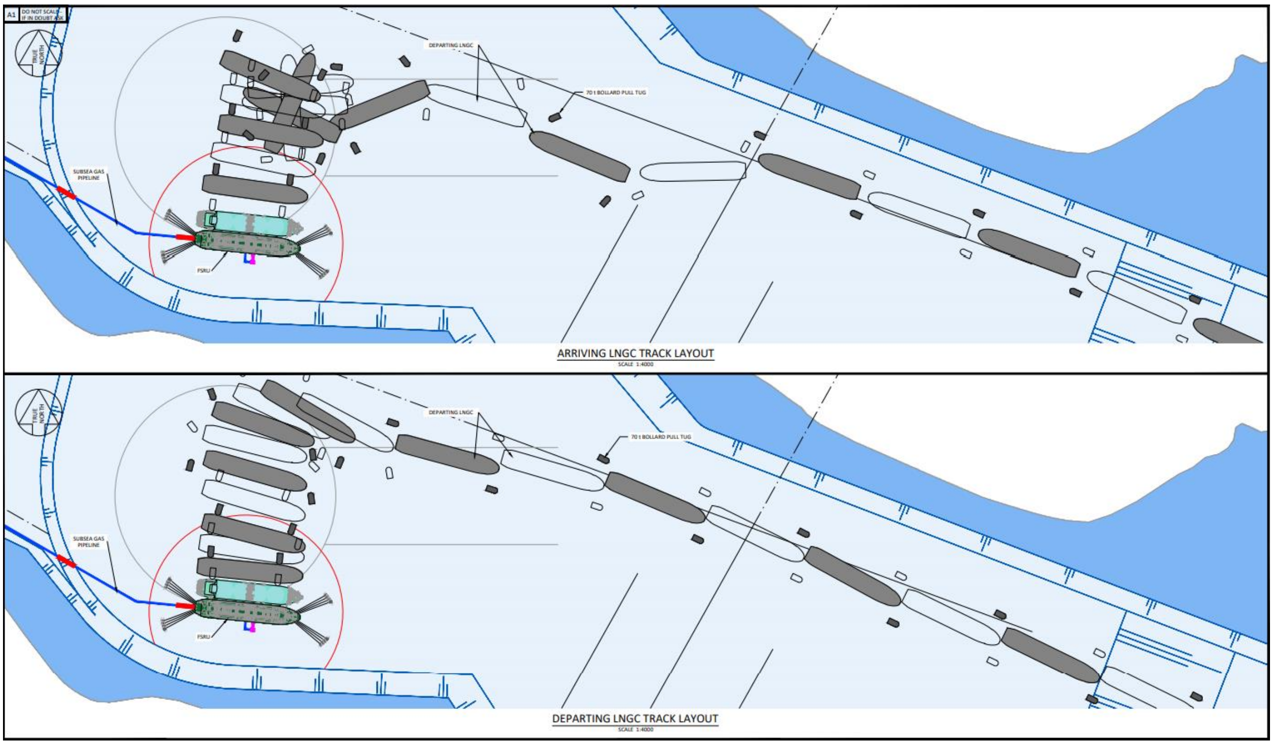


Figure 4-37: Marine Work LNGC Vessel Track Layout.

5 POLICY AND LEGISLATIVE FRAMEWORK

5.1 NATIONAL REGULATORY FRAMEWORK

2014 NEMA EIA Regulations (as amended), Appendix 3: 3(1)- (e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.

5.1.1 National legislation

The Constitution, 1996 is the supreme law of the Republic. Any law or conduct inconsistent with it is invalid and the obligations imposed by it must be fulfilled.

- Chapter 2 of the Constitution contains the Bill of Rights, one of which is Section 24: everyone has the right to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for benefit of present and future generations, through reasonable legislative and other measures that:
  - prevent pollution and ecological degradation;
  - promote conservation; and
  - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

One of the key legislative measures that has been established is the promulgation of the National Environmental Management Act 107 of 1998 (NEMA). NEMA aims to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith.

NEMA prohibits a person from commencing a listed activity without environmental authorisation. The Project triggers several activities listed in the EIA Regulations Listing Notices 1, 2 and 3 of 2014 (as amended). The procedural requirements for such an application and associated EIA that needs to be undertaken, are prescribed by the EIA Regulations, 2014 (as amended) (the EIA Regulations, 2014) and informed by guidelines published in terms of Section 24J of NEMA as well as applicable protocols and minimum information requirements.

In addition, the Project triggers an activity listed under the National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) which requires an atmospheric emission licence (AEL). The same EIA process prescribed by the EIA Regulations, 2014 need to be applied to the AEL application, with a number of additional requirements set out in NEMAQA and its Regulations.

As part of the EIA process, the EIA Regulations require that a description of the policy and legislative context within which the development is proposed is reported on in the EIA Report, including an explanation of how the proposed development complies with and responds to such legislation and policy context. This includes an identification of applicable legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments. This section has been prepared to satisfy this requirement.

National Environmental Management Act 107 of 1998

Legislation	Section	Relates to
National Environmental Management Act 107 of 1998	Section 2	Contains sustainable development and other principles that apply throughout South Africa to the actions of all organs of state that may significantly affect the environment.
	Chapter 5	Provides for integrated environmental management including the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
	Section 30	Deals with the control of emergency incidents, including the different types of incidents, persons responsible for the incidents and reporting procedures to the relevant authority.
Relevance to the Proposed Project, compliance and response:		
Three sets of listed activities, published 4th of December 2014 (w.e.f 8 December 2014) under Government Notices R.983, R.984, and R.985, and subsequently amended, describe the activities that require either a Basic Assessment (applies to activities in Listing Notices 1 and 3)), or Scoping and Environmental Impact Reporting (S&EIR) (applies to activities in Listing Notice 2)). All listed activities that are triggered in the above listing notices need to be assessed in the assessment report – refer to Section 2.2. Because the Project triggers activities in Listing Notice 2, the application for environmental authorisation is subject to the S&EIR process for all activities, including those listed under Listing Notice 1 and 3. As set out by Section 24C of the NEMA, the relevant competent authority for this activity is DEFF. The applicable 24J Guidelines which have been applied to the EIA process include: • Department of Environmental Affairs (2017), Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs, Pretoria, South Africa. • DEA (2017), Guideline on Need and Desirability, Department of Environmental Affair (DEA), Pretoria, South Africa The applicable protocols and minimum information requirements which have been applied to this project include the Procedures for the assessment and minimum criteria for reporting on identified environmental themes when applying for environmental authorisation (GN320 in GG 43110 of 20 March 2020; and GN 1150 of GG 43855 of 30 October 2020). Measures to protect the environment by mitigating impacts and responding to emergency incidents are contained in the EMPr.		

National Environmental Management: Waste Act 59 of 2008

Legislation	Section	Relates to
National Environmental Management: Waste Act 59 of 2008	Sections 16 – 18, 21 – 27, 35 - 41, 60	Provides for general and specific waste management measures; the remediation of contaminated land and reporting.

	Sections 19, 20, 43 – 59	Requirements for waste management licensing

Relevance to the Proposed Project, compliance and response:

A number of regulations and standards regulating waste management have been published under NEMWA. including:

- List of waste management activities, 2013 (amended)
- Waste Classification & Management Regulations, 2013
- National Norms & Standards for the Assessment of Waste for Landfill Disposal, 2013
- National Norms & Standards for Disposal of Waste to Landfill, 2013
- National Norms and Standards for the Remediation of Contaminated Land and Soil Quality, 2014

The EMPr contains a number of impact assessment outcomes and actions that include waste management measures to ensure that:

- All reasonable measures must be taken to avoid the generation of waste and where such generation cannot be avoided, minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
- Manage the waste in such a manner that it does not endanger human health or the environment or cause a nuisance through noise, odour or visual impacts;
- Prevent any employee or any person from contravening this Act; and prevent the waste from being used for an unauthorised purpose;

The proposed development does not trigger any listed activities (under Categories A and B) of this Act and as such does not require a Waste Management Licence.

National Environmental Management: Air Quality Act 39 of 2004

Legislation	Section	Relates to
National Environmental Management: Air Quality Act 39 of 2004	Provides for the protection of the environment by regulating air quality in order to prevent air Pollution.	
	Sections 22, 21 22A	Atmospheric Emission Licensing.
	Sections 23-25	Controlled emitters
	Section 32	Control of dust
	Section 34	Control of noise
	Section 35	Control of offensive odours

Relevance to the Proposed Project, compliance and response:

A number of regulations and standards regulating air quality have been published under NEMAQA. including:

- National Ambient Air Quality Standards, 2009
- National Ambient Air Quality Standard for Particulate Matter of Aerodynamic Diameter less than 2.5 micron metre (PM2.5), 2012
- Declaration of a Small Boiler as a Controlled Emitter and Establishment of Emission Standards, 2013
- National Dust Control Regulations, 2013
- Listed Activities and Associated Minimum Emission Standards 2013 (amended)

▪ Regulations regarding Air Dispersion Modelling, 2014 ▪ National Atmospheric Emission Reporting Regulations, 2015 ▪ National Greenhouse Gas Emissions Reporting Regulations, 2016 ▪ Declaration of greenhouse gases as priority air pollutants, 2017 ▪ National Pollution Prevention Plans Regulations, 2017 (amended) The proposed project requires an Atmospheric Emission Licence. The appointed specialist has applied the air dispersion modelling requirements in air quality specialist study and recommendations made therein will be carried through to the EMPr, as well as dust suppression measures.

Marine Living Resources Act 18 of 1998

Legislation	Section	Relates to
Marine Living Resources Act (Act 18 of 1998) amended 2000	Regulates the utilization, conservation and management of marine living resources and the need to protect whole ecosystems preserve marine biodiversity and minimize marine pollution.	
Relevance to the Proposed Project:		
The main implication of this act is the sustainable utilisation of marine resources. Due to the project being located in the Port of Richards Bay, all reasonable measures must be taken to avoid marine pollution to the marine living resources. The findings and recommendations of the relevant specialists, including the marine ecologist will be included in the EMPr.		

National Environmental Management: Integrated Coastal Management Act 24 of 2008

Legislation	Section	Relates to
National Environmental Management: Integrated Coastal Management Act 24 of 2008	Section 2	Provides for the protection and to enhance the status of coastal public property, and secure equitable access to the opportunities and benefits of coastal public property.
	Section 13	Persons right of reasonable access to coastal public property as well as the entitlement to use and enjoy coastal public property.
	Section 58	Duty to avoid causing adverse effects on coastal environment
	Section 69	Stipulate requirements for permits to discharge effluent that originates from a source on land into coastal waters.
Relevance to the Proposed Project, compliance and response:		
The discharge of cooled water from the Powership operations is from the moored Powerships into the sea, i.e. there is no discharge from land-based activities. DEFF has confirmed that a coastal waters discharge permit is not required. Measures to protect the coastal environment by mitigating impacts and responding to emergency incidents are contained in the EMPr. Further, discharge temperatures will conform to the current guideline, the South African Water Quality Guidelines for Coastal Marine Waters, Volume 1, Natural Environment (1995), i.e. the maximum acceptable variation in ambient temperature will not exceed + or – 1°C, in terms of the targeted value for the South African coastal zone.		

National Water Act 36 of 1998

Legislation	Section	Relates to
National Water Act 36 of 1998		Regulates the protection, use, development, conservation, management and control of water resources.
	Section 19	Prevention and remedying the effects of pollution
	Section 20	Control of emergency incidents
	Section 21	Permissible water use, including discharge & abstraction and development within 500m of a watercourse (including wetlands).
Relevance to the Proposed Project, compliance and response:		
As the proposed transmission line be constructed within and within close proximity to a watercourse, and due to the discharge of water from the cooling system in the Powerships, water use license is required for the proposed development, and the application is currently underway. The WULA process is prescribed by the Water Use Licence Applications and Appeals Regulations, 2017. Measures to protect water resources by mitigating impacts and responding to emergency incidents are contained in the EMPr.		

National Forest Act 84 of 1998

Legislation	Section	Relates to
National Forest Act 84 of 1998	Section 12	Provides for protection, control and licencing for cutting, disturbing, damaging or destroying protected trees
Relevance to the Proposed Project, compliance and response:		
If any protected trees in terms of this Act occur on site, the developer will require a licence from the DEFF to perform any of the above-listed activities.		

National Environmental Management: Biodiversity Act 10 of 2004

Legislation	Section	Relates to
National Environmental Management: Biodiversity Act 10 of 2004: Threatened or Protected Species Regulations and lists (2007 & 2017 (marine)); Alien and Invasive Species Regulations and lists (2020)	Provides for the management and conservation of biodiversity, protection of species and ecosystems, and sustainable use of indigenous biological resources, including threatened and protected species and ecosystems, and invasive and alien species	
Relevance to the Proposed Project, compliance and response:		
▪ Critical Biodiversity Area was identified within the proposed development study area; The EIA, including specialist studies and the EMPr identify impacts and contain mitigation measures to: ▪ avoid or minimise impacts on protected and threatened ecosystems and species to protect biodiversity; ▪ Identify permit requirements without which protected species may not be removed or damaged; ▪ Keep the proposed site and transmission routes clear of alien and invasive vegetation using appropriate means.		

National Environmental Management: Protected Areas Act 31 of 2004

Legislation	Section	Relates to
National Environmental Management: Protected Areas Act (31 of 2004)	Provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. Promotes sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas.	
Relevance to the Proposed Project, compliance and response:		
No protected areas are identified within the proposed development site however the Richards Bay Nature Reserve lies less than 1km to the southwest of the site, and the Enseleni Nature Reserve is located approximately 10km to the north of the site. These protected areas have been taken into account by the Ecological and Estuarine specialists' studies.		

National Heritage Resources Act 25 of 1999

Legislation	Section	Relates to
National Heritage Resources Act (No 25 of 1999) and regulations	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), which are not already covered under the ECA. Where they are covered under the ECA the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The Heritage Impact Assessment (HIA) will be approved by the authorising body of the provincial directorate of environmental affairs, which is required to take the provincial heritage resources authorities' comments into account prior to making a decision on the HIA.
Relevance to the Proposed Project, compliance and response:		

- No person may alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or paleontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority.
- No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter or deface archaeological or historically significant sites.
- Cultural and palaeontological impact assessments have been included as specialist studies in the EIA and any permits required will need to be obtained from the provincial heritage authority, Amafa aKwaZulu-Natali.

Conservation of Agricultural Resources Act 43 of 1983

Legislation	Section	Relates to
Conservation of Agricultural Resources Act 43 of 1983 and Regulations	Prohibition and control of weeds and invader plant species	
	Control measures for erosion	
Relevance to the Proposed Project, compliance and response:		
There are no applicable permit or licence requirements, however cognisance of these requirements is to be taken during vegetation clearance and the maintenance of the existing servitudes, for the entire duration of the project lifecycle. Provision for control of invasive species and soil erosion are contained in the EMPr.		

National Ports Act 12 of 2005

Legislation	Relates to
National Ports Act (12 of 2005)	Provide for the establishment of the National Ports Authority and the Ports Regulator; to provide the administration of certain ports by the National Ports Authority; and to provide for matters connect therewith.
	Prescribes that the National Ports Authority is to prepare and periodically update a Port Development Framework Plan (PDFP) for each port. The creation of new capacity in the ports' system results from the implementation of the Port Development Framework Plans.
Relevance to the Proposed Project, compliance and response:	
TNPA is required by the Act to promote economic development of the Port. Further, a balance between environmental protection and economic development must be achieved. The compatibility of the Project with Port planning is discussed in Section 6.	

Occupational Health and Safety Act 85 of 1993

Legislation	Section	Relates to
Occupational Health and Safety Act 85 of 1993 and Regulations	Section 8	General duties of employers to their employees
	Section 9	General duties of employers and self-employed persons to persons other than their employees
Relevance to the Proposed Project, compliance and response:		
The developer must be mindful of the obligations contained in the OHSA and mitigate any potential impacts. Hazardous Chemical Substances and Major Hazardous Installations are regulated under the Act. The associated requirements have been considered by the risk assessment specialist. Recommendations will be included in the EMPr.		

Hazardous Substances Act 15 of 1973

Legislation	Section	Relates to

Hazardous Substances Act 15 of 1973 and regulations	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances
Relevance to the Proposed Project, compliance and response:	
Provision is made in the EMPr to: ▪ Manage the hazardous substances in such a manner that it does not endanger human health or the environment. ▪ Prevent hazardous substances from being used for an unauthorised purpose.	

SANS 10103 (Noise Standard)

Legislation	Section	Relates to
SANS 10103 (Noise Regulations)		The measurement and rating of environmental noise with respect to annoyance and to speech communication, as well as the categories for community responses to excess environmental noise.
Relevance to the Proposed Project, compliance and response:		

The ambient noise level guidelines in SANS 10103:2008 is 70dBA during the day and 60dBA at night in industrial districts. These levels can be seen as the target levels for any noise emissions within the port and adjacent area (South32 Aluminium site). Mitigations measures related to noise impacts are included in the EMPr, as per the specialist's recommendations, refer to section 8.3.

Furthermore, the South African noise control regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7dB. This difference is usually measured at the complainant's location should a noise complaint arise. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7dB, the complainant will have a legitimate complaint. Guidelines for expected community responses to excess environmental noise is reflected in Table 5-1 below.

Table 5-1: Categories of environmental community / group response (SANS 10103:2008).

Excess Lr dB (A)	**Estimated Community/Group Response**	
	Category	**Description**
0 -10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 – 20	Strong	Threats of community / group action
15	Very Strong	Vigorous community / group action

National Road Traffic Act 93 of 1996

Legislation	Section	Relates to
National Road Traffic Act (No 93 of 1996)		Provides for controlling transport of dangerous goods, hazardous substances and general road safety
Relevance to the Proposed Project, compliance and response:		
The requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed project and included in the EMPr.		

Gas Act 48 of 2001

Legislation	Section	Relates to

Gas Act 48 of 2001	This Act regulates the development and operation of gas transmission, storage, distribution, liquefaction and re-gasification facilities. No person may construct or operate gas storage facilities without a licence issued by the Gas Regulator (NERSA) except if listed in Schedule 1, in which case, registration may be required. Schedule 1 includes any person engaged in the transmission of gas for that person's exclusive use. Registration with NERSA is also required for the importation of gas.
Relevance to the Proposed Project, compliance and response:	
As Karpowership will be importing, storing and regasifying natural gas and transporting it between its ships via a pipeline, it will need to comply with the provisions of this Act by applying for the necessary licence and/or registration. These application processes do not form part of the application process for environmental authorisation and AEL.	

Electricity Regulation Act 4 of 2006

Legislation	Section	Relates to
Electricity Regulation Act 4 of 2006; Regulations on New Generation Capacity, 2006; Integrated Resource Plan (IRP) 2019	The Act's main objective is to establish a national regulatory framework for the electricity supply industry and to make the National Energy Regulator of South Africa (NERSA) the custodian and enforcer of the national electricity regulatory framework. The Act empowers the Minister of Mineral Resources and Energy, in consultation with NERSA, to: ▪ determine that new generation capacity is needed to ensure the continued uninterrupted supply of electricity; ▪ determine the types of energy sources from which electricity must be generated, and the percentages of electricity that must be generated from such sources; ▪ determine that electricity thus produced may only be sold to the persons or in the manner set out in such notice; ▪ determine that electricity thus produced must be purchased by the persons set out in such notice; ▪ require that new generation capacity must – o be established through a tendering procedure which is fair, equitable, transparent, competitive and cost-effective; o provide for private sector participation. The Act also gives NERSA various powers to carry out its functions, including the power to consider applications for the licences required and issued under this Act. No person may operate any generation, transmission or distribution facility without a licence issued by NERSA. The objectives of the Regulations published under the Act are to: ▪ to facilitate planning for the establishment of new generation capacity; ▪ the regulation of entry by a buyer and a seller into a power purchase agreement; ▪ to set minimum standards or requirements for power purchase agreements;	

Legislation	Section	Relates to
	▪ the facilitation of the full recovery by the buyer of all costs efficiently incurred by it under or in connection with a power purchase agreement including a reasonable return based on the risks assumed by the buyer thereunder and to ensure transparency and cost reflectivity in the determination of electricity tariffs; and ▪ the provision of a framework for implementation of an IPP procurement programme and the relevant agreements to be concluded. The IRP is South Africa's national electricity infrastructure plan in which the country's energy mix is determined.	
Relevance to the Proposed Project, compliance and response:		
The primary enabling legislation for the Risk Mitigation IPP Procurement Programme is the Electricity Regulation Act, together with the Electricity Regulations on New Generation Capacity and the IRP 2019. Karpowership's proposal for New Generation Capacity through its Powership projects falls under the Risk Mitigation IPP Procurement Programme. In order to generate and transmit electricity, Karpowership will require a generation licence from NERSA. This application is separate to the application process for environmental authorisation and AEL.		

National Energy Regulator Act 40 of 2004

Legislation	Section	Relates to
National Energy Regulator Act 40 of 2004	This Act establishes a single regulator to regulate the electricity, piped-gas and petroleum pipeline industries. The statutory body is the National Energy Regulator of South Africa (NERSA). This Act requires NERSA inter alia to undertake the functions of the Gas Regulator as set out in section 4 of the Gas Act and the functions set out in section 4 of the Electricity Regulation Act, 2006, which includes the planning for new generation capacity and integrated resource plan.	
Relevance to the Proposed Project, compliance and response:		
NERSA has been identified an organ of state having jurisdiction in respect of an aspect of the activities for which the EIA process is being conducted and thus has been registered as an I&AP as required by the EIA Regulations, 2014.		

Infrastructure Development Act 23 of 2014

Legislation	Section	Relates to
Infrastructure Development Act 23 of 2014	▪ To provide for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the Republic; ▪ to ensure that infrastructure development in the Republic is given priority in planning, approval and implementation; ▪ to ensure that the development goals of the state are promoted through infrastructure development; ▪ to improve the management of such infrastructure during all life-cycle phases, including planning, approval, implementation and operations; and	

	▪ to provide for matters incidental thereto.
Relevance to the Proposed Project, compliance and response:	
The Risk Mitigation IPP Procurement Programme has been designated as a Strategic Integrated Project.	

5.1.2 Provincial legislation and planning

The Project's compatibility with provincial and conservation planning is discussed in Section 6.

Legislation	Relates to
KwaZulu-Natal Planning and Development Act6 of 2008	Strategic spatial development intentions for the municipality based on the IDP and SDF, influenced by and in alignment with adjacent municipalities.
KwaZulu-Natal Provincial Spatial Economic Development Strategy (2016)	The prioritisation of spatial economic development initiatives in the province, including strategy to ensure that investment occurs in the sectors that provide the greatest socio-economic return to investment.
The KZN Conservation Management Act, 9 of 1997 and Natal Nature Conservation Ordinance 15 of 1974	Provides for the establishment of the KZN Conservation body (Ezemvelo KZN Wildlife – EKZNW) and prescribes its powers, duties and functions, including direct management of nature conservation and protected areas. Permits are required for listed protected species.
KwaZulu-Natal Biodiversity Plan	The plan has been developed to guide development, protected areas expansion and conservation within the province. The plan identified areas as Critical Biodiversity Areas (CBAs) which cannot be lost if conservation goals are to be met, and Ecological Support Areas (ESAs), which are required to support the functioning of ecosystems and CBAs. Development guidelines for each category of CBA and ESA are included in the plan.
The Provincial Norms and Standards on Biodiversity Offset for KwaZulu-Natal (2009, 2013)	Provides details on how EKZNW, as the Provincial biodiversity authority, requires offsets to be investigated and reported upon. No biodiversity offsets have been recommended for the proposed project.
KZN COGTA – Adopted Provincial Norms and Standards for Climate Change and Energy Efficiency in Land Use Management (January 2020)	Providing set of norms and standards that focus on climate change and energy efficiency, which are interrelated, which must be used in the assessment of land development applications in order to proactively respond to climate change.
KwaZulu-Natal Coastal Management Programme	Developed to bring provincial coastal management in KwaZulu-Natal in line with the Integrated Coastal Management Act. The Provincial Coastal Management Programme (PCMP) sets out the objectives and requirements to fully realise integrated coastal management in KwaZulu-Natal.
KwaZulu-Natal Draft Climate Change Action Plan	This provincial level strategy is modelled on the NNCRP. It defines an approach to achieving climate resilience and emissions reductions within the context of both provincial development priorities and projected climate change impacts.

Legislation	Relates to
KwaZulu-Natal Provincial Growth and Development Plan (PGDP) (2019)	Aims to curb poverty, inequality and achieve shared growth. Alternative sources of energy are indicated as a priority, including generation of energy through gas and diesel turbines.
KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs Revised Strategic Plan 2015 – 2020	Relevant objectives of the strategy include the facilitation and creation of new markets; to drive growth of the KZN provincial economy; to enhance sector and industrial development and to investigate and develop viable alternative energy generation options.

Table 5-2: Applicable Provincial Plans, Strategies and Programmes.

5.1.3 Local legislation and planning

The Project's compatibility with regional and local municipal and conservation planning is discussed in Section 6.

Legislation	Relates to
Richards Bay Environmental Management Framework (EMF)	Secures environmental protection and promote sustainability and cooperative environmental governance. Guides the decision-making in the area.
uMhlathuze Land Use Scheme Regulations – 25 September 2019	Determines the use and development of land within the municipal area to which it relates in order to promote— (a) economic growth; (b) social inclusion; (c) efficient land development; and (d) minimal impact on public health, the environment and natural resources.
uMhlathuze Municipality Integrated Development Plan (IDP), 2019/2020	Aiming to reduce the demand for energy and investigate alternative energy sources, to meet the sustainable development goal of ensuring access to affordable, reliable and modern energy for all.
King Cetshwayo District Coastal Management Programme (updated 2015)	The simplified CMP includes only a summary of the situation assessment, coastal management precincts, a municipal vision and concluding with priorities and strategies.
Richards Bay/ uMhlathuze Estuarine Management Plan	In accordance with a National Estuarine Management Protocol, the plan is in line with the minimum requirements and general content for estuarine management plans (EMPs) and the responsible institutions for developing EMPs.
King Cetshwayo District Municipality Draft Integrated Development Plan (2020/21 – 2021/22)	The objective is to promote economic growth in the District and improve the socio-economic conditions of residents, including infrastructure development and service delivery.

Table 5-3: Applicable Regional and Local Planning Frameworks.

5.2 INTERNATIONAL AGREEMENTS

South Africa is a party to a number of international agreements which regulate shipping as well as the protection of marine resources:

- International Convention for the Prevention of Pollution from Ships – MARPOL 73/78
    - The MARPOL Convention regulates pollution from ships – accidental pollution and pollution from the general operations associated with shipping; Preserves the marine environment by

eliminating pollution from harmful substances. Ships sailing under the flag of a country that has entered into the MARPOL convention are expected to comply with the regulations. The MARPOL Convention was ratified by South Africa in 1985,

- Convention on Biological Diversity – 1992-1995
- International Convention on Civil Liability for Oil Pollution
- Damage – 1969-1997
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties – 1969-1986
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) – 1972-1978
- Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter – 1996-1998
- United Nations Convention on the Law of the Sea (UNCLOS) – 1982-1997
- Protocol relating to intervention on the high seas in cases of pollution by substances other than oil – 1973-1997
- International Convention for the Safety of Life at Sea – 1974-1980
- Convention on the Conservation of Migratory Species of Wild Animals
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds, or African-Eurasian Waterbird Agreement (AEWA)

Also of relevance to the Project is the Framework Convention on Climate Change, 1992 and the Paris Agreement. This is discussed in more detail under Section 6.

6 MOTIVATION, NEED AND DESIRABILITY

2014 EIA Regulations (as amended), Appendix 3: 3(1) (f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report; (g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;

6.1 PROPOSED DEVELOPMENT

This section contextualises the strategic planning context within which the Project is being proposed.

South African legislation, including the Constitution and NEMA, entrenches the principle of sustainable development as do the various National strategies, policies, programmes and plans, including the National Development Plan 2030 (NDP). The motivation for the need and desirability motivation for the proposed Project thus needs to be assessed within the context of these strategies, policies, programmes and plans by specifically looking at whether the proposed project is ecologically sustainable and socially and economically justifiable.

STRATEGIC OVERVIEW

The United Nations Sustainable Development Goals (SDGs) or Global Goals were adopted by all member states of the United Nations in 2015 in the commitment to end poverty, protect the planet and ensure peace and prosperity for all people by 2030. South Africa was one of these nations.

The provision of electricity falls under the SDG 7: Affordable and Clean Energy. Notably, the goals are integrated and an improvement in one area affects the outcome of the other SDG areas. For example, an improvement in SDG 7: Affordable and Clean Energy is likely to lead to an improvement in the other SDGs such as: 1 (No Poverty); 3 (Good Health and Well-Being); (8 (Decent Work and Economic Growth); 9 (Industry, Innovation and Infrastructure); 11 (Sustainable Cities and Communities) and 13 (Climate Action).

Figure 6-1: United Nations Sustainable Development Goals (Source: UN General Assembly, 21 October 2015).

The principles outlined in the National Environmental Management Act 107 of 1998 (NEMA) must be applied to all decision-making that may affect the environment and its biodiversity. The first two principles in Section 2 of NEMA are that, "environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably" and "[d]evelopment must be socially, environmentally and economically sustainable".

Given the integrative nature of sustainability, the requirement for and provision of reliable energy will cross cut various environmental, social and economic goals. Various specialist environmental studies are being commissioned to identify the potential environmental impacts of the proposed project on life below water, life on land and climate change in order to establish required mitigation in terms of alternatives and other mitigation measures. The findings indicate that:

- Ambient air pollutant and Greenhouse Gases emissions, due to the use of natural gas rather than Liquid Petroleum Gas as energy source, are likely to be very low;
- Marine environment impacts such as pollution and physical disturbance of the littoral zone, increased seawater temperatures and modifications to the hosted biological communities may occur. However, gas pipeline design and construction as well as maritime engineering mitigation measures can be implemented to avoid or reduce impacts;
- Risk management can be applied to limit incidents in the Port (including explosions);
- Life on land impacts - indigenous vegetation clearance, aquatic systems and wetlands - are within the limits of acceptable change as the relatively short distance (approx. 3km) 132KV transmission line is the only aspect of the project to have a terrestrial impact. The Karpowership with its relatively small footprint will be moored in the port and have no significant footprint typically associated with power stations or solar power plants.
- Abstraction for cooling purposes will be from the coastal waters with an abundant supply being available in the Port. Fresh water resource allocation, protection of the reserve as well as concerns related to water scarcity, usually associated with land-based power stations, will therefore not be a concern.
- Waste management impacts to the marine environment from black and grey water can be avoided in accordance with the MARPOL requirements. All effluent and solid waste will be removed from the ships and treated and disposed of in terms of the applicable legislation by authorised service providers.

The concept of generating power on the ocean has several benefits over land-based power plants, including a small footprint (e.g. the same amount of output can be achieved in a much smaller area compared to land based power plants), significantly shorter timeframes for project delivery / adding capacity, as the Powerships arrive already assembled and ready-to-operate, and land-based impacts are limited and of short term, associated with the establishment of the transmission line and the temporary assembly area for the gas pipeline.

More detail of each of these environmental factors is provided elsewhere in the draft EIA Report, namely the project scope alternatives (Section 3), baseline environment section (Section 4) as well as impact and risk assessment (Section 8).

These impacts also need to be considered together with the socio-economic-context i.e. the need to improve the economy and job creation, sustaining businesses and industry within a constrained energy sector and ensuring energy provision for a growing population where many are still disadvantaged and have to making a living without energy. The proposed project is likely to have a significant socio-economically benefit locally, provincially and nationally based on the proposed capacity to be generated and supplied to the grid network. Potential negative impacts on the socio-economic conditions also have to be considered such as air pollution and impacts on health and contribution to climate change; impacts on other economic activities and livelihoods and the safety risk due to the presence of a major hazardous installation. These issues, positive and negative are expanded in the sections that follow.

Climate Change

Natural gas is an efficient and relatively widely available alternative to other fossil fuels and produces roughly half of the amount of CO_2 per unit energy as coal. This scenario makes natural gas attractive as a potential 'bridge' or transitional fuel in the global shift toward renewable energy. South Africa's Integrated Resource Plan (IRP) lists gas-to-power technology as having the ability to provide flexible baseload capacity to complement the inherently intermittent sources of renewable energy. The IRP indicates that 11930 MW of energy will be sourced from gas/diesel by 2030, with the indication that no new diesel-based capacity will be installed, which means that ~8000MW of energy will be supplied by gas-to-power technology by 2030. In this context, the Richards Bay Powerships (540MW) will make a positive contribution of ~20% to the 2030 ambition of 8000MW of gas-derived electricity when considered cumulatively with the proposed Powerships at the ports of Saldanha Bay (415MW) and Ngqura (540MW).

Several potentially significant climate change-related impacts have been identified that require mitigation to lower significance to acceptable levels. The impacts of primary concern relate to: i) the increased frequency, duration and intensity of extreme climatic events in the medium- to long-term which carry the risk of damage to vessels, infrastructure and equipment associated with the Powerships; ii) potentially significant GHG emissions from the entire Powership logistics and value chain, as opposed to the relatively low significance of local emissions at Richards Bay; and iii) elevated fire risk due to an observed drying trend and the possibility of damage to linear electrical infrastructure from severe storms. Please refer to Section 8 for assessment of these impacts and the mitigations offered to avoid or reduce these impacts.

Socio-economic

The importance of energy for socio-economic benefit is well documented as early as 2012. The Draft 2012 Integrated Energy Planning Report: Executive Summary (IEPR) stated that "energy access is now widely recognised as a prerequisite for human development". The Draft 2012 Integrated Energy Planning Report: Executive Summary (IEPR) states that "energy access is now widely recognised as a prerequisite for human development". The access to electricity is outlined within the Municipal Services Act 32 of 2000, giving priority to the provision of basic needs to the local community that is "conducive to the prudent, economic, efficient and effective use of available resources". NEMA supports this through the principle of "equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination", as would be the case for facilities and citizens unable to afford the more expensive countermeasures to stable electricity supply throughout load shedding.

According to the National Development Plan (NDP) (2030), Government is committed to ensure economic growth and development through adequate provision of sustained energy services that are competitively priced, reliable and efficient. This must be ensured to promote sustainable development and to ensure that the living standard of South African citizens is maintained and improved.

South Africa has experienced a progressively worsening energy crisis from 2007 that has resulted in numerous load shedding events including Level 6 load shedding. Eskom, which provides over 90% of power generating capacity in South Africa (Donnelly, 2018; Mthethwa, 2019; Gosling, 2019; Cohen & Vecchiatto, 2019), has been unable to meet the demands of both the private and public sector. The load shedding measures which were implemented to prevent a total blackout has had dire effects on the South African Economy according to Goldberg, 2015 and Makinana, 2019. Load shedding reduced the South African GDP by roughly 0.30% in 2019, which translates to 8.5 billion of real, inflation-adjusted Rand (Writer, 2019).

Government interventions of introducing additional power stations, generators and even tariff increases have proved to be inefficient in terms of addressing the country's electricity shortages. The Integrated Resource Plan (IRP) 2019 stressed a short-term gap in supply to be anticipated between 2019 and 2022 due to the time expected for the new power stations (Medupi and Kusile) and the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to come online. This may further be delayed by the poor design and planning of the Medupi and Kusile plants and the delayed correction thereof (Hosken, 2020). The IRP specified the need for new energy efficient technology and the diversification of both the supply and nature of energy production to reduce pollution and minimise impacts related to climate change.

The CSIR (*Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020*) further predicts that load shedding can be expected for the next 2 – 3 years and that an urgent response is required to ensure reliable short-term energy supply.

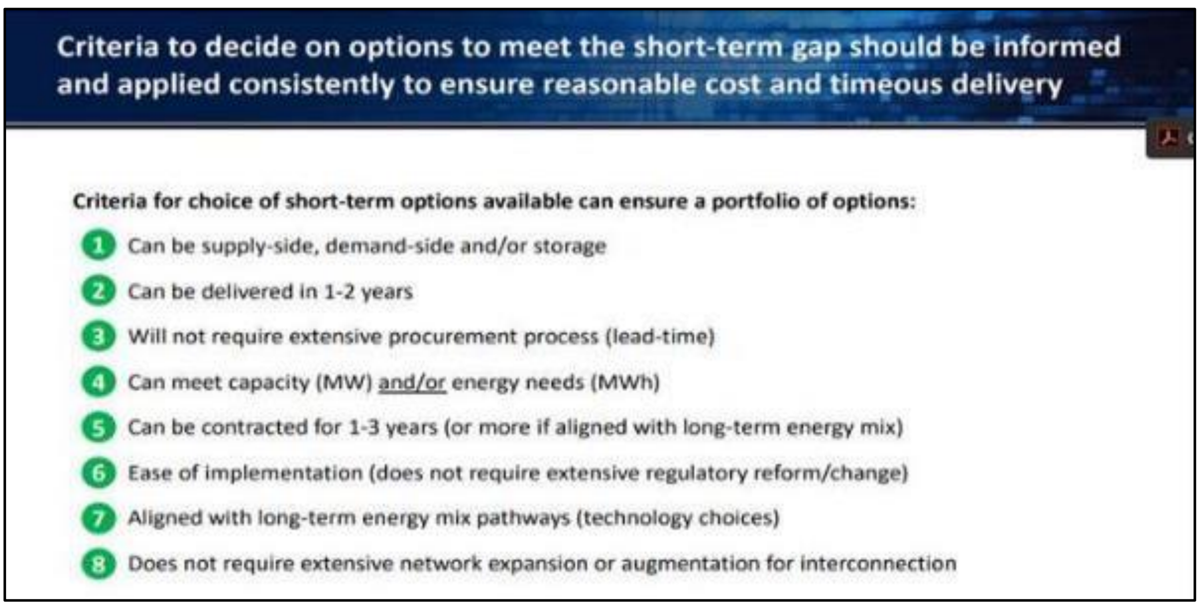


Figure 6-2: Extract from the CSIR Report (Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020).

The Minister of Mineral Resources and Energy published regulations to help address South Africa's ongoing power issues (Staff Writer, 2020 (b)). In addition, the National Development Plan (2030) outlined the need to move the electricity system from Eskom to an independent system and for accelerated procurement of independent power producers on a wide range of alternatives, moving away from the unsustainable use of coal as fuel resource.

The proposed Project, is aligned with National Government initiatives e.g. the "RFI Response Risk Mitigation Power Procurement Programme" and Request for Proposal (RFP) which aims to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The RFP stipulated stringent environmental, social and economic criteria inclusive of e.g.:

- the shift from coal and LPG to NG as a cleaner and more cost effective resource;
- BBBEE criteria;
- Skills development.

Karpowership, in submitting applications in terms of the IPP initiatives will comply with sustainable development criteria as these applications are compiled with input from various Government Departments that need to ensure compliance with the Constitution and NEMA principles and meet the country's international obligations.

According to Karpowership, projects will meet and exceed Economic Development qualification criteria stipulated within the RMIPPPP RFP. Karpowership will engage with local businesses and award contracts to local service providers for maintenance aspects as well as waste management, food and other daily consumables. They take pride in their positive impact on local communities through both social responsibility programs, tailored to the specific needs of the community, and the career opportunities that are provided.

Karpowership projects create significant direct and indirect employment, driving knowledge and skills transfer across a broad spectrum of disciplines including some that are unique to floating power plants. Karpowership also emphasizes youth development as the future of our business, industry, and the local economy. As a globally recognized leader with 1,800+ direct employees, they provide an opportunity for South Africans, which will make up the majority of their personnel, to develop specific skills and knowhow which will ultimately benefit the South African economy. They will also be provided with the opportunity to become part of an internationally diverse team, gaining and sharing experience and knowledge either locally or worldwide alongside industry leading colleagues.

There will be a significant number of local employees for both the construction and operation period which will exceed the Economic Development criteria that must be reached under the terms of the RMIPPPP. They also believe that the job creation, including within the power generation function, will be comparatively more than a renewable energy project should the project be selected to proceed.

The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R849.7 million of new business sales, R242.9 million of GDP and 1 001 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings by R115.9 million. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

The operation of the proposed Powerships and their associated infrastructure will generate R528.1 million of new business sales, contribute R320.7 million to GDP and create 288 sustainable FTE employment positions. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities.

The assessment of the Powerships and their associated infrastructure, or its net effect from a socio-economic perspective, indicates that the development would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of their establishment.

NEW GENERATION CAPACITIY AND RISK MITIGATION IPP PROCUREMENT PROGRAMME

The Department of Mineral Resources and Energy (DMRE) issued the Request for Proposals (RFP) to procure new energy generation capacity as per Government Notice 753 (7 July 2020): Determination Under Section 34(1) of the Electricity Regulation Act, 2006 (Act No. 4 of 2006) wherein the Minister, in consultation with the National Energy Regulator of South Africa (NERSA) has determined "that new generation capacity is needed to be procured to contribute towards energy security" and "the electricity must be purchased from independent power producers".

The Risk Mitigation Independent Power Producer (IPP) Procurement Programme has been identified by the DMRE as the appropriate programme to procure the new generation capacity designated in the above Determination. As such, a call for proposals to IPPs was published by DMRE "to ensure the establishment of this new generation capacity through the Risk Mitigation IPP Procurement Programme:

- The Risk Mitigation IPP Procurement Programme has been designed to procure the target of 2000 MWs of new generation capacity to be derived from different types of dispatchable power generation projects that will enter into public-private agreements with Eskom to provide new generation capacity in compliance with the Performance Requirements, among other things.
- The dispatchable power generation projects may utilise fuel to produce the energy output and may be comprised of more than one facility and project Site.
- Furthermore, the selected projects will contribute towards socio-economic development and sustainable economic growth, while enabling and stimulating the participation of independent power producers in the electricity supply industry in South Africa."

The updated Integrated Resource Plan (IRP) 2019 was developed as a "co-ordinated schedule for generation expansion and demand-side intervention programmes, taking into consideration multiple criteria to meet electricity demand". The IRP is a plan for infrastructure development based on a least supply and demand balance approach, taking into account security of supply and minimising negative emissions and water usage impacts on the environment. It has been developed within a context characterised by changes in energy technologies and their associated uncertainty of the impact on the future energy provision system. With this uncertainty expected to continue, a cautionary approach must be adopted when making assumptions and committing for the future in this rapidly changing environment. As such, long-term commitments are to be avoided as much as possible, to eliminate the risk that they might prove costly and ill-advised (IRP, 2019).

The decommissioning of the existing coal fleet (due to end of design life) can provide space for a relatively different energy mix. It must be noted that, in the period preceding 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity (IRP, 2019). This is essentially what a system like the Karpowership fleet can provide, ship-based power generating and transmission of energy to land-based transmission connection points. This capacity can be modularly up-scaled on site with a very short lead time to meet additional requirements, should these be required at a later stage.

Also of particular importance is securing energy security by developing adequate electricity generation capacity to meet our demand under both the low-growth economic environment as well once the economy improves to the level of 4% growth per annum. Electricity generation capacity must therefore be paced to restore the necessary reserve margin and to be ahead of the economic growth curve at least possible cost (IRP, 2019).

One concern and risk raised during the August 2018 public participation process undertaken for the IRP 2019 update, was related to the capacity provided for and practicality of gas to power and the risks it poses since South Africa does not currently have adequate gas infrastructure. The Karpowership generation process proposes the use of internationally sourced LNG gas supply that will be transported via a LNG carrier to the proposed FSRU location. A gas line will be established between the FSRU and Powerships to provide a secured supply of natural gas. No gas supply is required from local South Africa resources to ensure efficient operations and all other infrastructure will be supplied.

ESKOM POWER RELIABILITY AND GOVERNMENT'S RESPONSE TO THE ENERGY DEMAND

Eskom's existing generation plant Energy Availability Factor (EAF) was assumed to be averaging 86% in the promulgated IRP 2010–2030. The actual EAF at the time (2010) was averaging 85%. Since then, Eskom's EAF declined steadily to a low average of 71% in the 2015/16 financial year before recovering to average around 77% in the 2016/17 financial year. Information as at January 2018 indicated that EAF had regressed further to levels below 70%. This low EAF was the reason for constrained capacity early in December 2018 and January 2019 that resulted in load shedding (IRP, 2019).

Additionally, the IRP (2019) states that there are a number of Eskom coal plants that will reach end of design life from year 2019 and that most of the Eskom plants were designed and constructed for operation for 50 years. Eskom had also submitted a revised plant end of design life (decommissioning) plan. This submission brings forward the shutdown of some units at Grootvlei, Komati and Hendrina. The IRP (2019) showed that approximately 5 400 MW of electricity from coal generation by Eskom will be decommissioned by year 2022, increasing to 10 500 MW by 2030 and 35 000 MW by 2050. The socio-economic impact of the decommissioning of these Eskom plants were not quantified or included in the IRP.

A number of Eskom power plants (Majuba, Tutuka, Duvha, Matla, Kriel and Grootvlei) have been retrofitted with emission abatement technology to ensure compliance with the law (IRP, 2019). In 2014 Eskom applied for postponement of the date for compliance and permission in this regard was granted for a period not exceeding 5 years. According to the IRP (2019), Grootvlei was the only station that has been brought to compliance and failure to undertake abatement retrofits is likely to result in non-compliant plants. It is understood that Eskom has applied to postpone compliance with the minimum emissions standards for air pollution with multiple additional postponement applications for the majority of its powerstations during 2020. Eskom has stated that it will apply for rolling postponement rather than trying to meet the sulphur dioxide standards. Should these not be issued, Eskom maybe required to expedite plans to decommission old polluting stations that cannot meet the MES with potential dire consequences for secured energy supply.

Simulations used to update the IRP (2019) show that there is an immediate risk of energy shortage in the immediate term. Eskom's early shutdown of non-performing units (Grootvlei, Komati and Hendrina), coupled with the non-compliance status of some plants and the de-rating of Medupi and Kusile to below name-plate rating result in an immediate risk of huge power shortages. The recently experienced load shedding as well frequent alerts of possible shortages corroborate the observations from the power system simulations.

Industrialisation of South Africa has led to increased demand for electricity by an ever-growing population from a strained power service operated by, Eskom. This has led to a number of power shortfalls throughout the country, as supply cannot meet demand. The power shortfalls and the unreliable electricity generation has had major impact on the South African economy (Goldberg, 2015; Makinana, 2019). Furthermore, certain temporary and permanent shut downs of power plants across the country have come with serious impacts to energy supply. These shutdowns directly impact the energy supply to the host community thus directly impact the local economy. This has generated the need for a diversified/ innovative power supply. This is based on national policy and informed by ongoing planning undertaken by the Department of Energy (DoE) and the National Energy Regulator of South Africa.

The National Development Plan 2030 has outlined access to electricity as one of the "Elements of a Decent Standard of Living". South Africa has faced significant electricity shortages over a number of years and the escalating electricity crises experienced since 2007 has significantly impacted the standard of living of its citizens and resulted in ruinous economic losses.

In order to achieve sustainable and inclusive growth by 2030, South Africa needs to invest in a strong network of economic infrastructure to support the country's medium- and long-term objectives according to the National Development Plan (NDP) 2030.

The vision of the NDP includes the promotion of economic growth and development though adequate provision of quality energy services that are competitively priced, reliable and efficient. Addressing access to energy will promote sustainable development, encourage economic competition and ensure that living standards are maintained and improved. According to the Integrated Resource Plan 2019, the Minister of Energy determined that 39,730 MW of new generation capacity must be developed. Currently 18,000 MW of the required 39,730 MW has been committed to as follows:

- 6,422 MW new capacity under the REIPPP with a total of 3,876 MW operational on the grid;
- 4,514 MW Eskom build with remaining planned build of 6,418 MW;
- 100 MW of Sere Wind Farm; and
- 1,005 MW from OCGT for peaking.

A key component of the 20-year master-plan is the requirement for new energy generating capacity from a range of technologies like renewables and natural gas. Alternative sources of power generation allow countries to move away from open cycle gas turbines (OCGTs) (South Africa's- Eskom situation), and use of expensive diesel to generate electricity during peak demand (Siyobi, 2015).

The use of natural gas from LNG in power generation provides a cleaner alternative to coal and other fossil fuels, reducing carbon and other emissions such as SO_2 and PM_{10}, resulting in both immediate and long-term benefits for public health and the environment. LNG shipments allow the environmental benefits of natural gas to be spread around the world and can help reduce global greenhouse gas emissions according to a report by PACE Global LNG and Coal Life Cycle Assessment of Greenhouse Gas Emissions. The ability to burn natural gas for power generation is an ideal complement to renewable energy generation, like wind and solar power, which can be intermittent and inconsistent in their output. Natural gas power plants can be quickly turned on and off or ramped up and down to help provide consistent electricity production when solar or wind resources fluctuate.

As part of his 2020 State of the Nation Address on 13 February 2020, the President announced that government would implement measures to “rapidly and significantly increase generation capacity outside of Eskom”. Established measures include the Section 34 Ministerial Determination that supports the Integrated Resource Plan 2019, which facilitates additional energy generation to the national grid through renewable energy, natural gas, hydro power, battery storage and coal.

The Emergency/Risk Mitigation Power Purchase Procurement Program (2000 MW) (ERMPPPP) has been declared a Strategic Integrated Project (SIP) under the Infrastructure Development Act, 2014 under SIP 20. One of the objects of this Act is “the identification and implementation of strategic integrated projects which are of significant economic or social importance to the Republic or a region in the Republic or which facilitate regional economic integration on the African continent, thereby giving effect to the national infrastructure plan”.

South Africa’s electricity generation capacity shortfall can only be solved by additional generating capacity. Although additional power stations are under construction, there is a lengthy gap of time between the present shortage and the commissioning of all units of these new power stations. In the meantime, the economy suffers from the reduction of productivity and increased costs resulting from power interruptions caused by equipment failure (so-called unplanned maintenance) and load shedding.

Access to cost-effective temporary base-load generation of a significant magnitude will help to solve the problem by supplying the power to meet the load which is often being shed or reduced at present. Reliable power generation facilities are required to address both the immediate power shortfalls, as well as the longer term increasing demand for electricity. Powerships can deliver electricity in a very short timeframes as the normal delays associated with land-based power plants construction are negated as these powerships have been purpose built prior to deployment.

ECONOMIC RECOVERY AND ENERGY REQUIREMENTS

As per the President’s speech at the 2021 State of the Nation Address on 11 February 2021, in December 2020, government and its social partners signed the historic Eskom Social Compact, which outlines the necessary actions to be taken collectively and as individual constituencies, to meet the country’s energy needs now and into the future. Government have taken action to urgently and substantially increase generation capacity in addition to what Eskom generates. The following actions were highlighted as per the President’s address:

“- The Department of Mineral Resources and Energy will soon be announcing the successful bids for 2,000 megawatts of emergency power.

Government will soon be initiating the procurement of an additional 11,800 megawatts of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019.

Despite this work, Eskom estimates that, without additional capacity, there will be an electricity supply shortfall of between 4,000 and 6,000 megawatts over the next 5 years, as old coal-fired power stations reach their end of life."

Sustainable energy provision is also key to ensuring economic recovery. The CSIR reported that in 2019 load shedding reduced the South African economy by between R 60 billion to R 120 billion (Wright and Callitz, 2020). There are estimations that the overall economic loss to the South African economy over the last 10 years is as high as R 338 billion. Energy analysts have determined that every hour of every stage of load shedding costs the economy R 50 million to R 100 million (Hosken, 2020). Energy analysts predict that load-shedding will have a greater detrimental impact to South Africa's failing economy and may drive many businesses into bankruptcy and reduce investment into the country (Hosken, 2020).

IMPORTANCE OF NATIONAL & PROVINCIAL COLLABORATION AND PRIVATE PARTNERSHIPS

The planned economic recovery for the Country will be impossible in the absence of a reliable and adequate power supply to the economic sectors. Therefore, the success of one province impacts on the success of other provinces. The establishment of reliable power in one province has a domino effect on other provinces.

PORT PLANNING

Transnet have been actively involved over an extended period of time with the identification of gas to energy options to be established within the Ports e.g. "Transnet preparations for gas infrastructure in South Africa" as part of the South Africa Gas Options Conference held on September 2015 in Cape Town.

Based on the National Ports Plan, 2019, in terms of the strategic development plan, the Port of Richards Bay aspires 'to be a premier dry bulk and liquid bulk port with diversification in other segments'. It desires to be a growing, effective, economic, efficient and integrated port. It intends to grow the business by investing in infrastructure and improving terminal and supply chain efficiencies.

Furthermore, the signing of the MOU between uMhlathuze Municipality, Richards Bay Industrial Development Zone (RBIDZ) and Transnet National Ports Authority (TNPA) has ensured that the port is positioned to be a natural location for bulk handling capabilities. With the two phases of RBIDZ that are juxtaposed with first class industry while the deep-water Port of Richards Bay provides substantial volume for beneficiation opportunities for investments. In line with this vision, strategic projects in the port include the expansion of the port and upgrading of roads and services. Berth upgrades are also planned to ensure that sufficient berth capacity exists at all times.

The current layout of the port (published in 2019) is shown in figure 6.3 below. It is noted that the proposed position of the first towers for the transmission line, (positioned on the main land, adjacent to the moored Powerships and the large mangrove stand) are situated within area marked as "other", and out of the delineated open space.

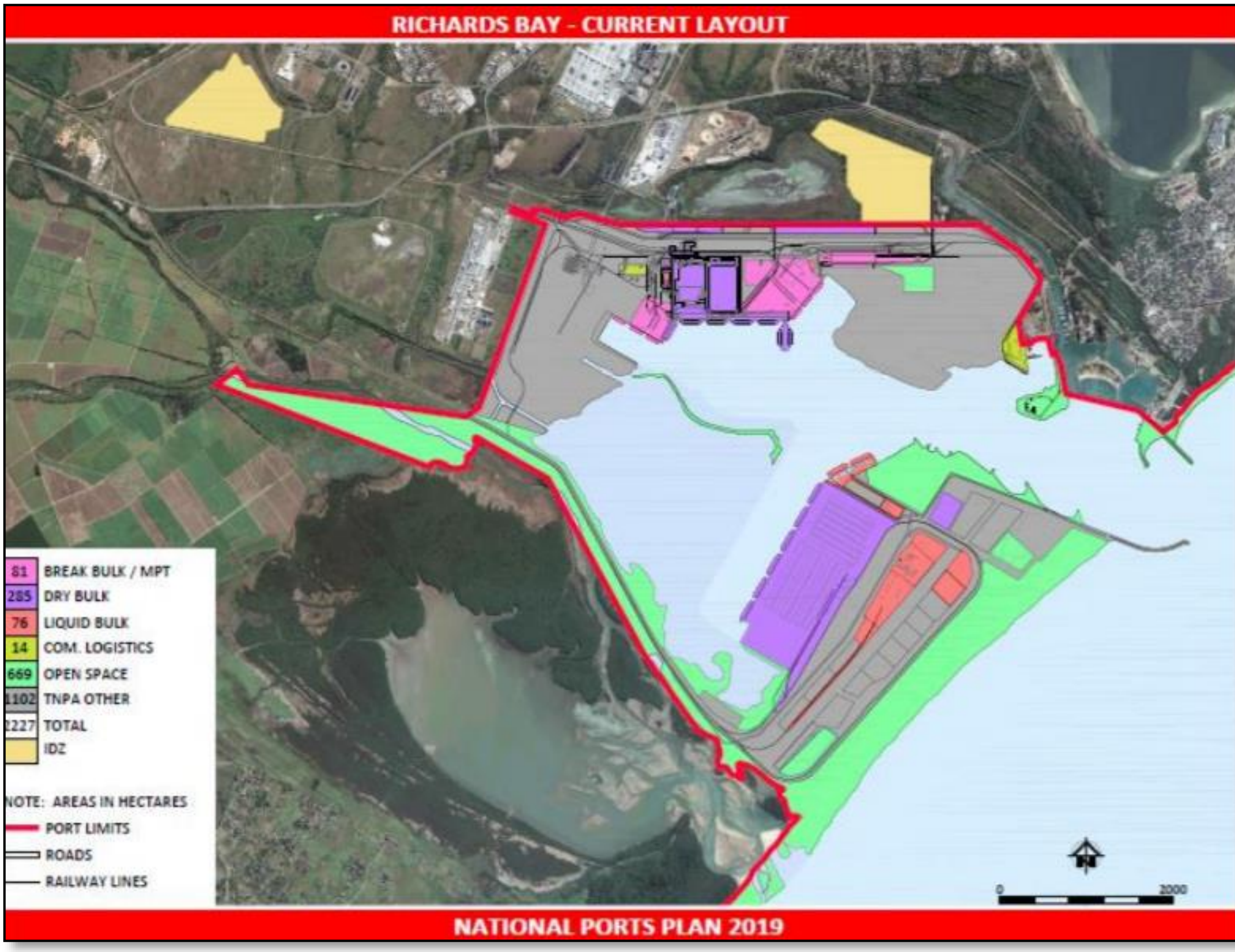


Figure 6-3: The 2019 layout for the Port of Richards Bay.

Further layout plans for short, medium and long terms (for the years 2028 and 2048) indicate further planned expansions and disturbance to the West of the port, as shown in figures 6-4, 6-5 and 6-6 below.

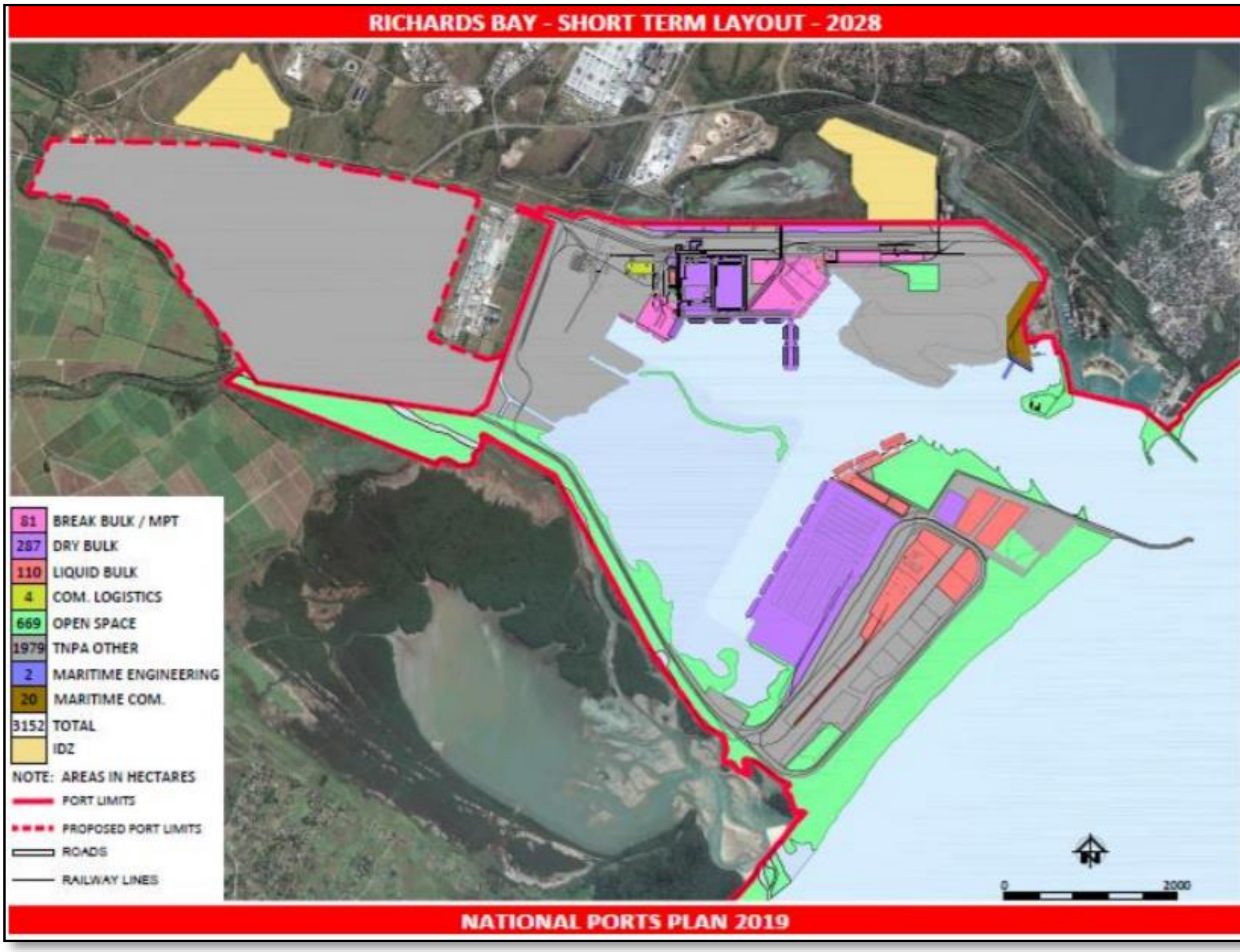


Figure 6-4: Richards Bay Port – Short term layout (2028).

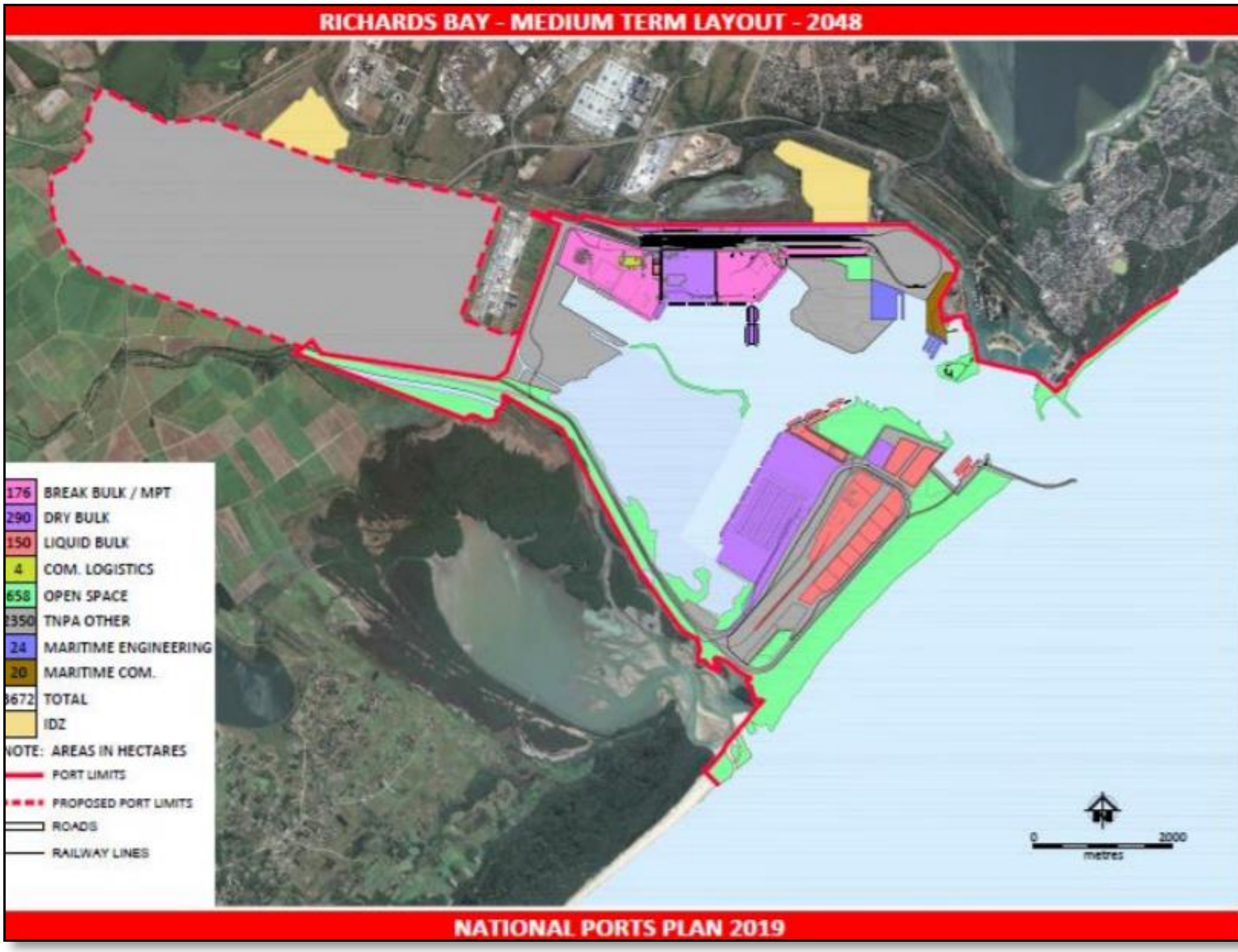


Figure 6-5: Richards Bay Port – Medium term layout (2048).

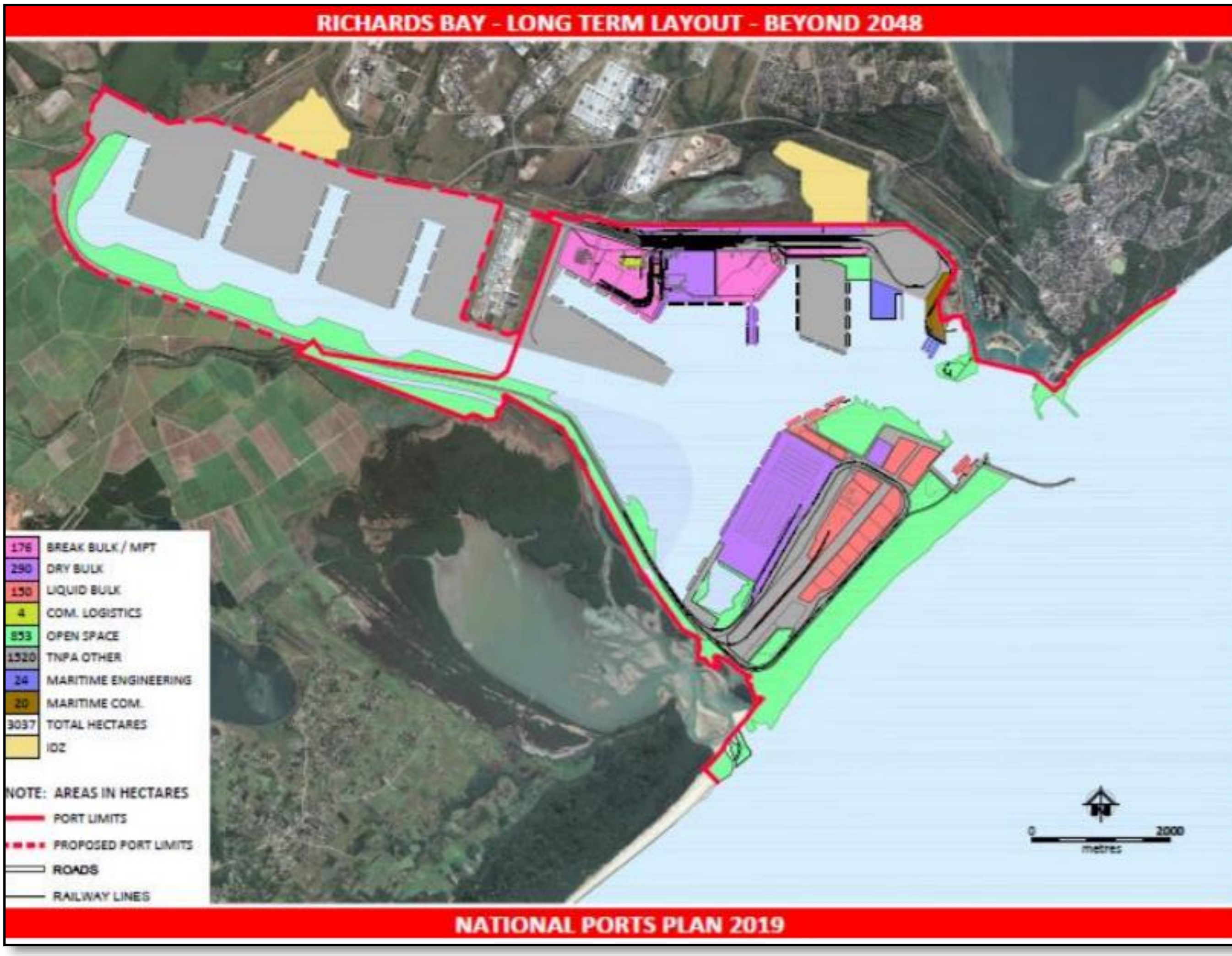


Figure 6-6: Richards Bay Port – Long term layout (Beyond 2048).

Based on the strategic plans for the Port of Richards Bay, the proposed development is situated within an area that is planned for development, and out of the demarcated open space area. In addition, the proposed purpose of the gas to power project can positively contribute in providing reliable electricity to the current and planned expansion activities within the port.

The project proposal, having been assessed by PRDW in relation to the proposed Port Plans, is reported to be aligned with the Transnet studies and plans.

CONSERVATION PLANNING

The study area falls within a critical biodiversity area (CBA), listed as irreplaceable, which encompasses all areas that are currently in a natural or near natural state. Further, the site is located within an Estuarine Functional Zone (refer to section 4 of this report). Whilst the sensitivity and significance of estuarine areas are recognised, given the highly transformed state of the estuarine complex, and the operation of the Richards Bay Estuary as an industrial port, the restoration of the estuary to its natural/pristine state is deemed both impractical and unattainable (as per Coastal and Estuarine Specialist Report, February 2021 – Appendix I). Furthermore, the neighbouring uMhlathuze estuary was declared protected area and excluded from future development. The Richards Bay estuary, on the contrary, is embarked for further development in the port expansion plans, and the proposed development site is situated within the planned expansion area, and not within the open space area (Refer to Port planning section above).

The socio-economic specialist anticipates that there would be no impact on the recreational fishing and small crafts community as the proposed Powership and FSRU are to be semi-permanently moored for 20 years in the same location in the protected waters deep within the Port of Richards Bay. The mooring site is more than 3 kilometres from the Tourism Precinct area. The vessels will be positioned in unused areas of the Port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time. The recreational activities are all positioned towards the Port entrance and will be unaffected by the Powerships. Given the mooring position of the Powerships and FSRU it is unlikely that the tourism agenda of Richards Bay will be affected. Furthermore, all current recreational and tourist activities are already in an area utilised by operating ships and as such it is unlikely that the Powerships will have a significant lasting impact on these activities.

The development of an Estuarine Management Plan for the uMhlathuze/ Richards Bay estuaries was initiated in early 2017 and, following the gazetting of the final draft EMP (DEA, 2018a) in November 2019 (GN 1395), was approved in July 2020.

Indicated in the spatial zonation in the abovementioned EMP are the marine aquaculture activities, the initial proposed LNG terminal and the proposed port expansion relative to the existing port limits. In respect to nearby mariculture activities, an area of 7 ha in the Port of Richards Bay on the northern edge of the sand spit has been leased out for a commercial marine sea finfish farm, using Dusky Kob. This is a collaborative undertaking between the various institutions as part of Operation Phakisa (DEA, 2018a). The initial proposed LNG terminal was to be located adjacent to the eChwebeni Natural Heritage Site. In terms of the port expansion, the indicated Gas to Power project location, as well as critical estuarine habitat (mangroves, mudflats/sandflats, Bhizolo/Manzamnyama Canal Complex, etc.) are included in, and will be directly affected by, the expansion plan (DEA, 2018a).

The potential conflict of use, i.e. the overlap between the project area and the mariculture activities needs to be investigated by the port and an agreement reached in terms of location of the Gas to Project and/or mariculture activities. While critical estuarine habitat will undoubtedly be dramatically modified by the expansion, it is important however, that the ecological integrity of these habitats should be protected until the proposed large-scale changes of the expansion come into effect.

MUNICIPAL PLANNING

Furthermore, in line with the planned expansions on the Port (as per the National Ports Plan, 2019), the port expansion is also captured in the uMhlathuze Local Municipality: Spatial Development Framework (SDF) (Draft Review, dated March 2020), as per extracted map below, figure 6-7:

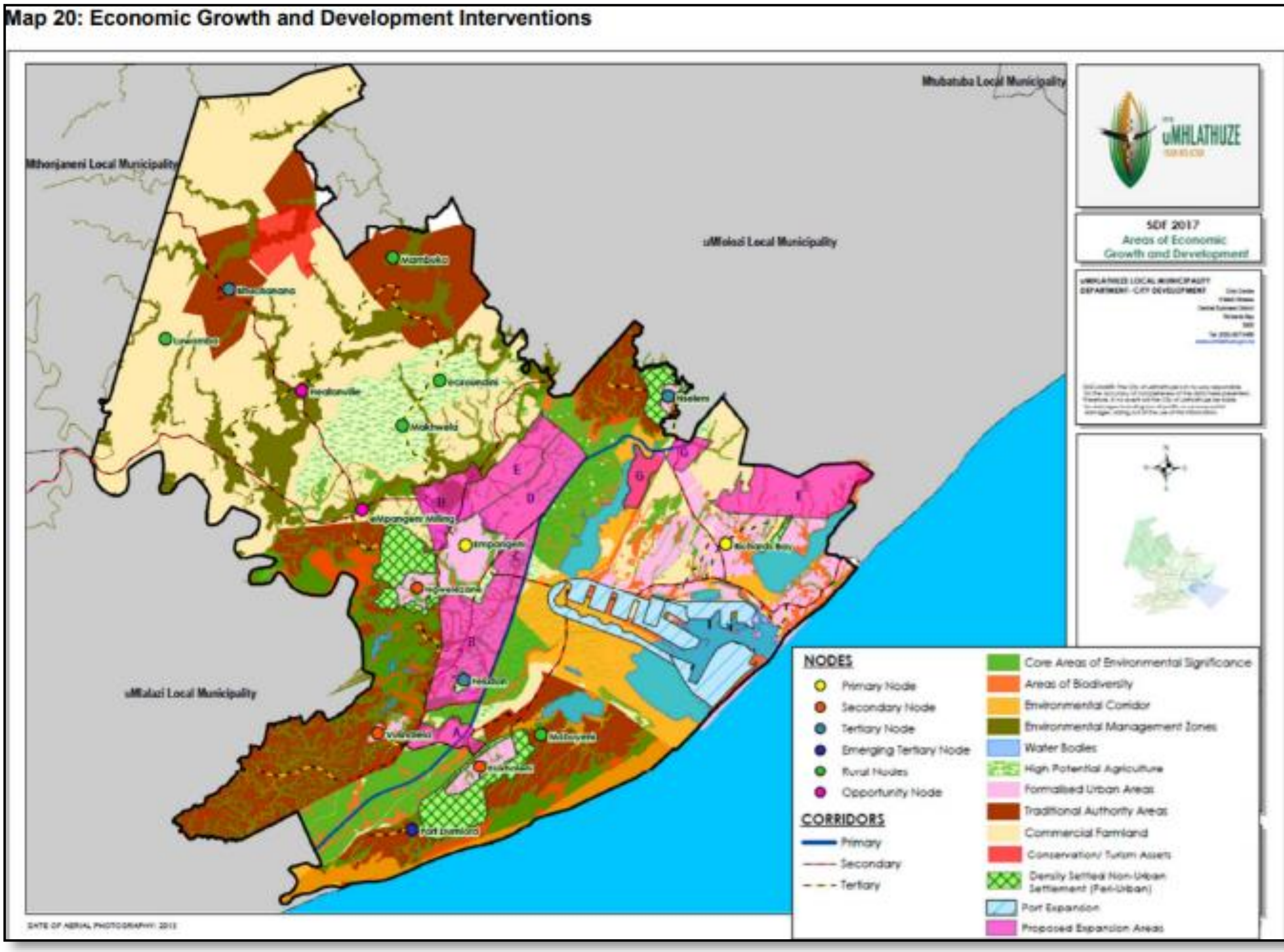


Figure 6-7: Economic Growth and Development Interventions (uMhlathuze Local Municipality SDF – Draft Review, March 2020).

According to the uMhlathuze 2019 Land Use Scheme Viewer (uMhlathuze website, online GIS tools), the study area is situated within an area zoned as Harbour (refer to figure 6-8 below). The uMhlathuze 2019 Land Use Regulations stipulates the permitted uses within Harbour land use; these permitted uses include the following:

- Industry – General
- Industry – Light
- Industry – Service
- Utilities Facility

The above uses are in line with the intent of the Harbour land use, including – land for administrative purposes, customs, *industrial uses*, and areas for bulk storage, terminals, custom posts, limited commercial activity, social, health and recreational activities.

The proposed development of infrastructure for the provision of electricity is in line with the permitted uses within the Harbour land use.

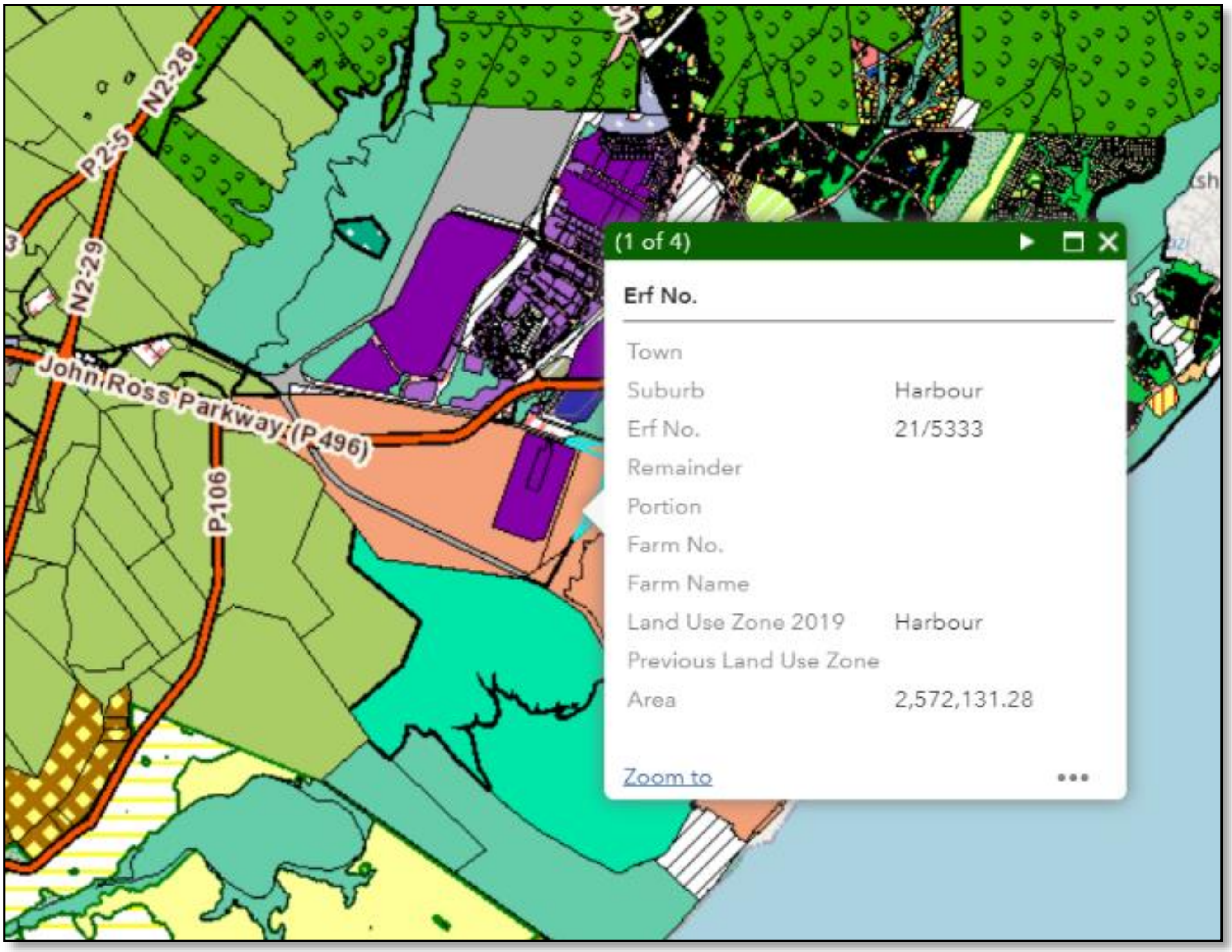


Figure 6-8: uMhlathuze 2019 Land Use Scheme Viewer – Development site zoned as Harbour.

With regards to the Municipality's Air Quality Management Plan, the emissions of ambient pollutants and GHG are relatively low so won't impact on ambient air quality (and therefore health) and won't contribute significantly to climate change. In terms of cumulative impacts, the annual average ambient concentrations of PM_{10} and SO_2 at the Richards Bay Clean Air Association (RBCAA) monitoring stations were used as background concentrations to gauge the potential cumulative effect of the Karpowership Project emissions in the Richards Bay area. The severity of the cumulative impact associated with SO_2 is predicted to be insignificant. The severity of the cumulative impact associated with NO_2 is predicted to be small. The severity of the cumulative impact associated with PM_{10} is predicted to be small.

6.2 THE ACTIVITY IN THE CONTEXT OF THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

Location and Land Use Suitability

Being a ship-based power generating operation (as opposed to land-based) with transmission of energy to land-based transmission connection points, the location within the Port of Richards Bay, which is adjacent to the Richards Bay IDZ, is suited for the importation of LNG as fuel source, the generation of power and the evacuation through the transmission line to the Eskom line connection through the newly established switching station and to the national grid.

Port Traffic, Navigational Requirements and Extent of Marine Based Infrastructure

The Port provide adequate footprint for the mooring of the Powerships and the FSRU and provides adequate clearance for the delivery of LNG via LNG Carriers.

The Powership and the cooling water discharge will occur within the operational Port, which is also planned to be further expanded, and outside of the delineated open space areas, as per the port layout, extract from the National Port Plan, 2019, as per figures 6-3 and 6-4.

The gas pipeline to transfer natural gas from the FSRU to the Powerships can be accommodated within the operational area of the port and positioned further away from the sensitive sand bank (a 200m offset from the water line to the moored vessels maintained), thus minimising potential marine impacts.

Environmental Sensitivities

Numerous independent specialist studies were conducted to assess the potential impact on the environmental and socio-economic aspects related to the proposed gas to Powership project. No fatal flaws were identified during the Specialist assessments and EIA process.

7 PUBLIC PARTICIPATION PROCESS

2014 EIA Regulations (as amended), Appendix 3: 3(1) (h) (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.

7.1 PRE-APPLICATION CONSULTATION

A virtual pre-application meeting was held with DEFF on the 17th September 2020 via Microsoft Teams, and the minutes are attached as Appendix H1. A public participation plan was subsequently approved by DEFF according to which the public participation process is being conducted. Other points discussed in the meeting and addressed in the report include assessing the compatibility of the proposed project with Port's planning, assessing cumulative impacts, the assessment of the decommissioning phase and the involvement of the DEFF Air Quality Branch.

7.2 REGISTERED INTERESTED AND AFFECTED PARTIES

A proponent or applicant must ensure the opening and maintenance of a register of interested and affected parties and submit such a register to the competent authority, which register must contain the names, contact details and addresses of—

- *(a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;*
- *(b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and*
- *(c) all organs of state which have jurisdiction in respect of the activity to which the application relates.*

An I&AP register was opened at the beginning of the scoping phase, and a copy of it up to the end of Scoping, is included in Appendix D7. Contact details of private persons have been omitted in interests of privacy. The register will continue to be updated on an ongoing basis during the rest of the EIA process. A complete version of the I&AP register will be submitted with the final EIA Report to DEFF.

7.3 LANDOWNER NOTIFICATION

The properties that are directly affected by the proposed development are listed in **Table 2-6**. All properties are owned by Transnet Limited. The details of the affected landowners are included in the I&AP database.

According to regulation 39(1) of GN No. R. 982 of 4 December 2014 (as amended), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads) or if it is a SIP as contemplated in the Infrastructure Development Act, 2014.

7.4 NOTIFICATION OF INTERESTED AND AFFECTED PARTIES

7.4.1 Site Notification

(a) fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of—

(i) the site where the activity to which the application or proposed application relates is or is to be undertaken; and

(ii) any alternative site;

<u>Site notices</u>

Site notices, in two languages (English and isiZulu), were erected at three (3) locations within the site:

Location 1: At the Richards Bay port's permit office (near the entrance to the port)

Location 2: By the access road, leading to the entrance to the South32 Aluminium SA site.

Location 3: Near the fenced boundary of South32 Aluminium SA site

Refer to Appendix D4 for photographic evidence of the site notices erected.

(b) giving written notice, in any of the manners provided for in section 47D of the Act, to—

(i) the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;

(ii) owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;

(iii) the municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area;

(iv) the municipality which has jurisdiction in the area;

(v) any organ of state having jurisdiction in respect of any aspect of the activity; and

(vi) any other party as required by the competent authority;

(i) owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;

A Background Information Document (BID) and Notice of Application (NOA) was emailed in two languages (English and IsiZulu) to identified Stakeholders and I&APs on 21st September 2020, including landowners, the municipal ward councillor, Ratepayers Association, and including the following organs of state: Department of Energy, Eskom, Water and Sanitation, Department of Environment, Forestry, and Fisheries, Ezemvelo KZN Wildlife, Amafa KZN, South Africa Maritime Safety Authority, KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA): King Cetshwayo, KZN Department of Economic Development, Tourism and Environmental Affairs: Coastal Management, Provincial Department of Transport, DEFF Oceans & Coast Branch; Air Quality & Climate Change Branch, Richards Bay Industrial Development Zone(RB IDZ), South African Heritage Resource Agency (SAHRA), South Africa Gas Development Corporation (SOC) Ltd, National Energy Regulator of South Africa (NERSA), and the South African National Roads Agency (SANRAL); City of Umhlatuze Municipality Air Quality, City of uMhlathuze Municipality: Environmental Planning, City of uMhlathuze Municipality: Municipal Manager, King Cetshwayo District Municipality (Air Quality), King Cetshwayo District Municipality

Refer to Appendices D3, D4 & D8 – Proof of Notification and copies of BID and NOA.

7.4.2 Advertisements

(c) placing an advertisement in—

(i) one local newspaper; or

(ii) any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and

Advertisements were placed in 2 languages (English and isiZulu) in 2 local newspapers, namely the Zululand Observer and the Bay Watch, published on the 21st September 2020 and the 22nd September 2020 respectively.
Refer to Appendix D6 – Proof of Placement of Advert.

<u>Ongoing and other communication methods</u>

Information flyers, containing the notification of the EIA process and the PPP, were placed on the 21th September 2020 at Seafarers Mission, located near the entrance to the port. Additional information flyers were also placed at Bayside Alusaf Aluminium entrance – on their front desk and at the turnstiles (designated place for flyers),

Refer to Appendices D3 and D4 for copies of the information flyers and photographic evidence of the placement information flyers (no pictures were allowed to be taken at the Bayside Alusaf facility).

During Scoping, the BID (including registration and comments forms) wase made available to I&APs on request. While I&APs were encouraged to submit comments and queries in writing, they were also invited to contact the EAP consultants telephonically if they so wished. These contact details appeared in the advertisements, onsite notices, BID, NOA and flyers.

<u>Additional Media Sources:</u>

Since commencement of the public participation process on the 21st September 2020, the following media publications had assisted in expanding the reach through to the public:

- **"Harbour gas-to-power project goes public (by Dave Savides), Zululand Observer, 21 Sept 2020;**
- **<u>https://www.dailymaverick.co.za/article/2020-10-18-turkish-floating-gas-power-ships-sail-into-public-consultation-process-after-back-door-passage-to-sa-freezes-up</u> (by Tony Carnie), Daily Maverick, 18 October 2020;**
- **<u>https://www.reddit.com/r/southafrica/comments/jk6kjq/turkish_floating_gas_power_ships_applied_for/</u> (29 October 2020).**

Refer to Appendix D11 – Other media Sources for copies.

7.4.3 Public Meeting:

The primary aims of the public meeting were to:

- provide I&APs and stakeholders with information regarding the proposed project and associated infrastructure;
- provide I&APs and stakeholders with information regarding the EIA process;
- provide an opportunity for I&APs and stakeholders to seek clarity on the project;
- record issues and concerns raised; and
- provide a forum for interaction with the project team.

Phelamanga, an independent public participation facilitation company, was appointed to facilitate the public participation process.

Recognising that not all stakeholders and I&APs are available at certain times of the day, the online meeting platform has enabled Phelamanga to provide a morning and evening meeting options for the relevant Stakeholders and registered I&APs to interact. The same information was to be provided at both sessions and registered I&APs were to receive the minutes of both sessions and the comments and issues trail. The meeting was held via Microsoft Teams and the link was shared to relevant stakeholders and Registered I&APs.

Date: 14 October 2020
Time: 10am and/or 6pm
Online Platform: Microsoft Teams

The draft Scoping Report was made available before the Webinar dates, and Stakeholders and registered I&APs were encouraged to submit questions or comments in advance of the online meeting so that feedback can be provided.

It must be noted that the evening meeting was not held as no attendees were present – the Secretariat (PPP facilitator), as well as the professional team and presenters, waited 45 minutes before closing off the meeting due to no attendees.

Minutes of the morning public meeting are attached as Appendix D12.

7.4.4 Public Review of the Draft Scoping Report:

The Draft Scoping Report was made available to all I&APs, including State Departments and DEFF for public comment for a period of 30 days between 06 October 2020 to 09 November 2020. The report was available on the Triplo4 website (www.triplo4.com). In addition, the draft Scoping Report was also electronically available via an online platform (GoogleDrive), the link to which has been emailed to the registered I&APs. Electronic copies have also been sent to DEFF and organs of state.

Various attempts (telephonically and emails) were made with the local municipality (various departments) and the ward councillor in order to be advised on suitable venues that are opened under the COVID, in order to place the public document at, but no responses were received.

However, it was confirmed telephonically with a librarian on the 5th October 2020 that the Richards Bay's public library re-opened as of the 6th October 2020, and a hard copy of the draft Scoping Report was placed there for public viewing on the 7th October 2020. No comments on the Draft Scoping Report were left at the public library, and no requests were made to view the copy of the report at Triplo4 office.

Refer to Appendix D4 for proof of placement of the Draft Scoping Report at the Richards Bay Library.

7.4.5 Comments Received on the Draft Scoping Report:

44. (1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in sub regulation (1) due to—

(a) a lack of skills to read or write;

(b) disability; or

(c) any other disadvantage;

(d) reasonable alternative methods of recording comments must be provided for.

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') have been documented and responded to in the Comment and Response Trail Report.

Table 7-1 below summarises the main issues raised during the commenting period on the draft Scoping Report that were to be addressed in the EIA phase, with the reference to the sections within this draft EIA Report that address these issues.

MAIN ISSUES RAISED DURING SCOPING	SECTIONS ADDRESSING THESE ISSUES IN THE DRAFT EIAR
Safety and Security Risks	Section 2.1.1 – Safety and Security Section 8 – Impact Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G - EMPr
Coastal and Climate Change Risks	Section 2.1.2 – Berthing and Mooring Section 8 – Impact Assessment Appendix I – Specialists Studies: Climate Change Impact Assessment Appendix G - EMPr
Leakage / spill risk from gas pipeline and potential impacts	Section 2.1.1 – Technology and Concept Designs Section 2.1.3 – Gas pipeline maintenance Section 3.1.5 – Fuel Alternatives Section 8 – Impact Assessment Appendix I – Specialists Studies: Marine Ecology Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G - EMPr

Source of the LNG	Section 2.1.4 – Source of LNG
Socio-economic benefits and impacts	Section 6 – Motivation, Need and Desirability Section 8 – Impact Assessment Appendix I – Specialists Studies: Socio-Economic Impact Assessment Appendix G - EMPr
Potential unplanned power supply interruptions due to Powership system failure	Section 2.1.1 – Technology and Concept Designs
Risk of bad weather preventing refuelling	Section 2.1.7 – Refuelling
Carbon Footprint and GHG emissions	Section 6.1 – Motivation, Need and Desirability Section 8 – Impact Assessment Appendix I – Specialists Studies: Greenhouse Gas Emission Report Appendix J – Specialists Studies: Atmospheric Impact Report
Detailed Layout and Sensitivity Maps	Appendix A – Site Plans
Public Participation Process in line with legal requirements	Section 7 – Public Participation Process
Cumulative Assessment	Section 8 – Impact Assessment Appendix I – Specialists Studies
List of all applicable listed activities	Section 2.2 - All Listed and Specified Activities Triggered in terms of NEMA and NEM: AQA
Heritage findings within the proposed laydown area for gas pipeline installation	Appendix I – Specialists Studies: Heritage & Palaeontology Impact
Alternatives assessment, including the option of not implementing the activity and the proposed location for the laydown area for gas pipeline installation	Section 3 – Alternatives Section 8 – Impact Assessment
Mitigation measures to reduce impacts on ocean and coast environment	Section 2.1.1 – Technology and Concept Designs Section 2.1.3 – Gas pipeline maintenance Section 8 – Impact Assessment Appendix I – Specialists Studies: Marine Ecology Assessment Appendix I – Specialists Studies: Coastal and Estuarine Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix I – Specialist Studies: Climate Change Assessment Appendix G - EMPr
Detailed methodology for the installation of the gas pipeline	Appendix J – Technical Reports: Gas pipeline Installation Methodology
Impact on the mixing zone	Section 8 – Impact Assessment Appendix I – Specialists Studies: Marine Ecology Assessment

Assessment of potential impacts on the Estuarine Functional Zone	Section 8 – Impact Assessment Appendix I – Specialists Studies: Estuarine and Coastal Assessment
Managing impacts on local species during breeding seasons during construction phase	Section 8 – Impact Assessment Appendix I – Specialists Studies: Estuarine and Coastal Assessment Appendix I – Specialists Studies: Ecological Assessment Appendix I – Specialists Studies: Marine Ecological Assessment Appendix G - EMPr
Atmospheric Impact Assessment to consider the study performed from 2017 to 2019, showing a considerable increase in PM_{10} exceedences at different monitoring stations.	Section 4.1.8.1 – Air Quality Appendix I – Specialists Studies: Atmospheric Impact Report
Life span of the project	Section 2.1 – Description of the activities
Location of the LNGC	Section 2.17 – Refuelling
Dust generation from Powership operations	Section 2.1.1 – Description of Powership, FSRU and LNGC
Assessment of the City's Disaster Management capacity	Section 2.1.1 – Safety and Security Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment

Table 7-1: Main issues raised during Scoping phase PPP to be addressed in the EIA phase.

Refer to Appendix D9– Comments and Responses Trail Report which includes the comments received during and post the Scoping phase (to date) and the corresponding responses.

7.5 PUBLIC PARTICIPATION FOR CURRENT EIA PHASE

7.5.1 Requirements of the approved PP Plan

- Registered I&APs will be notified via email of the availability of the Draft EIA Report, inclusive of specialist reports and EMPr for comment. I&APs who don't have email will be notified telephonically or by SMS.
- Flyers announcing the availability of these reports will also be distributed locally and put up on public notice boards with assistance requested from the municipality and ward councilor.
- The Draft EIA Report will be made available to I&APs, including State Departments and DEFF for comment for period of 30 days.
- The report will be available:
  - on the Triplo4 website (www.triplo4.com).
  - electronically available via an online platform such as Dropbox or GoogleDrive, the link to which will be emailed to all registered I&APs.
  - Electronic copies will also be sent to DEFF and organs of state, including State Departments.
  - The public copy venue will be confirmed with the municipality and ward councilor and will depend on what public venues are open under the Covid-19 pandemic. The Richards Bay library will be selected if opened.

- Other arrangements will be made to ensure people have access to the report should they be unable to access the public venue copy or an electronic copy.

7.5.2 Maintenance of I&AP Database

A database of I&APs (refer to Appendix D7), which includes organs of state, stakeholders, landowners, interest groups and members of the general public, will be maintained during the EIA phase.

Since the submission of the Final Scoping Report was submitted to DEFF on 18 November 2020, Triplo4 has continued to receive requests to be added to the database or to be provided with the associated project information.

7.5.3 Notifications to I&APs

I&APs and stakeholders were notified on the 22nd February 2021 of the availability of the Draft EIA Report, inclusive of specialist reports and EMPr for comment and the date of the public and stakeholders meeting.
The notification was emailed to all registered I&APs, as captured in the I&APs database.

Additional communication method to notify the public was used by placing notification flyers / put them on public notice boards, containing the commenting period on the draft EIA Report and the date of the public and stakeholders meeting, on the 22nd February 2021 at Seafarers Mission, located near the entrance to the port. Additional notification flyers were also placed at Bayside Alusaf Aluminium entrance – on their front desk and at the turnstiles (designated place for flyers).

The content of the notification email and flyer included the below:

Comment on the draft EIA report:

The Draft EIA Report (inclusive of the Environmental Management Programme (EMPr) and specialist reports) will be available to Interested and Affected Parties (I&APs), including State Departments as well as DEFF for comment for 30 days within the period 26th February – 31st March 2021 at the Richards Bay public library, Triplo4's Ballito office, on Triplo4's website: www.triplo4.com, as well as an online platform to registered Interested and Affected Parties (I&APs). ***Please contact the Triplo4 office if you experience any difficulty in accessing these reports.***

Public and Stakeholder Meetings:

As part of the public participation process, meetings will be independently facilitated, using online meeting platforms to allow for participation during the COVID-19 pandemic. Two meeting time options are offered - a morning session and an evening session. The same information will be provided at both sessions and registered I&APs will receive the minutes of both sessions. Questions or comments may be submitted in advance of the online meetings.
The meetings will be conducted on Thursday, 11th March 2021 at 10:00 and at 18:00.
The links to enable to join the online meetings will be provided to registered I&APs approximately a week in advance.

For I&APs who are unable to participate on such platforms, please contact the Triplo4 in advance so that additional assistance or alternative arrangements to participate can be made.

Please submit all comments and requests for registration as an I&AP (if not already registered) and/or further information to (EAP contact detailed).

Refer to Appendices D3 and D4 for copies of the notification flyers and photographic evidence of the placement notification flyers (no pictures were allowed to be taken at the Bayside Alusaf facility).

Public Meeting

The primary aims of the public meeting are to:

- provide I&APs and stakeholders with detailed information regarding the impacts of the proposed project and associated infrastructure;
- provide an opportunity for I&APs and stakeholders to seek clarity on the impacts and mitigations measures identified;
- record issues and concerns raised; and
- provide a forum for interaction with the project team.

Phelamanga, an independent public participation facilitation company, has again been appointed to facilitate the public participation process.

Recognising that not all stakeholders and I&APs are available at certain times of the day, the online meeting platform will be used to allow for participation during the COVID-19 pandemic. The online platform enables Phelamanga to provide a morning and evening meeting options for the relevant Stakeholders and registered I&APs to interact. The same information will be provided at both sessions and registered I&APs will receive the minutes of both sessions and the comments and issues trail. The meeting will be held via Microsoft Teams and the link will be shared to relevant stakeholders and Registered I&APs.

Date: 11th March 2021
Time: 10am and/or 6pm
Online Platform: Microsoft Teams

As included in the notification circulated, for I&APs who are unable to participate on such platforms, they were invited to contact Triplo4 in advance so that additional assistance or alternative arrangements to participate can be made.

The draft EIA Report (this document) will be made available before the Webinar date, and Stakeholders and registered I&APs are encouraged to submit questions or comments in advance of the online meeting so that feedback can be provided.

Minutes of the public meetings will be attached to the final EIA report.

7.5.4 I&AP Review of Draft Environmental Impact Assessment Report

The draft Environmental Impact Assessment Report, inclusive of specialist reports and EMPr, has been made available to I&APs, including organs of state for comment for 30 days within the period **26 February 2021 to 31 March 2021** during which I&APs are afforded the opportunity to raise any further issues and concerns, to be considered and incorporated into the final EIA Report for submission to DEFF.

A hard copy of the report has been made available at the Richards Bay public library.

The report is also available at Triplo4 Ballito Offices (Suite 5, The Circle, Douglas Crowe Drive, Ballito) and electronically on Triplo4's Website www.triplo4.com as well as an online platform to registered Interested and Affected Parties (I&APs). In addition, I&APs were invited to contact the Triplo4 office if they experience any difficulty in accessing these reports.

As included in the notification circulated, I&APs were invited to contact Triplo4 should they experience any difficulty in accessing these reports.

7.5.5 Comments and Response Trail Report

Once the comment period for the draft EIA Report has concluded, the Comments and Response Trail Report will be updated to record all the comments received and responses provided during the EIA process, and submitted to DEFF with the final EIA Report.

7.6 NOTIFICATION OF ENVIRONMENTAL AUTHORISATION

All registered Interested and Affected Parties will be notified within 14 days of DEFF's decision to grant or refuse Environmental Authorisation and their right to appeal such decision.

8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 OVERVIEW OF EIA PROCESS

The EIA process, including public participation that is required for an application for environmental authorisation and an atmospheric emission licence is prescribed by the EIA Regulations, 2014. Thus, the EIA process for the proposed Gas to Power via Powership project has to comply with these Regulations in order for the application to be valid. The process applicable to Karpowership's application is Scoping & Environmental Impact Reporting (S&EIR).

Subsequent to the application form for environmental authorisation having been submitted to the competent authority, DEFF at the beginning of October 2020, Triplo4, the Environmental Assessment Practitioner (EAP) commenced with the first phase, Scoping. In order to meet the prescribed 44-day timeframe, Triplo4 had already started identifying, notifying and engaging with Interested and Affected Parties (I&APs) in September.

The EAP, with guidance from DEFF, and input from specialists and I&APs, including relevant organs of state identified issues, impacts and risks associated with the proposed activities and their alternatives in context of the receiving environment and regulatory framework. The Scoping Report was made available for a 30-day comment prior to it being submitted for consideration to DEFF on 17 November 2020.The Scoping Report, including the plan of study for EIA contained therein was accepted by DEFF on 6 January 2021. This automatically triggered the commencement of the current phase, the EIA (also referred to as the EIR) for which the applicant and EAP have 106 days to complete.

In preparing this draft EIA Report for I&AP comment, Triplo4 engaged with numerous specialists and detailed studies were conducted and considered. Refer to Table 8-2 for the details of Specialist and Technical Team, as well as Appendix I for the full specialists and technical studies. Section 4 of this report contains the baseline descriptions of the environment, based on research conducted by the specialists' in the various field of expertise.

The site layout alternatives assessed during Scoping and considered feasible were brought forward to the EIA phase for further assessment, and are discussed in Section 3 of this report. They all fall within the site approved by DEFF at the end of Scoping, which is the Port of Richards Bay. The No-Go Option is also an alternative that is required to be assessed as part of the EIA.

The methodology used to assess the potential impacts is described in Section 8.2. Deviations from approved Scoping Report (including Plan of Study) and the assumptions, uncertainties and gaps in knowledge relating to the assessment and mitigation measures proposed are also presented in Section 8.8 respectively.

The findings of the assessment of the potential impacts and risks associated with the proposed project and alternatives, as well as identification of mitigation measures, are reported in detail in Section 8. The mitigation measures are also collated into the draft Environmental Management Programme (EMPr). Both the draft EIA Report and EMPr are made available for a 30-day period for I&APs to comment. Their comments will be incorporated into the final EIA Report for submission to DEFF in order for it to make a decision. DEFF will either grant or refuse environmental authorisation, and if granted, a number of conditions of approval will be imposed, including compliance with the approved EMPr.

8.2 IMPACT ASSESSMENT METHODOLOGY

2014 NEMA EIA Regulations (as amended), Appendix 3 (1) (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; viii) the possible mitigation measures that could be applied and level of residual risk.

This section describes the method used to assess and rank the impacts and risks of the site layout alternatives, including cumulative impacts for all phases of the proposed project, and indicates of the extent to which the issue and risk can be avoided or addressed by the management actions., In the

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The following criteria were considered for the assessment of each impact.

The **nature** of an impact is the type of effect that the activity will have on the environment. It includes what is being affected and how.

The **significance** of an impact is determined by a combination of its consequence and likelihood.

The table below describes the scoring of the impacts and how they determine the overall significance.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	1 – Insignificant / Non-harmful 2 – Small / Potentially harmful 3 – Significant / Slightly harmful 4 – Great / Harmful 5 – Disastrous / Extremely harmful
Duration a measure of the lifetime that the impact will be present	1 – Up to 1 month 2 – 1 month to 3 months 3 – 3 months to 1 year 4 – 1 to 10 years 5 – Beyond 10 years / Permanent
Spatial Scale the extent / size of the area that may be affected	1 – Immediate, fully contained area / within the site 2 – Surrounding area (< 2km) 3 – Within farm / town / city 4 – Within municipal area 5 – Regional, National, International
Overall Consequence = (Severity + Duration + Extent) / 3	
Likelihood	
Frequency how often the impact will occur	1 – Once a year or once / more during operation 2 – Once or more in 6 months 3 – Once or more a month 4 – Once or more a week 5 – Daily or hourly
Probability	1 – Almost never / almost impossible 2 – Very seldom / highly unlikely

the likelihood or the chances that the impact will occur	3 – Infrequent / unlikely / seldom 4 – Often / regularly / likely / possible 5 – Daily / highly likely / definitely
Overall Likelihood = (Frequency + Probability) / 2	
Overall Environmental Significance = Overall Consequence X Overall Likelihood	
Overall Environmental Significance:	
0 - 2.9	Very Low
3 - 4.9	Low
5 - 6.9	Medium - Low
7 - 8.9	Medium
9 - 10.9	Medium - High
11 and above	High

The impacts identified in the Scoping Report have been expanded on in this EIA Report following receipt of I&AP comments and more information from the various specialist studies. Impacts scoring a higher significance in the Scoping Report, received more attention in this EIA Report. The scoring and assessment of impacts as well as discussion of mitigations in this EIA Report have followed a detailed assessment process.

Refer to Section 8.4 (Impact Assessment) for the impacts and mitigation measures associated with the proposed activity.

Environmental, Cultural and Natural Heritage, and Social and Economic impacts associated with the project were further identified through site visits undertaken by project team and various specialists, consideration of the project description, site layout and the specialist studies. As part of the public participation process, I&APs were given an opportunity to provide input to the project at the public meeting sessions and through the review of the BID, advertisements, site notices and the Draft Scoping Report. I&APs will be given a further opportunity to provide input through the review of the EIA Report. The feedback received from I&APs also provided input into the identification of environmental and socio-economic issues to be assessed.

The assessment of the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 8.4.

8.3 SPECIALIST FINDINGS AND RECOMMENDATIONS

A description of the environmental impacts and risks identified during the EIA is described in this section.

The following potential impacts were considered in the EIA Phase for the proposed project. The specialist reports are made available with this draft EIA report for public comment (Appendix I), and take into account the comments submitted by I&APs during Scoping. Recommendations from the specialists for the mitigation of potential impacts were incorporated to the EMPr, attached as Appendix G.

8.3.1 Wetlands Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

The watercourses that have been delineated within the study area have undergone moderate to moderately high disturbance from historic and current land use practices. The changes that these watercourses have experienced are due to anthropogenic pressures in the catchment and wetland extent namely; construction of linear infrastructure (dirt and tar roads, overhead powerlines) within the catchment, increase in hardened surfaces in the catchment predominantly by industry development, construction of industry and industry platforms within the wetland, creation of dirt roads within the wetland, infilling within wetland, historic construction activities coupled with poor rehabilitation and proliferation of Alien Invasive Plants (AIPs) due to the aforementioned changes. This has resulted in the overall integrity of the assessed wetlands scoring an overall PES of C (moderately modified) for CVB01, FP01, FP02 and Seep06 and PES of D (largely modified) for FP03, UVB01 and UVB04 (Figure 8-1 below). The DWS Risk Assessment Matrix concluded that several aspects of the proposed development did not have the ability to be mitigated from a moderate to low risk rating.

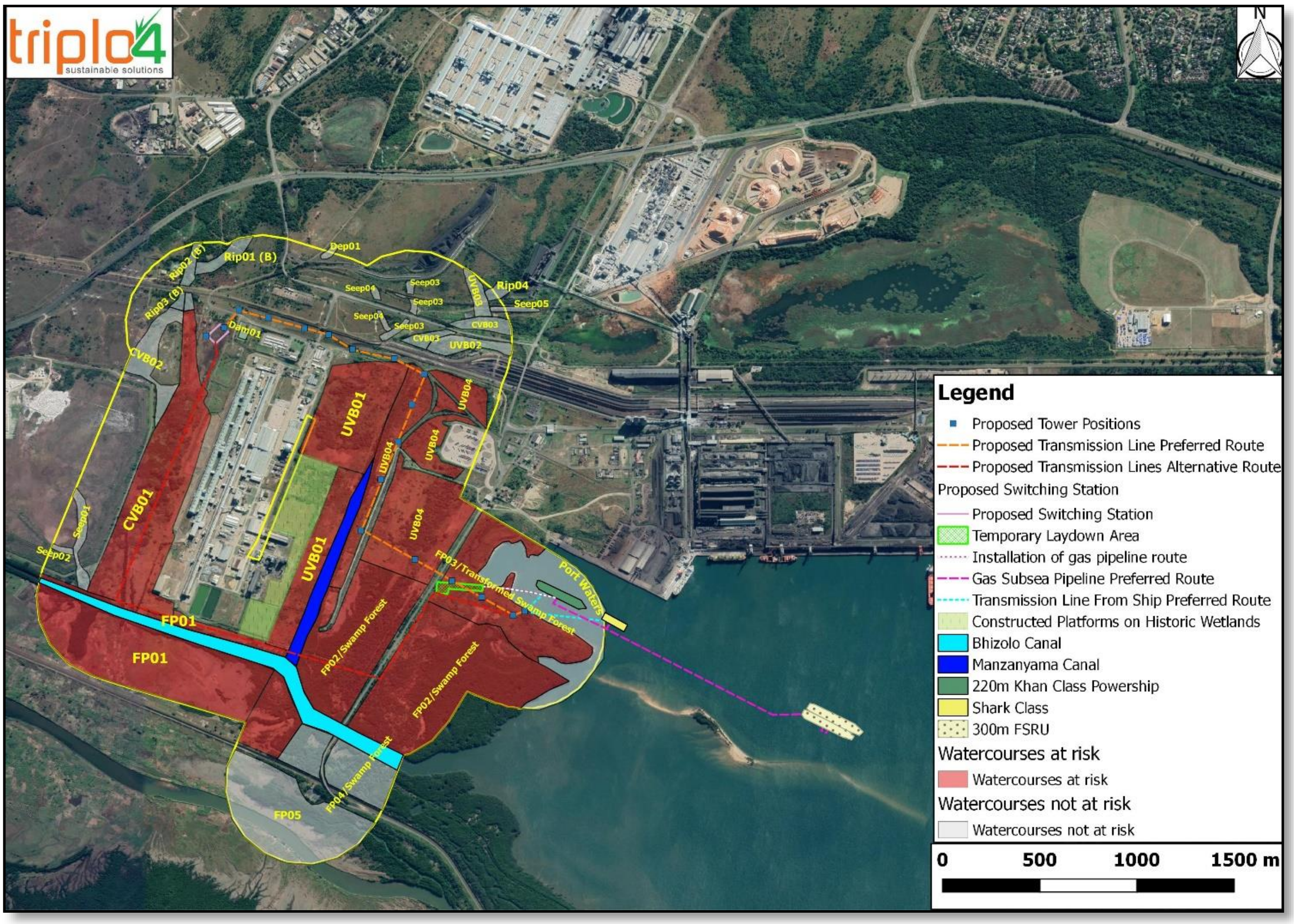

Figure 8-1: Map of the in-field delineations of the watercourses identified at the proposed development site and 500m assessment radius.

Construction Phase Impacts

The direct destruction of wetland vegetation may occur as a result of the construction of overhead powerlines within the wetland environment. This is a consequence of the excavation, trenching and infilling activities associated with the proposed development construction activities. Specific reference must be made to the following systems where the proposed development will extend into the delineated boundary: CVB01, FP01, FP02, FP03 and UVB04. The direct impact on the abovementioned systems will be the alteration of the hydrological flow regime, alteration to the geomorphological extent in certain areas, alteration of stream banks and beds, removal of wetland vegetation and alteration of the vegetation type in each system. Furthermore, the excavation, trenching and infilling within these wetland systems will result in the slight reduction in hydric soils as well as hydrophytes, which were calculated to supplying several ecosystem services to a moderately high degree. Alien Invasive Plants (AIPs) are already present in a large portion of the catchments associated with the proposed development. However, further encroachment by AIPs, pioneer species and opportunist weeds may occur if the appropriate mitigation, and rehabilitation strategies are not implemented. Extensive modification of the soil profile will take place in certain areas along the footprint of the proposed development, specifically during the construction phase. This will result in the destruction of seed banks, the decrease in the fertility of the soil and consequent sedimentation of downstream freshwater systems. Terrestrial and wetland environments may be transformed as a result of indiscriminate movement of construction vehicles and personnel; possible illegal harvesting of indigenous vegetation and burying of aquatic habitat as a result of deposition and unauthorised dumping by contracted personnel.

Vegetation removal may potentially result in an increase in exposed surfaces and subsequent potential for decreased soil particle cohesion and soil binding capacity, increasing the potential for erosion and sedimentation. Formation of rills and gullies from increased concentrated runoff has the potential to occur. This increase in volume and velocity of runoff increases the particle carrying capacity of the water flowing over the surface and into the at-risk wetlands, resulting in increased rates of erosion and sedimentation within the wetland systems. Soil compaction resulting in reduced infiltration and increased surface runoff together with the artificial creation of preferential flow paths due to construction activities, will result in increased quantities of flow and sediments entering the wetland systems. Erosion of certain land cover classes (e.g. bare-ground, shallow-rooted grass species and degraded veld) may occur as a result of increased surface runoff created by the hardened concreted surfaces. There is the potential for the creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic biota due to increased sediment deposition. During construction, there are several potential pollution inputs into the wetland systems. These pollutants alter the water quality parameters such as turbidity (increased suspended solids), nutrient levels, chemical oxygen demand and pH. Consequently, these impact the species composition of the system, especially species sensitive to minor changes in these parameters. Sedimentation of the downstream wetland systems may occur, resulting in altered sediment balances, destruction of habitats and the change in water quality (i.e. potential influx of nutrients and inorganic pollutants). Hydrocarbons including petrol/diesel and oils/grease/lubricants associated with construction activities (machinery, maintenance, storage, handling) may potentially enter the wetland systems by means of surface runoff or through dumping by construction workers. There will be a negative effect on the aquatic habitat within the construction footprint and downslope of footprint, particularly aquatic flora and fauna sensitive to changes in turbidity levels, nutrient levels, chemical oxygen demand and toxicants.

Operational Phase Impacts

There is a possibility of continued proliferation of AIPs, opportunist weeds and pioneer species due to ineffective rehabilitation. The continued encroachment by the marginal vegetation at several of the impacted wetland systems, due to excess nutrient input, will continue to alter the physico-chemical properties of the at-risk wetlands, as well as further change the water balance within the catchment area. Ineffective rehabilitation of the wetland systems disturbed area by overhead powerline base will result in the continued erosion and sedimentation of the downstream freshwater systems. Obstruction of flow due to the base of overhead powerlines, might result in the accumulation of sediment or other blockages will result in upstream ponding and will reduce flows to downstream areas thereby impacting on upstream and downstream wetland systems. There may be a reduction in the species composition and diversity of aquatic invertebrates as a result of certain species being sensitive to the proposed anthropogenic changes such as traversing through wetlands and potential foreign material entering wetlands. Hectare equivalent loss of wetlands in turn will reduce the potential of wetlands to provide ecosystem services to the surrounding environment, such as migratory route for semi-aquatic and/or aquatic organisms, lack of water supply to humans due to an increase proliferation of AIPs and deposition of high levels of nutrients to important wetlands, which can cause eutrophic conditions in these systems due to a lack of nutrient assimilation by wetland systems upstream.

Potentially increased levels of stormwater flow may result from the increase in the surface-area of concrete within the catchment areas. Potential decrease in soil permeability and infiltration may occur due to the increased hardening of surfaces. There may be continued, or increased, soil compaction on the footpath/tracks which have been created by the construction personnel. The transportation of excessive catchment sediment can result in a change in topsoil thus, a change in substrate in turn cause a proliferation of AIPs. If the site camp is not properly rehabilitated it could lead to further loss of habitat and topsoil from wetland systems, as a result of the increased velocity of surface water runoff from the bare surface associated with the camp and the erosion of wetland systems in close proximity to the camp. The current dirt roads and railway lines are an existing structure and the Port authority or Port tenants are currently utilizing these linear structures. Thus, the impacts associated with vehicle and human movement already exist. Sedimentation of wetland systems may continue as a result of sediment laden runoff entering the features from areas disturbed during construction and ineffectively rehabilitated. With ineffective rehabilitation, sedimentation will continue and will result in an impact on water quality and services that the wetlands on site provided. If rehabilitation is ineffective, aeolian processes may cause the erosion and transport loose, exposed material to downstream systems.

Recommendations

Mitigation Measures - Pre-Construction Phase

- Existing access/haulage routes must be utilised during construction as far as possible.
- Stormwater infrastructure must be positioned at areas where concentrated flows will enter the systems. The flow from stormwater infrastructure should not enter a system directly but should rather flow into an area of vegetated land, or dissipation area.
- Crossing structures utilised be wide enough to allow diffuse, unhindered through-flow of the wetland systems and avoid impoundment upslope.
- A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. All areas in which erosional and depositional features have formed must be reinstated to its natural condition.

Mitigation Measures - Construction Phase

- The impoundment of water upslope of the proposed development must be avoided. This is specifically relevant at the points where the proposed development will cross wetlands as per the current design and following wetlands: CVB01, FP01, FP02, FP03 and UVB04.
- Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development to reduce the siltation to the downstream wetlands. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the wetlands.
- Silt traps must be erected at the base of the slopes leading into the downstream wetlands and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis.

- Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found.
- If the construction activities influence the daily activities of the Port Authority adequate alternatives must be made outside of sensitive environments and preferably within currently degraded areas (e.g. detour routes).
- During the period when construction is required within wetlands, any heavy machinery (e.g. Tractor Loaded Backhoe (TLB), truck, generator) that will need to traverse the wetlands must do so cautiously to avoid any unnecessary damage to the vegetation. This will minimize the disturbance of the soil profile and the land cover. However, this should be avoided if possible to ensure the functionality and integrity of the wetlands are kept intact.
- Topsoil and subsoil which is excavated from the terrestrial and wetland areas must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential.
- All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and wetlands (e.g. stormwater flowing into the wetlands). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques.
- All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.
- Limit the movement of heavy construction vehicles on access roads created in wetland environments.
- AIP must be removed during the constructional of project. Areas where bare ground exist, must be re-vegetated with indigenous vegetation native to the area.

Mitigation Measures – Post Construction / Rehabilitation Phase

- Rehabilitation must commence within 30 days from the period when the construction phase has ended.
- All alternative tracks and footpaths created during the construction phase should be appropriately rehabilitated (e.g. tillage and revegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion.
- Any access roads () which were created must be decommissioned and rehabilitation to reinstate the natural vegetation, increase the surface roughness and resultantly increase infiltration (e.g. tillage and revegetation).
- All construction waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from site and the surrounding environment, this will need to be checked by the ECO and the various contractors.
- All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development where necessary.
- The reinstatement of the longitudinal bank profiles, which have been altered, must be rehabilitated if possible. The soil horizons must be reinstated on the correct structural order and the vegetation groundcover over the disturbed area re-vegetated according to the native indigenous species within the area.
- AIPs must be removed manually without further disturbance to the surrounding ecosystems. If manual removal is not possible, seek guidance from a local cooperative extension service or Working for Water. Dispose of the removed AIPs at a registered dumping site or burn the material on a bunded surface.

- Rehabilitation of the sections where AIPs are removed must take place. The appropriate indigenous grass and woody vegetation species seeds must be attained from a registered nursery with the guidance of a botanist who is familiar to the region.
- All areas in which erosional and depositional features have formed must be reinstated to its natural condition.
- Temporary access roads must be reinstated to the natural environmental condition.
- Alien Invasive Plants (AIP) encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan.

Mitigation Measures – Operational Phase

- The monitoring of the overhead powerlines and associated infrastructure must be conducted on a bi-annual basis to ensure that structural faults do not result in the unnecessary contamination of the wetlands and downstream wetlands.
- Additional monitoring is required as per the monitoring requirements outlined in the EMPr.

8.3.2 Hydropedology Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

<u>Findings</u>

Several hydropedological risks (i.e. the interactive relationship of soil with hydrology, including climate, rainfall duration, runoff patterns, groundwater contribution to baseflow and evaporation) were identified for the construction and operational phase of land components of the project. The risk associated with the construction and operational phase is estimated to be low and decrease to marginal after consideration of proposed mitigation measures. Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed) no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating in no likely change in PES or EIS. Based on the project type, no hydropedological flow buffers will be required.

Based on the available development layout plans the following will likely contribute to impacts of hydropedological flow drivers, soil quality and may compromise surface water quality in the nearby watercourse:

Construction Phase Impacts

- Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities.
- Disturbing vadose zone during soil excavations / infilling activities.
- In-situ placement of new soils, altering existing soil-flow processes (i.e. infilling of wetlands and cut-and-fill areas). Vegetation loss could decrease soil infiltration and increase runoff.
- Soil compaction. Soil & surface water contamination and sedimentation from the following activities:
  - Leakages from vehicles, machines, and building materials.
  - Erosion and sedimentation of watercourses if excavations are left open due to unforeseen circumstances (i.e. bad weather); and

    - Alteration of natural drainage lines which may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).
- Vegetation loss could decrease soil infiltration and increase runoff.

Operation Phase Impacts

- Alterations to natural soil flow processes due to excavations and soil stockpiling.
- Soil & surface water contamination and sedimentation from the following activities:
    - Oil & fuel leakages from maintenance and service vehicles.
    - Spillages from transformers associated with the project.

Recommendations

Mitigation Measures – Construction Phase

- Only excavate areas applicable to the project area.
- Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils.
- Cover excavated soils with a temporary liner to prevent contamination.
- Keep the site clean of all general and domestic wastes.
- Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Surface water monitoring.
- Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Have emergency fuel & oil spill kits on site.
- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
- Exposed soils to be protected using a suitable covering or revegetating.
- Have emergency fuel & oil spill kits on site.

Mitigation Measures – Post Construction / Operational Phase

- Placing a suitable geotextile in areas near or on-top of watercourses/wetlands, before placement of the soils, may help maintain some sub-surface soil processes.
- Compact and revegetate infilled areas to prevent erosion
- Revegetate areas (with indigenous vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion.
- Have emergency fuel & oil spill kits on site.
- Cover excavated soils to be protected using a suitable covering.

8.3.3 Aquatic Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Findings

The proposed project is located within a Sub-Quaternary Reach (SQR) that is already within a modified state. Thus, considering the project type which is linear and that impacts are of low significance with mitigation measures applied, the project can be considered for approval.

The construction and operation of the proposed 132kV Transmission Lines pose a risk ranging from Medium to Low. The impact rating for the construction phase ranges from medium to low pre-mitigation. Impacts to vegetation during the operational phase are medium pre-mitigation as a result of earthworks leading to the removal of vegetation within the riparian areas. This will create an ideal opportunity for alien invasive species to establish within the disturbed areas and require strict management. The hydrological regime will be adversely impacted during the construction regime. The clearing of vegetation and increase sediment input, and the hardened surface will result in increased runoff patterns into the drainage lines. Impacts on water quality may be medium pre-mitigation as outlined previously although this can be managed with due care. The construction phase is likely to impact on the associated aquatic biota due to changes in water quality and flow regimes but is expected to be of low significance. The operational phase impacts water quality will be low and can be reduced further with the recommended mitigation measures. It can be concluded that the construction and associated impacts of the transmission lines will be once off, and the operational phase will have no further inputs or impacts on the receiving environment.

Construction Phase Impacts

Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities have the potential to impact on aquatic resources. Soil compaction may lead to increase runoff flow potential. Soil and surface water contamination and sedimentation may result from leakages from vehicles, machines, and building materials as well as erosion and sedimentation of watercourses if excavations are left open due to unforeseen circumstances (i.e. bad weather). Alteration of the hydrological regime i.e. changes in natural drainage lines may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion). Vegetation loss will also be a consequence of clearing and construction activities. It should be noted that the milkwood tree, although not endangered, is a protected species according to the National Environmental Management: Biodiversity Act (Act 10 of 2004) and should not be disturbed. The impact of clearing and construction activities will also lead to the proliferation of alien invasive species and impaired water quality (surface and groundwater).

Operational Phase Impacts

Soil and surface water contamination from oil and fuel leakages from maintenance and service vehicles and from spillages from transformers associated with the project.

These impacts range from medium to low pre mitigation and impacts can be further reduced with appropriate mitigation.

<u>Recommendations</u>

Mitigation Measures – Construction Phase

- Construction must be restricted to the drier winter months when high rainfall and the risk of sediment runoff is limited.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.
- An alien invasive plant management plan needs to be compiled and implemented post rehabilitation to control current invaded areas and prevent the growth of invasive plants on cleared areas.
- Prevent uncontrolled access of vehicles through watercourses that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas.

- Temporary stormwater channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion.
- All chemicals and toxicants to be used for the construction must be stored outside aquatic areas and in a bunded storage.
- Spill kits must be available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- If long periods of flow obstruction may be required, during periods of flow, intermitted releases of water, for a few hours every few days should be allowed for.
- Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer.

Mitigation Measures – Operational Phase

- Vehicles use to service transmission lines and transformers must be well maintained and no service vehicles repairs must take place on site.
- Monitoring plan of alien invasive plants must be implemented to prevent streamflow reduction on the Mhlatuze River.
- All chemicals and toxicants to be used for the maintenance of the infrastructure must be stored outside aquatic areas and in a bunded storage.
- Spill kits to be available to ensure that any fuel or oil spills are clean-up and discarded correctly.

8.3.4 Hydrology Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Findings

The delineated flood lines for the 1:10, 1:20, 1:50 and 1:100-year return periods for the Mhlatuze River that runs adjacent to the Richards Bay Port. The aerial extent of the flood line reveals that there will be no impacts on the development, as the development falls outside the flood lines, Refer to Figure 8-2 below.

Figure 8-2: Delineated flood lines at the Richards Bay port.

Based on the available development layout plans the following will likely have an impact on the surface water bodies surrounding the site.

Construction Phase Impacts

- The building of relevant surface infrastructure.
- Areas will have to be cleared for construction lay down and to provide storage, ablution, and office space. This would expose bare soil and the soil will be "stockpiled" to be used to backfill the trench.
- Construction vehicles will be constantly manoeuvring through the area, compacting the soil, and any mishaps or damages could cause leakages of fuel and oil from the vehicles.
- Water from surface water bodies may be used for the washing of vehicles and other equipment, as well as for ablution purposes.
- Altering of natural drainage lines which may cause ponding or increased runoff patterns.
- Any flooding that occurs during this phase is likely to cause surface water contamination as soil and other debris is washed away into watercourses.

Operational Phase Impacts

- Alteration to natural flow processes due to the presence of infrastructure disturbing runoff patterns.
- Hydrocarbon contamination associated with service vehicles.
- Collapsible soils, as a result of backfilling development areas.
- Transformer oil spillages (if constructed) will impact on surrounding surface water bodies.

<u>Recommendations</u>

Mitigation Measures – Construction Phase

- Only excavate areas applicable to the project area.
- Cover excavated soils with a temporary liner to prevent contamination.
- Keep the site clean of all general and domestic wastes.
- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Retain as much indigenous vegetation as possible. Exposed soils to be protected by means of a suitable covering.
- Existing roads should be used as far as practical to gain access to the site, and crossing the rivers in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.
- Visual assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site.

Mitigation Measures – Operational Phase

- Only excavate areas applicable to the project area.
- Retain as much indigenous vegetation as possible.
- Ensure maintenance of transformers to prevent spillages.
- Water quality monitoring of the nearby river.
- Park vehicles in areas lined with concrete or fitted oil traps. Ensure vehicles are in good condition and not leaking fuel or oil when conducting maintenance. Have oil and fuel spill kits on site.

8.3.5 Geohydrology Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

<u>Findings</u>

The proposed development involves transmission lines (i.e. limited impermeable surface generation), and no groundwater abstraction activities are proposed. Hence, the impact of the proposed development on the groundwater reserve is considered zero.

Based on the risk assessment and project type, the impacts on the groundwater environment are low to marginal. Moreover, it is anticipated that the impact on groundwater is going to be uniform for all of the tower/pylon sites (i.e. there is no need for tower specific mitigation). No groundwater users have been identified in the area, there will therefore be no impact to groundwater users.

No decommissioning phase is anticipated for this project. However, similar risks as for the construction phase are anticipated if the facilities at the site are ever decommissioned; or if additional facilities are constructed.

Construction Phase Impacts

Impacts to groundwater will primarily occur as a result of earthworks. Waste pollution, excavation of parts of the vadose zone, and seepage and overland runoff from oil/fuel spills from construction vehicles will have Medium impacts on groundwater resources.

Operational Phase Impacts

The only impact is poor quality seepage from likely substations associated with the transmission line and park service vehicles. Seepage may percolate into the shallow aquifer zone.

Recommendations

Mitigation Measures – Construction Phase

- Only excavate areas applicable to the project area.
- Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils.
- Cover excavated soils with a temporary liner to prevent contamination.
- Retain as much indigenous vegetation as possible.
- Exposed soils to be protected using a suitable covering or revegetating.
- Have appropriate dewatering systems in place. Temporary dewatering of perched groundwater (if it occurs) - groundwater to be dewatered to the nearest surface drain/watercourse.
- Water quality monitoring of the downstream surface water if contamination impact is evident.
- Park heavy machinery in lined areas and place drip trays under vehicles at the site.
- Visual soil assessments for signs of contamination.
- Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines.
- Install a temporary cut off trench to contain poor quality runoff.
- Routine inspections of all infrastructure.

Mitigation Measures – Operational Phase

- Water quality monitoring of the downstream surface water if contamination impact is evident..
- Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines.
- Park service vehicles in lined areas and place drip trays under vehicles at the site.
- Visual soil assessments for signs of contamination.

8.3.6 Terrestrial Ecology Assessment

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Findings

The site comprises a mix of both transformed areas as well as modified and degraded habitat largely dominated by alien invasive species as well as some ruderal indigenous species. There are some areas of indigenous vegetation ranging from the Alluvial vegetation typical of the region to the Critically Endangered mangroves and Swamp Forests on site. The presence of, and potential impacts to, the mangroves and swamp forests within the alternative route preclude this option as it is considered fatally flawed. The preferred route traverses primarily transformed and modified habitat, with small sections of indigenous vegetation. The proposed switching station is located in indigenous vegetation. Wetlands are of high importance for this site, and the wetland specialist report should be consulted with regards to wetland recommendations. The preferred route is recommended as the best route for lowest impacts to terrestrial habitats. The alternative route is not recommended as it impacts on Critically Endangered habitats.

It is the opinion of the specialist that the proposed development go ahead, provided the mitigation measures are put into place.

Impact 1: Loss of vegetation communities

Loss of vegetation communities will definitely occur as a result of the proposed transmission line route (preferred), vegetation lost will comprise mostly transformed, modified and degraded vegetation but does traverse some areas of reed beds as well as bushveld. The switching station is also located within bushveld vegetation. As the project is located within a Port / Harbour Zone, and limited damage to indigenous habitat will occur, it is considered that this loss is acceptable for the preferred transmission line route and associated infrastructure and is within the limits of acceptable change. Impacts to vegetation are assessed for modified, degraded, and for each of the indigenous vegetation types affected by the proposed transmission line route and associated infrastructure.

Loss of modified habitat

Modified habitat will be lost as a result of the construction of the proposed transmission line as well as the laydown areas planned for the development. This is located primarily adjacent to the ship berth site. This vegetation is currently growing on artificially constructed berms as well as dumped building rubble and dredge. It is comprised primarily of alien vegetation with a few indigenous ruderal species. As such, sensitivity is low.

This vegetation has no current conservation value in and of itself however, it does form transitional habitat, as well as foraging areas and nesting for fauna.

The impact in the construction phase will be short-term, of minor extent and definite, with a low severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

In the operational phase, the impact will be short-term, of minor extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of low negative.

Loss of Reed beds

Reed beds will be lost as a result of the construction of the proposed transmission line where it crosses natural habitat between the harbour arterial road and the railway line. This vegetation is currently invaded with Schinus terebinthifolius among other invasive species but still serves as a wetland habitat with corresponding ecosystem services and faunal habitat provisions. The sensitivity is considered medium as the functional aspects are important.

The impact in the construction phase will be short-term, of minor extent and definite, with a high severity resulting in a high negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

In the operational phase, the impact will be short-term, of minor extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of low negative.

Loss of Bushveld

Bushveld will be lost as a direct result of the construction of the switching station facility. The bushveld area, though comprising habitat for both floral and faunal species is secondary in nature, with a corresponding moderate sensitivity.

The impact in the construction phase will be short-term, of minor extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

In the operational phase, the impact will be short-term, of minor extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of low negative.

Impact 2: Loss of Species of Conservation Concern (SCC) and Biodiversity

The construction of the transmission line, laydown area and switching station will possibly result in the loss of SSC including, but not limited to mangrove trees and the orchid Eulophia speciosa. which both occur on site. Permits will be required for the removal of these species, and they will likely be required to be planted as part of the landscaping of the development to compensate at a ratio of 1:3. It is also possible that other protected species will be found in these areas should additional field work be done.

The impact in the construction phase will be permanent, of national extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

As the construction of the transmission line, laydown area and switching station will result in the loss of areas of habitat, this will result in a loss of the biodiversity within those habitats. This impact includes all species, both fauna and flora that will be lost as a result of the proposed development. As the site is largely modified, comparatively small amounts of biodiversity will be lost. However, it is important to note that the area in general was once rich in biodiversity prior to the construction of the port, IDZ and related infrastructure.

The impact in the construction phase will be short-term, of local extent and highly probable, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact with minor extent, with a significance of low negative.

In the operational phase, the impact will be permanent, of local extent and probable, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Impact 3: Ecosystem function and Process

Fragmentation

This site is prone to fragmentation due to its location within the IDZ and the range of habitats present on site. Its location within a CBA also means that fragmentation is detrimental. As such, the loss of the vegetation will result in fragmentation of this already partially fragmented system, ameliorated somewhat by the dominance of alien species in some areas of the site (disturbed areas). The allowance for open space corridors reduces fragmentation risk, and thus, the impact due to fragmentation. Fragmentation can result in the loss of biodiversity due to loss of dispersal, pollination and gene issues, among other considerations. It should be avoided where possible. The nature of the transmission line is such that if habitats are allowed to recover beneath the line, the majority of fragmentation can be avoided.

The impact in the construction phase will be permanent, of national extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Invasion of alien species

The development of the proposed transmission line, laydown area and switching station will result in the influx of seeds and disturbance of existing seedbanks of alien invasive species. Considering the number of alien species already recorded from the site, this impact will occur and must be managed.

The impact in the construction phase will be permanent, of national extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Recommendations:

- In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas).
- No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants).
- Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. The aim of the plan will be to maintain the site free of alien invasions throughout the construction and operational phase of the development.
- Keep the construction footprint as small as possible.
- No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion.

- In wetland areas including reed beds, the construction of berms should be avoided as far as possible. Construction measures must consist of the least impactful individual erection of monopole structures. No servitudes should be cleared or maintained in this area.
- Prior to any clearance of vegetation comprising indigenous elements, this be walked over by a qualified botanist in the summer period to ensure no SSC are present. This must be done as removal or destruction of any SSC required permits from the relevant authorities.
- Construction measures must consist of the least impactful individual erection of monopole structures and all protected species avoided where possible.
- All SCC must be compensated for at a ratio of at least 3:1 either in gardens or as part of restoration and conservation efforts within the Richards Bay Port / Harbour Zone.
- Boundaries should be strictly maintained, and impacts retained within the boundary of the site.
- Areas of indigenous vegetation should be incorporated into the open space management plan of the Port / Harbour Zone in conjunction with Transnet where practicable.
- The land beneath the transmission line, and any other areas required for construction, but not for the operational phase, should be rehabilitated with indigenous species to retain connectivity within the system.
- Any existing and new alien species must be removed as soon as possible after emergence.
- As frogs can be excellent indicators of habitat quality and disturbance, it is recommended that regular amphibian surveys be conducted as part of a monitoring plan for the Karpowership site and Transnet port area as a whole.

8.3.7 Avifauna Assessment

This study dealt with several proposed components of the project, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships operations.

The study found that the site is mostly of low sensitivity due to the wide distribution of modified and degraded habitats and the alignment of the transmission line route with existing infrastructure. This places the route primarily within transformed or modified habitat, resulting in little overall loss of avifauna habitat. Impacts are Moderate and can be reduced to low with the recommended mitigation measures. The summary of impacts associated with the development can be seen in Figure 8-3 Below.

Impact	Without Mitigation	With mitigation
Transmission line		
Construction phase		
1: Loss of habitat	Moderate	Low
2: Disturbance of birds	High	Low
3: Poaching	Moderate	Low
4: Roadkill	Moderate	Low
Operational Phase		
1: Loss of habitat	Low	Low
2: Disturbance of birds	Low	Low
3: Poaching	Low	Low
4: Roadkill	Moderate	Low
5: Collisions	Moderate	Moderate
6: Electrocution	Moderate	Low
Powership		
Operational Phase		
7: Loss of habitat	Low	None
8: Disturbance	Moderate	None

Figure 8-3: Summary of Avifauna impacts associated with the Karpowership, transmission line, laydown area and switching station.

Recommendations:

The following mitigations and management actions are recommended:

- A walk-though must be done prior to construction to locate any nests, especially of any Species if Conservation Concern, which then should be dealt with on a case-by-case basis by an avifauna specialist.
- Bird guards should be placed on monopoles where there is a risk of electrocution through shorting circuits.
- Construction of the transmission lines should, wherever possible in natural vegetation, make use of existing servitudes, berms etc. Where none exist, each monopole should be individually placed and the clearance of a servitude avoided wherever possible.
- Construction should be timed to avoid breeding periods and movement times.
- In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas).
- Induction should include clear dangers of poaching.
- Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion.
- Keep the construction footprint as small as possible.
- Monitoring must be done to determine the rate of electrocution, as well as which species are affected.
- Monopoles and lines must be regularly checked for any faults that may result in increased risk of electrocution.

- New lines should be monitored monthly for a year to determine avifaunal mortality as a result of collisions and adaptive management techniques put in play to reduce impacts, or confirmation of low mortality levels.
- No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas.
- No off-road driving should be allowed, and only designated roads used for site and monopole access.
- No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- Power lines must be marked with flags to increase the likelihood that at risk species will see the lines.
- Speed limits should be posted and not exceed 40km/hr, especially at night when nocturnal and crepuscular species tend to rest on roads.
- The design of the lines must be in line with Eskom-EWT guidelines for transmission lines.
- Where possible, mowing of any servitude or berm areas should be avoided.

8.3.8 Estuarine and Coastal Environment

This study dealt with the proposed components of the project that are within the estuarine and coastal environment, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships, the FSRU and the submerged gas pipeline.

It is highlighted that integrated coastal and estuarine management is a cross-cutting speciality and many of the key issues and their potential impacts were collectively identified and addressed in the other specialist assessments, including the marine ecology, terrestrial ecology, avifauna, air quality, and climate change (sea level rise, etc.).

<u>Findings</u>

The project could add to the potential polluting activities in the Richards Bay/ uMhlathuze estuarine system, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Richards Bay/ uMhlathuze estuarine system, conflict with birds and the systems critically important nursery function as well as the potential introduction of pathogens which could affect the current state of the system. Mariculture facilities and operations could also be negatively impacted. Such events must be controlled collectively by the TNPA and the South African Maritime Safety Authority (SAMSA). While issues relating to pollution are not considered to be of greater threat or significance than current port activities, the risk of cumulative impacts to the sensitive estuarine environments increases as activities within the Port increases.

The project will positively impact on the Port and the economic activities related thereto by providing for short term provision of power to the SEZ when the country is experiencing power shortages. The increased electricity generation capacity, when considered as part of the national Integrated Resources Plan (IRP), from the project will contribute to an enabling environment for economic growth.

It is within the specialists'' opinion that the proposed activity is considered acceptable and that the preferred alternatives should be authorised taking due consideration of the mitigation measures included. This activity is deemed reasonable as it is proposed:

- within a transformed Port and SEZ which has been specifically set aside for such activities;
- will contribute to economic growth in an environmentally – economically and socially sound manner;

- While the ecological value of the habitats and species will be affected, such environmental impacts identified can be mitigated so as not to compromise the present state of the estuarine environment in the long term; and
- follows a formal environmental management assessment process with anticipated compliance with conditions of approval.

Construction Phase Impacts

Impact 1: Disturbance/loss of estuarine/marine fauna as a result of sea-based construction activities

Within the Port of Richards Bay, the proposed Gas to Power project will be located in the back of the port, adjacent to the highly sensitive habitats of the Kabeljous Flats (intertidal and subtidal sand and mudflats, the sandspit and mangrove forests).
Although this section of the port is used as a sacrificial working area and is also earmarked for future port expansion (Berth 600 Series), it is important that potential environmental impacts be assessed in order to minimise further environmental degradation and to formulate and implement appropriate mitigation measures, as part of environmental best practice until the long-term plans are realised. With proactive management, the impacts can be greatly reduced in terms of the extent, duration and overall significance.

Laying of the mooring facilities (heavy chain, anchor system) and the proposed subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, with knock on effects for benthic and pelagic organisms, which may result in smothering and/or injury of estuarine/marine organisms. Physical disturbance of the intertidal zone is expected during the assembly of the gas pipeline and undertaking of other construction related activities for the Gas to Power project. This may involve heavy machinery and construction personnel accessing and moving along the shoreline in the vicinity of the laydown area, including the “assembly cove”. The latter is a quiet water area, sheltered from vessel movement in the active channel, and although it is artificial, it provides shallow intertidal habitat for marine/estuarine fish and invertebrates. The intertidal zone is inherently dynamic, being exposed to constant daily changes and disturbance by propeller wash, ship movement, wind and wave action. Therefore, recovery of the intertidal fauna due to the disturbance by construction activities will be fairly rapid. In addition, the immediate shoreline of the dead-end basin provides limited habitat value for waterbird species in terms of nesting, feeding, and roosting, and thus disturbance in this regard is expected to be relatively low.

In respect to subtidal communities, pelagic fish and bottom dwelling fish species such as gobies and sole may be disturbed but are likely to evade the area of disturbance, whilst sedentary organisms residing in the sediment within the development footprint will be lost. Conversely, the exposed nature of the infrastructure will create new hard substrate to be colonised by benthic invertebrates, which will occur relatively quickly. This is likely to have a positive impact for indigenous marine species of the bay, but a negative impact if colonised by invasive species. Subtidal soft sediment communities do tend to recover quickly (several months) in response to periodic disturbance, particularly if colonising source material is easily available (as is the case due to unimpeded connectivity to the marine environment) and communities in the region of the proposed development are also likely to be reasonably tolerant of disturbance associated with the active shipping channel, such as shipping traffic and periodic dredging (Laird & Clark, 2014), as well as currents and wave penetration. Thus, provided sediment disturbance is limited to the development footprint, the proposed project activity is unlikely to have a significant effect on the benthic communities surrounding the mooring structures.

Impact 2: Changes in water quality as a result of sea-based construction activities

Laying of the mooring facilities (heavy chain, anchor system) and the subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, which in turn will affect the water quality in the immediate vicinity, specifically in respect to total suspended solids/ turbidity, dissolve oxygen concentrations, and sediment contaminants. This will have knock on effects for benthic and pelagic organisms.

Agitation of the sediment during the laying of the gas pipeline and anchorage legs on the seabed, as well as necessary levelling, will lead to increased total suspended solid (TSS) and turbidity of the water column. This has important negative implications in the case of light penetration and the primary productivity of microalgae (phytoplankton and microphytobenthos), and for invertebrates and fish. The response of larval fish to turbidity of the water column is generally species-specific (Harris and Cyrus, 1999) and estuarine fauna are generally well adapted to high levels of turbidity. However, fine particulate matter may result in the clogging of the feeding and breathing apparatus of certain organisms (e.g., filter feeding invertebrates and the gills of sensitive fish species). Notwithstanding, impaired visibility in the water column due to increased turbidity will also affect the detection of prey by predatory fish species, however these species are generally marine species and will migrate away or out of the harbour when conditions become unfavourable (Harris and Cyrus, 1999; Laird and Clark, 2014).

Overall, the quantity of sediment disturbance that will take place for this Gas to Power project is very small in comparison to current capital dredging operations required to maintain the depth of the shipping channels and berths. Further to this, the sandspit provides a form of natural barrier to the Kabeljous Flats.

Dissolved oxygen concentrations in the vicinity of the proposed project were good and above the minimum threshold for healthy biological communities (> 5 mg/L) (CSIR, 2018b). It is possible that disturbance of the seabed during laying of the pipeline and mooring anchors will release potentially anoxic sediments into the water column resulting in oxygen deficient conditions, with negative knock-on effects for aquatic organisms. This could be exacerbated by muddy sediments with high organic content for decomposition by bacteria in the sediment and limited re-ventilation of the water column by currents in the dead-end basin (CSIR, 2018b). However, sediment analyses revealed that, despite the predominance of muddy substrate within the project area, sediment quality was rated as good, and within the expected range in terms of organic content (CSIR, 2018). Thus, exposure to oxygen poor water, is expected to be low.

The presence of sediment contaminants, specifically heavy metals, is common occurrence and expected within ports given the nature of port activities and materials handled. Overall the sediment quality at sites 5 and 7 (refer to Figure 8-3 below) was rated as marginal and good, respectively (CSIR, 2018b). Evident, there is a greater risk of exposure of benthic and pelagic organisms at site 5 to sediment contaminants released during construction activities.

Figure 8-4: Sediment quality index categories for sediment monitoring sites for the winter 2017 survey.

Impact 3: Disturbance/loss of terrestrial fauna as a result of construction activities and noise

Noise pollution impacts associated with the construction of the necessary landside infrastructure and assembly of the subsea pipeline will be temporary, lasting for the duration of the construction period and are not anticipated to be much greater that the noise levels already experienced within the boundaries of the harbour.
By virtue of the frequently disturbed landscape and degraded wetland habitat, the area between the port and the Manzamnyama Canal is unlikely to provide critical habitat for fauna (especially waterbirds), and the species inhabiting this area are not likely to be significantly impacted as they would be somewhat tolerant of noise and disturbance due to frequent shipping traffic and harbour operations or are expected to evade the area of disturbance.

The temporary increase local noise levels, vessel movement and activity for laying of the anchor legs for the FSRU may disturb and temporarily displace feeding or roosting birds utilising the sandspit and intertidal flats, and will be highest during summer for migrant species. With regards to the transmission lines running adjacent (preferred route) and through (alternate route) the mangroves, the latter will cause significant local disturbance and mortality of fauna utilising this critical and unique habitat, extending from intertidal and supratidal aquatic communities to roosting or nesting birds, reptiles (e.g., snakes) and mammals (e.g., monkeys etc.).

Impact 4: Destruction of estuarine vegetation as a result of construction within the estuarine functional zone

The primary components of the project will be positioned along the active channel and dead-end basin of the 600 Berth Basin. The immediate surrounding landscape has been radically and irreversibly transformed as a result of historical port development and associated activities, accumulation of floating harbour waste, dumping of dredge spoil, dumping of building materials etc., and which is also evident in the disturbed wetland/ mixed grassland/shrubland communities and composition of the soils.
The laydown area /stringing yard for the assembly of the gas pipeline and the first land-based connection, that is the terminal tower, will be located in the disturbed wetland/mixed grassland/shrubland, which is characteristic of much the vegetation along the harbour arterial road (except for the distinct mangrove areas). The location

of the terminal tower is relatively similar for the preferred and alternate layout options for the powerships within the port basin.

Given the degraded state of the vegetation and landscape modification, the loss of functional estuarine habitat is likely to be insignificant. In comparison however, the alternate route will traverse historical, well-established dense mangrove habitat. While the footprint of each pylon may be relatively small, construction within the mangroves will result in destruction and disturbance of critical estuarine habitat and protected tree species in terms of the National Forest Act (Act No. 84 of 1998) (namely Black Mangrove, *Bruguiera gymnorrhiza*), far greater than development footprint.

Impact 5: Solid waste pollution generated during construction period

Solid waste will be generated by construction activities and may include concrete rubble and bricks, metal materials, material off-cuts and surplus, plastic waste and general litter. If not properly managed and contained, these materials may find their way into the port, sensitive littoral habitats or ultimately into the open marine environment. Floating or submerged solid waste (especially plastics) in the marine environment can be transported over vast distances through the ocean currents and therefore the area of impact could potentially be extensive. Debris in the oceans may have a lethal impact on marine fauna, with potentially severe consequences for rare and endangered species. It is recommended that intensive awareness training should be done with all staff regarding the impacts of construction waste and litter on the marine and estuarine environments. Poor management of the laydown area, the stringing yard and its operations (e.g., waste management facilities), and construction areas (e.g., pylons) may also lead to contamination of the immediate surrounding environment. There is a definite possibility that the impacts will occur if waste is not properly managed, and the intensity of these impacts may be severe and expensive or time-consuming to mitigate.

Impact 6: Chemical pollution arising from construction related spills of hazardous substances

During the construction period, there is the potential for accidental spills of hydrocarbons, oils from construction vehicles, plant, other equipment and the working barge, and other harmful substances and chemicals used (e.g., concrete). This may enter the water column directly during construction activities or be transported as contaminated runoff into the port from land-based activities as a result of incorrect handling and improper spill management. Once in the harbour channel, contaminants may be transported out to sea or into other sensitive areas of the harbour during strong winds coinciding with spring high tides. This will affect sediment and water quality with toxic and potentially lethal effects on the flora and fauna of Richards Bay, in the immediate vicinity of the activity, namely, the adjacent sandspit and Kabeljous Flats, and other areas on weather conditions and dilution. Accidental spills, regardless of volume or concentration, could lead to significant ecological damage.

Impact 7: Restriction of coastal access (for Operational Phase as well)

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

Operational Phase Impacts

Impact 1: Chemical pollution arising as day-to-day shipping practice

The potential for pollution from shipping (including Spent oil and lubricants, Paint, solvents and waste detergents, Waste from ship maintenance activities, Sewage, Galley waste, Sweepings from hatches and engine rooms, Slops from holds and tanks, Ballast water, General domestic waste, Medicinal/Medical waste, Spent Batteries, discharge of heated wate etc.) as a result of the proposed gas to power process is considered to be high and specific controls will need to be incorporated into the environmental authorisation, if approved.
It should be noted that as such pollution is deemed to not be land-based, and as such it will not be controlled by the ICM Act but rather in terms of International Convention for Prevention of Pollution from Ships Act (Act No. 2 of 1986) (MARPOL Act), the South Africa Maritime Safety Authority Act (Act No. 5 of 1998) (SAMSA Act), the Marine Pollution Act (Act No. 6 of 1981) (Control and Liability Act) as well as the Merchant Shipping Act (Act No. 57 of 1951). It is also primarily the responsibility of the National Department of Transport and the South African Maritime Safety Authority (SAMSA) to manage. Discharges must also be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DWAF, 1995; DEA, 2018b). The responsibility, in the case of oil pollution from ships and once oil has been released to sea, is the responsibility of DEFF, specifically through their Kuswag Programme, which undertakes regular oil spill surveillance and monitors for potential illegal oil discharges. This includes shoreline protection and clean-up, and at-sea response using dedicated oil response vessels and aircraft and dispersant spraying operations (DEA & RHDHV, 2017).
As the proposed operation of the gas to power process takes place within a port environment, the necessary TNPA environmental management programme and systems, specifically policies and processes relating to waste, dockside maintenance and repairs and comprehensive emergency response plans dealing with all foreseeable environmental emergencies, must be applied. It should be noted that the Polluter Pays principle whereby those responsible for the spill are held liable for the clean-up costs, will apply in any pollution incident.

Impact 2: Injury / mortality of marine/estuarine aquatic fauna due to abstraction

The abstraction of seawater for cooling will invariably result in the intake and extermination of small to medium bodied pelagic organisms (e.g., phytoplankton, larval stages of invertebrates and fish, juveniles and adults, which also constitute food resources for higher trophic levels. Also, areas subject to propeller wash from passing vessels will cause agitation of the bottom sediments. In these instances, soft sediment invertebrates, including juveniles and adults, may be placed into resuspension and may also be abstracted and exterminated. While populations of short lived, opportunistic species would by largely unaffected, longer lived species, such as macrocrustaceans (crabs and prawns), and fish, rays, and sharks would be significantly affected. However, the latter groups of organisms are generally highly mobile and will be expected to avoid the overall disturbance.

Another concern, is the intake and extermination of small pelagic organisms, as well as reproductive material/larvae arising from the highly productive intertidal and subtidal sand and mudflats of the Kabeljous Flats, that may be passively transported into this area during high tides, strong windy conditions and currents. This “material” would serve to restock this disturbed shipping area, serve as food resource to higher trophic levels, and also continue to contribute to the productivity of the bay.

Impact 3: Disturbance to estuarine/marine aquatic fauna due to noise/sound vibrations

While the proposed project is located within an industrial and commercial port where noise pollution is already prevalent, additional noise and vibrations will be generated by the operations of the powerships. Given that estimated noise level of Gas to Power project is less than the indicated injury sound levels, estuarine/marine aquatic fauna are unlikely to be significantly affected. Please refer to the Marine Ecology Assessment Report for further details (Appendix I).

Impact 4: Changes in water quality as a result of cooling water discharge

The discharge of heated water is likely to result in localised disturbance of the water column (specifically temperature), with knock-on effects for pelagic and potentially benthic organisms.
Thermal plume modelling indicates that water temperatures within 600 Berth Basin will increase by between 1.25-2°C during winter, and between 1.25-2.5°C during summer as a result of the discharge (4 m depth) relative to the baseline conditions under the preferred layout option (PRDW, 2020b). The dispersion of the thermal plume will meet the required ecological thresholds at 100 m and 300 m radial distance intervals of the mixing zone (DWAF, 1995; PRDW, 2020b), and therefore not expected to adversely aquatic fauna in this area.

While the modelled temperature increases are only marginally higher that what is expected for seasonal fluctuations based on water quality monitoring undertaken in the 600 Berth Basin (site 3 in Figure 8-4 below), the results of the monitoring reflect the absence of a marked thermocline, that is, temperature changes within the water column are gradual with increasing depth (CSIR, 2018b). The discharge of heated water will generate a marked increase in water temperature between -4 m to -6 m (PRDW, 2020b). In addition, modelling of the thermal plume indicates the potential for thermal effects reaching the narrow channel between the headland and the sandspit, which connects the Kabeljous Flats to the inner basin. As mentioned above the Flats are likely to provide important food resources and replacement stock into the disturbed shipping channel.

Figure 8-5: Water quality index categories for surface water monitoring sites - 2018 survey.

Water temperature, as a key physiological stimulus for aquatic organisms, affects general growth, reproduction and reproduction behaviour, feeding habits, respiration patterns, as well as movement/migration (DWAF, 1995). Younger life stages are generally more sensitive to rapid changes in environmental conditions, such as temperature. Severe changes in temperature close to the powership will likely cause the demise of sensitive aquatic fauna, particularly passive pelagic organisms, whilst highly mobile species will likely avoid unfavourable habitat conditions. This in turn will cause organic loading and potentially low dissolved oxygen levels near to the discharge point as biological demand increases during decomposition.

Impact 5: Disturbance to coastal/estuarine associated birds due to noise and light pollution

The proposed Gas to Power project will be located is within an industrial and commercial port where noise and light pollution is already prevalent. Once in operation, the powerships will operate throughout the day and night, or part thereof, with noise emanating from power generation, supportive activities and other potential sounds (e.g., alarms sirens/bells etc.). According to the noise generation study (Williams, 2021), the water area of dead-end basin and adjacent shoreline will be subject to 80-90 dB, all areas within a 500 m radius including a portion of the mangrove stand and shallow Kabeljous Flats, the landward section the sandspit, grassland and scrubland will experience 70-80 dB. The greater Kabeljous Flats and sandspit, broader mangrove and grassland/shrubland/wetland will experience industrial level noise limit 60-70 dB. Beyond these areas, noise levels will decrease from 60dB to 30dB. The recommended noise mitigation measures will bring noise levels within the acceptable limits for industrial areas (70 dB daytime, 60 dB night-time). However, any sensitive bird species utilising the Kabeljous Flats and sandspit for feeding, roosting and those seeking refuge within the mangroves (and linked habitats) will likely be disturbed by the additional noise and artificial light (specifically during the night) (Adams *et al.*, 2019) due to the relatively close proximity of the powership to the shoreline and important estuarine habitats. These areas may thus become unfavourable for coastal and estuarine-associated birds and the habitat value will thus be diminished in the long term. The populations of Threatened and Near-Threatened species are particularly at risk. Studies have also shown that artificial lighting can disorientate birds during flight and thus pose a threat to migrating species (Adams *et al.*, 2019). Artificial light can also cause behavioural and breeding modifications (Davies *et al.*, 2014). However, very few birds were seen utilising this area during the site investigation (see Avifauna Specialist Report – Appendix I), and given the level of disturbance already prevalent in this area of the port, it is possible that the ecological value of the sandspit has already been reduced.

The impacts of noise and light pollution can be partially mitigated by ensuring low light emission from the powership and relocation of the powership component to a less sensitive location within the port.

Impact 6: Injury/mortality of coastal/estuarine associated birds

powerlines pose a significant threat to birds, particularly big bodied species such as pelicans, flamingos, herons, spoonbills etc., which utilise the sandspit and the quieter areas of the canals, as well as other areas of the broader system (e.g., Thulazihleka Pan) or en route to the surrounding water bodies, including the neighbouring Mhlathuze Estuary and river floodplains, Lake Msingazi, Lake Nsezi and Lake Cubhu. The populations of Threatened and Near-Threatened species are particularly at risk. The risk of bird collisions is likely to be greater at night, or in poor weather conditions, when visibility is poor, and where the lines traverse open spaces such as the southern and western margin of the smelter site close the Bhizolo Canal and adjacent wetlands.

Impact 7: Chemical pollution arising from spills and leaks of hazardous substances

Any spills and leaks of hazardous substances will have a negative effect on the immediate estuarine/marine water quality, and potentially the most ecological significant habitats of the bay, and potentially the open ocean. Accidental spills, regardless of volume or concentration, could lead to significant ecological damage.

LNG and/or natural could leak into the bay due to incorrect coupling during refuelling, or via breakages in, or damages to, the fuelling line or subsea pipeline. LNG is non-toxic and spills on seawater vapourise rapidly, leaving no residue or film (Mokhatab *et al.*, 2014). Due to the shallow depth (<100 m), any subsea leaks will rise rapidly and dissipate into the atmosphere and thus not likely to result in dissolved oxygen depletion of the surrounding water column (Di, Feng and Chen, 2019).

Impact 8: Mortalities of coastal/estuarine associated fauna and habitat destruction due to explosion

Although highly unlikely and also unpredictable, a gas explosion will result in significant habitat disturbance/ destruction with the potential for numerous mortalities of marine /estuarine associated fauna.
The risk of impacts on the most ecologically important habitats of Richards Bay can be mitigated by relocation of the powership component to a less sensitive location within the port. Limited alternative options exist for mooring elsewhere within the port. The risk of explosion can also be mitigated to some degree by TNPA's pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies.

Impact 9: Impact on the ecology of the Mhlathuze Estuary/ Sanctuary

The proposed Gas to Power project to be located with the 600 Berth Basin will not directly affect the functioning of the uMhlathuze Estuary by virtue of this permanent separation. According to the noise generation study (Williams, 2021), noise disturbance (50-70 dB) will reach a marginal portion of the uMhlathuze system adjacent to where lower Bhizolo Canal enters the Port of Richards Bay. The recommended noise mitigation measures will bring noise levels within the acceptable limits for industrial areas (70 dB daytime, 60 dB night-time) (Williams, 2021). However, noise/vibration sensitive bird species present in the uMhlathuze Estuary may be affected, including species which travel between these two systems, as well as those affected by artificial light. Birds travelling between the systems may also be negatively affected by the overhead transmission lines. Given the importance of the uMhlathuze Estuary as an IBA, every effort must be made to reduce impacts on this area.

<u>Recommendations:</u>

Mitigation measures – Construction phase

- During construction, general environmental compliance monitoring must be undertaken by a suitably qualified environmental control office (ECO) on a weekly basis as a minimum to ensure that basic environmental best practices are followed and that conditions of the environmental authorisation are complied with. The presence of an on-site environmental officer is strongly recommended to monitor daily operations.
- Disturbance must be kept to a minimum by confining the pipeline laying down activity, working barge and/ or excavation/levelling equipment to within the project area.
- No animals (birds, fish, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason.
- Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and fauna, good house-keeping and the need for careful handling and management of chemical substances;
- Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.
- Duration of pipe laying and anchorage operations must be minimised as much as possible to reduce suspended sediment loads.
- Pipe laying and anchorage operations should not take place during spring high tides and very strong south-westerly winds or storm weather conditions.

- Laying of the pipeline and the anchor legs must be undertaken with as little disturbance of the seabed as possible.
- Monitoring of turbidity levels must be undertaken daily during the pipe laying and anchorage operations. TSS levels may not exceed 20 mg/l.
- The surrounding area must be surveyed prior to construction/laydown area establishment to determine the presence of nesting birds and sensitive fauna, and these must cordoned off where possibly or be safely relocated if necessary.
- The conservation authority must be contacted for the relocation of birds/ wildlife.
- The laydown area/stringing yard must only be located in disturbed wetland/grassland/shrubland.
- The existing pylon servitude adjacent to the Manzamnyama Canal and the existing berms must be used as the preferred route to minimise the disturbance footprint to the adjacent intertidal sand/mudflats of the canal.
- Mangrove and swamp forest habitat must be avoided.
- Restrict access to laydown area/stringing yard and working area only.
- Restrict vehicles to clearly demarcated access routes and construction areas only.
- Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used.
- Beyond the headland of the 600 Berth Basin, movement of supporting vessels to be restricted to the main channel only.
- Laying of the gas pipeline and mooring legs of the FSRU should be undertaken during the winter months reduce disturbance birds utilising the sandspit.
- Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations
- Construction vehicles, plant and machinery must be well maintained and fitted with silencers.
- Regular maintenance on vehicle and equipment undertaken.
- Construction vehicles, plant and machinery must be well maintained.
- Noteworthy vegetated areas must be avoided (e.g., mangroves) in the siting and enclosure of the laydown area/stringing yard.
- Siting of the pylons must utilise existing servitudes and berms to prevent additional, unnecessary terrain modification and habitat disturbance.
- Prior to site establishment, the site must be assessed for important plant species, which must be avoided, or rescued for transplanting. Necessary permits must be obtained.
- Post construction rehabilitation of the laydown area/stringing yard and all unnecessary access routes must be undertaken.
- Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies
- Construction workers and operational staff to adopt best practice waste minimisation procedures.
- Implement the correct handling and disposal procedures for general and hazardous waste.
- Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste.
- Good housekeeping to be done daily.
- No mixing of concrete in the intertidal zone.
- No dumping of construction materials or excess concrete in the intertidal and subtidal zones.
- Wind screening (e.g., fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g., litter) entering the Estuary.
- The laydown area must not be established within a high-risk area (i.e. below the high water mark);

- The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme;
- Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff);
- The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the port;
- Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies
- A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified;
- A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme;
- Ensure correct handling, storage and disposal procedures are followed (e.g., bunded storage areas to contain 110% of volume);
- Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface;

Mitigation Measures – Operational Phase

- During operation, a comprehensive monitoring programme must be implemented to ensure that operation as well as maintenance of the Gas to Power project and its various components comply with relevant standards and all environmental, health and safety regulations. This monitoring programme must include scheduled / routine inspections of the avifauna utilising the sandspit, the adjacent shoreline and shrubland vegetation.
- It is also recommended that noise level measurements (submerged noise) are undertaken during operation to obtain a better undertaking of the noise impacts.
- In response to possible pollution as a result of Shipping activities:
    - Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way;
    - A requirement to report environmental accidents and emergencies immediately they occur, to the port captain;
    - A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future;
    - Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications; and
    - In the event of a spill, a penalty should be issued and the ‘polluter pays’ principle should be applied for clean-up operations and rehabilitation, if necessary.
- The intake(s) must be located in deep water, away from shallow intertidal and subtidal habitat.
- The intake(s) must be of appropriate design to reduce the uptake of macrofauna and larger organisms as much as possible (e.g., screens).
- The intake(s) should preferably be positioned within or adjacent to the disturbed shipping channel where fewer larger organisms are likely to be encountered.
- No discharging to the dead-end basin where water circulation is poor, but rather where water circulation by tidal flushing would be maximised and/or facilitated by vessel movement.
- Heated cooling water to be discharged as deep as possible, and away from shallow intertidal and subtidal habitat.

- Discharge pipeline must be well secured and regularly checked for damages or leaks
- Discharges must be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DWAF, 1995; DEA, 2018b) and/or other applicable international standards.
- Install silencers on exhaust stacks and turbo chargers, and all supporting plant and machinery.
- Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines.
- Powerships and supporting components must be fitted low emission light fittings.
- Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline.
- Lighting during night-time must be limited to essential lighting only.
- Biannual bird monitoring of species utilising the sandpit and Kabeljous Flats must be undertaken to assess any level of disturbance.
- Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths.
- Specialist personnel must be well trained on the standard protocols for preparation, coupling and decoupling of the gas pipeline between vessels.
- Comprehensive safety checks frequently undertaken of all project components and processes.
- Frequent risk assessments and adaptive management where required.

8.3.9 Marine Ecology Assessment

This study dealt with the proposed components of the project that are within the marine environment, namely the Powerships, the FSRU and the submerged gas pipeline.

It must be highlighted that the specialist had selected a different methodology for the assessment of impacts, as the specialist believes that it reflects the findings of this study more adequately.

Findings

The following activities are screened out of this assessment because it is assumed they will be adequately controlled in terms of the Port of Richards Bay's existing harbour rules, port reception facilities, vessel management practices, oil spill contingency plans and other relevant domestic law:

- regular discharge of vessel wastes;
- ballast water exchange procedures;
- vessel lighting;
- vessel collisions with marine fauna;
- anchoring (no release of concrete from anchoring blocks); and
- hydrocarbon leakages from vessels.

Furthermore, other constituents' discharge, such as biocides or brine, is not considered in this assessment. None of these will be added to the cooling water, according to the project description.

The gas pipeline construction and installation and vessel mooring will have a Very Low impact on the benthic community. The predicted impact is deemed to be 'negligible' or will probably be indistinguishable from natural background variations. The uptake of cooling water will have a Low impact on marine organisms in the surrounding water body, as there is no lasting effect on this sensitive receptor. The discharge of cooling water will have a Low impact on the marine ecology in the receiving water body, as it will have no lasting effect on the sensitive receptor i.e. plankton and benthic organisms.

LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life. Thus, LNG leakage is not assessed in this study.

Construction and Operational Phase Impacts

Impact 1: The effects of gas pipeline construction and installation and vessel mooring on the benthic community

There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. This will cumulatively contribute a small amount to suspended sediment from port maintenance dredging activities. Accordingly, combined with natural episodic high turbidity events, the local biological communities should be acclimatised to elevated turbidity levels.

The installation of the submerged gas pipeline will result in the modification of approximately 2.1% of the benthic community structure on site. Assuming colonization by indigenous fauna, this will represent a minor increase in benthos biodiversity in the project area. Furthermore, this is within an already compromised area of the port. Trace metal concentrations measured in sediment in the Berth 600 Basin, where the proposed floating power plant (FPP) will be located, showed that the area is highly contaminated compared to other port areas (CSIR 2018). This indicates that this area has already been disturbed by port activities. As a result, the macrofaunal density in the region of the proposed powership and FSRU location is relatively low, especially compared to the those in the mudflats and other areas less impacted by port activities such as the Bhizolo and Mzingazi canals (Vivier and Cyrus, 2014; CSIR, 2018; Izegaegbe et al. 2020). The benthic community in the proposed FPP development area is primarily dominated by polychaete worms, likely indicating that the site is already disturbed (Giangrande et al. 2005).

The impact's spatial scale will be site-specific with a minor intensity as natural ecological functions are hardly altered. The duration of the effects will be between 1 and 4 seasons (3 to 12 months) (medium). The frequency of the impact is once-off, i.e. during the installation of the pipeline and mooring systems. The probability of the impact is substantial, but lasting damage to the benthic community is extremely low due to the minimal spatial scale of disturbance and low macrofaunal density and likely reasonably rapid recovery. Accordingly, the assigned overall environmental significance rating is Very Low.

No mitigation measures are proposed as there will be no net loss of biological diversity. The mooring's concrete blocks will provide hard structures for the colonisation of benthic communities, which tends to increase biological diversity in the project area. The impacts will be reversed once the infrastructure is completely removed, and resettlement has occurred.

Impact 2: The effects of the uptake of cooling water on marine organisms in the surrounding water body

Seawater abstracted by the powerships will entrain small marine organisms such as holoplankton, meroplankton and ichthyoplankton from the surrounding water body condenser cooling systems. This will be coupled with the impingement or trapping of larger organisms against the screens used to prevent debris from being drawn into the cooling water intake. As entrained organisms pass through the pumps, they are exposed to collective hydrostatic pressure, shear forces, accelerative forces from changes in velocity and direction, and mechanical buffeting and collision against the pump mechanisms' hard surfaces. These can cause physical damage to marine organisms, significantly larger, more fragile species, resulting in death or incapacitation, the latter reducing their ability to escape predators post-discharge. Furthermore, the abstracted seawater receives excess heat and increases in temperature through the cooling process, inducing thermal stress on entrained organisms. Temperatures of the cooling water can be expected to increase by 15°C (ΔT) whilst in the system. Rapid temperature increases above ambient conditions can affect marine organisms' survival, growth, metabolism, morphology, reproduction, and behaviour. No chemical stress on organisms is predicted as no biocides, chemicals, or brine will be discharged.

Although the cooling water intake velocities are large (2.4 to 11.4 m3 /s), in comparison to the approximate total volume of water in the berth basin (>10million m3 ; site-specific area x average depth), volume intake per time by the powerships is low. Furthermore, larger organisms will likely swim away from intake pipes so that entrainment will have a negligible impact.

The impact's spatial scale will be site-specific with minor intensity as natural functions are hardly altered. The duration of the marine ecology's effects will be temporary as plankton biomass recovers quickly due to short generation times (~0.3/day). The frequency of the impact is continuous. The probability of the impact occurring is definite, but although some deleterious effects are expected, there will be little impact on natural processes in the context of site-specific scale. Accordingly, the assigned overall environmental significance rating is Low.

Impact 3: The effects of the discharge of cooling water on the marine ecology in the receiving water body

The discharge of cooling water to the surrounding water body generates chronic level effects on biota. These include alterations in growth, metabolism, respiration patterns and reproduction, and/ or influence ecosystem-level processes such as alterations of the amount of oxygen dissolved in seawater, which can be detrimental to marine life (Robinson 2013, Anchor 2015). The sensitive receptors comprise the ‘resident biota’, including mangrove communities, benthos on the sand and mudflats, fish larvae, and juvenile fish in the water column. Mudflats and sandflats support a high biological diversity level and are considered an important nursery ground for juvenile fish.

Each year millions of larval and juvenile marine fish migrate into the Port of Richards Bay to use it as a sheltered, food-rich nursery area. The key recruitment period is between late winter and early summer, i.e. August to November (Whitfield 1994, Wallace 1975). After some years of growing into adults, the marine fish swim back out to sea to spawn beyond the Natal Sandy Inshore eco-region. Sensitive receptors of concern regarding this impact are plankton, fish larvae and juveniles (unable to swim away), and benthic crustacean families since larger organisms such as fish can swim out of the thermal plume.

Effluent discharges to receiving marine water bodies need to comply with South African regulations. These require that, in marine and estuarine settings, water quality deterioration resulting from effluent discharges should not compromise beneficial uses of the water body. Marine and estuarine effluent discharges are guided by water quality guidelines (WQG) set by the Department of Water Affairs (DWAF 1995).

A three-dimensional (3D) hydrodynamic modelling study was undertaken by PRDW (2020) to predict the extent of the thermal plume generated by the powerships at the Port of Richards Bay. This assumed a worst-case scenario with the powerships running at 100% and environmental conditions including currents and ambient water temperature for winter and summer. The study uses ‘ecological thresholds’ for thermal discharges defined by DWAF (1995) and the World Bank (1998). These are described below: o ΔT = 3°C at 100 m from the discharge point (World Bank, 1998) o $\Delta T = 1°C$ at sensitive receptors or the edge of the mixing zone, which for discharges beyond the surf zone can be assumed 300 m from the discharge point (DWAF, 1995). The modelling results show that a smaller footprint of ΔT is achieved when discharging at a depth of 8 m below the water surface. Thus this is the recommended discharge depth. Discharging at this greater depth allows the thermal plume to entrain colder sub-surface ambient water as it rises to the surface, reducing the plume's temperature.

The thermal plume meets the World Bank guideline and the South African Marine Water Quality Guideline when the cooling water is discharged 8 m below the water surface. However, these thresholds are generic, and we recommend that the guideline of $\Delta T = 1°C$ at 100 m from the discharge point be applied. In this case, it would mean that thermal plume exceeds the recommended guideline by 0.3°C. Nevertheless, the absolute temperature of the plume did not exceed any of the biological thresholds detailed in section 3.4.3.1 and that, where exceedance of the guideline was observed (within 100 m), no ecologically sensitive habitats are present. Deleterious effects within the Zone of Initial Dilution (ZID) are expected, but these should be limited to non-acute levels. Therefore, the probability of damage to marine ecology if guidelines are met is extremely low outside of the ZID; within the ZID, a low level of damage could occur. Community structure may be changed, but ecological function should continue.

The impact's spatial scale will be site-specific with negligible intensity as natural functions should remain unaltered beyond the zone of initial dilution. The duration of the impact will be between 1 and 4 seasons, or 3 to 12 months (medium). This comprises rapid rates of plankton regeneration (Sommer, 2009), large sessile organisms, including mussels, being replaced over >6 months and large macrobenthos taking about 1 year. The frequency of the impact is continuous, and the probability is definite. Accordingly, the assigned overall environmental significance rating is Low.

Impact 4: The effects of increased noise and vibration levels on the surrounding marine ecology

This section provides information based on estimations of underwater noise from commercial ships. i.e. this is presented as a high-level, non-quantitative assessment.

The potential underwater noise and vibration impacts may arise from the following sources:

- Noise from the establishment of the berthing, gas reticulation and electrical reticulation infrastructure.
- Noise from the Power Ships, FSRU and LNG supply vessels (their engines, steam turbines, cooling fans and pumps). The noise will include audible, low frequency and infrasound.

The proposed FPP facility in the Port of Richards Bay is surrounded by important habitats such as the mangroves, intertidal and shallow subtidal mud and sand flats, the subtidal benthic zone and the water body itself. These areas could be impacted by the surface noise and the underwater noise from the vessel operations. Underwater noise from human activities is known to have a number of adverse effects on individual aquatic organisms. Effects may arise from exposure to brief high-level sounds and may include death, injury, permanent or temporary hearing impairment or those behavioural responses that may disrupt important life functions (Hawkins and Popper 2016). With longer exposures, chronic effects may occur, including developmental deficiencies and physiological stress (Popper and Hawkin 2016). These may affect life functions, including individual health and fitness, foraging efficiency, avoidance of predation, swimming energetics and reproductive behaviour (Hawkins and Popper 2016).

The sensitive receptors to noise within the Port of Richards Bay are fish and marine mammals. Invertebrates are not considered to be overly sensitive to underwater noise. Richards Bay acts as an essential nursery habitat for many fish species due to its sheltered and food-rich waters. Aggregations of juveniles are present in the area during key recruitment periods (August to November) (Whitfield 1994, Wallace 1975). Juveniles are considered more sensitive to noise disturbances as they are less mobile, while adult fish can move out of affected areas.

The report had concluded that there is not enough information about underwater noise and vibration levels from floating power plant ships to conduct an assessment. Therefore, general sound levels from commercial vessels were presented and the biological thresholds of sensitive receptors.

However, it was noted that the effects of underwater noise from FPP operations on marine ecology are unlikely.

Recommendations:

- The contractors laying the pipes and anchors should minimise the area of seabed disturbed.
- The FPP operator must ensure that water temperatures at 100 m from the discharge points are compliant with the Water Quality guideline ecological threshold. This will confirm the performance of the discharge system and the numerical model predictions.
- All records of discharge volumes and quality are to be kept for auditing purposes.

8.3.10 Climate Change Assessment

This study dealt with all the proposed components of the project, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships, the FSRU, LNGC and the submerged gas pipeline.

Findings

- The LNGC is potentially physically at-risk during transportation and mooring/operation from a climate change perspective considering the anticipated increase in frequency and intensity of extreme weather events such as hurricanes and tropical storms. Depending on the location of the LNG source, the LNGC vessel may suffer damage in the event of a severe storm *en route* to the Port of Richards Bay, or — to a lesser degree — within the port. Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-low significance without mitigation, and of Low significance with mitigation.
- Much like the LNGC, the FSRU is potentially at-risk from the expected increase in frequency and intensity of extreme weather events such as hurricanes and coastal storm surges, i.e., physical risks. The proposed location for the FSRU, which is understood to be permanently moored, is in the lee of the main port and therefore only marginally exposed to extreme wind and wave conditions. Consequently, physical climate change risk to the FSRU is considered to be of Medium-low significance without mitigation, and of Low significance with mitigation.
- During installation of the gas pipeline, a potential direct impact relates to infrastructural and/or equipment damage or failure in the event of a severe storm. The significance of this impact is, however, Low, since it is relatively easily mitigated to a significance rating of Very Low by restricting installation to suitable weather conditions. During operation, a Medium-rated impact may occur if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions. Under storm conditions, it is possible that the structures may lead to localised erosion and accretion on opposite sides of the pipeline fixtures which may endanger the pipeline by undercutting. Similarly, to the construction phase, this impact can be mitigated to a Low significance using the precautionary principle in design and installation of the pipeline.

- Operation of the Powerships is likely to result in impacts during mooring and operation, as well as activities related to connection to the FSRU and gas pipeline. Much like the LNGC and the FSRU, the Powership is potentially exposed to the expected increase in frequency and intensity of extreme weather events and the subsequent physical risks. Given the location of the Powership within the main port area, this impact is rated as Very Low with mitigation measures applied. Similarly, impacts concerning connection with the FSRU and pipeline are also rated Very Low with mitigation. A positive impact — rated High — of the Powership operations is the addition of 540MW of baseload electricity to the national grid.
- Direct climate change impacts concerning the transmission line project component include increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events. These impacts are expected during the operational phase and can be mitigated to a Low significance rating relatively easily.
- From a physical risk perspective, installation and construction of the towers is unlikely to have a direct impact of any significance. During operation, climate change-induced extreme weather events such as droughts are likely to raise the risk of wildfires, particularly if a severe storm damages the towers and/or the transmission lines. Drier conditions and subsequent changes in vegetation combustibility could raise the risk of ignition further in this scenario. Nonetheless, the significance rating of the abovementioned impact is Low without mitigation, and Very Low with mitigation.
- The primary direct impact of not implementing the proposed project relates to a missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
- From an emissions perspective, the Powership performs most efficiently when operating at full capacity. The fuel efficiency of the generators will be based on several factors including temperature/cooling, revolutions per minute (RPM), generating capacity, and load capacity. What becomes evident is the increased fuel efficiency of larger generators operating at full load capacity, as opposed to the smaller generators, or operating at lower load. GHG emissions per MW (CO_2e/MWh) at Richards Bay are lowest when operating at 100% contracted capacity (0.504 t/MWh net). At the maximum design capacity, there is a small increase in emission rates at 0.5044 CO_2e/MWh for Richards Bay. This rate is when operating at 114.6% of contracted capacity and delivering 515.9 MW Net.
- Given the 540MW generation capacity of the ships located at Richards Bay, the emissions from 100% capacity are 272.16t CO_2e.
- The 540MW capacity Powerships at Richards Bay are expected to emit ~857 Gg CO_2e annually, equivalent to ~0.17% of the annual CO_2e emissions of South Africa's gross greenhouse gas emissions in 2017. Over the 20-year project lifespan, emissions will be ~19 000Gg CO_2e, comprised of $C0_2$ (85.9%), followed by CH_4 (13.5%) and N_20 (0.6%).

Recommendations:

- Mitigating the potential direct impact of damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends during LNG transportation – utilize existing early-warning systems and international standard operating procedures for vessels operating in inclement weather, including evasive action where appropriate. Adherence to port safety regulations and emergency procedures.

- Mitigating the potential cumulative impact of emission of greenhouse gases with global warming potential - Implement technical measures to reduce fugitive emissions at source and during transfer to FSRU and consider contributions to appropriate carbon offset/drawdown initiatives.
- Mitigating the potential direct impact of damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends during FSRU mooring/operation - Adherence to port safety regulations and emergency procedures during mooring/operation.
- Mitigating the potential cumulative impact of fugitive emission of greenhouse gases with global warming potential - Quality and safety checks undertaken immediately after connection to ensure that connection point is secure. Regular inspection on the quality and integrity of the pipeline and connections to prevent fugitive emissions.
- Mitigating the potential direct impact of damage to the submerged gas pipeline from extreme weather - Adherence to port safety regulations and emergency procedures, particularly during construction/installation.
- Mitigating the potential cumulative impact fugitive emissions - The ship-to-ship transfer of LNG will be managed under an internationally-accredited process via trained personnel to ensure compliance and within clear quality, health and safety regulations. The fuel lines between the FSRU and the Powership will be via double walled with annular space being inerted and continuously purged with Nitrogen “N2” gas. A gas detector in-circuit will identify a leak, so that the fuel gas can be immediately isolated and shut off, the leak identified, and the necessary repairs or replacements made.
- The project is likely to increase local adaptive capacity, by providing local, on-demand energy generation from a less carbon-intensive source. The anticipated growth in gross geographic product (GGP) is therefore likely to indirectly increase the financial adaptive capacity of the greater Richards Bay area, at a Medium-high significance rating.
- Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols.
- Consider contribution to carbon offset initiative to account for value-chain emissions/embedded carbon.

8.3.11 Air Quality Assessment

Findings

Natural gas used for energy generation is primarily methane, with low concentrations of other hydrocarbons, water, carbon dioxide, nitrogen, oxygen and some sulphur compounds. Liquefied Natural Gas (LNG) is natural gas which has been cooled below its boiling point of minus 161 °C in a process known as liquefaction. The process of liquefaction involves extracting most of the impurities in raw natural gas. The remaining natural gas is primarily methane with only small amounts of other hydrocarbons and consequently is widely considered a clean fossil fuel.

The quantity and nature of emissions to the atmosphere from LNG combustion depends on the quality of the fuel, fuel consumption, the combustion device, and the air pollution control devices.

The combustion of LNG results in gaseous emissions of sulphur dioxide (SO_2), oxides of nitrogen ($NO + NO_2 = NO_X$), carbon monoxide (CO), and some particulate matter (PM). Carbon dioxide (CO_2) is the main Greenhouse Gas resulting from LNG combustion.

SO_2 is produced from the combustion of sulphur in the LNG. NO_X is produced from thermal fixation of atmospheric nitrogen in the combustion flame and from oxidation of nitrogen bound in the LNG. The quantity of NO_x produced is directly proportional to the temperature of the flame. The non-combustible portion of the fuel remains as solid waste and emitted as particulates.

Emissions result from the ship manoeuvring from the port entrance to the berth, and during the LNG transfer when berthed alongside the FSRU. Total annual emissions resulting from the Karpowership Project are listed in Table 8-1 below.

Source	SO_2	NO_X	PM_{10}
Powership 1 (Khan)	36.7	917.1	183.4
Powership 2 (Shark)	10.5	262.0	52.4
FSRU	7.0	174.7	34.9
LNG vessel	2.6	22.1	0.5
Total	**56.8**	**1376.0**	**271.3**

Table 8-1: Annual emissions from the Karpowership Project in t/a for LNG.

The maximum predicted annual SO_2, NO_2 and PM_{10} concentrations and the 99th percentile concentration of the 24-hour and 1-hour predicted concentrations are very low relative to the National Ambient Air Quality Standards (NAAQS), as per Table 8-2 below.

	SO_2		
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.07	0.34	0.94
NAAQS	50	125	350
	NO_2		
Predicted maximum NO_2	1.34		18.9
NAAQS	40		200
	PM_{10}		
Predicted maximum PM_{10}	0.33	1.72	
NAAQS	40	75	

Table 8-2: Maximum predicted ambient annual SO_2, NO_2 and PM_{10} concentrations in µg/m^3 and the predicted 99th percentile concentrations for 24-hour and 1-hour averaging periods, with the South African NAAQS.

Monitoring has shown ambient SO_2 concentrations to be relatively low in the Richards Bay and below the NAAQS. The cumulative effect of the contribution of SO_2 from the Karpowership Project is predicted to be very small and the potential increase in ambient SO_2 concentrations is highly unlikely to result in exceedances of the NAAQS.

The cumulative effect of the contribution of NO_2 from the Karpowership Project is predicted to be very small and the potential increase in ambient NO_2 concentrations is highly unlikely to result in exceedances of the NAAQS.

Monitoring has shown that ambient PM_{10} concentrations are relatively high because of high regional background concentrations from sources such as biomass burning, industrial activity, terrestrial dust and long-range atmospheric transport. The cumulative effect of the contribution PM_{10} from the Karpowership Project is predicted to be very small and the potential increase in ambient PM_{10} concentrations is highly unlikely to result in further exceedances of the NAAQS.

The combustion of gaseous fuel for steam production or electricity in a gas reciprocating engine with design capacity equal to or greater than 10 MW heat input per unit is a Listed Activity under Category 1: Combustion Installation, and sub-category 1.5: Reciprocating Engines. Minimum Emission Standards (MES) for gas reciprocating engines using gas are set for NO_X and particulates, but not for SO_2. The MES are shown in Table 8-3 below with the proposed emission concentrations for the Karpowership engines. It appears that emission standards are not prescribed for steam turbines with a capacity of less than 50 MW.

Substance or mixture of substances		**Subcategory 1.5**	**Karpowership**
		MES under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa.	
Common name	**Chemical symbol**		
Particulate matter	N/A	50	≤10
Oxides of nitrogen (expressed as NO_2	NO_X	400	≤ 50
Sulphur dioxide	SO_2	N/A	max 2

Table 8-3: Minimum Emission Standards in mg/Nm^3 for Reciprocating Engines (Subcategory 1.5) according to GN 248 248 (DEA, 2010) and its revisions (DEA, 2013, 2019), compared with emissions for Karpowership.

With low predicted ambient concentrations for SO_2 and PM_{10} the consequence of impacts is very low. The predicted ambient NO_2 are somewhat higher, but the consequence of the impact is low. The likelihood of occurrence of impacts associated with SO_2, NO_2 and PM_{10} is very low. Therefore, the significance of impacts resulting from the Karpowership Project is predicted to be very low. The consequence and likelihood scores listed in Table 8-4 for the Karpowership Project with the Project adding to existing ambient concentrations, showing the impact significance.

Description	**Pollutants**	**Consequence**	**Likelihood**	**Significance**	
				Score	**Rating**
Karpowership Project	SO_2	2	1	**2**	**Very low**
	NO_2	2.7	1	**2.7**	**Very low**
	PM_{10}	2	1	**2**	**Very low**
Cumulative assessment	SO_2	2	1	**2**	**Very low**
	NO_2	2.7	1	**2.7**	**Very low**
	PM_{10}	2	1	**2**	**Very low**

Table 8-4: Air quality impact scores.

A quantitative assessment for HFO has not been conducted. In a case where HFO is used rather than LNG, the resultant ambient SO_2, NO_2 and PM_{10} concentrations are likely to be low and well below the NAAQS, although they may be somewhat higher than for LNG. The spatial extent on any air quality impact is likely to be somewhat bigger than for LNG. The significance of any impacts associated with HFO is likely to be low to very low.

Recommendations

No mitigation measures were recommended.

From an air quality perspective, it is the reasoned opinion of the specialist-based on the findings of the Atmospheric Impact Report, that the Karpowership Project should be authorised.

8.3.12 Noise Quality Assessment

Findings

The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. The noise impact will be the most significant during calm meteorological conditions when little wind noise masking will occur, therefore the wind speed and direction was not considered in the modelling.

The field study results showed that the ambient noise levels in the area of the proposed development was 45 dB(A). Noise sensitive area (NSA) 2 Seafarer's Club (refer to figure 8-6) is approximately 520m away from the nearest major noise source (The Powership). Taking this distance and Table 8 into consideration, it can be inferred that NSA 2 will experience noise levels of 56.7 dB(A), which is lower than the SANS 10103 rating limits. Given that this is an industrial zone, there are several facilities that will also contribute to the ambient noise levels in the area. The receptor at NSA 2 will therefore experience no noise impact as the noise from construction will be masked by the ambient noise from the other port operations.

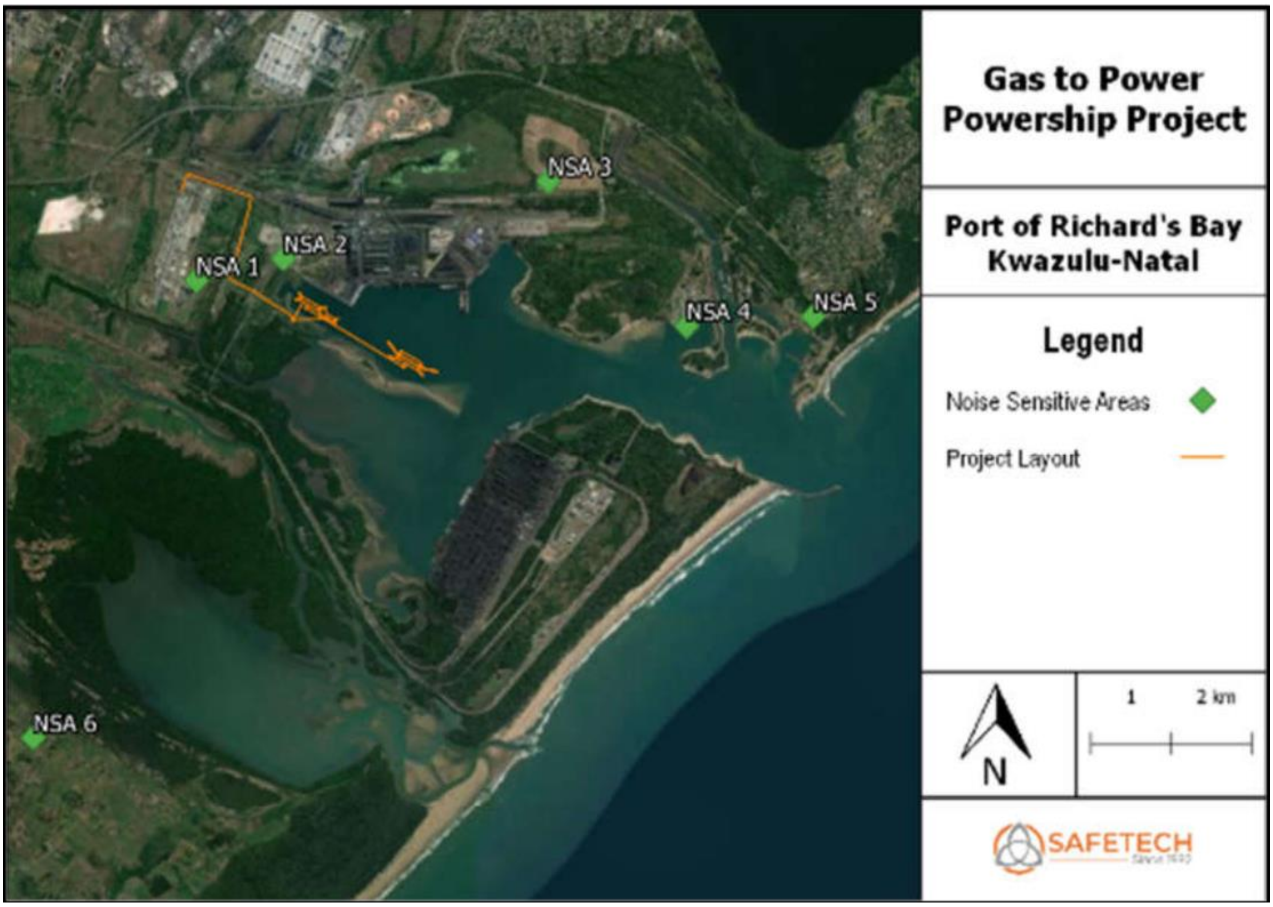

Figure 8-6: Noise Sensitive Areas.

In summary, for the construction phase it is unlikely that the construction noise will impact on the noise sensitive areas. With the effective implementation of the recommended mitigation measures, the residual noise impact associated with construction activities are predicted to be of very low significance.

The results of the noise impact assessment of the proposed Gas to Power - Powership Project within the Port of Richard's Bay shows that at all but one of the terrestrial receptors (NSA 2- the Seafarer's Club), the SANS 10103:2008 rating limits will not be exceeded. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation. The construction related noise impacts will be of Very- Low significance.

Recommendations

- The noise impacts are re-modelled when the final design of the infrastructure and methods of construction is determined. This will enable extra noise mitigation measures to be determined before the equipment is finally installed.
- A separate study should be considered to determine the impact on the marine environment. This should include the impact of anthropogenic noise on the protected species within the Richard's Bay Nature Reserve, as well as the underwater noise impacts.
- Periodic noise measurements are taken during the construction and operational phases.
- A long-term hydrophone system is installed in the vicinity of the FSRU, LNGC berth, harbour entrance and other sensitive areas in Richards Bay to determine the current underwater noise environment.

Further mitigations are recommended:

- As a precautionary measure piling should not occur at night. Piling should only occur during the day to take advantage of unstable atmospheric conditions.
- All construction operations should only occur during daylight hours if possible.
- All staff on the construction project should receive training to mitigate the noise impacts, such as switching off vehicles when not in use, location of Noise sensitive areas etc.
- The ambient noise around the project and at the closest receptors be monitored during the construction phase.

8.3.13 Cultural Heritage (including Archaeology) and Palaeontology

Findings

No cultural heritage sites were identified for both alternatives of the transmission line and the terrestrial laydown area for the installation of the subsea pipeline.

In respect of natural heritage, the area in which the approved site is located is of low to medium palaeontological sensitivity. Cretaceous deposits, that occur 3m – 5m below the surface, were noted during the harbour expansion project. The proposed Karpowership project will not reach these depths and each transmission line pole will pose a small area of impact.

No mitigation for heritage impacts is thus required.

If any shell layers are affected during the course of construction, KZN Amafa & Research Institute (KZNARI) must be informed immediately. This will not delay the construction since the material would already be exposed and on the surface. It will be merely to assess the deposits.

8.3.14 Major Hazards Installation (MHI) Risk Assessment

Findings

The MHI Risk Assessment established that an incident involving the Gas to Power Project at the Port of Richards Bay could impact on the neighbouring berths. The risks associated with this MHI were found to be acceptable.

The main risk attributed to the operation of the Powerships is the possible rupture of one of the gas transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting, leading to a flash and pool fire, considered as a High impact. The risks were found to be acceptable for the Gas to Power Operations.

No person within the port area is exposed to a risk greater than 1.0e-06 (one in a million) and ship staff is exposed to a risk of no more than 1.0e-05 (one in a hundred thousand). These risks are considered to be acceptable for persons operating in a national port.

Recommendations

The following measures are recommended to reduce the risks associated with the Powership installation on the site:

- Good housekeeping must always be observed on site;
- Inspection on the quality and integrity of the pipeline;
- Only suitably qualified people must be used for all installation work;
- An accredited installer must conduct a pressure test and provide the relevant compliance certificates.
- There must be an operational manual for each operation;
- An Emergency Plan must be developed and sent to the City of uMhlathuze Disaster Management department for comment and the formulation of action plans;
- Risk reduction programmes should continually be investigated to reduce the impact from accidental fires and explosions on surrounding communities.

8.3.15 Socio-Economic Assessment

Findings

The proposed Powerships and their associated infrastructure will generate both positive and negative impacts starting from the construction period and ending with the decommissioning phase. Many of the positive impacts will be concentrated in the local and national economies, creating a potential imbalance with the potential negative impacts that would exclusively be concentrated at a local level.

It is anticipated that there would be no impact on the recreational fishing and small crafts community for the Powership and FSRU are to be semi-permanently moored for 20 years in the same location in the protected waters deep within the Port of Richards Bay. The mooring site is more than 3 kilometres from the Tourism Precinct area. The vessels will be positioned in unused areas of the Port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time. The recreational activities are all positioned towards the Port entrance and will be unaffected by the Powerships.

Naval Island, Pelican Island and Alkantstrand beach form a tourism node at the Richards Bay Port Harbour Entrance. Given the mooring position of the Powerships and FSRU it is unlikely that the tourism agenda of Richards Bay will be affected. Furthermore, all current recreational and tourist activities are already in an area utilised by operating ships and as such it is unlikely that the Powerships will have a significant lasting impact on these activities.

No fatal flaws were identified, and from a socio-economic perspective, the proposed development is acceptable and will have a predominately positive impact on the socio-economic environment and should therefore be authorised.

Construction Phase Impacts

During the construction phase, the proposed Powerships and their associated infrastructure will have both positive and negative effects on the socio-economic environment.

The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R849.7 million of new business sales, R242.9 million of GDP and 1 001 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings by R115.9 million. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

The project may, however, also create negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows.

Operational Phase Impacts

During the operation of the proposed Powerships and their associated infrastructure, the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects.

The operation of the proposed Powerships and their associated infrastructure will generate R528.1 million of new business sales, contribute R320.7 million to GDP and create 288 sustainable FTE employment positions. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities.

Negative impacts include the potential changes in the sense of place. These potential losses, if they do occur, are likely to be small, given the industrial nature of the proposed development area. As in the case with the impacts observed during construction, negative effects can be mitigated (although not entirely eradicated), and positive impacts enhanced.

The assessment of the Powerships and their associated infrastructure, or its net effect from a socio-economic perspective, indicates that the development would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of their establishment.

Stimulation of production, employment, government revenue, skills development, household income, increased electricity supply, and socio-economic and enterprise development as a result of the investment in the project and its subsequent operations will outweigh possible production, employment and household income losses that could potentially be experienced by local businesses affected by changes in the areas sense of place, social conflicts and deterioration in economic and social infrastructure. Adherence to the proposed mitigation measures, however, would ensure that the offset of impacts is more balanced and that it also takes into account communities and businesses that will be negatively affected.

The positive effects generated by the project will not entirely offset all the negative impacts. These include impacts on the sense of place, and economic infrastructure that could occur during both construction and operational phases. These impacts though will affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings.

This means that when compared with the no-go option – which entails the Powerships and their associated infrastructure not being deployed, and none of the positive or negative impacts identified arising– the proposed project is associated with greater socio-economic benefits and should be authorised.

Recommendations

Potential negative impacts can largely be mitigated, and their significance reduced. The minimal visual impacts anticipated, however, cannot be fully eliminated although their significance is low as the surrounding area is industrial in nature and relatively far from residential areas.

Mitigation / Enhancement Measures – Pre-Construction and Construction Phase

- The developer should encourage the contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies.
- The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers where feasible.
- Organise local community meetings to advise the local labour force about the project that is planned to be established and the jobs that can potentially be applied for.
- Establish a local skills desk (in uMhlathuze LM) to determine the potential skills that could be sourced in the area.
- Employment of labour-intensive methods in construction where feasible.
- Sub-contract to local construction companies particularly SMMEs and BBBEE compliant and women-owned enterprises where possible.
- Use local suppliers where feasible and arrange with the local SMMEs to provide transport, catering and other services to the construction crews.
- Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases.
- Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.
- Recruit local labour as far as feasible to increase the benefits to the local households.
- Set up a recruitment office in Richards Bay and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment.
- Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence.

- Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area.
- Ensure that any damages or losses to nearby buildings that can be linked to the conduct of construction workers are adequately reimbursed.
- Assign a dedicated person to deal with complaints and concerns of affected parties.
- Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site.
- Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers.
- Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.

Mitigation / Enhancement Measures – Operational Phase

- The operator of the Powerships and related infrastructure should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.
- Where possible, local labour should be considered for employment to increase the positive impact on the local economy.
- As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and related infrastructure.
- The developer should consider establishing vocational training programmes for the local labour force to promote the development and transfer of skills required by the Powerships and their related infrastructure and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.
- A social development and economic development programme should be devised by the developer throughout the project's lifespan.
- The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits and should be reviewed on an annual basis and, where necessary, updated.
- When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises.
- In devising the programmes to be implemented, the developer should take into account the priorities set out in the local IDP.

8.4 IMPACT ASSESSMENT FINDINGS

Assessment of the significance of each impact, risk and an indication of the extent to which the issue and risk can be avoided or addressed by the management actions.

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in this section and Appendix C, the latter containing the detailed workings (severity, duration, extent, frequency, probability, significance ratings) used to determine the overall significance presented in the tables below.

The following potential impacts have been considered in the EIA Phase for the proposed project:

8.4.1 Terrestrial Ecological Impacts

8.4.1.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

Construction activities related to the transmission line, substation and laydown area will have Medium-Low to High impacts on loss of vegetation communities, loss of Species of Special Concern, biodiversity, ecosystem function and process. These Medium-Low to High impacts identified for the construction phase can be mitigated to Low and Very Low significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission line and laydown areas	Loss of modified vegetation	Medium-Low	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas). No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion.	Low
Construction of transmission line where it crosses natural habitat between the harbour	Loss of reed beds	Medium-High	In wetland areas including reed beds, the construction of berms should be avoided as far as possible. Construction measures must consist of the least impactful individual erection of monopole structures. No servitudes should be cleared or maintained in this area. No construction or storing of materials should be located outside of the defined construction	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
arterial road and the railway line			area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the degraded habitat areas where these will be left natural in the future even after planned port expansion.	
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of bushveld	Medium-Low	In natural areas, the construction of a servitude should be avoided wherever possible. Construction measures must consist of the least impactful individual erection of monopole structures. No servitudes should be cleared or maintained in this area. No construction or storing of materials should be located outside of the defined construction area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.	Very Low
Construction of the transmission line, laydown area and switching station	Loss of Species of Conservation Concern including, but not limited to mangrove trees and the orchid *Eulophia speciosa*	High	Construction measures must consist of the least impactful individual erection of monopole structures and all protected species avoided where possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. A full site walk-through should be conducted in the summer prior to any construction activities to list all SSC and associated permits should be obtained for their removal or transplantation. All SCC must be compensated for at a ratio of at least 3:1 either in gardens or as part of restoration and conservation efforts within the Richards Bay IDZ.	Low
INDIRECT IMPACTS				
Construction of the transmission line, laydown area and switching station	Loss of biodiversity in general	Low	Boundaries should be strictly maintained, and impacts retained within the boundary of the site. Alien species should be controlled. Areas of indigenous vegetation should be incorporated into the open space management plan of the IDZ in conjunction with Transnet where practicable. As frogs can be excellent indicators of habitat quality and disturbance, it is recommended that regular amphibian surveys be conducted as part of a monitoring plan for the Karpowership site and Transnet port area as a whole.	Very Low
Loss of dispersal, pollination and gene issues during construction	Fragmentation	Medium-High	The majority of the indigenous vegetation should be maintained as a part of the open space and managed for conservation if possible, in partnership with Transnet and the IDZ. Boundaries of the site should be adhered to, and no additional loss of vegetation should occur. Alien species within the site should be controlled. The land beneath the transmission line, and any other areas required for construction, but not for the operational phase, should be rehabilitated with indigenous species to retain connectivity within the system.	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Construction of transmission line, laydown area and switching station	Invasion of alien species	High	The area of construction and operation should be demarcated, and personnel not allowed to use the surrounding natural vegetation. Any existing and new alien species must be removed as soon as possible after emergence. An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.	Very Low

8.4.1.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

Similar to the construction phase, the operational activities related to the transmission line, substation and laydown area will have Medium-Low to Medium-High impacts on loss of vegetation communities, loss of Species of Special Concern, biodiversity, ecosystem function and process. Although the anticipated duration of these impacts will be over a longer duration, these Medium-Low to Medium-High impacts can be mitigated to Low and Very Low significance.

Given the fact that the alternative transmission line route traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest, both of extremely high sensitivity which constituted a fatal flaw for this route. The alternative route was therefore not considered as an option, and impact ratings was only undertaken for the preferred route, laydown area and switching station. The preferred route is recommended as the best route for lowest impacts to terrestrial habitats. The alternative route is not recommended as it impacts on Critically Endangered habitats.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission line and laydown areas	Loss of modified vegetation	Medium-High	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas). No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of reed beds	Medium-High	In wetland areas including reed beds, the construction of berms should be avoided as far as possible. Construction measures must consist of the least impactful individual erection of monopole structures. No servitudes should be cleared or maintained in this area. No construction or storing of materials should be located outside of the defined construction area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the degraded habitat areas where these will be left natural in the future even after planned port expansion.	Low
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of bushveld	Medium-High	In natural areas, the construction of a servitude should be avoided wherever possible. Construction measures must consist of the least impactful individual erection of monopole structures. No servitudes should be cleared or maintained in this area. No construction or storing of materials should be located outside of the defined construction area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.	Low
Construction of the transmission line, laydown area and switching station	Loss of Species of Conservation Concern including, but not limited to mangrove trees and the orchid *Eulophia speciosa*	Medium	Construction measures must consist of the least impactful individual erection of monopole structures and all protected species avoided where possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. A full site walk-through should be conducted in the summer prior to any construction activities to list all SSC and associated permits should be obtained for their removal or transplantation. All SCC must be compensated for at a ratio of at least 3:1 either in gardens or as part of restoration and conservation efforts within the Richards Bay IDZ.	Low
INDIRECT IMPACTS				
Construction of the transmission line, laydown area and switching station	Loss of biodiversity in general	Low	Boundaries should be strictly maintained, and impacts retained within the boundary of the site. Alien species should be controlled. Areas of indigenous vegetation should be incorporated into the open space management plan of the IDZ in conjunction with Transnet where practicable.	Low
Loss of dispersal, pollination and gene issues during construction	Fragmentation	Medium	The majority of the indigenous vegetation should be maintained as a part of the open space and managed for conservation if possible, in partnership with Transnet and the IDZ. Boundaries of the site should be adhered to, and no additional loss of vegetation should occur. Alien species within the site should be controlled. The land beneath the transmission line, and any other areas required for construction, but not	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			for the operational phase, should be rehabilitated with indigenous species to retain connectivity within the system.	
Construction of transmission line, laydown area and switching station	Invasion of alien species	Medium-Low	The area of construction and operation should be demarcated, and personnel not allowed to use the surrounding natural vegetation. Any existing and new alien species must be removed as soon as possible after emergence. An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.	Very Low

8.4.2 **Avifaunal Impacts**

The site is mostly of low sensitivity due to the wide distribution of modified and degraded habitats and the alignment of the transmission line route with existing infrastructure. This places the route primarily within transformed or modified habitat, resulting in little overall loss of avifauna habitat. Impacts are Moderate and can be reduced to low with the recommended mitigation measures.

8.4.2.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

The impact of the loss of habitat will be long-term, of local extent and definite, with a low severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the medium term, with a significance of low negative. The impact of disturbance to birds and nests will be short-term, of local extent and definite, with a high severity resulting in a high negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative. The impact of poaching will be short-term, of minor extent and probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to an improbable minor impact over the short term, with a significance of low negative. The impact of roadkill will be short-term, of local extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission line	Loss of habitat (destruction, degradation and fragmentation)	Medium-High	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas). Construction of the transmission lines should, wherever possible in natural vegetation, make use of existing servitudes, berms etc. Where none exist, each monopole should be individually placed and the clearance of a servitude avoided wherever possible. No construction or storing of materials should be located outside of the defined layout area.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion. A walk-though must be done prior to construction to locate any nests, especially of any Species if Conservation Concern, which then should be dealt with on a case-by-case basis by an avifauna specialist.	
Noise, vibration, dust and light during the construction phase	Disturbance of birds, particularly nests	Medium-High	Construction should take place once the chicks have left the African Fish Eagle nest and the nest is abandoned. In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas). Construction of the transmission lines should, wherever possible in natural vegetation, make use of existing servitudes, berms etc. Where none exist, each monopole should be individually placed and the clearance of a servitude avoided wherever possible. Where possible, mowing of any servitude or berm areas should be avoided. Construction should be timed to avoid breeding periods and movement times. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion. A walk-though must be done prior to construction to locate any nests, especially of any Species if Conservation Concern, which then should be dealt with on a case-by-case basis by an avifauna specialist.	Low
Poaching	Collection of eggs and killing or collecting of birds	Low	Construction should be timed to avoid breeding periods and movement times. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Induction should include clear dangers of poaching.	Very Low
Movement of construction vehicles and site visitors	Potential roadkill of birds including Species of Conservation Concern	Medium	No off-road driving should be allowed, and only designated roads used for site and monopole access. Speed limits should be posted and not exceed 40km/hr, especially at night when nocturnal and crepuscular species tend to rest on roads.	Low

8.4.2.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

The impact of the loss of habitat will be long-term, of minor extent and definite, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative. The impact of disturbance to birds and nests will be long-term, of minor extent and probable, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative. The impact of poaching will be long-term, of minor extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable moderate impact over the short term, with a significance of low negative. The impact of roadkill will be long-term, of local extent and probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative. The impact of collisions will be long-term, of regional extent and probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a low impact over the long term, with a significance of moderate negative. The impact of electrocution will be long-term, of local extent and probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of transmission line	Loss of habitat (destruction, degradation and fragmentation)	Medium-High	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas (except modified areas). Construction of the transmission lines should, wherever possible in natural vegetation, make use of existing servitudes, berms etc. Where none exist, each monopole should be individually placed and the clearance of a servitude avoided wherever possible. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion. A walk-though must be done prior to construction to locate any nests, especially of any Species if Conservation Concern, which then should be dealt with on a case-by-case basis by an avifauna specialist.	Low
Noise, vibration, dust and light during maintenance	Disturbance of birds, particularly nests	Low	Where possible, mowing of any servitude or berm areas should be avoided. Maintenance should be timed to avoid breeding periods and movement times. No maintenance or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the maintenance footprint as small as possible.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Karpowership should, in conjunction with Transnet, develop and implement a rehabilitation plan for the modified habitat areas where these will be left natural in the future even after planned port expansion.	
Poaching during maintenance work	Collection of eggs and killing or collecting of birds	Medium-Low	Construction should be timed to avoid breeding periods and movement times. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Induction should include clear dangers of poaching.	Low
Movement of maintenance vehicles and site visitors	Potential roadkill of birds including Species of Conservation Concern	Medium-High	No off-road driving should be allowed, and only designated roads used for site and monopole access. Speed limits should be posted and not exceed 40km/hr, especially at night when nocturnal and crepuscular species tend to rest on roads.	Low
Birds flying along possible flight paths between the river, canals, associated mangroves, reedbeds, swamp forests and bushveld	Collisions with the transmission lines	Medium	The design of the lines must be in line with Eskom-EWT guidelines for transmission lines. Power lines must be marked with flags to increase the likelihood that at risk species will see the lines. New lines should be monitored monthly for a year to determine avifaunal mortality as a result of collisions and adaptive management techniques put in play to reduce impacts, or confirmation of low mortality levels.	Medium-Low
Birds flying along possible flight paths between the river, canals, associated mangroves, reedbeds, swamp forests and bushveld	Electrocution of birds	Medium-High	The transmission line must be constructed according the Eskom and EWT guidelines for such infrastructure. Bird guards should be placed on monopoles where there is a risk of electrocution through shorting circuits. Monitoring must be done to determine the rate of electrocution, as well as which species are affected. Monopoles and lines must be regularly checked for any faults that may result in increased risk of electrocution.	Low

8.4.2.3 Impact assessment findings (with and without mitigation): Powership Alternatives 1 and 2: Operational Phase

The impact of loss of habitat will be long-term, of local extent and probable, with a low severity resulting in a low negative overall significance. The impact of disturbance of birds through light pollution, noise and vibration will be long-term, of local extent and probable, with a moderate severity resulting in a moderate negative overall significance. No mitigation measures are recommended at this time, as it is unlikely that this impact can be mitigated, though monitoring is required.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Erosion, changes to the sedimentation regime and sand spit associated with the portion of the bay	Loss of habitat	Low	The beaches, sedimentation and erosion must be monitored for changes over time. Ideally a baseline should be gathered to determine the effects of the powership independent of existing ships in the area. As birds do not use this habitat extensively, and little can be done at this stage due to planned port expansion, this impact is not possible to mitigate at this stage.	N/A
Operation of the powership and associated infrastructure	Disturbance of birds (light pollution, noise, vibration)	Medium-Low	The disturbance of birds must be monitored for changes over time. Ideally a baseline should be gathered to determine the effects of the powership independent of existing ships in the area. Thereafter ongoing monitoring should be done.	N/A

8.4.3 Wetland Impacts

The DWS Risk Assessment Matrix concluded that several aspects of the proposed development did not have the ability to be mitigated from a moderate to low risk rating.

8.4.3.1 Impact assessment findings (with and without mitigation): Transmission Line Alternative 1: Construction Phase

The clearing of vegetation, construction of the transmission line and laydown area for the gas pipeline installation within the wetlands will have direct Medium impacts on wetland resources. These impacts can only be mitigated Medium-Low and Medium impacts.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Demarcation of buffer zones and no-go areas and the allocation/preparation of spoil sites (topsoil separate from subsoil), waste dump sites and construction vehicle routes during the pre-construction and construction phases.	Disruption of the soil profile and thus creation of excess sediment in the catchment; Potential noise and air pollution as a result of onsite waste dump sites; The potential increase of preferential drainage parts as a result of construction vehicles creating unauthorised pathways; Compaction of topsoil as a result of construction vehicles baring excess weight on soil. Removed topsoil and subsoil which will be utilised for rehabilitation purposes	Medium	Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development which are given authorization to be utilised to reduce the siltation to the downstream wetlands. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the wetlands. Silt traps must be erected at the base of the slopes leading into the downstream wetlands and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the terrestrial and wetland areas must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential.	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
	contaminated by AIPs and loss due to natural wind mechanism.		All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and wetlands (e.g. stormwater flowing into the wetlands). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	
Construction vehicle movement throughout the lifespan of the proposed development during the pre-construction and construction phases.	Increased surface runoff and reduction in soil infiltration/permeability; Potential increase in risk of contamination of downstream watercourses due to oil leakages from construction vehicles; Compaction of topsoil by construction vehicles in the catchment; Potential creation of preferential drainage paths by construction vehicles coupled with heavy rainfall events; Potential increase in opportunity for erosional and depositional features to form; Potential for AIP to encroach if not maintained.	Medium-Low	Limit the movement of heavy construction vehicles on access roads created in wetland environments. All temporary access roads created for vehicular movement must be reinstated to natural environmental condition. Any erosional and depositional features must be reinstated and removed, respectively, especially from wetland environments. AIP must be removed during the constructional and operational phases of project. Areas where bare ground exist, must be re-vegetated with indigenous vegetation native to the area.	Low
Direct destruction of vegetation and topsoil layer within the footprint of the proposed Overhead Powerlines and temporary stringing yard during the pre-construction and construction phases (Overhead powerlines).	Disruption of the soil profile and thus potential sedimentation of watercourse; Increased risk of erosion due to exposure of bare-ground and reduced soil cohesion; Reduction in infiltration and increased risk of gully and rill erosion within watercourse; Fatality of in-situ sedentary organism unable to relocate; Potential relocation of avifaunal and faunal species unable to stand disturbances of the area; Potential increase in proliferation of AIPs	Medium	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.,	Medium Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Construction of the 132kV Overhead Lattice Steel Structure during the pre-construction and construction phases	Potential contamination of the surrounding terrestrial by concrete mix or hydrocarbons; Potential sedimentation of down slope watercourses; Increased hardened surfaces and thus higher energy surface and stormwater runoff into the down slope watercourses; Loss of habitat for species within watercourses and surrounding catchment; Potential contamination of sediment and groundwater due to continuous cement spills and poor construction ethics. Potential diversion of the natural flow of water during rainfall events. Potential loss of water being transported to downstream watercourses.	Medium	Existing access roads and areas where existing overhead powerlines have been built must be utilised, only those areas that do not have existing linear infrastructure can be disturbed for the newly introduced overhead powerlines. A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. Clearance of vegetation must be kept to a minimal within the wetland areas. The use of heavy construction vehicles within a wetland must not occur where possible. All excavated topsoil and subsoil from the wetland must be stockpiled separately and reinstated in the order of subsoil and topsoil once construction activities are completed. Stockpiled wetland subsoil and topsoil must not contain any AIPs when being reinstated. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Medium
Construction and installation of the gas pipeline during the construction phase	Potential sedimentation of down slope watercourses; Increased hardened surfaces and thus higher energy surface and stormwater runoff into the down slope watercourses; Loss of habitat for species within watercourses and surrounding catchment; Potential contamination of sediment and groundwater due to continuous cement spills and poor construction ethics. Potential diversion of the natural flow of water during rainfall events. Potential loss of water being transported to downstream watercourses.	Medium	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. Clearance of vegetation must be kept to a mininal within the wetland areas. The use of heavy construction vehicles within a wetland must not occur where possible. All excavated topsoil and subsoil from the wetland must be stockpiled seperately and reinstated in the order of subsoil and topsoil once construction activities are completed. Stockpiled wetland subsoil and topsoil must not contain any AIPs when being reinstated. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Medium
INDIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Establishment of a construction site camp and erection of ablution facilities within a previously disturbed area, 50m away from any delineated watercourses during the pre-construction and construction phases.	Potential encroachment by AIPs; Potential destruction of native and/or indigenous plant species in the catchment; Disruption to soil profile and consequent creation of excess sediment in the catchment; Compaction of the soil profile in the catchment; Potential alteration to the physcio-chemical properties of the downstream watercourses due to input of foreign material and excess sediment from catchment; Potential pollution of groundwater and surrounding watercourses if erected ablution facilities are poorly maintained.	Low	Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development which are given authorization to be utilised to reduce the siltation to the downstream wetlands. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the wetlands. Silt traps must be erected at the base of the slopes leading into the downstream wetlands and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the terrestrial and wetland areas must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and wetlands (e.g. stormwater flowing into the wetlands). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	Low
Establishment of a construction site camp for the installation of the gas pipeline during the pre-construction phase.	Potential encroachment by AIPs; Potential destruction of native and/or indigenous plant species within FP03; Disruption to soil profile and consequent creation of excess sediment; Compaction of the soil profile within FP03; Potential alteration to the physcio-chemical properties of FP03 due to input of foreign material and excess sediment; Potential creation and exacerbation of	Low	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
	erosional and depositional features.			

8.4.3.2 *Impact assessment findings (with and without mitigation): Transmission Line Alternative 2: Construction Phase*

For the Alternative 2 of the Transmission line, the impacts will be higher because of the transmission line traversing the sensitive swamp forest (FP02). Due to the sensitivity of this area, the impacts of the Medium-High activities of vegetation clearance and construction of the Overhead Transmission Line can only be mitigated to Medium impacts. Furthermore, this Alternative 2 route alignment crosses more wetland units than the Alternative 1 route, and will therefore have a larger footprint of impact. It is for these reasons that the wetland specialist does not support this route.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Demarcation of buffer zones and no-go areas and the allocation/preparation of spoil sites (topsoil separate from subsoil), waste dump sites and construction vehicle routes during the pre-construction and construction phases.	Disruption of the soil profile and thus creation of excess sediment in the catchment; Potential noise and air pollution as a result of onsite waste dump sites; The potential increase of preferential drainage parts as a result of construction vehicles creating unauthorised pathways; Compaction of topsoil as a result of construction vehicles baring excess weight on soil. Removed topsoil and subsoil which will be utilised for rehabilitation purposes contaminated by AIPs and loss due to natural wind mechanism.	Low	Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development which are given authorization to be utilised to reduce the siltation to the downstream wetlands. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the wetlands. Silt traps must be erected at the base of the slopes leading into the downstream wetlands and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the terrestrial and wetland areas must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and wetlands (e.g. stormwater flowing into the wetlands). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	
Construction vehicle movement throughout the lifespan of the proposed development during the pre-construction and construction phases.	Increased surface runoff and reduction in soil infiltration/permeability; Potential increase in risk of contamination of downstream watercourses due to oil leakages from construction vehicles; Compaction of topsoil by construction vehicles in the catchment; Potential creation of preferential drainage paths by construction vehicles coupled with heavy rainfall events; Potential increase in opportunity for erosional and depositional features to form; Potential for AIP to encroach if not maintained.	Medium-Low	Limit the movement of heavy construction vehicles on access roads created in wetland environments. All temporary access roads created for vehicular movement must be reinstated to natural environmental condition. Any erosional and depositional features must be reinstated and removed, respectively, especially from wetland environments. AIP must be removed during the constructional and operational phases of project. Areas where bare ground exist, must be re-vegetated with indigenous vegetation native to the area.	Low
Direct destruction of vegetation and topsoil layer within the footprint of the proposed Overhead Powerlines and temporary stringing yard during the pre-construction and construction phases (Overhead powerlines).	Disruption of the soil profile and thus potential sedimentation of watercourse; Increased risk of erosion due to exposure of bare-ground and reduced soil cohesion; Reduction in infiltration and increased risk of gully and rill erosion within watercourse; Fatality of in-situ sedentary organism unable to relocate; Potential relocation of avifaunal and faunal species unable to stand disturbances of the area; Potential increase in proliferation of AIPs	Medium-High	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.,	Medium

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Construction of the 132kV Overhead Lattice Steel Structure during the pre-construction and construction phases	Potential contamination of the surrounding terrestrial by concrete mix or hydrocarbons; Potential sedimentation of down slope watercourses; Increased hardened surfaces and thus higher energy surface and stormwater runoff into the down slope watercourses; Loss of habitat for species within watercourses and surrounding catchment; Potential contamination of sediment and groundwater due to continuous cement spills and poor construction ethics. Potential diversion of the natural flow of water during rainfall events. Potential loss of water being transported to downstream watercourses.	Medium-High	Existing access roads and areas where existing overhead powerlines have been built must be utilised, only those areas that do not have existing linear infrastructure can be disturbed for the newly introduced overhead powerlines. A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. Clearance of vegetation must be kept to a minimal within the wetland areas. The use of heavy construction vehicles within a wetland must not occur where possible. All excavated topsoil and subsoil from the wetland must be stockpiled separately and reinstated in the order of subsoil and topsoil once construction activities are completed. Stockpiled wetland subsoil and topsoil must not contain any AIPs when being reinstated. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Medium
Construction and installation of the gas pipeline during the construction phase	Potential sedimentation of down slope watercourses; Increased hardened surfaces and thus higher energy surface and stormwater runoff into the down slope watercourses; Loss of habitat for species within watercourses and surrounding catchment; Potential contamination of sediment and groundwater due to continuous cement spills and poor construction ethics. Potential diversion of the natural flow of water during rainfall events. Potential loss of water being transported to downstream watercourses.	Medium	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. Clearance of vegetation must be kept to a mininal within the wetland areas. The use of heavy construction vehicles within a wetland must not occur where possible. All excavated topsoil and subsoil from the wetland must be stockpiled seperately and reinstated in the order of subsoil and topsoil once construction activities are completed. Stockpiled wetland subsoil and topsoil must not contain any AIPs when being reinstated. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Medium
INDIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Establishment of a construction site camp and erection of ablution facilities within a previously disturbed area, 50m away from any delineated watercourses during the pre-construction and construction phases.	Potential encroachment by AIPs; Potential destruction of native and/or indigenous plant species in the catchment; Disruption to soil profile and consequent creation of excess sediment in the catchment; Compaction of the soil profile in the catchment; Potential alteration to the physico-chemical properties of the downstream watercourses due to input of foreign material and excess sediment from catchment; Potential pollution of groundwater and surrounding watercourses if erected ablution facilities are poorly maintained.	Medium-Low	Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development which are given authorization to be utilised to reduce the siltation to the downstream wetlands. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the wetlands. Silt traps must be erected at the base of the slopes leading into the downstream wetlands and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the terrestrial and wetland areas must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and wetlands (e.g. stormwater flowing into the wetlands). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Establishment of a construction site camp for the installation of the gas pipeline during the pre-construction phase.	Potential encroachment by AIPs; Potential destruction of native and/or indigenous plant species within FP02 and FP03; Disruption to soil profile and consequent creation of excess sediment; Compaction of the soil profile within FP02 and FP03; Potential alteration to the physcio-chemical properties of FP02 and FP03 due to input of foreign material and excess sediment; Potential creation and exacerbation of erosional and depositional features.	Medium-Low	A Wetland Rehabilitation and Monitoring Plan must be drafted and followed in order to reinstate the area to be disturbed. All areas in which erosional and depositional features have formed must be reinstated to its natural condition. Temporary access roads must be reinstated to the natural environmental condition. AIP encroachment must be controlled as per the Wetland Rehabilitation and Monitoring Plan. Areas where bare soils exist must be re-vegetated with indigenous vegetation native to that area.	Medium-Low

8.4.3.3 Impact assessment findings (with and without mitigation): Transmission Line Alternative 1: Operational Phase

De-establishment and rehabilitation of the site will have a positive Medium impact by increasing surface roughness and reducing the velocity of the surface runoff; decreasing erosion potential; increasing biodiversity; removing all potential contaminants; and reinstating the natural topography. The removal of vegetation during maintenance will have Medium-High negative impact, but this be mitigated to a Low negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
De-establishment of the site camp, spoil sites, waste dumps etc. and the rehabilitation of the temporary access/haulage roads during the rehabilitation phase.	**Positive impacts:** Increase surface roughness and reduce the velocity of the surface runoff; Decrease erosion potential; Increase biodiversity; Remove all potential contaminants; Reinstate natural topography.	Medium (Positive)	Rehabilitation must commence within 30 days from the period when the construction phase has ended. All alternative tracks and footpaths created during the construction phase should be appropriately rehabilitated (e.g. tillage and re-vegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion. Any haulage or access roads (legal or illegal) which were created must be decommissioned and rehabilitation to reinstate the natural vegetation, increase the surface roughness and resultantly increase infiltration (e.g. tillage and revegetation). All construction waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from site and the surrounding environment, this will need to be checked by the ECO and the various contractors. All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development where necessary. The reinstatement of the longitudinal bank profiles, which have been altered, must be rehabilitated if possible. The soil horizons must be reinstated on the correct structural order and the vegetation groundcover over the disturbed area re-vegetated according to the native indigenous species within the area. AIPs must be removed manually without further disturbance to the surrounding ecosystems. If manual removal is not possible, seek guidance from a local cooperative extension service or Working for Water. Dispose of the removed AIPs at a registered dumping site or burn the material on a bunded surface. Rehabilitation of the sections where AIPs are removed must take place. The appropriate indigenous grass and woody vegetation species seeds must be attained from a registered nursery with the guidance of a botanist who is familiar to the region.	Medium (Positive)

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Utilisation of the Overhead Powerlines	Removal of vegetation cover and loss of biodiversity; Destruction of aquatic and terrestrial habitats and loss of faunal species; Soil compaction and thus increased surface runoff and decreased infiltration/permeability; Increased friction against rainfall and surface runoff with the addition of vegetation; Increased opportunity for groundwater and watercourse contamination as a result of leaks from construction vehicles; Increased potential of erosional features if temporally cleared areas are not rehabilitated.	Medium-High	Ensure that all areas that have been disturbed in the catchment are adequately rehabilitated. No bare-ground areas should exist after construction. Areas where erosional features have formed (gully or rill erosion) should be reinstated with relevant topsoil immediate and re-vegetated initially with a fast growing indigenous grass native to the area and thereafter replaced with a similar vegetation type of the area. Areas where sedimentation has occurred must be immediately removed to ensure no drowning of indigenous vegetation and opportunity for AIPs to proliferate. AIPs within the area must be removed and replaced with indigenous vegetation native to the area.	Low

8.4.3.4 Impact assessment findings (with and without mitigation): Transmission Line Alternative 2: Operational Phase

De-establishment and rehabilitation of the site will have a positive Medium impact by increasing surface roughness and reducing the velocity of the surface runoff; decreasing erosion potential; increasing biodiversity; removing all potential contaminants; and reinstating the natural topography. However, the removal of vegetation during maintenance can only be mitigated to a Medium-Low negative impact from a Medium-High negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
De-establishment of the site camp, spoil sites, waste dumps etc. and the rehabilitation of the temporary access/haulage roads during the rehabilitation phase.	**Positive impacts:** Increase surface roughness and reduce the velocity of the surface runoff; Decrease erosion potential; Increase biodiversity; Remove all potential contaminants; Reinstate natural topography.	Medium (Positive)	Rehabilitation must commence within 30 days from the period when the construction phase has ended. All alternative tracks and footpaths created during the construction phase should be appropriately rehabilitated (e.g. tillage and re-vegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion. Any haulage or access roads (legal or illegal) which were created must be decommissioned and rehabilitation to reinstate the natural vegetation, increase the surface roughness and resultantly increase infiltration (e.g. tillage and revegetation). All construction waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from site and the surrounding environment, this will need to be checked by the ECO and the various contractors. All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development where necessary. The reinstatement of the longitudinal bank profiles, which have been altered, must be rehabilitated if possible. The soil horizons must be reinstated on the correct structural order and the vegetation groundcover over the disturbed area re-vegetated according to the native indigenous species within the area. AIPs must be removed manually without further disturbance to the surrounding ecosystems. If manual removal is not possible, seek guidance from a local cooperative extension service or Working for Water. Dispose of the removed AIPs at a registered dumping site or burn the material on a bunded surface. Rehabilitation of the sections where AIPs are removed must take place. The appropriate indigenous grass and woody vegetation species seeds must be attained from a registered nursery with the guidance of a botanist who is familiar to the region.	Medium (Positive)

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Utilisation of the Overhead Powerlines	Removal of vegetation cover and loss of biodiversity; Destruction of aquatic and terrestrial habitats and loss of faunal species; Soil compaction and thus increased surface runoff and decreased infiltration/permeability; Increased friction against rainfall and surface runoff with the addition of vegetation; Increased opportunity for groundwater and watercourse contamination as a result of leaks from construction vehicles; Increased potential of erosional features if temporally cleared areas are not rehabilitated.	Medium-High	Ensure that all areas that have been disturbed in the catchment are adequately rehabilitated. No bare-ground areas should exist after construction. Areas where erosional features have formed (gully or rill erosion) should be reinstated with relevant topsoil immediate and re-vegetated initially with a fast growing indigenous grass native to the area and thereafter replaced with a similar vegetation type of the area. Areas where sedimentation has occured must be immediately removed to ensure no drowning of inidgenous vegetation and opportunity for AIPs to proliferate. AIPs within the area must be removed and replaced with indigenous vegetation native to the area.	Medium-Low

8.4.4 Hydropedological Impacts

Hydropedological impacts for the Alternative 2 route alignment of the Transmission line will be similar to those assessed for Alternative 1. This is due to the similarity of the ground conditions for the two alternatives. Therefore the assessment table below refers to both alternatives.

8.4.4.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

The Medium-Low to Low negative impacts during the construction phase, such as the alteration of hydropedological processes and degradation of water resources, can be mitigated to Low and Very Low impacts.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Disturbing vadose zone during soil excavations / infilling activities	Infilling of wetlands and watercourses inducing alternative flow paths. Alteration to natural hydropedological flow paths. Impacts on macro-soil structure. Impacts on the hydropedological processes supporting the watercourses.	Medium-Low	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination.	Very Low
In-situ placement of new soils	Altering existing soil-flow processes (i.e. infilling of wetlands). Compaction of soil.	Low	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes.	Very Low
Leakages from vehicles and machines	Degradation surface water (wetland & estuary) quality	Low	Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Surface water monitoring.	Low
Oil & fuel spills from vehicles installing the transmission line	Poor soil quality or contamination of soil	Low	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Have emergency fuel & oil spill kits on site.	Very Low
INDIRECT IMPACTS				
Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities	Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. Loss of vegetation. Compaction of soils;	Low	All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Exposed soils to be protected using a suitable covering or revegetating. Have emergency fuel & oil spill kits on site.	Very Low
Vegetation clearing & soil stockpiling	Natural nutrient content decreases due to soil exposure. Loss of natural bio-organisms essential to soil processes.	Low	All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Retain as much indigenous vegetation as possible.	Very Low

8.4.4.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

The Medium-Low to Low negative impacts during the operational phase, such as altering the soil flow dynamics and the macro-soil structure, can be mitigated to Low and Very Low impacts.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Infilling wetlands/watercourses	This will highly likely result in interflow processes replacing responsive processes (i.e. will become the new dominant flow driver). This will also impact soil flow dynamics, and change flow volumes (as the material will become likely become dry over time) and predominant soil flow processes (i.e. form responsive to interflow type).	Medium-Low	Placing a suitable geotextile in areas near or on-top of watercourses/wetlands, before placement of the soils, may help maintain some sub-surface soil processes. Compact and revegetate infilled areas to prevent erosion.	Very Low
Disturbing the inner-soil architecture of the original soil profile	This will disturb natural flow processes. Alteration to natural hydropedological flow paths. Impact on macro-soil structure. Impact on the hydropedological processes supporting the watercourses.	Medium-Low	Revegetate areas (with vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion.	Low
Oil & fuel spills from vehicles conducting maintenance of the transmission lines	Poor soil quality	Low	Have emergency fuel & oil spill kits on site.	Very Low
INDIRECT IMPACTS				
Excavated soil will be placed in other areas (i.e. on top of other soils)	This will have an impact on the flow dynamics of the soil it is dumped on top of, and may reduce rainfall infiltration and induce runoff.	Low	Cover excavated soils to be protected using a suitable covering.	Very Low

8.4.5 **River and Riparian (Aquatic) Impacts**

Aquatic impacts for the Alternative 2 route alignment of the Transmission line will be similar to those assessed for Alternative 1. This is due to the similarity of the aquatic resources for both alternatives. Therefore the assessment table below refers to both alternatives.

8.4.5.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

The Medium to Medium-Low impacts, such as the loss of vegetation and habitat, can be mitigated to have Low and Very Low impacts.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Earthworks, Vegetation clearing	Removal of riparian vegetation and habitat impacting bank stability.	Medium	Construction must be restricted to the dryer winter months when high rainfall and the risk of sediment runoff is limited. Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.	Low
Earthworks, Vegetation clearing	Disturbance of the natural soil profile resulting in the proliferation of invasive alien plant species	Medium	An alien invasive plant management plan needs to be compiled and implemented post rehabilitation to control current invaded areas and prevent the growth of invasive plants on cleared areas.	Low
Mechanised machinery & seepage/runoff from building materials.	Leakages from vehicles and machines. Oil & fuel spills from vehicles installing the transmission and gas pipelines resulting in changes in water quality parameters and nutrient availability.	Medium-Low	Prevent uncontrolled access of vehicles through watercourses that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas. All chemicals and toxicants to be used for the construction must be stored outside aquatic areas and in a bunded storage. The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly. Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer.	Low
INDIRECT IMPACTS				
Earthworks and Vegetation clearing Sedimentation	Loss of aquatic vegetation and habitat.	Medium	Construction must be restricted to the dryer winter months when high rainfall and the risk of sediment runoff is limited. Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching. Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.	Very Low
Earthworks, soil compaction.	Changes in natural drainage lines which may lead to ponding or increased runoff patterns, and changes in surface flow dynamics.	Medium-Low	Temporary stormwater channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion.	Very Low
Changes in the natural flow regime.	Change in species composition due to loss of aquatic habitat, water quality changes.	Medium-Low	If long periods of flow obstruction may be required, during periods of flow, intermitted releases of water, for a few hours every few days should be allowed for.	Very Low

8.4.5.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

The Low impact of changes in water quality parameters and nutrient availability, can be mitigated to a Very low impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Net result of development.	Oil & fuel spills from vehicles conducting maintenance of the transmission lines resulting in changes in water quality parameters and nutrient availability.	Low	Vehicles use to service transmission lines and transformers must be well maintained and no service vehicles repairs must take place on site. Monitoring plan of alien invasive plants must be implemented to prevent streamflow reduction on the Mhlatuze River itself. All chemicals and toxicants to be used for the construction must be stored outside aquatic areas and in a bunded storage. The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly. Maintenance of construction vehicles/equipment should not take place within the watercourse or watercourse buffer.	Very Low

8.4.6 **Surface Water (Hydrology) Impacts**

Hydrological impacts for the Alternative 2 route alignment of the Transmission line will be similar to those assessed for Alternative 1. This is due to the similarity of the receiving environment and ground conditions for both alternatives. Therefore the assessment table below refers to both alternatives.

8.4.6.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

The direct Medium negative impacts from earthworks can lead to increased runoff from cleared areas, resulting in the increased potential for sedimentation of watercourses. This can be mitigated to a Low negative impact. The Medium-Low negative impact from surface water contamination can be mitigated to a Low negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Earthworks in proximity to surface water bodies	Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. Soil compaction and soil erosion.	Medium	Only excavate areas applicable to the project area. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes. All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. • Retain as much indigenous vegetation as possible. Exposed soils to be protected by means of a suitable covering. Existing roads should be used as far as practical to gain access to the site, and crossing the rivers in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.	Low
INDIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Leakages from vehicles and machines	Surface water contamination	Medium-Low	Visual assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Have oil & fuel spill kits on site.	Low

8.4.6.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

The identified impacts during the operational phase range between Medium-Low and Low. These impacts can all be mitigated to Very Low by implementing the mitigation measures stipulated by the hydrologist.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Leakages from pipeline and post-earthwork activities	Soil disturbance & erosion and sedimentation of nearby watercourses	Medium-Low	Only excavate areas applicable to the project area. Retain as much indigenous vegetation as possible.	Very Low
Spillages from transformers may run off into watercourses or leach through the soil	Water quality degradation of nearby watercourses	Low	Ensure maintenance of transformers to prevent spillages. Water quality monitoring of the nearby river.	Very Low
INDIRECT IMPACTS				
Poor quality overland runoff or seepage from hydrocarbon spills from vehicles parked at the site.	Water quality degradation of nearby watercourses	Low	Park vehicles in areas lined with concrete or fitted oil traps. Ensure vehicles are in good condition and not leaking fuel or oil when conducting maintenance. Have oil & fuel spill kits on site.	Very Low

8.4.7 **Groundwater Impacts**

Geohydrological impacts for the Alternative 2 route alignment will be similar to those assessed for Alternative 1. This is due to the similarity of the groundwater conditions for the two alternatives.

8.4.7.1 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Construction Phase

The potential Medium negative impacts on groundwater resources, such as disturbing the vadose zone, poor quality seepage and surface water contamination, can all be mitigated to Low negative impacts.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Earthworks	Disturbing vadose zone during soil excavations/construction activities.	Medium	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination. Retain as much indigenous vegetation as possible. Exposed soils to be protected using a suitable covering or revegetating.	Low
Earthworks	Temporary dewatering of perched groundwater (if it occurs)	Medium-High	Have appropriate dewatering systems in place. Dewater all groundwater to the nearest surface drain/watercourse.	Low
INDIRECT IMPACTS				
Earthworks	Poor quality seepage from machinery used to excavate soils. Oil, grease and fuel leaks could lead to hydrocarbon contamination of the vadose zone which could percolate to the shallow aquifer.	Medium	Water quality monitoring of the downstream surface water. Park heavy machineries in lined areas and place drip trays under vehicles at the site. Visual soil assessments for signs of contamination.	Low
Earthworks	Surface water contamination and sedimentation from the following activities: o Equipment and vehicles are washed in the water bodies (when there is water); o Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e. bad weather); and o Alteration of natural drainage lines which may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).	Medium	Water quality monitoring and visual assessments. Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines. Install a temporary cut off trench to contain poor quality runoff. Routine inspections of all infrastructure.	Low

8.4.7.2 Impact assessment findings (with and without mitigation): Transmission Line Alternatives 1 and 2: Operational Phase

The main impact identified is poor quality seepage which can be mitigated from a Medium negative significance to a Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Operation of the transmission line	Poor quality seepage from likely sub-stations associated with the transmission line and parked service vehicles. Seepage may percolate into the shallow aquifer zone.	Medium	Water quality monitoring of the downstream surface water. Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines. Park service vehicles in lined areas and place drip trays under vehicles at the site. Visual soil assessments for signs of contamination.	Low

8.4.8 **Climate Change Impacts**

Several potentially significant climate change-related impacts have been identified that require mitigation to lower significance to acceptable levels. The impacts of primary concern relate to the increased frequency, duration and intensity of extreme climatic events in the medium- to long-term which carry the risk of damage to vessels, infrastructure and equipment associated with the Powerships; and elevated fire risk due to an observed drying trend and the possibility of damage to linear electrical infrastructure from severe storms.

An indirect positive impact of the proposed project is that the adaptive capacity of local communities may be enhanced through more reliable electricity supply (with a lower carbon footprint than most of the national grid’s electricity sources), as well as the potential for improved economic and employment opportunities that are driven by local and regional and economic growth.

8.4.8.1 Impact assessment findings (with and without mitigation): Powership and Transmission Line Alternatives 1 and 2: Construction Phase

Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-Low significance without mitigation, and of Low significance with mitigation. Physical climate change risk to the FSRU is considered to be of Medium-Low significance without mitigation, and of Low significance with mitigation. During installation of the gas pipeline, a potential direct impact relates to infrastructural and/or equipment damage or failure in the event of a severe storm. The significance of this impact is, however, Low, since it is relatively easily mitigated to a significance rating of Very Low by restricting installation to suitable weather conditions.

ASPECT:		RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
GAS PIPELINE FROM FSRU TO POWERSHIP - SUB-SEA					
DIRECT AND INDIRECT IMPACTS					
Physical risk	Installation/construction	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures, account for extreme events in pipeline design and location	Very Low

8.4.8.2 Impact assessment findings (with and without mitigation): Powership and Transmission Line Alternatives 1 and 2: Operational Phase

During operation, a Medium-rated impact may occur submerged gas pipeline from the FSRU to Powership if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions. Under storm conditions, it is possible that the structures may lead to localised erosion and accretion on opposite sides of the pipeline fixtures which may endanger the pipeline by undercutting. Similarly, to the construction phase, this impact can be mitigated to a Low significance using the precautionary principle in design and installation of the pipeline. Given the location of the Powership within the main port area, this impact is rated as Very Low with mitigation measures applied. Similarly, impacts concerning connection with the FSRU and pipeline are also rated Very Low with mitigation. A positive impact — rated High — of the Powership operations is the addition of 540MW of baseload electricity to the national grid. The impacts from the 132kV Transmission Lines to Substation are expected during the operational phase and can be mitigated to a Low significance rating relatively easily. The significance rating of the impact from the 132kV Steel Lattice Towers is Low without mitigation, and Very Low with mitigation.

ASPECT:		RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
LNG CARRIER					
DIRECT AND INDIRECT IMPACTS					
Physical risk (direct)	Transportation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends during transportation (direct)	Medium-Low	Use of early warning systems and international standard operating procedures for vessels operating in inclement weather, including evasive action	Low
	Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends in-port (direct)	Very Low	Adherence to port safety regulations and emergency procedures	Very Low
FSRU					
DIRECT AND INDIRECT IMPACTS					
Physical risk	Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Medium-Low	Adherence to port safety regulations and emergency procedures	Low
GAS PIPELINE FROM FSRU TO POWERSHIP - SUB-SEA					
DIRECT AND INDIRECT IMPACTS					
Physical risk	Operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Medium	Implement quality, maintenance and environmental controls.	Low
POWERSHIP					
DIRECT AND INDIRECT IMPACTS					

ASPECT:		RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Physical risk	Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures	Very Low
	Connection to FSRU	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures	Very Low
Positive impacts	Electricity generation: 635MW (direct)	Generation of electricity and provision of 635MW into the national grid.	High (Positive)	Positive impact on regional and national economy and community from reliable and continuous electricity flow from the Powership.	High (positive)
	Increased community adaptation/resilience (indirect)	Increased local adaptive capacity through more reliable electricity for the SEZ and resultant growth in gross geographic product (GGP)	Medium-High	Community benefits from stable electrical supply and local economic growth	Medium-high (positive)
132KV TRANSMISSION LINES TO SUBSTATION					
DIRECT AND INDIRECT IMPACTS					
Physical risk	Operation	Increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events	Low	Underground transmission line is the preferred option from a fire risk perspective. Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols must be undertaken if overhead line is the preferred alternative.	Very Low
132kV STEEL LATTICE TOWERS					
DIRECT AND INDIRECT IMPACTS					
Physical risk	Operation	Increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events	Low	Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols	Very Low

8.4.9 Estuarine Impacts

8.4.9.1 Transmission Line Alternative 1 (Preferred): Construction Phase

Noise pollution impacts associated with the construction of the necessary landside infrastructure will be temporary, lasting for the duration of the construction period and are not anticipated to be much greater that the noise levels already experienced within the boundaries of the harbour.

With regards to the transmission lines running adjacent to the mangroves, the High impacts can be reduced to Medium-High by implementing the mitigation measures. Given the degraded state of the vegetation and landscape modification, the loss of functional estuarine habitat is likely to be insignificant and the impacts can be mitigated from a High negative impact to a Medium-Low negative impact.

The handling, storage and disposal of general, construction and hazardous waste during the construction phase may the potential to cause Medium-High negative impacts through pollution of the environment. These impacts can be mitigated to Very Low negative impact if good waste management practices and the mitigation measures are adhered to. There is the potential for accidental spills of hydrocarbons, oils from construction vehicles, plant, other equipment and the working barge, and other harmful substances and chemicals used (e.g., concrete). This may enter the water column directly during construction activities or be transported as contaminated runoff into the port consequently affecting sediment and water quality with toxic and potentially lethal effects on the flora and fauna of Richards Bay, in the immediate vicinity of the activity, namely, the adjacent sandspit and Kabeljous Flats. This will have a High negative impact on the port waters but can be mitigated to a Very Low negative impact.

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction activities and noise	Disturbance/loss of terrestrial fauna	High	The surrounding area must be surveyed prior to construction/laydown area establishment to determine the presence of nesting birds and sensitive fauna, and these must cordoned off where possibly or be safely relocated if necessary. The conservation authority must be contacted for the relocation of birds/ wildlife. No animals (birds, reptiles, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. The laydown area/stringing yard must only be located in disturbed wetland/grassland/shrubland. The existing pylon servitude adjacent to the Manzamnyama Canal must be used as the preferred route. Mangrove, saltmarsh and swamp forest habitat must be avoided. Restrict access to laydown area/stringing yard and working area only. Restrict vehicles to clearly demarcated access routes and construction areas only. Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used. Beyond the headland of the 600 Berth Basin, movement of supporting vessels to be restricted to the main channel only. Laying of the gas pipeline and mooring legs of the FSRU should be undertaken during the winter months reduce disturbance birds utilising the sandspit.	Medium-High

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations Construction vehicles, plant and machinery must be well maintained and fitted with silencers. Regular maintenance on vehicle and equipment undertaken.	
Construction within the estuarine functional zone	Destruction of estuarine vegetation	High	Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. The laydown area/stringing yard must only be located in disturbed grassland/shrubland and not in any mangrove, saltmarsh or intact wetland habitat. The existing pylon servitude adjacent to the Manzamnyama Canal must be use for the preferred route. Mangrove and swamp forest habitat must be avoided. Restrict access to laydown area/stringing yard and working area only. Restrict vehicles to clearly demarcated access routes and construction areas only. Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used. Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations Construction vehicles, plant and machinery must be well maintained. Noteworthy vegetated areas must be avoided (e.g., mangroves) in the siting and enclosure of the laydown area/stringing yard. Siting of the pylons must utilise existing servitudes and berms to prevent additional, unnecessary terrain modification and habitat disturbance. Prior to site establishment, the site must be assessed for important plant species, which must be avoided, or rescued for transplanting. Necessary permits must be obtained. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr. Post construction rehabilitation of the laydown area/stringing yard and all unnecessary access routes must be undertaken.	Medium-Low
Construction activities	Solid waste pollution	Medium-High	Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr. Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies Construction workers and operational staff to adopt best practice waste minimisation procedures. Implement the correct handling and disposal procedures for general and hazardous waste. Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste. Good housekeeping to be done daily. No mixing of concrete in the intertidal zone. No dumping of construction materials or excess concrete in the intertidal and subtidal zones. Wind screening (e.g., fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g., litter) entering the Estuary; and Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.	Very Low
Spills of hazardous substances	Chemical pollution	High	The laydown area must not be established within a high-risk area (i.e. below the high water mark); The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme; Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			chemical storage areas, to prevent erosion and run-off of contaminants into the port; Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures are followed (e.g., bunded storage areas to contain 110% of volume); Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; In response to possible pollution as a result of Shipping activities: o Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way; o A requirement to report environmental accidents and emergencies immediately they occur, to the port captain; o A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future; o Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications; and o In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	

8.4.9.2 Transmission Line Alternative 2: Construction Phase

Noise pollution impacts associated with the construction of the necessary landside infrastructure will be temporary, lasting for the duration of the construction period and are not anticipated to be much greater that the noise levels already experienced within the boundaries of the harbour. With regards to the transmission lines running through the mangroves, it will cause significant local disturbance and mortality of fauna utilising this critical and unique habitat, extending from intertidal and supratidal aquatic communities to roosting or nesting birds, reptiles (e.g., snakes) and mammals (e.g., monkeys etc.). This High negative impact was therefore not assessed for post-mitigation impact significance. The specialist recommends that the mangrove and swamp forest habitat be avoided entirely. Impacts on the terrestrial fauna and avifauna are assessed in the Terrestrial Ecology and Avifauna sections.

This route will traverse historical, well-established dense mangrove habitat. While the footprint of each pylon may be relatively small, construction within the mangroves will result in destruction and disturbance of critical estuarine habitat and protected tree species in terms of the National Forest Act (Act No. 84 of 1998) (namely Black Mangrove, *Bruguiera gymnorrhiza*), far greater than development footprint. This High negative impact was therefore not assessed for post-mitigation impact significance.

The handling, storage and disposal of general, construction and hazardous waste during the construction phase may the potential to cause Medium-High negative impacts through pollution of the environment. These impacts can be mitigated to Very Low negative impact if good waste management practices and the mitigation measures are adhered to. There is the potential for accidental spills of hydrocarbons, oils from construction vehicles, plant, other equipment and the working barge, and other harmful substances and chemicals used (e.g., concrete). This may enter the water column directly during construction activities or be transported as contaminated runoff into the port consequently affecting sediment and water quality with toxic and potentially lethal effects on the flora and fauna of Richards Bay, in the immediate vicinity of the activity, namely, the adjacent sandspit and Kabeljous Flats. This will have a High negative impact on the port waters but can be mitigated to a Very Low negative impact.

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction activities and noise	Disturbance/loss of terrestrial fauna	High	Not applicable – mangrove and swamp forest habitat to be avoided entirely	High
Construction within the estuarine functional zone	Destruction of estuarine vegetation	High	Not applicable – mangrove and swamp forest habitat to be avoided entirely	High
Construction activities	Solid waste pollution	Medium-High	Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr. Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies Construction workers and operational staff to adopt best practice waste minimisation procedures. Implement the correct handling and disposal procedures for general and hazardous waste. Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste. Good housekeeping to be done daily. No mixing of concrete in the intertidal zone. No dumping of construction materials or excess concrete in the intertidal and subtidal zones. Wind screening (e.g., fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g., litter) entering the Estuary; and Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Spills of hazardous substances and day-to-day shipping practice	Chemical pollution	High	The laydown area must not be established within a high-risk area (i.e. below the high water mark); The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme; Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the port; Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures are followed (e.g., bunded storage areas to contain 110% of volume); Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; In response to possible pollution as a result of Shipping activities: o Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way; o A requirement to report environmental accidents and emergencies immediately they occur, to the port captain; o A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future; o Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications; and In the event of a spill, a penalty should be issued and the ‘polluter pays’ principle should be applied for clean-up operations and rehabilitation, if necessary.	Very Low

8.4.9.3 Laydown Area and Stringing Yard: Construction Phase

The laydown area /stringing yard for the assembly of the gas pipeline and the first land-based connection, that is the terminal tower, will be located in the disturbed wetland/mixed grassland/shrubland, which is characteristic of much the vegetation along the harbour arterial road (except for the distinct mangrove areas). The location of the terminal tower is relatively similar for the preferred and alternate layout options for the powerships within the port basin. Access to the laydown area/stringing yard will be via the arterial road, however, an access route will be required for the construction of the pylons between the port and the Manzamynama Canal. This Medium impact can be mitigated to Medium-Low due to the temporary nature of the activities and impacts. Poor management of the laydown area, the stringing yard and its operations (e.g., waste management facilities), and construction areas (e.g., pylons) may also lead to contamination of the immediate surrounding environment. These Medium-High negative impacts can be mitigated to Very Low negative impact if good waste management practices and the mitigation measures are adhered to.

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction within the estuarine functional zone	Destruction of estuarine vegetation	Medium	Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. The laydown area/stringing yard must only be located in disturbed grassland/shrubland and not in any mangrove, saltmarsh or intact wetland habitat. The existing pylon servitude adjacent to the Manzamnyama Canal must be use for the preferred route. Mangrove and swamp forest habitat must be avoided. Restrict access to laydown area/stringing yard and working area only. Restrict vehicles to clearly demarcated access routes and construction areas only. Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used. Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations Construction vehicles, plant and machinery must be well maintained. Noteworthy vegetated areas must be avoided (e.g., mangroves) in the siting and enclosure of the laydown area/stringing yard. Siting of the pylons must utilise existing servitudes and berms to prevent additional, unnecessary terrain modification and habitat disturbance. Prior to site establishment, the site must be assessed for important plant species, which must be avoided, or rescued for transplanting. Necessary permits must be obtained. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr. Post construction rehabilitation of the laydown area/stringing yard and all unnecessary access routes must be undertaken.	Medium-Low
Construction activities	Solid waste pollution	Medium-High	Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr. Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies Construction workers and operational staff to adopt best practice waste minimisation procedures. Implement the correct handling and disposal procedures for general and hazardous waste. Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste. Good housekeeping to be done daily. No mixing of concrete in the intertidal zone.	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			No dumping of construction materials or excess concrete in the intertidal and subtidal zones. Wind screening (e.g., fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g., litter) entering the Estuary; and Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.	

8.4.9.4 Powership and Gas Pipeline Alternative 1: Construction Phase

Laying of the mooring facilities (heavy chain, anchor system) and the proposed subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, with knock on effects for benthic and pelagic organisms, which may result in smothering and/or injury of estuarine/marine organisms. Physical disturbance of the intertidal zone is expected during the assembly of the gas pipeline. These will have a Medium-High negative impact on the organisms but can be mitigated to a Medium-Low negative impact.

Laying of the mooring facilities (heavy chain, anchor system) and the subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, which in turn will affect the water quality in the immediate vicinity, specifically in respect to total suspended solids/ turbidity, dissolve oxygen concentrations, and sediment contaminants. This will have knock on effects for benthic and pelagic organisms. The result of this will be a Medium-High negative impact which can be mitigated to a Medium-Low negative impact.

Noise pollution impacts associated with the construction of the necessary landside infrastructure and assembly of the subsea pipeline will be temporary, lasting for the duration of the construction period and are not anticipated to be much greater that the noise levels already experienced within the boundaries of the harbour. The Medium negative impact of noise can be mitigated to a Low negative impact.

During the construction period, there is the potential for accidental spills of hydrocarbons, oils from plant, equipment and the working barge, and other harmful substances and chemicals used. These contaminants may enter the water column directly and affect sediment and water quality with toxic and potentially lethal effects on the flora and fauna of Richards Bay, in the immediate vicinity of the activity, namely, the adjacent sandspit and Kabeljous Flats. The High negative significance of this impact can be mitigated to a Very Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Sea-based construction activities	Disturbance/loss of estuarine/marine fauna	Medium-High	Disturbance must be kept to a minimum by confining the pipeline laying down activity, working barge and/ or excavation/levelling equipment to within the project area. Construction activities to be restricted to daylight hours. No animals (birds, fish, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.	Medium-Low
Sea-based construction activities	Changes in water quality	Medium-High	Disturbance must be kept to a minimum by confining the pipeline laying down activity, working barge and/ or excavation/levelling equipment to within the project area. Duration of pipe laying and anchorage operations must be minimised as much as possible to reduce suspended sediment loads. Pipe laying and anchorage operations should not take place during spring high tides and very strong south-westerly winds or storm weather conditions. Laying of the pipeline and the anchor legs must be undertaken with as little disturbance of the seabed as possible. Monitoring of turbidity levels must be undertaken daily during the pipe laying and anchorage operations. TSS levels may not exceed 20 mg/l. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.	Medium-Low
Construction activities and noise	Disturbance/loss of terrestrial fauna	Medium	The conservation authority must be contacted for the relocation of birds/ wildlife. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. Restrict access to laydown area/stringing yard and working area only. Restrict vehicles to clearly demarcated access routes and construction areas only. Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used. Beyond the headland of the 600 Berth Basin, movement of supporting vessels to be restricted to the main channel only. Laying of the gas pipeline and mooring legs of the FSRU should be undertaken during the winter months reduce disturbance birds utilising the sandspit. Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations Construction vehicles, plant and machinery must be well maintained and fitted with silencers.	Low
Spills of hazardous substances and day-to-day shipping practice	Chemical pollution	High	Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the port; Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures are followed (e.g., bunded storage areas to contain 110% of volume);	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; In response to possible pollution as a result of Shipping activities: o Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way; o A requirement to report environmental accidents and emergencies immediately they occur, to the port captain; o A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future; o Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications; and o In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	

8.4.9.5 Powership and Gas Pipeline Alternative 2: Construction Phase

Laying of the mooring facilities (heavy chain, anchor system) and the proposed subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, with knock on effects for benthic and pelagic organisms, which may result in smothering and/or injury of estuarine/marine organisms. Physical disturbance of the intertidal zone is expected during the assembly of the gas pipeline. These will have a Medium-High negative impact on the organisms but can be mitigated to a Medium-Low negative impact.

Laying of the mooring facilities (heavy chain, anchor system) and the subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment, which in turn will affect the water quality in the immediate vicinity, specifically in respect to total suspended solids/ turbidity, dissolve oxygen concentrations, and sediment contaminants. This will have knock on effects for benthic and pelagic organisms. The result of this will be a Medium negative impact which can be mitigated to a Low negative impact.

Noise pollution impacts associated with the construction of the necessary landside infrastructure and assembly of the subsea pipeline will be temporary, lasting for the duration of the construction period and are not anticipated to be much greater that the noise levels already experienced within the boundaries of the harbour. The Medium negative impact of noise can be mitigated to a Low negative impact.

During the construction period, there is the potential for accidental spills of hydrocarbons, oils from plant, equipment and the working barge, and other harmful substances and chemicals used. These contaminants may enter the water column directly and affect sediment and water quality with toxic and potentially lethal effects on the flora and fauna of Richards Bay, in the immediate vicinity of the activity, namely, the adjacent sandspit and Kabeljous Flats. The High negative significance of this impact can be mitigated to a Very Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Sea-based construction activities	Disturbance/loss of estuarine/marine fauna	Medium-High	Disturbance must be kept to a minimum by confining the pipeline laying down activity, working barge and/ or excavation/levelling equipment to within the project area. Construction activities to be restricted to daylight hours. No animals (birds, fish, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.	Medium-Low
Sea-based construction activities	Changes in water quality	Medium	Disturbance must be kept to a minimum by confining the pipeline laying down activity, working barge and/ or excavation/levelling equipment to within the project area. Duration of pipe laying and anchorage operations must be minimised as much as possible to reduce suspended sediment loads. Pipe laying and anchorage operations should not take place during spring high tides and very strong south-westerly winds or storm weather conditions. Laying of the pipeline and the anchor legs must be undertaken with as little disturbance of the seabed as possible. Monitoring of turbidity levels must be undertaken daily during the pipe laying and anchorage operations. TSS levels may not exceed 20 mg/l. Management of all site activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.	Low
Construction activities and noise	Disturbance/loss of terrestrial fauna	Medium	The conservation authority must be contacted for the relocation of birds/ wildlife. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. Restrict access to laydown area/stringing yard and working area only. Restrict vehicles to clearly demarcated access routes and construction areas only. Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used. Beyond the headland of the 600 Berth Basin, movement of supporting vessels to be restricted to the main channel only. Laying of the gas pipeline and mooring legs of the FSRU should be undertaken during the winter months reduce disturbance birds utilising the sandspit. Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations Construction vehicles, plant and machinery must be well maintained and fitted with silencers.	Low
Spills of hazardous substances and day-to-day shipping practice	Chemical pollution	High	Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the port; Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			Programme; Ensure correct handling, storage and disposal procedures are followed (e.g., bunded storage areas to contain 110% of volume); Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; In response to possible pollution as a result of Shipping activities: o Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way; o A requirement to report environmental accidents and emergencies immediately they occur, to the port captain; o A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future; o Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications; and In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	

8.4.9.6 Transmission Line Alternative 1 (Preferred): Operational Phase

The Injury/mortality of coastal/estuarine birds colliding with the transmission line is a High negative impact but can be reduced to a Medium negative impact. Birds travelling between the separated water body systems of the port may be negatively affected by the overhead transmission lines. This High negative impact can be mitigated to a Medium negative impact.

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Transmission lines	Injury/mortality of coastal/estuarine associated birds	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths.	Medium
Operational activities	Impact on the ecology of the Mhlathuze Estuary/ Sanctuary	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths.	Medium

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only	

8.4.9.7 Transmission Line Alternative 2: Operational Phase

This route joins into the harbour arterial road servitude, and before the lower Bhizolo Canal, it cuts west across the lower Manzamnyama Canal, passing through the mangroves, traversing the smelter site, before heading north through mixed mangrove and wetland habitat on the western boundary of this site. The Injury/mortality of coastal/estuarine birds colliding with the transmission line is a High negative impact but can remain as a High negative impact even after applying the mitigation measures. Birds travelling between the separated water body systems of the port may be negatively affected by the overhead transmission lines. This High negative impact can be mitigated to a Medium negative impact.

As all infrastructure is proposed to be installed within the access-controlled Port of Richards Bay, no change in coastal access is expected, as access is already restricted. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users. It should be noted that any assessment of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact in the EIR.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Transmission lines	Injury/mortality of coastal/estuarine associated birds	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths.	High
Operational activities	Impact on the ecology of the Mhlathuze Estuary/ Sanctuary	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths. Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only	Medium

8.4.9.8 Powership and Gas Pipeline Alternative 1: Operational Phase

The abstraction of seawater for cooling will invariably result in the intake and extermination of small to medium bodied pelagic organisms (e.g., phytoplankton, larval stages of invertebrates and fish, juveniles and adults, which also constitute food resources for higher trophic levels. The impact of the uptake of water will be High negative significance but can be mitigated to Medium-High negative impact significance.

The discharge of heated water is likely to result in localised disturbance of the water column (specifically temperature), with knock-on effects for pelagic and potentially benthic organisms, an overall High negative impact. This can be reduced to a Medium-High impact by implementing the mitigation measures proposed by the specialist.

Once in operation, the powerships will operate throughout the day and night, or part thereof, with noise emanating from power generation, supportive activities and other potential sounds (e.g., alarms sirens/bells etc.). Any sensitive bird species utilising the Kabeljous Flats and sandspit for feeding, roosting and those seeking refuge within the mangroves (and linked habitats) will likely be disturbed by the additional noise and artificial light (specifically during the night due to the relatively close proximity of the powership to the shoreline and important estuarine habitats. This will have a High negative impact on these birds which can only be mitigated to a Medium-High impact.

There is the potential for leaks of LNG and/or natural gas, accidental spills of oils and grease from the vessels and other supporting equipment /plant, and other harmful substances and chemicals used during operations and overall maintenance. This may enter the water column directly into the water of the port as a result of incorrect handling and improper spill management. Any spills and leaks of hazardous substances will have a negative effect on the immediate estuarine/marine water quality, and potentially the most ecological significant habitats of the bay, and potentially the open ocean. LNG and/or natural could leak into the bay due to incorrect coupling during refuelling, or via breakages in, or damages to, the fuelling line or subsea pipeline. LNG is non-toxic and spills on seawater vapourise rapidly, leaving no residue or film. Due to the shallow depth (<100 m), any subsea leaks will rise rapidly and dissipate into the atmosphere and thus not likely to result in dissolved oxygen depletion of the surrounding water column. The resultant High negative impact can be mitigated to a Low negative impact.

Although highly unlikely and also unpredictable, a gas explosion will result in significant habitat disturbance/ destruction with the potential for numerous mortalities of marine /estuarine associated fauna. This Medium negative impact can be safely mitigated to a Medium-Low impact by managing the risks associated with potential explosions.

The proposed Gas to Power project to be located with the 600 Berth Basin will not directly affect the functioning of the uMhlathuze Estuary by virtue of this permanent separation. However, noise/vibration sensitive bird species present in the uMhlathuze Estuary may be affected, including species which travel between these two systems, as well as those affected by artificial light. The High negative impact of the operation of powership on the Mhlathuze Estuary can be mitigated to a Medium negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Abstraction of seawater for cooling	Injury / mortality of marine/estuarine aquatic fauna	High	The intake(s) must be located in deep water, away from shallow intertidal and subtidal habitat. The intake(s) must be of appropriate design to reduce the uptake of macrofauna and larger organisms as much as possible (e.g., screens).	Medium-High

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			The intake(s) should preferably be positioned within or adjacent to the disturbed shipping channel where fewer larger organisms are likely to be encountered.	
Cooling water discharge	Changes in water quality	High	No discharging to the dead-end basin where water circulation is poor, but rather where water circulation by tidal flushing would be maximised and/or facilitated by vessel movement. Heated cooling water to be discharged as deep as possible, and away from shallow intertidal and subtidal habitat. Discharge pipeline must be well secured and regularly checked for damages or leaks Discharges must be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DWAF, 1995; DEA, 2018b) and/or other applicable international standards.	Medium-High
Noise and light pollution	Disturbance to coastal/estuarine associated birds	High	Install silencers on exhaust stacks and turbo chargers, and all supporting plant and machinery Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted low emission light fittings Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only Biannual bird monitoring of species utilising the sandpit and Kabeljous Flats must be undertaken to assess any level of disturbance	Medium-High
Spills and leaks of hazardous substances	Chemical pollution	High	Specialist personnel must be well trained on the standard protocols for preparation, coupling and decoupling of the gas pipeline between vessels. Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. A Spill Prevention and Emergency Response Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures are followed; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; and In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	Low
Gas explosion	Mortalities of coastal/estuarine associated fauna and habitat destruction	Medium	Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. Comprehensive safety checks frequently undertaken of all project components and processes. Frequent risk assessments and adaptive management where required.	Medium-Low
Operational activities	Impact on the ecology of the Mhlathuze Estuary/ Sanctuary	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths. Install silencers on exhaust stacks and turbo chargers, and all supporting plant and machinery Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted with low emission light fittings Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only	Medium

8.4.9.9 Powership and Gas Pipeline Alternative 2: Operational Phase

The abstraction of seawater for cooling will invariably result in the intake and extermination of small to medium bodied pelagic organisms (e.g., phytoplankton, larval stages of invertebrates and fish, juveniles and adults, which also constitute food resources for higher trophic levels. The impact of the uptake of water will be High negative significance but can be mitigated to Medium-High negative impact significance.

The discharge of heated water is likely to result in localised disturbance of the water column (specifically temperature), with knock-on effects for pelagic and potentially benthic organisms, an overall High negative impact. This can be reduced to a Medium-High impact by implementing the mitigation measures proposed by the specialist.

Once in operation, the powerships will operate throughout the day and night, or part thereof, with noise emanating from power generation, supportive activities and other potential sounds (e.g., alarms sirens/bells etc.). Any sensitive bird species utilising the Kabeljous Flats and sandspit for feeding, roosting and those seeking refuge within the mangroves (and linked habitats) will likely be disturbed by the additional noise and artificial light (specifically during the night due to the relatively close proximity of the powership to the shoreline and important estuarine habitats. This will have a High negative impact on these birds which can only be mitigated to a High impact.

there is the potential for leaks of LNG and/or natural gas, accidental spills of oils and grease from the vessels and other supporting equipment /plant, and other harmful substances and chemicals used during operations and overall maintenance. This may enter the water column directly into the water of the port as a result of incorrect handling and improper spill management. Any spills and leaks of hazardous substances will have a negative effect on the immediate estuarine/marine water quality, and potentially the most ecological significant habitats of the bay, and potentially the open ocean. LNG and/or natural could leak into the bay due to incorrect coupling during refuelling, or via breakages in, or damages to, the fuelling line or subsea pipeline. LNG is non-toxic and spills on seawater vapourise rapidly, leaving no residue or film. Due to the shallow depth (<100 m), any subsea leaks will rise rapidly and dissipate into the atmosphere and thus not likely to result in dissolved oxygen depletion of the surrounding water column. The resultant High negative impact can be mitigated to a Low negative impact.

Although highly unlikely and also unpredictable, a gas explosion will result in significant habitat disturbance/ destruction with the potential for numerous mortalities of marine /estuarine associated fauna. This Medium negative impact can be safely mitigated to a Medium-Low impact by managing the risks associated with potential explosions.

The proposed Gas to Power project to be located with the 600 Berth Basin will not directly affect the functioning of the uMhlathuze Estuary by virtue of this permanent separation. However, noise/vibration sensitive bird species present in the uMhlathuze Estuary may be affected, including species which travel between these two systems, as well as those affected by artificial light. The High negative impact of the operation of powership on the Mhlathuze Estuary can be mitigated to a Medium negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Abstraction of seawater for cooling	Injury / mortality of marine/estuarine aquatic fauna	High	The intake(s) must be located in deep water, away from shallow intertidal and subtidal habitat. The intake(s) must be of appropriate design to reduce the uptake of macrofauna and larger organisms as much as possible (e.g., screens). The intake(s) should preferably be positioned within or adjacent to the disturbed shipping channel where fewer larger organisms are likely to be encountered.	Medium-High
Cooling water discharge	Changes in water quality	High	No discharging to the dead-end basin where water circulation is poor, but rather where water circulation by tidal flushing would be maximised and/or facilitated by vessel movement. Heated cooling water to be discharged as deep as possible, and away from shallow intertidal and subtidal habitat. Discharge pipeline must be well secured and regularly checked for damages or leaks Discharges must be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DWAF, 1995; DEA, 2018b) and/or other applicable international standards.	Medium-High
Noise and light pollution	Disturbance to coastal/estuarine associated birds	High	Install silencers on exhaust stacks and turbo chargers, and all supporting plant and machinery Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted low emission light fittings Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only Biannual bird monitoring of species utilising the sandpit and Kabeljous Flats must be undertaken to assess any level of disturbance	High
Spills and leaks of hazardous substances	Chemical pollution	High	Specialist personnel must be well trained on the standard protocols for preparation, coupling and decoupling of the gas pipeline between vessels. Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. A Spill Prevention and Emergency Response Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures are followed; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; and In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	Low
Gas explosion	Mortalities of coastal/estuarine associated fauna and habitat destruction	Medium	Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. Comprehensive safety checks frequently undertaken of all project components and processes. Frequent risk assessments and adaptive management where required.	Medium-Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Operational activities	Impact on the ecology of the Mhlathuze Estuary/ Sanctuary	High	Installation of high visibility (day and night) bird flight diverters and perching deterrents along the entire transmission line route or known flight paths. Install silencers on exhaust stacks and turbo chargers, and all supporting plant and machinery Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted with low emission light fittings Where possible, lighting (e.g., spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only	Medium

8.4.10 **Marine Ecology Impacts**

8.4.10.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The gas pipeline construction and installation and vessel mooring will have a Very Low impact on the benthic community. The predicted impact is deemed to be 'negligible' or will probably be indistinguishable from natural background variations. The uptake of cooling water will have a Low impact on marine organisms in the surrounding water body, as there is no lasting effect on this sensitive receptor. The discharge of cooling water will have a Low impact on the marine ecology in the receiving water body, as it will have no lasting effect on the sensitive receptor i.e. plankton and benthic organisms.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
KARPOWERSHIP - RICHARDS BAY				
OPERATIONAL PHASE				
DIRECT IMPACTS				
Gas pipeline construction and installation and vessel mooring	Disturbance of benthic habitat and modification of the community structure	Very Low	No mitigation proposed.	Very Low
Uptake of cooling water	Ecological damage caused by entrainment	Medium	No mitigation proposed.	Low
Discharge of cooling water	Raised water temperatures could affect benthic crustacean families, and fish larvae and juveniles that could not move away from the affected area	Low	No mitigation proposed.	Low

8.4.10.2 Technology Alternatives: Heavy Fuel and Liquefied Natural Gas

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost effective generation of power, as opposed to coal-fired power stations. In addition, coal-fired power technology is associated with significant air pollution as a result of the coal-fired combustion. Natural gas emits between 45%

and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants than coal when used to generate electricity (Shell SA, Media Release, 2020).

The Powership engine technology provides for dual fuel usage and is capable of utilizing both Liquid Natural Gas (LNG) and Heavy Fuel Oils (HFO) as primary fuel sources. As indicated in the accepted Final Scoping Report, the HFO is not being considered further as an alternative fuel due to the significant advantages of the LNG. The operating fuel for power generation will be from LNG only and will not consume HFO for any part of the generation process. All relevant licenses, permits and approvals are for the consumption and use of LNG only.

LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life.

Impacts on the marine environment arising from an HFO spill would likely be much more significant than those from LNG leakage. HFOs can be particularly difficult to clean up if spilled in the ocean as HFO doesn't readily disperse or breakdown in the marine environment, as it has a tendency to stick to surfaces like sea ice or sink and emulsify in sea water (rather than floating on the surface or evaporating off) (Degnarain, 2020). HFO also remains longer in cooler waters before they have had the chance to evaporate off, making their presence felt for longer. HFO becomes more toxic when exposed to Ultra-Violet (UV) light and can be absorbed by organisms, increasing their mortality (Degnarain, 2020).

The use of natural gas to generate electricity, which is what the Powerships technology is designed to do, is the preferred alternative for power generation from a marine ecology perspective.

8.4.11 Air Quality Impacts

The significance of impacts resulting from the Karpowership Project is predicted to be very low.

The impacts to air quality will be identical for both powerships-FSRU positions alternatives. The spatial distance between the alternatives will not affect the total emissions. Wind effects for both alternatives will be similar and will therefore not change the dispersion of emissions.

8.4.11.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of SO_2	Very Low	No mitigation proposed.	Very Low
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of NO_2	Very Low	No mitigation proposed.	Very Low
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of PM_{10}	Very Low	No mitigation proposed.	Very Low

8.4.11.2 Technology Alternatives: Heavy Fuel and Liquefied Natural Gas

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost effective generation of power, as opposed to coal-fired power stations. In addition, coal-fired power technology is associated with significant air pollution as a result of the coal-fired combustion. Natural gas emits between 45% and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants than coal when used to generate electricity (Shell SA, Media Release, 2020).

The Powership engine technology provides for dual fuel usage and is capable of utilizing both Liquid Natural Gas (LNG) and Heavy Fuel Oils (HFO) as primary fuel sources. As indicated in the accepted Final Scoping Report, the HFO is not being considered further as an alternative fuel due to the significant advantages of the LNG. The operating fuel for power generation will be from LNG only and will not consume HFO for any part of the generation process. All relevant licenses, permits and approvals are for the consumption and use of LNG only.

Combustion of HFO results in emissions of oxides of nitrogen (NO and NO_2, referred to as NO_X), carbon monoxide (CO), sulphur dioxide (SO_2) and particulates. Heavy Fuel Oil (HFO) is a refined liquid fuel, consisting primarily of hydrocarbons with smaller amounts of hydrogen, nitrogen, sulphur, and volatile organic compounds. Low-sulphur HFO has a sulphur content of less than 2%.

In a case where HFO is used rather than LNG, the resultant ambient SO_2, NO_2 and PM_{10} concentrations are likely to be low and well below the NAAQS, although they may be somewhat higher than for LNG. The spatial extent on any air quality impact is likely to be somewhat bigger than for LNG. The duration of the impact, the consequence, frequency, probability, and likelihood of impacts using HFO are likely to be the same as for LNG. Therefore, *the significance of any impacts associated with HFO is likely to be low to very low.*

The benefits of running the engine on NG include emission reductions of NO_x, SO_x, CO_2, particulates, no smoke, reduced waste streams to meet the requirements of local or international legislations. No emission abatement will be installed for the control of these emissions. NO_x emissions are controlled to the required concentration at source using selective catalytic reduction (SCR). LNG has only trace amounts of sulphur, if any. LNG is the cleanest fuel possible, and the combustion of LNG does not result in SO_2 emissions of any significance. Similarly, particulate emissions are very low. The maximum predicted SO_2 concentrations resulting for the proposed project is well below 1 $\mu g/m^3$.

The use of natural gas to generate electricity, which is what the Powerships technology is designed to do, is the preferred alternative for power generation from an air quality perspective.

8.4.12 **Heritage, Archaeology and Palaeontological Impacts**

No heritage sites were identified for both alternatives of the transmission line and within the laydown area for the installation of the pipeline.

The area is in an area of low to medium palaeontological sensitivity. Cretaceous deposits, that occur 3m – 5m below the surface, were noted during the harbour expansion project. The proposed project will not reach those depths and it consists of small impact areas for each pole.

No further heritage impacts' mitigation is required.

If any shell layers are affected during the course of construction, KZNARI must be informed immediately. This will not delay the construction since the material would already be exposed and on the surface. It will be merely to assess the deposits.

8.4.13 **Major Hazards Impacts**

The impacts from MHI will be similar for both powerships-FSRU positions alternatives, as the same ships will used for both alternatives. The only difference will be in the alignment and positioning of the ships.

8.4.13.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The main risk contributing part of the operation is the possible rupture of one of the transfer hoses, considered as a High impact, which can be mitigated to a Medium impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
INDIRECT IMPACTS				
Rupture of one of the transfer hoses	Discharge of LNG into the marine environment leading to a flash and pool fire	High	Inspection on the quality and integrity of the pipeline; Good housekeeping must always be observed on site; Only suitably qualified people must be used for all installation work; An accredited installer must conduct a pressure test and provide the relevant compliance certificates. There must be an operational manual for each operation.	Medium

8.4.14 **Socio-Economic Impacts**

Stimulation of production, employment, government revenue, skills development, household income, increased electricity supply, and socio-economic and enterprise development as a result of the investment in the project and its subsequent operations will have Medium to High positive impacts as a result of the project. These will outweigh the Low negative impacts possible production, employment and household income losses that could potentially be experienced by local businesses affected by changes in the areas sense of place, social conflicts and deterioration in economic and social infrastructure. The socio-economic impacts of the alternatives will be identical, and were therefore not assessed separately.

8.4.14.1 Powership, Gas Pipeline and Transmission Line Alternatives 1 and 2: Construction Phase

During the construction phase, the proposed Powerships and their associated infrastructure will have both positive and negative effects on the socio-economic environment.

The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R849.7 million of new business sales, R242.9 million of GDP and 1 001 FTE employment positions will be generated by the project in the national economy through multiplier effects, all High positive impacts. In addition, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings by R115.9 million. The will all have Medium positive impacts. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

The project may, however, also create negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows. These can all be mitigate to Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Direct spend within local economies such as trade, accommodation, transport services, personal services, real estate, and insurance	Temporary stimulation of the national and local economy	High (Positive)	The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers where feasible.	High (Positive)

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Employment during construction phase	Temporary increase in employment in the national and local economies	High (Positive)	Organise local community meetings to advise the local labour force about the project that is planned to be established and the jobs that can potentially be applied for. Establish a local skills desk (in uMhlathuze LM) to determine the potential skills that could be sourced in the area. Recruit local labour as far as feasible. Employment of labour-intensive methods in construction where feasible. Sub-contract to local construction companies particularly SMME's and BBBEE compliant and women-owned enterprises where possible. Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering and other services to the construction crew	High (Positive)
Skills Development during construction phase	Contribution to skills development in the country and local economy	Medium-Low (Positive)	Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases. Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.	Medium (Positive)
Household Earnings	Temporary increase in household earnings	Medium (Positive)	Recruit local labour as far as feasible to increase the benefits to the local households. Employ labour intensive methods in construction where feasible. Sub-contract to local construction companies where possible. Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews.	Medium (Positive)
Combination of personal income tax, VAT, companies' tax, etc. by companies and employees during construction of the transmission line	Temporary increase in government revenue	Medium (Positive)	None suggested.	Medium (Positive)
Influx of worker during construction of the transmission line	Temporary increase in social disruptions associated with the influx of people	Medium-Low	Set up a recruitment office in Richards Bay and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment. Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence. Employ locals as far as feasible through the creation of a local skills database. Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area. Ensure that any damages or losses to nearby buildings that can be linked to the conduct of construction workers are adequately reimbursed. Assign a dedicated person to deal with complaints and concerns of affected parties	Low
Influx of worker during construction of the transmission line	Impact on economic and social infrastructure	Medium-Low	Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site. Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers. Where feasible, assist the municipality in ensuring that the quality of the local social	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			and economic infrastructure does not deteriorate through the use of social responsibility allocations.	
Increase in local traffic and in migration of construction workers	Changes to the sense of place	Low	The mitigation measures proposed by the visual and noise specialists should be adhered to Efforts should also be made to avoid disturbing such sites during construction.	Low

8.4.14.2 Powership, Gas Pipeline and Transmission Line Alternatives 1 and 2: Operational Phase

During the operation of the proposed Powerships and their associated infrastructure, the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects.

The operation of the proposed Powerships and their associated infrastructure will generate R528.1 million of new business sales, contribute R320.7 million to GDP and create 288 sustainable FTE employment positions, all High positive impacts. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities. The above will have Medium positive to High positive impact significance.

Negative impacts include the potential changes in the sense of place. These potential losses, if they do occur, are likely to be small, given the industrial nature of the proposed development area, and is therefore assigned Low impact significance both pre- and post-mitigation. As in the case with the impacts observed during construction, negative effects can be mitigated (although not entirely eradicated), and positive impacts enhanced.

The assessment of the Powerships and their associated infrastructure, or its net effect from a socio-economic perspective, indicates that the development would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of their establishment.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Spending on labour and procurement of local goods and services	Sustainable increase in production and GDP nationally and locally	High (Positive)	The operator of the Powerships and related infrastructure should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.	High (Positive)

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Creation of FTE employment positions	Creation of sustainable employment positions nationally and locally	High (Positive)	Where possible, local labour should be considered for employment to increase the positive impact on the local economy. As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and related infrastructure.	High (Positive)
Skills development contributions by Karpowership	Skills development of permanently employed workers	Medium-High (Positive)	The developer should consider establishing vocational training programmes for the local labour force to promote the development and transfer of skills required by the Powerships and their related infrastructure and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.	Medium (Positive)
Household Earnings	Improved standards of living for benefiting households	Medium-High (Positive)	Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy. As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and their related infrastructure.	Medium - High (Positive)
Salaries and wages payments	Sustainable increase in national and local government revenue	Medium-High (Positive)	None suggested.	Medium - High (Positive)
Increasing of the electricity supply	Provision of electricity for future development	High (Positive)	None suggested.	High (Positive)
Karpowership's involvement in programmes that seek to address the local communities social and economic needs	Local economic and social development benefits derived from the project's operations	Medium (Positive)	A social development and economic development programmes should be devised by the developer throughout the project's lifespan. The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. These plans should be reviewed on an annual basis and, where necessary, updated. When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises. In devising the programmes to be implemented, the developer should take into account the priorities set out in the local IDP.	Medium - High (Positive)
Increase in local traffic and new workers	Negative changes to the sense of place	Low	The mitigation measures proposed by the visual and noise specialists should be adhered to Efforts should also be made to avoid disturbing such sites during operation.	Low

8.4.15 Noise Impacts

The noise impacts of both alternatives will be identical, and were therefore not assessed separately.

8.4.15.1 Transmission Line Alternatives 1 and 2: Construction Phase

Noise will have a Medium-Low impact during the construction phase. This can be mitigated to Very Low impact by restricting all works to daylight hours and creating awareness amongst the workforce to be sensitive to the surrounding environment.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of Transmission Line	Nuisance to surrounding operations or landowners	Medium-Low	• All construction operations should only occur during daylight hours if possible. • No construction piling should occur at night where possible. Piling should only occur during the day to take advantage of unstable atmospheric conditions. • Construction staff should receive “noise sensitivity” training such as switching off vehicles when not in use, location of NSA’s etc. • An ambient noise survey should be conducted at the noise sensitive receptors during the construction phase.	Very Low

8.4.15.2 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The Medium-High impact of operation of the powership, FSRU and LNG carrier can be mitigated to a Medium-Low impact by installing suitable noise abatement technology and undertaking noise monitoring.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of powership, FSRU and LNG carrier	Nuisance disturbance to operations within the port	Low	• The noise impact from the proposed project should be measured during the operational phase, to ensure that the impact is within the required legal limit. • A marine specialist should be consulted to determine the effects of underwater noise on marine animals in the vicinity. • Install acoustic enclosures around all major noise emitting components to supress the noise emissions from equipment such as engines. • Install Silencers on equipment such as exhaust stacks and turbo chargers.	Low

8.4.16 NO-GO ALTERNATIVE

Should the Karpowership gas-to-energy project is not implemented, the benefits of the proposed activity will not be realised (with the status quo remaining) and neither will the associated negative impacts/risks. This means that the supply of additional electricity to the national grid will not be supplemented by an IPP. The status quo with regard to the national supplier will remain, i.e. the national grid will continue to be strained as a result of aging and failing systems within the fleet. This will be exacerbated by the time taken for the national supplier to design, assess, receive authorisation, construct and bring online any new power generation facilities. The negative impacts on the physical and social environmental will also not occur. In contrast, any positive impacts or opportunities that will be created by the proposed development, such as job creation or social upliftment, will not be realised.

Aspect	Impact	Significance
Terrestrial ecology	No impacts on loss of vegetation communities, loss of Species of Special Concern, biodiversity, ecosystem function and process.	Medium (Positive)
Avifauna	No disturbance to birds, loss of habitat, collisions or electrocutions.	Medium (Positive)
Wetlands	No impact to the wetland units CVB01, FP01, FP02, FP03 and UVB04.	Medium (Positive)
Hydropedology	No impacts on hydropedological flow drivers, soil quality or potential to compromise surface water quality in the nearby watercourse.	Medium-Low (Positive)
River and riparian (aquatic)	No adverse impacts hydrological regime of the river and riparian areas or on the aquatic biota.	Medium-Low (Positive)
Hydrology	No impact of sedimentation or contamination of surface water.	Medium (Positive)
Geohydrology	No impacts to the vadose zone or quality of the groundwater resources	Medium (Positive)
Climate Change	Supplementary baseload will have to be sought elsewhere, possibly from sources with higher emissions than LNG	High (Negative)
Estuarine	No disturbances to the estuarine habitats and organisms	High (Positive)
Marine Ecology	No impacts to the benthic community, the marine ecology or marine organisms.	Low (Positive)
Air quality	No health risks through inhalation of air pollutants	Very Low (Positive)
Heritage, archaeology and palaeontology	Not assessed.	N/A
Major Hazard Risks	No risks of major hazards such as flash and pool fires	Medium (Positive)
Socio-economic	No influx of workers and job seekers from outside of the local community, no increase in impact on the surrounding economic and social infrastructure, no limited visual and noise disturbances	Medium-Low (Positive)

	No contribution towards the national and local economy through new business sales, contribution to GDP or employment.	High (Negative)
Noise	Ambient noise levels both above ground and underwater will remain the same and not cause a nuisance or any adverse impacts on sensitive receptors.	Medium-Low (Positive)

Table 8-5: Impact of implementing the No-Go Alternative.

The following benefits could occur if the no-go alternative is implemented:

- No impacts on loss of vegetation communities, loss of Species of Special Concern (mangrove trees and the orchid *Eulophia speciosa*), biodiversity, ecosystem function and process
- There will be no negative impacts (such as contamination and sedimentation, or destruction of vegetation) on the wetlands identified along the transmission line route. This will mean that the wetlands remain in their current state.
- No impacts on hydropedological flow drivers, soil quality or potential to compromise surface water quality in the nearby watercourse.
- The hydrological regime of the river and riparian areas will not be adversely impacted by the clearing of vegetation and increase sediment input, and the hardened surface will result in increased runoff patterns into the drainage lines. The likely to impact on the associated aquatic biota due to changes in water quality and flow regimes will be negated.
- No sedimentation or contamination of surface water from construction or operation activities.
- There will be no impacts to the vadose zone or quality of the groundwater resources.
- A missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
- No disturbances to the estuarine habitats and organisms.
- No impacts to the benthic community, the marine ecology or marine organisms.
- No increase in ambient concentration of SO_2, NO_2 and PM_{10}, resulting in no health risks through inhalation of air pollutants.
- No risks of major hazards such as flash and pool fires.
- No influx of workers and job seekers from outside of the local community, no impact on the surrounding economic and social infrastructure, no limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows and no potential changes in the sense of place.
- The ambient noise levels both above ground and underwater will remain the same and not cause a nuisance or any adverse impacts on sensitive receptors.

In contrast to the above, the following implications will occur if the no-go alternative is implemented:

- Supplementary baseload will have to be sought elsewhere, possibly from sources with higher emissions than LNG, contributing to climate change.
- There will be no notable contribution towards the national and local economy during the construction phase. The estimated total of R849.7 million of new business sales, R242.9 million of GDP and 1 001 FTE employment positions will not be generated by the project in the national economy through

multiplier effects. Aside from the above positive effects, the project will not contribute to skills development in the country, increase government revenue, or raise household earnings by R115.9 million. The no increase in household earnings is also likely to not improve the standards of living of the affected households temporarily during the construction phase.

- The non-operation of the proposed Powerships and their associated infrastructure will not generate R528.1 million of new business sales, contribute R320.7 million to GDP or create 288 sustainable FTE employment positions. In addition, government revenue will not rise, electricity supply will not be increased, and various socio-economic and enterprise development initiatives will not be undertaken from the revenue generated by the development. These funds will not be allocated towards socio-economic development in the area and will not bring a significant benefit to local communities.

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country and will not contribute further to the local economy by provide employments opportunities. Hence the “no-go” alternative is not the preferred alternative.

8.4.17 CUMULATIVE IMPACTS

The preceding impact assessment assessed the impacts associated with the proposed project largely in isolation. As per the legislated requirements, cumulative impacts associated with a proposed development must be assessed.

A cumulative impact, in relation to an activity, is the incremental impact of the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts from similar or diverse activities. Cumulative impacts can take place frequently and over a period of time that the effects cannot be assimilated by the environment over time.

The cumulative impacts have been assessed by identifying other similar project proposals and other applicable projects, such as gas-to-energy or electricity generation, and transmission or distribution facilities within 10 km of the proposed Karpowership gas-to-power project that have either been approved or are currently underway.

Given the similar proposed projects and current operations within close proximity to the study area, cumulative impacts can potentially occur. Anticipated cumulative impacts, based on information available at the time of the assessment, and as relevant to this powership project, were assessed and included in this EIA report.

Regarding other proposed projects in the area, it must be noted that limited information was available. At this stage, the approach of the Independent Power Producer (IPP) Procurement Programme is not clear, and it will have to be further confirmed whether only one bidder or more will be selected for the programme, and as such, will affect the potential cumulative impacts. Furthermore, at this stage, only the proposed scope of projects that are currently underway can be assessed (based on information available), and any changes to the scope as a result of the permitting process and the final project outcome (e.g. authorised alternatives) are unknown and thus cannot be assessed.

8.4.17.1 Identification of Similar Developments

The project site is located within the existing and operational port of Richards Bay, adjacent to the Richards Bay Industrial Development Zone (RBIDZ). This area is characterised by light and heavy industrial operations, with further planning to expand the port and the operations at the RBIDZ.

Other proposed gas to power projects identified within the area include –

1. 320MW Emergency Risk Mitigation Power Plant (RMPP) and associated infrastructure near Richards Bay. The project includes *inter alia* the construction of a Main Power Island consisting of aeroderivative gas turbines operated in open cycle comprising air intake, air filter structures and exhaust stack for the generation of electricity using LPG, auxiliary transformers, LPG storage comprising up to 10 000m^3 of storage (13 bullets) demineralisation water treatment plant, 3 effluent reticulation systems and 132kV interconnecting substation and power lines connecting to the grid transmission infrastructure.
2. 400MW gas to power project at the RBIDZ (proposed amendments to the existing Environmental Authorisation and EMPr). The scope includes 6 gas turbines for mid-merit/peaking plant power provision, with 2 steam turbines utilizing the heat from the engineers in a separate steam cycle, as well as 3 fuel tanks of 2000m^3 each for on-site fuel storage.
3. Liquid Natural Gas (LNG) project, as proposed by the Transnet National Port Authority (TNPA) within the Port of Richards Bay. Based on limited information available, the scope of the proposed project seemingly includes a gas pipeline infrastructure within the harbour, running from the eastern portion of the port (Coal terminal) to the proposed power plant and gas distribution facility, located near the Bayside substation, within South32 property adjacent to the port.
4. Grid connection infrastructure for the 400MW RBGP2 gas-to-power plant. Based on the final Scoping Report, this project includes the development of an 8.5km long 132kV overhead powerline and switching station to connect the authorised RBGP2 400MW gas-to-power facility to the national grid at a feasible grid connection point to the south of the power station site.
5. Richards Bay Gas to Power - IDZ 1 F - EAP Savannah
6. Eskom 3000 MV CCPP - IDZ 1D - EAP Savannah
7. Nseleni Independent Floating Power Plant - Port/ old Bayside complex - SE Solutions

Other existing and operational facilities in proximity to the study area include various substations (Impala, Hillside, Athene, Polaris, Newside), various 132kV overhead power lines (Impala/Nseleni 1, Alusaf Bayside/Impala 1, Alusaf Bayside/Impala 2, Athene/Hillside 1, Athene/Hillside 2 and Athene/Hillside 3), Phinda gas-to-power facilities, Richards Bay Coal Terminal, Fermentech Fertilizer Supplier facility, South32 / Bayside Aluminium facility and Mondi Richards Bay facility. In addition, developments that have received authorisation which potentially pertain to cumulative impacts in terms of emissions include Eskom CCPP, Elegant Afro Chemicals Chlor-Alkali Plant, Hulamin (previously Isizinda) expansions, and the Mondi Upgrade.

Cumulative effects associated with these similar types of projects include *inter alia*:

- Marine vessel traffic;
- Avifaunal collisions and mortalities;
- Wetland and habitat destruction and fragmentation;
- Physio-chemical changes to aquatic resources
- Job creation;
- Social upliftment; and
- Upgrade of infrastructure and contribution of energy into the National Grid.

From a cumulative impacts perspective, it is not anticipated that the Karpowership gas-to-energy project will result in unacceptable risks or loss to the environment. This is supported by the fact that the proposed project will be located within the IDZ, an area already earmarked and zoned for industrial use. This means that the site, will at some point be used for an industrial purpose. Furthermore, the location of the powerships and FSRU are within the existing port limits and will integrate into the daily port operations.

The cumulative impacts have been further separated according to the aspects and are discussed in detail in the subsequent sections.

8.4.17.2 Potential Cumulative Impacts on Terrestrial Ecology

No cumulative impacts were identified for terrestrial ecology.

8.4.17.3 Potential Cumulative Impacts on Avifauna

No cumulative impacts were identified for avifauna.

8.4.17.4 Potential Cumulative Impacts on Wetlands

The cumulative loss of wetlands within the Port of Richards Bay and surrounding landscape has been extensive due to the current and past land use changes (e.g: from the industrial and port activities). The further loss of wetlands within the Port of Richards Bay and surrounding landscape would result in a High Negative Cumulative Impact. In terms of mitigation, avoidance (in terms of destruction of wetlands and adhere to the provided buffers) and rehabilitation of wetlands would improve the Present Ecological State and the functionality (important services) of the wetlands.

8.4.17.5 Potential Cumulative Impacts on Hydropedology

No cumulative impacts were identified for hydropedology.

8.4.17.6 Potential Cumulative Impacts on River and Riparian (Aquatic) Resources

Physiochemical changes in water quality of the surrounding unnamed drainage lines as a net result of the increase of surrounding industrial activities and associated impacts. They may be a result of both the construction and operational activities related to the surrounding developments, and will have a Medium impact on the aquatic resources.

8.4.17.7 Potential Cumulative Impacts on Hydrology

No cumulative impacts were identified for hydrology.

8.4.17.8 Potential Cumulative Impacts on Geohydrology

No cumulative impacts were identified for geohydrology.

8.4.17.9 Potential Cumulative Impacts on Climate Change

Cumulative climate change impacts for the LNGC project component relate to the emission of greenhouse gases (GHGs) with varying levels of global warming potential (GWP, refer to **Error! Reference source not found.** on page **Error! Bookmark not defined.**). While the emissions from operation of the Powerships have been quantified and are known (refer to Section **Error! Reference source not found.**), emissions from the extraction and transport (i.e., the logistics and value chain) of the LNG used to fuel the Powership are not known. The significance ratings of High (without mitigation) and Medium (with mitigation) of cumulative GHG emissions from the LNGC component is therefore an estimate only and may need to be refined based on new information.

Cumulative climate change impacts for the FSRU project component relate to the emissions of greenhouse gases (GHGs) with varying levels of global warming potential. There is potential for fugitive emissions during the transfer of LNG between the LNGC and FSRU, as well as during transfer from the FSRU to the Powership via the undersea gas pipeline. Given the localized nature of this impact (i.e., at source/site), emission-related risk is lower since fugitive emissions from a leak in the transfer process will likely be quickly identified and rectified as they will directly impact performance and efficiency of the Powership. The impact is also offset to a certain extent by the design specifications of the gas pipeline and hose, particularly related to its diameter. The overall emissions impact of the FSRU project component is consequently of medium and medium-low significance with and without mitigation, respectively.

Operation of the gas pipeline may result in emissions of greenhouse gases with global warming potential from potential leaks. This impact is described and assessed under the FSRU sub-heading above, and the impact scores are consequently the same. It is important to note that the cumulative impact of fugitive GHG emissions should be considered as part of the entire Powership operation since vessels are connected by linear infrastructure to each other.

The operation of the Powerships at Richards Bay will emit ~17.04 MT CO_2e over its 20-year lifespan. This impact is potentially significant and needs to be considered cumulatively alongside the emissions from Powership operations at Saldanha Bay and Ngqura which will generate 12.5 and 17.04.27 MT $C0_2$e in their operational lifetimes, respectively. This means that total emissions for the 20-year lifespan of all three proposed Powerships will be ~56 MT $C0_2$e. The average annual emissions for all three Powerships will therefore be ~18.7 MT $C0_2$e, roughly 0.16% of South Africa's annual GHG emissions in 2017. Technological measures to reduce emissions at source as well as potential contributions to appropriate carbon offset, storage or drawdown initiatives can reduce the impact significance to Medium-High.

Contributions to overall project emissions from the construction phase are rated as Very Low and easily mitigated for both the 132kV Transmission Lines to Substation and Steel Lattice Towers.

8.4.17.10 Potential Cumulative Impacts on Estuaries

Cumulative impacts that may arise include, but are not limited to:

- The project will positively impact on the Port and the economic activities related thereto by providing for short term provision of power to the SEZ when the country is experiencing power shortages. The increased electricity generation capacity, when considered as part of the national Integrated Resources Plan (IRP), from the project will contribute to an enabling environment for economic growth; and
- The project could add to the potential polluting activities in the Richards Bay/ uMhlathuze estuarine system, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Richards Bay/ uMhlathuze estuarine system, conflict with birds and the systems critically important nursery function as well as the potential introduction of pathogens which could affect the current state of the system. Mariculture facilities and operations could also be negatively impacted. Such events must be controlled collectively by the TNPA and SAMSA. While issues relating to pollution are not considered to be of greater threat or significance than current port activities, the risk of cumulative impacts to the sensitive estuarine environments increases as activities within the Port increases.

All efforts should be made to mitigate potential negative cumulative impacts identified by considering the proposed development in both a local and regional context in terms of other current and proposed coastal activities.

8.4.17.11 Potential Cumulative Impacts on Marine Ecology

There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. This will cumulatively contribute a small amount to suspended sediment from port maintenance dredging activities. Accordingly, combined with natural episodic high turbidity events, the local biological communities should be acclimatised to elevated turbidity levels.

8.4.17.12 Potential Cumulative Impacts on Air Quality

A background concentration refers to the portion of the ambient concentration of a pollutant due to sources, both natural and anthropogenic, other than the source being assessed. The annual average ambient concentrations of PM_{10} and SO_2 at the RBCAA monitoring stations were used as background concentrations to gauge the potential cumulative effect of the Karpowership Project emissions in the Richards Bay area.

Current ambient SO_2 concentrations are low relative to the NAAQS. The addition to the existing SO_2 concentrations will be less than 1 µg/m^3 throughout the assessment area. The cumulative effect of the emissions from the Karpowership Project on ambient SO_2 concentrations is therefore predicted to be very small and will not result in exceedances of the NAAQS. The severity of the cumulative impact associated with SO_2 is predicted to be insignificant.

For NO_2, at the point of predicted maximum concentrations 1.3 µg/m^3 will be added to the existing annual ambient concentrations and a maximum of 19.0 µg/m^3 will be added to the 1-hour concentrations. The addition will be less than this elsewhere in the Port of Richards Bay and the assessment area where predicted ambient concentrations are much lower. The cumulative effect of the emissions from the Karpowership Project on ambient NO_2 concentrations is small and is unlikely to result in exceedances of the NAAQS. The severity of the cumulative impact associated with NO_2 is predicted to be small.

Ambient PM_{10} concentrations have been shown to have increased in Richards Bay over the last three years, but these remain well below the NAAQS. Monitoring has shown that ambient PM_{10} concentrations are relatively high because of high regional background concentrations from sources such as biomass burning, industrial activity, terrestrial dust and long-range atmospheric transport. At the point of maximum predicted ambient concentrations, the Karpowership Project will add less than 1 µg/m^3 to the existing annual ambient concentrations and will add a maximum of 1.7 µg/m^3 to the 24-hour concentrations. The addition will be less than this elsewhere in the modelling domain where predicted ambient concentrations are very low. The cumulative effect of the emissions from the Karpowership Project on ambient PM_{10} concentrations is small and is unlikely to result in exceedances of the NAAQS. The severity of the cumulative impact associated with PM_{10} is predicted to be small.

8.4.17.13 Potential Cumulative Impacts on Heritage, Archaeology and Palaeontology

No cumulative impacts were identified for heritage, archaeology and palaeontology.

8.4.17.14 Potential Cumulative Impacts on Material Hazards Identification

No cumulative impacts were identified for Material Hazards Identification.

8.4.17.15 Potential Cumulative Impacts on Socio-Economy

Potential Positive Cumulative Impacts during the Construction Phase

In terms of the temporary increase in the GDP and production of the national and local economies during construction, currently Eskom has planned to develop a Combined Cycle Power Plant (CCPP) and associated infrastructures, with a generating capacity of up to 3000MW operated with natural gas as the main fuel resource. Should this development (planned for commissioning within 36 months) arise, the demand for goods and services required for the construction of similar facilities would grow. This could provide sufficient economies of scale and thus open up opportunities for the establishment of new industries in the country and new businesses in the local area, specifically in the sectors that are not well represented in the economy.

With regard to the contribution to skills development in the country and in the local economy, there will be improved labour productivity and employability of construction workers for similar projects as well as possible development of local skills and expertise in R&D and manufacturing industries related to the gas industry through partnerships with the University of Zululand.

There will be an improved standard of living of the positively affected households. The temporary increase in government revenue will result in lower government debt and servicing costs.

Potential Negative Cumulative Impacts during the Construction Phase

Change in perception of the area due to the construction of the infrastructure linked to similar developments albeit temporarily due to the impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase.

Potential Positive Cumulative Impacts during the Operational Phase

Temporary increase in the GDP and production of the national and local economies during construction will result in improved energy supply in the country; reduced carbon emissions in generation of electricity; and sufficient economies of scale could be created to establish new businesses in the local economies. These businesses could then supply the goods and services required for the operation and maintenance of the facility than cannot currently be procured in the area. This would contribute to the local economies' growth and development.

The creation of sustainable employment positions nationally and locally will improve living standards of the directly and indirectly affected households. Development of new skills and expertise in the country to support the development of the gas industry (such as the RBCCPP) for permanently employed workers.
The improved standard of living for benefitting households will have a knock-on effect of improving the productivity of workers and improving the health and living conditions of the affected households.

The resultant sustainable increase in national and local government revenue will result in a possible improvement in service delivery.

The provision of electricity for future development will increase volume and certainty of the energy supply.

Local community and social development benefits derived from the project's operations will include declining levels of poverty in uMhlathuze LM, and KwaZulu-Natal, improved standards of living of the members of the community and households that benefit from the various programmes, and possible improvements in access to services and status of local infrastructure.

Potential Negative Cumulative Impacts during the Operational Phase

There will be a change in perception of the area due to the Powerships presence in the port over the operating timeframe due to the impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase.

8.4.17.16 Potential Cumulative Impacts on Noise

The cumulative impact from the other noise sources in the Port of Richard's Bay is extremely difficult to predict. As the noise level at a receptor increases, the "loudest noise" will generally be heard. Therefore, if in future another noise source e.g., a power plant, is located closer to the receptor and it is generating more noise energy, the new noise source will be perceived above the other noise sources.

8.4.17.17 Potential Cumulative Impacts on Marine Traffic

A marine traffic analysis is being undertaken to ascertain the effect of LNG vessels calling at the proposed FSRU mooring in the port, on current and future vessel traffic of the Port of Richards Bay. The marine traffic analysis is based on LNG delivery considering LNGC vessels, with a capacity of 218 000 m^3 resulting in an LNG demand estimate of 24 vessel calls per annum.

The average number of traffic vessels calling at the Port of Richards Bay for a typical calendar year is approximately 2 100 vessels, with the majority being vessels for bulk operations. Bulk operations in the port currently focus on four major activities: export coal from Richards Bay Coal Terminal (RBCT), dry bulk, break-bulk and liquid bulk. The existing traffic in the port considers general cargo vessels of 50 000 DWT manoeuvring to and from the 700 series minor bulk berths and bulk carriers of 150 000 DWT manoeuvring to and from the 6 berths at the 300 series for the export of coal from RBCT. Other traffic in the port considers liquid bulk vessels from berth 208 and berth 209 and MPT vessels from the 600 series berths. The latter traffic may impact the FPP site, but the assumed frequency of this traffic will be low. The primary challenge for the port will be to accommodate the growing demand for the handling of break bulk cargoes. Medium term development projects see the 600 series break bulk basin expanding to include a new break bulk berth. This may impact the vessel traffic at the FPP site. At the FPP site, a gas reciprocating engine powership or barge will be moored on a spread-mooring in the protection of the harbour to export power via overhead transmission cables to an Eskom transmission substation on the shore. The powership and FSRU will be moored on independent spread-moorings but in close proximity in order to reduce the gas distribution pipeline length and overall footprint of the facility infrastructure.

The impact on existing port vessel traffic as a result of the LNG demand estimate of 24 vessel calls per annum is an increase in vessel traffic by less than 1%. The vessel call estimate for the short term is being carried out to determine the trends in the increase in vessel traffic over the next seven years and to assess the associated implications for navigational safety. The annual percentage growth in demand is being used to estimate the future vessel traffic for the various cargo handled within the port for the years 2021 to 2028. The effect on future port operations of the LNGC traffic combined with the forecasted future port traffic will then be assessed. Additionally, the effect on current and future port operations with respect to navigation of traffic vessels past the FPP and FSRU mooring is being assessed.

Aspect	Cumulative Impact	Cumulative Impact Significance

Terrestrial ecology	No cumulative impacts identified.	N/A
Avifauna	No cumulative impacts identified.	N/A
Wetlands	Loss of wetlands within the Port of Richards Bay and surrounding landscape	High (Negative)
Hydropedology	No cumulative impacts identified.	N/A
River and riparian (aquatic)	Physiochemical changes in water quality of the surrounding unnamed drainage lines	Medium (Negative)
Hydrology	No cumulative impacts identified.	N/A
Geohydrology	No cumulative impacts identified.	N/A
Climate Change	The cumulative GHG emissions from the LNGC component is therefore an estimate only and may need to be refined based on new information.	High (Negative)
	There is potential for fugitive emissions during the transfer of LNG between the LNGC and FSRU, as well as during transfer from the FSRU to the Powership via the undersea gas pipeline.	Medium (Negative)
	The operation of the Powerships at Richards Bay will emit ~17.04 MT CO_2e over its 20-year lifespan. When considered cumulatively with the emissions from the powerships proposed at the Ports of Saldanha and Ngqura, total emissions for the 20-year lifespan of all three proposed Powerships will be ~56 MT $C0_2e$.	High (Negative)
Estuarine	Increase in economic activities related to the port and providing for short term provision of power to the SEZ when the country is experiencing power shortages.	High (Positive)
	Addition to the potential polluting activities in the Richards Bay/ uMhlathuze estuarine system, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Richards Bay/ uMhlathuze estuarine system, conflict with birds and the systems critically important nursery function as well as the potential introduction of pathogens which could affect the current state of the system. Mariculture facilities and operations could also be negatively impacted.	High (Negative)
Marine Ecology	Temporary increase in turbidity during the installation of the pipeline and mooring structures on the seabed in conjunction with port maintenance dredging activities.	Low (Negative)
Air quality	Increase in ambient concentrations of SO_2, NO_2 and PM_{10}	Very Low (Negative)
Heritage, archaeology and palaeontology	No cumulative impacts identified.	N/A

Major Hazard Risks	No cumulative impacts identified.	N/A
Socio-economic	Change in perception of the area.	Low (Negative)
	increase in the GDP and production of the national and local economies as well as	High (Positive)
Noise	The cumulative impact from the other noise sources in the Port of Richard's Bay is extremely difficult to predict. As the noise level at a receptor increases, the "loudest noise" will generally be heard. Therefore, if in future another noise source e.g., a power plant, is located closer to the receptor and it is generating more noise energy, the new noise source will be perceived above the other noise sources.	N/A
Marine Traffic	Increase in marine traffic.	Low (Negative)

Table 8-6: Significance of Potential Cumulative Impacts.

8.4.18 DECOMMISSIONING PHASE IMPACTS

The Karpowership project has a potential lifetime of approximately 20 years. At the end of the Power Purchase Agreement (PPA), the ship will depart the harbour and all pipelines and grid connections which are classified as own built will be decommissioned and the infrastructure subsequently removed. The decommissioning process will begin at the end of the PPA. Prior to commencing decommissioning, the Project will be shut down, de-energised and disconnected from the national grid. The Applicant will give landowners sufficient notice prior to the commencement of the decommissioned activities.

It is not anticipated that the proposed Karpowership project will be decommissioned in the foreseeable future. When decommissioning takes place, the legislation applicable at that time should be complied with, and relevant environmental processes and practices implemented. Therefore, an assessment of impacts for this phase is not applicable at this stage.

In the unlikely event that decommissioning occurs in the foreseeable future, the impacts and associated mitigation measures are expected to be similar to those that take place during the construction phase.

8.5 ENVIRONMENTAL IMPACT STATEMENT

2014 NEMA EIA Regulations (as amended), Appendix 3 3(1) (l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.

During the EIA, the impact of the Proposed Gas to Power via Powership Development on the biophysical, heritage and socio-economic environments were assessed. Table 8-7 below is a summary of key findings of EIA, including positive and negative impacts and risks of the proposed activity and identified alternatives. Detailed information can be found in Sections 8.3, 8.4, Specialists studies (Appendix I), Impact Matrix (Appendix C) and the EMPr (Appendix G). Please also refer to Appendix A2 and Appendix A3 for the Sensitivity and Cumulative Maps.

Aspect	Finding
Terrestrial Ecological	The site comprises a mix of both transformed areas as well as modified and degraded habitat largely dominated by alien invasive species as well as some ruderal indigenous species. The preferred transmission line route traverses primarily transformed and modified habitat, with small sections of indigenous vegetation, and is considered the best route for lowest impacts to terrestrial habitats.. The alternative transmission line route traverses Critically Endangered habitats (sensitive mangroves and swamp forests) and is considered fatally flawed. Construction and operational activities related to the transmission line, switching station and laydown area will have Medium-Low to High impacts on loss of vegetation communities, loss of Species of Special Concern, biodiversity, ecosystem function and process. These Medium-Low to High impacts identified for the construction phase can be mitigated to Low and Very Low significance. No cumulative impacts were identified. It is the opinion of the specialist that the proposed development go ahead, provided the mitigation measures are put into place. The recommended mitigations measures were included in the EMPr.
Avifauna	The site is mostly of low sensitivity due to the wide distribution of modified and degraded habitats and the alignment of the majority of the transmission line route with existing infrastructure, placing it primarily within transformed or modified habitat, resulting in little overall loss of avifauna habitat. Impacts are Moderate and can be reduced to low with the recommended mitigation measures, as incorporated to the EMPr. No cumulative impacts were identified for avifauna.
Wetland	A total of twenty five (25) watercourses were identified within the 500m assessment radius of the project area, which are one (1) artificial dam, one (1) estuary/port waters, three (3) Channelled Valley Bottom (CVB) wetlands, one (1) depression wetland, five (5) floodplain (FP) wetlands, four (4) Unchannelled Valley Bottom (UVB) wetlands, six (6) hillslope seepage wetlands and four (4) river riparian systems. These watercourses have undergone moderate to moderately high disturbance from historic and current land use practices. This has resulted in the overall integrity of the assessed wetlands scores ranging from moderately modified to largely modified. It was determined that CVB01, FP01, FP02, FP03, UVB01, UVB04 and Seep06 will be impacted upon by the proposed development. These impacts can be reduced following the specialist's mitigations measures which are included in the EMPr, in addition to the implementation of the Wetland Rehabilitation Plan. Several aspects of the proposed development did not have the ability to be mitigated from a moderate to low risk rating.

Aspect	Finding
	The clearing of vegetation for the construction of the preferred transmission line route and the laydown area for the gas pipeline installation within the wetlands will have direct Medium impacts on wetland resources. These impacts can only be mitigated Medium-Low and Medium impacts. The impacts of alternative 2 for the transmission line route will be higher as it will travers the sensitive swamp forest (FP02) and it will have a larger footprint of impact, and therefore the wetland specialist does not support this route. The cumulative loss of wetlands within the Port of Richards Bay and surrounding landscape has been extensive due to the current and past land use changes (e.g: from the industrial and port activities). The further loss of wetlands within the Port of Richards Bay and surrounding landscape would result in a High Negative Cumulative Impact. In terms of mitigation, avoidance (in terms of destruction of wetlands and adhere to the provided buffers) and rehabilitation of wetlands would improve the Present Ecological State and the functionality (important services) of the wetlands. The specialist supports the proposed Transmission Line Preferred Route and all of its construction activities.
Hydropedology	Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed) no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating in no likely change in the present ecological state or Ecological importance and Sensitivity. Hydropedological process is predicted to be unmodified and the functionality of the wetland will remain unchanged. The Medium-Low to Low negative impacts during the construction phase, such as the alteration of hydropedological processes and degradation of water resources, can be mitigated to Low and Very Low impacts with the implementation of appropriate mitigations, as recommended by the specialist and incorporated to the EMPr.
Aquatic	The proposed project is located within a Sub-Quaternary Catchment that is already within a modified state. Of the six assessment sites, only one presented flowing water with slightly lower levels of Dissolved Oxygen Saturation (minimal deviation). The macro-invertebrate assemblage was in a largely modified state. The impact of the proposed project range from medium to low pre mitigation, and impacts can be further reduced with the implementation of appropriate mitigations, as recommended by the specialist and incorporated to the EMPr. The impacts associated with the construction phase will be once off, and the operational phase will have no further inputs or impacts on the receiving environment.

Aspect	Finding
	Considering the project type which is linear and that impacts are of low significance with mitigation measures applied, the project can be considered for approval.
Hydrology	The aerial extent of the flood line reveals that there will be no impacts on the development, as the development falls outside the flood lines, i.e. no flood risks according to the 1:100Y flood line contour. Certain activities occurring during the construction/preparation and operational phases have the potential to impact negatively on surround surface water bodies (low to moderate risks). These impacts can be further reduced, following the implementation of the mitigation measures, as recommended by the specialist and incorporated to the EMPr. No cumulative impacts were identified for hydrology.
Groundwater / Geohydrology	No groundwater abstraction activities are proposed, therefore the impact of the proposed development on the groundwater reserve is considered zero. Based on the risk assessment and project type (incorporating a worst-case scenario approach), the potential medium impacts on the groundwater environment (quantity and quality) can be mitigated to low. No groundwater users have been identified in the area, there will therefore be no impact to groundwater users. Risks during the construction phase is low and can be considered reversible impacts, and marginal impacts are anticipated for the operational phase of the transmission lines and switching station. No cumulative impacts were identified for geohydrology.
Climate Change	Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-Low significance without mitigation, and of Low significance with mitigation. Physical climate change risk to the FSRU is considered to be of Medium-Low significance without mitigation, and of Low significance with mitigation. During installation of the gas pipeline, a potential direct impact relates to infrastructural and/or equipment damage or failure in the event of a severe storm. The significance of this impact is, however, Low, since it is relatively easily mitigated to a significance rating of Very Low by restricting installation to suitable weather conditions. During operation, a Medium-rated impact may occur submerged gas pipeline from the FSRU to Powership if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions. Under storm conditions, it is possible that the structures may lead to localised erosion and accretion on opposite sides of the pipeline fixtures which may endanger the pipeline by undercutting. Similarly, to the construction phase, this impact can be mitigated to a Low significance using the precautionary principle in design and installation of the pipeline. Given the location of the Powership within the main port area, this impact is rated as Very Low with mitigation measures applied. Similarly, impacts concerning connection with the FSRU and pipeline are also rated Very Low with mitigation. A positive impact — rated High — of the Powership operations is the addition of 540MW of baseload electricity to the national grid. The impacts from the Transmission Line are expected during the operational phase and can be mitigated to a Low

Aspect	Finding
	significance rating relatively easily. The significance rating of the impact from the towers is Low without mitigation, and Very Low with mitigation. The primary direct impact of not implementing the proposed project relates to a missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
Estuarine and Coastal	Direct impacts on the ecological integrity and functioning of the system, as an important breeding, feeding and resting area for estuarine/marine/coastal associated fauna, and for protection of threatened species, are therefore likely, and must be mitigated. The nature of the landscape is highly modified as a result of the historical development, more recent port developments, and active development projects taking place within the IDZ, with limited natural areas remaining. Furthermore, the long-term development plans for the port entail the excavation and extension of the 600 Berth Basin to increase berth capacity. The potential impacts associated with the project vary from being localised, that is, in situ of the project components within the port, to further afield in terms of noise impacts to the adjacent mangroves, the Kabeljous Flats and potentially the uMhlathuze Estuary sanctuary. The close proximity of the project to these highly sensitive areas renders them vulnerable to disturbance. During the construction phase, the destruction of estuarine vegetation is the highest-ranking potential impact according the estuarine impact assessment, specifically mangrove habitat, and is rated as (very) high in terms of significance without mitigation, and medium to high negative with mitigation. During the operational phase, the biggest risk to the ecology of Richards Bay is noise and light disturbance to coastal/estuarine associated birds. The potential impact is rated as highly negative without mitigation, and medium to highly negative with mitigation. This impact is also relevant to the uMhlathuze Estuary sanctuary This is due to the proximity of the project to the primary bird habitat in the estuary, the long duration of the project (>10 years), and the extent being regarded as regional-international due to the migratory bird species that may be affected, thus habitat and species disturbances mortalities will be reduced if a more appropriate location is pursued. The project could add to the potential polluting activities in the Richards Bay/ uMhlathuze estuarine system, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Richards Bay/ uMhlathuze estuarine system, conflict with birds and the systems critically

Aspect	Finding
	important nursery function as well as the potential introduction of pathogens which could affect the current state of the system. Mariculture facilities and operations could also be negatively impacted. Such events must be controlled collectively by the TNPA and SAMSA. While issues relating to pollution are not considered to be of greater threat or significance than current port activities, the risk of cumulative impacts to the sensitive estuarine environments increases as activities within the Port increases. Recommended mitigation measures are included in the EMPr. The project will positively impact on the Port and the economic activities related thereto by providing for short term provision of power to the SEZ when the country is experiencing power shortages. The increased electricity generation capacity, when considered as part of the national Integrated Resources Plan (IRP), from the project will contribute to an enabling environment for economic growth It is within the specialists'' opinion that the proposed activity is considered acceptable and that the preferred alternatives should be authorised taking due consideration of the mitigation measures included. This activity is deemed reasonable as it is proposed: • within a transformed Port and SEZ which has been specifically set aside for such activities; • will contribute to economic growth in an environmentally – economically and socially sound manner; • While the ecological value of the habitats and species will be affected, such environmental impacts identified can be mitigated so as not to compromise the present state of the estuarine environment in the long term; and • follows a formal environmental management assessment process with anticipated compliance with conditions of approval.
Marine Ecology	Four potentially significant impacts on the surrounding marine ecology at the Port of Richards Bay were identified, and three of them assessed and no mitigation measures beyond those built into the project design are required. There is a gap on information about underwater noise and vibration levels from floating power plant ships to conduct an assessment, and therefore, general sound levels from commercial vessels were presented and the biological thresholds of sensitive receptors, and the effects of underwater noise from the operations on marine ecology were considered unlikely. The gas pipeline construction and installation and vessel mooring will have a Very Low impact on the benthic community. The predicted impact is deemed to be 'negligible' or will probably be indistinguishable from natural background variations. The uptake of cooling water will have a Low impact on marine

Aspect	Finding
	organisms in the surrounding water body, as there is no lasting effect on this sensitive receptor. The discharge of cooling water will have a Low impact on the marine ecology in the receiving water body, as it will have no lasting effect on the sensitive receptor i.e. plankton and benthic organisms. There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life. Recommended mitigation measures are included in the EMPr.
Air Quality	With low predicted ambient concentrations for SO_2 and PM_{10} the consequence of impacts is very low. The predicted ambient NO_2 are somewhat higher, but the consequence of the impact is low. The likelihood of occurrence of impacts associated with SO_2, NO_2 and PM_{10} is very low. Therefore, the significance of impacts resulting from the Karpowership Project during operation is predicted to be very low. In terms of cumulative impacts, the annual average ambient concentrations of PM_{10} and SO_2 at the Richards Bay Clean Air Association (RBCAA) monitoring stations were used as background concentrations to gauge the potential cumulative effect of the Karpowership Project emissions in the Richards Bay area. The severity of the cumulative impact associated with SO_2 is predicted to be insignificant. The severity of the cumulative impact associated with NO_2 is predicted to be small. The severity of the cumulative impact associated with PM_{10} is predicted to be small. No mitigation measures were recommended. From an air quality perspective, it is the reasoned opinion of the specialist-based on the findings of the Atmospheric Impact Report, that the Karpowership Project should be authorised.

Aspect	Finding
Heritage, Archaeology and Palaeontology	The project site falls within in an area of low to medium paleontological sensitivity. No cultural heritage sites were identified for both alternatives of the transmission line and the terrestrial laydown area for the installation of the subsea pipeline. The Cretaceous deposits that occur 3m – 5m below the surface will not be impacted by the proposed transmission line, as the proposed project will not reach those depths and it consists of small impact areas for each pole. Due to this high level of recent activity and development in the area, the possibility of any impact on maritime heritage resources is considered to be low, and no cumulative impacts were identified.
Major Hazard Installation (MHI)	A potential incident involving the Gas to Power Project at the Port of Richards Bay could impact on the neighbouring berths. The risks associated with this MHI were found to be acceptable. The main risk attributed to the operation of the Powerships is the possible rupture of one of the gas transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting, leading to a flash and pool fire, considered as a High impact which can be mitigated to a Medium impact. The risks were found to be acceptable for the Gas to Power Operations. No person within the port area is exposed to a risk greater than 1.0e-06 (one in a million) and ship staff is exposed to a risk of no more than 1.0e-05 (one in a hundred thousand). These risks are considered to be acceptable for persons operating in a national port and no cumulative impacts were identified Recommended mitigation measures are included in the EMPr.
Socio-Economic	The proposed Powerships and their associated infrastructure will generate both positive and negative impacts starting from the construction period and ending with the decommissioning phase. Many of the positive impacts will be concentrated in the local and national economies, creating a potential imbalance with the potential negative impacts that would exclusively be concentrated at a local level. The project will have Medium positive impact as it is anticipated to make a notable contribution towards the national and local economy. In addition, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings by R115.9 million. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily. The project may, however, also create negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this

Aspect	Finding
	negative impact are (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows. These can all be mitigate to Low negative impact significance. During the operation of the proposed Powerships and their associated infrastructure, the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects. The operation of the proposed Powerships and their associated infrastructure will increase new business sales, contribute to GDP and create sustainable employment positions, all High positive impacts. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities. The above will have Medium positive to High positive impact significance. Negative impacts during the operational phase include the potential changes in the sense of place. These potential losses, if they do occur, are likely to be small, given the industrial nature of the proposed development area, and is therefore assigned Low impact significance both pre- and post-mitigation. As in the case with the impacts observed during construction, negative effects can be mitigated (although not entirely eradicated), and positive impacts enhanced. In terms of cumulative impacts, there will be a change in perception of the area due to the Powerships presence in the port over the operating timeframe due to the impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase. The development would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of their establishment. Recommended mitigation measures are included in the EMPr. No fatal flaws were identified, and from a socio-economic perspective, the proposed development is acceptable and will have a predominately positive impact on the socio-economic environment and in the opinion of the specialist, should therefore be authorised.

Aspect	Finding
Noise	The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. It is unlikely that the construction noise will impact on the noise sensitive areas. With the effective implementation of the recommended mitigation measures, the residual noise impact associated with construction activities are predicted to be of very low significance. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation. Recommended mitigation measures are included in the EMPr.

Table 8-7: Summary of key findings of EIA, including positive and negative impacts and risks of the proposed activity and identified alternatives.

8.6 PROPOSED IMPACT MANAGEMENT OUTCOMES

2014 NEMA EIA Regulations (as amended), Appendix 3 3(1) (m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;

The following outcomes must be considered for this project:

- Impacts relating to site establishment are managed and minimised;
- Impacts on flora and fauna are managed and minimised;
- Impacts on heritage resources are managed and minimised;
- Construction vehicle movement are restricted to approved footprint;
- Construction of fencing and gate of the construction camp / laydown area are managed within sensitive environments;
- Water for construction is compliant with the requirements of the National Water Act (Act No. 36 of 1998);
- Impacts related to storm and waste water are avoided, prevented and managed;
- Impact to watercourses and estuaries are managed in adherence to legislation and specialist recommendations;
- Impacts to marine environment are managed in adherence to legislation and specialist recommendations;
- Vegetation clearance and associated impacts are minimised and managed;
- All precautions are taken to minimise the risk of injury, harm or complaints;
- No pollution or disease arises in terms of poorly maintained ablution / sanitation facilities or lack thereof;
- All necessary precautions linked to the spread of disease are taken;
- Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies;
- Safe storage, handling, use and disposal of hazardous substances;

- Spillages and contamination of soil, surface water and groundwater are avoided, minimised and managed;
- Dust prevention measures are applied to minimise the generation of dust;
- Noise management is undertaken in accordance with SANS 10103 and the Occupational Health and Safety Act (Act No. 85 of 1993).
- Fire prevention measures are carried out in accordance with the relevant legislation.
- Erosion and sedimentation as a result of stockpiling are reduced.
- Minimise the risk of environmental impact during periods of site closure;
- Post-construction and rehabilitation activities are undertaken in accordance with EMPR requirements as well as Rehabilitation Plans;
- Socio-economic development is enhanced and job creation and economics in the area are improved;
- Effective awareness and training for all construction staff to minimise environmental impacts;
- Ensuring social and ecological well-being of the site and community;
- Impact on No-Go areas are avoided through effective demarcation and management of these areas;
- Impacts resulting from earthworks are managed and guided by specifications;
- Construction materials are sourced from authorised sites;
- Potential impacts to the environment caused by waste (general and hazardous) are avoided or managed;
- All onsite staff are aware and understands the individual responsibilities in terms of this EMPr.
- Stormwater related impacts are avoided, minimised and managed;
- Dust, emissions and odour impacts are minimised and managed;
- Impact to heritage and palaeontological resources are managed in terms of the National Heritage Act.
- Compliance with all environmental legislative requirements during the operational phase of the project is implemented and managed; and
- Environmental impacts during the Operation and Maintenance Phase are managed in terms of Operational Maintenance Management Plan requirements.

8.7 SCOPING REPORT AND PLAN OF STUDY DEVIATIONS

Deviations from the Scoping Phase have been identified and explained with motivations in the preceding sections of this EIA Report as applicable, and include the following:

1. Whereas some Specialists have adopted the Triplo4 impact assessment methodology, others have maintained their own methodologies that were relevant to their specialist fields, to ensure an accurate representation of the significance of the environmental impacts assessed. Where possible and with the approval of the Specialists, Triplo4 have transferred the assessment information to be in accordance with the approved PoS impact assessment methodology. Triplo4 have endeavoured to ensure that our impact ratings are a true reflection of those assessed by the Specialists. The marine ecology assessment was utilised directly, as the Specialist's selected methodology was more appropriate to determine the impacts on marine ecology.
2. The transmission line connection point (on land) has been shifted closer to the shore by approx. 85m, i.e. the start point (tower 15/19) was moved to the location of tower 17 (Figure 8-7). This deviation was required in terms of the engineering design and this location was assessed by the relevant specialists.
3. The position of FSRU and LNGC (when arriving for refuelling) was slightly adjusted, within the same location, which in turn the length of the pipeline connecting the FSRU with the Powership was

extended by approx. 250m (Figure 8-8 – FSRU and LNGC new position in green and blue, and FSRU and LNGC previous position – outlined in purple and white). This deviation was required in terms of the engineering design and is deemed insignificant and thus was accommodated for assessment in the report.

4. The preferred positions of the Powerships were slightly shifted to the West, approx. 150m (Figure 8-9 - the new position of the Powership in orange, and the previous position marked next to it). This deviation was required in terms of the engineering design and is deemed insignificant and thus was accommodated for assessment in the report.

Figure 8-7: Transmission line – deviation of the start point.

Figure 8-8: Deviation of the FSRU and LNGC positions

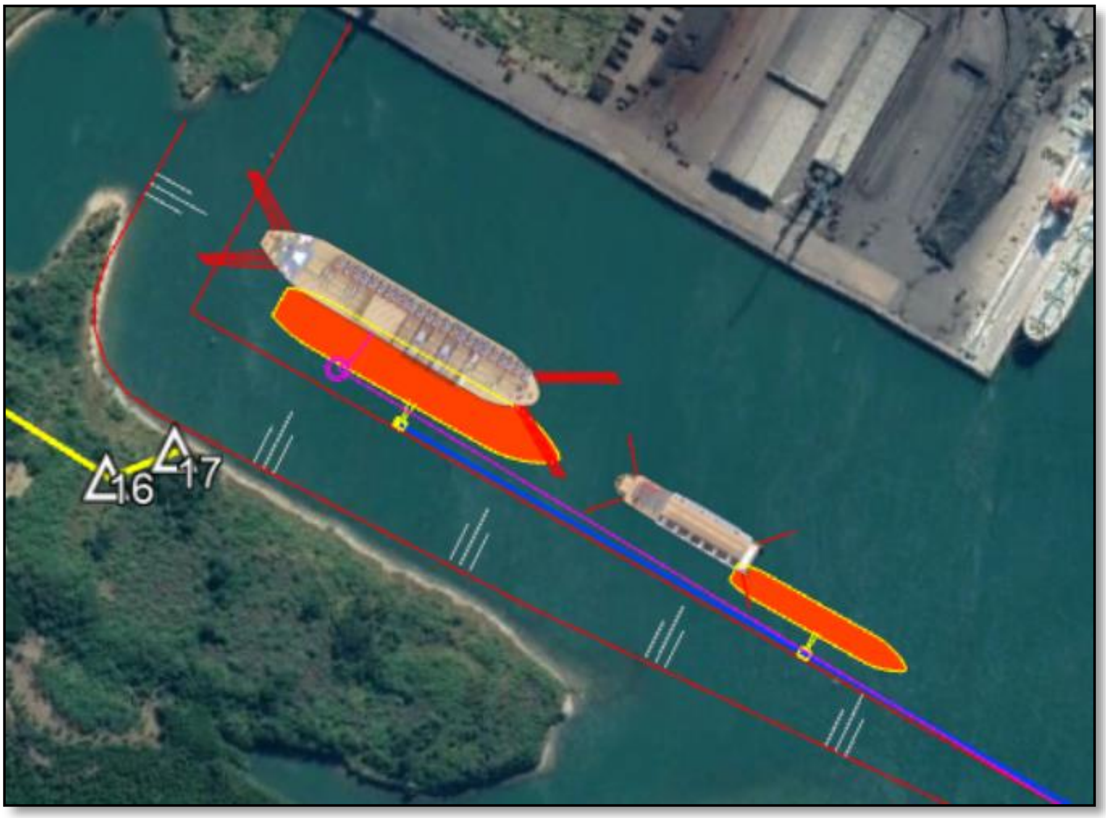

Figure 8-9: Deviation of the Powerships positions

8.8 ASSUMPTIONS, UNCERTANITIES AND GAPS IN KNOWLEDGE RELATING TO THE ASSESSMENT AND MITIGATION PROPOSED

The information in this report is based on findings of several specialists' studies. The layouts and engineering drawings of the proposed Gas to Power Project at Port of Saldanha, have been provided to the EAP by the engineer and planner respectfully. During the compilation of this EIA Report, the following assumptions and limitations relating to this assessment were identified by the EAP and specialists:

- The scope of this report is limited to assessing the environmental impacts of the proposed Karpowership gas-to-energy project and its associated infrastructure.
- The information provided by the applicant and specialists are accurate and unbiased.
- Information from secondary sources and I&APs is accurate.
- Assessments of impact significance for social impact often need to be made without quantification. These are based on a consideration of the likely severity of impacts and/or expert judgements, unless otherwise specified or quantified.
- The assessment only considers the impacts of the proposed project and the no-go and does not make comparisons with or assessments of other gas-to-energy projects as there are currently none in the area. Proposed *Risk Mitigation IPP Procurement Programme* projects have been considered under the cumulative impacts section.
- There will be a temporary Right of Way (RoW) of 30m (15m either side of the centre line) of the pipeline during the construction and operational phase of the transmission line.

Wetland Ecologist

- According to the SANBI guidelines, specialist assessments should be performed during the rainfall season of assessed area. In this case, KZN is a summer rainfall area and therefore assessments should be performed between October and April. Fieldwork for this project was done at the at mid-September 2020, 2 weeks away from the rainy season but KZN areas have already experienced a moderate amount of rainfall thus far during the September 2020 month.
- Accessibility to certain portions of the landscape where watercourses were present was difficult due to the dense vegetation in the area which made these areas inaccessible.
- A construction method statement was not provided by the engineer and therefore the potential impacts on the watercourses that may arise as a result of the construction activities were determined using the specialist's knowledge and experience with similar projects.
- Only those wetland/riverine habitats which will be significantly impacted by the proposed development were accurately delineated in the field. The remaining watercourses within a 500m assessment radius were delineated at a desktop level and broadly verified in the field to obtain an extent of the wetland/riverine areas, and to facilitate an understanding of the dynamics of the systems.
- This is a once off assessment which can only take into consideration the current condition with some speculation of historical events based on evidence observed in the area and satellite imagery. As vegetation and habitats may vary both temporally and spatially, there must be recognition of fact that certain aspects or features may be missed if they do not present themselves on the day.
- All delineation verification is done using a GPS system. The precision of such systems is generally limited to 5m and therefore this error must be taken into account when utilising the GPS coordinates.
- Only vegetation which was present within at risk watercourses were assessed in the field, all other systems were assessed at desktop level and visually confirmed on site.
- While the assessment techniques utilised in this report are used in order to standardise and 'objectify' the assessment of the systems' function, potential impacts and services, it must be noted that much of the information is subjectively collected based on the assessor's previous experience and training. The assessor will, if additional information or counter arguments are provided and verified, hold the right to amend the report if need be.

- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological issues identified during the infield assessment and based on the assessor's working knowledge and experience with similar development projects.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures are to be included in the project-specific Environmental Management Programme report (EMPr).

Terrestrial Ecologist

- The field work was conducted over one day on 23rd of September 2020.
- The site assessment was conducted in summer and does constitute a summer site visit (November to April) as per the guidelines for KwaZulu-Natal as per Ezemvelo KwaZulu-Natal Wildlife.
- A site visit at this time is sufficient to record trees, forests and associated species assemblages but may miss grass species and geophytic plants that flower over spring and summer (typically early November).
- A second site visit is planned where the Port area will be visited as access was not possible during the site visit.
- Assessment of the route options within the port area at this stage are based on photographs supplied by other specialists and a brief drive through the area.
- This report serves as a preliminary investigation. Site data analyses and full plant identification, along with vegetation community and sensitivity mapping and impact rating will be done in the final report.

Geohydrologist

- No exploratory drilling or fieldwork was conducted as part of this study. Although data in this assessment is extracted from reliable data sources, the risk assessment is considered preliminary until groundwater data is verified with intrusive site work (i.e. drilling of onsite boreholes, on-site water quality and quantity testing).
- Limited groundwater quality and quantity data are available for the project area. Available groundwater data was extrapolated to conceptualise the best-case hydrochemistry and groundwater conditions of the site.

Estuarine Ecologist

- Having been provided with all the relevant information required;
- Only readily available data and information was used; and
- No physical, chemical or biological sampling was undertaken during this assessment.

Marine Ecologist and Noise Specialist

- Underwater noise was identified as a gap in knowledge, as there is currently no baseline as no precedent done in South Africa. It is concluded that there is not enough information about underwater noise and vibration levels from floating power plant ships to conduct an assessment. Therefore, general sound levels from commercial vessels were presented and the biological thresholds of sensitive receptors, and the marine ecologist indicated that impacts on marine ecology are unlikely.

Water Balance

- The project will consist out of two (2) components, namely (1) pre-constructed ships moored in the harbour and (2) the development and operation of transmission lines on the land surface.
- Due to the nature of the land development (i.e. the development of transmission lines and pylons over a large area where little to no water will be required) the water balance focused on

conceptualising the likely water use and distribution for the Karpowership electricity generation (i.e. water used on the ships will be derived from seawater).

- A water balance for the land component of the project is deemed unnecessary for water quantities used during this process (i.e. for drinking or technical water) will most probably be sourced by local contractors on a very small scale.

Hydropedologist

- This study is desktop-based, and hence no intrusive work was undertaken. It is assumed that literature data evaluated accurately describes the soil and hydropedological occurrences.
- The concepts presented are simplifications of the temporal variability of water transfer functions. Realistically, water transfer functions, such as throughflow and groundwater sources, may take a few months up to several years to recharge streams (Le Roux, et al., 2011) However, hydropedology hillslopes have been effectively applied to simulate runoff response mechanisms (Van Tol, Le Roux, & Lorentz, 2013).

Air Quality Specialist

- No ambient monitoring is done for this assessment, rather available ambient air quality data is used.
- The Model Plan of Study (uMoya-NILU, 2020) describes the dispersion modelling methodology has been accepted by the Licensing Authority.
- The assessment of potential human health impacts is based on predicted (modelled) ambient concentrations of SO2, NO2, and PM10 and the health-based National Ambient Air Quality Standards (NAAQS).

Socio-economic Specialist

- *Construction phase assumptions:* The following assumptions regarding the construction phase of the proposed Powerships and its related infrastructure are made:
    - The construction of Powerships related infrastructure is planned to commence in 2021 contingent on project approval.
    - The planned construction period is 12 months.
    - The total investment is valued at R323.5 million in 2020 prices, of which R208.7 million will be spent within the South African economy with the rest on imported goods and services.
    - Only local expenditure is considered in this analysis.
    - The construction of the related infrastructure will create an estimated 108 Full Time Equivalent (FTE7) project specific employment opportunities over the period of construction, 87 of which will be created for South African citizens.
    - Approximately 44% of the total employment positions for South African citizens will be from local communities.
- *Operational phase assumptions*: The following assumptions regarding the operational phase of the proposed Powerships and its related infrastructure are made:
    - The Powerships are anticipated to begin operating once construction is completed.
    - The average annualised operations and maintenance cost of the Powerships will be valued at R195.5 million in 2020 prices, per annum over the 20-year operational life of the project.
    - Almost half (46.6%) of operational local spending will be directed at covering labour costs associated with the employment of 166 workers, 96 skilled workers and 69 unskilled workers.
    - During its operation, the Powerships and related infrastructure will employ 166 project specific personnel of which 120 employment positions will be created for South African citizens.

- Approximately 43% of the total employment positions for South African citizens will be from local communities.

- *Decommissioning phase assumptions*: The costs of decommissioning the plant are not yet known. Given the nature of the Powerships and the largely unlimited input supply, it is highly likely that instead of decommissioning them, they will be refurbished in order to extend its lifespan beyond the 20-year period.

Major Hazard Installation Risk Specialist

- *Events Following a Loss of Containment*:
  - Where no Boiling Liquid Expanding Vapour Explosion (BLEVE) and fireball occur following an instantaneous release with direct ignition, a liquid pool is formed, and a vapour cloud will expand to atmospheric pressure. The direct ignition of the vapour cloud is modelled as a flash fire (probability 0.6) and explosion (probability 0.4).
  - For an above-ground storage vessel (or road tanker), a BLEVE or fireball may occur. A BLEVE can occur when a flame impinges on a vessel containing a material that is a gas at atmospheric pressure and temperature but is a liquid at storage temperature and pressure. It is assumed that a BLEVE occurs when the vessel or road/ rail tanker is full. While BLEVEs are possible because of catastrophic vessel failure and localised vessel failure, they typically occur outside of these two events. Should this not occur, a vapour cloud may form. The ignition of the vapour cloud is modelled as a flash fire and explosion.
  - The flash fire is modelled through simulating the expansion of the initial cloud to the lower flammability limit (LFL) with air entrainment. The damage area then corresponds to the LFL cloud footprint. The explosion is modelled using the total mass subject to the lower flammability limit (LFL).
  - Accidental high velocity releases of ignited flashing liquids of pressurised flammable material at ambient temperature are classed as liquid jet fires. Jet fires occur when the jet of hydrocarbon can entrain air and burn at its edge. The jet remains ignited because the burning of the flame is greater than the velocity of the hydrocarbon jet, i.e. the flame can burn back towards the source of the jet. As a worst-case scenario, it is assumed that all failures occur in a horizontal position, i.e. the flame is orientated horizontally.
- *Scenarios Modelled*: This report was done in terms of SANS 1461 and this standard refers to 'BEVI' as the preferred reference to be used. All modelling was conducted according to Bevi and stipulates the following:
  - There are no scenarios for intrinsic failure for ships. It is assumed that loading takes place for most of the time that a ship is present, and the loading scenarios are dominant compared to intrinsic failure.
  - The only scenarios that are relevant in addition to loading, are external damage as a result of ship collisions. These are very much determined by the local situation. In the case that a ship is in a port outside the transport routes, the probability of a collision that leads to an outflow is so small that it does not need to be taken into consideration.
- *Jet Fires*:
  - Jet fires occur when flammable material of a high exit velocity ignites. Ejection of flammable material from a vessel, pipe or pipe flange may give rise to a jet fire and in some instances the jet flame could have substantial 'reach'. Depending on wind speed, the flame may tilt and impinge on pipelines, equipment or structures. The thermal radiation from these fires may cause injury to people or damage equipment some distance from the source of the flame.

- For this Assessment, jet fires from a 1-inch leak in a transfer hose was assumed. The worst-case scenario of the jet fire being horizontal and in the same direction of the wind was assumed.
- The flame length for a 1-inch hole in the transfer hose was calculated at 68.689m with a wind speed of 1.5m/s. The effects from the jet fire could not extend beyond the ships. The jet fire could not reach and impact on other activities at any of the berths.

- *Flash Fires*:
  - A loss of containment of flammable materials if not immediately ignited, would mix with air and form a flammable cloud. This cloud could drift and if ignited could result in a flash fire or vapour cloud explosion.
  - The cloud of flammable material would be defined by the lower flammable limit (LFL) and the upper flammable limit (UFL). An ignition within a flammable cloud can result in an explosion if the front is propagated by pressure. If the front is propagated by heat, the fire moves across the flammable cloud at the flame velocity and is called a flash fire. In some instances, pockets of flammable clouds may extend beyond the LFL due to localised conditions. The ½ LFL endpoint assumes there are no isolated pockets and that ignition would not occur beyond this point.
  - A flash fire from a catastrophic leak (Hose shear and overfill) from the ship is shown below. Flash fires could have impacts beyond the berths.
  - The flammable cloud will extend past the berth for a distance for about 350m. This release can also extend onto the next berth depending on angle of release and wind direction.
- *Confined Gas Explosions*:
  - Vapour cloud explosions are one of the most devastating events which can occur in the process industries. It was recognised that a facility design should include limiting explosion damage. The determination of peak overpressures from gas explosions and development of design criteria for structural support become more complex due to high pressure inventories in congested areas.
  - There are four key factors in an explosion. These are related to the overpressure which is the pressure rise above normal atmospheric pressure, the positive phase duration which is the time during which the pressure is above atmospheric pressure, the degree of confinement of the flammable mixture which causes turbulence and acceleration of the flame front and influences the overpressure, and the impulse (area under the pressure-time profile).
  - It is well established that it is not the size of the vapour cloud that matters when it comes to blast strength, but the degree of confinement of the vapour cloud and congestion in the path of the flame front. The energy of ignition source (e.g. naked flame) plays a dominant role in determining the blast strength, although a well-designed facility with strict implementation of hazardous area classification requirements in terms of hardware and safety management system can reduce the strength of a potential ignition source significantly.
  - The Multi-Energy Model (MEM) for rapid assessment of explosion overpressure has been developed by TNO (1997). It is based on the concept that significant overpressures can be generated by the ignition of a vapour cloud only in the presence of partial confinement or obstacles in the path of the flame front. This model, however, requires assumptions on the initial blast strength, which significantly influences the predictions. CFD models used in offshore modules have shown that rapid assessment models can underestimate the blast overpressures.
  - There are confined areas at the Port such as the service chambers and buildings.

- *Delayed Ignition*:
    - The probability of delayed ignition depends on the end of the calculation. In the calculation of the location-specific risk only ignition sources on the site of the establishment are considered. Ignition sources outside the establishment are ignored: it is assumed that if the cloud does not ignite on site and a flammable cloud forms outside the establishment, ignition always occurs at the biggest cloud size. In the calculation of societal risk, all ignition sources are considered, including population. If ignition sources are absent, it is possible in the societal risk calculation that the flammable cloud does not ignite.

Climate Change Specialist

- If the Powership at Richards Bay is operating at 100% capacity generating 450MW at 0.506 tCO_2e/MWh over an hour it generates 227 t CO_2e/hour or 230 t CO_2e/hour. If it is assumed it is generating at the operational maximum of 3723 hours per annum, this equates to 847.05 Gg CO_2e at best or 856.51 Gg CO_2e at worst annually or 0.15% of the annual CO_2e emissions of the gross greenhouse gas emissions (Gg $C0_2e$) for South Africa in 2017 or $1.6x10^{-9}$% of global emissions from 2014.This is made up as follows:
- Over the expected operating lifespan of the Powership project of 20 years (74 460 operational hours), at constant 100% capacity generation emissions are 17.04 MT CO_2e.
- A maximum of 3723 operational hours per year was assumed for the calculations.
- It is assumed that the diesel component — a high-emitting, heavy fuel oil — of the gas/diesel category will not increase post-2018, and that the remaining ~8000MW are consequently earmarked for gas-to-energy infrastructure.

- The following assumptions were allowed for in the Greenhouse Gas Emissions section:
    - Total emissions calculated are based on site reference conditions 1013.25 mbar and 25°C.
    - Total emissions calculated are based on Plant operation at 100% contracted capacity.
    - Total emissions calculated are based on 3723 hours per annum operation.
    - Engine degradation allowed for 1.5% over 18,000 hrs (Wartsila 18V50SG degradation curve, Appendix B)

Cumulative Impacts

- The potential cumulative impacts of the proposed development on the environment is required to be considered. Cumulative impacts, as the name suggests, take into account the incremental, collective or aggregated impacts on a particular aspect of the environment. These types of impacts are difficult to quantify given their high spatial and temporal variability. In addition, the cumulative impact assessment must assess the cumulative impacts from the various existing and proposed developments with the area. Triplo4 have made every effort to obtain the details of the surrounding existing and proposed developments.

9 CONCLUDING STATEMENT AND RECOMMENDATIONS

9.1 FINAL PROPOSED ALTERNATIVES

The following are the final proposed alternatives, as described in detail in Section 3 and 8.4.

9.1.1 Powership and FSRU Positioning

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time.

No dredging is required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided. The Sand-spit area has been identified as sensitive and a 200m offset from the water line to the moored vessels maintained.

Key considerations for a feasible position are the size of the turning circle for the LNG carrier as well as that the approach channel and turning circle will be shared with the coal terminal and bulk berths, i.e. traffic in basin from coal vessels, cargo vessels and tugs are not impeded by the Powership project.

The preferred position alternative (figure 9.1 below) is supported from the engineering design perspective, as the Powerships are positioned within the dead-end basin adjacent to the break bulk quay /multi-purpose terminal, and thus located closer to the first tower of the transmission line, positioned on the main land 'promontory' adjacent to the large mangrove stand, and positioned further away from the sensitive sand bank (a 200m offset from the water line to the moored vessels maintained).

This alternative position was approved by TNPA in Richards Bay for the power barges in the 2015 study, and thus in line with their port planning.

This alternative was assessed by the specialists and no fatal flaws were identified.

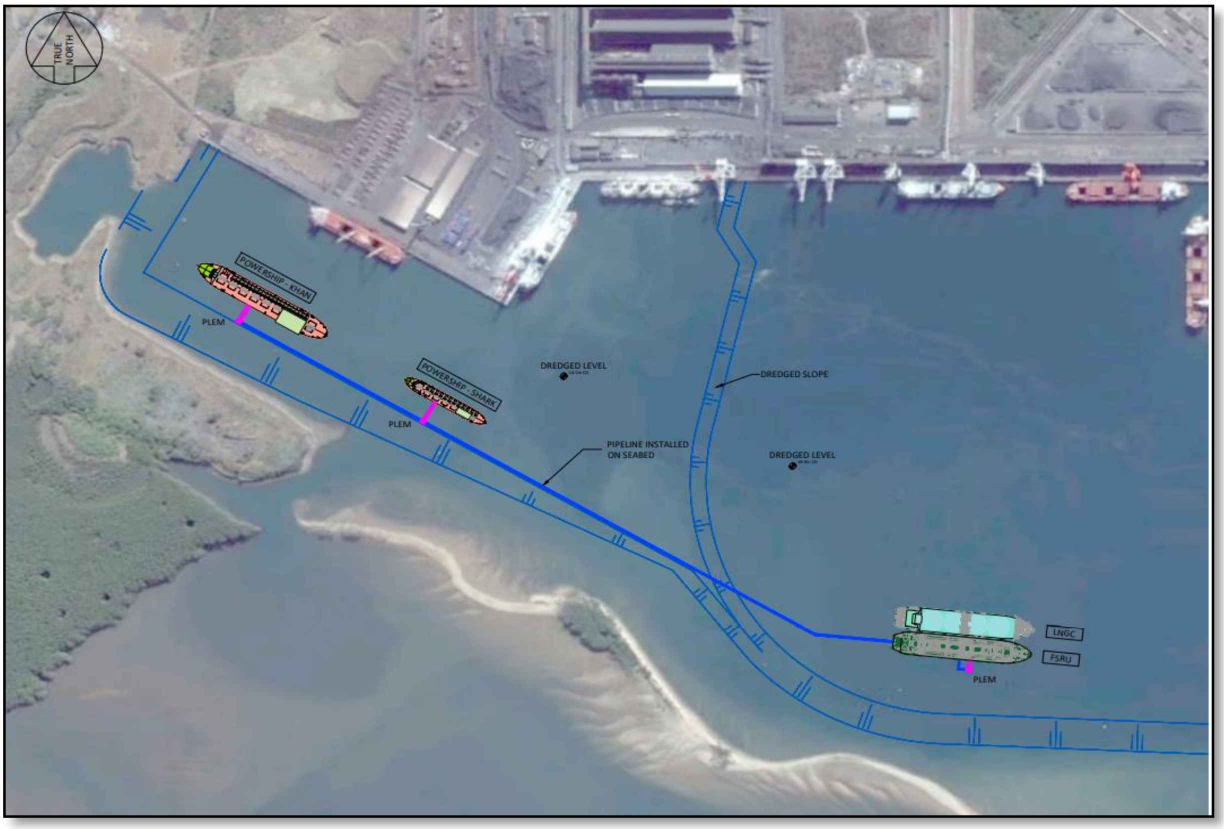

Figure 9-1: Preferred Alternative for the Powerships and FSRU position within the port – closer to transmission tower.

The FSRU will be mooring against the break-water at geographical co-ordinates 28°48'0.48"S 32° 2'33.79"E (central point).

The two Powerships will be mooring at geographical co-ordinates (central points) 28°47'39.65"S 32° 1'42.60"E (khan Class) and 28°47'44.85"S 32° 1'54.12"E (Shark class).

The physical size of the Powerships and FSRU:
Powerships – 19 000m²
FSRU – 29 300m²

9.1.2 Gas Pipelines Alternatives

A subsea gas pipeline is proposed to be installed along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powerships to ensure gas supply for power generation and connected to the vessels via a flexible marine hose riser. The proposed gas pipeline diameter is 24 inches, equivalent to approx. 60cm (600mm). In terms of the Pipeline End Manifold (PLEM) installation, each of the three PLEMs needs to be set down on a stable and level foundation. The seabed surface layer needs to be excavated and levelled to achieve this. Divers will excavate and level a 10m x 10m foundation area on the seabed at the pre-surveyed PLEM position. The excavation will be done using hydraulic spades and 6" pumps, to create a 10m x 10m foundation.

The preferred route alternative for the gas pipeline (Figure 9.2 below) is directly influenced by the preferred position of the Powership in relation to the position of the FSRU (as discussed in section 9.1.1). The route is approx. 1700 meters in length, and is preferred from an engineering perspective, as it is in line with the preferred position of the Powerships and the FSRU within the port, positioning the Powerships in closer proximity to the land and the transmission line.

An approx. 10 meters servitude will be required for the placement of the subsea gas pipeline, therefore the total footprint is of this gas pipeline route is approx. 17 000m² .

From the marine ecology perspective, both alternatives were assessed to have the same impacts during the operational phase, and no fatal flaws were identified by the other specialists.

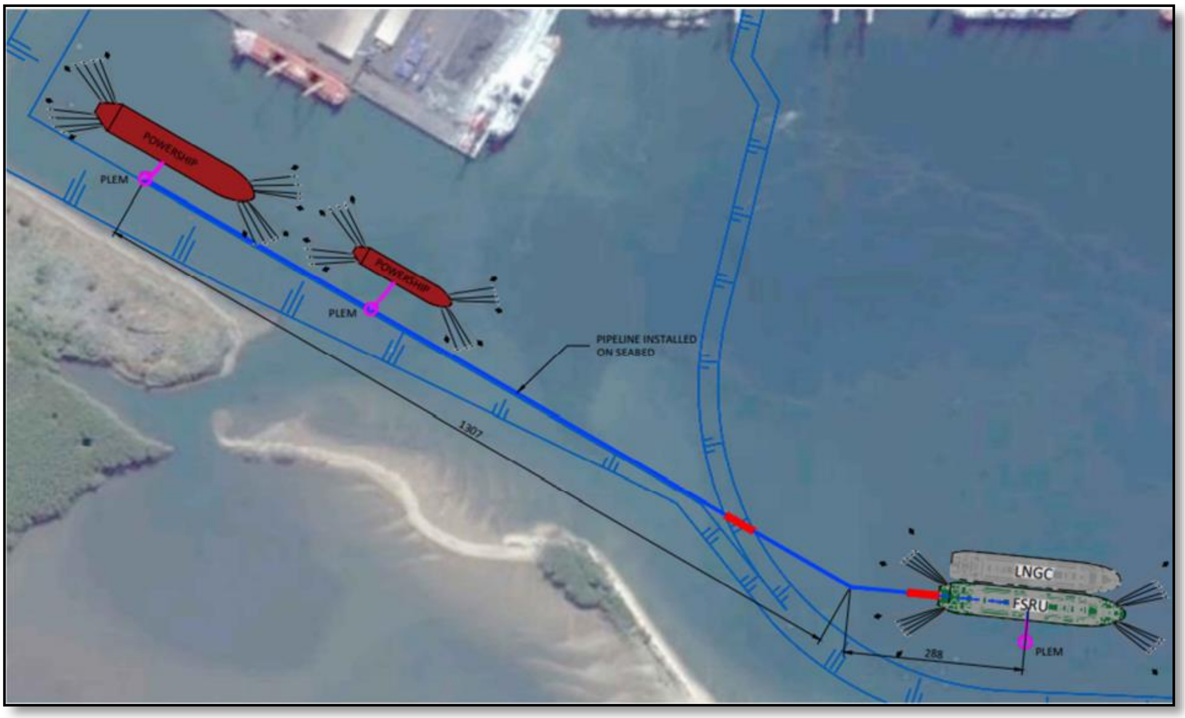

Figure 9-2: Alternative 1: Gas Pipeline route (Blue Line).

The estimated size for the temporary laydown area for the installation of the gas pipeline is 9987m² (0.9987 hectares), as indicated in Figure 9-3 below. The selected site is adjacent to the existing harbour arterial and within a historically transformed area due to previous disturbance. This area will be rehabilitated after the completion of the installation of the pipeline.

Figure 9-3: Proposed location for the temporary laydown area for the installation of the gas pipeline

Table 9-1 below indicates the coordinates of the preferred gas pipeline route alternative and the laydown area.

Subsea Gas pipeline	GPS-COORDINATE	
	Longitude	Latitude
Gas pipeline Route Preferred Alternative – Start point	28°48'1.71"S	32° 2'32.26"E
Gas pipeline Route Preferred Alternative – End point	28°47'38.14"S	32° 1'47.19"E
Gas pipeline Route Preferred Alternative – mid way point	28°47'49.87"S	32° 2'6.68"E
Temporary laydown area (central point)	28°47'36.76"S	32° 1'28.21"E

Table 9-1: Coordinates for the gas pipelines' alternatives.

9.1.3 Transmission Line Alternatives

The power from the Powership will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powership to the National Grid utilising the existing Impala – Bayside network via a proposed new 132kV on shore switching station.

The preferred transmission line route (Figure 9-4 below) runs from the moored Powerships to the first tower (tower 17) then runs towards the existing Harbour arterial road, crossing the road and towards the existing powerline servitude to the west through crossing of an open grassland/scrubland and unchannelled valley bottom wetland, then running along the exiting servitude along Manzamnyama Canal, before heading north and finally in a westerly direction before reaching its end point.

This preferred alternative route is shorter to the end point (Approx. 3km, 17 towers), and the majority of the of the route is located in areas of low to moderate ecological sensitivity, and will be traversing high sensitive wetland and swamp forest. The route was further refined following the scoping phase, to reduce the towers within the sensitive area (namely open grassland/scrubland and unchannelled valley bottom wetland) from two towers to one.

The location of the route is in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude.

The existing servitude will be used for access for the majority of this route, and an additional access / working servitude will be required for the construction of tower 13 between the port and the Manzamynama Canal (i.e. from the Harbour arterial road to Tower 12) as well as from the start point to the Harbour arterial road (towers 17 to 14).

The second route alternative (i.e. Alternative 2) traverses two Critically Endangered vegetation types with extremely high sensitivity, and relevant specialists' studies (e.g. terrestrial assessment and wetland assessment) considered this route as a fatal flaw and are in supported of the preferred transmission line route.

Figure 9-4: Transmission line route alternatives from the Powerships to the proposed switching station – Preferred Alternative (yellow) and Alternative 2 (purple).

In terms of the start point of the transmission line (tower 17 in figures 9-5 and 9-6 below), the area is transformed due to previous disturbance in the area.

Figure 9-5: Imagery from 2004 indicated that the area of the transmission lines has been disturbed.

Figure 9-6: Imagery from 2006 indicated that the area of the transmission lines has been disturbed.

The proposed connection point of the 132kV powerline from the Powership into the existing Eskom electricity grid is a new 132kV switching station situated alongside the Bayside substation on the Reminder of Erf 6363, as illustrated in Figure 9-7 below, and currently engagement with Eskom on the connection to the line is underway. Should this not be possible, the transmission line will need to be connected to the Eskom line at the Bayside substation. Letter of consent from the landowner was obtained and further engagements will be done accordingly.

Figure 9-7: Proposed connection to the Eskom line and placement of the switching station.

The Monopole towers, each with a footprint of 15m x 15m (for stay wires) or 0.6m x 0.6m to a maximum of 2.5m x 2.5m (for monopole bases), are to be positioned within the servitude of 30m for the length of the route. The total footprint of the preferred transmission line route is 93 000m². The footprint of the proposed new switching station is approx. 7000 m².

The preferred evacuation line is in accordance with the proposed 2015 Transnet Evacuation Route.
In terms of the components of the transmission line, single double circuit towers were selected, in order to minimise the environmental footprint of the installation. In addition, the proposed monopoles towers will include bird friendly measures as part of their designs.

Table 9-2 below show the GPS co-ordinates for the of the start and end points of the preferred transmission line route – from the powerships to the start point, and from the start point to the end point.

Transmission line	**GPS-COORDINATE**	
	Longitude	**Latitude**
From powership (Khan Class) to First Tower – Preferred Alternative Start point	28°47'37.95"S	32° 1'42.32"E
From powership (Khan Class) to First Tower Preferred Alternative End point	28°47'44.90"S	32° 1'41.17"E

From powership (Shark Class) to First Tower Preferred Alternative Start point	28°47'44.51"S	32° 1'54.08"E
From powership (Shark Class) to First Tower Preferred Alternative End point	28°47'44.90"S	32° 1'41.17"E
Transmission Line Route – Preferred Alternative – Start point	28°47'44.63"S	32° 1'41.11"E
Transmission Line Route – Preferred Alternative – End point	28°46'48.42"S	32° 0'42.84"E
Transmission Line Route Preferred Alternative – mid-way point	28°47'11.83"S	32° 1'15.87"E
Transmission Line Route Preferred Alternative (bend 1)	28°47'42.19"S	32° 1'38.59"E
Transmission Line Route Preferred Alternative (bend 2)	28°47'26.09"S	32° 1'9.85"E
Transmission Line Route Preferred Alternative (bend 3)	28°46'56.45"S	32° 1'22.06"E
Transmission Line Route Preferred Alternative (bend 4)	28°46'44.22"S	32° 0'46.68"E

Table 9-2: Coordinates for the Preferred Alternative for the Transmission line route

9.1.4 Technology alternatives;

The Powership engine technology provides for dual fuel usage and is capable of utilizing both Liquid Natural Gas (LNG) and Heavy Fuel Oils (HFO) as primary fuel sources. As indicated in the accepted Final Scoping Report, the HFO is not being considered further as an alternative fuel due to the significant advantages of the LNG. The operating fuel for power generation will be from LNG only and will not consume HFO for any part of the generation process. All relevant licenses, permits and approvals are for the consumption and use of LNG only.

Relevant specialists' studies had assessed the fuel alternatives and identified that the use of LNG will have less potential impacts than the HFO, in terms of impacts on air quality and the marine environment.

The use of natural gas to generate electricity is the preferred alternative for power generation.

9.1.5 No-go option

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country and will not contribute further to the local economy by provide employments opportunities. From the environmental perspective, the specialists hadn't identified any fatal flaws in authorising the proposed project, and mitigation measures were provided to manage identified impacts.

From a socio-economic perspective, when compared with the no-go option – which entails the Powerships and their associated infrastructure not being deployed, and none of the positive or negative impacts identified arising– the proposed project is associated with greater socio-economic benefits and should be authorised, hence the "no-go" alternative is not the preferred alternative.

9.2 EAP'S OPINION AND RECOMMENDED CONDITIONS OF AUTHORISATION

Based on the findings of the independent specialist studies, the proposed project will not result in highly sensitive environmental or social impacts, given that all standards be adhered to and mitigation measures as well as specialist recommendations be implemented. It is the reasoned opinion of the EAP that the proposed 540MW Gas to Power Powership Project, should be authorised. This is however, subject to the implementation of the mitigation measures and monitoring for potential environmental and socio-economic impacts as outlined in the EIA Report and EMPr being implemented by Karpowership South Africa (Pty) Ltd.

The authorisation would include the following key infrastructure and components:

- Two Powerships;
- FSRU;
- LNGC for refuelling;
- Gas pipeline;
- 132 kV Transmission Lines;
- Switching Station; and
- Temporary laydown area

It is the recommendation of the EAP that the following key management and mitigation conditions must be incorporated into the authorisation for the project:

- All mitigation measures specified within the EMPr (Appendix G) are to be implemented.
- The EMPr (Appendix G and its appendices) for this EIA Report must be a binding document between Karpowership South Africa (Pty) Ltd and the appointed contactor for construction and maintenance, in order to ensure compliance with environmental specifications and management measures.
- It is recommended that external EMPr monitoring takes place by an independent Environmental Control Officer (ECO) to ensure that the requirements of the EMPr are being correctly implemented, thus ensuring the protection of the surrounding environment.
- Permits from relevant provincial authorities, i.e. Biodiversity Permits, must be obtained prior to the removal or relocation of the identified Species of Conversation Concern.
- Obtain all other mandatory and environmental permits for the project, as required.

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