FINAL ENVIRONMENTAL IMPACT ASSESSMENT

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

DFFE REF NO: 14/12/16/3/3/2/2007
A Project of Karpowership SA (PTY) Ltd)

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KARPOWERSHIP

triplo4 sustainable solutions

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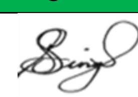
Shanice Singh Senior Sustainability Consultant EAP (EAPASA)	06 January 2023 / Ballito	
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EXECUTIVE SUMMARY:
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1. Introduction

Karpowership SA (Pty) Ltd proposes a Gas to Power via Powership Project at the Port of Richards Bay, uMhlatuze Local Municipality, Kwazulu-Natal.

Triplo4 Sustainable Solutions has been appointed to undertake the Scoping and Environmental Impact Reporting (S&EIR, also referred to as the EIA process required in terms of the National Environmental Management Act 107 of 1998, as amended (NEMA).

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 technology agnostic New Generation Capacity under the Risk Mitigation IPP Procurement Programme (RMI4P) issued by the Department of Mineral Resources and Energy (DMRE) to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of current power generating technology with its inherent adverse environmental and economic impacts. The "Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) Programme (2000MW) 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.

The Integrated Resource Plan (IRP) 2019 identifies the necessary generation mix of technologies to respond to the demand for electricity. Inherent in the planning process is the commitment to energy security, cost efficiency and effectiveness, and environmental sustainability. The RMI4P succeeded in attracting project proposals featuring a variety of technology combinations to provide dispatchable generation. These determinations facilitate the process of procuring the required electricity capacity. Preferred Bidder status in the RMI4P was awarded to eight projects on 18 March 2021 and three further projects on 1st June 2021, being:

- ACWA Power Projects DAO (Solar PV + BESS + Diesel Generator)
- Oya Energy (Solar PV + BESS + Diesel Generator + Onshore Wind)
- Umoyilanga Energy (Solar PV + BESS + Liquid Petroleum Gas (LPG) Generator + Onshore Wind)
- Two projects for Mulilo Total (Reciprocating Gas Engines + Solar PV) and (Solar PV + BESS + Diesel Generator))
- Three projects for Karpowership SA (Floating Modular Reciprocating Gas Engines with Heat Capture Steam Turbines)
- Three further Preferred Bidder projects were added on 1 June 2021 to Scatec (Solar PV + BESS).

The Gas to Power via Powership Project at the Port of Richards Bay forms part of the solutions provided by the RMI4P preferred bidders that provide for a combination of a range of technologies that can be noted above.

Gas generated electricity has been identified by the DMRE as one of the most affordable and reliable forms of power. From the 11 preferred bidders, only a single (1) project bid at lower cost, confirming the affordability of the gas to power project as a fully dispatchable technology.

28 projects submitted bids in response to the RMI4P on 22 December 2020. Bids were assessed for

compliance with qualification criteria and then assessed on lowest cost and committed economic development contributions. The Karpowership Port of Richards Bay project was subsequently named as one of the 11 successful bids announced by the DMRE. Karpowership's project status, upon award as a preferred bidder for the RMI4P, became classified as a Strategic Integrated Project (SIP) and are to be managed within the requirements as set out in the Infrastructure Development Act 23 of 2014- Appendix 7.1

2. Governance Framework

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) ("**Listing Notices**"). The procedural requirements for such an application and associated EIA that needs to be undertaken, are prescribed by the EIA Regulations, 2014 promulgated under NEMA (as amended) ("**EIA Regulations**").

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 is applied to the AEL application, with a number of additional requirements set out in NEMAQA and its Regulations.

The EIA Regulations outline two authorisation processes. Dependant on the type of activity that is proposed, either a Basic Assessment or a Scoping and Environmental Impact Assessment process is required to obtain Environmental Authorisation (EA).

Triplo4 has determined that the proposed Gas to Power via Powership Project at the Port of Richards Bay triggered activities in Listing Notice 1-3 of the EIA Regulations.

Table 0-1: Listed Activities

Activity	Summarised Description
Listing Notice 1	
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.
12	The development of infrastructure or structures with a physical footprint of 100 square metres or more within a watercourse or within 32m of a watercourse.
15	The development of structures in the coastal public property where the development footprint is bigger than 50 square metres
17	Development in the sea or in an estuary or within the littoral active zone; in respect of infrastructure or structures with a development footprint of 50 square metres or more.
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
19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.
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
27	The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation.
Listing Notice 2	
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.

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
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.
7	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods– (i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) 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.
14	The development and related operation of— (ii) an anchored platform; or (iii) any other structure or infrastructure — on, below or along the sea bed.
Listing Notice 3 (KwaZulu-Natal)	
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.
12	The clearance of an area of 300 square metres or more of indigenous vegetation within an identified geographical areas.
14	The development of— (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.

A Water Use Authorisation in terms of Section 21 of the National Water Act 36 of 1998 (NWA) is required and was granted from Department of Water and Sanitation in July 2021.

3. Environmental Process

The EIA Regulations define the detailed approach to the S&EIR process, which consists of two phases: the Scoping Phase and the Impact Assessment Phase (the current phase).

A Scoping and Environmental Impact Reporting (S&EIR) process was conducted during 2020-2021, which is required for an EA, as per the timeline below:

- The Scoping Report, including the Plan of Study and approved Public Participation (PP) Plan for the EIA, was accepted by the Competent Authority (CA), namely the Department Forestry, Fisheries and the Environment (DFFE), on 06 January 2021.
- A Final EIA Report (EIAr) and Environmental Management Programme Report (EMPr) were submitted to the CA on the 26 April 2021. The CA refused the EA application and provided Karpowership SA with the Record of Refusal (RoR) on 23 June 2021.
- On 13 July 2021, Karpowership SA appealed the CA's refusal. On 1 August 2022, the Appeal Authority (the Minister) dismissed the appeal and exercised her powers in terms of Section 43(6) of NEMA. The application was remitted back to the CA, with the instruction to address various perceived gaps and defects through a new EIAr and associated PPP, in order for the application to be considered by the CA.

The CA advised that an updated EIAr, addressing the various perceived gaps in information, and subject to a Public Participation Process (PPP), must be submitted to the CA for reconsideration.

The key objectives of the EIA are to:

- Inform Interested and Affected Parties (I&APs) about the proposed Project and the EIA process followed;

- Obtain comments from I&APs (including the relevant authorities and the public) and ensure that all issues, concerns and queries raised are fully documented and addressed in the EIA Report;
- Identify and assess potential significant impacts associated with the proposed development;
- Formulate mitigation measures to avoid and/or minimise impacts and enhance benefits of the Project; and
- Produce a Final EIA Report which will provide all the necessary information for the Competent Authority to decide whether (and under what conditions) to authorise the proposed Project.

Figure 0-1: Overview of the Port of Richards Bay

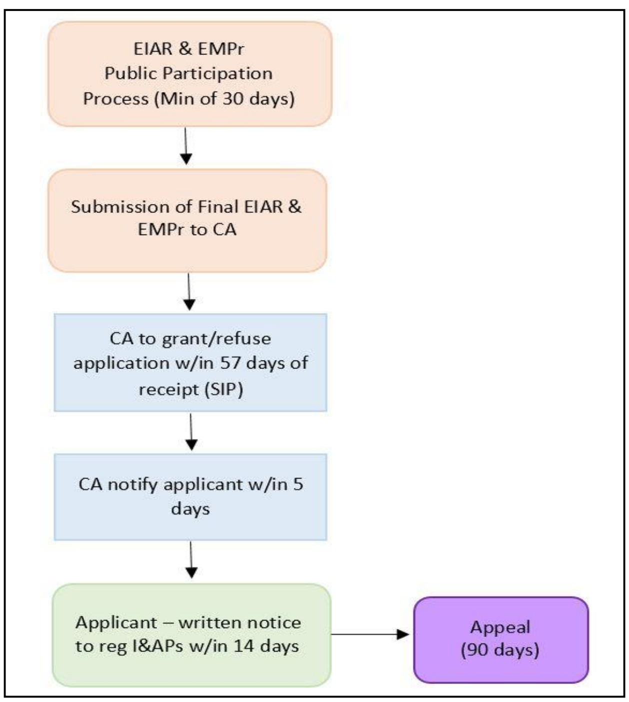


Figure 0-2: EIR Process

4. Description of the Site & Environment

The project is located in the Port of Richards Bay. It is located within proximity to the Richard's Bay Industrial Development Zone (RBIDZ) in the uMhlatuze Local Municipality in the KwaZulu-Natal Province. The Port of Richards Bay, located within Ward 2 of the uMhlathuze Local Municipality, is state-owned and managed by Transnet National Ports Authority (TNPA) in a landlord capacity.

The port of Richards Bay situated adjacent to the Richards Bay Industrial Development Zone (RBIDZ) – Special Economic Zones (SEZ), which is specifically designed to allow for related industries to be based in an Industrial Zone.

The proposed Powerships, Floating Storage & Regasification Unit (FSRU), temporary Liquified Natural Gas Carrier (LNGC) and gas line, will be located in the Port of Richards Bay under the jurisdiction of TNPA. While the transmission line is across Transnet properties as well as uMhlatuze Local Municipality properties, and the proposed switching station situated slightly within South32 Aluminum Pty Ltd property (alongside the existing Bayside substation).

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. The Powerships are positioned within the dead-end basin adjacent to the break bulk quay/multi-purpose terminal.

Figure 0-3: Overview of Port Site

Figure 0-4: Overview of Transmission Route

Industrial development currently developed close to the section of the Port where the proposed project is located includes a large-scale aluminium smelter (Bayside) as well as a phosphorous chemical plant (Foscor). Bidvest Terminals are situated within the Port boundaries, to the East of the proposed project.

The majority of recreational uses of the Port are generally located on the Northern side of the Port. Recreational fishing and other legal and illegal fishing take place at the harbour mouth, which is more than 4km away from the proposed location of the Powerships and FSRU.

The study area falls within a Critical Biodiversity Area listed as irreplaceable. Richards Bay Game Reserve, which is also an Important Bird Area (IBA) 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. Overall, the proposed terrestrial transmission line (preferred route) is located in low sensitivity areas, mainly due to its location in transformed areas or in highly degraded areas adjacent to transformed areas.

UMhlatuze LM has a population of approximately 351 531 persons and is characterised by high levels of educational attainment.

5. Project Motivation

The Karpowership project has arisen in response to the need to address the current energy crisis experienced in South Africa. It is in response to a bid issued by DMRE as part of the RMI4P. The purpose of the RMI4P is to satisfy the short-term electricity supply gap, ease the current electricity supply constraints and reduce the wide-scale usage of diesel-based peaking electrical generators using alternative energy technologies ((Steenkamp & Weaver, 2022; DMRE, 2021a). The energy generated through the Karpowership project will contribute towards alleviating the loadshedding burden and resultant negative socio-economic impacts by providing much needed dispatchable energy, which can be provided at baseload, mid-merit and peaking.

The RMI4P, declared a Strategic Integrated Project, is an important response to the energy crisis, and in line with the mandate of the State to provide services that ensures socio-economic growth and well-being for the benefit of all of society. Karpowership's proposed project is in accordance with the IRP 2019 where provision has been made for gas in the energy mix. Powerships should not be considered a replacement of renewable energy, but rather a complementary technology to renewable energy, which supports the transition away from coal and diesel, and a reduction in the negative environmental impacts associated with coal and diesel. Coupled with the urgent need to respond to the energy crisis Karpowership's project bring a solution where electricity can be dispatched on instruction when the energy supply is under strain (i.e. it is dispatchable).

In addition, the project will result in positive multiplier impacts on the local economy during both the construction and operational phases. Karpowership will play a positive role in the local economy through skills, enterprise and supplier development programmes. The direct, indirect, and induced economic impacts of the project on employment, income generation, new production and economic value will be positive. This will include skills development and capacity development towards the realisation of a just energy transition in South Africa. It is therefore anticipated that the Karpowership project will result in an overall positive socio-economic impact when considering the host of economic and environmental impacts.

It is worth reiterating that the Karpowership project is located within an active port, and adjacent to the Richards Bay Industrial Development Zone (Special Economic Zone), which is considered a key growth node catering specifically for the energy and maritime sectors. However, a responsible and sustainable approach to the proposed project is still required, in line with the requirements of NEMA and the environmental management Acts, Policies and Guidelines. The Duty of care (as prescribed in Section 28 of NEMA) must be observed. Therefore, numerous multidisciplinary specialist impact assessments have been undertaken as part of the EIA process, integration of specialist findings was ensured and the application of a polycentric view to the impact assessment was applied. Negative and positive impacts have been identified, and as far as possible all negative impacts have been avoided or mitigated to reduce the impact, and further management recommendations provided for as per the EMPr. All Specialists supported the project and no fatal flaws were identified for the preferred alternatives. The polycentric approach of the EIA gave consideration to all relevant factors, inclusive of potential impacts that the proposed project could have on the local as well as the broader community.

There is further opportunity for scientific research and monitoring programmes to inform adaptive management to the life cycle of this project, and for similar port-based projects. The Sustainability Specialist, based on Specialists' inputs, independently assessed the project's geographical, physical, biological, social, economic and cultural aspect of the environment through the application of three methods that assisted with synthesizing and conceptualizing technical information for decision making purposes. The following conclusion was reached: *"Given that the professionals who undertook the specialist studies have supported the granting of the environmental authorisation, with various requirements for mitigation and management, I support this project be granted the environmental authorisation, provided the necessary mitigation and management recommendations are upheld. The recommendations provided in this report offer further opportunity to reduce the negative impacts of this project on the environment and enhance the positive contributions and legacy that Karpowership SA can contribute to this community."*

6. Project Description

The Project entails the generation of electricity by two Powerships moored in the Port of Richards Bay, fed with natural gas from a third ship, a Floating Storage & Regasification Unit (FSRU). The three ships will be moored in the port for the Project's anticipated 20-year lifespan. A Liquefied Natural Gas Carrier (LNGC) will bring in liquified natural gas (LNG) and offload it to the FSRU approximately once every 20 to 30 days, dependent on power demand which is determined by the buyer, ESKOM. The FSRU stores the LNG onboard and turns the liquid form into gaseous form (Natural Gas) upon demand from the Powership (Regasification). Natural gas will be transferred from the FSRU to the Powerships via a subsea gas pipeline. The Project's design capacity is 540MW. Electricity will be generated on Powerships by 27 reciprocating engines, each having a heat input in excess of 10MW (design capacity of 18.32MW each at full capacity). Heat generated by operation of the reciprocating engines is captured, and that energy is used to create steam to drive three steam turbines that each have a heat input of circa 15.45MW. The contracted capacity of 450MW, which cannot be exceeded under the terms of the RMI4P, will be evacuated via a 132kV transmission line over a distance of approximately 3.6km. The electricity will be evacuated from the Powership to the Impala substation, via a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds electricity into the national grid.

7. Alternatives

The EIA Regulations, 2014 (as amended) require that all S&EIR processes must identify and describe feasible and reasonable alternatives. Numerous alternatives were identified and considered to date.

Table 0-2: Alternatives Screened Out

Alternative	Screened Out Reason
Layout Alternative: Powership - The 2 Powerships are located closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and higher tower.	This is a feasible alternative, however considered less suitable from engineering and environmental perspectives.
Layout Alternative: Transmission Lines - The route is located to a large extent of its length within wetlands, and it	Considered as a fatal flaw and therefore not supported

traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest.	

The following alternatives were considered in the EIA:

7.1. Layout Alternatives

Marine:

Preferred Powership and Gas Pipeline Alternative 1: The Powerships are positioned within the dead-end basin and located closer to the first tower of the transmission line. The powerships positioned on the mainland 'promontory' adjacent to the large mangrove stand, and positioned further away than alternative 2 from the sensitive sand bank. This alternative position was approved by TNPA and in line with their port planning.

Powership and Gas Pipeline Alternative 2: is considered less suitable from engineering and environmental perspectives, as the Powerships and the mooring systems are placed closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and higher tower.

Transmission:

Alternative 1 (Preferred): The majority of the route is located in areas of low to moderate ecological sensitivity and will be traversing highly sensitive wetland and swamp forest, and a large portion of this alternative follows the route of the existing powerline servitude. This alternative offers a shorter route to the end point.

Alternative 2: this route traverses areas that have been historically transformed, however these areas are still considered highly sensitive. 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.

7.2. Design Alternatives

The proposed transmission line can be constructed of either monopole or lattice steel construction, based on the final engineering design requirements, the topography and geotechnical survey results. As the extent of the lattices' footprint is much bigger and require more vegetation clearance than the monopoles, the monopoles are the preferred options.

7.3. Technology Alternatives: Fuel

The Powerships to be deployed will generate electricity using Wärtsilä engines running exclusively on natural gas. Wärtsilä conducts extensive research on the use of different fuel sources within its engines, improving and optimising their technology to future-proof and deliver leading efficiency. Wärtsilä have made significant progress on the possibility of using hydrogen gas to power with their engine technology; whilst it is already technically possible to utilise a mix of hydrogen with natural gas, this technology is in its infancy and is undergoing rigorous research and development for pure hydrogen operations, and outcomes of that research and development (R&D) are anticipated within the coming years.

7.4. No Go Alternative

The option of not implementing the activity, i.e. the "no-go" alternative, was considered. In respect of the Project, it would mean that the existing status quo would prevail. While the benefit of this option is that there will be no negative environmental or social impacts, there also would be no positive environmental or socio-economic benefits as well as deployment of cleaner turnkey energy technology in keeping with the South Africa's Just Energy Transition objectives.

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 measures recommended by the EAP and specialists, as contained in Section 7 of the Final EIA report and the EMPr are implemented.

In fact, the proposed project will have positive environmental impacts due to mitigation measures involving ecological research and subsequent long-term improvements resulting from improved knowledge. Negative environmental impacts resulting from loadshedding, declining energy or the use of more environmentally harmful alternative fuel sources will also be avoided.

The highly significant positive socio-economic impacts will not be realised in the no-go scenario. A socially just transition for the poor and unskilled workforce and marginalised individuals and Government's target for a sustainable energy supply mix will also not occur in context of the Karpowership Project in Port of Richards Bay. The lost benefit of having electricity derived from natural gas, reduces the stability and resilience of power grids, thereby reducing the energy transition towards facilitating rapid deployment of renewable energy sources. Dispatchable power to the national grid to meet existing as well as future increased electricity demand within the country will not be available to prevent the disastrous and devastating economic decline associated with loadshedding resulting from an ever-increasing deficit of power. Continued loadshedding will negatively impact on the wellbeing of the majority of the SA population, on the economy as a whole as well as on local and international investor sentiments. Opportunities to stimulate the economy through employment, social development programmes, bursaries for education, other educational programmes, skills development programmes and procurement from local suppliers will be lost while the broader economic sectors such as industry, tourism, and entertainment will also face growth constraints. Moreover, individuals and especially the disadvantaged and marginalised, will have to face increasing risks to their livelihoods as well as reduced economic opportunities.

When the minimal potential environmental and socio-economic risk with mitigation is measured against the potential environmental and socio-economic benefits, there is simply no contest. The environmental benefits are significant and the social and economic benefits vastly outweigh the mitigated environmental and socio-economic impacts.

The no-go option is thus not consistent with the principles of sustainable development in relation to the provision of electricity which falls under the SDG 7: Affordable and Clean Energy and SDG 8: Decent Work and Economic Growth. 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. Hence the "no-go" alternative is not recommended.

8. Stakeholder Engagement

Stakeholder engagement is a key component of the S&EIR process and is being undertaken in accordance with the requirements of the EIA Regulations. Stakeholder engagement periods include the following:

- Initial notification and submission of the BID;
- Formal public comment period on the draft EIA Report

The key stakeholder engagement activities during the EIA processes are summarized in Table 0-3 below.

Table 0-3: Summary of Stakeholder Engagement Activities

Activity	**Date**
Initial Notification	
Advert, BID, Site Notices, Flyers, Leaflets, Radio Announcements	24 -28 October 2022
Pre-Consultation Meetings	12 October – 09 November 2022
Impact Assessment	
Draft EIAR Comment Period	10 November – 13 December 2022
Public & Virtual Meeting	23 November 2022

9. Assessment of Potential Impacts

9.1. Specialist Studies & Technical Reports

Specialist studies were undertaken to investigate key potential direct, indirect and cumulative impacts:

- Hydrology & 1:100 Year Floodline Assessment
- Aquatic Assessment
- Hydropedology Assessment
- Geohydrology Assessment
- Water Balance Assessment
- Wetland Delineation & Functionality Assessment
- Heritage & Palaeontology Assessment
- Terrestrial Biodiversity Assessment

- Avifauna Assessment
- Baseline Underwater Noise Report
- Underwater Noise Assessment Report
- Underwater Heritage Report
- Marine Ecology Assessment & Fisheries Impact Report
- Marine Avifaunal Assessment
- Estuarine and Coastal Assessment
- Traffic incl. Marine Assessment
- Thermal Plume Modelling Report
- Air Quality Impact Assessment
- Ambient Noise Impact Assessment
- Climate Change Impact Assessment
- Socio-Economic Impact Assessment
- Small Scale Fishers Specialist Engagement Report
- Sustainability Report
- Tourism Impact Assessment
- Visual Impact Assessment
- Major Hazard Installation Assessment
- Role of Gas in the Just Transition
- Cost implications Gas vs Renewable forms of Energy

For all potentially significant impacts, the significance of the anticipated impact was rated without and with recommended mitigation measures in Table 0-4

9.2. Impact Significance

The significance of potential impacts of the proposed Project was determined in order to assist decision-makers. The overall impact ratings, assuming mitigation measures (refer to Section 9.3.2) are effectively implemented, are:

- No significant or negligible impacts or risks were identified for specialist studies conducted in terms of heritage, traffic, marine traffic, major hazard installation, hydrology, geohydrology, hydropedology, tourism and visual aspects.
- Negative impacts and risks of very low and/or low significance were identified for wetlands, Terrestrial Biodiversity, atmospheric emissions and terrestrial noise. Socio-economic negative impacts ranged from low to medium.
- The overall impact of the Project on the Richards Bay Estuary and coastal environment after mitigations will be medium to low,
- The overall impact of the Project on the Richards Bay Avifauna after mitigation will be medium to very low.
- Low to very high positive impacts were indicated for aspects related to the Tourism Industry, and the socio-economic assessment indicated numerous positive impacts ranging from low, medium to high positive.

A polycentric approach to the proposed project requires the holistic consideration of all relevant factors, inclusive of potential impacts that the proposed project could have on the local as well as the broader community. Section 2(4)(b) of NEMA states that *Environmental management must be* <u>*integrated,*</u> *acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in* the *environment by pursuing the selection of the best practicable environmental option.* Sustainable development as per NEMA requires the integration of social, economic, and environmental factors in the planning, implementation, and evaluation of proposed projects, to ensure that development serves the needs of present and future generations.

The independent sustainability specialist assessment therefore considered both the positive and negative impacts of actual and potential impacts on the geographical, physical, biological, social, economic, and cultural aspects of the environment in a polycentric and holistic approach that:

- Acknowledges that this environment is a complex and dynamic system
- Acknowledges the interrelated socio-ecological and socio-economic relationships
- Identifies the risks and consequences of alternatives and options for mitigation of activities, to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management as set out in Section 2 of NEMA.

The table below summarises the impacts assessed in the EIA, including their significance before and after the implementation of essential mitigation measures.

Table 0-4: Summary of Impacts

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Hydrology Impacts (Section 7.5.1)		

Disturbing vadose zone during soil excavations / infilling activities	Neutral/ Negligible	Neutral/ Negligible
Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses	Low	Neutral/ Negligible
Surface water contamination and sedimentation	Low	Neutral/ Negligible
Soil disturbance & erosion and sedimentation of nearby watercourses (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Switching station spillages (incidents only; operational phase	Neutral/ Negligible	Neutral/ Negligible
Leakages from vehicles occurring during transmission line maintenance (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Aquatic Impacts (Section 7.5.2)		
Removal of riparian vegetation and habitat impacting bank stability; Disturbance of the natural soil profile resulting in the proliferation of invasive alien plant species; Loss of aquatic vegetation and habitat.	Medium	Low
Changes in natural drainage lines which may lead to ponding or increased runoff patterns.	Medium	Low
Leakages from vehicles and machines. Oil & fuel spills from vehicles (Construction phase)	Medium	Low
Leakages from vehicles and machines. Oil & fuel spills from vehicles (Operational phase)	Low	Low
Change in species composition due to loss of aquatic habitat, water quality changes.	Low	Low
Hydropedology Impacts (Section 7.5.3)		
Site preparation impacting on soil interflow processes, soil quality, soil structure and land capability	Neutral/ Negligible	Neutral/ Negligible
Disturbing vadose zone during soil excavations / infilling activities	Low	Neutral/ Negligible
In-situ placement of new soils, altering existing soil-flow processes impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Vegetation clearing & soil stockpiling impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Surface water (wetland) quality	Low	Neutral/ Negligible
Soil quality	Low	Neutral/ Negligible
Excavation will disturb soil interflow processes	Low	Neutral/ Negligible
Oil & fuel spills impacting on soil quality	Low	Neutral/ Negligible
Geohydrology Impacts (Section 7.5.4)		
Disturbing vadose zone during soil excavations / construction activities	Low	Neutral/ Negligible

Hydrocarbon contamination of the vadose zone (construction phase)	Low	Neutral/ Negligible
Surface water contamination and sedimentation from the following construction activities	Low	Neutral/ Negligible
Impacts to downstream groundwater users	Neutral/ Negligible	Neutral/ Negligible
Temporary dewatering of perched groundwater (if it occurs)	Low	Neutral/ Negligible
Hydrocarbon contamination of the vadose zone (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Impacts to downstream groundwater users (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Wetland Impacts (Section 7.5.5)		
Direct habitat modification – Direct impact	Medium-Low	Low
Water Quality (Pollution) – direct impact	Medium-Low	Low
Catchment modifications (land cover and surface runoff) – indirect impact	Low	Very Low
Water Quality (Pollution) – indirect impact	Low	Very Low
Archaeology and Palaeontology Impacts (Section 7.5.6)		
No impact		
Terrestrial Biodiversity Impacts (Section 7.5.7)		
Loss of modified habitat (Construction Phase)	Medium-Low	Low
Loss of reed beds (Construction Phase)	Medium	Low
Loss of bushveld (Construction Phase)	Medium-Low	Low
Loss of flora Species of Conservation Concern (SCC) (Construction Phase)	Medium	Low
Loss of fauna SCC (Construction Phase)	Medium	Low
Loss of biodiversity in general (Construction Phase)	Medium-Low	Low
Fragmentation (Construction Phase)	Medium-Low	Low
Invasion of alien species (Construction Phase)	High	Low
Loss of modified habitat (Operational Phase)	Medium-Low	Low
Loss of reed beds (Operational Phase)	Medium-Low	Low
Loss of bushveld (Operational Phase)	Medium-Low	Low
Loss of flora SCC (Operational Phase)	Medium-Low	Low
Loss of fauna SCC (Operational Phase)	Medium-Low	Low
Loss of biodiversity in general (Operational Phase)	Medium-Low	Low
Fragmentation (Operational Phase)	Medium-Low	Low
Invasion of alien species (Operational Phase)	High	Low
Avifauna Impacts (Section 7.5.8)		
Powerships: Habitat Loss (Construction Phase)	Medium-Low	Medium-Low
Powerships: human disturbance (Construction Phase)	Medium	Medium-Low
Transmission Line: Habitat Loss (Construction Phase)	Medium-Low	Very Low
Infrastructure: human disturbance (Construction Phase)	Medium	Medium-Low
Habitat loss: Infrastructure (Operational Phase)	Medium-Low	Very-Low

Project infrastructure: collisions (Operational Phase)	Medium-High	Medium-Low
Project infrastructure: electrocution (Operational Phase)	Medium-Low	Medium-Low
Powership: light pollution (Operational Phase)	Low	Low
Powership: noise and vibration impacts (Operational Phase)	Medium	Medium
Powership: human disturbance (Operational Phase)	Medium-Low	Very-Low
Underwater Noise Impacts (Section 7.5.9)		
No impact		
Underwater Archaeology Impacts (Section 7.5.10)		
Extremely low probability of Maritime and Underwater Cultural Heritage resources	Neutral/ Negligible	Neutral/ Negligible
Coastal, Estuary and Marine Ecology Impacts (Section 7.5.11)		
Disturbance or loss of estuarine and marine fauna (Construction phase)	Medium-Low	Low
Changes in water quality as a result of water-based construction activity	Medium	Medium-Low
Disturbance to surrounding estuarine ecology, and fisheries and mariculture, due to increased noise levels	Medium-Low	Medium-Low
Avifauna Impacts (Powerships and Transmission line)	Medium	Medium-Low
Loss of fauna Species of Conservation Concern (Construction phase)	Medium	Low
Solid waste pollution (Operational Phase)	Medium-Low	Low
Chemical pollution arising spills of hazardous substance (Construction Phase)	Medium-High	Medium-Low
Intake of cooling water on marine organisms in the surrounding water body (Operational Phase)	Medium	Medium-Low
Cooling water discharge on the estuarine/marine ecology (Operational Phase)	Medium-High	Medium
Effects on surrounding estuarine/marine ecology due to increased underwater noise and vibrations (Operational Phase)	Medium-High	Medium
Effects on surrounding estuarine/marine ecology due to increased light pollution (Operational Phase)	Medium-High	Medium-Low
Effects of the combined operational impacts on ecosystem services (fisheries and mariculture)	Medium	Medium
Chemical pollution arising from construction related spills of hazardous substances and shipping activities (Operational Phase)	High	Medium-Low
Effects of catastrophic accidents on estuarine/marine ecology, avifauna and ecosystem services (Operational Phase)	Low	Low
Atmospheric Impacts and Risks (Section 7.5.12)		
SO_2 ; NO_2 and PM_{10}	Low	Low

Terrestrial Noise Impacts and Risks (Section 7.5.13)		
Noise impacts from construction activities	Medium-Low	Low
Noise impacts from operational activities	Medium-Low	Low
Climate Change Impacts and Risks (Section 7.5.14)		
Contribution to climate change	Low (Positive)	Low (Positive)
Socio-Economic Impacts and Risks (Section 7.5.15)		
Changes in biodiversity and climate on the livelihoods of communities	Low	Low (Positive)
The economics, and livelihoods for local fishermen in the region (not just fishermen within the harbour location)	Medium	Medium (Positive)
Reduction of tourism and related activities in the Municipal area and in the broader region.	Medium	Low (Positive)
Increase in demand for municipal infrastructure, social services and crime associated with the construction workers and job seekers (Construction phase)	Low	Low
Increase in demand for municipal infrastructure, social services and crime associated with the construction workers and job seekers (Operational phase)	Medium	Medium
Skills transfer and development (Construction Phase)	Low (Positive)	Medium (Positive)
Skills transfer and development (Operational Phase)	Low (Positive)	Low (Positive)
Sense of place experienced due to visual and noise effects	Low	Low
Increases in economic production, value, income and employment during construction and operations	High (Positive)	High (Positive)
Tourism Impacts and Risks (Section 7.5.16)		
Potential negative noise impact in the Port of Richards Bay on the marine tourism activities	Low	N/A
Potential negative visual and noise impacts on tourism at the Port of Richards Bay	Low	N/A
Potential positive impacts of Karpowerships electricity provision on the hospitality and tourism industry in Richards Bay	Very High (Positive)	Very High (Positive)
Potential Positive Impacts on Energy and Industrial Tourism in Richards Bay	Low (Positive)	Low (Positive)
Traffic Impacts (Section 7.5.17)		
No impacts.		
Visual Impacts (Section 7.5.18)		
No Impacts.		
Major Hazard Installation Risk (Section 7.5.19)		
Acceptable impacts.		
Marine Traffic Impacts and Risk (Section 7.5.20)		
No impacts		

9.3. Key Mitigations Measures

The mitigation hierarchy (avoid, reduce, rehabilitate, and offset) was applied. Key design mitigation proposed to address impacts of the bypass are summarised below:

Avoid

The following key measures are intended to avoid specific impacts:

- Screening out Alternative 2 of the transmission line as this route option 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 which should be avoided.
- The positioning of the 2 Powerships closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and a higher tower. This feasible alternative was screened out as was considered less suitable from engineering and environmental perspectives.
- Alignment of the transmission line along transformed or disturbed areas, and existing servitudes.
- The use of close-loop water systems that exclude the use of biocides chlorine and thus any potential pollution within the marine environment.

Reduce

- The design of the Powerships provides for built-in noise mitigation e.g. double hull and anti-vibration mounts.
- Management of water intact velocities and placement of intake outside the benthic environment to reduce impacts within the marine ecosystem.
- Navigational simulations and TNPA agreements regarding FSRU and Powership positioning ensured the optimal location of the vessels to avoid marine traffic collisions and align with TNPA Port planning.
- Various measures were stipulated as per the EMPr for the construction and operational phase to reduce impacts.

Rehabilitate

Rehabilitation is stipulated for any areas disturbed during construction as per the measures provided in the EMPr and rehabilitation plan. For example, in terms of wetland rehabilitation, should the rehabilitation measures implemented successfully, approx. 23.3 ha equivalent of wetlands will be improved in comparison to the current state. In addition, the EMPr and the rehabilitation plan also provides for the maintenance of areas to prevent degradations during the operational phase.

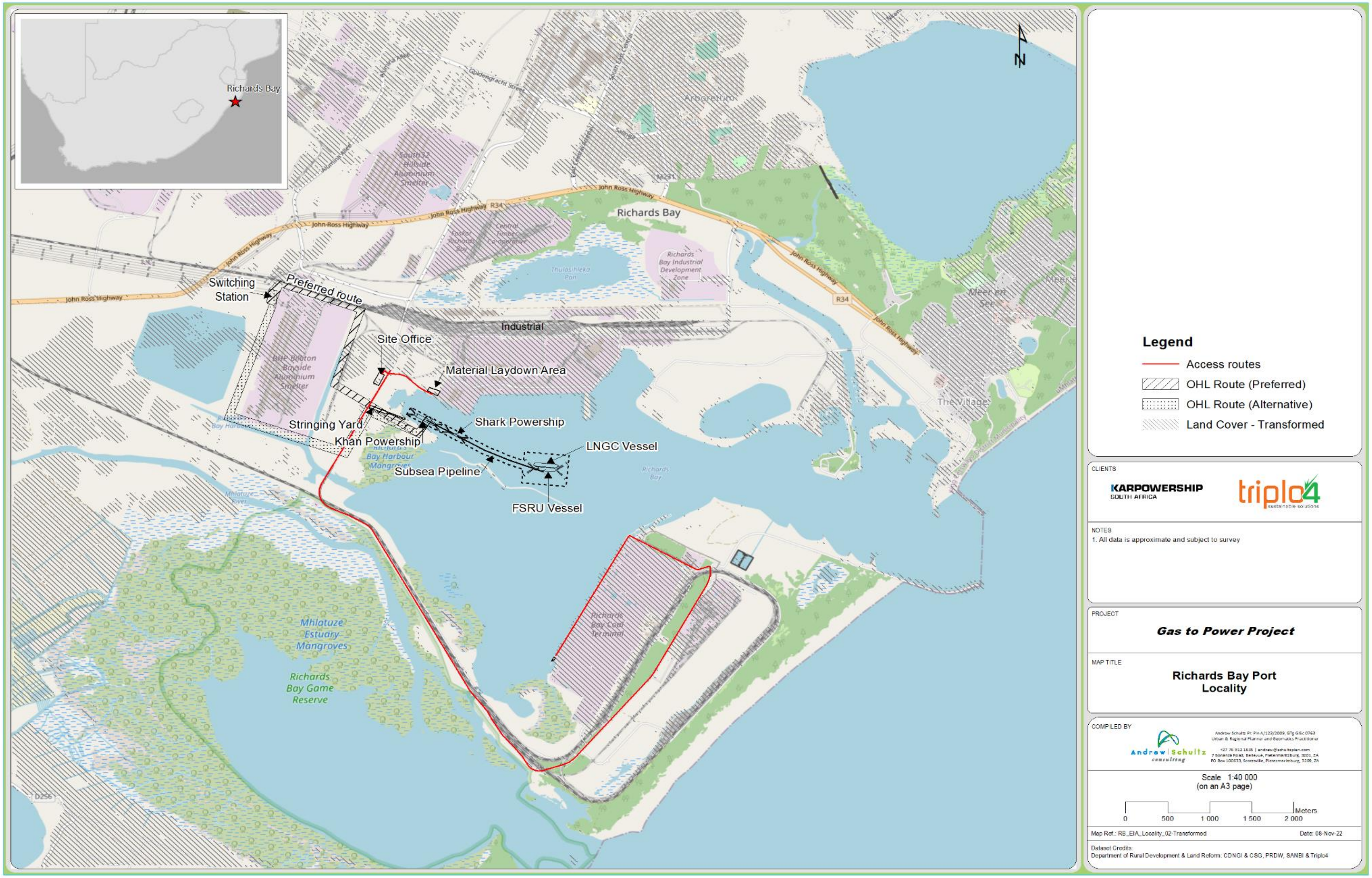
10. Conclusion & Way Forward

This Final EIAR Report identified and assessed the potential biophysical and socio-economic impacts associated with the Proposed Gas to Power Powership Project at the Port of Richards Bay.

It is the opinion of the EIA project team, incorporating the signatories below, that all components of this application, including the EIR with attached independent specialist reports, EMPr, public participation process and supporting documentation, comply with the relevant guidelines and contain all the required information in terms of GN 982 of the EIA Regulations to enable an informed decision by the competent authority.

It is the reasoned opinion of the EAP that the Gas to Power Powership project is acceptable, will not create unacceptable environmental impacts and can be reasonably authorised subject to the implementation of the mitigations and management measures set out in the EMPr. This opinion was reached with due consideration of:

- the independent specialist studies, with each and every specialist concluding their assessment with a supportive statement for the proposed development (i.e. no fatal flaws were identified for the preferred alternatives);
- the independent contributions to the need and desirability assessment;
- the impacts identified from a macro, micro, cumulative and polycentric (integrative) perspective in terms of the geographical, physical, biological, social, economic and cultural aspect of the environment; and
- the potential to avoid or minimise negative impacts and maximise positive impacts through inter alia the socio-economic development plan and reduced loadshedding.



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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
IPP	Independent Power producer
IRT	Issues and Response Trail
IUCN	International Union for Conservation of Nature
MPA	Marine Protected Area
NEMA	National Environmental Management Act
NEM:AQA.	National Environmental Management: Air Quality 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
RMI4P	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
SIP	Strategic Integrated Project
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 **Final** Environmental Impact Assessment Report for the Proposed Gas to Power Powership Project at the Port of Richards Bay, uMhlatuze Local Municipality, King Cetshwayo District Municipality, KwaZulu-Natal (the Project).

1.2 Background

1.2.1 RMI4P Context

The proposed Project has been formulated in response to the Request for Proposals (RFP) for up to 2,000MW of New Generation Capacity of dispatchable power from a range of technologies under the Risk Mitigation Independent Power Producer Programme(RMI4P) issued by the Department of Mineral Resources and Energy (DMRE) to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its current adverse environmental and economic impacts.

Furthermore, emergency power is required urgently for South Africa's economic development and upliftment, primarily to provide reliable dispatchable power to the national grid to prevent load-shedding. The energy crisis has had a significant impact on the South African economy over the past 15 years and is dispatched to continue well in to the future without an emergency risk response such as the RMI4P.

The RMI4P is different to the Renewable Energy Independent Power Producer Procurement Programme (REI4P) and the wider development of the electricity generation in South Africa in that it was established to address the current, and critical shortfall in electricity supply and grid instability which has resulted in South Africa's energy crisis. The procurement thus seeks to address the short-term deficit in electricity supply, rather than determining the future energy mix.

The RMI4P Request for Proposals (RFP) stipulates that all proposed projects must provide between 50 and 450 MW each of dispatchable power for a 20 year contract term, and that various stringent qualification criteria must be met including environmental, social and economic development, BBBEE, skills development, demonstration of financial and technical track record and capability and legal compliance. Bids were assessed by a panel of independent private sector experts for RFP qualification compliance, and then assessed with a weighting of 90% on bid price and 10% on Economic Development commitments made by the bidder. The proposed Project offers 450 MW of dispatchable generation for a 20 year operational period. The 20 year term is as stipulated for all projects in accordance with the RFP and will be reflected in related Power Purchase Agreements (PPA). Projects under the RMI4P have been declared Strategic Integrated Projects (SIP) in terms of the Infrastructure Development Act 23 of 2014 by the Presidential Infrastructure Coordinating Commission Council on 24 July 2020 under SIP 20. Karpowership SA's Port of Richards Bay project was announced by the DMRE on 18 March 2021 as one of the initial 8 successful bids (3 further projects were awarded Preferred Bidder status on 1 June 2021). The Project has been gazetted as a designated Strategic Integrated Project (SIP) by the SIP Steering Committee as set out in

Government Gazette 43547, in accordance with the provisions of the Infrastructure Development Act 23 of 2014 (IDA) – Appendix 7.1 – SIP Confirmation Letter.

The Gas to Power Powership Project at the Port of Richards Bay forms part of the dispatchable solutions provided by RMI4P Preferred Bidders via a range of technologies as indicated in the list of Preferred Bidders below. Gas, as per the DMRE, has been identified as one of the most affordable forms of power. 28 Projects submitter bids in response to the RMI4P RFP, from which 11 Preferred Bidders were selected. From those 11 preferred bidders, only 2 bidders (of which one was another Karpowership SA project) provided a marginally lower bid evaluation price (also included in the list of Preferred Bidders below, data from publicly available IPP Office communications), confirming the affordability of the gas to power project.

Preferred Bidder	Technology	Contracted Capacity	Evaluation Price MW/h
ACWA Power Project DAO	Solar PV + BESS + Diesel Generator	150 MW	1,462.00
Karpowership SA Coega	Floating Modular Reciprocating Gas Engines with Heat Capture Steam Turbines	450 MW	1,468.87
Karpowership SA Richards Bay	Floating Modular Reciprocating Gas Engines with Heat Capture Steam Turbines	450 MW	1,496.03
Mulilo Total Hydra Storage	Solar PV + BESS + Diesel Generator	75 MW	1,515.97
Oya Energy Hybrid Facility	Solar PV + BESS + Diesel Generator + Onshore Wind	128 MW	1,550.34
Karpowership SA Saldanha	Floating Modular Reciprocating Gas Engines with Heat Capture Steam Turbines	320 MW	1,686.48
Umoyilanga Energy	Solar PV + BESS + Liquid Petroleum Gas (LPG) Generator + Onshore Wind	75 MW	1,721.64
Scatec Kenhardt 3	Solar PV + BESS	50 MW	1,884.56
Scatec Kenhardt 2	Solar PV + BESS	50 MW	1,884.61
Scatec Kenhardt 1	Solar PV + BESS	50 MW	1,884.64
Mulilo Total Coega	Reciprocating Gas Engines + Solar PV	197.76 MW	1,885.37

1.2.2 South African Energy Crisis

In the South African context, the failure to deliver stable electricity is a function of numerous factors including corruption, non-payment by citizens, public entities and private sector firms, demand inelasticity, misallocation of resources, lack of infrastructure maintenance, a stagnation in the demand for electrical energy in South Africa since 2007, and the inflexible construction programme marred with delays and cost over-runs (i.e., Medupi and Kusile) (Department of Public Enterprises, 2019).

In response to the South African energy crises, the National Development Plan (NDP) prioritised the need for energy infrastructure to be robust, extensive, and affordable to the meet the needs of industry, the commercial sector as well as households (DMRE, 2021).

Subsequently, the Integrated Resource Plan (IRP) 2019 identifies the necessary generation mix of technologies to respond to the demand for electricity. Inherent in the planning process is the commitment to energy security, cost efficiency and effectiveness, and environmental sustainability. The RMI4P succeeded in attracting project proposals featuring a variety of technology combinations. These determinations facilitate the process of procuring the required electricity capacity. The objective of the RMI4P is to satisfy the short-term electricity supply gap, ease the current electricity supply constraints and reduce the wide-scale usage of diesel-based peaking electrical generators using alternative energy technologies. RMI4P is part of an attempt by government to procure a net increase of more than 23 900 megawatts (MW) of energy over the next eight years (i.e., short term).

As South Africa increases its renewable energy penetration through further renewable bid windows, it is becoming apparent that dispatchable and flexible generation is required which is found in gas and to a lesser extent battery technology. The role of gas is indisputable in the just energy transition as it provides additional dispatchable capacity at scale that enables the large exploitation of renewable resources. With the likely demand profile for electricity in South Africa uncertain, the amount of generation required will remain unknown. However, for portions of generation that will be provided by variable sources, provision must be made for supplying all the generation from dispatchable resources in the times where the variable sources do not provide the required energy. Energy technologies are classified as dispatchable (gas, coal, nuclear, oil, hydro) or non-dispatchable (wind, solar). Both these technology groupings play an important role in meeting baseload and peaking demand and thereby ensuring security of supply. Natural gas can complement these non-dispatchable technologies by providing a dispatchable source of energy as a quick ramp up which will expedite the proliferation of renewable technologies in South Africa. Powerships should not be considered a replacement of renewable energy, but rather a complementary technology to renewable energy, which supported the transition away from coal.

1.2.3 Karpowership Overview

The applicant is Karpowership SA Pty Ltd, a South African company that is a 49% owned Black Empowered Company and 51% owned by Karpowership, a member of Karadeniz Energy Group that owns, operates and builds Powerships (floating power plants).

Since 2009, 36 Powerships have been completed to provide a total installed capacity of 6,000 MW globally, with additional Powerships either under construction or in the pipeline. Karpowership is operational in 14 locations across the world as per the Figure 1-1. Almost 1 GW of additional generation capacity is currently being commissioned in three more countries, with others at various stages of project development. Karpowership directly employs more than 2,600 people from 26 nationalities and has created more than 10,000 direct and indirect jobs around the world. The company has generated approximately 70 billion kilowatt hours of power around the world.

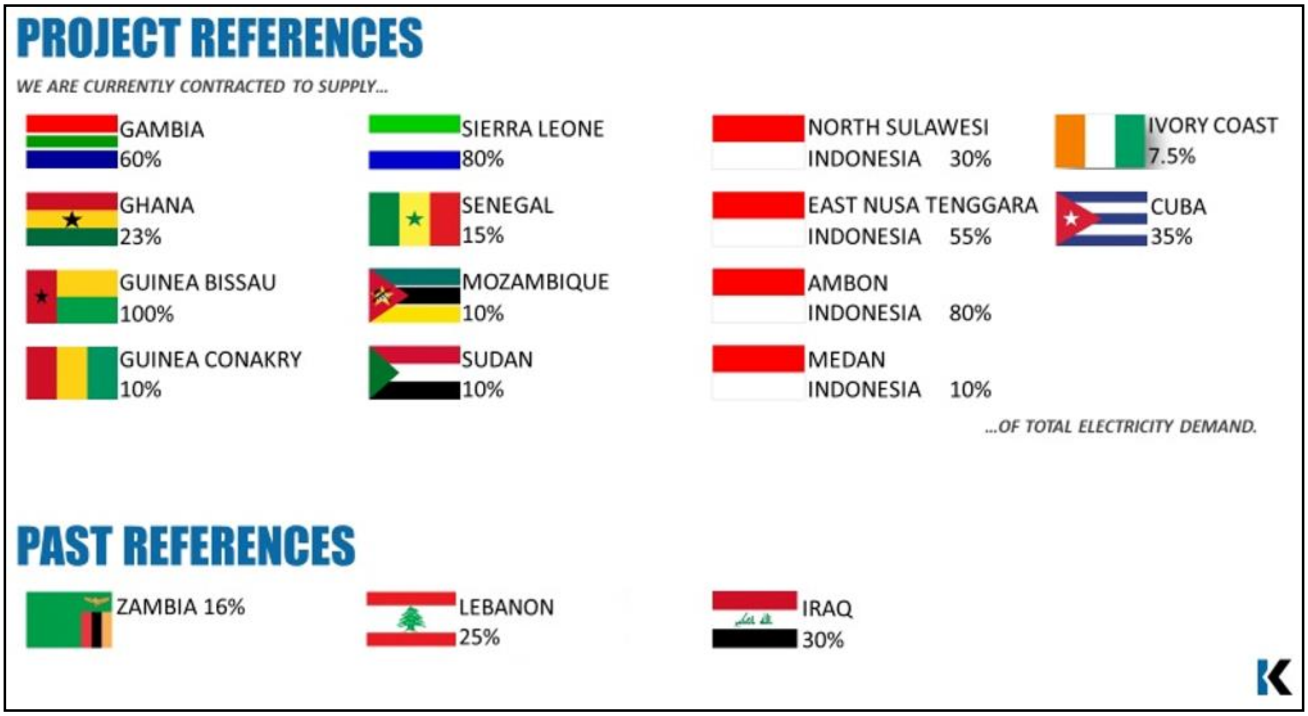


Figure 1-1: Karpowership's Project References

1.2.4 Summary of the Environmental Impact Assessment Process

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 as well the Atmospheric Emission Licence for the proposed Gas to Power Powership Project at the Port of Richards Bay, located within ward 2 of the uMhlatuze Local Municipality, KwaZulu-Natal.

The Competent Authority responsible for evaluating and deciding on the application for environmental authorisation is the Department of Forestry, Fisheries and the Environment (DFFE): Integrated Environmental Authorisations Directorate. The same EIA will inform Karpowership's application for an atmospheric emission licence (AEL). The licensing authority for the AEL is DFFE Air Quality Authorisations which is a sub-directorate within Directorate of Climate Change and Air Quality Management. The respective landowners of the Port and surrounding properties are the Transnet National Ports Authority (TNPA), uMhlatuze Local Municipality and South32 Aluminium SA Pty Ltd.

A Scoping and Environmental Impact Reporting (S&EIR) process was conducted during 2020-2021 and the Environmental Authorisation was refused. The refusal was appealed by Karpowership (Pty) Ltd. The Minister dismissed the appeal and exercised her powers in terms of Section 43(6) of NEMA. The application was remitted back to the Component Authority (CA) to allow the applicant to address various gaps and defects highlighted, through a new EIAr and associated Public Participation Process (PPP) for the application to be considered by the CA. As per in-person consultationmeeting with the CA, it was agreed that the main components to be addressed comprise of Noise, Climate Change, Socio-Economic Assessment, Need and Desirability / Holistic Approach, Public Participation and Integration and Polycentric Approach to enhance the specialist studies.

This was undertaken through various measures, including the inclusion of additional information and considerations in expert reports, weekly integration meetings held between various specialists to ensure consistent and open communication was held between the specialists, the identifying and conducting numerous stakeholder engagements and the special inclusion of reports which aimed at providing a holistic analysis of the benefits and detractions of the power project.

1.2.5 Project Summary

The project consists of three key parts: Liquefied Natural Gas, electricity generation and dispatch of electricity into the national power grid. Powerships are pre-constructed fully integrated floating power plants, with all necessary plant and equipment on board to allow the generation facility to plug directly into the grid, and for operations and maintenance to take place.

The Powership can be installed at a coastal site where there is an available substation for electrical connection and suitable marine conditions for berthing or mooring. Mooring will be followed by interconnection of the Powership to the national power grid. Finally, fuel connection takes place via pipeline and the electricity generative is evacuated via a transmission line to a substation on land. Refer to Figure 1-2 illustrating the concept:

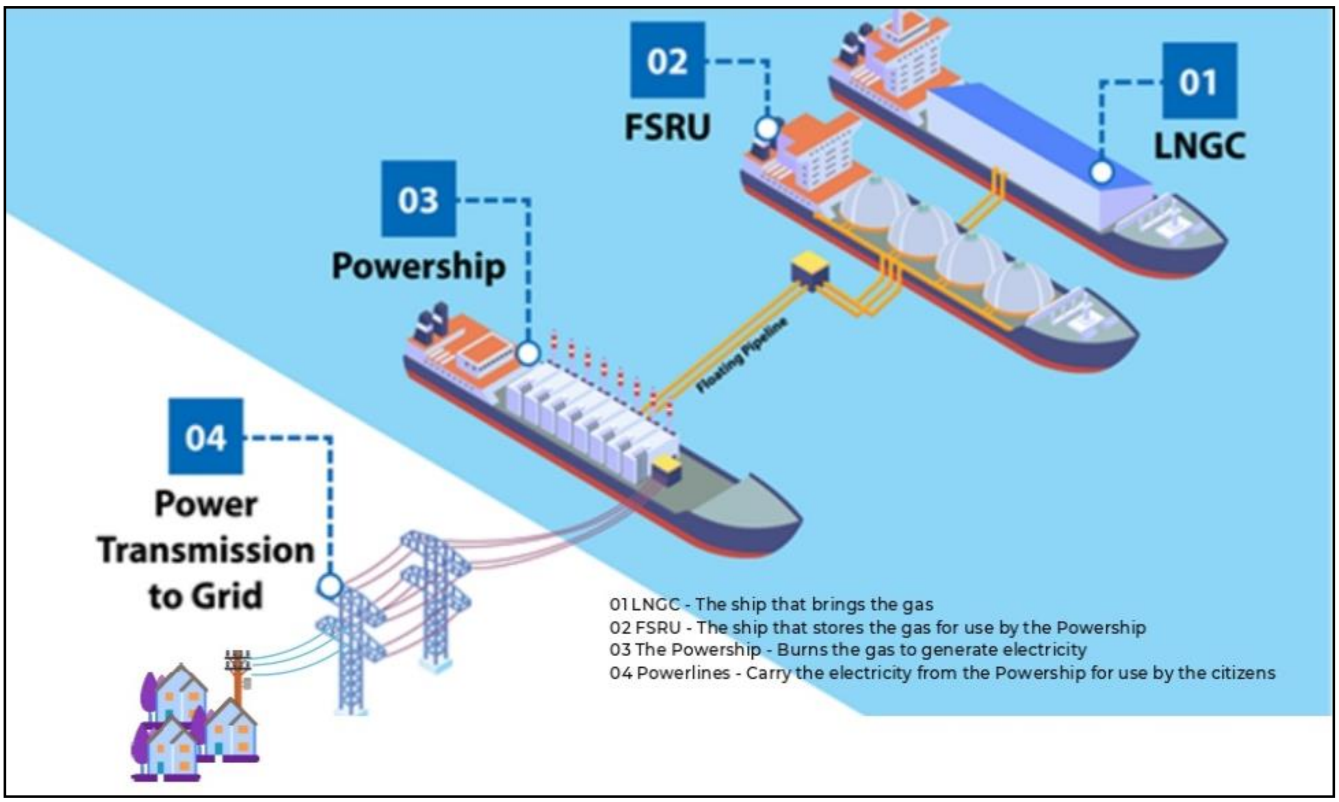


Figure 1-2: Generic image showing the Powership operations.

For the Richards Bay project, Karpowership proposes to moor two Powerships and a Floating Storage Regasification Unit (FSRU), connected by a subsea gas pipeline in the Port of Richards Bay to generate electricity which will be evacuated by means of a 132kV line. The Project's design capacity is 540MW. Electricity will be generated on Powerships by 27 reciprocating engines, each having a heat input in excess of 10MW (design capacity of 18.32MW each at full capacity). Heat generated by operation of the reciprocating engines is captured, and that energy is used to create steam to drive three steam turbines that each have a heat input of circa 15.45MW. The contracted capacity of 450MW, which will be measured at the Point of Utility Connection and cannot be exceeded under the terms of the RMI4P, will be evacuated via a 132kV transmission line over a distance of approximately 3.6km to the Switching Station. The electricity will be evacuated from the Powership to the Impala substation, via a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds electricity into the national grid. In addition, a LNG carrier shall periodically supply LNG to the FSRU (anticipated every 20 to 30 days depending on dispatch instructions for electricity generation) and will temporarily stay in the location within the Port (over a 1-to-2 day period) while offloading the LNG cargo.

The proposed technology for the production of electricity, incorporates the use of steam engines together with natural gas-fired reciprocating engines to improve the efficiency of energy generation through steam engines. Construction is limited to transmission and gas supply lines as the ships are built internationally and arrive fully equipped in the Port ready for operation.

The proposed Port based activities (Powerships, FSRU, gas pipeline, temporary LNG carrier) are situated within the Port of Richards Bay which is managed by Transnet Port National Authority (TNPA), and the proposed transmission line from the Port to the proposed switching station traverses various properties owned by Transnet, uMhlatuze Local Municipality and South32 Aluminium SA.

1.3 Summary of Environmental Authorisation Requirements

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

- Environmental Authorisation from the Department of Forestry, Fisheries and the Environment (DFFE) 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 DFFE, but the application is considered by a separate Branch within the same Department. The AEL application has been submitted and is currently under assessment (Refer to Appendix H5).
- A Water Use Licence from the Department of Water and Sanitation (DWS) in terms of the National Water Act 36 of 1998 (NWA) and the Water Use Licence Applications and Appeals Regulations, 2017. A Water Use Licence (Licence No: 11/W12F/CHI/10657) was issued by DWS on 09 July 2021.

1.4 Purpose of this Report

NEMA EIA Regulations 2014 (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 Final EIA Report documents the findings of the EIA as per the reporting requirements of the EIA Regulations, 2014, which is then made available to I&APs for public comment for a period of no less than 30 (thirty) days.

1.5 Independent Environmental Assessment Practitioner

NEMA EIA Regulations 2014 (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.

Table 1-1: Independent EAP Details

EAP	Triplo4 Sustainable Solutions
EAP	Mrs. Hantie Plomp
Educational qualifications	Masters in Environmental Management
Professional Registrations	EAPASA; SACNASP; AP with GBCSA
Voluntary Memberships	IAIAsa; IWMSA; IODSA, WISA
Experience at environmental assessments (yrs.)	> 20 years
Postal Address	P.O. Box 6595 Zimbali, 4418
Telephone Number	032 946 3213

EAP	Triplo4 Sustainable Solutions
Cell Number	083 308 8003
Fax Number	032 946 0826
Email Address	richardsbayksa@triplo4.com
Assisted by:	Mrs. Chen Read
Educational qualifications	Postgraduate Diploma in Environmental Management
Professional Registrations	*EAPASA;* AP with GBCSA
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	> 10 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

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 (Chapter 7) and the EMPr (Appendix 6). The methodologies and relevant protocols applied to each specialist study are described in the specialist reports attached as appendices (Appendix 9 and Appendix 7 – EMPr to this EIA). The specialists and technical experts who provided input to the EIA process are listed in the Table 1-2.

Table 1-2: Details of Specialist Assessments and Technical Team.

RICHARDS BAY SPECIALIST STUDIES, ASSESSMENTS AND TECHNICAL INFORMATION				
REPORT			SPECIALIST	CITATION
A TERRESTRIAL BIODIVERSITY	A1	Hydrology Assessment	GCS (Pty) Ltd	A1 Hydro, Oct 2022
	A2	Aquatic Assessment	GCS (Pty) Ltd	A2 Aquatic, Oct 2022
	A3	Hydropedology Assessment	GCS (Pty) Ltd	A3 Hydropedology, Oct 2022

RICHARDS BAY SPECIALIST STUDIES, ASSESSMENTS AND TECHNICAL INFORMATION				
REPORT			SPECIALIST	CITATION
& ECOSYSTEMS	A4	Geohydrological Assessment	GCS (Pty) Ltd	A4 Geohydro, Oct 2022
	A5	Water Balance Assessment	GCS (Pty) Ltd	A5 Water Balance, November 2020
	A6	Wetland Delineation and Functional Assessment	ENVASS / Triplo4	A6 WDFA, Oct 2022
	A7	Wetland Rehabilitation Plan	ENVASS / Triplo4	A7 WRP, Oct 2022
	A8	Archaeological Impact Assessment,	Umlando	A8 HIA, Oct 2022
	A9	Terrestrial Ecological Assessment	The Biodiversity Company	A9 Terrestrial Ecology, Oct 2022
	A10	Avifauna Impact Assessment	Anchor Environmental and The Biodiversity Company	A10 Terrestrial Avifauna, Nov 2022
	A11	Avifauna Monitoring Plan	The Biodiversity Company	A11 Avifauna Monitoring Plan, Nov 2022
B MARINE , COASTAL & ESTUARINE BIODIVERSITY & ECOSYSTEMS	B1	Baseline Underwater Noise Assessment	Subacoustech Environmental Ltd	B1 Baseline Underwater Noise, Jan 2023
	B2	Underwater Noise Assessment	Subacoustech Environmental Ltd	B2 Underwater Noise, Jan 2023
	B3	Underwater Heritage Compliance Letter	Contract Maritime Archaeologist	B3 Underwater Heritage, Oct 2022
	B4	Coastal, Estuarine and Marine Impact Assessment	Coastwise Consulting, GroundTruth and Anchor Environmental	B4 Coastal, Estuarine and Marine, Dec 2022
C ATMOSPHERIC CONDITIONS	C1	Atmospheric Impact Assessment	uMoya-NILU Consulting (Pty) Ltd	C1 AIR, Dec 2022
	C2.1	SA Terrestrial Noise Assessment	Safetech	C2.1 Terrestrial Noise, Oct 2022
	C2.2	Ghana Airborne Noise Assessment	Subacoustech Environmental Ltd	C.2.2 Ghana Noise, Oct 2022

RICHARDS BAY SPECIALIST STUDIES, ASSESSMENTS AND TECHNICAL INFORMATION				
REPORT			SPECIALIST	CITATION
	C3	Climate Change Impact Assessment	Promethium Carbon	C3 CCIA, Oct 2022
D SOCIAL CONDITIONS AND RISKS	D1	Socio-Economic Impact Assessment	Social Risk Research	D1 SEIA, Dec 2022
	D1.1	Small Scale Fishers Engagement	Afro Development Planning Pty Ltd	D1.1 SFF, Jan 2023
	D1.2	Tourism Impact Research	3T Business Fusion	D1.2 Tourism, Nov 2022
	D1.3	Traffic and Transportation Evaluation	Fulcrum Development Consultants	D1.3 TTE, Oct 2022
	D2	Landscape and Visual Input	Environmental Planning and Design	D2 VIA, Oct 2022
	D3	Major Hazard Risk Installation Assessment	Major Hazard Risk Consultants	D3 MHI, Jan 2023
	Independent Contributions to the Need and Desirability			
	8.1	Gas to Power Projects and the Just Energy Transition from Fossil Fuels in the South African Political Economy	Political Economy Southern Africa	
	8.2	South Africa Country Specific Energy Security Assessment	Prof Lwazi Ngubevana	
	8.3	The Economic Impacts of Rolling Blackouts in South Africa	Afro Development Planning Pty Ltd	
	8.4	Sustainability Assessment	Afro Development Planning Pty Ltd	

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

Table 1-3 outlines the requirements of the Environmental Impact Assessment Report as per the NEMA EIA Regulations, 2014 (as amended). According to Appendix 3 (1) “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…” 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 5 of the EIA Report.

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

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 Appendix 4
	(ii) The expertise of the EAP, including a curriculum vitae;	
(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 1 Appendix 2
	(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 4
(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 8
(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	(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 5 and Appendix 3 – Public Participation

Relevant section in GNR. 982	Requirement description	Relevant section in this report
accepted scoping report, including:	(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 5 and Appendix 3 – Public Participation
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 6
	(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 7.5
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 7.2
	(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 7.5
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 7.5 and Appendix 6 - EMPr
	(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	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 7 and Appendix 9 – Specialist Studies
	(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	

Relevant section in GNR. 982	Requirement description	Relevant section in this report
impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including		
(j) an assessment of each identified potentially significant impact and risk, including—	(i)cumulative impacts;	Section 7
	(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
(l) an environmental impact statement which contains	(i) a summary of the key findings of the environmental impact assessment	Sections 7 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 1
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 7 and 9
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes	Section 7.5

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	
(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 7.3
(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 affirmation by the EAP in relation to -	(i) The correctness of the information provided in the report;	Appendix 4
	(ii) The inclusion of comments and inputs from stakeholders and interested and affected parties; and	
	(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 7.4
	(ii) a motivation for the deviation	
(v)	any specific information that may be required by the competent authority; and	Appendix 5 - DFFE Correspondence

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(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.	The methodologies and relevant protocols applied to each specialist study are described in the specialist reports - Appendix 9 to this EIA. Appendix 7 – Transmission Line EMPr.

1.8 Report Structure

The EIA Report has been structured as follows –

- Executive Summary
- Chapter 1: Introduction
  - Provides an introduction and background to the proposed project and outlines the purpose of this document.
- Chapter 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.
- Chapter 3: Alternatives
- Chapter 4: Policy and Legislative Framework
  - Identifies all the legislation and guidelines that have been considered in the preparation of the EIR and project compliance.
- Chapter 5: Public Participation Process
  - Details the stakeholder engagement approach and summarises stakeholder comments that informed the impact assessment until date of release of the DEIR for public comments on 10 November 2022.
- Chapter 6: Description of the Environment
  - Provides a brief overview of the biophysical, 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.
- Chapter 7: Environmental Impact Assessment
  - Describes the specialist studies undertaken and assesses the potential impacts of the project utilising the impact assessment method.
- Chapter 8: Motivation, Need & Desirability

- Chapter 9: Concluding Statement and Recommendations
- Chapter 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

2.1.1 Overview

The Karpowership Project entails the generation of electricity by two Powerships moored in the Port of Richards Bay, fueled with natural gas supplied from a third ship, a Floating Storage & Regasification Unit (FSRU). The three ships will be moored in the port for the Project's contracted 20-year lifespan (as per the RMI4P requirements- Appendix 7.2). A Liquefied Natural Gas Carrier (LNGC) will deliver Liquified Natural Gas (LNG) and offload it to the FSRU approximately once every 20 to 30 days, dependent on power demand which is determined by the buyer, ESKOM. The FSRU stores the LNG onboard and turns the liquid form into gaseous form (Natural Gas) upon demand from the Powership (Regasification). Natural gas will be transferred from the FSRU to the Powerships via a subsea gas pipeline. The Project's design capacity is 540MW and the contracted capacity will be 450MW of electricity to be supplied to the national grid, which will be measured at the Point of Utility Connection and cannot be exceeded under the terms of the RMI4P. Electricity will be generated on the two Powerships by 27 reciprocating engines, each having a heat input in excess of 10MW (design capacity of 18.32MW each at full capacity). Heat generated by operation of the reciprocating engines is captured, and that energy is used to create steam to drive three steam turbines that each have a heat input of circa 15.45MW. The engines utilized on the Powerships are designed for maximum efficiency during stop / start scenarios, and can generate megawatts to the grid speedily from start-up and reach full load in less than 10 minutes. The engines are designed to start and stop – at the push of a button – time after time without efficiency loss.

The electricity that is generated is converted by the on-board High Voltage substation and the electricity evacuated via a 132kV transmission line over a distance of approximately 3.6km. The electricity will be evacuated from the Powership to the Impala substation, via a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds electricity into the national grid.

There are two alternative transmission line routes from the Powership to the proposed switching station – see Chapter 3 for the assessment of these alternatives.

Refer to table of figures below, showing project layout.

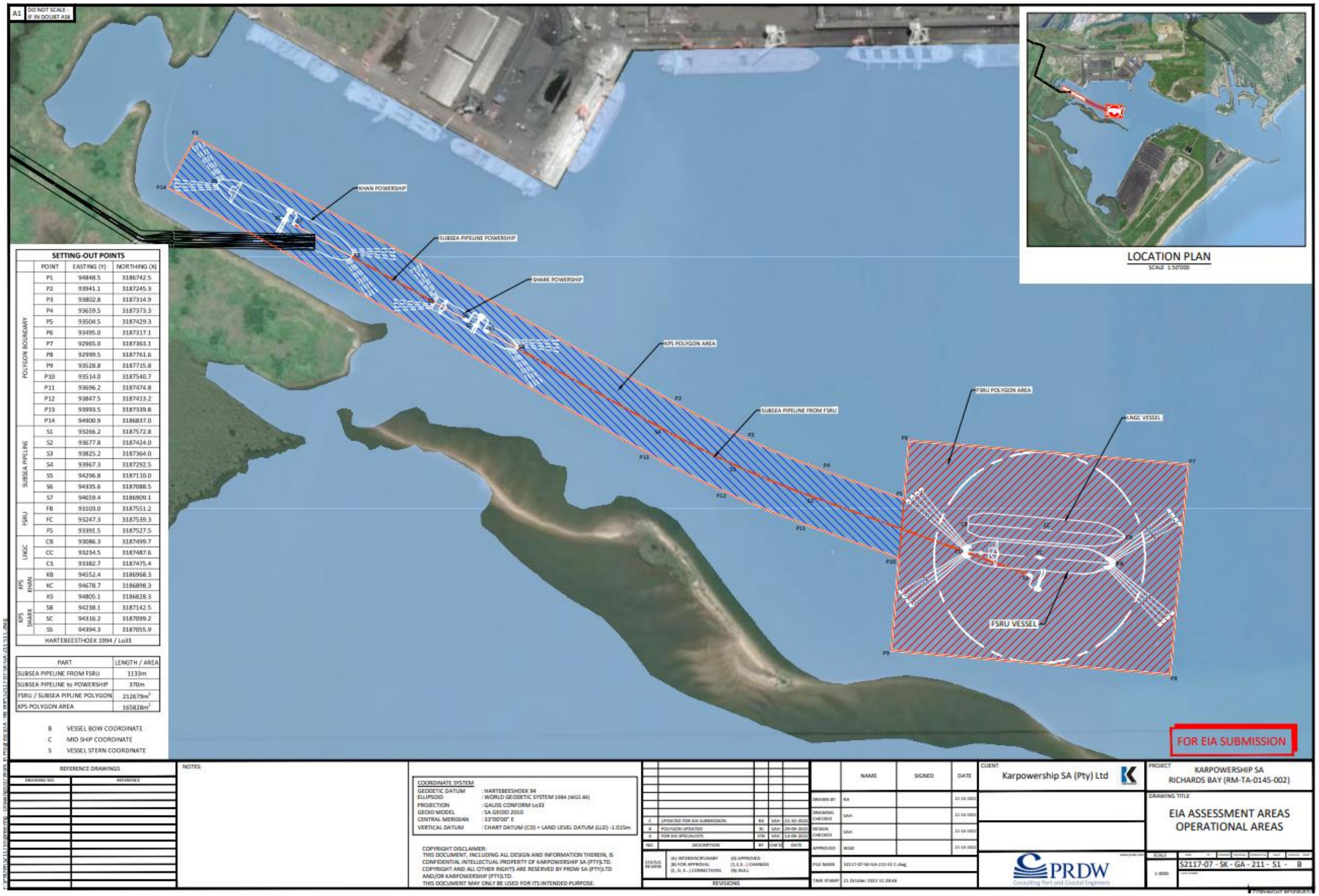
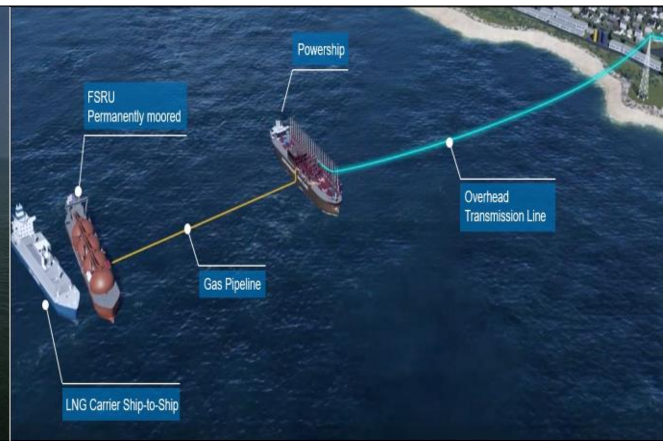


Figure 2-1: Overall Project Layout (Marine)

Figure 2-2: Overall Project Layout showing alternative corridors routes (Transmission line)

Table 2-1: Images of various Powerships

<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Image 1: Powership – Shark Class</td><td>Image 2: Powership – Khan Class</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Image 3: Floating Storage & Regasification Unit (FSRU)</td><td>Image 4: Project Concept</td></tr>
</table>

The sub-chapters which follow provide details related to the proposed activity, and its various components. Chapter 3, which follows, provides an assessment of the proposed activities, with a focus on alternatives.

2.1.2 Location

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. The Port of Richards Bay, located within Ward 2 of the uMhlathuze Local Municipality, is state-owned and managed by Transnet National Ports Authority (TNPA) in a landlord capacity. The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay (Figures 2-1). The transmission line route (2 alternatives) will be installed 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, within properties owned by TNPA, uMhlathuze Municipality and South32 Aluminium (Figure 2-2).

Please refer to Chapter 2.3 for further detail on the project location and Chapter 3 for details on the alternatives considered which include two alternative Powership positions, the gas line route associated with each Powership position, alternative transmission line routes, connections and switching station position.

2.1.3 Berthing, 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 and in acceptable positions to the port operator so as not to impact the safety of marine traffic and other port operations.

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 comprising catenary mooring chains and anchors, which are designed to secure the vessels taking into consideration all local conditions. The Khan Class and Shark Class Powerships will use piled anchors. Each Powership will have 16 mooring legs each consisting of a catenary mooring chain connected to an anchor pile with a padeye connector. The anchor piles will be installed using vibro piling to drive the casing to refusal and then the Reverse Circulation Drilling method (RCD) to drill the pile to depth. The FSRU will be anchored using 16 mooring legs each consisting of a catenary mooring chain connected to a Vertical Load Anchor (VLA) which is dragged by anchor handling tug down to its embedment depth. No marine structures are planned, and the mooring system for the vessels will be heavy chain lying on the seabed attached to anchor piles or vertical load anchors. The vertical load anchors are by design buried during the installation. The intention is to install the anchor piles such they are flush or below the surrounding seabed.

No dredging is envisaged for the mooring locations.

The Sandspit area in the Port has been identified as sensitive and a minimum 170m distance from the water line to the moored vessels is maintained, as shown in figures 2-3 and 2-4 below.

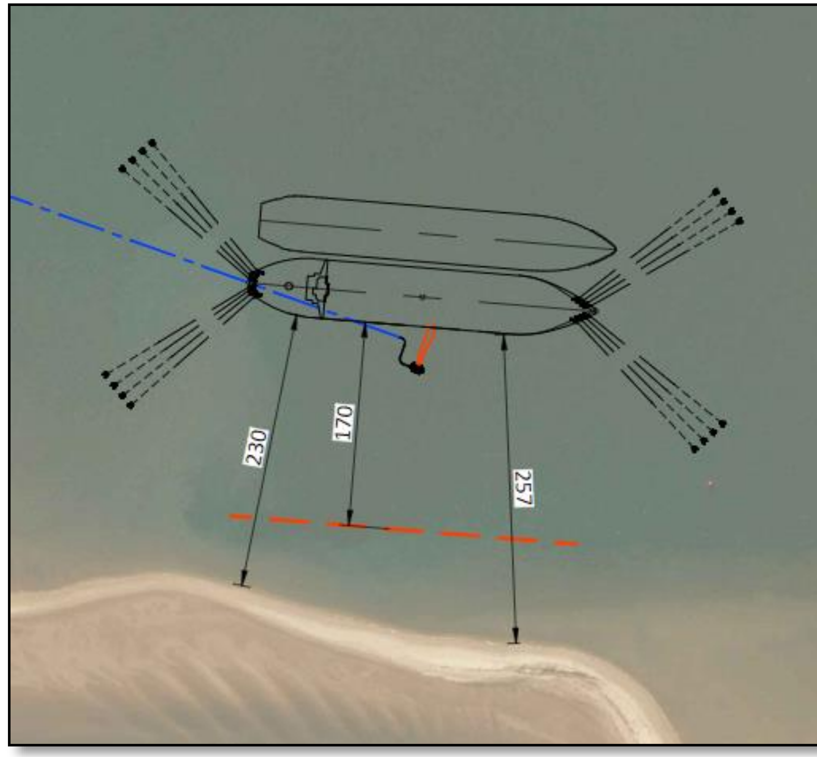


Figure 2-3: Powerships' distance from the sandspit /shore (in meters)

Figure 2-4: FSRU distance from the sandspit (in meters)

2.1.4 Gas Lines

A gas line is required between the FSRU and Powerships to ensure gas supply for power generation.

The FSRU discharges gas via 2no flexible risers to the FSRU pipeline end manifolds (PLEM) on the seabed next to the FSRU. The FSRU PLEM incorporates shutoff valves and pigging connections for maintenance. The gas is then transported from the FSRU PLEM to the Shark class Powership PLEM via a 24" steel pipeline with 50mm concrete weight coating, installed on the seabed. The Shark class Powership PLEM positioned adjacent to the Shark class Powership manifold, incorporates shutoff valves, expansion spools and 2no 12" flexible risers delivering gas to the Shark class Powership manifold flange. The gas supply then continues from the Shark class Powership PLEM to the Khan class Powership PLEM via a 24" steel pipeline with 50mm concrete weight coating, installed on the seabed. The Khan class Powership PLEM positioned adjacent to the Shark class Powership manifold, incorporates shutoff valves, pigging connection, an expansion spool and 2no 12" flexible risers delivering gas to the Khan class Powership manifold.

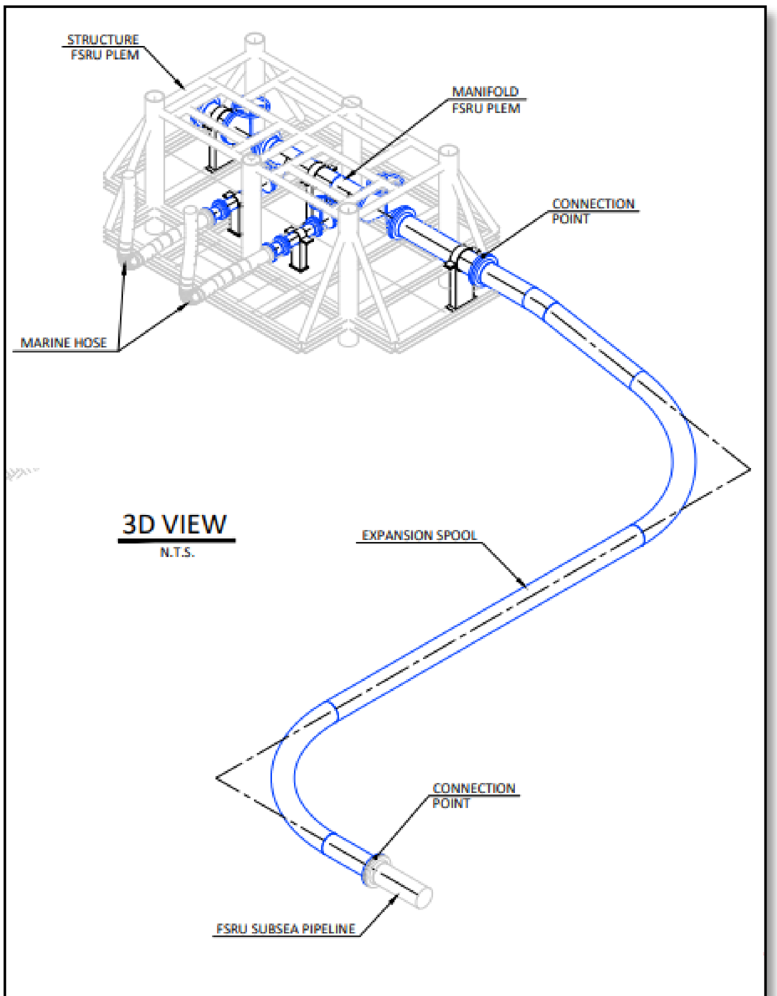


Figure 2-5 Typical PLEM and Tie-in Detail

For the gas pipeline, including the pipeline end manifolds (PLEM), there may need to be minor route rectification works along the subsea pipe route to limit the free span length of any section of the pipeline, over the undulating seabed. This will comprise flattening high spots or building up support under the pipe at low points. Due to the minor nature of this work, it will likely be undertaken by divers as the pipeline is installed.

The subsea gas pipeline connecting the FSRU to the Powerships will be installed on the seabed

It is anticipated that the subsea pipeline will have a servitude of approximately 50m either side of the pipe centre line.

The recommended routes identified by the EIA process will be included in the commercial agreement to be entered into with Transnet National Port Authority (TNPA). Please refer to Appendix 10. for further details on this technical aspect.

2.1.5 Transmission line

The proposed transmission line will be constructed of either monopole or lattice steel construction based on the final engineering design requirements, the topography and geotechnical survey results. The available space will further influence the specific tower designs. The span lengths between towers will vary. Average spans lengths will be approximately 200m however based on the ground profile shorter spans of less than 100m or larger spans of greater than 300m can be constructed.

There are two potential routes being considered for connection from the Powership to the National Grid, both with the same start and end point:

Alternative 1 - 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 offers a shorter route to the end point (Approx. 3.6km, estimated 16 towers) and is in accordance with the proposed 2015 Transnet Evacuation Route

Access for construction and maintenance of the transmission line 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, as well as from the start point to the Harbour arterial road.

Alternative 2 - 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.

For both alternatives, each tower will cover a maximum footprint of 2.75m by 2.75m for monopoles which will necessitate the clearing of vegetation to allow for these structures to be erected.

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

2.1.6 Switching Station

The electricity generated on the ship is required to be integrated into the Eskom National grid via a switching station. The location of the switching station is on shore. The switching station is part of the Eskom self-build process and will be built by Karpowership and handed to Eskom for their ownership and operation. The switching station will facilitate the control of the incoming lines from the Powership and the outgoing lines to the existing Impala – Bayside network line.

The switching station will measure approximately 17 898m^2 in size and will comprise of an incoming circuit for the lines from the ship, a busbar system to distribute the electricity and an outgoing circuit for the electricity to Eskom. The switching station further comprises of landing gantries, breakers, isolators, current transformers, voltage transformers and a control room for the monitoring, measurement and control of the power.

2.1.7 Operational Processes and Associated Measures

Powerships are equipped with cutting-edge modular medium speed reciprocating engine technology for generation, enabling reliable supply of electricity with minimal impacts from load profile and number of starts and stops. For all practical purposes, Powerships can maintain the same high efficiency even at partial loads by operation of a subset of the engines at full load and also offer the shortest response times for load variations. This modular technology and built-in redundancy allows that, even if one or more engines are taken off-line for any reason, it is most likely that the Powerships can continue operating and meeting the full contracted capacity requirements. The Powerships themselves have an effective operating lifespan of more than 25 years, more than covering the 20-year PPA provided for under the RMI4P.

Powerships store onboard all key spare parts that may be required to keep the generation running, essentially eliminating the risk of down-time caused by sourcing of necessary parts during the lifespan of a project, either related to routine maintenance or unplanned maintenance that may be required.

Another benefit of Karpowership over land-based solutions is that, in the highly unlikely event that a Powership falls completely out of commission, or if the buyer's requirements change, vessels can be quickly replaced with another suitable Powership from Karpowership's fleet to minimise any disruption to the power delivery.

2.1.7.1 Water Usage

The Powership uses seawater and potable water for cooling the reciprocating engines, condensers and other auxiliaries.

Part of the cooling seawater intake is processed into potable water through a vaporization process for steam generation (on-board water treatment unit) and non-process water consumption. In this way, seawater is primarily used for steam generation, make up water and for domestic use. Water supply for domestic use (cleaning, crew hygiene, etc.) is produced using the on-board water treatment unit whereby seawater is treated via freshwater generators and sea water reverse osmosis systems. Potable water for drinking purposes will be sourced as bottled water from local service providers. The Powerships have onboard sewage treatment units and oily bilge separators to be utilized while sailing, but the vessel will be moored for the duration of the Project and during this term wastewater disposal will be contracted to a licenced local service provider.

The Powership operates a once through cooling system, which abstracts seawater directly for cooling and then discharges it into the sea with no chemicals or other additives used. The total intake/outlet flow rates at 100% load are 8.49 m^3/s. The temperature of the discharged seawater (ΔT) ranges from 10.0 to 15.0°C within the Powerships process water. A smaller footprint of ΔT is achieved when discharging at a depth 8 m below the water surface. The largest ΔT's are generally found at or near the surface, while the bottom is much less affected by the temperature change due to the buoyancy of the discharge. The thermal plume exceeds the 1°C ΔT guidance by 0.2°C. Nevertheless, the plume's absolute temperature did not exceed any of the biological thresholds assessed by the specialists. The conceptual process flow diagram (PFD) for the project's operational water balance is shown in Figure 2-6 below.

Water supply for domestic use is produced using the onboard water treatment unit. Drinking water for the crew will, where required, be provided by local suppliers. No bulk water supply will be necessary from the uMhlatuze Local Municipality or the King Cetshwayo District Municipality for operations. The Powership also has a sewage treatment unit and oily bilge separator to be utilized while sailing to the Port for installation. During the operational phase, the sewage will be taken off the vessels for treatment by a licensed service provider.

The following volume of water required daily is anticipated:

- 300 litres of drinking water will be required for onboard crew utilisation;
- 20 000 litres for potable water will be required for on-board utilisation;
- 15000 litres technical water for continuous Steam Turbine Generators (STG) operation (5000 litres per STG) (processed from sea water intake); and
- 25-30 litres of water per engine is required.

No chemicals whatsoever, including chlorine, are discharged with the cooling water. No biocides and no other additives are necessary to control biofouling in seawater pumping and temperature exchange systems.

Further details are captured in the Water Balance Report, attached as Appendix 9-A5.

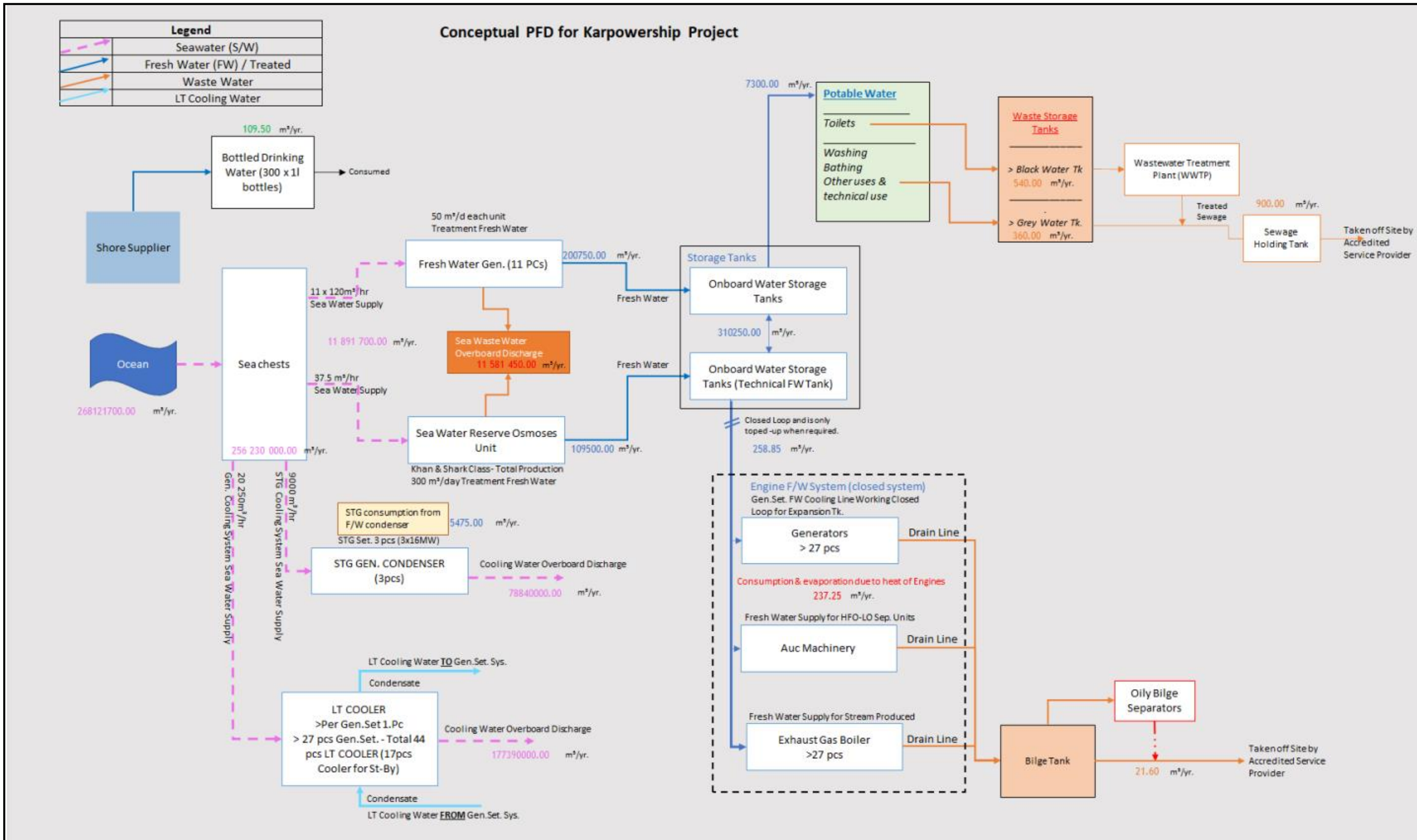


Figure 2-6: Conceptual Process Flow Diagram for the Project's Operational Water Balance

2.1.7.2 Water Temperature

As above, the Powerships will use seawater for cooling the gen-sets and optionally processed for the steam turbine generators and fresh water uses. The total intake/outlet flow rates at 100% load are 8.49 m^3/s. The temperature of the discharged seawater (ΔT) ranges from 10.0 to 15.0°C within the Powerships process water. A smaller footprint of ΔT is achieved when discharging at a depth 8m below the water surface. The largest ΔT's are generally found at or near the surface, while the bottom is much less affected by the temperature change due to the buoyancy of the discharge. The thermal plume exceeds the 1°C ΔT guideline by 0.2°C. Nevertheless, the plume's absolute temperature did not exceed any of the biological thresholds. 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.

A calibrated 3D hydrodynamic model was used to predict the extent of the thermal plume generated by the Powerships considered at Port of 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 sub-surface ambient water as it rises to the surface, reducing the temperature of the plume.

To reduce the risk of recirculation of the discharge back to the intakes, based on recommendations the discharge pipeline running down the vessel hull will have 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 Integrated Dispersion Modelling of Thermal Plume Report, attached as Appendix 10.2, and the Marine Ecology Report, attached as Appendix 9-B4.

2.1.7.3 Risk and Possible Explosions

Safety performance is focused on risk and on the safe operation of the vessels as well as the containment of the LNG within the containment systems, including the pipeline. It is important to note that Powerships and FSRUs are operated by global leaders in a highly safety conscious industry, and that international best practices are adhered to at all times with respect to design, operations, procedures and training.

The gas lines between the FSRU and the Powerships are equipped with gas detectors in circuit which will identify any leak, so that the fuel gas can be immediately isolated and shut off, allowing the leak cause to be identified and the necessary repairs or replacements made. However, should there be a minor leakage of LNG, it will disperse quickly and rapidly rise into the atmosphere.

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 Powership, 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 potential lightning situations, it is normal practice to cease STS (Ship-To-Ship) transfer operations if they are underway and make safe the transfer hoses through an inerting procedure and maintaining the cargo containment without oxygen.

Fire can be extinguished in the Powerships by means of various methods which include permanently installed systems in the Powerships 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 and portable firefighting equipment, personnel protection equipment is available and used throughout all areas of the 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 carried out rigorously.

2.1.7.4 *Safety and Security Measures*

Powership are equipped with advanced CCTV systems monitoring all areas, inside and out. To protect the Powership against unauthorized entry to the project site from land, the Powership site is surrounded by fencing and razor wire. A dedicated professional security team is responsible for monitoring and constantly patrolling the vessels to prevent any un-authorized entry or attacks. In addition, prior to deployment of the Powership to the 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 the 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 security advisors to have changed in the area over time.

In addition, a vessel can be moved relatively quickly with TNPA approval in the event that South Africa becomes exposed to terrorist activities and the risk becomes severe. Access to these facilities is also more easily controlled than land-based facilities, by natural virtue of their position in the ocean.

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. This MHI application can only be made upon completion of the EIA process, once the EA has been granted (refer to the Major Hazard Installation Risk Assessment, Appendix 9 – D3). The attached procedures (Appendix 11) are examples of internally developed procedures utilised at Karpowership operations. Karpowership SA will develop and implement procedures aligned with relevant standards, legislative and key stakeholder (e.g. TNPA) requirements. These procedures will be updated as required throughout the full project lifespan to ensure the procedures remain current and applicable.

2.1.7.5 *Occupation Health and Safety*

Oxygen Twenty one undertook a comprehensive legal compliance review for Karpowership SA to comply with all legal requirements and applicable international norms and best practices, that include the following but will not be limited to:

- Compensation for Occupational Injuries and Diseases Act 130 of 1993;

- Occupational Health and Safety Act 85, 1993 and all applicable regulations;
- Government Gazette notice No 1235 – Code of Practice Inshore Diving;
- Basic Conditions of Employment Act 75, 1997;
- Maritime Occupational Safety Regulations, 1994, R 1904;
- SAMSA Acts, Regulations and Codes

A comprehensive HSEQ management manual which underpins the HSEQ Policy of Karadeniz Holding and Group Companies Management, was developed. The HSEQ management system is aligned to international norms and standards such as ISO9001 and ISO 45001. The policy of Karadeniz Holding and Group Companies Management and existing procedures or amendments thereof will be implemented where required for Karpowership SA. These will include but not be limited to:

- Emergency Response Plan
- Fire Safety Plan
- Fire Alarm System
- Tanks Integrated Management Plan
- House Keeping and Leak Emergency on Board
- Technical Periodic Inspection Procedure
- Fugitive Emissions Management Plan

Please refer to Appendix 11 - Policy & Procedures.

2.1.7.6 *Lighting*

The project is proposed within the operational Port and there is therefore an existing level of light associated with the Port activities. Lighting is critical for the safe and secure operations of the Powerships as well as the Port operation at nights. The lighting aspects of the project was considered to ensure appropriate management in accordance with the Port's requirements where navigational vessels must display lights as directed by the Harbour Master. Minimum illumination levels, expressed in lux, that would ensure a safe working environment as per SANS 10389-1: Exterior lighting, Part 1: Artificial lighting of exterior areas for work and safety and the OHS Act of South Africa will be applicable to reduce risks and ensure that accidents are prevented. Excessively light levels and colour differences, where the distinction of colours are critical to ensure tasks are performed safely, must also be avoided in terms of environmental pollution and disruption of Port shipping and guidance activities.

Light pollution is the alteration of natural light levels in the night environment by artificial lighting where it may cause environmental harm or nuisance. Light pollution may arise from:

- Glare from excessive brightness of a light source;
- Over-illumination;
- Light clutter from excessive grouping of light sources;
- Light trespass from the unwanted direct lighting of an area;
- High energy, short wavelength UV/violet/blue light that is strongly detected by wildlife; and
- Areas requiring lighting must not be over lit and lighting trespass must be avoided.

Lighting will be provided during the construction phase at the respective working areas to provide a safe working environment. All effort will be made to limit the illumination to effective and safe levels and reduce the timeframe of exposures where possible.

The Powership and FSRU lighting will be carefully arranged to minimise lighting pollution and lighting effects on the natural environment. Light intensity and light trespass will be reduced by:

- Mounting lighting fixtures as low as possible;
- Dimming lights where possible and turning off lights when areas are not in use or lighting is not required;
- Where fixed lighting may not adequate for ship operations, portable or temporary lighting will be used to ensure safe operations and navigation on the ship.
- Directing light to the task by reducing the mounting height, repositioning lighting fixtures and adjusting the angle of lighting;
- Using shields on lighting fixtures to prevent light spill outside the footprint area.

High energy, short wavelength UV/violet/blue light which may be detected by nocturnal species will be minimised and avoided at the side of the Powership facing the sensitive natural receptors.

2.1.7.7 *Air Emissions & Filtration Systems*

Natural Gas (NG) will be the fuel used for the generation of electricity in the proposed Karpowership Project. The pollutants that are emitted using this type of fuel include oxides of nitrogen (NOx), low sulphur dioxide (SO_2) and low particulate matter (PM_{10}) but in small quantities and within the thresholds allowed by South African law. This is fully disclosed in the AEL and is closely monitored during the lifetime of the Project.

The Powerships' 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 the locations where high levels of organic or inorganic dusts exist, such as coal dust. 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.

2.1.7.8 *Storage of Hazardous Goods*

The LNG stored on the FSRU at any given time will not exceed 175 000m^3. The FSRU is made up of a series of pressurised and cooled containers to store the LNG. Storage of Natural Gas (i.e. gaseous form) on the Powership is of very small quantities and can be assumed as zero. The reason for this is because LNG is regassified on the FSRU and is then sent to the Powership as gas on demand from the generation engines and it is used in its entirety. Health and Safety protocols and requirements are ensured for the storage of hazardous goods such as small quantities of lubricating oil stored for equipment maintenance purposes.

2.1.7.9 *Fueling of the Powership*

The fuel is supplied to the Powerships by a separate vessel, a FSRU, which stores the LNG and converts it to a gaseous state for delivery to the Powership through a gas pipeline on demand based on the generation requirement. The FSRU has an overall length of approximately 300m with an approximate breadth of 50m and incorporates a series of pressurised containers and regassification equipment.

The FSRU is refuelled through vessels specially fitted for the purpose of carrying LNG – a Liquid Natural Gas Carrier or LNGC. Refuelling would be required approximately every 20 to 30 days, depending on the power generation demand from Eskom and output of the Powerships. This LNGC will temporarily moor alongside the FSRU over a 1 to 2 day period, while offloading the LNG cargo via STS transfer to the FSRU. The LNG delivered by the LNGC will be sourced from the global market through the Project's contracted fuel supplier, Shell SA, and therefore does not form part of the Karpowership application.

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 process which takes one to two days including all mooring, connection work, safety checks, offloading, disconnection, and preparation for safe transit out of the port. The FSRU can hold enough LNG to allow the Project 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 on the FSRU in case of any short notice delays. This contingency is to avoid interrupting the supply of LNG to the Powership and thus, to ensure continuously reliable power generation.

The ship-to-ship transfer of LNG will be managed in accordance with STS operation, the applied standard is Ship-to-Ship Transfer Guide (Liquefied Gases) - 2nd edition (OCIMF/SIGTTO) via trained personnel to ensure compliance to this standard and with all quality, health and safety requirements.

The FSRU regasifies the required amount of LNG and sends this to the Powership in gaseous form Natural Gas (NG) continuously on demand through a connecting pipeline. The FSRU is specifically designed, constructed and equipped to supply the fuel gas required, at the designated pressure and flow rates for the power generator engines installed on the Powerships.

For daily operations, standard port limits will apply. For LNG STS (ship-to-ship) operation, an approximate 250-300m meters radius from the STS manifold will be defined as restricted zone and 500 meters radius as controlled traffic zone.

Natural gas boil-off of LNG (Boil Off Gas (BOG)) on board the FSRU is not flared or vented. The 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 as a last resort so as to avoid any discharge of natural gas to the atmosphere. All BOG management shall be performed in accordance with operating procedures in the approved FSRU Barge Operating Manual. The FSRU has a chromatograph and a metering system from which the data recorded will be provided in real time and formally reported to the Powership in accordance with established procedures.

Under normal operations it is anticipated that the demand for gas will be significantly in excess of the natural boil off resulting in LNG being re-gasified for export to the Powerships for supply to the engines. The engines in operation drive the corresponding 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 switching station and to the national grid.

For further detail on fuelling please refer to Appendix 11.

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost-effective generation of power, as opposed to coal or diesel-fired power generation. Compared to coal, natural gas emits between 45 and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants when used to generate electricity (Shell SA, Media Release, 2020).

Karpowership SA is partnering with Shell SA to supply LNG to the Projects. Shell is one of the global leaders in LNG supply. They are able to leverage economies of scale and their robust networks to secure LNG from the global market. There is a fuel supply management team in place and LNG procurement will be arranged based on COD date and demand during the Project terms. The gas will be sourced from Shell SA with relevant licenses and permissions for the supplier's full supply/value chain. The applicant has also indicated that they have received assurances from the LNG supplier that the gas will not be sourced from fracking.

According to Shell SA, "*Natural gas is the cleanest-burning hydrocarbon, producing around half the carbon dioxide (CO_2) and just one tenth of the air pollutants of coal when burnt to generate electricity. LNG is a clear, colourless and non-toxic liquid which forms when natural gas is cooled to -162ºC (-260ºF). The cooling process shrinks the volume of the gas 600 times, making it easier and safer to store and ship. In its liquid state, LNG is not explosive and cannot burn.*

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).

2.1.7.10 *Global LNG Market*

The market for Liquefied 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.

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.

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.

2.1.7.11 *LNG Supply Sources*

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 and well prepared 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. Shell SA was selected after a competitive selection process as they offered the best value for this Project. Any well–established company would have to supply LNG from within their total global portfolio. Therefore, the LNG will not be sourced from a dedicated source(s) continuously, but rather from the best fit supply location taking the market and logistics, in particular, into account at any given time also allowing the switch to indigenous or regional gas supply if it becomes available and feasible at any time in the project term. This global supply portfolio also adds to supply security, because if any shipping route or supply location becomes inaccessible, it can be substituted logistically.

The RMI4P also specifies termination clauses within the international LNG supply agreements, which can be executed if a suitable local or regional gas supply becomes available at any time through the Project term.

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.

2.1.7.12 *Waste Generation and Management*

Due to daily activities, the Powership and FSRU will require regular maintenance and repairs which will produce waste. Approximately 75m^3 of sewage (black water) as well as grey water (washing and kitchen) will be generated monthly. All effluent and solid (general and hazardous) waste will be removed by authorised service providers in terms of legislation and TNPA and MARPOL requirements and will be treated and disposed of in authorised land-based treatment and disposal sites. Refer to Appendix 11.9.

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 ejected from the engines via exhaust gasses. In order to utilise this waste heat, Powerships use Exhaust Gas Boiler Equipment to convert waste heat to superheated steam which is redirected to the Steam Turbine Generators to generate electricity.

2.1.7.13 *Hull Cleaning*

Hull cleaning equipment to be used by Karpowership involves 'Brushcart' technology which is a diver-steered, hydraulically powered unit with twin / triple rotating discs that can be fitted with either brushes or blades, depending on the application. For niche areas, (fewer regular surfaces) shrouded hand tools and a containment box have been designed.

Each cleaning tool has a suction shroud that connects separately to the central, fully enclosed suction system through which debris is pumped to the surface support system for treatment. Extracted water and debris is then processed through a multi-staged, modular filtration and treatment system where the fouling debris and particles are removed, and then the filtrate passed through an automated UV disinfection unit. No chemical biofouling agents are used for the hull cleaning process, which will be done in accordance with TNPA approved operational procedures.

The anti-fouling strategy will include the Ultrasound System that works by emitting specific low powered pulsed ultrasonic frequencies from a digital control unit, via transducers that are in direct contact with the vessel's sea chest boxes, and various points of the seawater system. In the same way, the ultrasound will resonate within the wall of the sea chest arrangement parts, providing pollution free protection against fouling.

2.1.8 Construction of the Powerships and FSRU

The Powerships are assembled off-site and will be delivered fully equipped and functional to the Port of Richards Bay. Powerships, through their modular generation capability, allow for greater technical flexibility for load cycling and shedding. The Khan Class Powerships are approximately 289m in length with an approximate breadth of 45m and Shark Class Powerships are approximately 180m in length with an approximate breadth of 26m. The gas reciprocating engines for power generation allow a reliable supply of electricity with minimal impacts from load profile and number of start and stops. They are essentially ships which have been fitted with the necessary gas fuelled generation equipment, including reciprocating engines and steam turbines, as well as a high voltage substation and all necessary equipment to transmit electricity to the grid.

2.1.9 Construction of the Gas Pipeline

2.1.9.1 Site Access

The subsea pipeline is to be brought onto site in 18m lengths by road truck, concrete weight coated 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 and laydown area.

2.1.9.2 Pipeline Assembly

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 with sufficient space near the launch site has been selected in order to reduce new impacts. The estimated size for the stringing yard for the installation of the gas pipeline is 10 000m^2.

The proposed location of the stringing yard and launchway is proposed as 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. 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. This area will be fully rehabilitated after the completion of the installation of the pipeline.

Figure 2-7: Typical Stringing Yard

Figure 2-8 Typical Launchway across beach

2.1.9.3 Pipeline Installation

The pipeline is to be installed by pulling it from the shore fitted with floatation units, towing it into position using tugs or workboats and lowering it onto the seabed. The pipeline is lowered with minimal disturbance to the seabed and weighted with a 50 mm thick concrete weight coating to ensure the on-bottom stability of the pipeline during operation. 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.

Minor seabed preparation works are anticipated to receive the pipe and the PLEMs, with the intention to place both directly on the seabed. In cases where there may be a high point, some material might need to be moved to keep the PLEM level or the span lengths within limits.

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

The above methodology for the gas pipeline is captured in **Appendix 10.10 – Technical Information.** The methodology will also need to be approved by TNPA prior to construction start.

2.1.9.4 *Pipeline Maintenance*

The gas pipeline infrastructure is designed to require little to no maintenance during its design life. Furthermore, the maintenance of the gas pipeline will be managed by the Operation and Maintenance Contractor that will be appointed by the applicant. 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.

2.1.10 Socio-economic Commitments

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 RMI4P.

Karpowership has, as a key strategic element of its Economic Development programme, identified priority areas that they will specifically focus on in ensuring long-term sustainable impacts of the initiatives that they will support. The stated objective of the Karpowership Economic Development Plan for Richards Bay is “to contribute towards progressing social and economic transformation in the societies that we operate in, through the creation, and support of societal initiatives that flourish and grow in an inclusive and sustainable South African economy”. The four areas of commitment in terms of this Plan are:

- Socio-economic development;
- Enterprise development;
- Supplier development; and
- Skills development.

2.1.10.1 Socio-economic Development (SED) Programme

The estimated budget for SED is based on the commitment that was made at the Bid Stage of spending 1.28% of the Revenue generated during the 20-year operation period on Socio Economic Development. This equated to the following Rand values:

R586 533 198 - Projected for 20-year Power Purchase Agreement
R29 326 659 - Projected per annum
R2.44m - Approx. per month projections

Karpowership may allocate a maximum projected SED spend within the KwaZulu Natal Province of:

R146 633 299 - Projected for 20-year Power Purchase Agreement
R7 331 664 - Projected per annum
R611k - Approx. per month projections

This budget allocation will be triggered in instances where SED projects have been successfully implemented in the identified beneficiary communities. The extended provincial spend will be considered to prevent a migration from neighbouring communities into the beneficiary communities by people looking to access improved socio-economic circumstances, e.g., bursaries, educational programmes etc. Projects identified are:

- Primary and secondary school focus on building educator and learner capacity in STEM;
- Scholarships/Bursary Programme;
- Installation of Energy Efficient Systems;
- Environmental Sustainability;
- Support to Vulnerable Communities; and
- Sports and Recreation.

2.1.10.2 Enterprise Development Programme

Karpowership's Enterprise Development seeks to:

- Accelerate development of industry-aligned suppliers by ~~and~~ investing in these entities in order to achieve impact, compliance, financial and sustainability objectives;
- Successfully scaling and integrating SME's into commercial value chains, including that of Karpowership; and
- Financing for growth and expansion.
-

Karpowership will provide financial and non-financial support to Exempt Micro Enterprises (EMEs), these are entities with a turnover below R10 million, and/or Qualifying Small Enterprises (QSEs), businesses with a turnover above R10 million but below R50 million. Support will be focused on enterprises that have a minimum fifty-one percent (51%) shareholding by Black people, with emphasis on women and youth-owned businesses.

The overall projected budget allows for a preliminary Enterprise Development spend within the uMhlathuze Local Municipal area to be:

R234 613 278 - Projected for 20-year Power Purchase Agreement
R11 730 663 - Projected per annum

In addition, should the development needs require, Karpowership may allocate a maximum projected Enterprise Development spend within the KwaZulu Natal Province of:

R58 653 319 - Projected for 20-year Power Purchase Agreement
R2 932 665 - Projected per annum

The focus area of the Enterprise Development will include:

- Vendor Kiosks for SMME's;
- Agricultural Project;
- Youth Enterprise Development; and
- Enterprise Development short term funding.

2.1.10.3 Supplier development programme

The list of possible interventions is generic as Karpowership has not appointed any of its local suppliers. Once the suitable Supplier Development Beneficiaries have been identified, the intention is to assess the business to identify the tailor-made training requirements and to establish success measurement indicators accordingly.

The projected budget for Supplier Development initiatives within the uMhlathuze Local Municipal area is:

- Approximate Projected Budget for the Construction Phase is R650k, to be split over 12 months.
- Approximate Projected Budget is R1.1 million, projected as per annum, over the 20-year Power Purchase Agreement period (Operations Phase).

The following is a list of high-level generic training interventions which may be applied when implementing the Supplier Development Plan –

- Technical training;
- Financial Management;
- Leadership Development;
- Occupational Health and Safety Standards;
- Marketing & Branding;
- Business Development;
- Legal Compliance, i.e. Contract Management;
- Customer Service; and
- Tender Support, i.e. Proposal Writing.

2.1.10.4 Skills development programme

The aim of the Skills Development Programme will be to help address prevailing skills shortages and contribute to the development of skills in Local Communities surrounding the intended Operational Site, and to incentivise training and skills development for improved employability, which will lead to prospects for increased income earning potential. Karpowership has identified the following jobs, among others, Ship Chandler Services, services include but are not limited to food and drink provisions, repairs, spare parts, safety inspections and medical supplies i.e.: supplies to the Powership and FSRU operations; engineering services; maritime services, including ship-to-ship transfers; and supply of treatment systems, some of which will initially be fulfilled by foreign nationals however, it is anticipated that over a period South African citizens, with a specific focus on the local community, will be upskilled and trained to fulfil these positions/services.
The training initiatives will be aimed at providing preference to the development of Youth within the Local Communities, namely between the ages of 18 (eighteen) and 35 (thirty-five) years. A separate program, which will be implemented which will address the Recognition of Prior Learning (RPL) for persons over the age of 35 (thirty-five) years.

Projected budget for Skills Development initiatives within the uMhlathuze Local Municipal area is:

- Approximate Projected Budget is R32 585 178 over the 20-year Power Purchase Agreement period (Operations Phase)
- Approximate Projected Budget is R1 629 259, projected as per annum.

Projected budget for Skills Development initiatives within the KwaZulu Natal Province shall be:

- Approximate Projected Budget is R8 146 294 over the 20-year Power Purchase Agreement period (Operations Phase)
- Approximate Projected Budget is R407k, projected as per annum.

Karpowership recognises the importance Learnerships and Apprenticeships programmes. To this end, Karpowership Academy, an in-house training mechanism, will be established in South Africa, in addition to working closely with institutions of higher learning to assist with Skills Development initiatives. Training and skills development will take place continually to ensure that adequate maintenance and operational related labour force is available within the immediate community.

Please refer to Section 7.5.15 of this report for further details on the findings from the Socio-Economic Impact Assessment.

2.1.11 Timeframes

2.1.11.1 Contract Period

The Risk Mitigation Independent Power Producer Programme was technology agnostic and required tenderers to provide solutions that would ensure dispatchable energy to the buyer (Eskom). The 11 Preferred bidders were declared Strategic Integrated Projects (SIP) in terms of the Infrastructure Development Act 23 of 2014 by the Presidential Infrastructure Coordinating Commission Council on 24 July 2020 under SIP 20. As per the requirements of the Risk Mitigation IPP Procurement Programme, all projects would be required to sign a 20-year Power Purchase Agreement (PPA) with Eskom.

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. The RFP limits the project to a delivered capacity of 450MW at the Point of Utility Connection.

2.1.11.2 Operating Hours

The operating hours depend entirely on dispatch instructions from Eskom, which can only be given between the hours of 05:00 and 21:30 (16.5 hours) on any given day throughout the year (i.e. it is not permitted to be operational for the remaining 7.5 hours).

Within these 16.5 operating hours per day (maximum), dispatch instructions can be anywhere between 0MW to 450MW.

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

<u>NEMA</u>

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

Table 2-2: Applicable Listed Activities.

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 electricity 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. A switching station will be required to facilitate the supply of electricity into the national grid. The transmission line and switching station will be located within and adjacent to the Port of Richards Bay, and its capacity falls below the threshold of 275 kV. This infrastructure is within an urban area and an industrial complex, as confirmed by EDTEA.
Activity 12	*The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or*	Based on the proposed route of the transmission line, and the locations of the proposed towers, switching station and the temporary construction facilities, the development will take place within a watercourse (wetland) and within 32 metres of a watercourse. These structures and infrastructure will be located within and adjacent to the Port of Richards Bay, within an urban area.

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; — *excluding—* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;* *(ee) where such development occurs within existing roads, road reserves or railway line reserves; or* *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*	
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;*	Structures in the coastal public property exceeding 50 square meters include: Mooring system, gas pipeline, transmission line and the temporary construction facilities.

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(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.*	The development of these structures and infrastructure 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 and thus can be excluded from this activity. The transmission line and temporary construction facilities are deemed to increase the development footprint of the port and thus are not excluded from this activity.
Activity 17	*Development—* *(i) in the sea;* *(ii) in an estuary;* *(iii) within the littoral active zone;* *(iv) in front of a development setback; or* *(v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater;* *in respect of—* *(a) fixed or floating jetties and slipways;* *(b) tidal pools;* *(c) embankments;*	The Powerships and FSRU are not being constructed. However, the mooring system, the gas pipeline, the proposed towers for the transmission line, the switching station and the temporary construction facilities will cumulatively exceed a footprint of 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. This infrastructure and structures are deemed to increase the development footprint of the port and thus are not excluded from this activity.

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(d) rock revetments or stabilising structures including stabilising walls; or *(e) infrastructure or structures with a development footprint of 50 square metres or more —* *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;* *(bb) 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;* *(cc) the development of temporary infrastructure or structures 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* *(dd) where such development occurs within an urban area.*	
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, excluding where —* *(i) the planting of vegetation or placement of material relates to restoration and maintenance of indigenous coastal vegetation undertaken in accordance with a maintenance management plan; or* *(ii) such planting of vegetation or placing of material will occur behind a development setback.*	Sections of the transmission line near the shore will need to be stabilised to prevent erosion on the substrate where the transmission line is established. Furthermore, rehabilitation for the terrestrial footprint in the littoral zone 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

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
		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, 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—* (a) *will occur behind a development setback;* (b) *is for maintenance purposes undertaken in accordance with a maintenance management plan;* (c) *falls within the ambit of activity 21 in this Notice, in which case that activity applies;* (d) *occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* (e) *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.*	The proposed transmission line and the temporary construction facilities will take place within a watercourse (i.e. floodplain wetland and unchannelled valley bottom wetland) 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. These infrastructure and structures are deemed to increase the development footprint of the port and thus are not excluded from this activity.
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—* (f) *will occur behind a development setback;*	The Powership mooring system, the gas pipeline, the erection of the towers for the transmission line, and the temporary construction facilities 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. These structures and infrastructure are deemed to increase the development footprint of the port and thus are not excluded from this activity.

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(g) is for maintenance purposes undertaken in accordance with a maintenance management plan; *(h) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *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 proposed switching station and the temporary construction facilities will cumulatively require clearance of more than 1 hectare of indigenous vegetation. DFFE IQ desk has confirmed that the transmission line comprising of towers / pylons and 132kV lines is considered as a linear activity, and thus is excluded from this activity.

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. The Project's design capacity is 540MW and the contracted capacity will be 450MW of electricity to be supplied to the national grid. Electricity will be

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
		generated by 27 reciprocating engines, each having a heat input in excess of 10MW (design capacity of 18.32MW each at full capacity). Heat generated by operation of the reciprocating engines is captured, and that energy is used to create steam to drive three steam turbines that each have a heat input of circa 15.45MW.
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;* *(ii)* the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or *(iii)* where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.	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— (i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) 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 (iii) 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. The area is an industrial complex, as confirmed by EDTEA.
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 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*	The storage and handling of a dangerous goods at the Powerships and FSRU will have a combined

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	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;* *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*	capacity of more than 500 cubic meters- therefore this triggers both Listing Notice 2, activity 4 and this activity. The FSRU with a storage capacity not exceeding 175 000 cubic metres is located within the estuarine functional zone at Richards Bay.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	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* *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;*	This activity will be triggered by the transmission line and its servitude, the switching station and the temporary construction facilities which will cumulatively require clearance of more than 300 square meters of indigenous vegetation.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	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;* *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;*	The proposed transmission line and the temporary construction facilities will take place within a watercourse (i.e. floodplain wetland and unchannelled valley bottom wetland) and within 32 metres of a watercourse, within the littoral active zone and in an estuarine functional zone. These infrastructure and structures are deemed to increase the development footprint of the port and thus are not excluded from this activity.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	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 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*	

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	(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.*	

NEM:AQA
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 2-3 below indicate the applicable listed activities under NEM:AQA for the proposed project.

Table 2-3: 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).

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

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 DFFE, but a separate Branch within the Department.

The minimum emission standards prescribed for Activity 1.5 are presented in Table 2-4 below:

Table 2-4: Minimum Emission Standards in mg/Nm3 for Subcategory 1.5: Gas Reciprocating Engines.

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

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 2-5 below presents the location of the proposed activity.

Table 2-5: 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 2-6 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.

Table 2-6: Property Description & 21 Digit SG Code – As per the preferred transmission line route.

Properties	21 SG CODES	CENTRAL GPS-COORDINATE	
		Longitude	**Latitude**
Remainder of Lot 223 uMhlatuzi No.16230 Held by T10589/1994 Landowner: Transnet Limited ***Powerships, FSRU & gas pipeline***	N0GV00000001623000000	32°1'32.46"E	28°47'39.14"S
Portion 21 (of 8) of Erf 5333 Richards Bay Held by T6562/1992 Landowner: Transnet Limited ***Transmission line***	N0GV04210000533300021	32°1'27.60"E	28°47'36.35"S
Portion 45 of Erf 5333 Richards Bay Held by T33569/1996 Landowner: Transnet Limited ***Transmission line***	N0GV04210000533300045	32°1'10.78"E	28°47'22.84"S

Properties	21 SG CODES	CENTRAL GPS-COORDINATE	
		Longitude	Latitude
Remainder of Erf 5333 Richards Bay Held by T14568/1979 ***Transmission line and switching station***	N0GV04210000533300000	32°00’42.22”E	28°46’51.22”S
Remainder of Portion 8 of the Erf 5333 Richards Bay Held by T29471/984 ***Transmission line***	N0GV04210000533300008	32°1'27.60”E	28°47'36.35”S
Remainder of Erf 6363 Richards Bay Held by T29471/984 ***switching station***	N0GV042100000636300000	32°00'48.3”E	28°46'45.4”S

Figure 2-9 below present the Locality Map which illustrates the following:

- Baseline sensitivity map;
- Preferred Powership position and FSRU;
- Preferred gas pipeline route,
- Preferred transmission route corridor and alternative corridors;
- Site access via existing access roads network from the N2 will be used to access the Powerships site; and
- Stringing yard and site offices.

2.3.1 Locality Plan of Activity (Marine & Transmission)

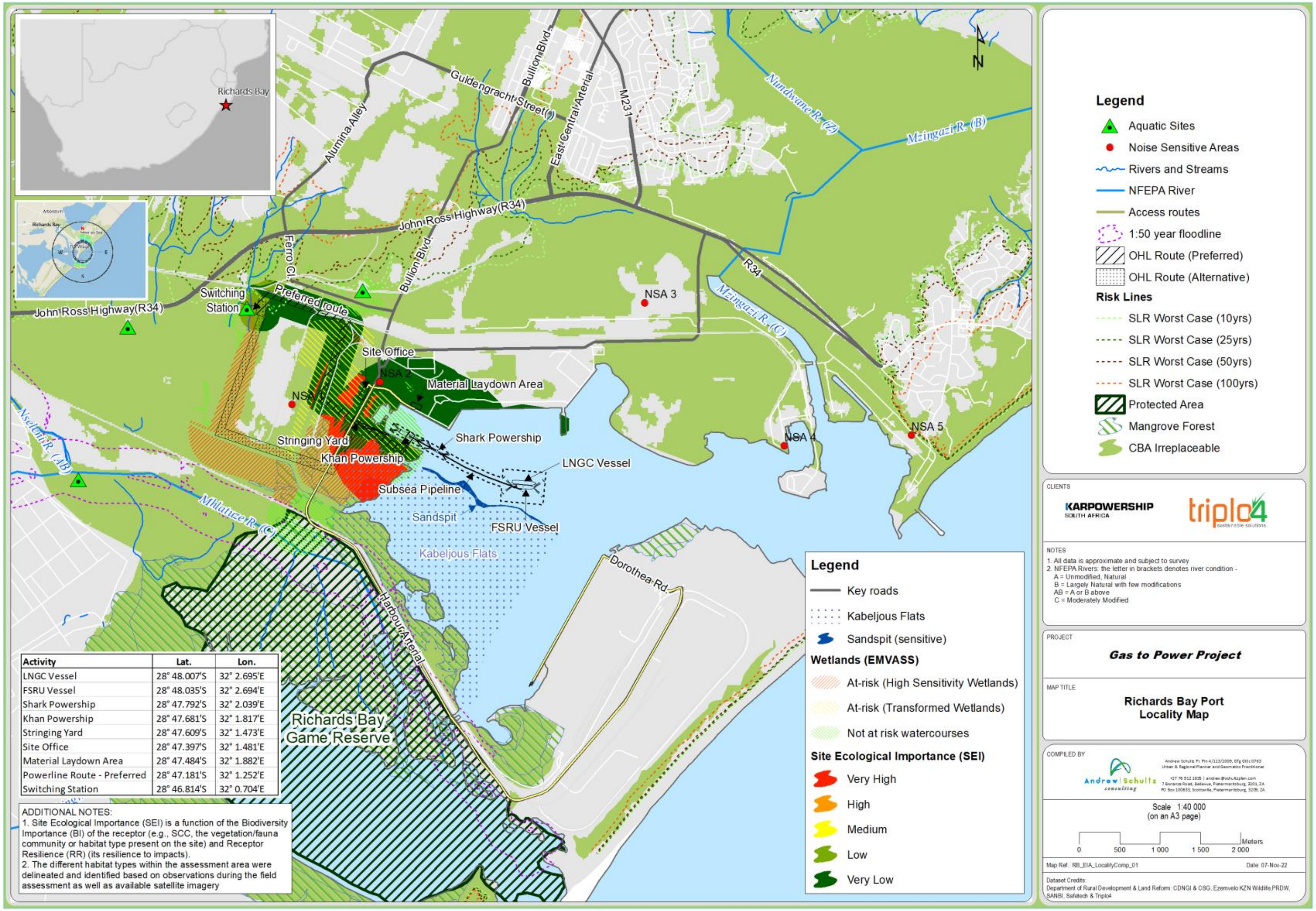


Figure 2-9: **Locality Map (Marine & Transmission) – Refer to Appendix 1.1**

2.3.2 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 construction facilities, during the construction phase. The position of the access road is indicated in Figure 2-10 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 temporary construction facilities, during the construction phase, apart from approx. 30m deviation from the existing road leading to the temporary construction site office, and approx. 7m access road that leads to the temporary stringing yard. The load out berth will be accessed via existing road (Figures 2-11 and 2-12). 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 5 between the port and the Manzamynama Canal (i.e. from the Harbour arterial road to Tower 6), as well as from the start point to the Harbour arterial road (towers 1 to 4) as described in Section 3.2.3.

Figure 2-10: Google map showing existing access roads system to the Port of Richards Bay.

Figure 2-11: Access roads to temporary construction facilities – existing roads (blue and green) and proposed road (yellow)

Figure 2-12: Existing access road to the proposed load-out berth

3 ALTERNATIVES

3.1 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 Port Site Selection

Two (2) Port sites were considered for the KwaZulu-Natal Province, which were the Port of Durban and the Port of Richards Bay.

Port site selection was based on criteria such as adequate space for ship(s) positioning, delivering of gas via LNG carrier, adequate navigational routes, turning circles, size and depth of Ports; Port planning, existing facilities and infrastructure, available grid capacity and evacuation capacity.

The Port of Durban was identified to have limitations in terms of congested traffic, economic consideration of the evacuation line and commercial constraints. On that basis, this site was deemed not feasible, and therefore was not further investigated.

The port of Richards Bay situated adjacent to the Richards Bay Industrial Development Zone (RBIDZ) – Special Economic Zones (SEZ), which is specifically designed to allow for related industries to be based in an Industrial Zone. In addition, this site is positioned within an area of the Port that is envisioned not to require dredging.

The Richards Bay Port meets the specifications for the proposed Powership project, and therefore was selected as the preferred location, and no other sites within this region are suited for the Project.

3.1.2 Current Port Site Selection

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.

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.

The current layout of the port (published in 2019) is shown in figure 3-1 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) is situated within area marked as "other", and out of the delineated open space.

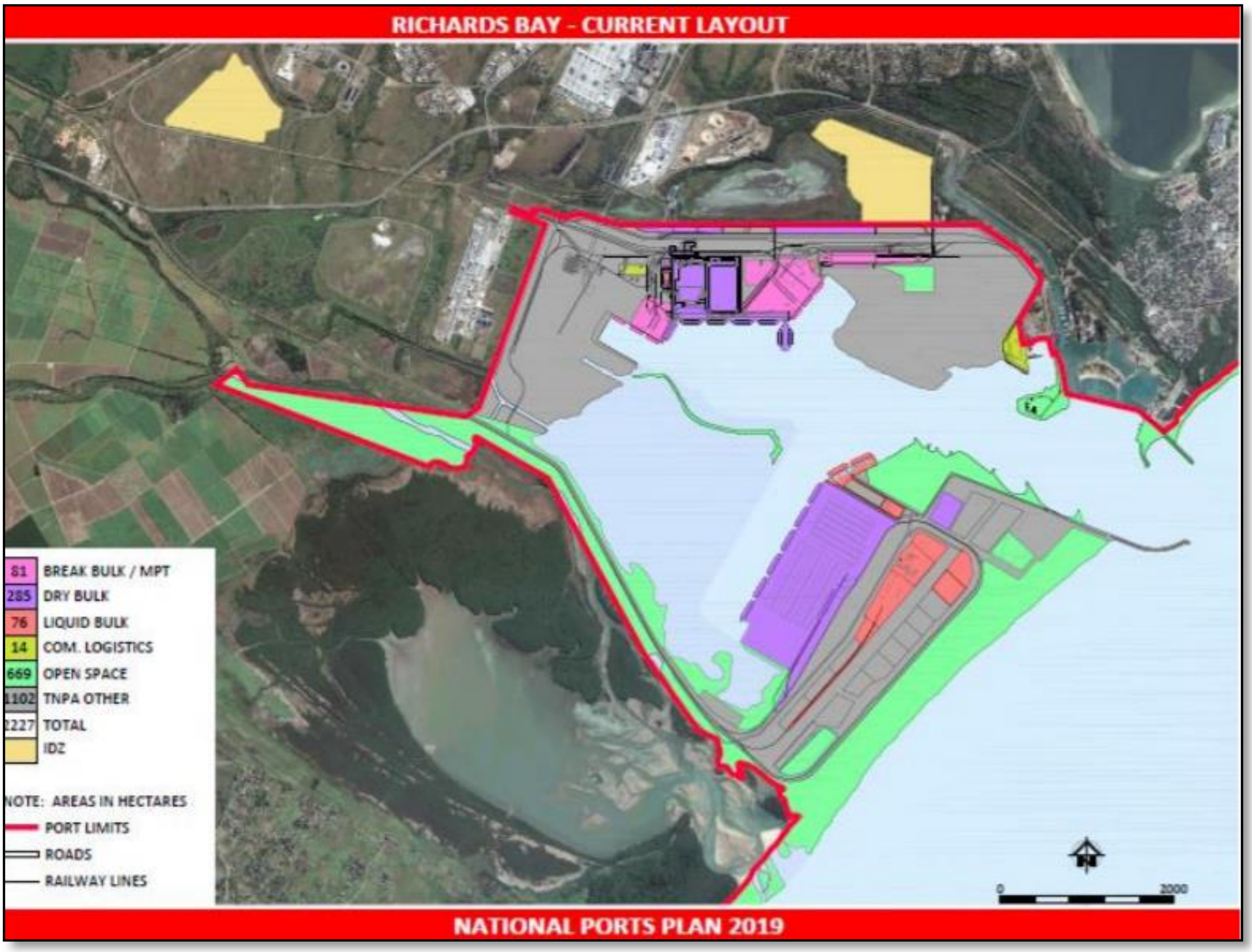


Figure 3-1: The 2019 layout for the Port of Richards Bay.

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. This is further discussed in Chapter 6 – Need and Desirability.

Based on the strategic development 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.

In terms of the site alternative, the selected site meets the technical requirements for the project, the project specifications, Port planning and operational requirements. The location also addresses the RMI4P timeframes that require quick implementation and evacuation of the generated electricity.

The selected site alternative is thus considered technically and operationally reasonable and feasible in terms of Section 24O of NEMA.

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

3.2 Layout Alternatives assessed in EIA

Table 3-1: Summary of Alternatives

Alternative	Description	Status	Key reasoning	Report Section
Layout Alternative Powerships	Alternative 1: The Powerships are positioned within the dead-end basin, and located closer to the first tower of the transmission line	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.1
	Alternative 2: The 2 Powerships are located closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and a higher tower.	Screened out	This is a feasible alternative, however considered less suitable from engineering and environmental perspectives.	Section 3.2.1
Layout Alternative Gas Pipeline	Alternative 1: Subsea pipeline preferred route, as it is in line with the preferred positions of the Powerships	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.2
	Alternative 2: Subsea pipeline relates to the second alternative of the Powerships' positions and not supported from engineering and environmental perspectives, as the vessels are closer to the sensitive sand bank and further away from the shore,	Screened out	This is a feasible alternative, however considered less suitable from engineering and environmental perspectives.	Section 3.2.2
Layout Alternative: Transmission Lines	Alternative 1: Shorter route and the majority of the route is located in areas of low to moderate ecological sensitivity	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.3
	Alternative 2: The route is located to a large extent of its length within wetlands, and it	Assessed in EIA	Considered as a fatal flaw and therefore not supported	Section 3.2.3

Alternative	Description	Status	Key reasoning	Report Section
	traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest.			
Design Alternative: Transmission Lines	Lattice	Screened out	This is a feasible alternative but not preferred. ▪ larger excavations for their foundation; ▪ larger clearing of vegetation; ▪ Less visually appealing; ▪ higher vertical risk area to flying birds.	Section 3.2.4
	Monopole	Assessed in EIA	This is a feasible and preferred alternative with support from relevant specialists.	Section 3.2.4
Technology Alternatives: Fuel	Natural Gas	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.5
	Hydrogen	Not assessed in EIA	This is not a current feasible option, however, it is not an excluded option over the 20 years timeframe of the project. When commercially viable for implementation on the utility scale of the Project, the relevant environmental processes will be completed.	Section 3.2.5

3.2.1 Layout Alternatives: Powerships and FSRU Positioning

The Powerships and FSRU are to be moored in the 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 comprising catenary mooring chains and anchors. The key criteria for the mooring site requiring consideration are the size of the turning circle for the LNG carrier as well as the approach channel being shared with the container terminal, i.e. traffic in basin from container vessels, cargo vessels and tugs. The Powerships need to be located outside the approach channel entrance and outside the turning circle so as to not to impede vessel traffic movement in the port. This will keep the safety exclusion zones required for the ship-to-ship transfer from the LNG to the FSRU. For daily operations, standard port limits will apply. For LNG STS (ship-to-ship) operation, an approximate 250-300m meters radius from the STS manifold will be defined as restricted zone and 500 meters radius as controlled traffic zone. These figures will be supported by an accredited association's report in this regard.

Figure 3-2: Powership mooring system.

The Powerships and FSRU are to be moored in the protected waters within the Port of Richards Bay. No marine structures are planned, and the mooring system for the vessels will be heavy chain lying on the seabed attached to anchor piles or vertical load anchors. The vertical load anchors are by design buried during the installation. The intention is to install the anchor piles such they are flush or below the surrounding seabed. No dredging is envisaged.

The Sand-spit area in the Port has been identified as sensitive and a minimum 170m distance from the water line to the moored vessels is 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 were identified and assessed:

- **Alternative 1** is the preferred position and is confirmed with TNPA. 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 mainland 'promontory' adjacent to the large mangrove stand, and positioned further away than alternative 2 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 engineering and environmental perspectives. The Powerships and the mooring systems are placed closer to the sensitive sand bank, which is not supported in terms of underwater noise and temperature, as well avifaunal impacts. In addition, in terms of the evacuation line, placing the Powerships further away from the shore will require a much longer overhead transmission line, which will require a much taller tower. The height of the tower can reach 95 meters, and as extremely heavy conductors are used, this might force to put an additional tower in the bay. Adding a tower or moving the tower closer to the edge of the bay area will have geotechnical conditions implications. Given the engineering implications, combined with the environmental sensitivities, this alternative is not supported.

The two alternatives are illustrated in figures 3-3, 3-4 and 3-5 below:

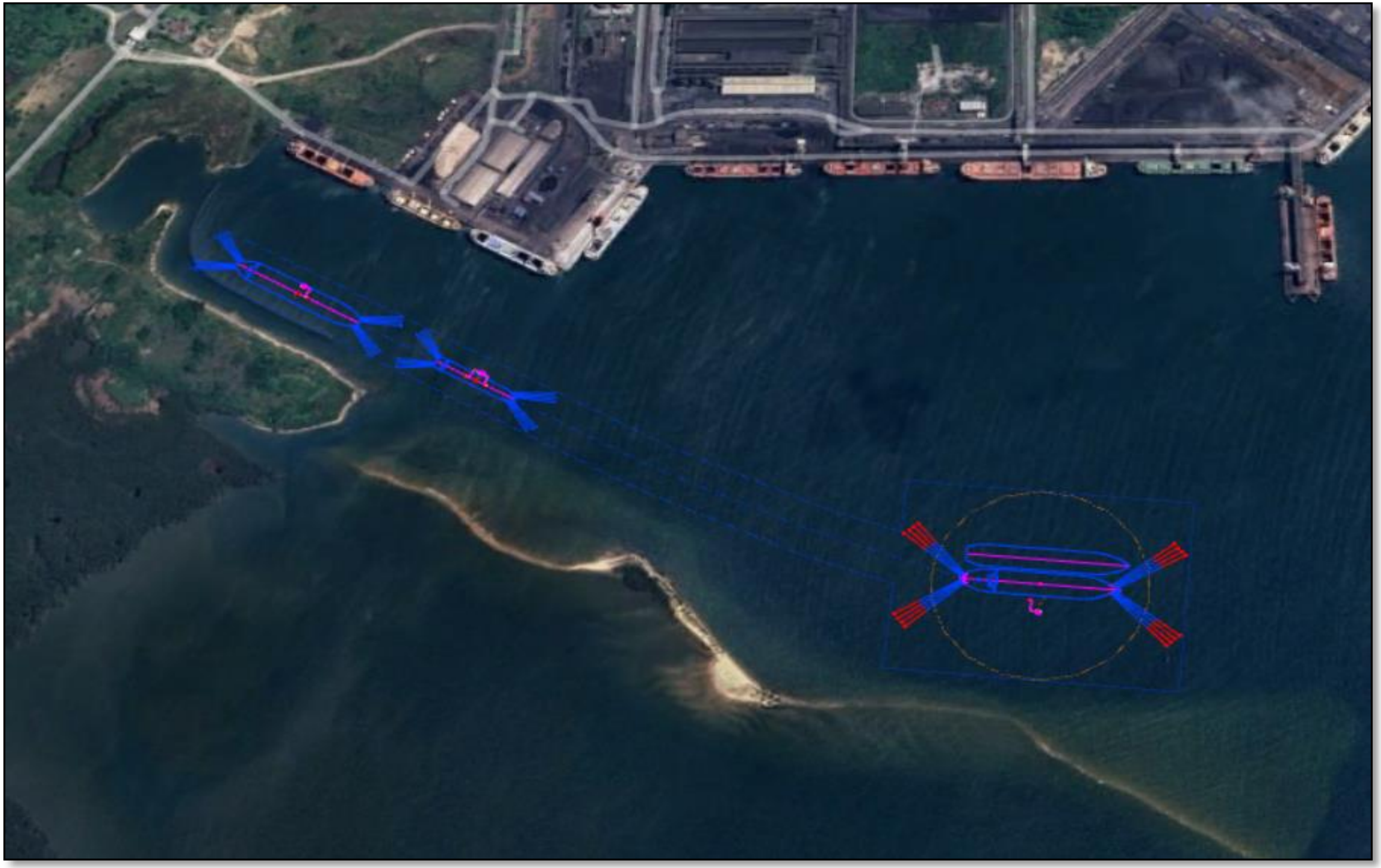


Figure 3-3: Alternative 1 – Preferred: Powerships and FSRU position within the port – closer to transmission tower.

Figure 3-4: Alternative 1 – Preferred: Powerships and FSRU position within the port – Polygon points (Appendix 1.5)

Figure 3-5: Alternative 2: Powerships and FSRU position within the port – further from transmission tower.

Table 3-2: Coordinates for layout alternative 1: Powerships, FSRU and LNGC positions (Figure 3-4)

Setting-Out Points		GPS (WGS84)(DEG)							
	Point	Lng(°E) Deg Dec	Deg	Min	Sec	Lat(°N) Deg Dec	Deg	Min	Sec
POLYGON BOUNDARY	P1	32,028537	32	1	42,73	-28,793257	-28	47	35,73
	P2	32,037788	32	2	16,04	-28,797860	-28	47	52,30
	P3	32,039198	32	2	21,11	-28,798498	-28	47	54,59
	P4	32,040662	32	2	26,38	-28,799035	-28	47	56,53
	P5	32,042244	32	2	32,08	-28,799551	-28	47	58,38
	P6	32,042350	32	2	32,46	-28,798540	-28	47	54,75
	P7	32,047776	32	2	51,99	-28,798993	-28	47	56,38
	P8	32,047389	32	2	50,60	-28,802586	-28	48	9,31
	P9	32,041972	32	2	31,10	-28,802134	-28	48	7,68
	P10	32,042138	32	2	31,70	-28,800556	-28	48	2,00
	P11	32,040278	32	2	25,00	-28,799948	-28	47	59,81
	P12	32,038733	32	2	19,44	-28,799381	-28	47	57,77
	P13	32,037244	32	2	14,08	-28,798708	-28	47	55,35
	P14	32,027992	32	1	40,77	-28,794106	-28	47	38,78
FSRU	FB	32,046346	32	2	46,85	-28,800680	-28	48	2,45
	FC	32,044870	32	2	41,53	-28,800563	-28	48	2,03
	FS	32,043393	32	2	36,22	-28,800446	-28	48	1,60
LNGC	CB	32,046522	32	2	47,48	-28,800217	-28	48	0,78
	CC	32,045005	32	2	42,02	-28,800097	-28	48	0,35
	CS	32,043488	32	2	36,56	-28,799976	-28	47	59,91
KPS KHAN	KB	32,031551	32	1	53,58	-28,795316	-28	47	43,14
	KC	32,030262	32	1	48,94	-28,794675	-28	47	40,83
	KS	32,028974	32	1	44,31	-28,794034	-28	47	38,52
KPS SHARK	SB	32,034755	32	2	5,12	-28,796911	-28	47	48,88
	SC	32,033959	32	2	2,25	-28,796514	-28	47	47,45
	SS	32,033163	32	1	59,39	-28,796118	-28	47	46,03

Table 3-3: Sizes of layout alternative 1: Powerships, FSRU and LNGC Polygon (Figure 3-4)

Component	Area
FSRU polygon	212 679m^2
Powership polygon area	165 828m^2

Table 3-4: Coordinates for the alternative 2: Powerships, FSRU and LNGC positions (Figure 3-5)

Component	Coordinates
Powership (Shark & Khan) Polygon The Powerships will be positionedwithin this polygon based on site specific conditions	Middle Point of the Polygon: 28°47'59.57"S 32° 2'19.07"E

3.2.2 Layout Alternatives: Gas Pipelines

A gas line is required between the FSRU and Powerships to ensure gas supply for power generation.

The gas is transported from the FSRU pipeline end manifolds (PLEM) to the Shark class powership PLEM via a 24" steel pipeline with 50mm concrete weight coating, installed on the seabed. The gas supply then continues from the Shark class powership PLEM to the Khan class powership PLEM via a 24" steel pipeline with 50mm concrete weight coating, installed on the seabed.

The subsea gas pipeline connecting the FSRU to the Powerships will be installed on the seabed

It is anticipated that the subsea pipeline will have a servitude of approximately 50m either side of the pipeline.

The recommended routes identified by the EIA process will be included in the commercial agreement to be entered into with Transnet National Port Authority (TNPA).

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. 1500 meters in length, and is preferred 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.
- **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, as well as environmental perspectives. Powerships and the mooring systems are placed closer to the sensitive sand bank, which is not supported in terms of underwater noise and temperature, as well as avifaunal impacts. In addition, in terms of the evacuation line, placing the Powerships further away from the shore will require a much longer overhead transmission line, which will require a much taller tower. The height of the tower can reach 95 meters, and as extremely heavy conductors are used, this might force to put an additional tower in the bay. Adding a tower or moving the tower closer to the edge of the bay area will have geotechnical conditions implications. As the position of the Powerships in Alternative 2 is not supported, consequently the associated gas pipeline is not supported from the engineering design perspective, and the environmental impacts, therefore making this alternative less feasible or preferred.

Figures 3-6 and 3-7 below present the alternative gas pipelines, based on the alternative for the position of the Powerships and FSRU.

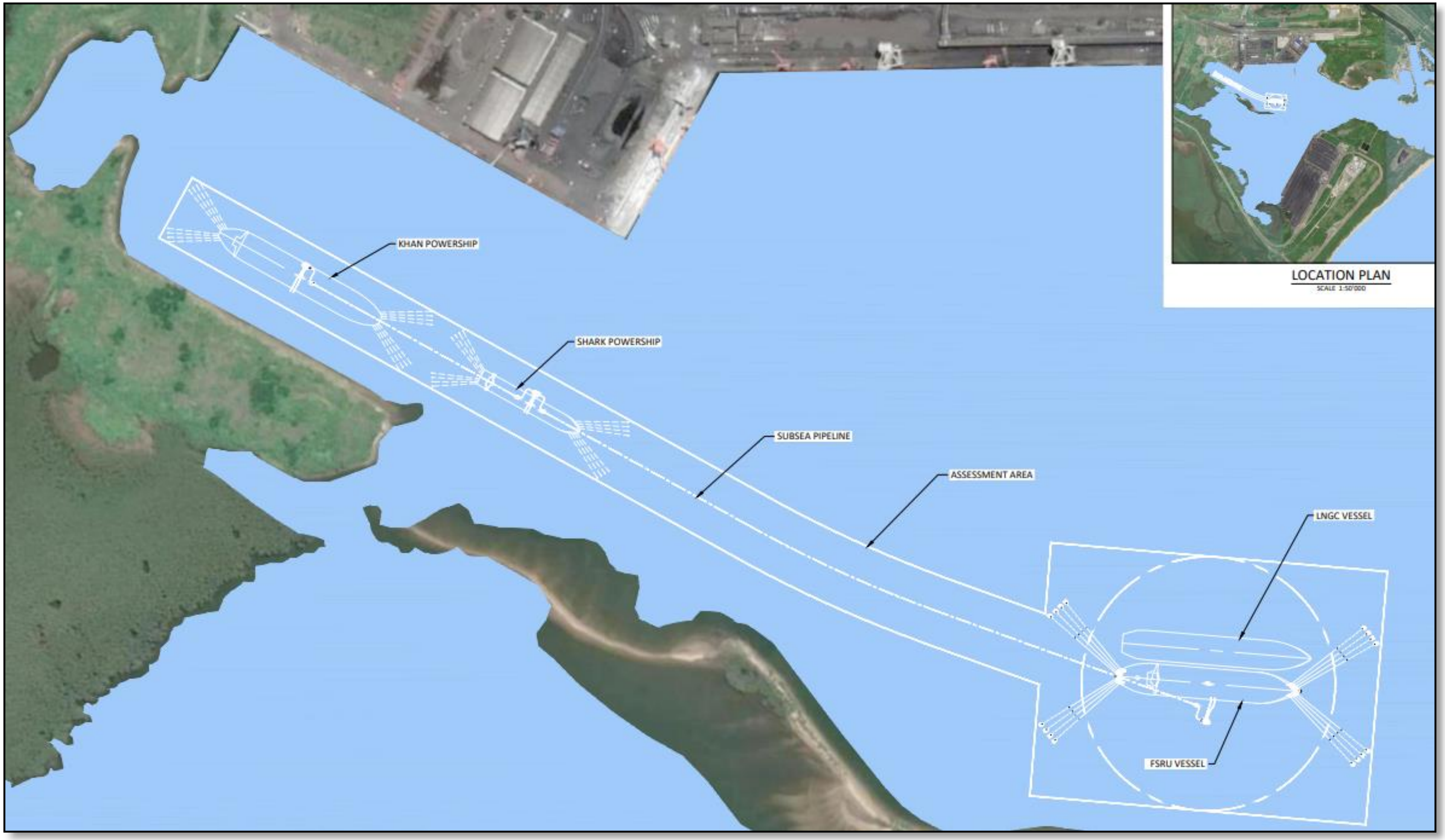


Figure 3-6: Alternative 1: Gas Pipeline route and approx. 50 meters servitude on either side

Figure 3-7: Alternative 2: Gas Pipeline route (Pink Line)

Table 3-5: Coordinates for the alternative 1 (preferred): Subsea Gas pipeline (Figure 3-6)

Setting-Out Points		GPS (WGS84)(DEG)							
	Point	Lng(°E) Deg Dec	Deg	Min	Sec	Lat(°N) Deg Dec	Deg	Min	Sec
SUBSEA PIPELINE	S1	32,044673	32	2	40,82	-28,800863	-28	48	3,11
	S2	32,040470	32	2	25,69	-28,799491	-28	47	58,17
	S3	32,038966	32	2	20,28	-28,798939	-28	47	56,18
	S4	32,037516	32	2	15,06	-28,798284	-28	47	53,82
	S5	32,034157	32	2	2,96	-28,796613	-28	47	47,81
	S6	32,033761	32	2	1,54	-28,796416	-28	47	47,10
	S7	32,030460	32	1	49,66	-28,794774	-28	47	41,19

It must be noted that these coordinates are indicative, to be placed within the polygon boundary's coordinates, as indicated in Table 3-2 above.

Table 3-6: Coordinates for the alternative 2: Subsea Gas pipeline (Figure 3-7)

Subsea Gas pipeline	GPS-COORDINATE	
	Longitude	Latitude
Gas pipeline Route Alternative 2 – Start point	32° 2'29.01"E	28°48'4.70"S
Gas pipeline Route Alternative 2 – End point	32° 2'17.26"E	28°47'59.62"S
Gas pipeline Route Alternative 2 – mid way point	32° 2'20.57"E	28°47'57.46"S

Table 3-7: Sizes of layout alternatives: Subsea Gas Pipeline

Component	Diameter	Length	Working servitude
Layout alternative 1			
Subsea pipeline from FSRU to Powership	24 inch, equivalent to approx. **60cm** (600mm)	1503m	50m on either side
Layout alternative 2			
Subsea pipeline from FSRU to Powership	24 inch, equivalent to approx. **60cm** (600mm)	500m	50m on either side

<u>Contractors Facilities:</u>

During the construction phase, contractor facilities are proposed to be temporarily used.

The estimated size for the temporary stringing yard for the installation of the gas pipeline is 10 000m², as indicated in Figure 3-8 below (also appended as Appendix 1.8). The selected site is adjacent to the existing harbour arterial and within sections of historically transformed areas due to previous disturbance. This area will be rehabilitated after the completion of the installation of the pipeline.

In addition, site office and concrete coating, as well as material laydown areas will be used, as indicated i in Figure 3-8 below (also appended as Appendix 1.8). Existing roads will be used as access roads, apart from approx. 30m deviation from the existing road leading to the site office, and approx. 7m access road that leads to the temporary stringing yard. The size of these facilities are indicated in Table 3.8 below. Lastly, a load out berth will be used, situated within existing footprint, and will be accessed via existing road (Figures 3-9 and 3-10).

Figure 3-8: Proposed locations for the temporary construction facilities

Figure 3-9: Construction facilities in relations to the preferred Powerships positions

Figure 3-10: Existing access road to the proposed load-out berth

Table 3-8: Coordinates and areas of the proposed construction facilities

Description	Central Coordinates		Area
Stringing Yard	32 01' 32.28" E	28 47' 37.81" S	10 000m²

Material laydown	32 01' 52.99" E	28 47' 29.11" S	8 000 m²
Site Office and concrete coating	32 01' 28.88" E	28 47' 23.73" S	11 000 m²

Refer to Appendix 1.8 - Construction Laydown Areas and Access Roads

3.2.3 Transmission Line Alternatives

The electricity from the Powerships 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.

Two transmission line routes were considered for connection from the Powership to the National Grid:

Alternative 1 - preferred - 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 (Figure 3-11 below).

The route is the preferred overhead transmission line from the Powerships to the proposed switching station, as it offers a shorter route to the end point (Approx. 3.6km, estimated 16 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 5).

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 5 between the port and the Manzamynama Canal (i.e. from the Harbour arterial road to Tower 6) as well as from the start point to the Harbour arterial road (towers 1 to 4).

Alternative 2 - the route begins at the same start point (connecting to the Powership). 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 (Figure 3-12 below).

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.

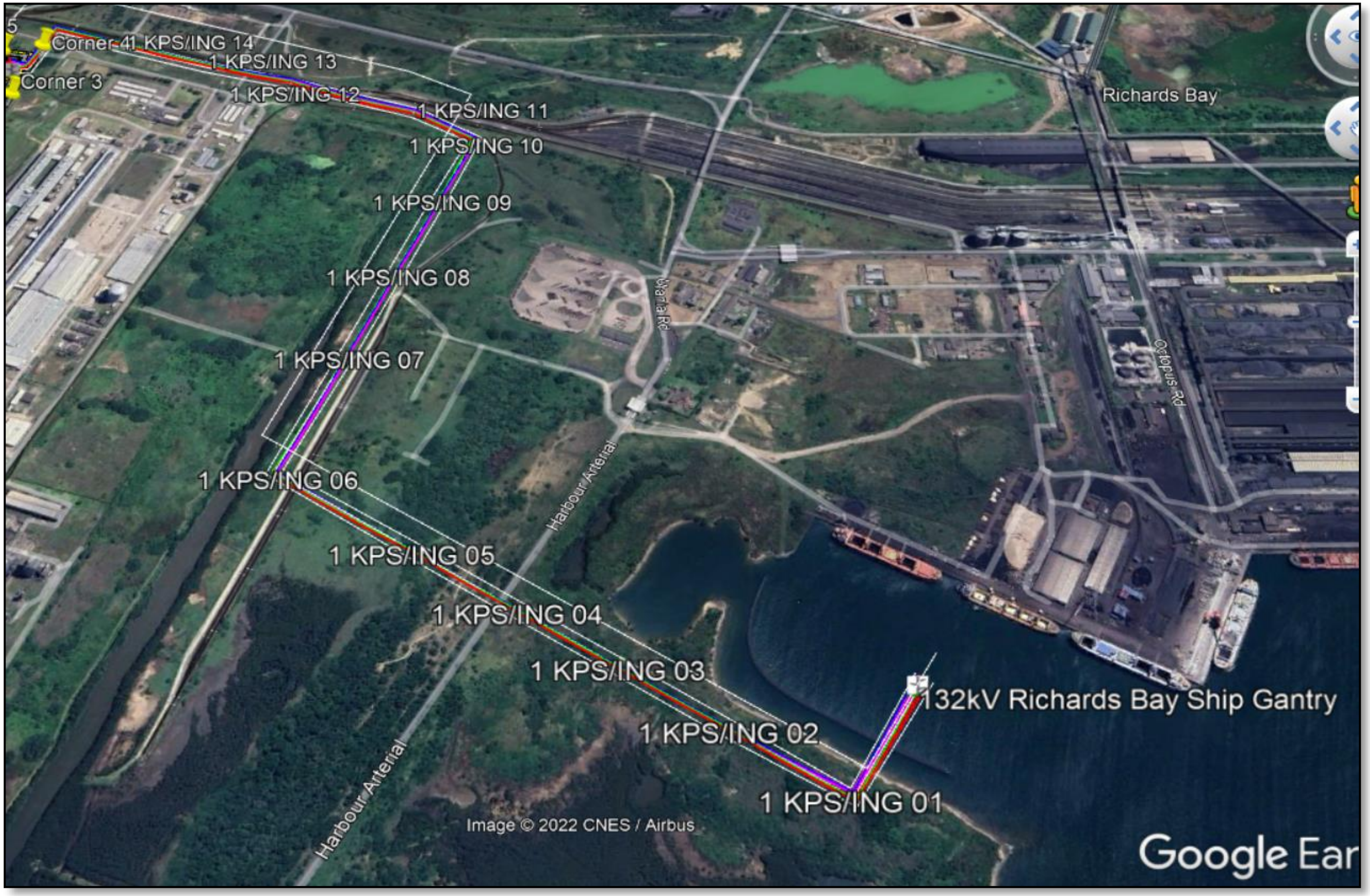


Figure 3-11: Transmission line route - Alternative 1 (preferred)

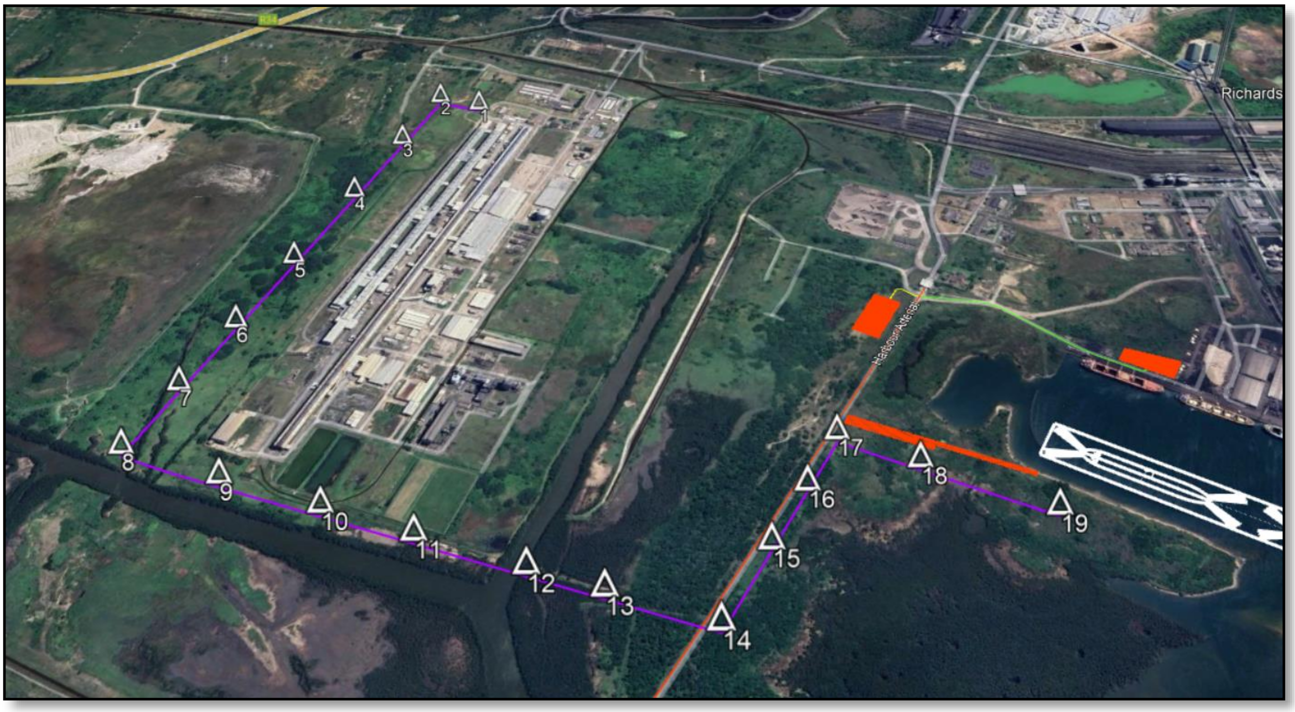


Figure 3-12: Transmission line route - Alternative 2 (not supported)

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 towers will include bird friendly measures as part of their designs.

The towers are to be positioned within the working servitude of 31m for the length of the route, within the transmission line corridor, as per Figure 3-13 below.

Figure 3-13: Showing transmission line corridor for the preferred alternative route

Table 3-9: Alternative 1 - Coordinates and areas of the proposed transmission line route

Alternative 1 (preferred)	GPS-COORDINATE				Area
	Left		Right		
	Longitude	Latitude	Longitude	Latitude	
Start	32° 1'52.32"E	28°47'40.71"S	32° 1'49.71"E	28°47'39.14"S	3600m with 31m working servitude = **111 600m²**
Bend 1	32° 1'46.34"E	28°47'48.46"S	32° 1'45.23"E	28°47'44.85"S	
Bend 2	32° 1'7.44"E	28°47'26.38"S	32° 1'11.10"E	28°47'24.78"S	
Bend 3	32° 1'19.44"E	28°46'55.55"S	32° 1'23.20"E	28°46'54.38"S	
Bend 4	32° 0'46.72"E	28°46'45.19"S	32° 0'44.99"E	28°46'42.04"S	
Bend 5	-	-	32° 0'41.05"E	28°46'45.65"S	
End	32° 0'43.48"E	28°46'52.68"S	32° 0'39.89"E	28°46'51.45"S	

Table 3-10: Alternative 2 - Coordinates and areas of the proposed transmission line route

Alternative 2	Longitude	Latitude	Area
Start point	32° 2’17.26”E	28°47’59.62”S	4000m with 31m working servitude = **124 000m²**
End point	32° 1’41.17”E	28°47’44.90”S	
Mid-way point	32° 0'38.92"E	28°47'44.07"S	
Bend 1	32° 1'23.59"E	28°47'37.78"S	
Bend 2	32° 1'13.48"E	28°47'54.36"S	
Bend 3	32° 0'23.24"E	28°47'39.11"S	
Bend 4	32° 0'42.61"E	28°46'52.51"S	

<u>Connections from the Powerships to the Transmission Line:</u>

Power will be transferred from the Shark Class Powership to the Khan Class Powership via an overhead connection to the towers which are already existing on the Powerships. The overhead line will span approximately 100m between the ships. The below image is schematic (not to scale), for illustrative purposes only (Figures 3-14). The start point on land of the transmission line is situated within an area that is transformed due to previous disturbance in the area, as per historic images (Figures 3-15 and 3-16 below).

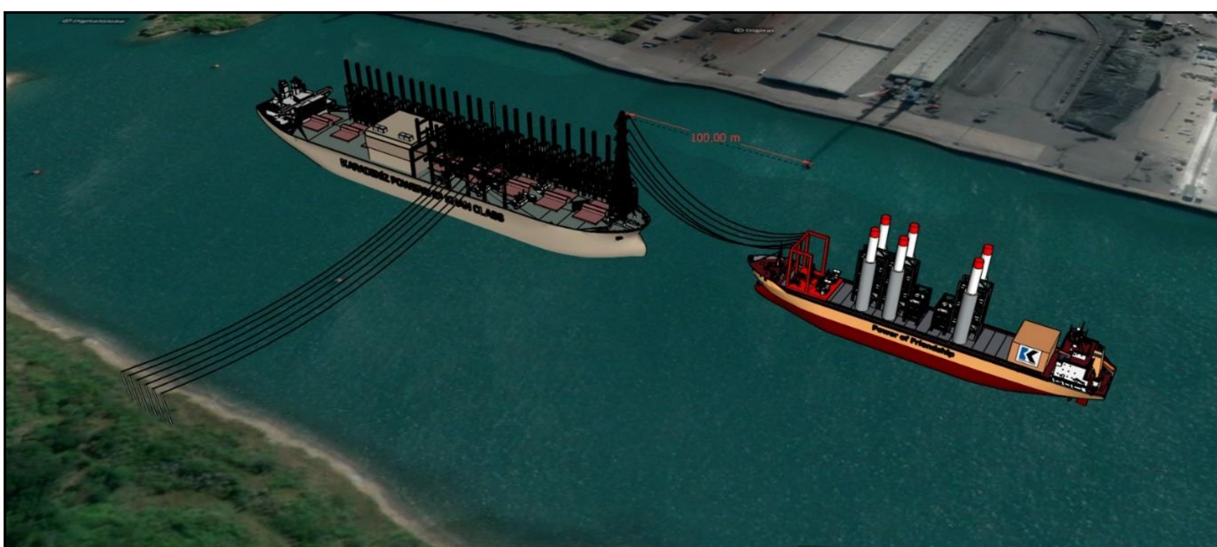


Figure 3-14: Illustration of the connection from the Powerships to the transmission line

Figure 3-15: Imagery from 2004 indicated that the area of the transmission lines has been disturbed

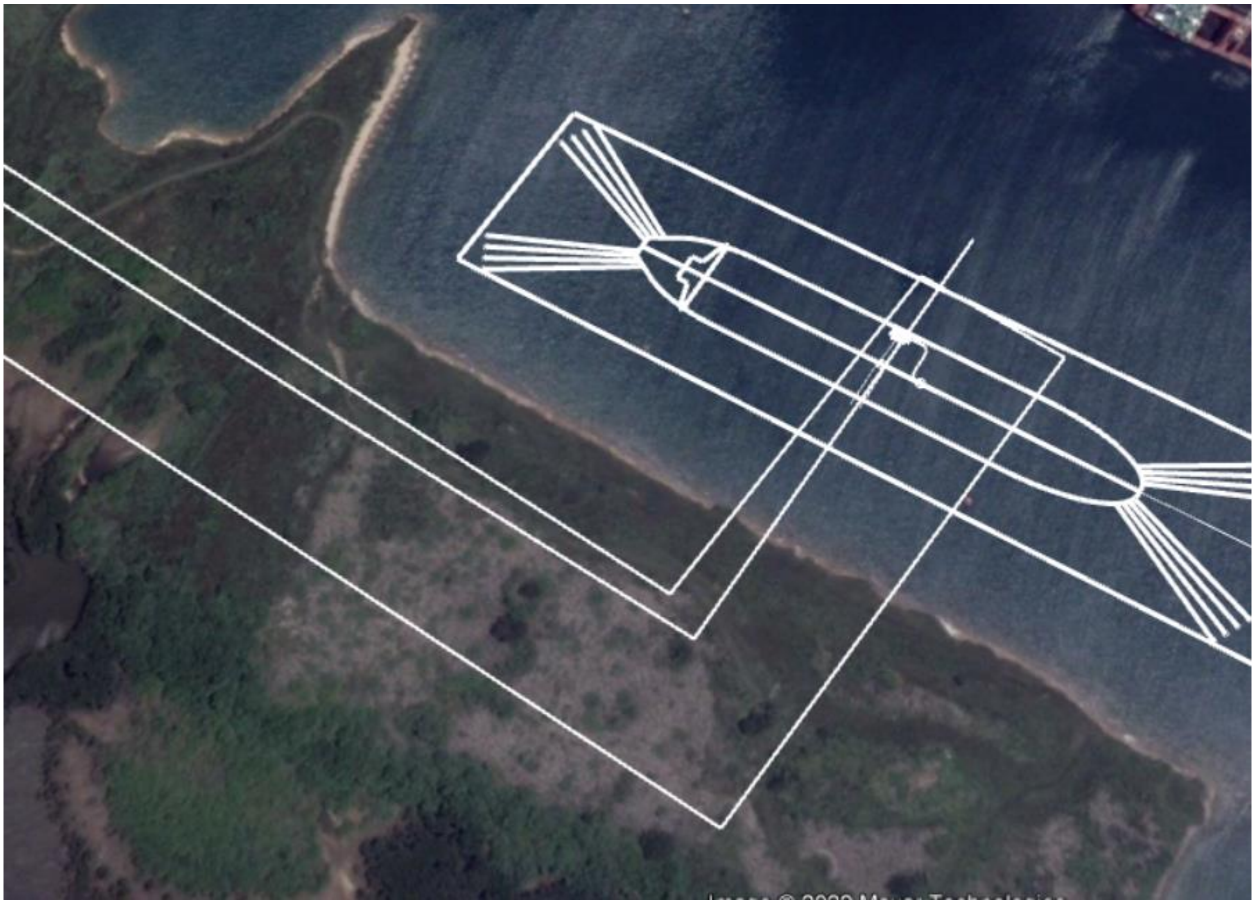


Figure 3-16: Imagery from 2011 indicated that the area of the transmission lines has been disturbed

Switching Station

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 3-17 below, and currently engagement with Eskom on the connection to the existing Impala – Bayside network line is underway.

The proposed switching station was designed to meet the operational requirements of Eskom. Network and security requirements were assessed and incorporated to the switching station layouts.

Figure 3-17: **Proposed connection to the Eskom line and placement of the switching station.**

Table 3-11: Coordinates and areas of the proposed Switching Station

Ingwenya Switching Station			
Corner	**Longitude**	**Latitude**	**Area**
1	32° 0'41.05"E	28°46'45.65"S	17 898 m²
2	32° 0'39.89"E	28°46'51.45"S	
3	32° 0'43.37"E	28°46'52.06"S	
4	32° 0'44.61"E	28°46'46.33"S	
Midpoint	32° 0'42.25"E	28°46'49.01"S	

3.2.4 Design Alternatives: Transmission Tower

The proposed transmission line can be constructed of either monopole or lattice steel construction, based on the final engineering design requirements, the topography and geotechnical survey results.

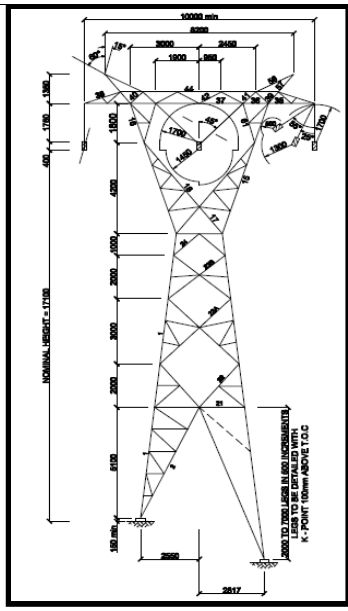
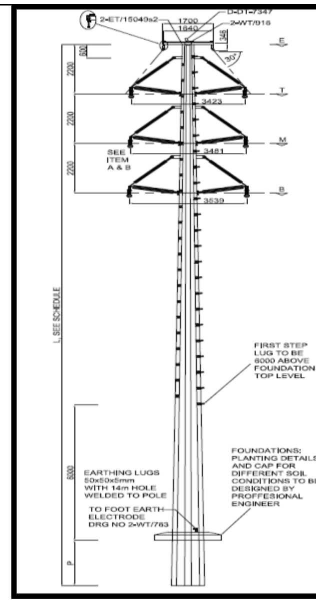
	

Figure 3-18: Typical 132kV single circuit lattice steel tower	**Figure 3-19: Typical 132kV Monopole Suspension**

3.2.4.1 Lattice

The construction of lattice tower designs are least preferred due to the following:

- As the extent of the lattices' footprint is much bigger than the monopoles, the monopoles are the preferred options.
- Larger clearance of vegetation required;
- Higher vertical risk area to flying birds; and
- Lattice towers are more costly and visually-intrusive than other tower types.

This alternative has been screened out and not assessed in the impact assessment.

3.2.4.2 Monopole

The construction of a monopole design is the **preferred alternative**, based on the following:

- The footprint occupied by a monopole, compared to a lattice structure of the same capacity, is far less.
- Reduced clearance of vegetation required;
- As the number of components used in monopoles are much less than those used in lattice tower structures, the installation time is much lower;
- Due to its built-in flexibility and lower aerodynamic coefficient, poles are subject to lesser wind load as compared to the conventional tower structures;
- Occupying lesser space makes monopoles look aesthetically smarter; and
- Since poles are more continuum-type structures, they offer more resistance to vandalism.

A disadvantage associated with the monopole relates to the requirement of heavy cranes for the deployment and installation of the monopoles.

3.2.5 Technology Alternatives: Fuel

3.2.5.1 Natural Gas (Preferred & Current)

The Powerships are designed to use Natural Gas, a cleaner burning fuel for the cost-effective generation of power, as opposed to coal-fired power stations which are 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 use of natural gas to generate electricity, which is what the Powerships technology is designed to do, is the preferred alternative for power generation.

3.2.5.2 Hydrogen (Future)

The Powerships to be deployed will generate electricity using Wärtsilä engines running exclusively on natural gas. Wärtsilä conducts extensive research on the use of different fuel sources within its engines, improving and optimising their technology to future-proof and deliver leading efficiency. Wärtsilä have made significant progress on the possibility of using hydrogen gas to power with their engine technology; whilst it is already technically possible to utilise a mix of hydrogen with natural gas, this technology is in its infancy and is undergoing rigorous research and development for pure hydrogen operations, and outcomes of that R&D are anticipated within the coming years.

In the medium to longer term, green hydrogen or other sources of hydrogen may potentially be more environmentally suitable from a climate change perspective, especially when combined with carbon capture during production, but suitable safety precautions, including accidental release measures, will need to be developed due to hydrogen’s hazard classification; hydrogen is an extremely flammable gas that also carries significant risk of explosion when heated. Karpowership’s partnership with Wärtsilä is beneficial as the engine driven power plants would practically ease the transition from natural gas to hydrogen (or a mix of natural gas and hydrogen) if and when the option becomes commercially viable for implementation on the utility scale of the Project, to avoid any possibility of stranded assets, as technologies change and fossil fuels continue on the path of phase out. This future alternative will be investigated via a separate environmental process to assess all aspects that could impact on the environmental as well as socio-economic aspects with due consideration of the known risks, at an appropriate time when the feasibility of hydrogen fuelled power generation has sufficiently matured.

3.2.6 No-go option

The option of not implementing the Project, i.e. the “no-go” option, was considered as an alternative. In respect of the Project, it would mean that the existing status quo would prevail. While the benefit of this option is that there will be no negative environmental or social impacts, there will also not be any positive environmental or socio-economic benefits.

This alternative entails that the proposed gas-to-power facility would not become part of the RMI4P to provide dispatchable power to the national grid in order curtail the disastrous effects of loadshedding resulting in the down-ward spiralling effect on the economy and general decline of individual well-being. The opportunity to utilise gas as a cleaner, greener fuel in the just transition from coal and more polluting energy sources will remain unexplored.

The no-go alternative provides the baseline against which the other alternatives are assessed, taking into consideration both the micro and macro aspects related to the purpose of the project.

The project is proposed within the active Port of Richards Bay, within an area that is planned for development, and out of the demarcated open space area. The port of Richards Bay situated adjacent to the Richards Bay Industrial Development Zone (RBIDZ) – Special Economic Zones (SEZ), which is specifically designed to allow for related industries to be based in an Industrial Zone. Further development and increased economic activity are keenly sought in the surrounding area. The zoning of the study area as Harbour relate to industry activities.

Portion of the transmission line runs along the exiting servitude and within degraded areas, and has already been determined to be a preferred alternative.

Further ecological research (arising from long-term monitoring of the Project) is provided for in the EMPr to improve the understanding of the dynamics the dynamics of the avifauna in the area, as well as to improve the management of the estuarine bay. In addition, the Project will contribute to the prevention of environmental degradation in rural and poor / disadvantaged communities which would, in the absence of a reliable electricity supply, have to revert to the destruction of flora for cooking and heating purposes. This would impact negatively on air quality.

Prolonged loadshedding will further exacerbate these impacts. Adequate electricity provision also reduces potential environmental pollution associated with, for instance, raw sewage pumpstation overflows, the inadequate treatment of sewage, and the generation of poor quality final effluent from sewage treatment works, which is discharged into freshwater systems and ultimately discharged into the ocean. Such discharges destroy both freshwater and marine ecosystems not only due their toxicity levels, but also due to high oxygen demand. Within the commercial and more affluent residential communities a more common method of dealing with loadshedding is by the operation of diesel generators. This too results in negative air quality impacts with accompanying increased sulphur dioxide, oxides of nitrogen and particulate matter levels as well as noise pollution. In contrast, the Project will result in insignificant sulphur dioxide and particulate matter levels which can be properly monitored and managed. It is only the very affluent households and businesses which can presently invest in solar power alternatives and therefore natural gas generated energy as a transitional and alternative fuel to coal and diesel, is preferred from an environmental perspective.

The following table presents the key Local and National considerations for the no-go option at the proposed Port of Richards Bay:

Table 3-12: Local and National considerations for the no-go option

Considerations For the No-Go:	Considerations Against the No-Go
• Medium to low impacts (after mitigations) to coastal and marine ecosystems will not occur. • Medium to very low impacts (after mitigations) to Avifauna will not occur. • Low risks from ship-to ship transfer of LNG and NG will be avoided.	• Port operations will continue to seek economic development and levels of impacts will occur irrespective of the presence or absence of the project due to the nature and intent of the Port. • Impacts to the environment will occur as a direct result of loadshedding and poverty

Considerations For the No-Go:	Considerations Against the No-Go
• Climate change impacts originating from the generation of gas to power as per the proposed project will not occur. • Medium-low impacts of the overhead transmission line between the ships and the proposed switching station will not occur. • High socio-economic impacts from influx of people looking for work opportunities may not occur.	resulting in the destruction of flora and uncontrolled release of fugitive emissions. • Climate change and air quality impacts due to reliance on coal based power generation as well as the use of wood, paraffin or coal based fires for cooking and heating and diesel-powered generators to sustain business and individual households and living will continue. • No additional dispatchable power will be generated and supplied to the National grid and loadshedding that could have been reduced will be present. • The significant economic losses (approximately R1 billion rand for 1 day of loadshedding) will not be reduced. • The opportunity through new technology gas to power electricity generation, that can pave the way to a just transition, aligned with South Africa needs as a developing country, will be lost. • No direct skilled and unskilled employment opportunities will be created during the construction and operation phase. • Opportunities for research to improve environmental understanding through dedicated and ongoing monitoring with continued and long term strategies to improve biodiversity will be lost. • Socio-economic and enterprise development initiatives with the generation of new business and social upliftment will not be realised. • Opportunity to rehabilitate and improve wetlands will not be realised.

While the no-go alternative will not result in any direct negative environmental impacts from the gas-to power project, it will also not result in any positive indirect environmental benefits or direct and indirect socio-economic benefits. The status quo cannot be assumed to be environmental and socio-economically neutral as the micro and macro environmental and economic conditions will continue to result in both positive and negative impacts to the environment, economy and society regardless of whether the proposed project is developed or not.

In addition, the status quo may be unsustainable, if not simply unjust, and in this instance may prevent already marginalised communities from accessing power as the constrained national grid may fail and result in even more intense loadshedding. Alternatives such as generators or household / rooftop solar systems may not be financially viable and women and children will have to revert to practices of burning biomass and cooking over open fires to provide food for the family. Similarly, a reversion to the use of candles or paraffin sources would be necessary in order to do homework and participate in further education.

The no-go option 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. It will also not contribute further to the local economy by provide employment opportunities. Hence the “no-go” alternative is not the preferred alternative.

The highly significant positive socio-economic impacts will not be realised in the case of the no-go option, thereby impeding the socially just transition for the poor, the unskilled workforce and marginalised individuals, as well as retarding Government’s target for a sustainable energy supply mix. Further, dispatchable power to the national grid to meet existing as well as increased electricity demand within the country will not be available to prevent the inevitable catastrophic economic decline associated with loadshedding resulting from the widening electricity deficit. Continued loadshedding will negatively impact on the wellbeing of the majority of the SA population, on the economy as a whole as well as on local and international investor sentiments.

Opportunities to stimulate the economy through employment, social development programmes, bursaries for education, other educational programmes, skills development programmes and procurement from local suppliers will be lost while the broader economic sectors such as industry, tourism, and entertainment will also remain growth constrained. Moreover, individuals and especially the disadvantaged and marginalised will have to face increasing risk to their livelihoods and job security.
When the minimal potential environmental and socio-economic risk, with mitigation, is compared against the potential environmental and socio-economic benefits, there is simply no contest - the social and economic benefits vastly outweigh the mitigated environmental and socio-economic impacts.

The no-go option is thus inconsistent with the principle of sustainable development. 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 9.7, which include compliance with the EMPr. Hence the “no-go” alternative is not recommended.

4 POLICY AND LEGISLATIVE FRAMEWORK

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.

The section below describes the policy and legislative context within which the proposed development is located, and how the proposed development complies with and responds to the legislation and policy context. In addition, specialists had considered and indicated relevant legislations, guidelines and policies in their respective studies.

4.1.1 National legislation

The Constitution of the Republic of South Africa, 1996 ("**Constitution**") 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 which states:

- everyone has the right to an environment that is not harmful to their health or well-being; and

- The environment must be protected for benefit and use 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.

The NEMA does not prohibit development from taking place- rather it provides that projects must be sustainable and the impacts thereof must be assessed and minimised.

As part of the Environmental Impact Assessment ("**EIA**") process, Regulation 3(1)(e) of the EIA Regulations, 2014 (as amended) ("**EIA Regulations**") requires 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.

The below is a description of the national, provincial and local (municipal) policy and legislative landscape that must be considered and provides a brief explanation of how the proposed Project will address the legislative requirements.

National Environmental Management Act 107 of 1998 and its associated subordinate legislation

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td rowspan="5">National Environmental Management Act 107 of 1998</td><td colspan="2">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.</td></tr>
<tr><td>Section 2</td><td>Defines sustainable development and other principles that apply throughout South Africa to the actions of all organs of State that may significantly affect the environment.</td></tr>
<tr><td>Chapter 5</td><td>Provides for integrated environmental management including the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.</td></tr>
<tr><td>Section 28</td><td>Contains the important “duty of care” which provides that the developer has a general duty to care to the environment to avoid environmental degradation and where such degradation cannot be avoided to minimise the impacts.</td></tr>
<tr><td>Section 30</td><td>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.</td></tr>
<tr><td colspan="3">Relevance to the Proposed Project, compliance and response:</td></tr>
<tr><td colspan="3">NEMA provides set requirements and thresholds which are created to give force to the principles detailed in Section 2.

NEMA prohibits a person from commencing a Listed Activity without an environmental authorisation. These Listed Activities are found in the EIA Regulations Listing Notices 1, 2 and 3 of 2014 (as amended) (“Listing Notices”). The Listing Notices 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.

The proposed Project triggers several activities listed in the Listing Notices. The procedural requirements for such an application and associated EIA are prescribed by the EIA Regulations, 2014 (as amended) (“EIA Regulations”) and are further informed by Guidelines published in terms of Section 24J of NEMA as well as applicable protocols and minimum information requirements.</td></tr>
</table>

Because the proposed Project triggers activities in Listing Notice 2, the application for an 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 DFFE.

Section 24J of NEMA prescribes that any Guidelines which are relevant, must be used to inform the environmental assessment of the proposed Project. The relevant Guidelines applied are:

- Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs ("**DEA**") [1] (2017), Pretoria, South Africa.
- This Guideline details and explains the minimum requirements for Public Participation ("**PP**") in an EIA process.

- Guideline on Need and Desirability, DEA (2017) Pretoria, South Africa
    - This Guideline explains how Need and Desirability for a proposed project are detailed in an EIA.

The applicable protocols and minimum information requirements which have been applied to this Project include:

- 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).
    - These prescribe protocols in respect of specific environmental themes for the assessment of, as well as the minimum report content requirements on, the environmental impacts for activities requiring environmental authorisation.

The EIA process for this proposed Project complies with the requirements of NEMA, the EIA Regulations, the Procedures, and takes into account the specified Guidelines.

The Environmental Management Programme ("**EMPr**") details all practical steps to be taken to both reduce environmental and social impacts, but also all steps to mitigate any foreseen impacts.

National Environmental Management: Waste Act 59 of 2008 ("NEMWA") and its associated subordinate legislation

Legislation	**Section**	**Relates to**
National Environmental Management: Waste Act 59 of 2008	Sections 16 – 18, 21 – 27, 35 - 41, 60	Provides for general waste management measures; the remediation of contaminated land and reporting.
	Sections 19, 20, 43 – 59	Listed waste management activities, consequences and requirements for waste management licensing
Relevance to the Proposed Project, compliance and response:		

[1] Note, references to "Department of Environmental Affairs ("DEA"), or the Department of Environment, Forestry and Fisheries ("DEFF") are the erstwhile names of the current Department of Fisheries, Forestry and Environment ("DFFE").

A number of regulations and standards regulating waste management have been published under NEMWA and updated to Government Gazette 46602 dated 24 June 2022 including: ▪ List of waste management activities that have, or are likely to have, a detrimental effect on the environment, 2013 (as amended) ▪ National Waste Management Strategy, 2020 ▪ 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 numerous 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 Project 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 ("NEMAQA") and its associated subordinate legislation

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 21, 22, 22A	Listing of activities in 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 (amended)
- Declaration of greenhouse gases as priority air pollutants, 2017
- National Pollution Prevention Plans Regulations, 2017 (amended) (including the
- Regulations prescribing the format of the Atmospheric Impact Report (2013) and;
- Regulations regarding the phasing-out and management of ozone-depleting substances (2014);
- Amendments to the Regulations regarding the Phasing-Out and Management of Ozone Depleting Substances (2021)

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. 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. Dust related mitigation measures for the construction phase was addressed in the EMPr. Green House Gases ("**GHG**") emissions have also been assessed.

Carbon Tax Act 15 of 2019 and its associated subordinate legislation

Legislation	Section	Relates to
Carbon Tax Act 15 of 2019	Provides for the implementation of a taxation system for emitters of GHG's	
	Sections 2 - 6	Determining of tax, tax base and calculation thereof
	Section 18	Reporting
Relevance to the Proposed Project, Compliance and Response:		
As the proposed project will release GHG's and will require an Atmospheric Emission License, the proposed project will be subject to the Carbon Tax Act and its relevant Regulations.		

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.		

Marine Living Resources Amendment Act 5 of 2014

Legislation	Section	Relates to
Marine Living Resources Amendment Act 5 of 2014	Amends the Marine Living Resources Act (1998), so as to insert, amend or delete certain definitions; to amplify the objectives and principles provided for	

	in the MLRA (1998); to make provision for measures relating to small-scale fishing and for the powers and duties of the Minister in this regard; to effect technical amendments; and to provide for matters connected therewith.
Relevance to the Proposed Project:	
This Amendment Act assists in defining and identifying important I&APs in the PPP.	

National Environmental Management: Integrated Coastal Management Act 24 of 2008

Legislation	Section	Relates to
National Environmental Management: Integrated Coastal Management Act 24 of 2008, as amended by Amended by the National Environmental Management: Integrated Coastal Management Amendment Act, No. 36 of 2014	Section 2	Provides for the preservation, protection and enhancement 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 therefore 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 and Mariculture Use (2018), i.e. the impact of the discharge temperatures must be assessed and impacts on receptors defined in the EIA		

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 freshwater 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:		

<table>
<tr><td>As the proposed transmission line will be constructed within and within close proximity to a watercourse, and due to the discharge of water from the cooling system in the Powerships, a water use license is required for the proposed development, and the licence was obtained in 2021. 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.</td></tr>
</table>

National Forest Act 84 of 1998

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td>National Forest Act 84 of 1998</td><td>Section 12</td><td>Provides for protection, control and licencing for cutting, disturbing, damaging or destroying protected trees</td></tr>
<tr><th colspan="3">Relevance to the Proposed Project, compliance and response:</th></tr>
<tr><td colspan="3">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. No protected trees have been identified on the proposed project site.</td></tr>
</table>

National Environmental Management: Biodiversity Act 10 of 2004

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td>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)</td><td colspan="2">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</td></tr>
<tr><th colspan="3">Relevance to the Proposed Project, compliance and response:</th></tr>
<tr><td colspan="3">A 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.</td></tr>
</table>

National Environmental Management: Protected Areas Act 31 of 2004

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td>National Environmental Management: Protected Areas Act (31 of 2004)</td><td colspan="2">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.</td></tr>
<tr><th colspan="3">Relevance to the Proposed Project, compliance and response:</th></tr>
</table>

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.		

Marine Pollution (Control and Civil Liability) Act 6 of 1981

Legislation	Section	Relates to
Marine Pollution (Control and Civil Liability) Act 6 of 1981		
	Section 24 requires a pollution safety certificate for the operation of an offshore installation from the South African Marine Safety Authority (SAMSA)	
Relevance to the Proposed Project, compliance and response:		
No pollution certificate is required for the proposed project, however SAMSA requires a risk assessment to be conducted for approval.		

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. Compatibility of the Project with Port planning is required.	

Occupational Health and Safety Act 85 of 1993

Legislation	Section	Relates to
	Section 8	General duties of employers to their employees

Occupational Health and Safety Act 85 of 1993 and Regulations	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, as amended by the Hazardous Substances Amendment Act 53 of 1992	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 must be complied with Table 4-1: Provision is made in the EMPr to manage the Noise Impacts during in the construction and operational phases.		

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.		

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 IDA's main aim is to speed up the delivery and implementation of nationally important social and economic infrastructure by designating priority projects as strategic infrastructure projects ("**SIP's**"). The Projects are declared and Gazetted SIP's in **Section 8(1)(a)** read with **Section 7(1)** of the IDA.

Section 7(1)(b) states:

"(1) A project or group of projects qualifies as a strategic integrated project for the purposes of this Act if-

(b) it complies with any of the following criteria:

(i) It would be of significant economic or social importance to the Republic.

(ii) it would contribute substantially to any national strategy or policy relating to infrastructure development; or

(iii) it is above a certain monetary value determined by the Commission; and

(c) the Commission has included the project in the national infrastructure plan and has, in terms of section 8, designated the project as a strategic integrated project."

When considering whether to grant an environmental authorisation for the Projects, the DFFE must consider the socio-economic advantages of the Project, the fact that the Project is a declared SIP as well as ramifications for the IPP projects list on a national level against any significant environmental impacts.

Section 2(4)(i) of the NEMA states:

"The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in light of such consideration and assessment."

Further at (l):

"There must be inter-governmental co-ordination and harmonisation of policies, legislation and actions relating to the environment."

Similarly any other government authority considering the Project, must give consideration to these factors.

Section 8(4)(a) of the IDA further provides that:

"Every organ of state must ensure that its future planning or implementation of infrastructure or its future spatial planning and land use is not in conflict with any strategic integrated project implemented in terms of this Act."

This designation means that the State has recognised the project as vital to the South African economy, which must therefore be taken into account when considering the need and desirability of the Project and the Environmental Authorisation of the Project. The status of the Project as a SIP also means that other projects must consider the cumulative impacts of their projects in relation to these Projects (giving due preference and weighting to the SIP project status) and that organs of state must factor SIP projects into their future planning.

Civil Aviation Act 13 of 2009

Legislation	Section	Relates to
Civil Aviation Act 13 of 2009	▪ Obstacle approval will be necessary for objects above select height.	
Relevance to the Proposed Project, compliance and response:		
The proposed project will require consent from the SACAA for infrastructure above 60 meters tall.		

4.1.2 Provincial legislation and planning

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

Table 4-2: Applicable Provincial Plans, Strategies and Programmes.

Legislation	Relates to
KwaZulu-Natal Planning and Development Act 6 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 (2022)	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. CBAs and ESAs are considered in the terrestrial ecological assessment.
The Provincial Norms and Standards on Biodiversity	Provides details on how EKZNW, as the Provincial biodiversity authority, requires offsets to be investigated and reported upon. No biodiversity offsets have been recommended by the specialists for the proposed project. Should

Legislation	Relates to
Offset for KwaZulu-Natal (2009, 2013)	the application for environmental authorization be accepted conditional on an offset, then a detailed Offset Report and Offset Agreement would need to be prepared, together with an Offset Management Plan, providing details of how the offset site would be secured, financial requirements and provision, and implementation arrangements. These documents would need to be reviewed and accepted by Ezemvelo KZN Wildlife and the Competent Environmental Authority before the proposed activities could commence.
KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs - 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 (2019)	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.
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 2020 – 2025 (March 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.

4.1.3 Local legislation and planning

The Project's compatibility with local municipal and conservation planning is discussed in Section 8.

Table 4-3: Applicable Regional and Local Planning Frameworks.

Legislation	Relates to
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.

("uThungulu Coastal Management Programme")	
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.
Richards Bay Environmental Management Framework (EMF)	Secures environmental protection and promote sustainability and cooperative environmental governance. Guides the decision-making in the area.
uMhlathuze Municipality Spatial Planning and Land Use Management By-Law (2017)	These By-Laws provide for processes for the development, implementation and review of the Municipality's land use schemes.
uMhlathuze Land Use Scheme Regulations (April 2021)	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) 2022 – 2027 (May 2022)	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.
uMhlathuze Local Municipality Spatial Development Framework (May 2022)	The SDF provides strategic guidance on locations of development and land use, which feeds into strategic decisions of the local municipality.
Richards Bay/ uMhlathuze Estuarine Management Plan (Draft only) (2019)	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.
uMhlathuze Local Municipality Flammable Liquids By-law, 2002	Regulates storage of flammable substances. Karpowership currently in communication with the Municipality to determine whether the by-laws apply to the proposed project.

International Agreements

South Africa is a party to several international agreements which regulate the marine environment and 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
    - This treaty has three main goals, namely: conservation of biodiversity; sustainable use of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources
- International Convention on Civil Liability for Oil Pollution
    - International maritime treaty adopted to ensure that adequate compensation would be available where oil pollution damage was caused by maritime casualties involving oil tankers
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter ("**London Convention**") – 1972-1978
    - This Convention's objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter.
- Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter ("**London Protocol**") – 1996-1998
    - The London Protocol updates and is intended to replace the London Convention. The London Protocol prohibits all wastes, except for those identified on the "reverse list". These improvements to the London Convention further ensure that the few materials that are permitted for ocean disposal are carefully evaluated and will not pose a danger to human health or the environment and that there are not more feasible alternatives for their reuse or disposal.
- United Nations Convention on the Law of the Sea (UNCLOS) – 1982-1997
    - UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources.
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties - 1969-1986
    - The Convention affirms the right of a coastal State to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate danger to its coastline or related interests from pollution by oil or the threat thereof, following upon a maritime casualty.
- Protocol relating to intervention on the high seas in cases of pollution by substances other than oil – 1973-1997
    - The Protocol relating to Intervention on the High Seas in Cases of Marine Pollution by Substances other than Oil was adopted to extend the provisions of the 1969 Convention referred to above.
    - The list of hazardous substances covered by Protocol was amended and extended in 1991, 1996 and 2002.
- International Convention for the Safety of Life at Sea – 1974-1980
    - This Convention aims to specify minimum standards for the construction, equipment, and operation of ships, compatible with their safety.
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) – 1979

  - This Convention is a treaty under the mandate of the United Nations Environment Programme. It provides a global platform for the conservation and sustainable use of migratory animals and their habitats.
- International Whaling Commission's (IWC) Resolution 2018-4
  - The Resolution on Anthropogenic and Underwater Noise requires effective remediation of noise impacts when cost effective solutions are available.
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds, or African-Eurasian Waterbird Agreement (AEWA)
- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) – 1998
  - This Convention was created to empower the role of citizens and civil society organisations in environmental matters and is founded on the principles of participative democracy.
  - The Convention establishes a number of rights to the individuals and civil society organizations with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities, at a national, regional or local level, will contribute to these rights to become effective.
- United Nations Framework Convention on Climate Change (1992)
  - The UNFCCC is a global commitment by countries to cooperatively find solutions to limit the global average temperature increase.
- The Paris Agreement (2015)
  - The Paris Agreement establishes a global goal on adaptation – of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change in the context of the temperature goal of the Agreement.

5 PUBLIC PARTICIPATION PROCESS (PPP)

The EIA Regulations provide requirements and the framework in terms of which PPP for an EIA process must take place, including projects declared as Strategic Integrated Project ("**SIP**") as contemplated in the Infrastructure Development Act 23 of 2014. The PPP for Scoping Phase was undertaken in accordance with the Public Participation Plan that was approved by DFFE.

The Minister's decision on the EA appeal in August 2022 highlighted issues with the PPP during 2021. Bearing this in mind, Triplo4 decided to address these concerns and took active steps to ensure this PPP went above the 'minimum requirements' stipulated in the EIA Regulations and to implement the suggestions provided in the Public Participation Guidelines where reasonably possible and applicable in this PPP. Triplo4 undertook an enhanced PPP for this EIA Phase, by procuring the services of an Independent Public Participation specialist, Phelamanga, as well as independent service providers to distribute and manage the PPP notifications and the Virtual Meeting. This would ensure that capacity was not a deterrent during this PPP.

The PPP was undertaken in a manner to promote equitable and effective participation, and specifically participation by vulnerable and disadvantaged persons and in accordance with Chapter 6 of the EIA Regulations, Regulations 39, 40, 41, 42, 43, 44 and 45 and the relevant Public Participation Guideline.

This chapter is divided in the following manner:

- Summary of the PPP during the Scoping Phase in 2020 to provide a complete overview of PPP undertaken for the application;
- Summary of Enhanced PPP Approach with:
    - Actions taken before the public comment period of the draft EIA Report (DEIR); and
    - Actions taken during public comment period of the DEIR.

5.1 Actions Taken During the Scoping Phase (2020)

Table 5-1: Summary of PPP actions during Scoping Phase (2020)

Item	Date	Actions
1.	2020/09/15	EAP submitted first draft of PPP Plan to DFFE.
2.	2020/09/17	EAP pre-application meeting with DFFE (Regulation 8 of EIA Regulations). DFFE communicated comments on PPP during meeting for the EAP to revise PPP Plan.
3.	2020/09/18	EAP submitted amended PPP Plan to DFFE.
4.	2020/09/21	**DFFE approved amended PPP Plan.**
5.	2020/09/21 & 23	Advertisements in Zululand Observer Newspaper in two languages (English and isiZulu) on 21st September 2020 and Bay Watch newspaper in two

Item	Date	Actions
		languages (English and isiZulu) 22nd September 2020 – requests for I&APs to register (2 day campaign). Three A2 site notices were placed within the site area, in English and isiZulu and were placed prominently at: - Location 1: site entrance to the Port Registration Office; - Location 2: at the access road leading to the entrance of the South32 Aluminum site; and - Location 3: near the fenced boundary of the South32 Aluminum site; A5 sized-posters ("flyers") were placed at: - Seafarers Mission near the port entrance, Richards Bay; - Bayside Alusaf Aluminum front desk, Richards Bay; - Bayside Alusaf Aluminum dedicated place at turnstile entrance, Richards Bay.
6.	2020/09/22	Background Information Document ("**BID**") and Notice of Application ("**NOA**") distributed to relevant Stakeholders and I&APs; emailed in two languages (English and Zulu) to identified Stakeholders and I&APs on 2020/09/21, including landowners, the municipal ward councilor, Department of Energy, Eskom, Department of Water and Sanitation, Department of Forest, Fisheries and the Environment, Ezemvelo KZN Wildlife, Amafa KZN, South Africa Maritime Safety Authority, Department of Economic Development, Tourism and Environmental Affairs (EDTEA): King Cetshwayo, Department of Economic Development, Tourism and Environmental Affairs: Coastal Management, Department of Transport, 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); local ratepayers association/s, UMhlathuze Local Municipality and the King Cetshwayo District Municipality.
7.	2020/10/06	EAP distributed the Draft Scoping Report for comment until 2020/11/06. Hard copies were delivered to and available at: - Richard's Bay Library; - Triplo4 Ballito Offices: Suite 5, The Circle, Douglas Crowe Drive, Ballito; and Electronic copies were made available via: - Emails to registered I&APs with a Google Drive Link to access the relevant documentation; - Triplo4 Website: www.triplo4.com.
8.	2020/10/14	Online Public Meetings/Webinars held on the 14th October 2020 10h00–12h00 (morning meeting) and 18h00–18h45 (evening meeting). It is recorded that no attendees were present for the evening meeting. Phelamanga, the independent PPP facilitator, as well at the EAP and

Item	Date	Actions
		presenters waited for 45 minutes before the meeting was closed due to no attendees being present for the meeting. For all Online Public Meetings on the 14th October 2020, the specialists presented independently on their specialist area and also responded to I&APs queries raised after the specialist's presentation. In a few instances where the specialist was unavailable to present, a voiceover was prepared.
9.	2020/11/06	Period for receiving public comments closed. From the BID until the submission of the Final Scoping report to DFFE, comments and Responses Report was compiled and responses submitted to I&APs.
10.	2020/11/17	Submission of Final Scoping and Plan of Study (PoS) to DFFE.
11.	2021/01/06	**Scoping Report accepted by DFFE.**

Table 5.2 below lists the main issues raised during the commenting period on the draft Scoping Report that were to be addressed in the EIA phase (as relevant). This report addressed these aspects through the specialists' reports, technical reports and the various descriptions as per relevant chapters of this reports, as summaries below.

Table 5-2: Main issues raised during Scoping phase PPP to be addressed in the EIA phase.

MAIN ISSUES RAISED DURING SCOPING PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE EIAR
Government Policy • Criticism of the RMI4P • Project duration and commitment	Chapter 1 and 8
Climate change – Inadequate GHG Assessment	Appendix 9
Port Planning and TNPA Engagement	Chapter 8
Socio-Economic: • Local employment opportunities • Fishermen	Chapter 2 and 6 Appendix 9
Marine Heritage	Chapter 6 Appendices 6 and 9
Avifauna Impacts: • Previous Reports • Important Habitat • Significance of Sandspit	Chapter 6 and 7 Appendix 9
Noise (terrestrial and underwater)	Chapter 6 and 7 Appendix 9
Landowner Consent	Appendix 7
Air Quality Impact Assessment • Cumulative impacts • Health Risks	Chapter 6 and 7 Appendix 9

MAIN ISSUES RAISED DURING SCOPING PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE EIAR
Leakage and explosion risks	Appendices 6 and 9
Alternative Technology and No-Go	Chapter 3
EIA & Public Participation Process	Chapter 5 Appendix 3
Safety and Disaster Management	Chapter 2 and 7 Appendices 6 and 9
Ecological Impacts	Chapter 7 Appendix 9
Marine Impacts • Pollution • Traffic Temperature	Chapter 7 Appendices 9 and 10

5.2 Actions Taken Before the Public Comment Period (2022)

5.2.1 Meeting with DFFE

On 24 August 2022, an in-person consultation meeting was held between Triplo4 Sustainable Solutions, KSA and DFFE, confirming the approach to the EIA phase as well as the timeframe for the process. It was confirmed by the DFFE that it was not required to redo the Scoping Phase and the process should entail only a new EIA phase.

5.2.2 Identifying and creating initial I&AP database

Potential stakeholders were identified in a number of ways to ensure a detailed I&AP database. These included:

- Use of the existing I&AP database compiled from the Scoping Phase as well as initial EIA phase.
- Online searches were conducted from Government, Academic, NGOs and other applications which were in the public domain, as well as media sources, to augment and expand the existing database based on brainstorming exercises and further probes to identify stakeholders;
- Potential I&APs identified as a result of KSA's engagements with stakeholders;
- The database also includes stakeholders and I&APs that have been sourced from electronic and print media reports, and engagements with Government Departments;
- Established lists from other relevant databases were utilized to augment the existing database;
- Officials and NGOs were approached to determine other I&APs;
- Karpowership SA appointed Community Liaison Officers to further engage with the community and identify key stakeholders especially those from the **rural, marginalized communities, the poor, tribal communities and councils and the inadequately resourced;**
- During the Socio-Economic Impact Assessment, engagements with businesses and the Small Scale Fishers informed the database;
- Landowners, the Municipalities, NGOs and forums were contacted and requested to refer and forward all relevant details of stakeholders / I&APs to the EAP for inclusion onto the I&AP database or to forward the notifications to their members to inform them that they could register as an I&AP.

The database consisted of two main components, namely potential I&APs with e-mail addresses and those with only cellphone numbers. At the time of submitting the I&AP notification and invitation to register on the 24th October 2022, a total of 577 emails were submitted, in addition to 35 SMSs.

5.2.3 Developing and updating of I&AP database

The comprehensive database of I&APs, which included authorities, different spheres of government (national, provincial and local), stakeholders, landowners, traditional authorities, social groups, informal Small Scale Fishers, NGOs, business and representative chambers, education and research institutions, interest groups and members of the general public, was compiled based on the approach above. This database was updated throughout the PPP process that commenced on 24 October 2022 (the date on which the first formal notifications were sent to I&APs) and registered I&APs and referrals from I&APs responding to the communications for participation, were added.

Triplo4 investigated "soft" and "hard" bounces from email notifications as well as the "unsubscribe" lists, where possible, and updated the database continually throughout the PPP process. Triplo4 resubmitted e-mails and also made all efforts to contact I&APs to verify undeliverable addresses.

"Soft" bounces are instances where emails could not be delivered due to temporary reasons, such as full mailboxes or the server timed out, and "hard" bounces are instances where emails could not be delivered due to permanent reasons, such as invalid email address or blockage by the recipient's server.

5.2.4 Language selection

The Public Participation considered, as part of appropriate participation methods, the language requirements for the posting of notices, newspaper and radio advertisements, flyers and information brochure and communication at the public meetings.

While the official KwaZulu Natal Provincial Language Policy (the Policy) is explicitly applicable only to State Departments, the Policy was used to confirm the official provincial languages, in this case being English, Afrikaans, isiXhosa, isiZulu. The Policy was consulted to ensure that the PPP conducted was inclusive of the official provincial languages and therefore the communication methods to announce the project and provide information of participation included: English, Afrikaans, isiXhosa and isiZulu.

5.2.5 Capacity Building

Capacity building, which forms part of the public participation process, is seen as an ongoing, multi-pronged approach to improve the abilities and skills of marginalised, vulnerable and previously disadvantaged groups to understand the proposed project and therefore be able to meaningfully engage in the PPP. By utilising capacity building and participatory techniques, marginalised, vulnerable and previously disadvantaged groups are better equipped to meaningfully contribute to engagements and the wider public participation process. Capacity building therefore is an approach to PP which seeks to involve communities and people who do not have access to resources or have not been afforded the opportunity to higher levels of education. Steps were taken to take information to the I&APs personally via door-to-door distribution of pamphlets and flyers and in-person discussions and at a level more understandable for the relevant I&AP. This is done with the goal of promoting equitable and effective participation across different sectors and communities in society. Karpowership SA undertook various steps in addition to the formal PP arranged by the EAP, in order to commence fostering relationships with I&APs and to further add to the steps with capacity building.

5.2.5.1 Small Scale Fisher (SSF) Workshop

It was confirmed by the DFFE that no SSF cooperatives were registered to fish in the Port of Richards Bay. As an active Port and industrial zone, TNPA does not allow fishing to take place in the port. However, to ensure that no marginalized groups, whether formally registered or not, were excluded from the PPP, a workshop was held with informal small scale fishers (SSFs) to explain aspects of the project and obtain viewpoints of how the project may impact on fishing and the fishing community. This engagement was specifically to ensure that informal SSFs had an appropriate opportunity to express their views and concerns regarding the project. Taxis were arranged to transport the SSFs to the meeting held at the Zululand Chambers of Business Foundation, Pelican Hall, at Alton Road, Richards Bay, on the 7th October 2022 from 14:00 to 16:00.

From the comments received, it was noted that the perceptions of some fishers were potentially negatively influenced by the media projecting objections and opposing views to the project. It was established that the informal SSFs were not directly affected as no fishing was conducted in the immediate vicinity of the project.

Refer to the SSF Engagement report – Appendix 9 – D1.1

5.2.5.2 Community Liaison Officers (CLOs)

Karpowership SA employed a male and female CLO to engage with the community, organise arrangements for the community to attend the SSF workshop and Public Meetings, and clarify information where possible or alternatively, refer queries to Triplo4. The CLOs were appointed in in early 2022.

Karpowership SA provided the following for inclusion in terms of capacity building:

"Karpowership is committed to building robust and open channels of communication with social and business communities which are located in the vicinity of the Powership. To this end, Karpowersip SA employed Community Liaison Officers (CLOs) for the purpose of fostering relationships with different sectors of society and facilitating the building of open communication channels to ensureKarpowership SA receives feedback and input from societal representatives.

Engagement with I&APs is not restricted to the 'formal' public comment period on the Draft Environmental Impact Assessment Report. Consequently, steps were taken prior to this phase in order to ensure as many potential I&APs were informed of the proposed Gas to Power project and therefore more people were able to engage with the EAP during the formal public comment period.

It is important to highlight that the steps taken were not done solely for the sake of the EIA PPP, but to assist Karpowership SA with the identification of community issues and needs and the development of its Economic Development Plan as well as to create the foundation for continued engagement with stakeholders during the operational period of the project. The following is a summary of engagements:

- *Various meetings with COGTA, the Amakhosi and their duly elected representatives representing Ubizo, Bhejane, Madlebe, Kwambonami, Somopho, and Sokhulu;*
- *Engagements with various ward councillors and representations from the Umfolozi Municipality;*
- *Engagements with the City Manager and other representatives of uMhlathuze Municipality;*
- *Engagements with various business and commercial entities including the Zululand Chamber of Commerce and Industry; Success Ways Holdings, North Coast Workers Forum, National Business Forum, Esikhaleni/KwaDlangezwa Business Council; the National African Federated Chamber of Commerce and Industry, King Cetshwayo Artisan Organisation, Mkhenkana Traded Services;*

- *Engagements with representatives of the Lungelo Youth Development, Empangeni Child and Family Care, Richards Bay Family Care;*
- *Meetings with representatives for small scale fishers from the surrounding areas of Richards Bay including Amatigulu, Nhlabane, Nkunzebomvu, Esikhaleni, Amatigulu, Senzakwenzeke; Mcejo; Aquanhlanzi; Esikhaleni, Meer en See."*

5.2.5.3 Information Booklet

Capacity building requires that information is disseminated to I&APs at a level at which they can understand and from which they can extract value. To address this, Karpowership SA designed and distributed an 'Information Booklet', which aimed to provide information regarding the project in a format and at a level which was easily accessible to I&APs who were not formally educated. The booklet provided by Karpowership SA comprised of the following sections:

- Background of the Company;
- Project concept – How do Powerships work and how is power generated;
- How Powerships engage with the Natural Environment
- Benefits of the Powership technology to mitigate South Africa's energy crisis
- The Just Energy transition and how Powerships play a role through the use of natural gas as a cleaner, source of energy
- Project locations of the proposed projects
- Health and Safety associated with Powerships' operations
- Plans for community investment and job creation as part of mandatory requirements
- Types of support to local fishing communities
- Frequently asked questions to assist the community to understand issues potentially in the public domain
- Public participation in the process of environmental authorisation.

1500 booklets were printed in English, and were distributed at the public in-person meetings for the 3 proposed projects (i.e. at Richards Bay, Saldanha Bay and Coega). 500 booklets per project were distributed.

Refer to Appendix 3.6.

5.2.5.4 Information Leaflet

A further Information Leaflet was developed and distributed with the reminder e-mail notification of the public participation and registration notices as well as over 68 000 "knock-and-drop" notices that were delivered to individual properties as per the external distribution services provider, Vibrant Direct. The English leaflet, translated in isiZulu, isiXhosa and Afrikaans, comprised of basic information on the project in simple terms, specialist aspects being assessed, the importance of public participation and how to engage in the PPP for the project.

Refer to Appendix 3.2.

5.2.5.5 Pre-consultation engagement

Meetings were held with the following key stakeholders to provide opportunity for open communication on the proposed project, referrals of key stakeholders to include in the database and preliminary comments and clarification:

- RBCAA;

- uMhlathuze Local Municipality;
- Richards Bay IDZ; and
- DFFE: Sustainable Aquaculture Management.

Refer to Appendix 3.7 for final minutes of the meeting with uMhlathuze Local Municipality, as well as the minutes of the meetings with RBCAA, RBIDZ and DFFE: Sustainable Aquaculture Management.

Engagement was also undertaken with the Dept. of Economic Development, Tourism and Environmental Affairs (EDTEA): King Cetshwayo, in order to obtain clarity on the site's urban/industrial determination, and sourcing of relevant study done in the area, i.e. Richards Bay Oil and Gas Feasibility Study. It was confirmed by the EDTEA that the land surrounding the Richards Bay Port was classified as urban and industrial areas.

In addition, attempts for pre-consultation engagements were made with the following key stakeholders, and at the distribution of the draft EIA report for public review, no responses were received to carry out the requested engagement:

- Ezemvelo Wildlife;
- King Cetshwayo District Municipality; and
- ESKOM.

Engagement with stakeholders during the PPP period are captured and reported on in Section 5.3.2.

5.2.6 Additional resources:

5.2.6.1 External PP facilitator/expert

An independent and experienced PP facilitator, Phelamanga, was appointed to manage the in-person as well as virtual meeting facilitation. The facilitator had full access to the e-mail account to review comments and responses as well as notices and engagements with stakeholders and registered I&APs.

Refer to appendix 3.11.1 for information on the service provider.

5.2.6.2 Online platform specialists

An independent and experienced PP facilitator, Phelamanga, was appointed to manage the in-person as well as virtual meeting facilitation. The facilitator had full access to the e-mail account to review comments and responses as well as notices and engagements with stakeholders and registered I&APs.

Refer to appendix 3.11.1 for information on the service provider.

5.2.6.3 Dedicated e-mail and cellphone contact details

A dedicated e-mail address richardsbayksa@triplo4.com was created. The purpose of the address was to ensure project specific e-mails be attended to in an efficient and effective manner as well as independent scrutiny by the Independent Service Providers. The dedicated cellphone number also ensured that calls could be identified as project specific calls and engagements ensured in accordance thereof.

5.2.7 Notification of PPP and Registration

Numerous notification methods were undertaken, consisting of the following:

5.2.7.1 Direct notification to I&AP database

Notification letters and background information documents (in 4 languages) were distributed on the 24 October 2022 to all identified I&APs by WAHM using the MailerLite programme with a dedicated e-mail address, as per the comprehensive I&APs database. The notification letter and the BID contain a brief description of the project, and the EIA and PP processes, and include an invitation register as an I&AP.

Refer to copy of:

- PPP Notification letter – Appendix 3.2;
- Background Information Document (BID) – Appendix 3.8;
- Proof of circulation of the notification letter and BID and statistics– Appendix 3.3

A reminder e-mail containing the notification letter, background information document and capacity building leaflet in the four languages was distributed by WAHM on 02 November 2022 via the MailerLite application to all I&APs that had not unsubscribed from the mailing list. The purpose was to remind potential I&APs to register as an I&AP and submit comments as per the BID.

An SMS was submitted to potential I&APs using the MailerLite platform. This SMS, with characters not exceeding the 169 characters count, was submitted to potential I&APs where only a cellphone number was available.

Please refer to the statistics – Appendix 3.3.

All I&APs that registered were acknowledged and included in the database.

5.2.7.2 Newspaper ads (local and national)

Advertisements to draw the public's attention to the project were placed in 3 local newspapers and in 3 national newspapers, in 4 languages (official provincial languages), as summarised in table 1-2 below. The adverts contain the proposed project scope of works, location, project details, the dates and locations for review of the draft EIA Report, the dates and locations of the public meetings, as well as details of EAP and contacts to register and submit comments.

The advertisements were placed within the newspaper body where possible (as per individual newspaper) to improve visibility.

Table 5-3: Summary of newspapers advertisements

Local Newspapers	**Language**	**Date of Publication**
Zululand Observer	English, Afrikaans, isiZulu	24 October 2022
The Bay Watch	English, Afrikaans, isiZulu, isiXhosa	26 October 2022
Isolezwe KZN	isiZulu, IsiXhosa	24 October 2022
National Newspapers	**Language**	**Date of Publication**
Sunday Times	English	30 October 2022
Rapport	Afrikaans	30 October 2022
Ilanga	IsiZulu& IsiXhosa	24 October 2022

Refer to copies of:

- Advertisements, providing the displayed detail – Appendix 3.4
- Proof of publications - Appendix 3.5

5.2.7.3 Radio Announcements

The PP Guidelines provide suggestions of different means to reach a wider audience, taking into account rural and historically disadvantaged groups and literacy levels. The methods provided are suggestions and do not amount to mandatory requirements for PPP. Further, there is no proof that these methods are inherently the best techniques to reach a wider audience. Such methods suggested by the PP Guidelines include: "announcing the PPP on a local radio station in a local language, at an appropriate time". It was recognised that the radio announcements may assist those with reading disabilities, poor literacy levels and the visually impaired.

Announcements to inform the local communities were read in selected local radio stations, in the two most widely spoken languages in the Richards Bay area (English and isiZulu), during the various dates and slots, as describe in Table 5-4 below. The announcements were read by the show hosts. The announcements were focused on informing the public of the project, the dates and locations for the public meetings, the public locations to review the draft EIA Report, as well as the EAP contact details to obtain further information.

The radio stations were selected based on their reach within the project and surrounding areas, community and language preferences of the listeners and direction provided by the CLOs that live within the community and understand the societal dynamics. Times were chosen to be played predominantly during commuting hours and lunch-time hours.

Table 5-4: Summary of Radio announcements

Radio station	Language	Date and time
Ukhozi FM	IsiZulu	**24/10/2022** Between 12pm -3pm
Gagasi 99.5 FM	IsiZulu	**27/10/2022 and 2/11/2022** Between the 4am-6am
East Coast Radio	English	**24/10/2022** 2 slots – Between the 4am-6am Between 7pm -10pm

5.2.7.3.1 Selected Radio Stations

The following present the profiles of the selected radio stations:

- **East Coast Radio (ECR)**
  As the leading English-language commercial radio station in KwaZulu-Natal, ECR has a listenership of 1 265 000. The station's core audience is predominantly aged 25 to 49, split equally between male and female. It is also strongest in the Socio-Economic Measurement (SEM) segmentation 7-10 market and the most diverse of all stations in the province.

- **Gagasi 99.5 FM**
  South Africa's only bilingual radio station broadcasting in English & Zulu from Umhlanga, KwaZulu-Natal. This is an urban contemporary radio station with the highest concentration of urban listeners. They are music driven, relevant, and intimate and keep in touch with what matters most to their listeners. Gagasi has 1 915 000 black urban listeners in KZN, with their core listenership being 15 - 34 year olds within the Living Standard Measures 5 – 10 segmentation.

- **<u>Ukhozi FM</u>**

  Ukhozi FM is one of the biggest radio stations on the planet and the largest in Africa, with its listenership in constant access of 7.9 million over the past decade. Ukhozi FM broadcasts mainly in IsiZulu and loosely targets isiZulu speaking and understanding audiences in South Africa. Ukhozi FM is a South African radio station, broadcasting nationwide and streaming to the world. Ukhozi FM's headquarters is in KwaZulu Natal, Durban. The station caters to people ranging from young to elderly, specifically the youth, reinforcing a sense of pride and culture to the young people of South Africa.

  Ukhozi FM focuses on Edutainment and Infotainment as a guiding philosophy, which inform its broadcasting goals of upliftment, power, comfort, escapism, connectedness and culture to its listeners.

Refer to copy of:

- Radio announcements' scripts - Appendix 3.4;
- Proof of announcements - Appendix 3.5

5.2.7.4 Government Gazette advertisement

Although the Applicant was amenable to the placement of notices in the Government Gazette, due to the timeline of the EIA process as well as the process and timeframe required for the placement of a notice, this avenue was not deemed ideal and was not further pursued.

5.2.7.5 Specific approaches to existing community structures, committees and leaders

Specific engagements were held between the Applicant's Business Developer and the CLOs with the Business Community as per Section 5.2.5.2 depicted in Italics, to create an understanding for the project and for concerns and comments from these stakeholders to be recorded and internalised by the Applicant.

In addition, Triplo4 identified non-governmental organisations, committees and leaders with memberships who may be interested in the project and submitted a dedicated letter requesting these stakeholders to either provide contact details (considering compliance with POPIA) or alternatively disseminate the notification for registration and participation to their members via their internal databases. These included:

List of Stakeholders notified via Richards Bay KSA richardsbayksa@triplo4.com

1. Transnet - Port of Richards Bay
2. Richards Bay Industrial Development Zone (RBIDZ)
3. Zululand Chamber of Commerce and Industry (ZCCI)
4. Zululand Deep Sea Angling Association
5. WESSA Southern KZN
6. Ward 2 Councilor
7. uMhlathuze Municipality Amakhosi
8. Richards Bay Ratepayers Association
9. City of uMhlathuze Municipality: Environmental Planning
10. City Development City of uMhlathuze

Common Stakeholders notified via Saldanha Bay KSA saldanhabayksa@triplo4.com

11. South Durban Community Environmental Alliance (SDCEA)

12. Anti-Gas Alliance
13. Centre for Environmental Rights
14. Southern African Foundation for the Conservation of Coastal Birds (SANCCOB)
15. Birdlife South Africa
16. Coastal Links
17. Black Women in Sustainable Development
18. The Green Connection
19. Masifundise Development
20. National Association of Clean Air (NACA)
21. Oceans not Oil
22. Young Women In Business
23. Frack Free SA
24. Groundwork
25. Organisation Undoing Tax Abuse (OUTA)

It must be noted that no responses to these letters were provided by these stakeholders.

Refer to Appendix 3.3 for copies of the letter submitted via the dedicated e-mail addresses.

5.2.7.6 Site Notices and flyers

Over 20 locations were strategically selected along the site area, for the display of site notices (over 100 site notices), as well placements of public notices flyers, including the leaflets, as described in section 5.2.5.4 (over 420 copies distributed). These locations were selected upon engagement with the local Community Liaison Officers (CLOs), to ensure wide reach. These notices were distributed in the four official provincial languages, i.e. English, Afrikaans, isiZulu and isiXhosa. The site notices were printed in size A2 and the public notices flyers, together with the leaflets, in A5.

Over 420 flyers and leaflets were placed at the selected sites.

Refer to copies of:

- List and maps of selected locations for site notices and public notices flyers – Appendix 3.2
- Site notices, providing the displayed detail - Appendix 3.2;
- Photographs as proof of site notices displayed - Appendix 3.3;
- Public notices flyers (including the leaflets), providing the displayed detail - Appendix 3.2;
- Photographs as proof of public notices flyers placed - Appendix 3.2.

5.2.7.7 Enhanced Notification methods

In an effort to further reach and notify marginalised communities who may not have access to various public amenities, radio or internet services, a “knock and drop” initiative was carried out, and a pack containing flyers and leaflets (in 4 languages) were distributed by Vibrant Direct, the professional service provider, to over 68 000 households (see Table 5-5 below). These areas were strategically selected by the distribution company, based on their data and experience in reaching these marginalised and potentially vulnerable communities, as well as consultation with the CLOs, and their familiarity with the area.

The flyers contain the same content as the adverts and site notices, and in addition, contain the leaflets (as per section 5.2.5.4). Refer to Section 5.2.7.6 for information regarding the public notice flyers.

The leaflets were designed with the purpose to build capacity to better understand of the essence of the project, using simple terms and images, in all 4 languages. As per arrangement with the service provider, the following distributions with approximate numbers were made:

Table 5-5: Locations for "knock and drop" distribution

Location	HOUSEHOLD COUNT
Esikhawini	9500
Dube Village	1000
Mkhobosa 1& 2	1500
Vulindela	500
Kwa Dlangezwa	1500
Ongoye	1500
Gobandlovu	2600
Mandlankala	1000
U.V.S. Township	50
Matangweni	850
Empembeni	1000
Mabhuyeni	1000
Kwa Mthiyane	1000
Kwa Mthethwa	8000
Nseleni T/S	3482
Mandlazini	1000
Bucanana To Biyela	8500
Mzingazi	3000
Taxi Ranks (see further details below the table)	10000
Bhejane	1500
Vondlo	850
Mkhoma	1000
Ngwelezane Rural Areas	4000
Dondolo	1500
Vulindlela	500
Fairview	704
Kildare	394
Grantham Park	716
Panorama	302
TOTAL	**68 448**

Taxi ranks – the above allocation of 10 000 flyers went to the following taxi ranks:

- Esikawini Main Mall Rank;
- Esikawini Mpembeni Rank;
- Ngwelezane Main Rank;
- Nseleni Main Rank;
- Kwa Dlangezwa Main Rank;

- Empangeni Town Rank;
- Empangeni Top Boxer Rank;
- Empangeni Rail Rank;
- Empangeni OK Mall Rank;
- Richards Bay Junction 14 Rank; and
- Richards Bay Meer en See Main Rank.

Refer to copy of:

- List and map of selected locations for distribution of the flyers and leaflets – Appendix 3.2;
- Public notices flyers, providing the displayed detail - Appendix 3.2;
- Leaflets, providing the displayed detail - Appendix 3.2;
- Proof of distribution of the flyers and leaflets – Appendix 3.3;
- Details of the distribution company – Appendix 3.11.3

5.2.8 Specific focus group engagements

Various specific focus group engagements were initiated. Please refer to Section 5.2.5.1 and the SFF workshop summary as per the independent Socio-Economic Specialist Assessment Report.

In addition, please refer to the minutes of the meeting as per Section 5.2.5.5 regarding the specific focus group engagements with:

- uMhlathuze Municipality;
- RBIDZ;
- RBCAA; and
- DFFE: Sustainable Aquaculture Management.

Refer to Appendix 3.7 for final minutes of the meetings.

5.2.9 Additional Media Coverage

As a result of the media coverage, (own initiatives by the stakeholders), wide spread awareness of the project as well as details of the public participation was additionally made available to the public. This included various organisations placing notices on their websites:

Table 5-6: Summary of additional coverage before the public comment period

Stakeholder/Organisation	Published/Uploaded Date	Description /content
Weskus Sakekamer – Business Chamber	27 October 2022	Individual Referral Letter (Section 5.2.7.5)
The re-launching of the EIA phase has been widely advertised in the media. Please refer to Appendix 3.10 for the media coverage noted by Triplo4.		

Table 5-7: Media Sources – Articles published online before the public comment period

Website	Article Title	Date
Daily Maverick	Creecy firm in rejecting Karpowership plan — but gives Turks a third bite at the cherry	10/08/2022
Center for Environmental Rights	Karpowership Projects Risk being another Medupi	11/08/2022

Coastal Links	Karpowerships Rejection a relief for West Coast Fishers	12/08/2022
Financial Mail	Editorial Ramaphosa's Deepening Mantashe Problem	31/08/2022
Zululand Observer	Environmental Group Hosts Women's Rally	01/09/2022
Mail & Guardian	Juggling act needed to end power crisis	16/09/2022
MoneyWeb	Karpowership aims for environmental ruling in SA by April	28/09/2022
Mybroadband	Karpowership down but not out — aims to sell power to South Africa by mid-2024	29/09/2022
Mail & Guardian	Environmental ruling on Karpowership to be made in early 2023	07/09/2022
Daily Maverick	DNG Energy, the company that promised SA Energy Security, struggles to keep its own lights on	10/10/2022
Daily Maverick	Karpowership Gas Leviathan bubbles back up - again	25/10/2022
News 24	Karpowership Reboots bid for Powerships at Richards Bay, Saldanha	25/10/2022
Herald live	Walking a tightrope between environment and energy needs	27/10/2022
Zululand Observer	Another push for controversial floating gas-to—power project	28/10/2022
News 24	OPINION | Big gas is a huge risk for SA	31/10/2022
Cape Argus / IOL	Gas—power firm reapplies in new bid to boost SA grid	01/11/2022

Triplo4 also placed the BID in all 4 languages on its website, should any person becoming aware of the project visit the website for information.

5.3 Actions Taken During the Public Comment Period (2022)

5.3.1 Availability of DEIR for public comments

I&APs were informed that the Draft EIAR would be available for a period of 33 days **(10 November 2022 – 13 December 2022)** and informed where hardcopies would be available for perusal and how they could access online versions of the Draft EIAR.

Links to the draft EIA Report were emailed to I&APs on 09 November 2022. The links which were made available on the Triplo4 website, became 'live' on 10 November 2022.

Hard copies were placed at the following venues on 9 November 2022, as advertised:

- Richard's Bay Public Library (Physical Address: Kruger Road CBD, Richard's Bay);
- Empangeni Public Library (Physical Address: Corner of Union and Commercial Streets, Empangeni).

These venues were selected in consultation with the local CLOs and their engagement with the local communities. As these venues are public amenities, no I&AP was denied entrance in order to view the Draft EIAR. These libraries were contacted on a weekly basis, and it was confirmed by the libraries that although people from time to time were viewing the documents, no person had left a comment or signed the comments form.

A further ~~hard~~ copy of the Draft EIAR could be found at Triplo4's Ballito Office: Physical Address: Douglas Crowe Drive, The Circle, Suite 5, Ballito. No person had come to the office to view the documents.

The hard copies were placed at the above locations on 09 November 2022.

Refer Appendix 3.13 for proof of the placement of the hardcopies of the DEIR at the public libraries.

The hardcopies of the DEIR are still available for perusal at the libraries and have not been removed. Similarly, the links to access the DEIR have not been deactivated, and any person, whether an I&AP or not, is able to access the full DEIR on the Triplo4 website.

5.3.2 Public Meetings

Two public meetings were held on Wednesday 23 November 2022. An independent public participation specialist, Phelamanga, was appointed to facilitate the public participation process. The meetings were chaired by the independent PPP facilitators and presentations were made by key specialists and project representatives.

Measures were put in place to ensure that all I&APs and Stakeholders are provided with a reasonable opportunity to participate.

Two meeting time options with three-hour timeframes were offered - a morning session (during working hours 10:00 to 13:00) and an evening session (after working hours 17:00 – 20:00). The same information was provided at both sessions, and registered I&APs received the transcripts of both sessions.

These capacity building measures, various methods of distribution and engagements together with the languages for communication, the selection of the venue within close proximity of the project as well as availability of arranged transport was selected to ensure that rural or historically disadvantaged communities or people with special needs (e.g., illiteracy, disability or any other disadvantage) be included in the PPP.

Questions or comments could be submitted in advance of these meetings, and during the virtual meetings, attendees were given the opportunity to raise questions via a Q&A function. Details on the meetings and dates are captured in Table 5-8 below.

Table 5-8: Public meetings details

Meeting	Venue Address and Coordinates	Date	Time
In person	Zululand Chambers of Business Foundation (ZCBF) King Fisher Hall at Alton Rd, Richards Bay Central. Coordinates – 28°45'23.04"S 32° 2'5.52"E	**23 Nov 2022**	**10am-1pm**
Virtual	The registration link will be emailed to all previously & newly registered I&AP's.	**23 Nov 2022**	**5pm-8pm**

5.3.2.1 In person public meeting

The in-person public meeting was held at the Zululand Chambers of Business Foundation (ZCBF) King Fisher Hall at Alton Road, Richards Bay Central from 10h00 – 13h39. The location of the in-person meeting was chosen for its close proximity to central transportation routes and the site of the project.

Transportation was provided from the following areas: Esikhaleni, Empangeni, Dlangezwa, Mandlanzini, Mzingazi, Nseleni and Umfolozi (Kwambonambi and Kwamthethwa). The session was attended by 345 people in total, of which 322 were not consultants, specialists or representatives of the applicant.

To ensure an uninterrupted meeting and unpredictability of loadshedding and power outages following loadshedding (tripping of substations), a back-up generator was arranged for the meeting. Fortunately, there was no need for the use of the generator.

The meeting was chaired and facilitated by Phelamanga and was attended by the EAPs, the Applicant's representatives, as well as select specialists, who had travelled to the venue to present their findings and conclusions in person. Specialist attended and presented in-person based on the potential significance of the report findings and most frequent issues raised. In the event a specific expert was not able to present in person, the expert recorded a 'voice-over' that was played during their section of the presentation. Questions were answered by the relevant specialist, the consultants or the applicant's representative.

Hardcopy comment sheets were distributed to I&APs, should they prefer to comment in writing rather than to raise questions in person.

The meeting was recorded and the transcript of the meeting (verbatim minutes) was sent to all registered I&APs on 05 December 2022.

The meeting was conducted in English and independent translators for Afrikaans, isiZulu and isiXhosa were present to conduct translations, should this have been requested by any of the I&APs. Sign language interpreters introduced themselves in sign language and requested I&APs that require sign language to provide such indication. No sign language requirements were indicated at the meeting. The slides presented were summarised in isiZulu by the translator during the meeting and attendees could raise questions or comments in the language of their choice. These were then translated to English. The response provided in English was also translated to the language in which the comment or question was posed.

Refer to Appendix 3.12.1 for the the slideshow presented during the meeting, the verbatim minutes of the meeting as well as the record of written statements received from IAPs via the comments forms distributed at the meeting as well as the notices submitted regarding the presentations and minutes., E-mail responses to the queries received via the hardcopy comment sheets were responded to as per the Comments and Responses Report.

5.3.2.2 Virtual public meeting

Registration

Attendees were required to register for the meeting before the event, and provide their contact details to ensure that correct contact details for I&APs were recorded for the I&AP database and attendance register. In notifications, I&APs were informed of the format of the virtual public meeting and that they could register for the event until the ending time of the virtual public meeting, therefore allowing all I&APs to join the virtual public meeting at any stage during the meeting.

On 17 November 2022, I&APs on the database were sent a notification and link to register for the public meeting scheduled for 23 November 2022 from WAHM via the MailerLite application. On 18 November 2022 a "steps on how to register" and an "attendees guide" was submitted to I&APs to assist with registration. Refer to proof of notification and guidance as per Appendix 3.12.2.

Where I&APs struggled with registrations, Triplo4 assisted with the registrations and WAHM resolved technical connectivity issues.

Registrations remained open until the formal closure of meeting.

Meeting

The second public meeting was held virtually from 17h00 – 20h10 on 23 November 2022.

The virtual meeting was widely advertised in the Local, Regional and National Newspapers (Rapport, Sunday Times and iLanga). In addition, the meeting was advertised in the local and Regional Radio Stations, given the country-wide impacts of loadshedding as well as the wide spread media coverage of the project. It was anticipated that a very large number of I&APs may want to join the virtual meeting and provision was made for a thousand (1000) attendees to join throughout the meeting, via the AirMeet platform administered by WAHM. The Q&A format / function was therefore best suited for a large number of people, providing optimum opportunity for wide-ranging and numerous questions to be raised, rather than address a select few. This therefore meant that questions could still be raised by attendees through a "Q&A" function, with presentations optimised to 2 hours and opportunity for presenters to answer multiple questions on a specific topic integratively. The BID document, as well as the draft EIA Report clearly indicated that during the virtual meeting, attendees will be given the opportunity to raise questions via a Q&A function.

The optimisation of Q&A also entailed the moderation of questions by the EAP. Questions raised were displayed and once moderated were indicated as "Approved" or "Rejected" (the indication displayed to the person who raised the question only). All questions that were either approved or rejected during the virtual meeting, were answered and included in the minutes of the meeting. Once answered, questions were marked as "Yes". No questions were 'removed' from public view during the virtual public meetings. All questions which were submitted were either answered at the meeting or thereafter and as per the circulated minutes of the meeting to all I&APs (both in-person and virtual).

The virtual meeting platform provided an option to upvote questions, which is useful to identify the questions that people are interested in having answered. The facilitator explained the process of raising questions as well as the process of responses at the beginning of the meeting and assurance was also provided throughout the session that all questions raised will be responded to either within the meeting or after the meeting in the minutes.

Total of 127 registration were made, and the session was attended by 82 people in total, of which 43 were not consultants, specialists or the applicant's representatives. This additional virtual meeting was arranged in addition to the in-person public meeting, to afford I&APs another opportunity to obtain information, raise queries or clarify aspects heard at the in-person meeting.

The meeting was chaired and facilitated by Phelamanga and select specialists presented their findings and conclusions. To ensure that the same information was given at the public meetings, the specialists who presented in the in-person public meeting presented in the virtual meeting as well. In the event a specific expert was not able to present during the meeting, the expert recorded a 'voice-over' that was played during their section of the presentation. All Specialists that were available joined the virtual meeting to address specific questions.

The meeting was conducted in English and independent translators for Afrikaans, isiZulu and isiXhosa were introduced at the beginning of the meeting, and attendees were informed that the translators were available should the services be needed. No requests for translations were received. A sign-language interpreter was also present for the meeting and introduced herself. No requests for sign language interpretation were received.

Following the meeting, WAHM provide the attendee list from the AirMeet platform and the downloaded list of all questions asked, marked as answered or unanswered. The meeting was recorded and the transcribed minutes of the meeting were sent to all registered I&APs on the 08 December 2022 together with all questions raised that were not answered during the meeting. A total of 50 questions were raised and answered.

Refer to Appendix 3.12.2 for the slideshow presented during the meeting, the minutes as captured verbatim with the questions and responses that were not answered during the meeting.

5.3.2.3 Additional Notifications of Public meetings

In the days leading up to the public meeting, additional announcements were made on East Coast Radio to inform the local communities of the project, the dates and locations for the public meetings, the public locations to review the draft EIA Report, as well as the EAP contact details to obtain further information. The announcements were read by the show host in English of the 17/11/2022 in two slots – at 05:57 and at 16:48.

As explained in **section 5.2.7.3**, the radio stations were selected based on their reach within the project and surrounding areas, community and language preferences of the listeners and direction provided by the CLOs that live within the community and understand the societal dynamics.

5.3.3 Additional stakeholder engagements

Focus meetings were held with key stakeholders to provide further opportunity for open communication on the proposed project, to determine any issues that may not have been raised during the two public meetings held on 23 November 2022, or if there were any clarifications required by the stakeholders. These focus meetings didn't have a formal agenda, with the purpose being to allow the stakeholders to raise any concerns, ask any questions or provide any comments related to the proposed project.

These focus meetings were held with the following stakeholders:

- Richards Bay Clean Air Association (RBCAA);
- Black Business Council (BBC);
- Success Way Foundation;
- The National African Federated Chamber of Commerce and Industry (NAFCOC) KZN;
- Ezemvelo KZN Wildlife.

In addition, Triplo4 reached out to the following stakeholders to check if they wished to have a focus meeting, and it was confirmed that no focus meeting was required:

- uMhlathuze Local Municipality; and
- King Cetshwayo District Municipality.

5.3.4 **Continuous media awareness**

It is noted that there was continued media coverage on the PPP by external media outlets, which provided additional opportunities to alert potential I&APs to register for the PPP.

Please refer to Appendix 3.10 for the media coverage noted by Triplo4.

5.3.5 **Engagements to obtain comments**

Triplo4 continually strived to obtain comments from I&APs, including comments from Authorities e.g. EKZN Wildlife, Municipality, etc.

The following is a summary of efforts undertaken:

Triplo4 submitted reminders of the closing of the commenting period on the 10 December 2022 to the following relevant authorities and stakeholders:

- Richards Bay Industrial Development Zone (RBIDZ)
- KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
- Provincial Department of Agriculture
- Provincial Department of Transport
- King Cetshwayo District Municipality
- Department of Water and Sanitation
- Department of Rural Development and Land Reform
- DFFE Directorate: Climate Change.

The EAP, in a quest to obtain comments, requested stakeholder meetings with stakeholders and the following is provided for clarity:

Organisation / Stakeholder	**Date of Request (via e-mail)**	**Outcome & Response**
Richards Bay Industrial Development Zone (RBIDZ)	26 October 2022 28 October 2022	Pre-Consultation Meeting 07 November 2022
uMhlathuze Local Municipality	21 September 2022	Pre-Consultation Meeting 12 October 2022
Richards Bay Clean Air Association (RBCAA)	26 October 2022	Pre-Consultation Meeting 03 November 2022
Richards Bay Clean Air Association (RBCAA)	24 November 2022	Focus Meeting 01 December 2022
Ezemvelo KZN Wildlife	07 October 2022 13 October 2022 20 October 2022 24 November 2022 29 November 2022 01 December 2022	Focus Meeting 09 December 2022

KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs	20 October 2022 24 October 2022	Guidance on urban determination 26 October 2022
King Cetshwayo District Municipality	28 October 2022 02 December 2022	Requests for a focus meeting. No responses received.

Site visits with Directorates: Oceans & Coasts, were conducted for Port of Richards Bay to provide a full understanding of the sites and a more comprehensive project overview.

5.4 Actions Taken After the Public Comment Period (2022 – 2023)

5.4.1 Comments and Responses ~~Trail~~ Report

Following the concluding of the public participation period on 13 December 2022, the Comments and Responses Report was updated to record all the comments received and responses provided during the EIA process, and was submitted to the DFFE with the final EIA Report on 6 January 2023.

To ensure no prejudice, comments or queries received from IA&Ps after the closing date of 13 December 2022 were still acknowledged and responded to and are included in the comments and Responses Report.

The table below summarises the main issues raised during the commenting period on the draft EIA Report that were to be addressed in the EIA phase, with the reference to the sections within this final EIA Report that address these issues.

Table 5-9: Main issues raised during EIA phase PPP (10 November 2022 – 13 December 2022)

MAIN ISSUES RAISED DURING EIA PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE EIAR
Impacts on critical endangered and protected vegetation units	Section 3.2.3 – Transmission Line Alternatives Section 7.5.5 – Wetland Impacts Section 7.5.7 – Terrestrial Biodiversity Impacts Appendix 9 – A6 – Wetland Delineation and Functionality Assessment Appendix 9 – A9 – Terrestrial Biodiversity Assessment
The study area falls within a Critical Biodiversity Area (CBA) listed as irreplaceable	Section 3.2.3 – Transmission Line Alternatives Section 7.5.5 – Wetland Impacts Section 7.5.7 – Terrestrial Biodiversity Impacts Appendix 9 – A6 – Wetland Delineation and Functionality Assessment Appendix 9 – A9 – Terrestrial Biodiversity Assessment
Consultation must be undertaken with Ezemvelo KZN Wildlife	Section 5.2.5.5 – Pre Consultation Engagement Section 5.3.3 – Additional Stakeholders Engagement
Consideration of KZN Provincial Biodiversity Conservation Plan	Appendix 9 – A9 – Terrestrial Biodiversity Assessment

and other environmental management tools	
Plant Search and Rescue Plan to be developed	Appendix 6 – EMPr
Rehabilitation Plan to be developed	Appendix 9 – A7 – Wetland Rehabilitation Plan Appendix 6 – EMPr
Avifaunal mitigation measures to avoid collision	Appendix 6 – EMPr Appendix 9 – A10 – Avifauna Assessment
The conduct of the public meetings	Section 5.3.2 – Public Meetings Appendix 3.12 – Public Meetings
Impacts on avifaunal sensitive areas	Section 7.5.8 – Avifaunal Impacts Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – A10 – Avifauna Assessment Appendix 9 – A11 – Avifaunal Monitoring Plan
Avifaunal Baseline Data collection	Appendix 9 – A10 – Avifauna Assessment Appendix 9 – A11 – Avifaunal Monitoring Plan Appendix 6 - EMPr
Terrestrial Noise impacts on Avifauna	Section 7.5.8 – Avifaunal Impacts Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Section 7.5.13 – Terrestrial Noise Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – A10 – Avifauna Assessment Appendix 9 – C2 – Terrestrial Noise Assessment Appendix 6 - EMPr
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Lighting Impacts on sensitive areas	Section 7.5.8 – Avifaunal Impacts Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – A10 – Avifauna Assessment Appendix 6 - EMPr
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Consideration of the approved Richards Bay/uMhlathuze Estuarine Management Plan	Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment
Impacts on *Zostera capensis*	Section 6.1.10.3 - *Zostera capensis* Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – A9 – Terrestrial Biodiversity Assessment Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment
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Hydrological Impacts	Section 7.5.1 – Hydrological Impacts Appendix 9 – A1 – Hydrology Assessment
Consideration of coastal processes and coastal climate vulnerability	Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Section 7.5.14 – Climate Change Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – C3 – Climate Change Impact Assessment Appendix 10.3 – Geotechnical Review
Impacts of seawater abstraction for cooling system	Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 6 – EMPr Appendix 10.2 - Integrated Dispersion Modelling of Thermal Plumes
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Air Quality and refuelling Emissions	Section 7.5.14 – Climate Change Impacts Section 7.5.19 – Major Hazard Installation Impacts Appendix 9 – C3 – Climate Change Impact Assessment Appendix 9 – D3 - Major Hazard Installation Risk Assessment
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Heritage and Underwater Archaeology Impacts	Section 7.5.6 – Heritage Impacts Section 7.5.10 – Underwater Archaeology Impacts Appendix 6 – EMPr Appendix 9 - A8 - Heritage Assessment Appendix B3 - Underwater Heritage Compliance Letter
Risk of collision with marine fauna and other vessels	Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – D3 - Major Hazard Installation Risk Assessment Appendix 6 – EMPr Appendix 10.1 - Marine Traffic Assessment
Access to site	Section 2.3.2 – Site Access Appendix 9 – D1.3 – Traffic Evaluation
Marine Traffic Management	Section 7.5.10 – Marine Traffic Appendix 10.1 – Marine Traffic Assessment
Impacts on biodiversity in the estuarine area	Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 6 - EMPr
Consideration of municipal-climate change policy tools	Appendix 9 – C3 – Climate Change Impact Assessment
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Renewable Energy Vs. Gas	Chapter 8 – Motivation, Need and Desirability Appendix 8.1 - Gas to Power Projects and the Just Energy Transition from Fossil Fuels in the South African Political Economy Appendix 8.2- South Africa Country Specific Energy Security Assessment
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	Section 7.5.11 – Coastal, Estuarine and Marine Ecology Impacts Appendix 9 – B4 - Coastal, Estuarine and Marine Ecology Assessment Appendix 9 – B1 – Underwater Noise Baseline Assessment Appendix 9 – B2 – Underwater Noise Assessment Appendix 6 - EMPr
Socio Economic Impacts	Section 7.5.15 – Socio-Economic Impacts Appendix 8 - Independent Contributions to the Need and Desirability Appendix 9 - D1 - Socio-economic Impact Assessment Appendix 9 - D1.1 - Small Scale Fishers Engagement
The conduct of the Public Participation	Chapter 5 – Public Participation Process Appendix 3 – Public Participation

5.4.2 Notification of outcome of CA decision

All registered Interested and Affected Parties will be notified within 14 days of the DFFE's decision on the Application for Environmental Authorisation.

5.4.3 Availability of FEIR

The Final EIR was also uploaded to the Triplo4 website and is still available for downloading by any person who wishes to review the FEIR.

6 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;

This section provides a brief overview of the existing environment within which the project is proposed.

6.1 Biophysical Environment

6.1.1 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 6-1 below present the main attributes of the Natal Coastal Plain Eco-region.

Table 6-1: Main attributes of the Natal Coastal Plain Eco-region (Kleynhans et al., 2005).

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

6.1.2 Climatic Conditions

The Köppen Climate Classification suggest Richards Bay is situated in a humid subtropical climate (class = Cfa) which receives rainfall in the summer months (Kottek, et al., 2006). The Mean Annual Precipitation (MAP) is in the order of 1 285 mm/annum and the Mean Annual Evapotranspiration (MAE) is in the order of 1300 mm/a (S-Pan) (WRC, 2015).

Based on the climate model reived (2021 - 2050 under the RCP 8.5 (CSIR, 2019), the following is noted:

- The projected increase in MAP by 2050 is – 53.24 mm/yr (less);
- Projected changes are at least 9.2 more hot days compared to 2022;
- Projected increase in temperatures by as much as 1.77°C; and
- Projected increase in extreme rainfall days to increase by 1.38 days.

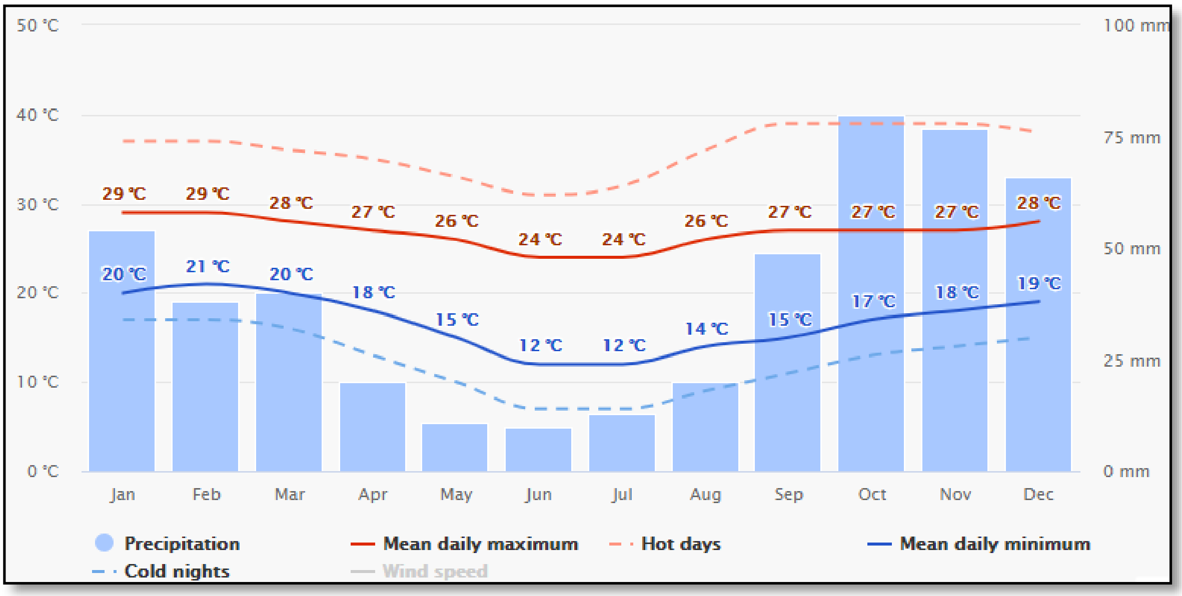


Figure 6-1: Average temperature and rainfall – Richards Bay (Meteoblue, 2022)

6.1.3 Storms and Storms related Weather

Increase in global average temperature can be commensurate with an increase in weather extremes. Of particular relevance for the Port of Richards Bay is the trend in tropical storms and low-pressure systems such as cut-off lows that bring widespread rain.

6.1.3.1 Tropical storms and cyclones

Owing to its latitude, South Africa is impacted by tropical storms over the south-western Indian Ocean. However, it has been impacted less than Mozambique and Madagascar over which many spring and summer tropical storms pass directly over (the latter of which buffers the southern Africa mainland from many of these storms). That said, many tropical storms are occurring further west and south over the Indian Ocean and Mozambique Channel. There is evidence to suggest that these tropical storms are becoming more frequent within the vicinity or impacting South Africa's coastline despite rarely making landfall.

Since 2020, three major tropical storms have impacted South Africa significantly. In December 2020, Tropical Storm Chalane resulted in exceptionally heavy rainfall across South Africa's northern provinces. A month later, Cyclone Eloise resulted in 10 deaths in South Africa. Perhaps the most pertinent impacts in recent memory, however, are those linked to Subtropical Depression Issa which struck the coastline of KwaZulu-

Natal on 12 April 2022. Despite being a relatively weak storm, the low-pressure system resulted in torrential rainfall in KwaZulu-Natal resulting in severe flooding and coastal erosion, damaging several thousand properties, displacing tens of thousands and killing at least 461 people. The floods were described by insurer Santam, as the worst natural disaster to hit South Africa on their records.

The maximum longitude of the midpoints of all recorded tropical storm track segments were plotted against time. There is a clear trend over the last 180 years of storms moving further west, closer to the east coast of southern Africa (Figure 6-2). It is also clear that tropical storms have become more frequent within South Africa's Exclusive Economic Zone (EEZ) with the first ca. 1940 and moving beyond the latitude of Richards Bay with three major storms since 2002.

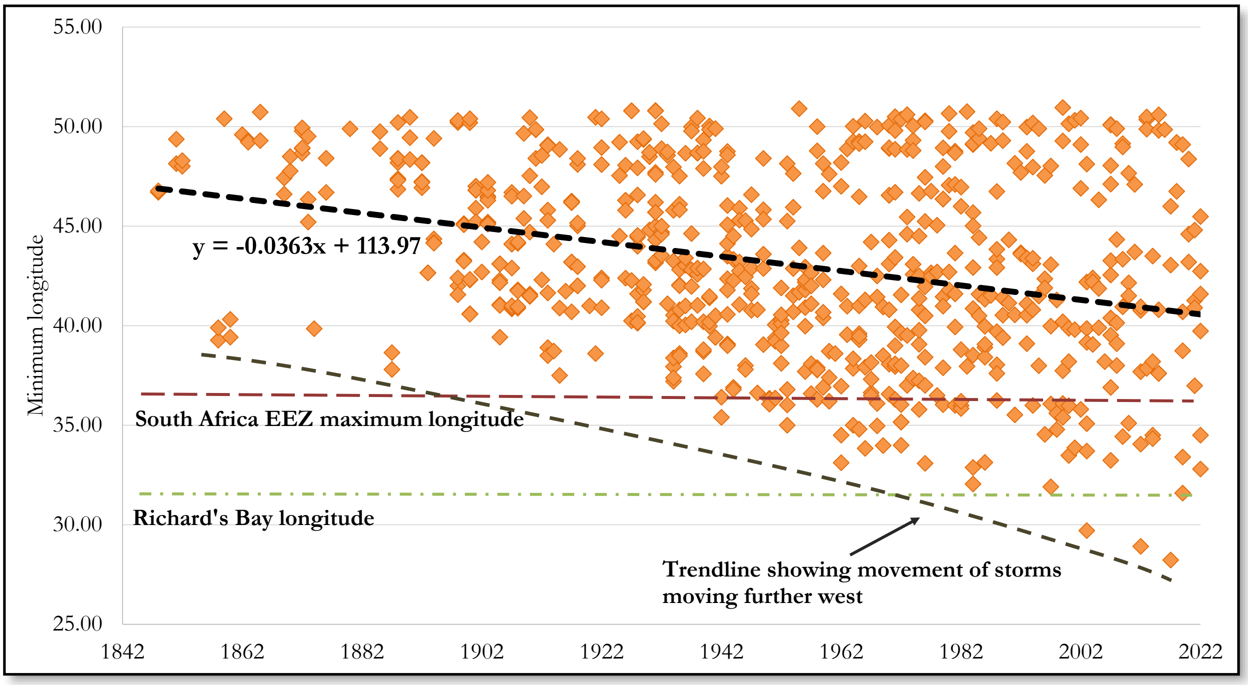


Figure 6-2: Plot of all recorded tropical storms in the International Best Track Archive for Climate Stewardship (IBTrACS) record over time against the minimum longitude each storm reached.

High intensity tropical storms have become more frequent in the South Indian Ocean since the first record of a category 5 storm in 1994. Category 4 and 5 cyclone tracks are plotted per decade in Figure 6-3. It is difficult to pick out a trend and there is no clear pattern, it is clear that cyclones moving over the subcontinent into the interior of the region are all since 2000. It is also important to bear in mind that these tracks represent the centre of these systems which are themselves much larger and result in weather conditions over large areas well away from the storm centres.

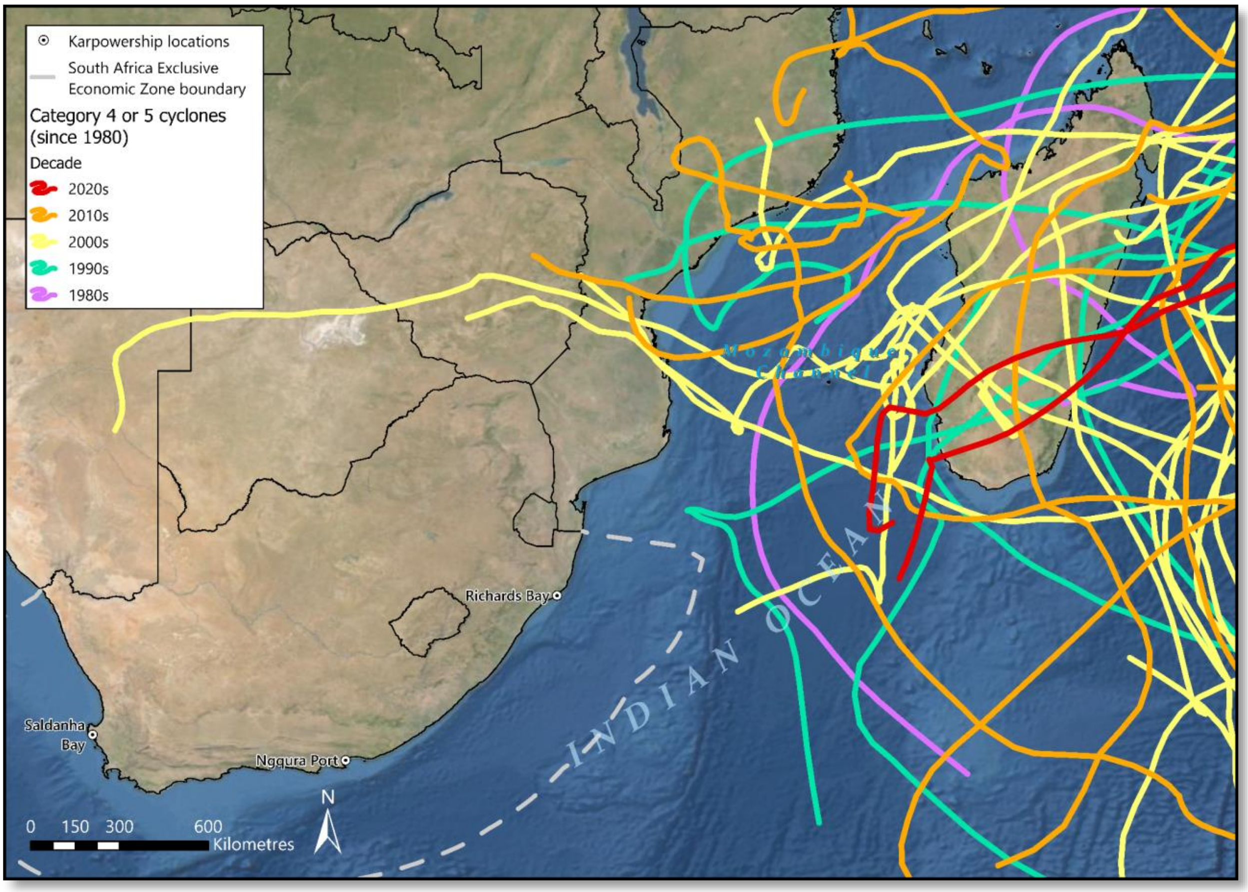


Figure 6-3: Category 4 and 5 cyclones tracks in the south-western Indian Ocean per decade.

Trends indicate potentially greater frequency of tropical storms that could fall within South Africa's EEZ and indeed make landfall along the KwaZulu-Natal coastline.

6.1.3.2 Sea surges and wave action resulting from storm activity

One of the key impacts of coastal and tropical storms are the associated storm surges that result from the high-wind speeds interacting with the ocean surface. In the region, the veering away of cyclones away from the continent in a south-easterly direction, or those that become semi-stationary result in the largest swells experienced. A combination of high sustained onshore winds and the storm area are the two primary variables that influence wave impact.

Waves that impact maritime activities and infrastructure are primarily linked to ocean currents, frontal patterns, cut-off low systems and tropical depressions and cyclones. Wave climate is highly seasonal and varies in intensity and wave period.

The east coast of South Africa is among the least impacted overall in terms of wave height and return period.

Although less vulnerable than sandy coastlines and coastal plains, harbours and ports such as those in which the Karpowerships are located remain at risk. Near-shore offshore infrastructure and coastal developments are particularly vulnerable to storm surges. This risk increases with a rise in mean sea level. At the Port of Richards Bay, the area surrounding the port (particularly around the uMhlathuze River mouth) and Qhubu Lake shoreline are most likely to be affected by a combination of sea level rise, tides and storm surges (Figure 6-4). Coastal infrastructure including those associated with harbours and port will require increased maintenance to withstand increased storm surges. The coastal flooding risk for Richards Bay is classified as medium risk in the medium-term with maximum regional wave heights likely to be around 9 m.

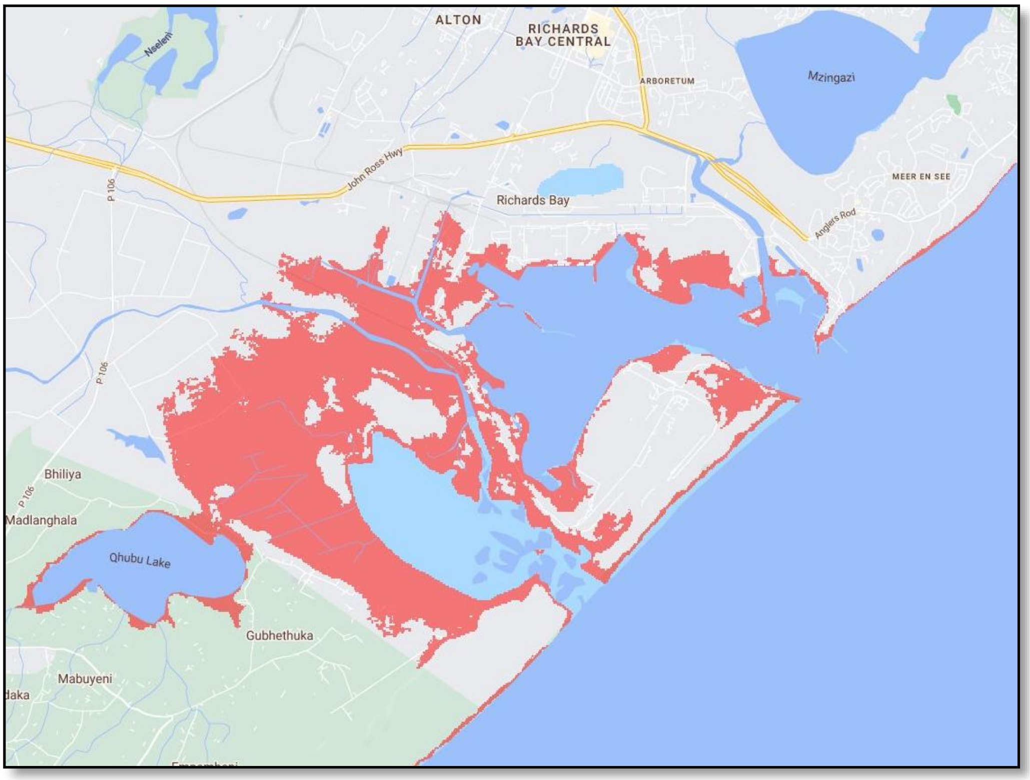


Figure 6-4: Area impacted (in pink) at and around the Port of Richards Bay by a 1 m rise in water level through combinations of sea level rise, tides, and storm surge.

6.1.4 Ocean pH

Ocean acidification due to increased deposition and dissolution of higher concentrations of atmospheric CO_2. The problem is particularly widespread in the open ocean (away from coastlines). At Richards Bay, surface sea water pH has declined from roughly 8.12 to 8.07. By 2050, pH is predicted to be ~0.2 lower than a baseline of 1950 along the east coast of southern Africa under SSP5. Change of this magnitude and based on a trend of historical data poses a low risk the project and associated infrastructure.

6.1.5 Wind

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.

Wind velocity is expected to increase across all seasons in South Africa but to a very small degree (maximum 6% increase). On occasions where a 10% increase in wind speed is experienced, there is a 26% increase in wave height. This compounds the impacts during storm surges and can result in significant increases in sediment transport into harbours and ports. Other than during storm events, the risk posed to the project from wind speed under climate change is low. Wind direction is also not likely to shift significantly along the KwaZulu-Natal coast.

6.1.6 Sea Level

Local and regional sea level varies in space and time due a number of factors such as tides, wind, waves and atmospheric conditions.

Data from the [South African] Hydrographic Office shows that sea level at Richards Bay has increased by ±4.2 cm (1.06 mm y^{-1}) between 1978 and 2018 based on a linear trend. According to The Intergovernmental Panel on Climate Change (IPCC) sixth assessment report (AR6) projections (medium confidence), sea level around Richards Bay is expected rise by 10-40 cm (from a 1995-2014 mean) by 2050 under different SSPs, with the *earliest* expected 1 m rise (from a 1995-2015 mean) by ca. 2095 under the Shared Socioeconomic Pathway 5 (SSP5 -8.5).

6.1.7 Sea Surface Temperature

Sea surface temperature (SST) is a fundamental component of climate science given that 71% of earth's surface is covered by oceans and that oceans absorb significant amounts of extra heat arising from GHGs.

SST at Richards Bay has increased by ±0.89˚C since 1900, with a decadal mean of 24.33˚C at present. By 2030 the mean SST could reach 24.4˚C (24.27-24.9˚C depending on SSP) and 25.3˚C by the late 2040s.

It should be noted that the increase in mean SST in the region and particularly further north into the Mozambique Channel may result in more favourable conditions necessary for the formation of tropical cyclones.

6.1.8 Geology, Soil and Land morphology

According to the 2732 Durban-1:250 000 Geological map series (DMEA, 1998), the local geology at the site is characterised by undifferentiated quaternary sands, underlain by older Swazian aged Gneiss.

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 [Freely drained, yellow, eutrophic, apedal soils comprise > 40% of the land type (red soils comprise < 10%)].

In general, the moisture regime of the 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 conditions. 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 leads 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 this is mainly due to sub-surface geology, products of weathering, degree of saturation, soil texture and slope position (refer to Figure 6-5).

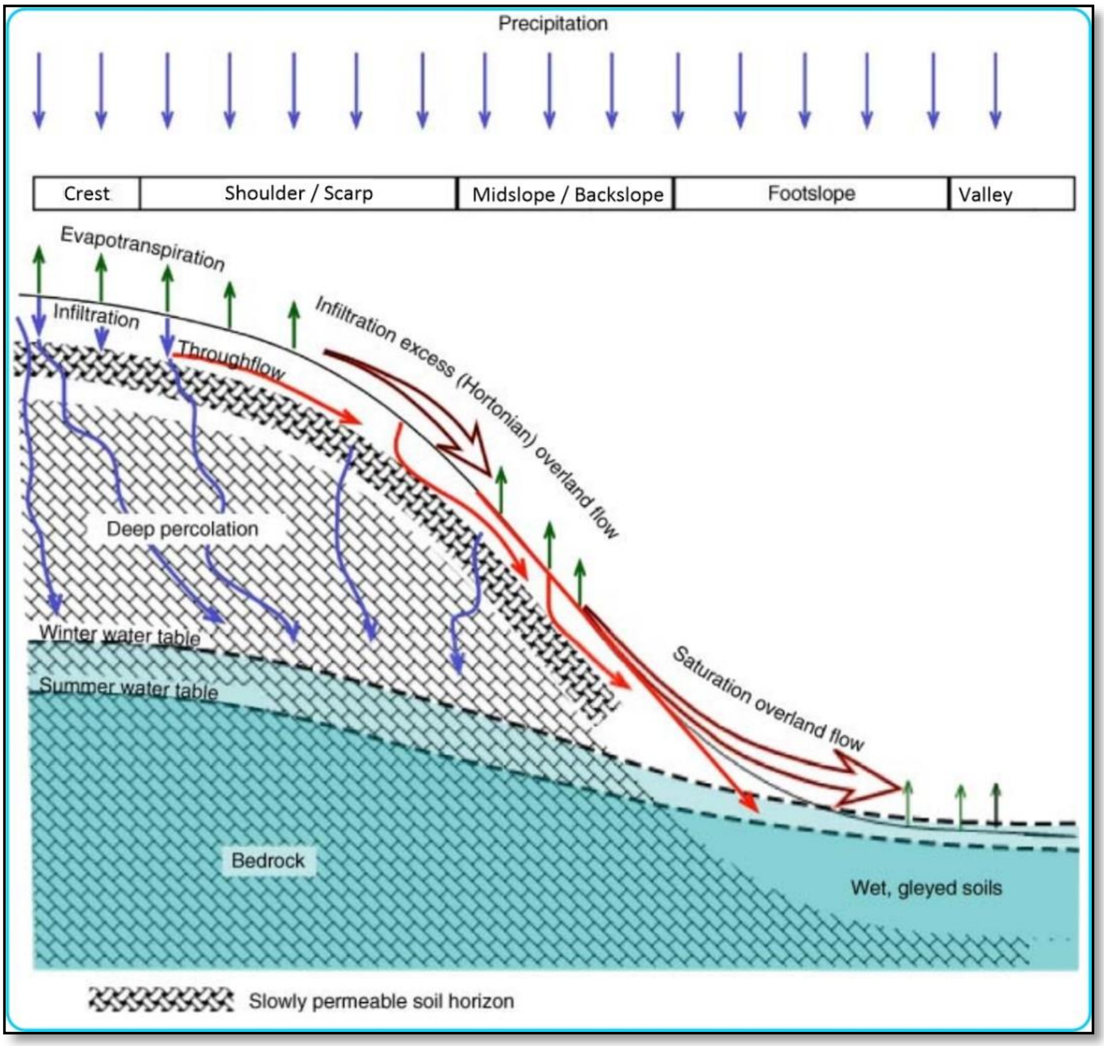


Figure 6-5: Land morphology concept (Almond, 2016)

The soils in the project predominantly consist of reclaimed land consisting of sand and man-made sand deposits (ARC, 2006).The combined average diagnostic depth of all the soils is > 1200 mm. Average clay content for footslope soils ranges from 20 to 40% (ARC, 2006).

6.1.8.1 Soil distribution

Soil occurrences were derived from available data and extrapolated to areas based on available Google Earth Imagery (i.e. similar vegetation types relative to land morphology will likely have similar soils as investigated areas).

6.1.8.2 Soil permeability

Fine to medium-grained sand is expected for the study area. The permeability of the diagnostic soils in the area is therefore expected to range from 2 to 5 cm/hr and will be predominantly governed by slope, soil texture and clay content (i.e. clayey areas in flat areas will have a lower permeability as appose to sandy soils on a steep slope).

6.1.9 Water Resources

6.1.9.1 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 6-6 below. The total extent of the sub-catchment area is approximately 22.6 km².

According to National Groundwater Archive (NGA) and SADAC GIP borehole data for the project area, seven (7) groundwater users within a 2.5 km radius of the proposed transmission line – refer to Figure 6-6. Groundwater boreholes and surface water users fall within other drainage zones, and will likely not be impacted by the activities at the site (drainage for the site is towards the Mshwati River).

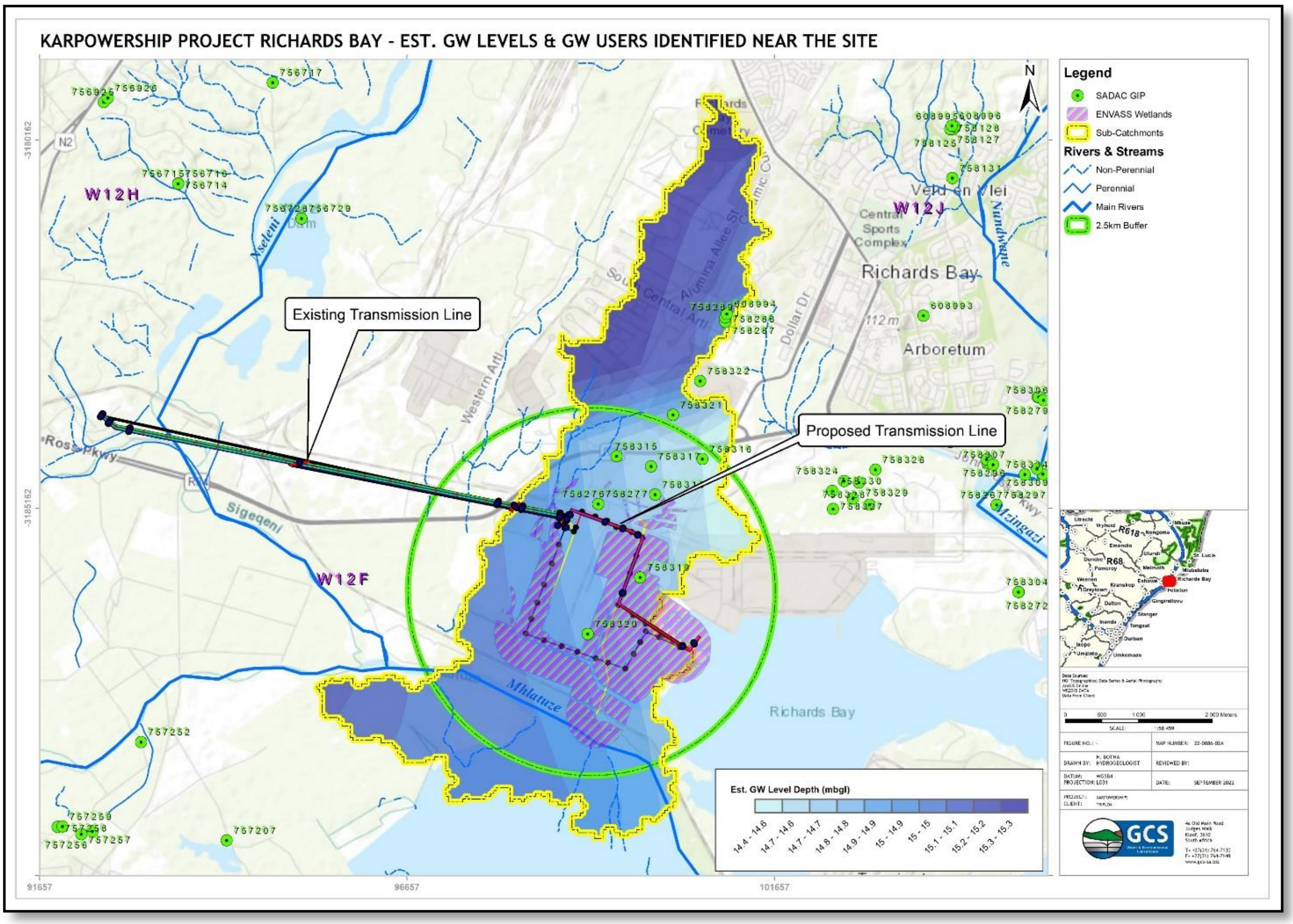


Figure 6-6: Groundwater users identified in the study area (2.5 km buffer of the proposed transmission line)

Eleven (11) SADAC GIP 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 475.2 m³/day is assumed.

The site conceptual geohydrological model (SCM) for the site is shown in Figure 6-7 below. The SCM shows that two (2) aquifers exist in the area:

- An unconfined aquifer associated with the unconsolidated sands; and
- A confined and fractured aquifer network associated with deeper and older granite/gneiss rock.

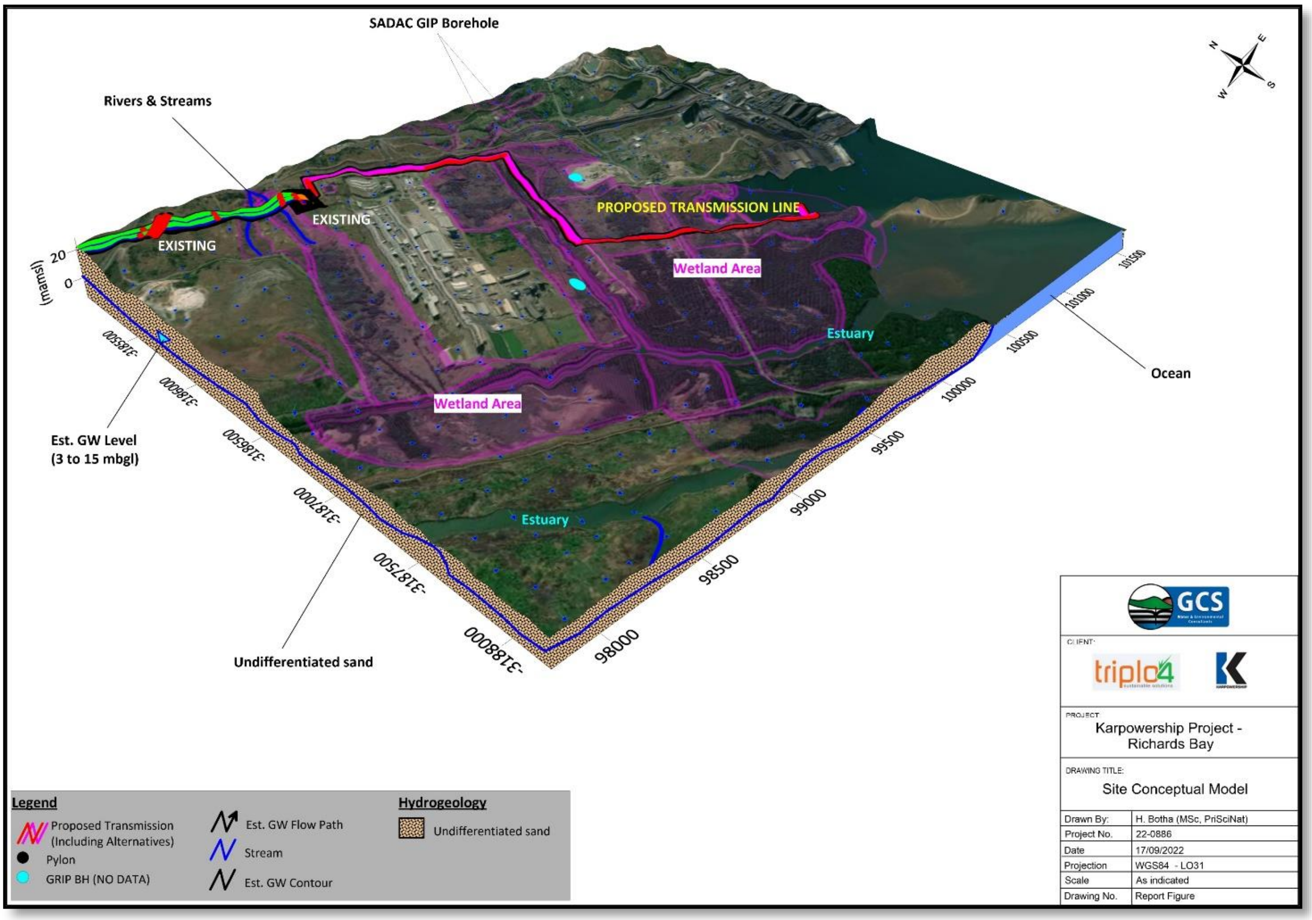


Figure 6-7: The site conceptual geohydrological model

6.1.9.2 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 6-8 below.

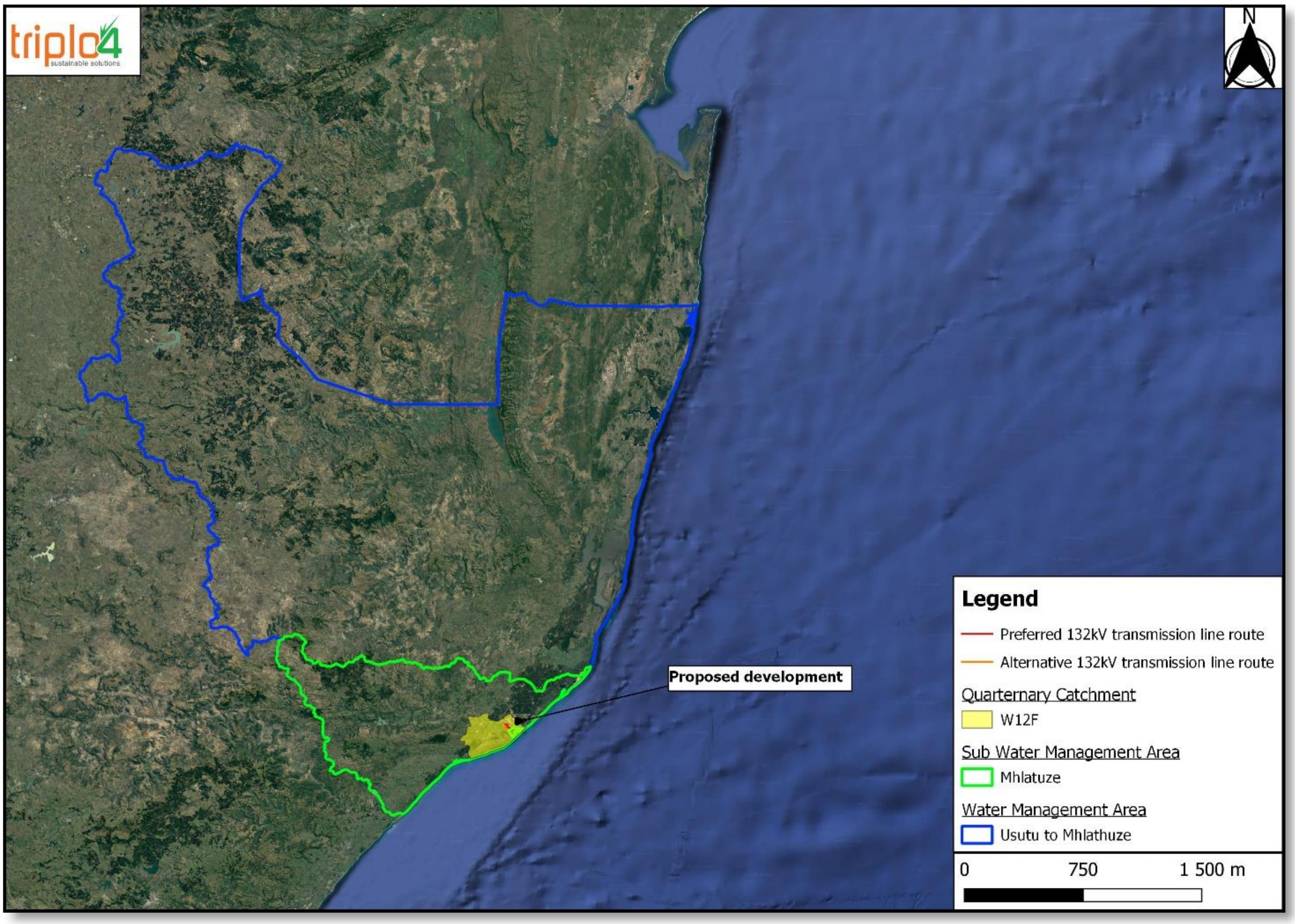


Figure 6-8: Map of the WMA, sub-WMA and Quaternary Catchment that fall within the proposed development

6.1.9.3 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 Routes. Only a small portion of both of the aforementioned routes do not occur within the FEPA Estuary. Upon the site visit conducted, it was determined that the Preferred and Alternative Routes occur in a swamp forest and wetland environment which have the habitat to host red data species, thus showing the importance of these systems, as per figure 6-9 below.

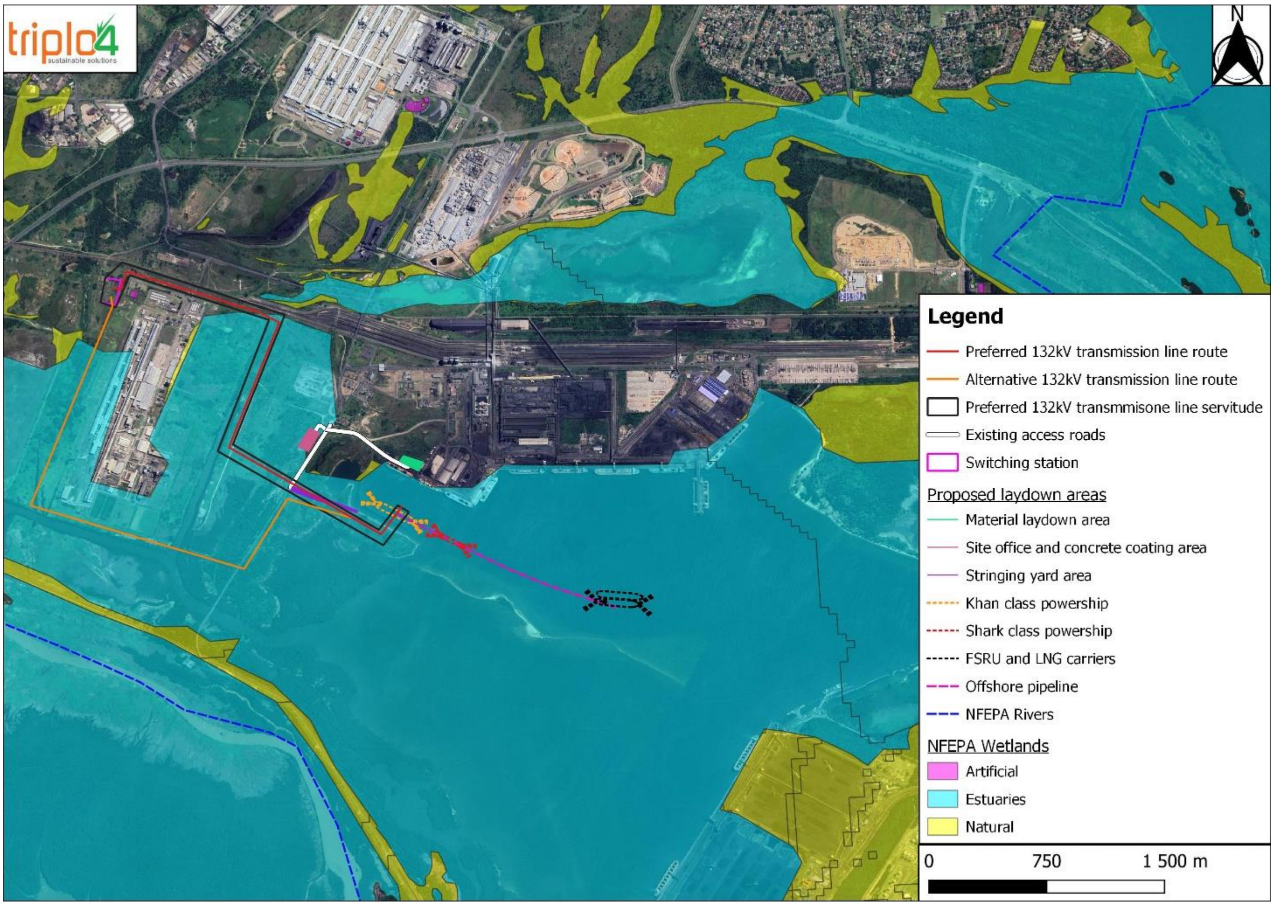


Figure 6-9: Map of the FEPA Rivers and Wetland in relation to the proposed development, from the NFEPA dataset.

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.

Wetland Delineation

A total of twenty-six (26) watercourses were identified within the 500m assessment radius (as per figure 6-10 below). The classification of these watercourses are: one (1) artificial dam, one (1) estuary/port waters, three (3) channelled valley bottom wetlands, two (2) depression wetlands, five (5) floodplain wetlands, four (4) unchannelled valley bottom wetlands, six (6) hillslope seepage wetlands and four (4) 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. In terms of extreme weather events, wetlands can have socio-economic value by acting as buffers against these events.

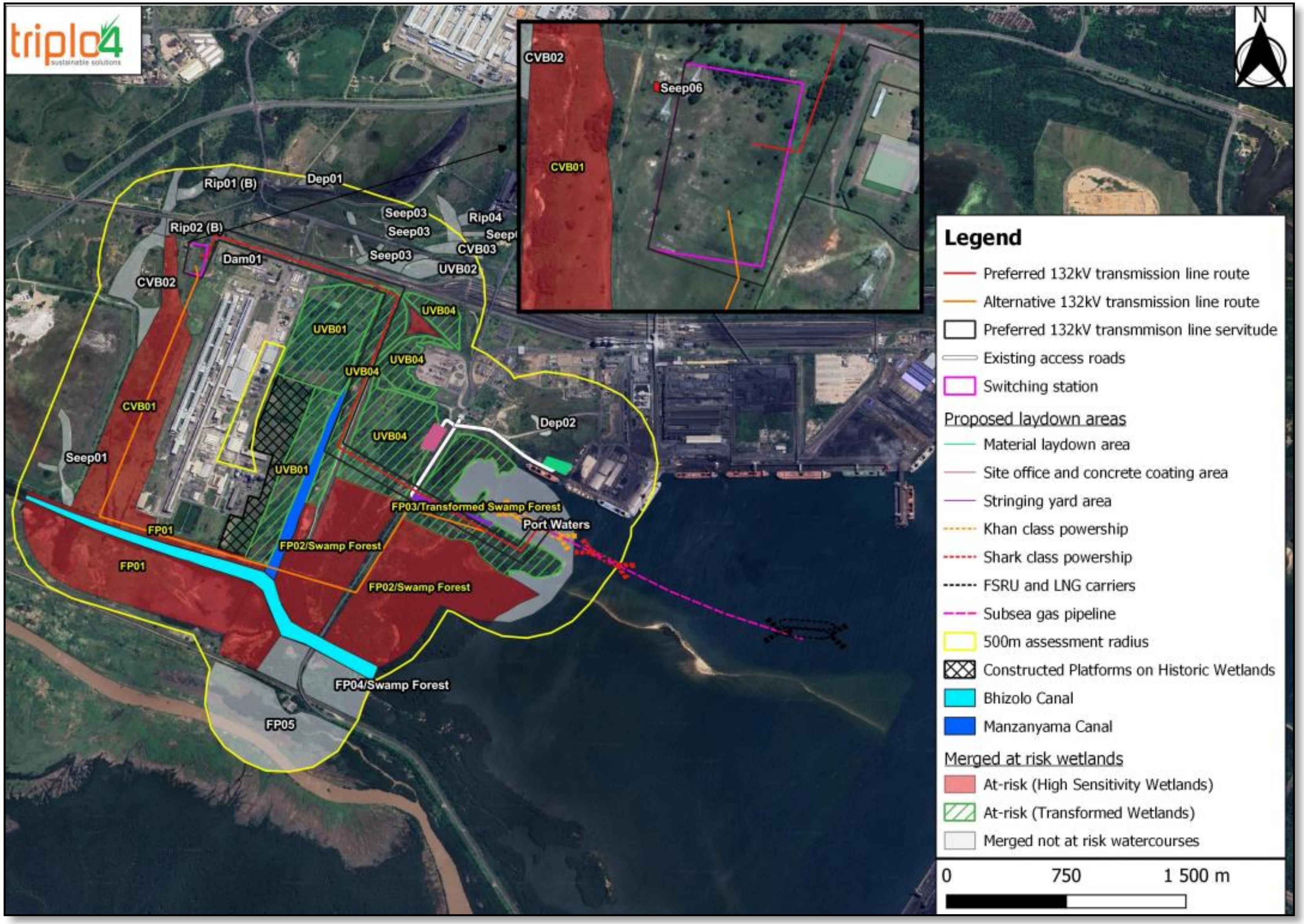


Figure 6-10: Map of the in-field delineations of the watercourses identified at the proposed development site and 500m assessment radius.

Aquatic Assessment

Six assessment sites were investigated (refer to Figure 6-11 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).

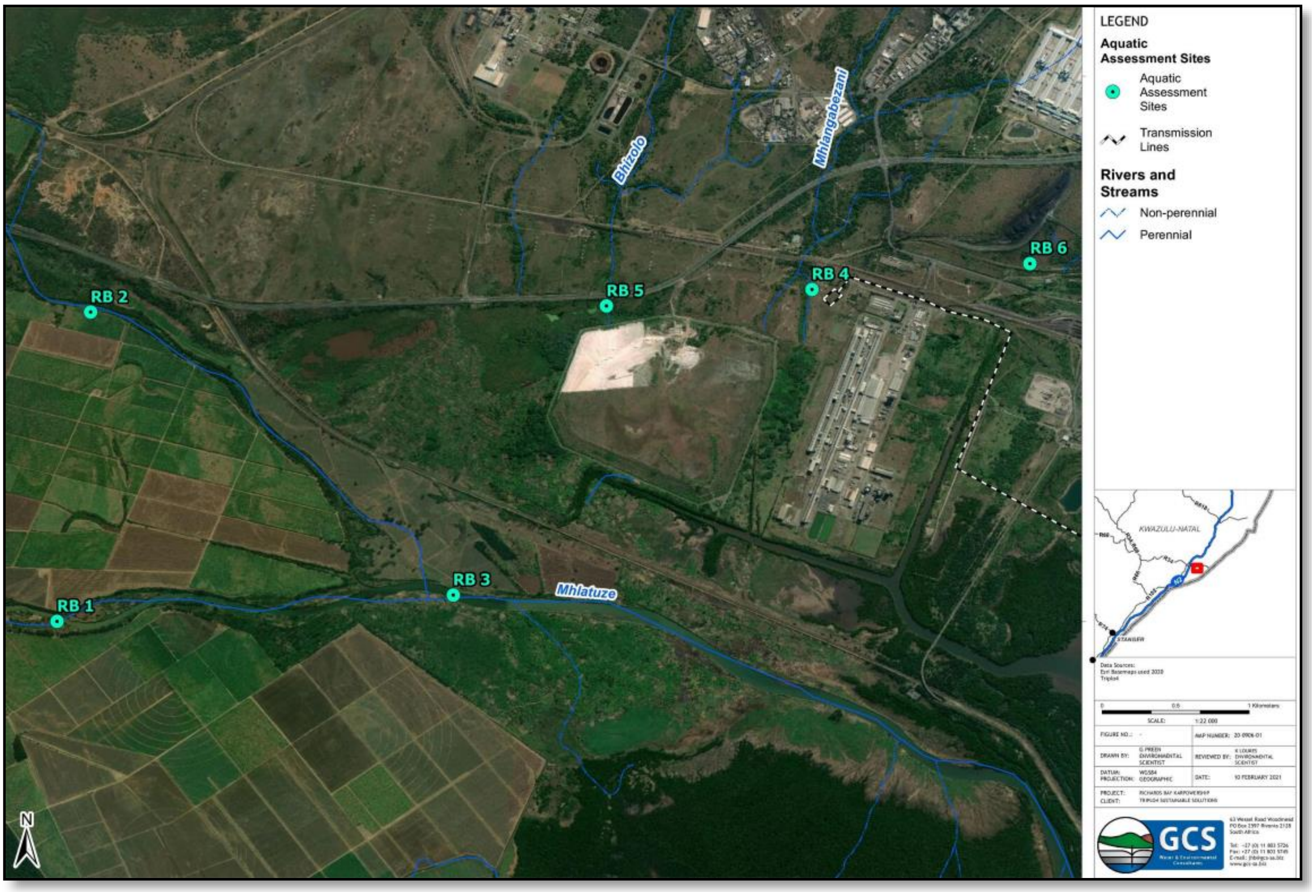


Figure 6-11: Aquatic Assessment Sites for the proposed development.

6.1.10 Fauna and Flora

6.1.10.1 Vegetation Types

According to Mucina and Rutherford (2006), there are two vegetation types within the Karpowership site: Subtropical Alluvial Vegetation (Aza 7) and Maputaland Coastal Belt (CB1). This vegetation is mapped in the National Vegetation Map of 2018 (Mucina & Rutherford, 2018). The map indicates that Swamp Forest and Mangrove Forest occur adjacent to the Karpowership site.

The site has been heavily modified in several areas, and as a result, there are several sections traversed by both the preferred and alternative routes that comprise ruderal and weedy vegetation with large numbers of alien invasive species. As the site is located within a Port/ Harbour zone, it is largely disturbed. The areas traversed by the transmission line options have been divided into several different vegetation types, the descriptions of which are outlined in Table 6-26-2.

The presence of the estuary, and several canals structured around the river provide a range of habitats for both plants and animals. There is thus a salinity gradient from the estuary inland of these flooded areas. The gradient allows for the presence of mangroves and associated mudflats with some salt marsh species close to the estuary, with a change to reed beds (dominated by *Phragmites australis*) as the water becomes fresher inland. On the edges of freshwater streams, canals and within permanent wetlands, swamp forest is present (indicated by the presence of *Ficus tricopoda*). Dry land allows for the development of *Vachellia*-dominated bushveld vegetation with scattered *Syzygium cordatum* trees.

The area is complex in its vegetation and habitat types (Figures 6-12 and 6-13), and descriptions of the ecological importance can be seen in Table 6-26-2.

Table 6-2: Summary of habitat types delineated within the field assessment area of the proposed development

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Transformed	Very Low	Very low	Very Low	Very High	Very Low
	No natural habitat remaining.	Several major current negative ecological impacts.		Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality	
Modified	Very Low	Very low	Very Low	Very High	Very Low
	No confirmed and highly unlikely populations of SCC.	Several major current negative ecological impacts.		Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality	
Degraded	Low	Low	Low	High	Very Low

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
	< 50% of receptor contains natural habitat with limited potential to support SCC.	Several minor and major current negative ecological impacts.		Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	
Mangroves	Very High	Very High	Very High	Low	Very High
	Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type.	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types.		Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore	
Reed Beds	Medium	Low	Low	High	Very Low
	> 50% of receptor contains natural habitat with potential to support SCC.	Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Several minor and major current negative		Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
		ecological impacts.			
Swamp Forest	Very High	Very High	Very High	Low	Very High
	Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type.	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types.		Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore	
Bushveld	Medium	Low	Low	Medium	Low
	Confirmed or highly likely occurrence of populations of NT species	Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Several minor and major current negative ecological impacts.		Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality	

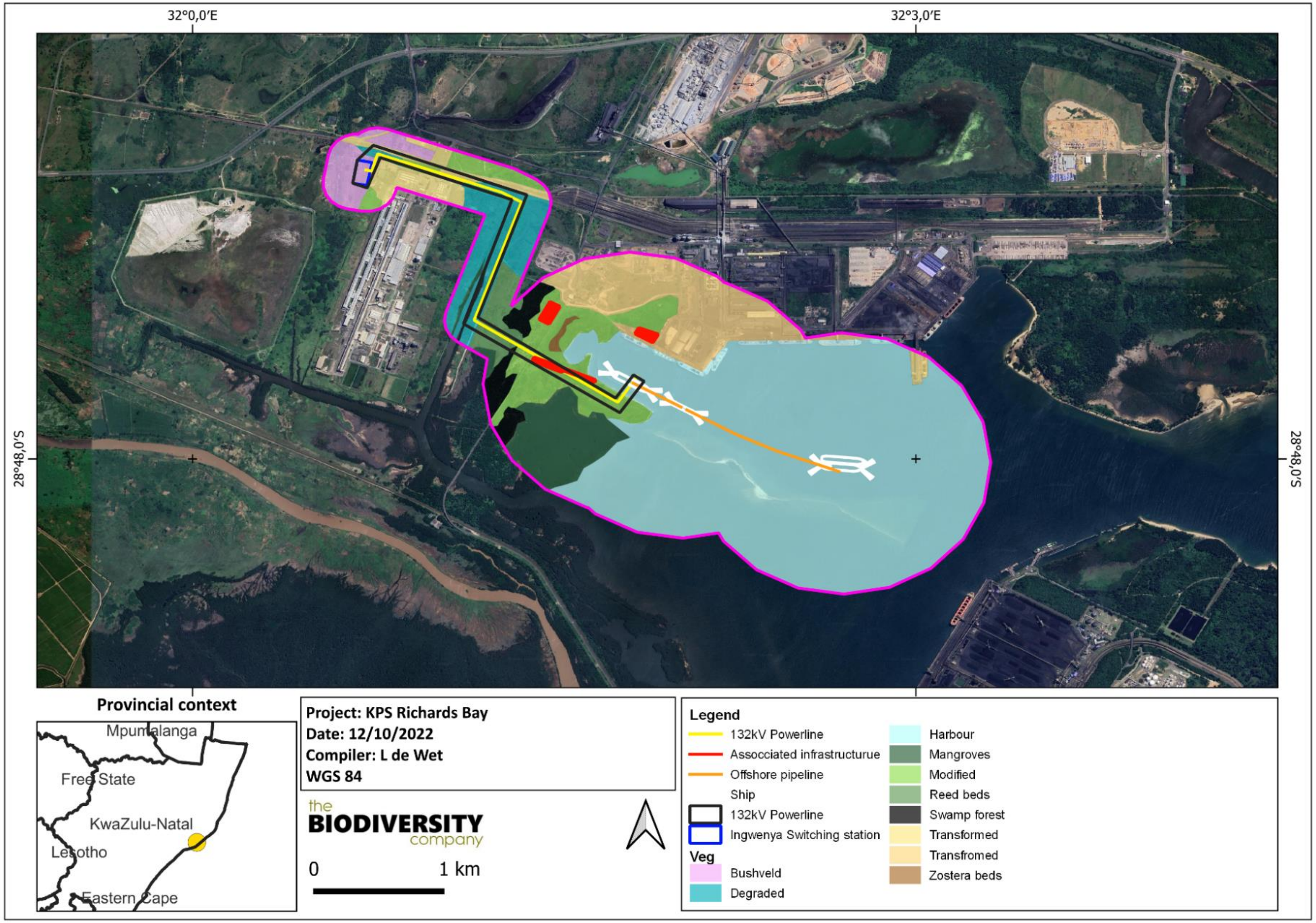


Figure 6-12: Site specific Vegetation Type

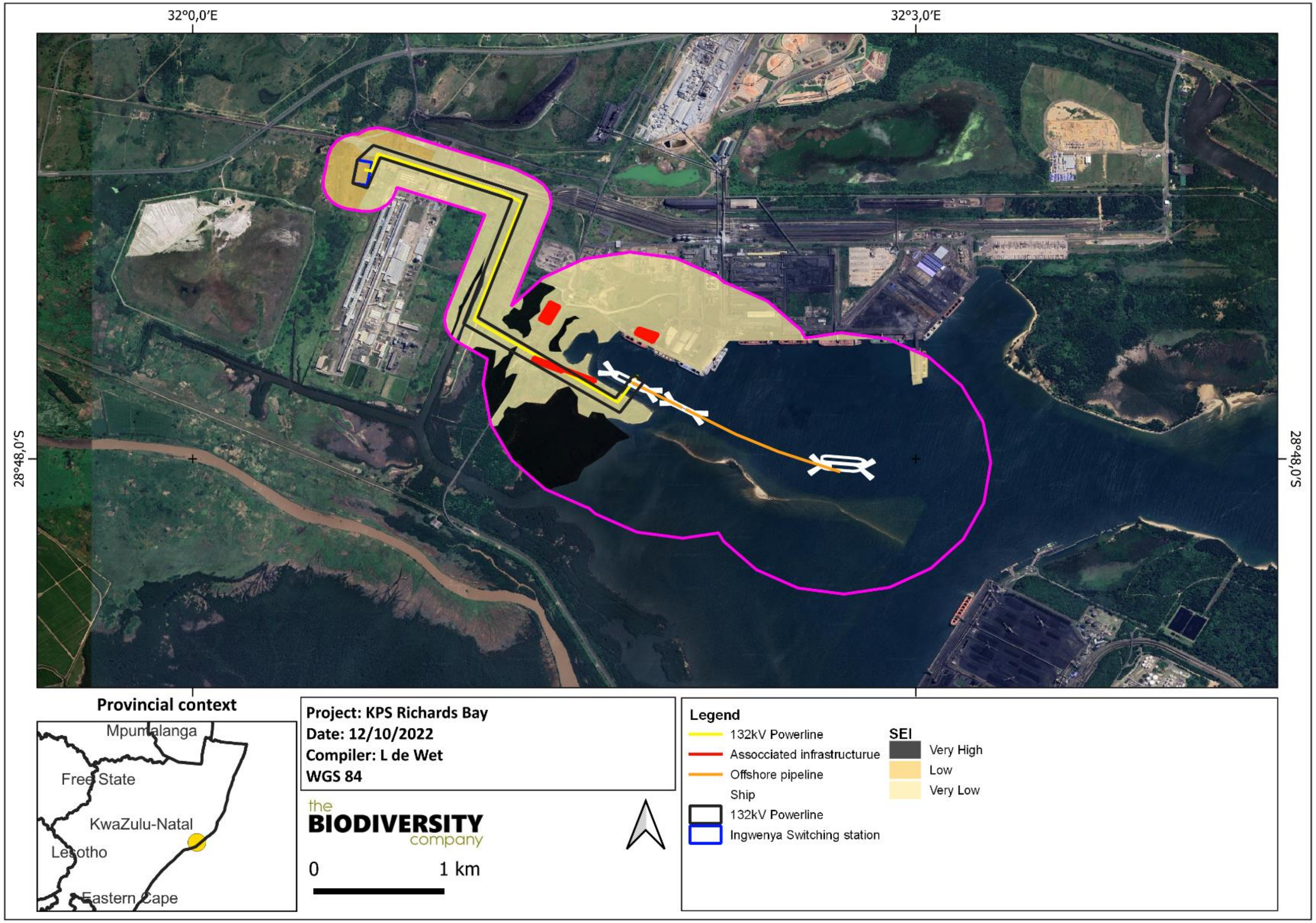


Figure 6-13: Site specific Ecological Importance

6.1.10.2 Critical Biodiversity Area and Protection Level

The study area falls within a CBA listed as irreplaceable which encompasses all areas that are currently in a natural or near natural state. The planned layout is located almost entirely in an Irreplaceable CBA. Richards Bay Game Reserve, which is also an Important Bird Area (IBA) 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 (Figure 6-14).

Ecosystem protection level is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. The proposed development is located within a WP and MP ecosystem (Figure 6-15).

Overall, 7 species of Conservation Concern were expected from the study area, however, no SSC were recorded from the site.

Overall, 22 species of Protected Species were expected and have been recorded from the study area. Of these fifteen (15) are listed on Schedule 12 of the Provincial Conservation Ordinance, and Seven (7) are on the National List of Protected Trees.

Some Protected Species recorded from the site include the Swamp Forest dominant tree *Ficus trichopoda*, as well as the mangrove trees (*Rhizophoramucronata*), all of which are on the National List of Protected Trees. *Sideroxylon inerme*, and *Mimusops caffra* also protected trees were also recorded from the site. In addition, some geophytic species from the Iridaceae family were recorded, these are protected in terms of the Provincial Conservation Ordinance. One orchid species, *Eulophia speciosa* was recorded from the severely degraded vegetation adjacent to the Port.

Aliens Invasive Plants (AIPs) occur throughout the site, primarily due to disturbance occurring as part of the Industrial Development of the area. Some recorded species include Brazilian pepper (*Schinus terebinthifolius*), Siam weed (*Chromolaena odorata*), Lantana (*Lantana camara*), and Guava (*Psidium guajava*).

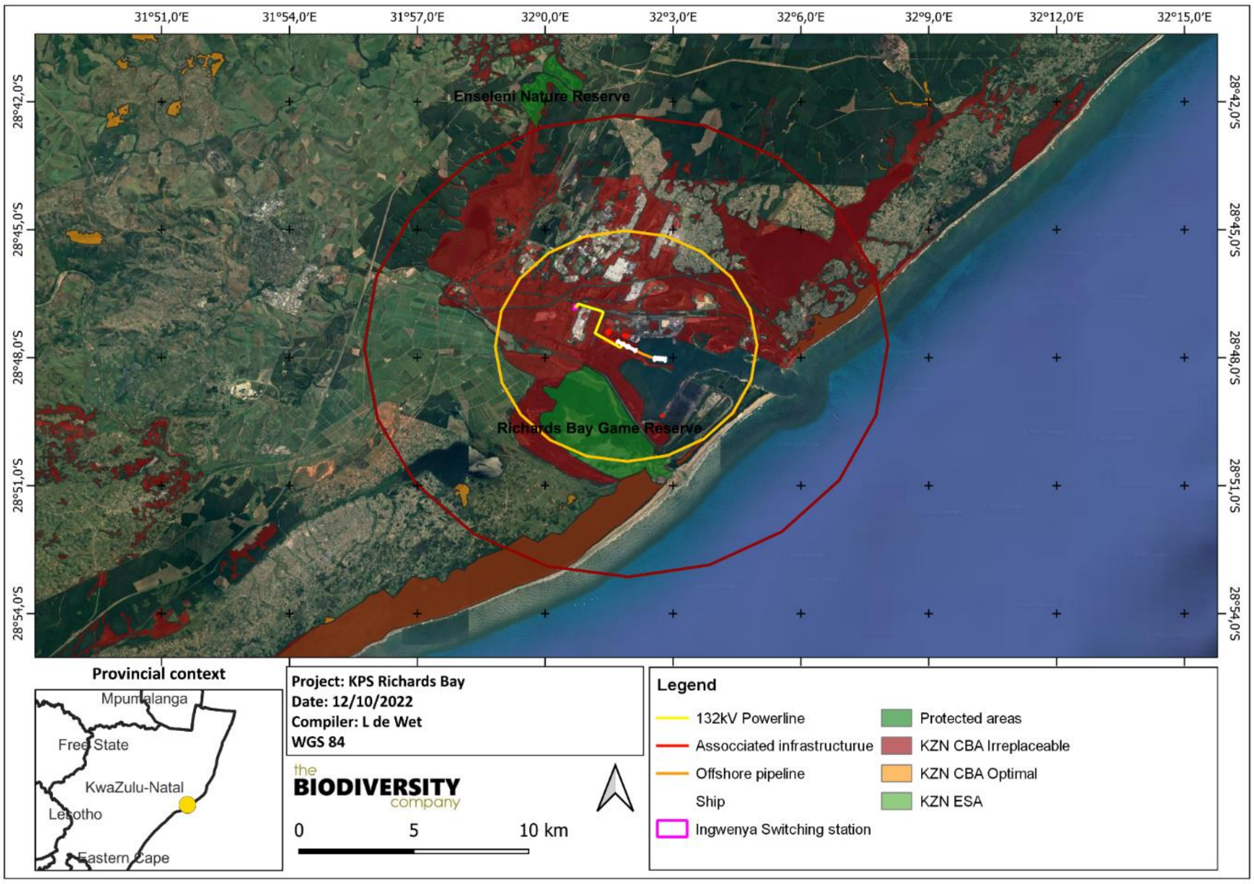


Figure 6-14: Critical Biodiversity Areas and Ecological Support Areas within and near to the site.

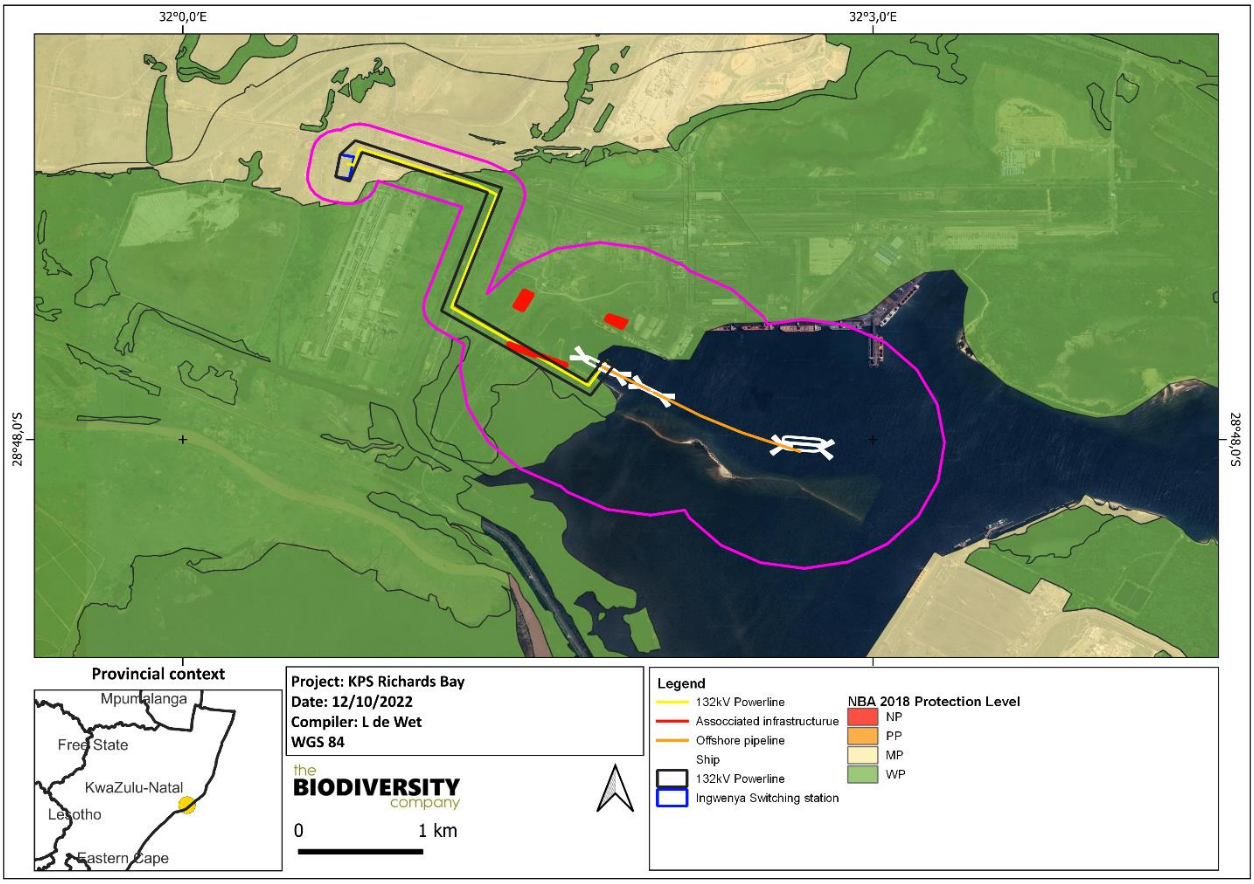


Figure 6-15: Ecosystem Protection Level

6.1.10.3 Zostera capensis

Mostert (2014) found there to be *Zosterna capensis* beds within the Mangrove swamp areas within the permanently inundated section of this isolated mangrove swamp. It is noted to be the first recorded instance of *Z. capensis* within Richards Bay in 30 years (Mostert 2014). The location of the *Z. capensis* beds (which are of conservation importance) is approximately 70m from the proposed laydown area and >70m from other proposed infrastructure. It should be noted that this wetland and associated area of mangroves and *Z. capensis* was formed artificially after the dredging of this section of the bay (the 600 series).

Attempts were made to confirm the presence of the *Zostera capensis* in this area but the mangroves surrounding the permanently inundated areas were dense and the centre inaccessible. In addition, a drone was used to attempt to access these areas and confirm the presence of *Zostera* however, the water was not clear and confirmation could not be made. It is assumed that the beds are still present. However, the location of the ancillary infrastructure is not expected to impact any *Zostera*.

The absence of any *Zostera capensis* beds surrounding the sandspit and beach adjacent to the berthing site of the powership were confirmed during the site visit conducted by the ecological specialist in April 2021.

6.1.10.4 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 6-16 below. One of the SCC species was recorded on site: Hippopotamus (*Hippopotamus amphibius*).

Reptile species recorded for 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 6-16 below.

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

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 6-16: Mammal and Reptile Species of Conservation Concern and Likelihood of Occurrence.

Two amphibians have been recorded at 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.

6.1.10.5 Avifauna

The project area is surrounded by a range of bird habitats, primarily estuarine, but also freshwater wetlands to the north and south of the estuaries, marine and coastal habitats to the east of the estuaries and limited terrestrial habitats inland of this.

While the Richards Bay Estuary is dominated by a working harbour, most of the uMhlathuze estuary has been set aside as a sanctuary area, namely, the Richards Bay Game Reserve. The protected area, often referred to as the Sanctuary, is an Important Bird Area (IBA). Despite being a working harbour, the Richards Bay Estuary also contains significant areas of bird habitat, including a long sandspit and extensive mudflats known as the Kabeljou flats, recognised as important for waders and terns (Cyrus & Vivier 2014), and the eChwebeni Natural Heritage Site (near the Coal terminal) of conservation significance and consisting of mud flats and an ecologically sensitive mangrove area providing suitable breeding environments for numerous bird species (Figure 6-17).

The sandspit which separates the intertidal flats from proposed berthing area of the Powerships and FSRU, within the Richards Bay Port, is an important roosting area for waterbirds, particularly waders and terns. Sandflats are also prevalent on shoreline edges in undeveloped areas of the Richards Bay Estuary.

Figure 6-17: Map of the core study area (delineated by the yellow line), showing the locations of the estuaries, the sandspit, Kabeljou flats, Thulazihleka Pan and eChwebeni National Heritage Site in relation to the location of the Powerships (within red box).

The Richards Bay and uMhlathuze Estuaries have long been recognised as important in terms of the diversity and abundance of bird populations that they support, providing extensive and varied habitat for waterbirds. Indeed, out of the 42 South African estuaries with the highest numbers of birds, the combined Richards Bay - uMhlathuze Estuary was ranked top in terms of species richness (numbers of species recorded, not counting vagrant species), 11th in terms of total numbers of birds, and third overall in terms of conservation importance for estuarine waterbirds in South Africa (Turpie, 1995).

Excluding exotic and vagrant species, some 91 non-passerine waterbird species have been recorded in seasonal counts of the Richards Bay and uMhlathuze Estuaries, belonging to ten different taxonomic orders (Table 6.3). Of these, 70 species are South African residents, and 21 species are palearctic migrants. Vagrant species are extremely rare and, together with exotic species, are of no conservation importance.

Table 6-3: Taxonomic composition of the waterbirds recorded in the estuarine habitats of the study area.

Common groupings	Order	SA Resident species	Palearctic migrant species	Total
Waterfowl	Podicipediformes (Grebes)	1	-	**1**
	Anseriformes (Ducks, geese)	11	-	**11**
	Gruiformes (Rails, crakes, gallinules, coots)	7	-	**7**

Common groupings	Order	SA Resident species	Palearctic migrant species	Total
Cormorants, darters, pelicans	Pelecaniformes (Cormorants, darters, pelicans)	6	-	**6**
Wading birds	Ciconiiformes (Herons, egrets, ibises, storks, openbill)	18	-	**18**
	Phoenicopteriformes (Flamingos)	2	-	**2**
Waders, gulls, terns	Charadriiformes: Waders	9	19	**28**
	Charadriiformes: Gulls	2	-	**2**
	Charadriiformes: Terns	6	2	**8**
Kingfishers	Alcediniformes (Kingfishers)	4	-	**4**
Birds of prey	Falconiformes (Birds of prey)	4	-	**4**
	Strigiformes (Owls)	-	-	**-**
Total		**70**	**21**	**91**

The last five counts conducted over the period 2020-2022 have recorded an average of just 14 species with the highest count being 18 species in April 2022. The range of months counted are not sufficient to show seasonal trends.

Since 2012, both the numbers of birds and the numbers of species recorded have been much lower than in earlier counts, and the trend is suggestive of a catastrophic decline in bird numbers. There are good reasons to believe that there has been a dramatic reduction in bird numbers, and that this trend could continue, given the development and expansion of the port, with increases in pollution and industrial and recreational activity, habitat loss due to agriculture and urban expansion in the surrounding areas, and external factors affecting water bird populations at broader scales.

The most dramatic declines have been in the numbers of migratory waders, who primarily depend on the open mudflats for foraging. These are mainly located in the Richards Bay Estuary. The numbers of many of these species have plummeted nationally (Turpie et al. 2019) and globally, as a result of habitat degradation and loss on their breeding grounds as well as their wintering areas. The most recent counts have also taken place in highly polluted conditions.

While the relatively disturbed terrestrial areas in the vicinity of the Port and associated infrastructure are likely to be used to some extent by indigenous terrestrial avifauna, it will tend to be the more robust, generalist and widespread species. Thus, the remaining areas of natural bush in the vicinity of the Port are not likely to be of high conservation value for terrestrial birds. Furthermore, the vegetation surrounding the port is currently covered in a fine layer of coal dust as a result of the offloading and movement of coal from transport carriers to the coal terminal and onto the ships. These areas are used by species such as Pied crows, Yellow-billed kites and smaller passerine birds. However, these birds occur in very low densities due to these areas being highly industrialised and polluted. In the context of this study, it is the larger species that are likely to be more vulnerable to collisions with the electrical infrastructure associated with the project. Note that most of the larger species that are found in or flying over the developed and semi-natural or natural areas around the port are waterbirds.

A total of 109 waterbird species have been recorded in and around the Port of Richards Bay, out of the 135 waterbird species occurring in South African wetlands (Allan 2009, cited in MER 2013). Of these, 82 are resident or local visitors (75%), while 27 are long-distance Palaearctic migrants (25%). A further 29 rare vagrant waterbird species have also been recorded. This high waterbird diversity is attributed to the wide variety of habitats in the area (MER, 2013).

The Caspian Tern, Lanner Falcon and Great White Pelican area the most common of the Red Data species in the project area of influence that have been recorded in recent counts (2020-2022).

Outside of the species of conservation concern, there are a number of species that are not on the Red Data List but are likely to be at risk of collision and/or electrocution. These species are shown in Table 6-4 and are considered high risk based on their occurrence/abundance within the project area of influence and their sensitivity to disturbance (noise, light) and their proneness to collision with the proposed transmission lines.

Table 6-4: Bird species (that are not Red Data listed) that are considered at risk

Common name	Scientific name	Collisions	Disturbance
African Fish Eagle	*Haliaeetus vocifer*	X	X
Egyptian Goose	*Alopochen aegyptiaca*	X	
Grey Heron	*Ardea cinerea*	X	X
Goliath Heron	*Ardea goliath*	X	X
Hadeda (Hadada) Ibis	*Bostrychia hagedash*	X	
Pied Crow	*Corvus albus*	X	
Spur-winged Goose	*Plectropterus gambensis*	X	
Woolly-necked Stork	*Ciconia episcopus*	X	X
Whimbrel, Common	*Numenius phaeopus*	X	X
Tern, Swift	*Sterna bergii*	X	X
Tern, Lesser Crested	*Sterna bengalensis*	X	X
Tern, Common	*Sterna hirundo*	X	X
Tern, Little	*Sterna albifrons*	X	X

6.1.11 Estuarine and Marine Environment

The development site and development footprint falls within an Estuarine Functional Zone (EFZ) of the Richard Bay estuary, with areas notably transformed and currently impacted by port development and ongoing activities. The area has undergone drastic historical modifications including infilling, canalisation of rivers, quay wall construction, capital 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 disturbed macrobenthic community. It follows that the development site and development footprint contains very high sensitivity aquatic biodiversity features associated with the Richards Bay estuary.

Richards Bay has been explored as a site suitable for marine aquaculture, specifically finfish cage culture, due to warm water temperatures and sheltered conditions. An Aquaculture Development Zone (ADZ) study has commenced in the Port of Richards Bay (DFFE 2020), but no details are available on this as yet.

6.1.11.1 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).

The uMhlathuze/Richards Bay estuarine system remains a national priority system, and is recognised for its importance for birds and as fish nursery habitat (van Niekerk, Turpie and Lamberth, 2019). It is rated as an Endangered ecosystem (ecosystem threat status) and thus at risk of losing vital aspects of it structure, function and composition, and it is poorly protected (Van Niekerk, Skowno, et al., 2019).

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) refer to Figure 6-18 below. Despite the historical separation, Richards Bay still functions as an estuarine system due to the underdeveloped areas being shallow in nature (Vivier and Cyrus, 2014a).

Figure 6-18: Landscape features of the Richards Bay Estuary (after CRUZ 2009, in MER 2013)

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 6-19 below shows the delineation of Richards Bay Estuarine, as well as the neighbouring uMhlathuze Estuary to the south.

Figure 6-19: Estuarine functional zone of the uMhlathuze/Richards Bay estuarine systems.

The size of the Richards Bay EFZ is approximately 5 509 ha, comprising 3 543 ha (or 64 %) developed and/or transformed area and 1 966 ha (or 36 %) natural habitat, of which approximately 869 ha is open water habitat (Van Niekerk et al., 2019). Tidal currents and circulation have been significantly modified by the historical change in configuration from the natural, joined, shallow-water embayment to the current divided system (DEA, 2017a). 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, 2017a). Freshwater inputs into the system are via the Mzingazi

River/Canal (draining from Lake Mzingazi), Manzamnyama and Bhizolo canals (DEA, 2017a), thus freshwater mixing processes are mostly confined to these restricted upper areas.

By virtue of port development, as well as urban and agricultural development, the uMhlathuze/Richards Bay estuarine complex has experienced devastating, mostly irreversible, habitat loss, transformation, and degradation (Begg, 1984; MER, 2013). 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 because of port development.

Notwithstanding the above, the importance of the transformed Richards Bay (and uMhlathuze Estuary) in supporting critical ecosystem services, such as habitat provision and feeding grounds for fish and crustaceans, has long been recognised (Begg, 1984; Cyrus and Forbes, 1996; Forbes et al., 1996; Weerts, 2002). It still supports habitats of conservation significance, including intertidal salt marsh, reeds and sedges, mangroves, swamp forest, intertidal and shallow subtidal sand banks and mudflats, the subtidal benthic zone, Zostera beds and the water body itself (AECOM, 2014; Begg, 1984; Cyrus and Vivier, 2014b; MER, 2013; van Niekerk and Turpie, 2012; Weerts, 2002).

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 mudflats, 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, which support a high diversity and abundance of macrobenthos (AECOM, 2014).

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 the proposed Powerships 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 (AECOM, 2014). As with the mudflats, sandflats are considered an important nursery ground for juvenile fish and serve as a habitat for birds.

The sandflats, mudflats and mangroves that make up the Kabeljous Flats were ranked in the top three most important habitats of the 12 habitat types found in the port, and were consequently categorised as of high conservation significance (CSIR, 2005 cited in CRUZ, 2009). In comparison, the harbour (marine embayment) and deep-water sediments, and intertidal beaches were rated the three least important habitats of 12 habitat types within the harbour boundaries. An overview of the sensitive habitats of Richards Bay is provided in Figure 6-20 below. The development site falls within the area marked as Development Areas. A photographic record of the site observations is provided in the Estuary, Coastal and Marine Assessment Report, Appendix 9-B4.

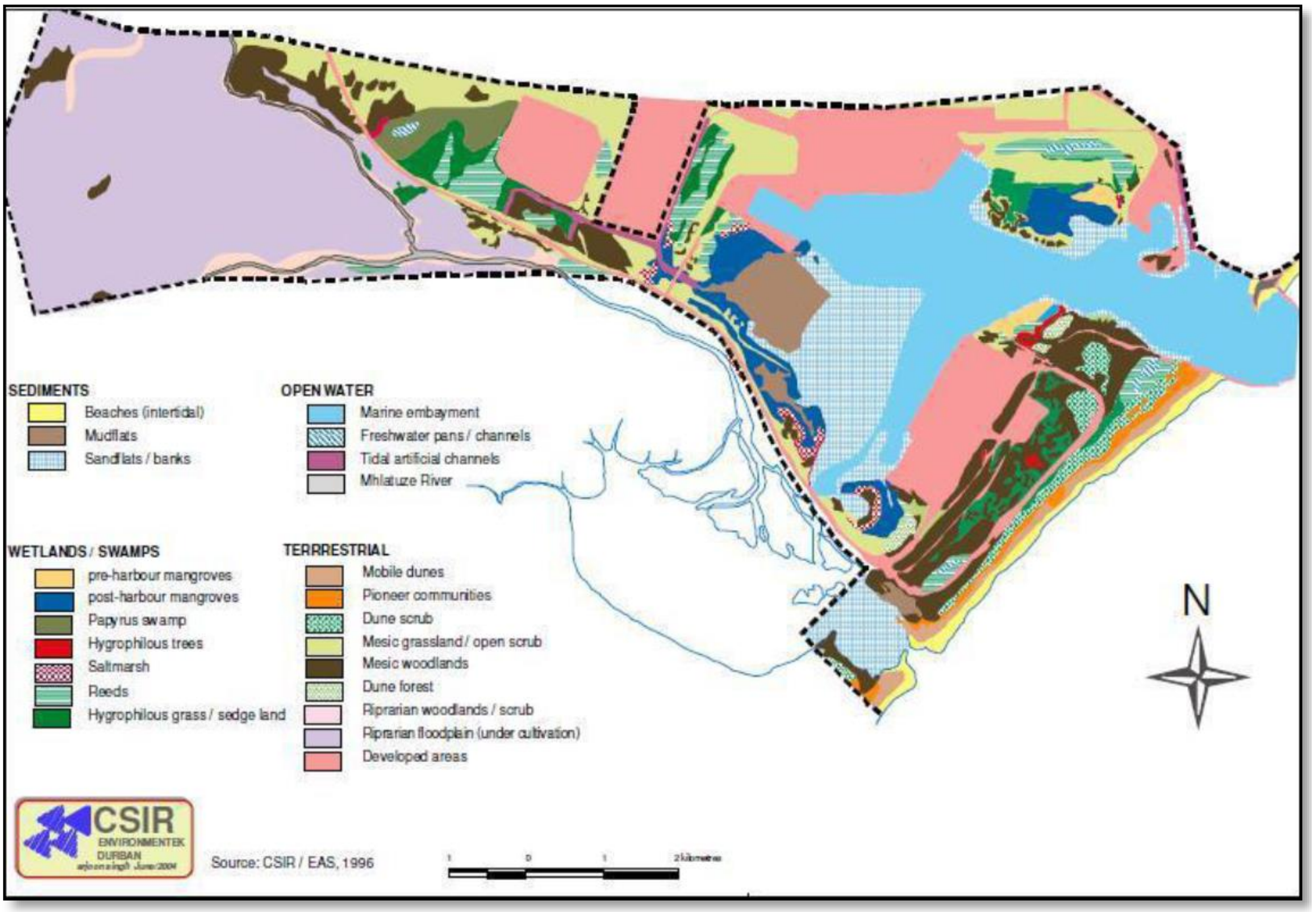


Figure 6-20: Sensitive habitats of Richards Bay Estuarine.

6.1.11.2 Oceangraphy and Hydrodynamic

The tides in Richards Bay are semi-diurnal (with a period of 12 hours 23 min) and have a mean spring and neap tidal range of 1.84m and 0.51m.

Tidal flows are strongest near the port entrance in the deep navigation channel and are considered to range from approximately 0.03 m/s during neap tides to about 0.17 m/s during spring tides.

Various wave climates and wind conditions result in different wave conditions within the port. Wave intrusions into the port from the open sea are markedly dampened at the entrance. However, under strong south westerly winds, waves impinge on the port's windward northern areas whilst strong north-easterly winds generate the reverse effect. Within the port, it is apparent that the sand spit plays a shielding role for the existing berths and the shallow mudflats; the degree of protection depending mainly on the wind direction (van Ballegooyen et al., 2015).

6.1.11.3 Water Quality

Taking all water quality parameters into account (i.e. Salinity, pH, Temperature, Dissolved Oxygen, Turbidity and Suspended Solids, Nutrients, Chlorophyll-a and Trace Metals), the overall water quality for sites 3 and 7 (near the proposed locations for the Powerships and FSRU) was rated as good and excellent, respectively, according to the integrated water quality index (CSIR, 2020) (Figure 6-21 below), with the only concerns being high chlorophyll-*a* concentrations in winter, and high orthophosphate concentrations in summer. It was also noted, that Trace metal concentrations measured in sediment in the Berth 600 Basin, where the proposed project will be located, showed that the area is highly contaminated compared to other port areas.

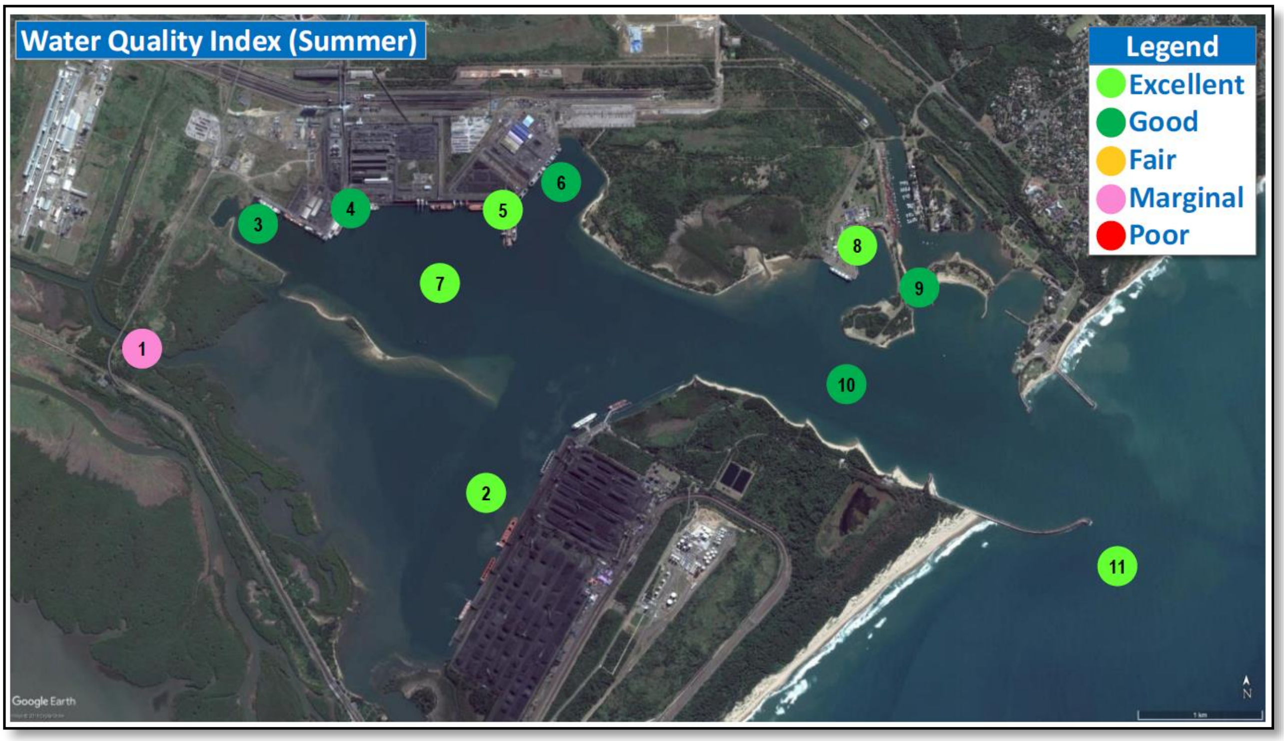


Figure 6-21: Water quality index categories for surface water monitoring sites for the summer 2020 survey (CSIR, 2020)

6.1.11.4 Marine Fauna

Zooplankton

Zooplankton is commonly described as organisms floating in the water column and that have limited mobility. This group comprises predominantly small crustaceans, namely calanoid copepods, larvae of benthic fauna, single celled organisms as well as larger organisms, like mysid shrimps and jellyfish.

Since construction, there has been a reduction in estuarine zooplankton species density in the port of Richards Bay and adjacent Mhlatuze Estuary. Higher zooplankton abundances are present in the port compared to the adjacent estuary. This is mainly attributed to the high number of *Oithona* spp. present in the port and the less stable aquatic environment in the shallow estuary. Salinity and temperature were the main environmental factors that governed the distribution of zooplankton abundance. Abundance varied seasonally within the port and was highest during spring and summer.

Ichthyoplankton

Several studies have recorded the occurrence of larvae and eggs of both marine and estuarine fish species in the port. A total of 28 species that occurred are either partially or wholly dependent on estuaries to complete their life cycle. These species dominated in terms of density within the port.

Subtidal Macrobenthos

Macrobenthos, also known as benthic invertebrates, are relatively sedentary, long-lived organisms residing within the sediment or at the sediment-water interface and possess various physiological and/or behavioural adaptations to tolerate extreme fluctuations in the physical and chemical conditions of the estuarine environment. The long-term ecological monitoring programme of the Port of Richards Bay (CSIR, 2020), indicates that, the macrobenthic community within Bay is typical of estuarine embayments on the South African east coast. The macrofaunal density in the proposed Powerships and FSRU location region is relatively low, especially compared to the mudflat habitat.

Macrocrustaceans (Prawns)

Regarding macrocrustaceans, Richards Bay as well as the Mhlathuze Estuary are major providers of prawn nursery grounds in the KZN region. Penaeid prawns in the western Indian Ocean are typically associated with suitable estuarine nursery grounds.

The prawn stocks on the Thukela Bank off the coast of northern KZN, South Africa’s former prawn trawling area, are derived largely from KZN nursery grounds, particularly the large estuarine systems of St Lucia, Richards Bay and Mhlatuze (DWAF 2004, Forbes & Forbes 2013).

Studies on the macrocrustaceans utilising the canals and the Kabeljous Flats yielded 34 species, comprising 14 prawns, one sand prawn and 20 crab species. The most abundant species on the Kabeljous Flats was the small pelagic shrimp, *Acetes erythraeus*, followed by *Metapenaeus monoceros* and *Marsupenaeus japonicus* (CRUZ, 2009). These areas are expected to support significant food resources for the predacious fish populations of the port (MER, 2013). The importance of the harbour as a nursery for estuarine crustacean species of considerable ecological and commercial value must be considered in future development plans (Weerts et al., 2003).

Fish and Elasmobranchs

Being an estuarine system, the undeveloped, shallower sections of the Richards Bay Port function as an important nursery ground for many fish species. Fish 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).

The Richards Bay Estuary is ranked as the third most important estuary out of 247 South African systems in terms of its importance for fish populations (Turpie et al., 2002).

Of the 100 fish found in previous surveys of the Richards Bay Port, 53% of species use the estuary as a nursery area, and 14% are important in the commercial line fisheries.

Of the species that use the port as a nursery area, Perch *Acanthopagrus vagus* and Elf *Pomatomus saltatrix* are listed as Vulnerable on the IUCN Red List and Dusky kob *Argyrosomus japonicus* is listed as Endangered (Carpenter *et al.* 2015, Fennessy 2020, Mann *et al.* 2014). Also found in the port are Bonefish *Albula vulpes*, Catface rockcod *Epinephelus andersoni,* and the Bronze bream *Pachymetopon grande* which are all listed as Near Threatened in the IUCN Red List (Adams *et al.* 2012, Fennessy 2018, Mann *et al* 2014). Additionally, the Vulnerable Yellowbelly rockcod *Epinephelus marginatus* and Mozambique tilapia *Oreochromis mossambicus* are also found in the port (Bills 2019, Pollard *et al.* 2018).

Studeis had emphasised the ecological importance of the Lower Bhizolo Canal and Kabeljous Flats as nursery habitat, the varying habitat requirements of different fish communities, and the importance of maintaining such varied habitats in the Richards Bay harbour to ensure the system continues to support diverse fish assemblages.

Common species encountered in the Port include mullet *Crenimugil buchanani* , *Chelon dumerili*, and *Planiliza macrolepis*, as well as spotted grunter *Pomadasys commersonnii*, slimy *Leiognathas equula*, target fish *Terapon jarbua*, and the bream *Acanthopagrus berda*, (Beckley et al., 2008; Vivier and Cyrus, 2014b).

Several shark and ray species have been recorded 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.* These species are all listed as either Vulnerable (VU), Endangered (EN), or Critically Endangered (CR) on the IUCN Red List.

Marine Megafauna

While there are numerous whale species that utilise the warm waters of the South African east coast for feeding or during migrations, they prefer the offshore marine environment and generally do not venture into KZN ports. Sharks and dolphins are commonly observed within the Port of Richards Bay, and turtles less so.

The Humpback dolphin (*Sousa plumbea*) occurs along inshore areas in water not deeper than 25 m off the east coast of Africa. Along the KZN coastline, they are most commonly found in large estuarine systems. The Richards Bay area is the preferred habitat for this species, and the harbour entrance serves as important feeding area (Atkins et al., 2004; Johnson, 2012; Keith et al., 2013). Consequently, the Humpback dolphin regularly occurs within the port. The conservation status of this species has declined from Near-Threatened to Endangered according to the IUCN Red List of Threatened Species due to declining sighting rates and group sizes (Braulik et al., 2017), and it is considered to be South Africa's most endangered marine mammal (IUCN CSG, 2016). Given the sensitivity of this species, Keith *et al.* (2013) suggested that further development of the Richards Bay Port should be carefully considered. Based on species distributions, several other dolphin species may occur in the Port's vicinity as well, *e.g.,* Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus*.

As part of the Socio-Economic Study (Appendix 9-D1), engagements were made by the specialist with local stakeholders, including the Editor-in-Chief for the Zululand Observer, who had indicated that to his knowledge, the current operation of commercial vessels at the Port has no negative effect on the dolphins.

6.1.11.5 Health Status and Biodiversity and Conservation Importance

The 2018 National Biodiversity Assessment (NBA) 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 PES of both the uMhlathuze and Richards Bay estuaries is D (*i.e.,* heavily modified), refer to Figure 6-22 below. The ecological functioning of Richards Bay is more threatened by degradation and habitat loss than by pollution and poor water quality. Nonetheless, such impacts will become more problematic with future port expansion.

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

Figure 6-22: Desktop Present Ecological Status allocated to uMhlathuze and Richards Bay estuaries in the 2018 NBA

Based on their Estuary Importance Scores, the uMhlathuze Estuary is ranked within the top 10 most important estuaries of 256 systems in South Africa and the Richards Bay Estuary is ranked the 26th most important estuarine system.

These two estuaries collectively support the largest area of mangroves in the country. Furthermore, Richards Bay is ranked third on a national level in terms of its importance to waterbird populations. Both estuaries are very important estuarine nursery areas both in terms of protecting biodiversity and also nationally important fisheries, namely Kob (*Argyrosomus japonicas*), and potentially Zambezi sharks (*Carcharhinus leucas*).

As one of only three estuarine bays in the country, the uMhlathuze/Richards Bay estuarine system is an extremely rare estuarine type and was included in the priority estuaries requiring formal protection in order to conserve South Africa's estuarine biodiversity. The 2011 biodiversity plan required 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 achieve a Recommended Ecological Category (REC) of A (natural) or best attainable state (Turpie et al., 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 both impractical and unattainable. The uMhlathuze/Richards Bay estuarine system remains a national priority system and is recognised for its importance for birds and as fish nursery habitat.

6.1.12 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 sources 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}).

Available monitoring has shown ambient SO_2 concentrations to be relatively low in the Richards Bay and below the NAAQS.

Ambient NO_2 concentrations may be attributed mostly to local sources including industrial emissions and traffic. The annual average NO_2 concentrations are very low relative to the NAAQS of 40 µg/m3 at the three City of uMhlathuze monitoring stations in 2019 and 2020.

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.

Please refer to Appendix 9-C1 for detailed Atmospheric Impact Report.

6.1.12.1 Coal Dust Issue

According to recent air quality results from Richards Bay Clean Air Association (RBCAA), it is apparent that black coal dust fallout has been an ongoing severe issue around the Port of Richards Bay and surrounding residential areas. In the latest RBCAA Air Quality Monitoring Report for September 2022 (dated November 2022), it was reported that 268 air quality complaints were received during September 2022. In comparison, in September 2021, only 9 complaints were logged. Of the 268 complaints received in September 2022, 260 were related to the coal dust issue. These complaints reflect the frustrations of the local residents from the impacts of the coal dust on their properties and health. Some of these comments recorded in the RBCAA complaints register include:

- Coal dust fall everywhere and premises have been continually covered in black dust – i.e. on vehicles, outdoor furniture, swimming pool, etc.
- Residents have to keep windows and doors close at all time. Daily cleaning, repeated every few hours, are required.
- This issue has been going for over a year.
- The black deposits can be lifted with a magnet, and the magnetic properties are deeply concerning.
- Chronic health impacts are of significant concern - constant and severe sinus infections and eye irritation, affecting adults and kids.
- Animals are also impacted with respiratory issues and skin irritations.

The source of the coal dust is the coal terminal at the Port of Richards Bay. A recent fire at the Port of Richards Bay resulted in damage to a coal conveyor. According to the monitoring report, responses were received from Transnet, indicating that volumes of coal had been drastically increased over the last 6 months, and with the increased storage, there is the potential for emissions, as well as emissions from the export activities. Transnet further indicated immediate dust mitigation measures that have been put in place to minimize emissions.

Further to this, during the September site investigation and windy conditions, significant air pollution (coal dust emission) was observed by the Marine Ecologist, emanating from the multipurpose terminal (600 Berths). The surrounding vegetation including nearby mangroves were also noted as being covered in soot. This airborne-impact is a major concern for the fauna and flora of the Richards Bay Estuary.

Figure 6-23: Coal dust emissions emanating from the multipurpose terminal (Credit: B. Clark, 29/09/2022)

6.1.13 Terrestrial Noise

Noise sensitive areas (NSA's) within the study area and surrounding area have been identified and illustrated in Figure 6-24 and Figure 6-25 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 6-24: Location of Noise Sensitive Areas

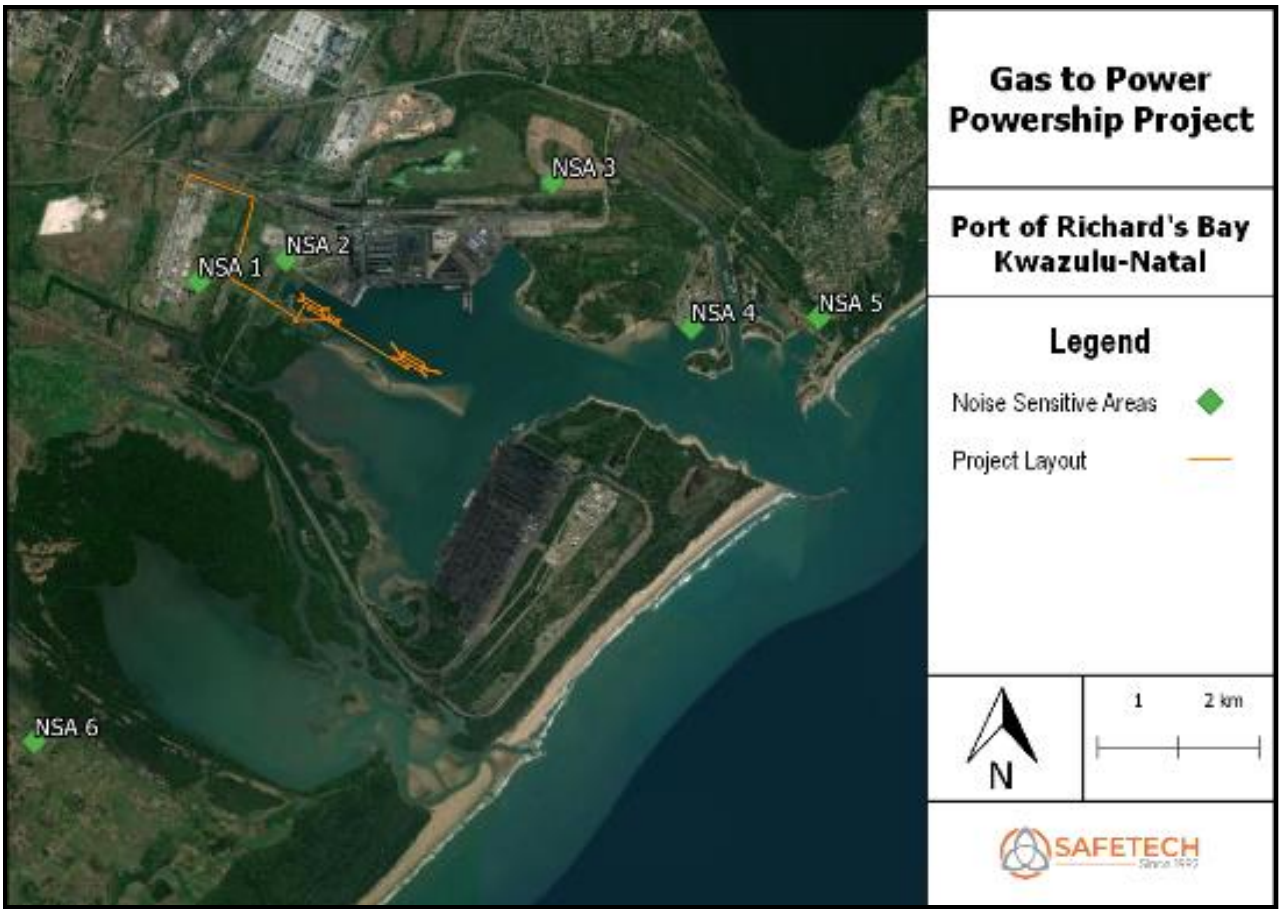


Figure 6-25: Noise Sensitive Areas.

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 6-26 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).

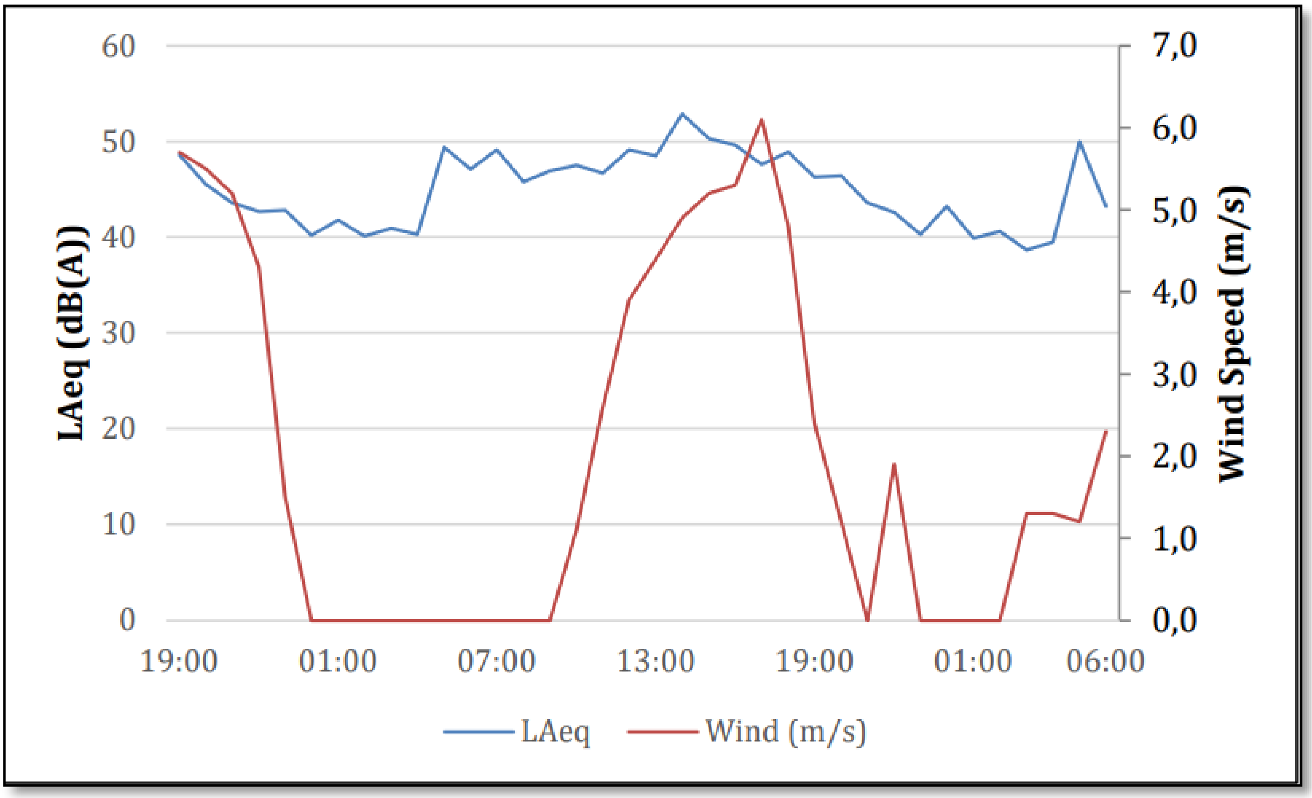


Figure 6-26: Ambient Noise Levels vs Wind Speed.

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 6-27 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 6-27: 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 noise source. As can be seen from the residual noise monitoring results, the current residual noise is not exceeding the recommended day/night rating levels of industrial districts during high wind periods. It is however highly likely that the residual will be below the SANS 10103:2008 rating limit for industrial areas during calm conditions.

6.1.14 Underwater Noise

Underwater noise levels at the Port of Richard's Bay have been measured over a 48 hour period, as an indicative sample baseline of the conditions prior to the proposed installation of Powerships (Figure 6-28 below).

Noise in the harbour during the survey was always controlled by machinery onboard ships docked at one of the terminals, when in their vicinity. Outside the harbour, i.e. south of the sandbar and on the Harbour Entrance Channel east out of the harbour, the ambient noise was generally dominated by snapping noise from marine wildlife, likely to be fish, shrimp and other crustaceans, unless a ship was passing into or out of the port with direct 'line of sight'. No ship-related noise was apparent much beyond one kilometre of the nearest dock, unless a ship was in motion nearby. This indicates that the noise at this distance had reduced to below the level of background noise.

The highest underwater noise levels were measured nearby the Coal Terminal, and these occurred where a bulk carrier vessel was passing during measurements. The measured noise level here were up to 134.4 dB SPLRMS (129.7 dB SPLRMS on average during measurements). Other high noise levels were detected in the vicinity of the Bulk Cargo Quay, especially the jetty extending from its east end. The levels here were generally high because of the vessels at the terminals on either side.

Figure 6-28: Average dB SPLRMS baseline levels from attended measurements in Port of Richard's Bay between 15th and 17th November 2021 (including proposed location of the Powerships)

6.2 Cultural and Natural Heritage

6.2.1 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, any 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 Powerships 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.

Historically the Mhlatuze Lagoon, as it was referred to in the 1940s, was connected to the sea via large sand banks that made entry into the lagoon with boats and ships near impossible. Freak accidents, such as the SS Newark (1908) did occur, where the ship was run aground in a storm.

The environment surrounding the harbour has been heavily impacted by the original harbour construction in the early 1970s. The harbour dredged the deep Thulazihleka Lake (or Mhlatuze Lagoon) and cleared areas to create a harbour entrance at the Mhlatuze River mouth. The lake was divided into two parts with the southern part of the lake becoming a sanctuary with its own newly created river mouth south of the harbour entrance.

The secondary effects were an increase in wetlands in the area, and much of the original area was flooded. Furthermore, the harbour created a larger area than the original lake and thus removed much of the original land. Areas were dredged and other areas were ‘created’ by the sand from the dredging, or the sand was dumped onto existing land. For example, 103 hectares of coastal dune was cleared along the southern dunes, and the sand was used to reclaim some of the land for the coal terminal (Zululand Observer, 1 April 1976).

In 1970s, the construction of the Richards Bay harbour was initiated. This involved dredging 25m of deposit from the lagoon and creating a direct accessible link to the ocean for the coal terminal. These excavations went through the Cretaceous deposits. Much of this material was deposited on the western side of the harbour where the Lagoon was now divided into two sections. The creation of the harbour means that the lagoon deposits were severely affected and removed all possible existing maritime heritage. There will be no maritime heritage in the harbour; it was all removed by dredging.

In 2006, Transnet expanded the port and excavated the new Berth 306 in the location of the study area. Again, excavations went beyond the Cretaceous levels removing all heritage.

In summary, the historical maps and history of the lagoon and Harbour shows that all remotely possible maritime heritage from this area has been removed.

6.2.2 Palaeontology

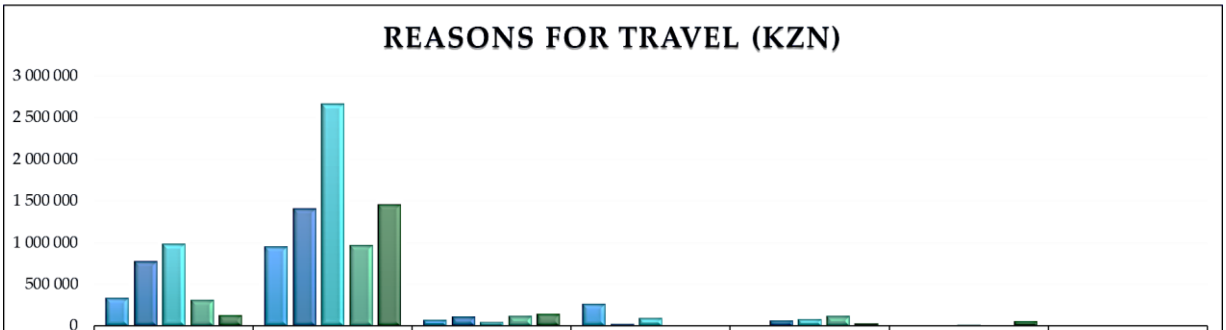
The project site is located within an area of low to medium paleontological sensitivity (Figure 6-29). The green area refers to the Cretaceous deposits that occur 3m – 5m below the surface. These deposits were noted during the harbour expansion project. The proposed project will not reach those depths and it consists of small impact areas for each pole of the proposed transmission line.

Figure 6-29: Paleontological Sensitivity Map.

6.3 Social and Economic Conditions

6.3.1 Tourism

The Kwa-Zulu Natal (KZN) province has a high share of tourist arrivals from the *Visiting friends & relatives (VFR)* and *Holiday* segments. The *Medical tourism* segment had a high share of arrivals in 2021 with over 200,000 arrivals as compared to 20,000 in 2020 (Figure 6-30 below). This increase can be attributed to the demand for medical assistance as a result of the Covid-19 pandemic.



	Holiday	VFR	MICE	Medical	Religious	Education/training	Other
2021	333 984	954 137	70 845	267 544	0	6 036	0
2020	777 125	1 412 749	109 036	23 989	67 332	0	0
2019	986 414	2 665 855	47 556	92 210	82 095	13 166	0
2018	308 573	967 705	119 127	0	116 063	0	0
2017	129 004	1 458 672	141 760	0	27 984	56 555	

2021 2020 2019 2018 2017

Figure 6-30: Reasons for Travel (KZN) (Source: South African Tourism 2022)

The Richards Bay port is located in the City of uMhlathuze Local Municipality. According to the IHS Markit (2020) report, the number of trips by tourists visiting the City of uMhlathuze Local Municipality from other regions in South Africa has decreased at an average annual rate of -5.75% from 2009 (259,000) to 2019 (143,000).

International tourists constitute 22.72% of the total number of trips, with domestic tourism representing the balance of 77.28% in 2019. On a positive note, KZN province continues to show growth in figures with a **34,5%** increase in *Bed-Nights spent* in 2021, moving from **2,034,157** in 2020 to **2,736,387** in 2021.

Tourism spending as a share of Gross Domestic Product (GDP)

- The tourism spending in the City of uMhlathuze Local Municipality, as a percentage of GDP in 2019 was 6.3%.
- This assessment indicates how important tourism is to the local economy. An important note about this variable is that it does not reflect what is spent in the tourism industry of that region, but only what is spent by tourists visiting that region as their main destination.
- The City of uMhlathuze Local Municipality is part of the King Cetshwayo District Municipality. Tourism spending as a percentage of GDP for 2019 was 4.8% in King Cetshwayo District Municipality and it was 5.6% in the KwaZulu-Natal Province as a whole.
- Tourism spending in South Africa had a total percentage share of GDP of 5.6% in 2019.

The devastating floods in Kwazulu-Natal and load shedding contributed to the decline, weakening an already fragile national economy that had just recovered to pre-pandemic levels. Trade, catering & accommodation was negatively impacted by both the floods in KwaZulu-Natal and power cuts across the country (Stats SA, 2022). The industry recorded a contraction of 1.5% as floods damaged retail outlets and storage facilities. There was also a loss of trading hours due to load shedding (Stats SA, 2022).

The dynamics and complex impact of load shedding coupled with cumulative impacts from Covid-19 resulted in devastating impacts on South Africans in general and businesses across all industries including tourism and hospitality (Goldberg (2016). The small businesses including the hospitality facilities were adversely affected due to the lack of financial support to provide backup power such as generators and solar power (Steenkamp *et al*. 2016, Duminy, 2019). The effects of power outages and the grid's total collapse would possibly result in greater economic mayhem than the pandemic did in 2020 and 2021 (Swilling 2022).

6.3.2 Landscape Context and Visual Aspects

The proposed Powerships, FSRU, power lines and new switching station are all located either within or in very close proximity to the Port and the Richards Bay Industrial Development Zone (RBIDZ).

The RBIDZ has been developed to attract large scale industrial development particularly industry that will benefit from close ties to the Port of Richards Bay.

Industrial development currently developed close to section of the Port that will be affected by the proposed project includes a large scale aluminium smelter (Bayside) as well as a phosphorous chemical plant (Foscor). Bidvest Terminals are situated within the Port boundaries, to the East of the proposed project.

These elements form a heavy industrial backdrop to the East, North and West of the Port.

To the North of these elements, the R34, known as the John Ross Highway, links the N2 Freeway to the Port and the centre of Richards Bay. This is a major road that carries a significant amount of industry and business related traffic.

Along its entire length, views of heavy industry are obvious from the R34, and as the motorist gets closer to the Port, existing industry largely screens Port operations.

Close to the N2, the road passes over what in essence are cultivated flood plain areas. Views from this section of the road see industry largely in the background.

As the viewer gets close to the Port, the road is elevated above the floodplain and adjacent land is relatively well vegetated. This vegetation generally screens views to the south and towards the Port. However, views of heavy industry to the north are still obvious. This industry includes a second (Hillside) aluminium smelter.

The majority of recreational uses of the Port are generally located on the Northern side of the Port. Views into the section of the Port that will be affected by the proposed development are relatively few and far between. They include:

- **The Tuzi Gazi Waterfront** from where it is only possible to see views of the main channel that leads into the area where the proposed Powerships will be located. None of the ships or infrastructure will be visible from this location.

- **Navel Island** from where views towards the proposed Powerships are likely to be possible. The proposed ships are likely to be viewed against a backdrop of shipping moored on the 600 series berths, Port infrastructure as well as heavy industrial development behind the Port.

- **The Boat Clubs** that are located on Commodore Close. These include the Zululand Yacht Club, the 1st Richards Bay Sea Scouts and the Meerensee Boat Club. Due to their location on a canalised inlet that links to Lake Mzingazi and an extensive area of mangroves, the area of the port within which the proposed development is located is screened from these clubs.

- **Pelican Island** which is located at the southern end of Commodore Close but only accessible from Sandbar Way further to the south. This is a popular piece of coastal open space that is linked to the mainland by a short causeway. The area of the Port within which the proposed ships will be moored is totally screened from Pelican Island by Navel Island.

- **The Inner Northern Breakwater** which is located at the harbour mouth. This is a very popular location particularly for local fishermen and visitors to nearby beaches. Views are possible down the harbour channel to the area where the proposed ships will be moored. At their closest, they will be viewed at distances in excess of 4.5km. The ships will be viewed in the context of the working Port with other ships being loaded alongside the 600 series jetties, large scale Port infrastructure and large scale industry behind that.

- **The harbour waterbody** which is popular for recreational boating, with majority of activities generally occur around the boating clubs towards the eastern end of the Port. It is possible however that some activities could extend towards the western end where the commercial Port operations and the proposed Powerships / FSRU will be located. This is a heavily industrialised port in which landside industries are directly linked to the Port.

Figure 6-31 below shows the important activities inside the Richards Bay Port.

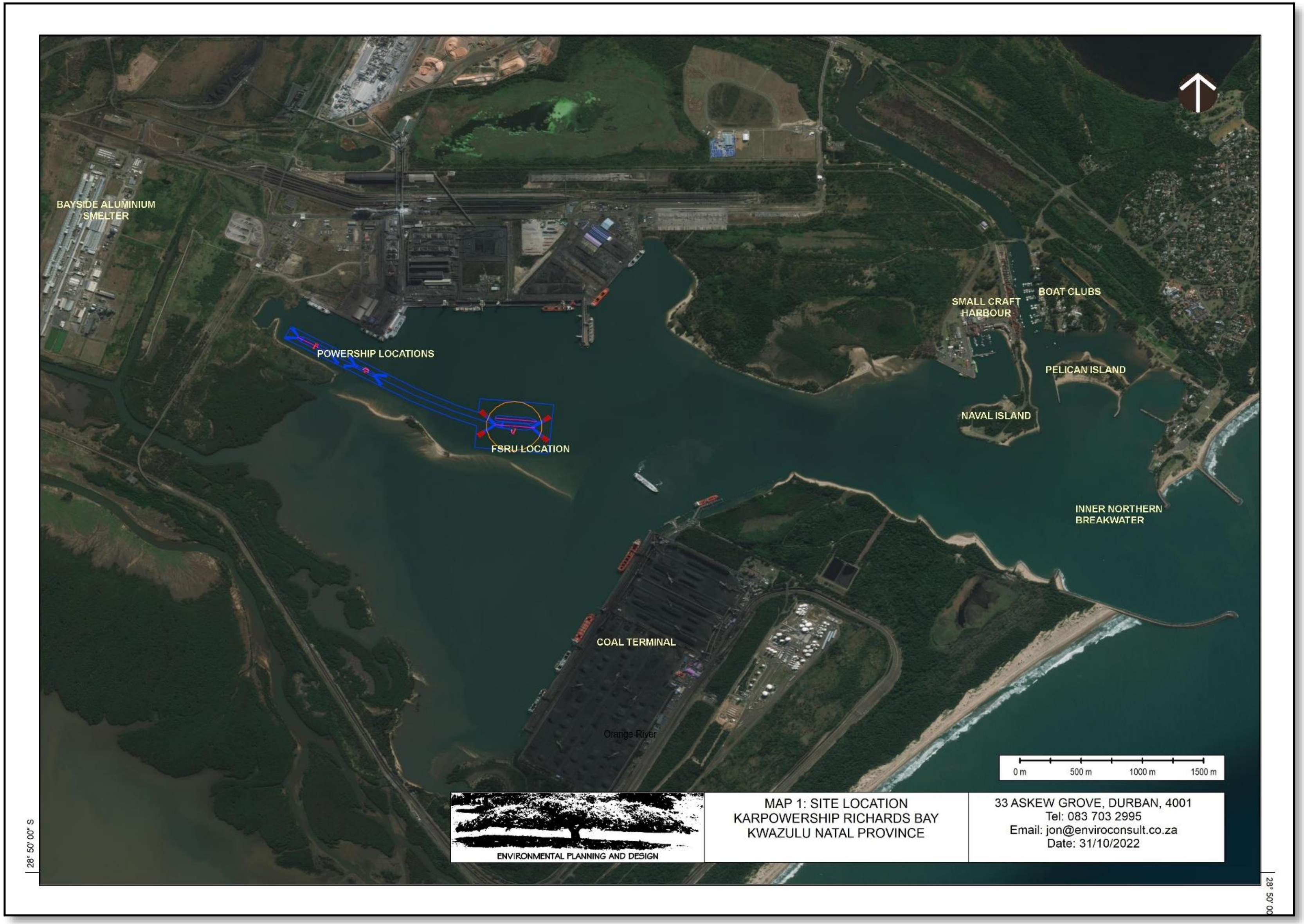


Figure 6-31: **Major land-uses inside the Richards Bay Port**

6.3.3 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 and barge. 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 LNG Carrier 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 LNG Carrier 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.

6.3.4 Traffic

There are two roads that connect Richards Bay with the N2 - the John Ross Highway R34 and the North Central Arterial (R619).

The John Ross Highway is a dual carriageway multilane highway that is located away from sensitive areas such as Central Business Districts (CBDs) and residential area. The North Central Arterial (R619) is a single carriageway two lane road that runs adjacent to sensitive areas such as the Richards Bay CBD and a few residential areas.

Trucks that need to access the N2 should utilise the John Ross Highway interchange only as this route has the necessary traffic capacity. The route from the N2 via the Nseleni/R619/North Central Arterial interchange should not be utilised due to the restricted traffic capacity along R619/North Central Arterial.

6.3.5 Socio-Economic Aspects

6.3.5.1 Population, Income and Employment Profile

UMhlathuze LM falls within KwaZulu-Natal and collectively accounts for 3.1% of the population, and 3.2% of the households in the province. UMhlatuze LM has a population of approximately 410 465 persons, with an average annual growth rate of 1.14%. This growth rate compares favourably to the average annual growth in the population of KZN (1.08%) but is significantly lower than that seen in South Africa (1.5%).

In terms of household profile, there are currently an estimated 103 915 households in uMhlatuze LM, with an estimated population density of 438 households per square kilometre (KZN = 120, SA = 48) and an average household size of 3.95 persons (KZN = 4.1, SA = 3.6). Over the period 2009 to 2021, uMhlathuze LM experienced household and household density growth of 1.3% per annum, rivalling 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, indicating the pull factor of the economic opportunities available within the area.

Employment levels are an important indicator of socio-economic wellbeing because they provide insight into the proportion of the population with access to income and the ability to provide for basic needs, such as food and shelter, among others.

A review of the employment profile of uMhlathuze LM reveals that a relatively high proportion of the population in the area of impact 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.

6.3.5.2 Education Profile

UMhlathuze LM is characterised by relatively high levels of educational attainment, with almost 28% of the population having completed matric and 10.0% of the population having attainted some form of tertiary qualification in 2019. This is likely attributable to the presence of the University of Zululand within the municipality as well as several other tertiary colleges such as uMfolozi College and the Richards Bay Technical Training & Assessment Centre. Despite this, just over half of the population (56.2%) of uMhlathuze LM has not attained a matric qualification with 6.1% of the population having no education. 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.

6.3.5.3 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.

6.3.5.4 Regional Economic Profile

Electricity, gas and water contribute a small margin to the economy of uMhlathuze LM in line with provincial and national norms. Both output and Gross Value Added (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 Richards Bay IDZ conducted a feasibility study during 2019 into the establishment of an oil and gas hub. The exact status of the implementation of the Oil and Gas Hub by the IDZ could not be established as part of this project. It is anticipated that the Karpowership project may make a positive contribution to the development of this this project by the IDZ.

6.3.5.5 Fisheries

The following summarises the fisheries activities in the Port of Richards Bay, based on information presented in the relevant the specialists'' studies, namely Socio-Economic Impact Assessment (Appendix 9-D1), Small Scale Fishers Engagement Report (Appendix 9-D1.1), and Coastal, Estuarine and Marine Impact Assessment (Appendix 9-B4).

It must be noted that all fishing is prohibited within the port. There is no small-scale fishing taking place within the Port of Richards Bay since it is an operating harbour. There is recreational, and illegal fishing taking place at the mouth of the harbour and up to 5 km from the shore. Angling is taking place from pier and shore outside the harbour for both recreational and livelihoods purposes.

6.3.5.5.1 Inshore fisheries

Richards Bay Port is a popular site for multiple fisheries sectors; it is used extensively by local residents for recreational estuarine angling and the Port sees some of the highest numbers of boat launches for recreational boat angling and commercial line fishing in KZN (Mann-Lang *et al.*, 1997 in Jairam 2005).

6.3.5.5.2 Shore angling

The Richards Bay Port is a popular estuarine recreational angling site, used extensively by the residents of the Mhlathuze Municipality (which includes the towns of Empangeni and Richards Bay). The total annual fishing effort expended by shore-anglers was estimated at approximately 69 000 angler outings (Beckley *et al.* 2008). All of the most retained shore-angled species recorded by Beckley *et al.* (2008) are estuarine dependent. As shore angling mainly takes place within the Richards Bay Port, it follows that the predominant species caught have some estuarine association. The ecology and estuarine function of the Richards Bay Port are fundamental to the shore angling fishery within the area.

6.3.5.5.3 Recreational boat angling

An access-point study on recreational boat-angling was conducted in Richards Bay by Everett and Fennessy in 2007. Approximately 10 977 individual angler-outings were undertaken annually by 1497 anglers. Recreational line fishers tend to stay within 15 nautical miles of the Richards Bay Harbour (Jairam 2005). 91% of fish caught in the Richards Bay Harbour were released due to their small size. The total annual retained catch was estimated at 5 355kg (Everett and Fennessy 2007).

Small recreational fishers fish from the Richards Bay Port and, due to the size of their fishing boats, stay within 5 miles of the coastline to secure their catches. Similarly, there is a small craft harbour mostly used for smaller fishing vessels and the yachting community. Engagements with the recreational community established that there is no legal fishing taking place within the harbour itself. Recreational fishing take place at the harbour mouth.

6.3.5.5.4 Charter Boat fishing

Charter boats take paying recreational fishers out, so there is a commercial motivation driving the fishing effort, but total catch is still limited by the recreational bag limits. Pradervand & van der Elst (2008) reported 4 charter boats operating out of the Richards Bay Harbour, together making an average of 228 launches per annum and landing approximately 9.9 tonnes of fish.

6.3.5.5.5 Commercial Line fishing

Over and above direct employment and revenue, commercial line fishery provides indirect or secondary opportunities for businesses in Richards Bay (Jairam 2005).

The Richards Bay Port is particularly important in the area between St Lucia and Tugela, as it provides line fishers with access to several productive reefs, especially the deeper reefs (100-200 m) to the north of the Tugela River (Penney *et al.* 1999). As of 2004, there were 11 licenced commercial ski boats (line fishers) operating regularly out of Richards Bay (Jairam 2005). Richards Bay sees the highest number of commercial skiboat launches in KZN (Mann-Lang *et al.* 1997 in Jairam 2005).

Spatially referenced catch and effort data for commercial fisheries that operate in the Richards Bay area were obtained from the Department of Agriculture, Forestry and Fisheries (DFFE) and mapped using GIS. Fishing on the offshore reefs closest to Richards Bay is preferred. Of the 100 fish species found in Richards Bay Port, 14 are important in the commercial line fishery. Of the species in the Richards Bay line fishery, five have juvenile stages which use estuaries to some extent. Currently, the stock is in a critical state and spawner biomass per recruit (SB/R) has collapsed to 1.1-4.5% of pristine spawning biomass. The preservation of estuaries as obligate nursery grounds for the species is fundamental to its preservation (Sink *et al.* 2019).

6.3.5.5.6 Prawn fisheries

Although the Richards Bay estuarine system makes up only approximately 7% of the total estuarine area along the KZN coast, in comparison to St Lucia which makes up about 80% of the total area, the recruitment contribution from Richards Bay to the Thukela Bank prawn stocks is considered to be equal to that of St Lucia (Ayers *et al.* 2013). Therefore, in times where the St Lucia estuary mouth is closed, Richards Bay can be considered to be the sole contributor to the inshore shallow-water prawn stocks.

6.3.5.5.7 Small -scale and subsistence fisheries

The Small-Scale Fisheries Policy proposes that certain areas on the coast be prioritized and demarcated as small-scale fishing areas (DAFF 2012). In some areas access rights could be reserved exclusively for use by small-scale fishers. A basket of species may be harvested or caught within particular designated zones. The basket allocated to the small-scale community based legal entity will depend on quantity of the marine living resources available in the Total Allowable Catch (TAC), zonal allocations and Total Allowable Effort (TAE). The Port of Richards Bay is currently located in 'Basket Area E – Pondoland MPA to the Mozambican border', which has 127 different resources marked for potential exploitation by small-scale fishers.

Engagements with the recreational and small-scale fishing community established that there is no legal fishing taking place within the harbour itself. The port is an industrial zone, for which the small-scale fishing cooperatives are not registered to fish in. Recreational fishing and other legal and illegal fishing do take place at the harbour mouth which is more than 4 km away from where the Powerships and the FSRU will be moored. The illegal fishers often use gill nets at night which have a devastating impact on marine life. This has been happening since as early as 2014.

During the specific focused meeting with small scale fishers in Richards Bay, the community mapping exercise (e.g. community members pointing at areas on the map that are used for fishing) did not yield any comments on the project's site itself, or community use of the project's site. No fishing activities were noted inside of the Port area or the immediate surrounds. Furthermore, DFFE has confirmed that no small-scale fishing cooperatives are registered to fish in the port. As an active port and industrial zone, TNPA does not allow fishing to take place in the port.

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Overview of EIA Process

The EIA process, including public participation, is prescribed by the EIA Regulations, 2014 as a requirement for the application for an EA and an atmospheric emission licence. Thus, the EIA process for the proposed Gas to Power via Powership project must 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, DFFE at the beginning of October 2020, Triplo4, the EAP, commenced with the first phase of the EIA process, the Scoping Phase. 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 2020.

The EAP, with guidance from DFFE 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 Draft Scoping Report was made available for a 30-day comment prior to it being submitted for consideration to DFFE from 17 November 2020 – 06 November 2020.The Final Scoping Report, including the Plan of Study for the EIA contained therein, was accepted by DFFE on 06 January 2021.

The approval of the Scoping Report automatically triggered the commencement of the current phase, the EIA (also referred to as the Environmental Impact Report (EIR)) for which the applicant and EAP have 106 days to complete. The Final EIAr and EMPr were submitted to the DFFE on the 26 April 2021. The DFFE refused the EA application and provided KSA with the Record of Refusal (RoR) on 23 June 2021. KSA appealed the DFFE refusal on 13 July 2021. On 1 August 2022, the Appeal Authority (the Minister of the DFFE), dismissed the grounds of appeal but in doing so exercised her powers in terms of Section 43(6) of NEMA to:

"*remit the matter to the CA […] so that the various gaps in information and procedural defects in relation to the PPP that led to the rejection of the EA application may be addressed during the reconsideration and re-adjudication of the EA application, provided that the timeframes prescribed by the 2014 EIA Regulations in respect of the EIA process are adhered to by the appellant and the CA".*

As a result of the Minister's decision, the previous EIA from 2020 has been archived, updated and additional specialist studies have been undertaken and an enhanced PPP is underway to address the gaps raised by the Minister.

In preparing this Final EIA Report for I&AP comments, Triplo4 engaged with numerous specialists and detailed studies were conducted and considered. Refer to Table 1-2 for the details of the Specialist and Technical Team, as well as Appendix 9 for the full list of specialists and technical studies. Section 6 of this DEIR contains the baseline descriptions of the environment, based on research conducted by the specialists' in the various fields of expertise.

The site layout alternatives assessed during the Scoping Phase and considered feasible were brought forward to the EIA phase for further assessment (including the ‘No-Go Option’ as an alternative), and are discussed in Section 3 of this DEIR. All site layout alternatives fall within the site approved by DFFE at the end of the Scoping Phase, which is the Port of Richards Bay.

The methodology used to assess the potential impacts is described in Section 7.2. 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 and highlighted in Sections 7.4 and 7.5 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 Chapter 7. The mitigation measures are also collated into the Final Environmental Management Programme (EMPr). Both the draft EIA Report and EMPr were made available for an extended 33-day period for I&APs to comment. Comments received were incorporated into the final EIA Report for submission to DFFE in order for it to make a decision. DFFE 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.

7.2 Impact Assessment Methodology

2014 NEMA EIA Regulations (as amended), Appendix 3 (3) (1) (h)(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 can be reversed; may cause irreplaceable loss of resources; and can be avoided, managed or mitigated; (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 processes undertaken to identify impacts, to assess and rank the impacts and risks, to describe environmental impacts and risks identified during the EIA process, to 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, and any deviations from approved Scoping Report (including Plan of Study). Assumptions, uncertainties and gaps in knowledge relating to the assessment and mitigation proposed are also discussed. In the EIAR, the significance of the potential impacts are considered before and after identified mitigation is implemented, for direct, indirect, and cumulative impacts, in the short and long term, for all phases of the proposed project. The specialist studies are synthesised and integrated into the overall impact assessment and recommendations for mitigation are included in the EMPr.

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 **duration** of the impact is the period during which the impact is occurring. Inherent in this is the **reversibility** of the impact, meaning that if the duration of the impact is not permanent, then it can be reversed, i.e. the impact is reversible. Should an impact not be reversible, then this is explicitly stated.

The **irreplaceable loss of resources** has been assessed, but not explicitly stated as such. For example, a less severe impact will be insignificant or non-harmful and the resultant loss of resources can be replaced. In contrast, the loss of resources from disastrous or extremely harmful impacts cannot be satisfactorily replaced.

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

Table 7-1 below describes the scoring of the impacts and how they determine the overall significance.

Table 7- 1: 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 or 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 the likelihood or the chances that the impact will occur	1 – Almost never / almost impossible 2 – Very seldom / highly unlikely 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
Reversibility	
Reversibility degree to which the impact t can be reversed	Reversible – the impact is reversible Irreversible – the impact is not reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	Yes – the impact causes a loss of resources that cannot be replaced No – the impact causes a loss of resources that can be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	Yes – the impact results in a fatal flaw No – the impact does not result in a fatal flaw

Table 7-2 below lists other similar potential projects in the area, which were considered for the cumulative impacts assessments.

Table 7- 2: Other similar potential projects in Richards Bay Port area

Project name and description	Applicant	Status in Oct 2022 (to Triplo4 knowledge)
320MW Emergency Risk Mitigation Power Plant (RMPP) and associated infrastructure near Richards Bay. The Project site is to be located in Alton, near the Richards Bay Industrial Development Zone (IDZ). The facility will have an installed generating capacity of 320MW, to operate with liquified petroleum gas (LPG) or naphtha as an initial source and will convert to utilising natural gas once this is available in Richards Bay.	Phinda Power Producers (Pty) Ltd	Environmental Authorisation was granted in July 2021, but the decision was challenged by NGO's by an appeal. The appeal was dismissed by Minister in November 2021. The NGO's have taken the matter on review to the Pretoria High Court.
RBGP2 400MW gas to power project at the RBIDZ 1F (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	Richards Bay Gas Power (Pty) Ltd	Environmental Authorisation was issued in 2016. Amendment was applied for in 2020, and in May 2022 a review application was launched in the Pretoria High

Project name and description	Applicant	Status in Oct 2022 (to Triplo4 knowledge)
separate steam cycle, as well as 3 fuel tanks of 2000m³ each for on-site fuel storage.		Court challenging the reissued authorization.
Nseleni Independent Floating Power Plant (NIFPP) - Port/ old Bayside complex. Floating gas powered power station made up of floating Combined Cycle Gas Turbine (CCGT) power plants and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, in the Port of Richards Bay. Four Floating Power Barges generating a nominal 700 MW per barge resulting in 2 800 MW generation capacity.	Nseleni Power Corporation (Pty) Ltd and Anchor Energy (Pty) Ltd	The proposed Nseleni Independent Floating Gas Power Plant in Richards Bay was refused of two of its licence applications by different regulatory authorities. Nseleni's application for an Environmental Authorisation (EA) was refused by the DFFE on 19 November 2021, and the project's application for a water use license was refused by the DWS on 25 November 2021. Nseleni have apparently appealed the refusals.
Eskom 3000 MV CCPP and associated infrastructure on Portion 2 of Erf 11376 and Portion 4 of Erf 11376 within the RBIDZ Zone 1D. The facility will operate with natural gas as the main fuel resource and diesel as a back-up resource.	Eskom Holdings SoC Limited	Environmental Authorisation was issued in December 2019, and in August 2022 a review application was launched in the Pretoria High Court challenging the authorization. Judgment was handed down by the Court on 6 October 2022. The Court dismissed the application brought by the NGO's and confirmed that the project's Environmental Authorisation is valid.

7.3 Assumptions, Uncertainties and Gaps in Knowledge Relating to the Assessment And Mitigation Proposed

The information in the EIA report is based on findings of the specialists' studies. The layouts and engineering drawings of the proposed Gas to Power Project at Port of Richards Bay 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, including cumulative impacts where relevant.
- The information provided by the applicant and specialists are accurate and unbiased.
- Information from secondary sources is accurate.
- The assessment considers the impacts of the proposed project, the no-go as well as the cumulative, in relation to other relevant similar gas-to-energy projects in the area.

Each specialist's report (attached in Appendix 9) had indicated the relevant assumptions and limitations made for the study. Table 7-3 below provides an indication of these sections within each report.

Table 7- 3: Specialists' Studies Assumption and Limitations Indications

Specialist Studies	Page No.	Section
Appendix A1 – Hydrology Assessment	27	5.4
Appendix A2 - Aquatic Assessment	6	2,1
Appendix A3 - Hydropedology Assessment	12	1.4
Appendix A4 - Geohydrology Assessment	10	1.5
Appendix A5 - Water Balance Assessment	4 & 8	1.5 & 2.3
Appendix A6 - Wetland Delineation and Functional Assessment	18	6
Appendix A7 - Heritage Assessment	N/A	N/A
Appendix A8 - Terrestrial Biodiversity Assessment	3	1.4
Appendix A9 - Avifauna Assessment	26	1.6
Appendix B1 - Baseline Underwater Noise Assessment	1	1
Appendix B2 - Underwater Noise Assessment	18 &31	6.1
Appendix B3 - Underwater Heritage Compliance Letter	N/A	N/A
Appendix B4 – Coastal and Estuarine and Marine assessment	ix	Disclaimer
Appendix C1 - Atmospheric Impact Report	10	2.9 & 6.2.3
Appendix C2.1 - Terrestrial Noise Assessment	13 & 22	1.5 & 4.1
Appendix C2.1 - Ghana Ambient Noise Assessment	7 & 10	2.2 & 3.4
Appendix C3 - Climate Change Impact Assessment	26 & 30	3.1.6 & 3.2.5
Appendix D1 - Socio-economic Impact Assessment	57	2

Specialist Studies	Page No.	Section
Appendix D1.1 - Small Scale Fishers Engagement	N/A	N/A
Appendix D1.2 - Tourism Assessment	18 & 30	5.1.2 & 7.3
Appendix D1.3 - Traffic Evaluation	7	2.2.1
Appendix D2 - Visual Impact Assessment	2	5
Appendix D3 - MHI Assessment	19 & 66	2.4.5 & 11.8

7.4 Scoping Report and Plan of Study Deviations

Deviations from the Scoping Phase have been identified and include the following:

1. The transmission line connection point (on land) has been shifted closer to the shore by approx. 125m, i.e. the start point (tower 15/19) was moved to the location of the labelled tower 01 (Figure 7-1). This deviation was required in terms of the engineering design and the connection to the Powership, and this location was assessed by the relevant specialists.
2. 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 7-2 – 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.
3. The preferred positions of the Powerships were slightly shifted. The position of the Khan Powership was shifted approx. 110m to the South, and the position of the Shark Powership was shifted approx. 170m to the south-western direction (Figure 7-3 - the new position of the Powerships outlined in white, and the previous positions outlined in purple). 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 footprint of the proposed switching station was updated from approx. 7000m² to 17 898m². This was required by the engineering design to meet the operational requirements of Eskom. Network and security requirements were assessed and incorporated to the switching station layouts. The terrestrial area of the proposed switching station was assessed by the relevant specialists, and as there are no major sensitivities within this area, this is not considered as a significant change.
5. The width of the working servitude for the transmission line was updated from 30m to 31m wide, in line with Eskom requirements.
6. The transmission component of the project includes detailed description on the associated infrastructure, such as switching station.
7. Detailed descriptions and locations of the temporary construction facilities were included.
8. A corridor servitudes were determined for both the gas pipeline and transmission line installation. The transmission corridor will allow for technical construction requirements to be maintained on site, with a corridor which includes the 31m working servitude. The subsea gas pipeline will have a servitude of approximately 50m each side.
9. Polygon for Vessels (Powerships and FSRU & LNGC): Polygons were included to allow for optimal positioning of the vessels post Environmental Authorization (if issued) within the polygon as part of detailed designs. Marine traffic studies and full mission bridge simulations (with TNPA harbour masters) have been

completed and the Karpowership team are confident that final locations of the vessels, within the polygons provided, would be supported and approved by TNPA.

10. The recommended impact assessment methodology was provided to all Specialists for the EIA. Some Specialists deviated from the recommended impact assessment methodology provided by Triplo4 as they were of the opinion that a different impact assessment methodology was more appropriate to their specific discipline / area of specialization in order to ensure a scientifically aligned conclusion after proposed mitigation measures are implemented.

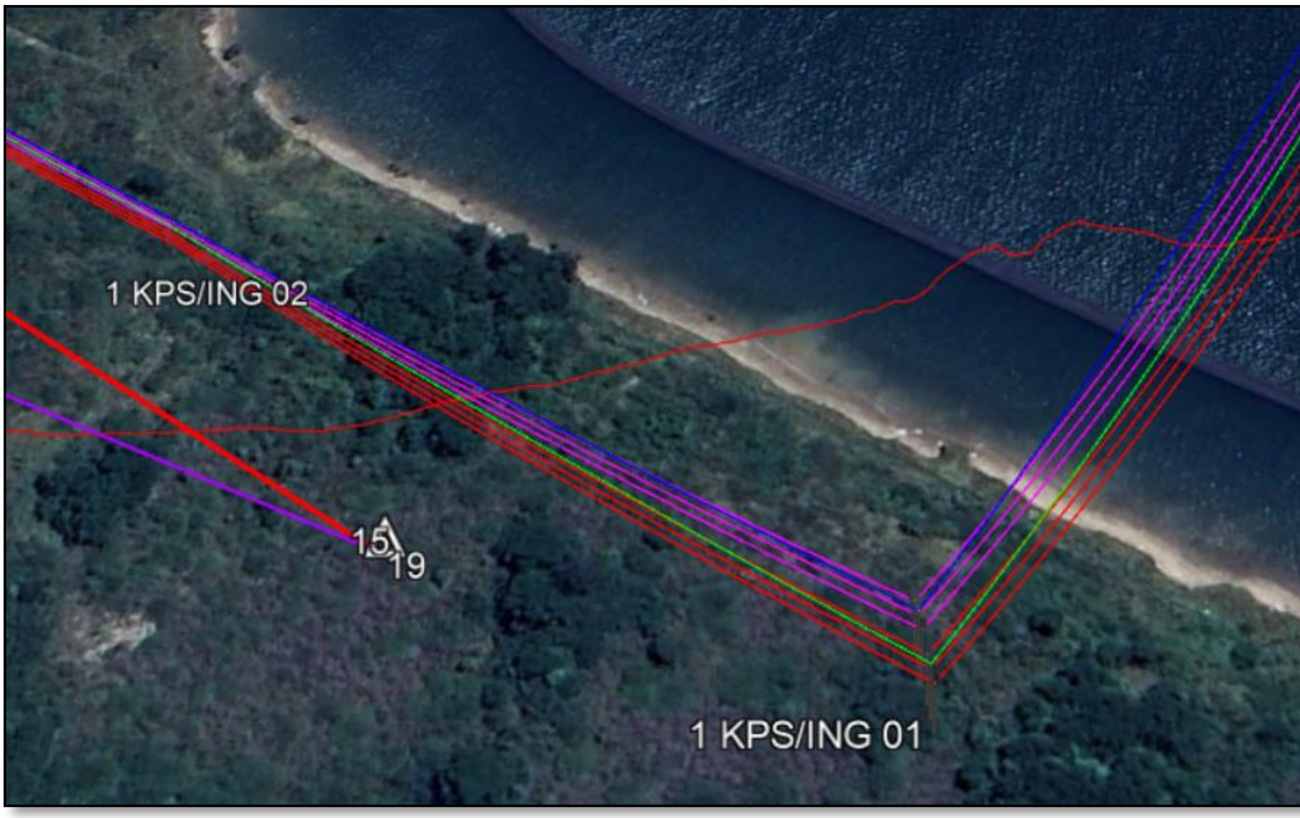


Figure 7-1: Transmission line – deviation of the start point.

Figure 7-2: Deviation of the FSRU and LNGC positions

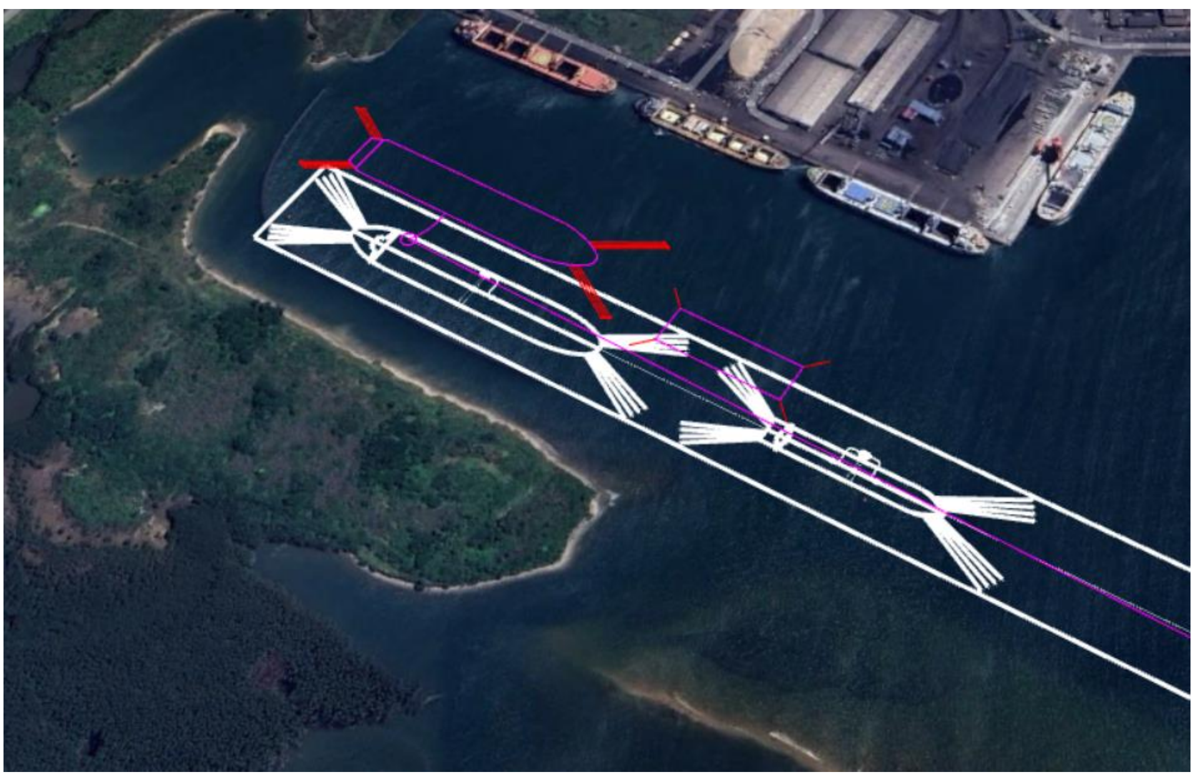


Figure 7-3: Deviation of the Powerships positions

7.5 Specialists' Findings Impact Assessment and Recommendations

A description of the environmental impacts and risks identified during the EIA and looked at by the specialists is contained in this section together with their recommendations.

The specialists' assessments inform the impact assessment findings presented in Section 7.5 and the specialists recommendations for the mitigation of potential impacts have been incorporated into the EMPr, attached as Appendix 6.

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in this section, the latter containing the detailed workings (severity, duration, extent, frequency, probability and significance ratings) used to determine the overall significance presented in the tables below.

The reversibility of impacts and irreplaceable loss of resources, although not explicitly rated as such in some specialists' studies, are inherent in the duration and severity on each impact respectively as informed by the specialist studies, the findings of which are presented in Section 7.5.

The following potential impacts were considered in the EIA Phase for the proposed project:

7.5.1 Hydrology Impacts

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 (> 500m away).

The development does not fall within the 1:100-year flood lines (Figure 7-4 below). Section 144 of the National Water Act stipulates that no "permanent" facilities should be placed within the 1:100-year flood line does not apply to the project.

Limited sedimentation and erosion for the drainage lines and streams associated with the site are anticipated. The flood lines also suggest a low flooding risk associated with the desktop delineated drainage lines for the project area, and that the proposed transmission lines are situated outside flooding areas. The 1:100-year flood line should be considered an avoidance area (buffer area).

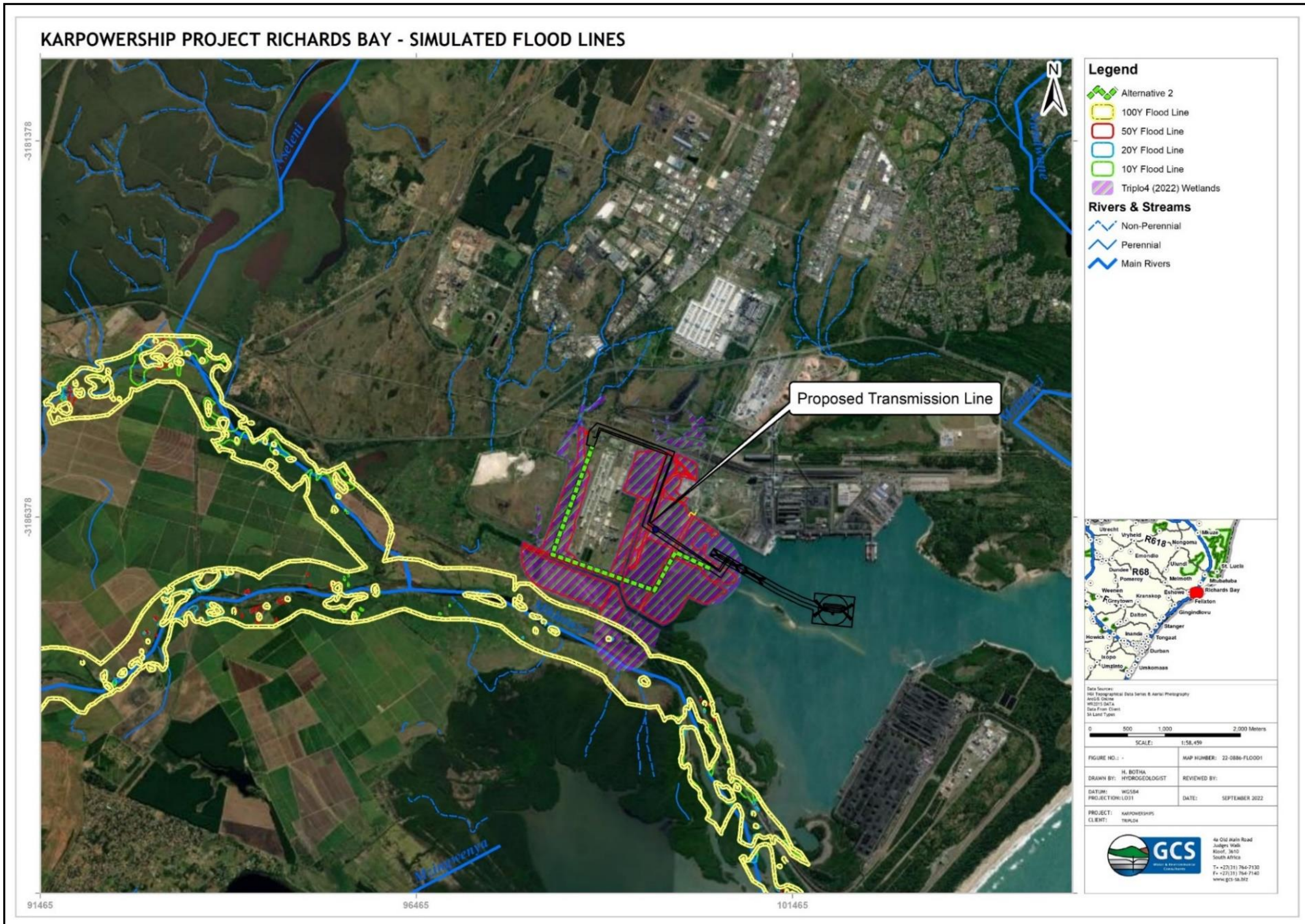


Figure 7-4: Delineated flood lines at the Richards Bay port

7.5.1.1 *Impact assessment findings (with and without mitigation):* ***Transmission Line Alternatives and Laydown Area: Construction Phase***

The following will likely have an impact on the surface water bodies surrounding the site during the construction / preparation phase:

- 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 natural drainage lines 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 are washed away into watercourses.

Table 7-4: Estimated hydrological risks (construction/preparation phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Vadose zone soils.	Disturbing vadose zone during soil excavations/construction activities.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	Only excavate areas applicable to the project area. Cover excavated soils with a temporary liner to prevent contamination. Retain as much indigenous vegetation as possible. Exposed soils are to be protected using a suitable covering or revegetating.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
	• 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.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Water quality monitoring of the downstream surface water. Place drip trays under vehicles at the site. Visual soil assessments for signs of contamination (monthly)	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation: Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	Recommended Mitigation Measures	Post Mitigation: Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	Confidence
Primary Surface Water Receivers > Non-perennial streams > Mhlatuze River > Wetland system (Watercourses)	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).	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Install a temporary cut-off trench to contain poor-quality runoff (if required) Routine inspections of all infrastructure (monthly)	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

7.5.1.2 Impact assessment findings (with and without mitigation): ***Transmission Line Alternatives: Operation Phase***

The following will likely have an impact on the surface water bodies surrounding the site during the operational phase:

- 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.
- Switching station oil spillages (if constructed) will impact surrounding surface water bodies.

Table 7-5: Estimated hydrological risks (operational phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation: Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	Recommended Mitigation Measures	Post Mitigation: Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	Confidence
Soil disturbance & erosion and sedimentation of nearby watercourses.	Transmission line installation areas that were backfilled with collapsible soils may cause soil subsidence.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	• Only excavate areas applicable to the project area. • Retain as much indigenous vegetation as possible.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Water quality degradation of nearby watercourses	switching station spillages (incidnets only)	Spillages from switching station may run off into watercourses or leach through the soil. (incidents only)	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	• Ensure maintenance of switching station to prevent spillages (i.e. incidents).	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
	Leakages from vehicles occurring during transmission line maintenance	Poor quality overland runoff or seepage from hydrocarbon spills from vehicles parked at the site.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	• Water quality monitoring of the nearby river if there are visual signs of any sedimentation or surface pollution.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium

7.5.1.3 Cumulative Impacts

As the proposed activities will stretch over several sub-catchments and take place close to other proposed power development there will be cumulative impacts (however limited due to the project type).

The following similar projects are known to occur/are proposed within a 30 km radius of the study area:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

These proposed energy developments are situated in different drainage areas, **rendering the likely impact associated with this project, zero.** Any hydrological risk for this project will be confined to the delineated sub-catchments (worst case). Considering the sub-catchment conceptual hydrological cycle and the activities associated with the site and surroundings, no impacts are expected in terms of the hydrological cycle. This is due to the proposed site activities not significantly altering the hydrological functions of the given environment.

7.5.1.4 Mitigation Measures

The following mitigation measures should be and can realistically be implemented as part of the EMPr to further reduce the risk of flooding on site and contribution to stormwater generation potential:

- During the construction phase, it is recommended that sandbags and temporary berms be used, to manage stormwater runoff (if storms do occur). Temporary stormwater systems should be sufficient to manage the stormwater at the site during the construction phase.
- Ensure that eroded areas are re-vegetated, to ensure reduced sedimentation risk and reduced runoff volumes to the streams.
- The Department of Environmental Affairs (DEA) published a generic Environmental Management Plan (EMPr) for substations and powerlines (22 March 2019). It is proposed that the mitigation and monitoring plan presented in this report be further supplemented by the generic EMP document.
- It is proposed that water monitoring be implemented as captured in the Hydrological Report, and as required.
- To prevent erosion and deposition during construction use:
  - Minimise vegetation disturbance during construction.
  - Re-vegetate as soon as possible to establish and maintain good ground cover across the site.
  - Conduct regular inspections and maintenance of the site to ensure that vegetation cover is adequate, and no rivulets are generated.
- Stormwater management should focus on the following, for each site, before the work takes place:
  - <u>Assess the site constraints and any site-specific concerns, including:</u>
    - Specific vegetation that may need to be identified and/or isolated from the site disturbance.
    - Highly erodible soils may require additional erosion control measures.
    - The type of construction should consider landform. Avoid slab-on-ground construction on steep sites.
    - Up-slope drainage catchments that may need to be diverted around the work site.
    - Workspace limitations may require site-specific sediment control measures and/or the extensive use of skips or bins for material storage and waste management.
    - Expected rainfall intensity during the period of disturbance (wet season vs dry season).

- Stabilise the site entry/exiting points:
  - A stabilised site access must be established and if possible, limited to one point only. The access allows for the construction vehicles to enter the work area of goods while preventing the unnecessary tracking of sediment onto the nearby environment from multiple locations. A stabilised entry/exit point normally consists of a stabilised rock pad.
- Prevent erosion & manage stockpiles:
  - Suitable material storage areas must be located up-slope of the main sediment barrier (e.g. sediment fence).
  - Stockpiles kept on site for more than two weeks will require an impervious cover (e.g. builder's plastic or geofabric) to protect against raindrop impact. Stockpiles of sandy material located behind a sediment fence will only need a protective cover if the stockpiles are likely to be exposed to strong winds.
  - On steep sites and sites with limited available space, erodible materials may need to be stored in commercial-sized bins or mini-skips before use.
- Manage Site Waste:
  - Adequate waste receptacles must be provided on-site and maintained in a way that potential and actual environmental harm resulting from such material waste is minimised.
  - Building activities must be carried out on a pervious surface, such as grass or open soil, or in such a manner that all sediment-laden runoff is prevented from discharging into a water body.

7.5.1.5 Specialist's Conclusion

The Hydrological assessment **cannot find any grounds or identify high hydrological risks to not proceed with the development** of the proposed transmission lines. This is grounded on the assumption that the proposed mitigation measures, EMPr and EIA recommendations are implemented during the construction and operational phase of the transmission lines.

7.5.2 Aquatic Impacts

Six assessment sites were investigated, to assess the possible impacts associated with the proposed project (Figure 7-5 below). Only one site on an unnamed non-perennial drainage line (RB04) presented flowing water in which sampling could be undertaken. A downstream assessment site could not be assessed as it falls within the estuarine functional zone.

The impact of the proposed project range from medium to low pre mitigation and impacts can be further reduced with appropriate mitigation. The proposed project is located within a Sub-Quaternary Reach (SQR) that is already within a modified state.

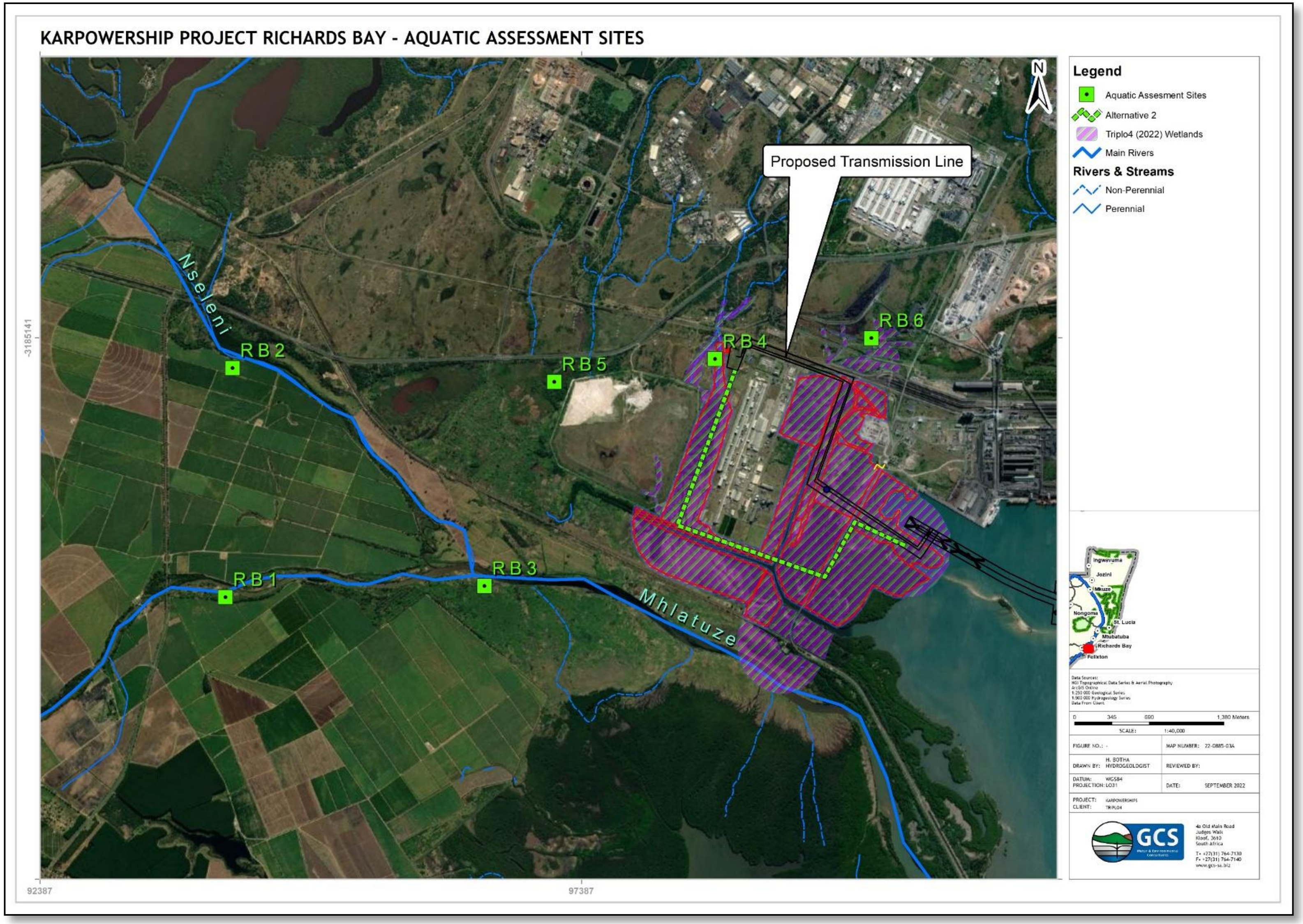


Figure 7-5: Aquatic assessment sites in relation to the Proposed Transmission Lines

7.5.2.1 Impact assessment findings (with and without mitigation): ***Transmission Line Alternatives and Laydown Area:***

Table 7-6: Estimated aquatic risks (Construction and Operation Phase)

ASPECT	PHASE	SUMMARY OF POTENTIAL IMPACT	POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
						M	D	S	P	TOTAL	STATUS	SP	M	D	S	P	TOTAL	STATUS	SP
Vegetation	Construction	**Riparian vegetation**	Removal of riparian vegetation and habitat impacting bank stability.	Surrounding unnamed drainage lines	Earthworks, Vegetation clearing	6	2	1	4	36	-	M	2	2	1	3	15	-	L
			Disturbance of the natural soil profile resulting in the proliferation of invasive alien plant species		Earthworks and Vegetation clearing	8	2	1	4	44	-	M	2	2	1	3	15	-	L
		Instream vegetation	Loss of aquatic vegetation and habitat.		Earthworks and Vegetation clearing Sedimentation	6	2	1	4	36	-	M	2	2	1	3	15	-	L
Hydrological Regime	Construction	**Changes in surface flow dynamics**	Changes in natural drainage lines which may lead to ponding or increased runoff patterns.	Surrounding unnamed drainage lines	Earthworks, soil compaction.	8	2	1	3	33	-	M	2	2	1	2	10	-	L
Water Quality	Construction	**Changes in Water quality parameters and nutrient availability**	Leakages from vehicles and machines. Oil & fuel spills from vehicles installing the transmission and gas pipelines.	Surrounding unnamed drainage lines	Mechanised machinery & seepage/runoff from building materials.	8	2	1	3	33	-	M	6	2	1	2	18	-	L
	Operational	**Changes in Water quality parameters and nutrient availability**	Oil & fuel spills from vehicles conducting maintenance of the transmission lines.	Surrounding unnamed drainage lines	Net result of development.	8	1	1	2	20	-	L	6	1	1	1	8	-	L
Biota	Construction	**Change in species diversity**	Change in species composition due to loss of aquatic habitat, water quality changes.	Surrounding unnamed drainage lines	Changes in the natural flow regime. Altered water quality.	6	2	1	3	27	-	L	4	2	1	2	14	-	L
Cumulative impacts		**Cumulative impact on Water Quality**	Physiochemical changes in water quality.	Surrounding unnamed drainage lines	Similar LNG gas to power projects proposed in the study area	2	4	1	2	14	-	L	2	4	1	1	7	-	L

7.5.2.2 Cumulative Impacts

The following similar projects are known to occur/are proposed within a 30 km radius of the study area:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

Based on available information for the above-mentioned projects, and in terms of the potential contributing impact on the aquatic environment after consideration of this project, it is concluded that the contributing aquatic impact to other similar projects in the area **will be very low**.

7.5.2.3 Mitigation Measures

<u>Construction phase</u>

- Construction within and in the nearby vicinity of all watercourses or wetlands must proceed mainly during the dry, winter months where possible in order to minimize soil erosion linked to high runoff rates;
- 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;
- The milkwood trees must be marked using danger tape so ensure no accidental disturbance or removal of this species;
- Temporary stormwater channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
- Prevent uncontrolled access of vehicles through watercourses that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas
- The construction footprint should be kept to a minimum and construction vehicles and machinery must make use of existing access routes as much as possible;
- Laydown yards, camps, and storage areas must be beyond the aquatic areas;
- Stockpiles (including building rubble) are to be located outside aquatic 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;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks, and general good "housekeeping";
- Provision of adequate sanitation facilities located outside of the watercourse/riparian area or its associated buffer zone;
- 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;

- Monitoring should be done to ensure that sediment pollution is timeously addressed; and
- 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.

Operational Phase

- Vehicles use to service transmission lines and transformers must be well maintained and no service vehicles repairs must take place on site; and
- Monitoring plan of alien invasive plants must be implemented to prevent streamflow reduction on the Mhlatuze River.

7.5.2.4 Specialist's Conclusion

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 purpose of a monitoring program is to directly measure, assess, and report on the status and trends of the applicable environment. The objective of such a program will be to identify potential impacts emanating from the operational activities on the receiving aquatic ecosystems from the dams. However, 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. It is therefore not believed necessary to implement a bio-monitoring plan in regard to the proposed project.

It is recommended that:

- An estuarine impact assessment is undertaken;
- It is recommended that the mitigation measures be implemented during the construction and operational phase of this project; and
- The Department of Environmental Affairs (DEA) published a generic Environmental Management Plan (EMP) for substations and powerlines (22 March 2019). It is proposed that the mitigation and monitoring be further supplemented by the generic EMP document.

7.5.3 Hydropedology Impacts

Available soil data were evaluated for the project area to produce a soil distribution map. The soil map was used to categorize the hydrological soil types (HST), into the following categories:

- Recharge.
- Responsive (shallow).
- Responsive (saturated).
- Interflow (A/B); and
- Interflow (A/bedrock).

Generally, interflow (A/B) soils (Reclaimed Sand) are dominant in the project area. In these HSTs the flow path is predominantly downslope in a lateral direction. If interflow soils are upslope from responsive soil types (typically estuary areas or wet topographic depressions) overland flow may occur at the contact (i.e. predicting a wetland stream). Deep secondary flow towards the saturated zone is expected, which will act as recharge soils.

Areas associated with wetlands and estuaries will primarily be responsive (wet). In responsive (wet) soils associated with the project area, the build-up of water is expected in the B and upper A horizons after rain and overland discharge and minor lateral seepage are expected (due to saturation excess). Secondary vertical seepage to deeper soil zones from the saturated B horizon is expected.
Several hydropedological risks were identified for the construction and operational phase of the transmission line (refer to tables 7-7 and 7-8 below). The risk associated with the construction and operational phase is estimated to be low and decrease to neutral 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 to no likely change in Present Ecological State (PES) or Ecological importance and Sensitivity (EIS).

Based on the project type, no hydropedological flow buffers will be required.

7.5.3.1 Impact assessment findings (with and without mitigation): ***Transmission Line Alternatives and Laydown Area: Construction Phase***

The following will likely contribute to the impacts of hydropedological flow drivers, and soil quality:

- 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).
- 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 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.

Table 7-7: Estimated hydropedological risks (Preparation & Construction Phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Soil interflow processes: • Infilling of wetlands and watercourses inducing alternative flow paths. • Alteration to natural hydropedological flow paths. • Impacts on the macro-soil structure. • Impacts on the hydropedological processes supporting the watercourses. Soil structure & land capability: • 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. • Vegetation loss. • Soil compaction; and Soil erosion.	Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	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. All development footprint areas remain as small as possible and vegetation clearing is limited to what is essential. Retain as much indigenous vegetation as possible. Exposed soils are to be protected using a suitable covering or revegetating.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
	Disturbing vadose zone during soil excavations/infilling activities.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
	In-situ placement of new soils, altering existing soil-flow processes (i.e. infilling of wetlands or excavations).	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
	Vegetation clearing & soil stockpiling.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Surface water (wetland) quality	Leakages from vehicles and machines. Surface water contamination and sedimentation from the following activities: • Equipment and vehicles are washed in the water bodies (when there is water); • Erosion and sedimentation of watercourses 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).	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Existing roads should be used as far as practical to gain access to the site, and crossing watercourses in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles. Have emergency fuel & oil spill kits on site.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Soil quality	Oil & fuel spills from vehicles installing the transmission line	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

7.5.3.2 *Impact assessment findings (with and without mitigation):* ***<u>Transmission Line Alternatives: Operational Phase</u>***

The following will likely contribute to the impacts of hydropedological flow drivers, and soil quality:

- Nett implications of alterations to natural soil flow that occur during the construction phase.
- Soil & surface water contamination and sedimentation from the following activities:
  - Oil & fuel leakages from maintenance and service vehicles.
  - Spillages from switch stations associated with the project.

Table 7-8: Estimated hydropedological risks (Operational Phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Soil interflow processes: • Infilling of wetlands and watercourses inducing alternative flow paths. • Alteration to natural hydropedological flow paths. • Impacts on the macro-soil structure. • Impacts on the hydropedological processes supporting the watercourses.	Disturbing the inner-soil architecture of the original soil profile will disturb natural flow processes – during the construction phase. Excavated soil will be placed in other areas (i.e. on top of other soils) and will have an impact on the flow dynamics of the soil it is dumped on top of. This may reduce rainfall infiltration and induce runoff.	The net result of earthworks & development activities.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Revegetate areas (with vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion. Cover excavated soils to be protected using a suitable covering.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Soil quality	Oil & fuel spills from vehicles installing the transmission line	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Have emergency fuel & oil spill kits on site.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

7.5.3.3 Cumulative Impacts

As the proposed activities will stretch over several sub-catchments and take place close to other proposed power development there will be cumulative impacts (however limited due to the project type).

The following similar projects are known to occur/are proposed within a 30 km radius of the study area:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

From a review of the above-mentioned draft EIA reports for the projects, the impacts in terms of wetlands which are predominantly sustained by hydropedological attributes are described as being insignificant. Based on available information for the study area, and in terms of the potential contributing impact on the hydropedological system after consideration of this project, it is concluded that the contributing impact to other similar projects in the area will be low to neutral. The cumulative impact in terms of construction and operation phases associated with this project is anticipated **to be low to neutral**.

7.5.3.4 Mitigation Measures

No dedicated buffer areas were identified as part of the hydropedology assessment, as the predicted impacts associated with the proposed activity on the hydropedological environment are deemed low to neutral. It is however proposed to:

- Maintain the construction buffer around wetlands in the project area, as specified by the wetland report; and
- Maintain the operational phase buffer (working servitude) for any vehicles servicing the transmission line.

The recommendations are made:

- Appropriate erosion and protection barriers/structures should be considered for areas where land will be cleared.
- There is some potential for erosion. Measures should be taken to ensure that this is minimized where possible.
- The Department of Environmental Affairs (DEA) published a generic Environmental Management Plan (EMPr) for substations and powerlines (22 March 2019). It is proposed that the mitigation and monitoring plan presented in this report be further supplemented by the generic EMP document.
- It is recommended that mitigation measures, as described in be implemented during the construction and operational phase of this project.

7.5.3.5 Specialist's Conclusion

The hydropedology assessment **cannot find any grounds or identify high hydropedological risks to not authorising the proposed transmission lines**. This is grounded on the assumption that the proposed mitigation measures and recommendations are implemented during the construction and operational phase of the transmission lines.

7.5.4 Geohydrology Impacts

Based on the investigation undertaken, two (2) aquifer systems are envisioned - an unconfined aquifer associated with the unconsolidated sands, and a confined and fractured aquifer network associated with deeper and older granite/gneiss rock.

Available groundwater level data suggest that the water table for the area ranges from 3 to 15 metres below ground level (mbgl).

Based on the Source-Pathway-Receptor (SPR) model, the following receptors are noted for the project area:

- The non-perennial streams and wetland (estuary) system downstream of the site;
- The vadose zone soils; and
- The groundwater table.

The risk and impact assessment undertaken suggest that the potential geohydrological impact at the site (quantity and quality) is low to neutral.

- Risks during the construction phase are low and can be considered reversible impacts.
- Low to neutral impacts are anticipated for the operational phase of the project.

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).

7.5.4.1 Impact assessment findings (with and without mitigation): ***Transmission Line Alternatives and Laydown Area: Construction Phase***

The site conceptual geohydrological model (SCM) for the site shows that aquifer underlying the site consists of undifferentiated sand and can be regarded as a low to a moderate-yielding aquifer, with reported yields ranging from 0.1 to 0.5 l/sec. Based on extrapolated groundwater level data, it is estimated that the groundwater level for the site is in the order of 13 mbgl. Available data suggest that the groundwater table mimics the topography and groundwater flows from high-lying areas (water divides) to low-lying areas.

In the SCM, the main source of groundwater recharge is rainfall. The rainfall infiltrates into the ground to become groundwater through the Vadose Zone. The water then moves both vertically and horizontally in the weathered zone. Water flowing horizontally towards the south-east is likely to discharge into the perennial streams/river and wetland areas as base flow whereas water flowing vertically is likely to recharge the fractured aquifer (i.e. partially due to vertical percolation through the vadose zone and weathered aquifer zones).

Any poor-quality seepage from the activities associated with the development of the transmission lines (i.e. crossing of waterbodies with vehicles, seepage and runoff from oil spillages and building material dumping along the watercourse) could lead to contamination of the vadose zone which could percolate to the shallow aquifer. This risk is more likely to occur during the construction phase and not the operational phase of the project.

The current scale of abstraction for the sub-catchment associated with the project is predicted at “Small Scale”, and aquifer stress is “Class A - Unstressed or low level of stress”. The stress induced is maintained under the climate change scenario (Projected reduction in MAP for 2021 - 2050 under the RCP 8.5 = -53.24 mm/yr).

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

Table 7-9: Potential geohydrological risks and mitigation measures (construction phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Vadose zone soils and subsequent aquifer (groundwater table)	Disturbing vadose zone during soil excavations/construction activities.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low – negative (-13 to -24) (-20)	Only excavate areas applicable to the project area. Cover excavated soils with a temporary liner to prevent contamination. Retain as much indigenous vegetation as possible. Exposed soils are to be protected using a suitable covering or revegetating.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
	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.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low – negative (-13 to -24) (-20)	Place drip trays under vehicles at the site. Visual soil assessments for signs of contamination (monthly)	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Primary Surface Water Receivers > Non-perennial streams > Mhlatuze River > Wetland system (Watercourses)	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).	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Install a temporary cut-off trench to contain poor-quality runoff (if required) Routine inspections of all infrastructure (monthly)	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Groundwater Users in the Area (Groundwater table and users of groundwater)	Two (2) groundwater user/register borehole falls downstream of the proposed development. Limited impacts are anticipated due to the project type. These boreholes could not be identified in the field, and hence questioned whether they still exist.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	Neutral impact. No mitigation required								

7.5.4.2 *Impact assessment findings (with and without mitigation): **Transmission Line Alternatives: Operational Phase***

Table 7-10: Potential geohydrological risks and mitigation measures (operational phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Perched Water Table Dewatering	Temporary dewatering of perched groundwater (if it occurs)	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Have appropriate dewatering systems in place.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
Vadose zone soils and subsequent aquifer (groundwater table)	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.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	Water quality monitoring of the downstream surface water. Park service vehicles in lined areas and place drip trays under vehicles at the site. Visual soil assessments for signs of contamination (when servicing of transmission lines takes place)	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
Groundwater Users in the Area (Groundwater table and users of groundwater)	Two (2) groundwater user/register borehole falls downstream of the proposed development. Limited impacts are anticipated due to the project type.	Net Result of Earthworks and development	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	No monitoring is proposed. Impact probability is neutral.								

7.5.4.3 Cumulative Impacts

Other proposed energy developments are situated in different drainage areas, rendering the likely impact associated with this project, zero. Any geohydrological risk for this project will be confined to the delineated sub-catchments (worst case). The construction and operational phase risk tables consider cumulative risks.

Based on available information for the study area, and in terms of the potential contributing impact on the groundwater system after consideration of this project, it is concluded that the contributing groundwater impact to other similar projects in the area will be zero. The cumulative impact in terms of construction and operation phases associated with this project is **anticipated to be neutral**.

7.5.4.4 Mitigation Measures

The following mitigation measures were proposed for inclusion into the EIA and EMPr:

- All waste generated during construction on site (i.e. building rubble, used oil and paint containers, etc.) must be stored in designated areas which are isolated from surface drains. Waste storage facilities should be covered to prevent dust and litter from leaving the containment area, and to prevent rainwater ingress.
- Minimise the amount of exposed ground and stockpiles of building material (i.e. sand, cement, wood, metal, paint, solvents, etc.) to prevent suspended solid transport loads and leaching of rocks/materials. Stockpiles can be covered, and sediment fences constructed from a suitable geotextile.
- The Department of Environmental Affairs (DEA) published a generic Environmental Management Plan (EMPr) for substations and powerlines (22 March 2019). It is proposed that the mitigation and monitoring plan presented in the geohydrological report be further supplemented by the generic EMP document.
- It is proposed that the water monitoring be implemented as discussed in Section 7 of the geohydrological report, and as required.

7.5.4.5 Specialist's Conclusion

This assessment **cannot find any grounds or identify high geo-hydrological risks to not proceed with the development** of the proposed transmission lines. This is grounded on the assumption that the proposed mitigation measures, EMPr and EIA recommendations are implemented during the construction and operational phase of the transmission lines.

7.5.5 Wetland Impacts

After the application of the initial risk screening assessment, it was determined that the proposed development consist of a total of twenty six (26) watercourses (refer to Figure 7-3), in which the classification of these watercourses are one (1) artificial dam, one (1) estuary/port waters, three (3) channelled valley bottom (CVB) wetlands, two (2) depression wetland, five (5) floodplain (FP) wetlands, four (4) unchannelled valley bottom (UVB) wetlands, six (6) hillslope seepage (Seep) wetlands and four (4) river riparian systems. The riverine systems were classified as B channel streams.

It was determined that CVB01, FP01, FP02 and Seep06 will be impacted upon by the transmission line alternative route (i.e. alternative 2) and switching station, whereas CVB01, FP03, UVB01, UVB04 and Seep06 will be impacted upon by the transmission line preferred alternative, temporary laydown areas and switching station. These wetlands that will be impacted upon by the proposed development were determined to be of a high risk (as per the risk screening) as a result of their position in the landscape in relation to the proposed development. It must be noted that the risk rating was provided on the basis that the proposed development will occur within the wetland extent.

The overall Present Ecological State (PES) scores for CVB01, FP01, and Seep06 were calculated to be C (moderately modified), whereas FP03, UVB01 and UVB04 all calculated to be a D (largely modified) PES. The aforementioned scores for the at risk watercourses were primarily as a result of 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 indicated that modifications have moderately and largely impacted the wetlands within the study area which has subsequently impacted on the habitat quality, diversity, and size.

Although the at risk wetlands within the study area have undergone anthropogenic alterations as a result of the broader catchment activities, the at risk wetlands within the study were recorded to have maintained an ecosystem structure and function to have the ability to supply valuable Ecosystem Services (ESS) to the surrounding environment.

The at risk wetland systems calculated to have the potential to supply the following ESS at a moderate to moderately high level; nitrate and toxicant removal, sediment and phosphate trapping; and flood attenuation, streamflow regulation, erosion control and carbon storage at a moderate level. Furthermore, socio-cultural ESS were calculated to be supplied at a moderately low to low level as these wetlands were predominantly not utilised by the surrounding community, besides UVB01 in which the natural resource (reed type Cyperus papyrus) vegetation was being harvested. Furthermore, due to all the at risk wetlands besides Seep06 being identified at a desktop level to be National Freshwater Ecosystem Priority Area (NFEPA) and Critical Biodiversity

Areas, conservation and maintenance of these wetlands are imperative to achieve biodiversity goals for conservation and protection of these unique environments.

It was identified utilising the Risk Assessment Matrix that several aspects of the construction activities associated with the proposed development scored a moderate risk rating, however these aspects did not have the potential to be mitigated from a moderate to low risk rating, and therefore the proposed development has undergone a full Water Use License Application (WULA) process and received the relevant licence for the project.

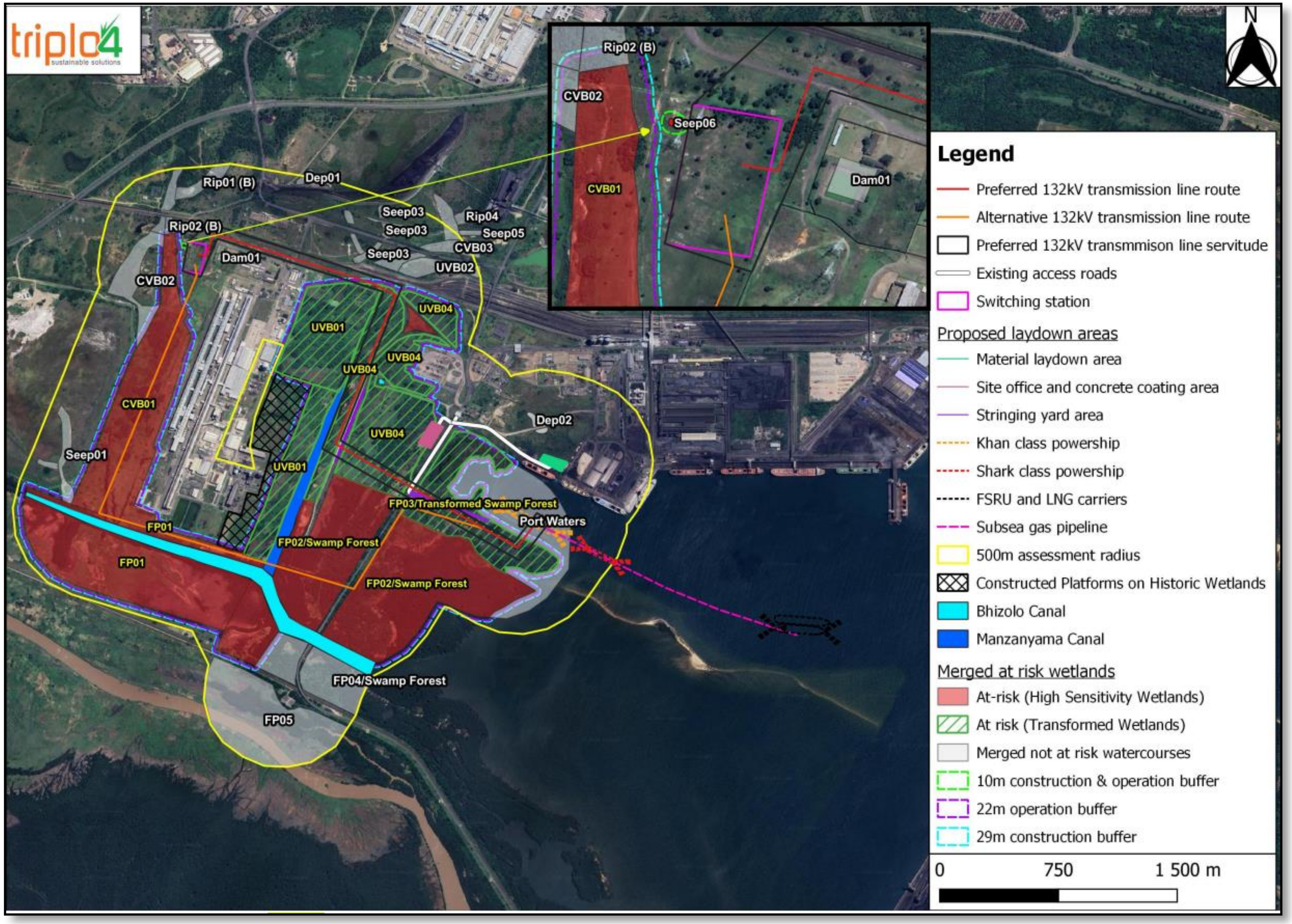


Figure 7-6: Map of the in-field delineations of the watercourses identified at the proposed development and 500m assessment radius

From the quantitative impact assessment conducted, it is evident that the overall impact significance scores can be mitigated to a medium to low and low impact rating, and utilising the specialist's preferred methodology, the overall impact significant scores are noted to be low to very low, post-mitigation.

All impacts are regarded as reversible, with no loss to irreplaceable features. However, it must be noted that in order to achieve reversibility of impacts and no loss of irreplaceable features, the mitigation measures outlined in Wetland report (Appendix 9–A6), coupled with the Wetland Rehabilitation Plan (Appendix 9–A7), must be implemented.

It was concluded that no fatal flaws exist for the preferred alternative of the proposed development from a wetland perspective. Furthermore, the specialist is not in support of the proposed Alternative 2 of the transmission line, as this route was deemed to impact on a major portion of wetlands within the study. Alternative 2 therefore was not assessed further in terms of impact ratings and scores.

The potential residual impacts associated with the proposed development were considered to be Low, should the Wetland Rehabilitation Plan be strictly implemented and subsequently monitored onsite.

With regards to the terminology irreplaceability, other terminology is utilised in the impact assessment such as: partial loss of wetland habitat, partial loss of ecosystem services and partial loss of migratory routes for semi-aquatic species. Furthermore, it must be noted that mitigation measures outlined in the Wetland report and the Wetland Rehabilitation Plan would render the aforementioned irreplaceable terms (e.g. partial loss of wetland habitat) to be reversible as the mitigation and rehabilitation measures being proposed will improve the functionality of the wetlands if properly implemented. Additionally, the rationale for these wetlands to be improved in terms of functionality can be better understood reading the Wetland Rehabilitation Plan. A brief explanation of this is that certain area of these wetlands were noted to not be functional anymore due to historic and current land use practices. The rehabilitation plan, when followed step by step, will ultimately create more functional area in the wetlands.

FP03 and UVB04 were determined to be directly impacted by the proposed development; however upon conducting the Wetland Offset utilizing the best practice guideline, FP03 and UVB04 did not require any offsetting due the potential improvement of the Wetland Functionality Targets and no change value for the Ecosystem Conservation Target. Other delineated wetlands are indirectly impacted and therefore did not fall part of the offsetting consideration.

From a freshwater perspective associated with the proposed development in Port of Richards Bay, Karpowership will have a minimal impact on freshwater resources, seeing that it will occur in an operational port and will only require monopole transmission lines on land, some of which will be placed in an already existing transmission line servitude.

Buffer Zone

It is recommended that the buffer zone be applied, as calculated for the at-risk wetlands which may potentially be impacted on by the proposed development. Due to most portions of the proposed development (Transmission Line Preferred Route and temporary laydown areas) occurring within or adjacent to the wetland, the buffers provided in Table 7-11 are not entirely practical. Thus, it is of the wetland specialist's opinion that the proposed development can occur within the wetland if the mitigation measures in the Wetland report are followed, along with implementation of the Wetland Rehabilitation Plan. The following activities should not be conducted within the calculated buffer zones (with the exclusion of the temporary construction facilities) - no ablution facilities, washing of vehicles, stockpiling, waste dumping (organic or artificial), haulage roads, and any other activities which may be detrimental to the health and functionality of the watercourse. Additionally, any unauthorised, or potentially detrimental activities, which occur in the direct vicinity, or upstream, of the watercourse should be rehabilitated according to the site EMPr, and preventative or mitigation strategies. Table 7-11 and Figure 7- 6 provide the recommended buffer zone relative to the study area.

Table 7-11: Recommended buffer zones for the wetlands that will be potentially impacted on by the proposed development

Watercourse	Construction Phase (m)	Operational Phase (m)
CVB01, FP01, FP02, FP03, UVB01, UVB04	29	22
Seep06	16	10

Rehabilitation

Due to certain activities of the proposed development occurring within the wetland footprint and being potentially permanent structures within the wetland, approximately 4.4 ha of wetland area will be lost.

If no rehabilitation will be conducted, ha equiv. of the at risk wetland systems will be an overall of 144.6 ha equiv. and a loss of 185.2 ha equiv. as compared to its current state. Furthermore, the difference of hectare equivalent loss for the at-risk wetlands systems will be an overall loss of 38.7 ha equiv. as compared to the current state.

If the relevant rehabilitation outlined the Wetland Rehabilitation Plan (Appendix 9-A7) are conducted, the overall ha equiv. for the at risk wetland systems will be 206.6 ha equiv. and a reduced loss of 123.2 ha equiv. as compared to its current state.

The difference of ha equiv. from the current state will be **an improvement of 23.3 ha equiv. if the rehabilitation is successful** and conducted in accordance to this rehabilitation plan (Table 7-12 and Figure 7-7).

Table 7-12: The overall hectare equivalents of the at-risk wetland systems in their current, post-development without rehabilitation, and post-development with rehabilitation states

States	Wetlands	Area (ha)	Ha Equiv.	Ha Equiv. Loss	Difference from Current State (ha)
Current State	CVB01	46.9	30.0	16.9	-
	FP01 FP02 FP03	188.8	112.2	76.6	-
	UVB01 UVB04	98.5	45.5	53.0	-
	Total	**334.2**	**187.7**	**146.5**	**-**
Post-Development – No Rehabilitation	CVB01	46.1	23.9	22.2	-5.3
	FP01 FP02 FP03	187.0	85.9	101.1	-24.5

States	Wetlands	Area (ha)	Ha Equiv.	Ha Equiv. Loss	Difference from Current State (ha)
	UVB01 UVB04	96.7	34.8	61.9	-8.9
	Total	**329.8**	**144.6**	**185.2**	**-38.7**
Post-Development – Rehabilitation	CVB01	46.1	32.7	13.4	+3.5
	FP01 FP02 FP03	187.0	123.8	63.2	+13.4
	UVB01 UVB04	96.7	50.1	46.6	+6.4
	Total	**329.8**	**206.6**	**123.2**	**+23.3**

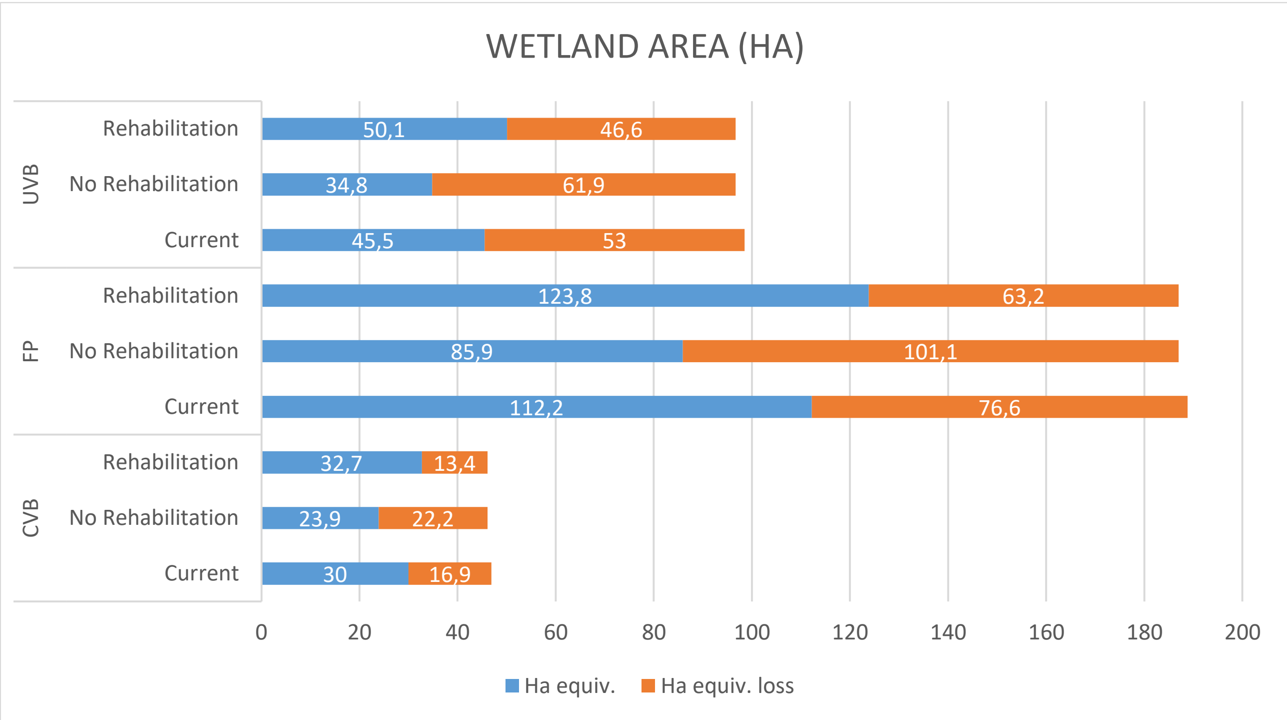


Figure 7-7: Representations of the hectare equivalent gain and loss of overall at risk wetland systems in its currents state, state without rehabilitation and state with rehabilitation.

7.5.5.1 *Impact assessment findings (with and without mitigation): **Transmission Line Alternative 1 and Laydown Area:***

The following is a representation of the quantitative impact assessment for the proposed development, as well as the mitigation measures that must be implemented to realise the post-mitigation significance scores.

Table 7-13: Impact categories and significance rating relating to the proposed development.

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
DIRECT IMPACTS									
Direct habitat modification	- *Vegetation removal* - *Direct infilling and/or excavation* - *Establishment of AIPs* - *Modification of profile (e.g. beds and banks)* - *Alteration in habitat types* - *New structure being introduced*	Medium (Negative)	Medium Low (Negative)	• 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. • The use of heavy construction vehicles within a wetland must not occur where possible. If usage of heavy construction vehicles is required in wetlands wooden planks must be placed in wetland area first and heavy construction vehicles to only drive on these planks. • All excavated topsoil and subsoil from the wetland must be stockpiled separately and reinstated in the order of subsoil and topsoil once	Medium Low (Negative)	Low (Negative)	Reversible	No	No

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
				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 must be re-vegetated with indigenous vegetation native to that area. • The drafted Wetland Rehabilitation and Monitoring Plan (T4-WRP-RB, Oct 2022) must be implemented and followed in order to reinstate the areas that will be disturbed.					

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
Water Quality (Pollution)	- *Hydrocarbon input from construction vehicles* - *The incorrect positioning and maintenance of the portable chemical toilets and use of the surround environment as ablution facilities may result in sewage and chemicals entering the wetlands* - *General waste being deposited into the wetlands by*	Medium (Negative)	Medium Low (Negative)	• Inspect all storage facilities and vehicles daily for the early detection of mechanical deterioration or leaks. • The placement of drip trays must be conducted under vehicles that are stationary on site. • Mixing and transferring of chemicals or hazardous substances must take place on drip trays, shutter boards or other impermeable surfaces within bunded areas and should only be mixed or transferred by suitably trained personnel. • Drip trays must be utilised at all fuel dispensing areas. • Vehicles and machinery should preferably be cleaned off site. Should cleaning be required on site it must only take place within designated areas away from the prescribed buffer zone and watercourses, and should only	Medium Low (Negative)	Low (Negative)	Reversible	No	No

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
	construction personnel - *Excess sediment input as a result of the construction activities and associated soil displacement* - *Raw cement entering the wetlands through incorrect batching procedure and/or direct disposal.*			occur in areas that have been previously disturbed and bunded areas. • Dispose of used oils, wash water from cement and other pollutants at an appropriate licensed waste facility. • All construction material brought onto site must be non-reactive to prevent contamination. • Clean up any spillages immediately with the use of a chemical spill kit and dispose of contaminated material at an appropriately registered facility. • The digging of pit latrines is not allowed under any circumstances. • None of the open areas or the surrounding environment may be used as ablution facilities.					
INDIRECT IMPACTS									

Catchment modifications (land cover and surface runoff)	- *Vegetation removal* - *Erosion* - *Sedimentation* - *Increased surface runoff volume and velocity* - *Reduced infiltration* - *Alteration in habitat types* - *Reduction in soil permeability*	Medium Low (Negative)	Low	• 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. • All excavated topsoil and subsoil from the terrestrial areas must be stockpiled separately and reinstated in the order of subsoil and topsoil once construction activities are completed. • Stockpiled terrestrial 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 must be re-vegetated with indigenous vegetation native to that area.	Low	Very Low	Reversible	No	No

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
Water Quality (Pollution)	- *Hydrocarbon input from construction vehicles* - *The incorrect positioning and maintenance of the portable chemical toilets and use of the surround environment as ablution facilities may result in sewage and chemicals entering the wetlands* - *General waste being deposited into the wetlands by*	Medium Low (Negative)	Low	• Inspect all storage facilities and vehicles daily for the early detection of mechanical deterioration or leaks. • The placement of drip trays must be conducted under vehicles that are stationary on site. • Mixing and transferring of chemicals or hazardous substances must take place on drip trays, shutter boards or other impermeable surfaces within bunded areas and should only be mixed or transferred by suitably trained personnel. • Drip trays must be utilised at all fuel dispensing areas. • Vehicles and machinery should preferably be cleaned off site. Should cleaning be required on site it must only take place within designated areas away from the prescribed buffer zone and watercourses, and should only	Low	Very Low	Reversible	No	No

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
	construction personnel - *Excess sediment input as a result of the construction activities and associated soil displacement* - *Raw cement entering the wetlands through incorrect batching procedure and/or direct disposal.*			occur in areas that have been previously disturbed and bunded areas. • Dispose of used oils, wash water from cement and other pollutants at an appropriate licensed waste facility. • All construction material brought onto site must be non-reactive to prevent contamination. • Clean up any spillages immediately with the use of a chemical spill kit and dispose of contaminated material at an appropriately registered facility. • The digging of pit latrines is not allowed under any circumstances. • None of the open areas or the surrounding environment may be used as ablution facilities.					

7.5.5.2 Cumulative Impacts

Four other power production developments were considered for cumulative impacts, namely:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

Overall, wetlands within the Port of Richards Bay and the IDZ have been extensively disturbed due to current and past land use practices such as industrial and port activities.

The RBGP2 400MW Gas to Power Project at the RBIDZ 1F consisted of no wetlands on site and no wetlands that will be impacted upon by the proposed project. Impacts can be indirect in nature and very unlikely (Low Negative).

The study area of the Nseleni Independent Floating Power Plant – Port/ Old Bayside Complex consisted of several wetlands that may be impacted by the proposed project. Wetlands will be most likely directly and indirectly impact on by the project. In terms of cumulative impacts, the greater catchment of the Port of Richards Bay and IDZ will experience a (Moderate Negative) loss of wetlands if the Nseleni Independent Floating Power Plant and Karpowership project commences. However, if the Wetland Rehabilitation Plan outlined for the Karpowership project is implemented in conjunction with the mitigation and rehabilitation measures formulated for the Nseleni Independent Floating Power Plant project, the functional area of wetlands in the Port of Richards Bay and IDZ area can be improved to mitigate the (Moderate Negative) loss to (Low Negative) loss.

The Eskom 3000 MV CCPP and associated infrastructure Project consisted of several wetlands on the site that will be impacted by the proposed project. Wetlands will be most likely directly and indirectly impacted by the project. In terms of cumulative impacts, the greater catchment of the Port of Richards Bay and IDZ will experience a (Moderate Negative) loss of wetlands if the Eskom 3000 MV CCPP project and Karpowership project commence. However, if the Wetland Rehabilitation Plan outlined for the Karpowership project is implemented in conjunction with a mitigation and rehabilitation measures for the Eskom 3000 MV CCPP project, the functional area of wetlands in the Port of Richards Bay and IDZ area can be improved to mitigate the (Moderate Negative) loss to (Low Negative) loss.

The study area of the Phinda 320MW Emergency Risk Mitigation Power Plant (RMPP) and associated infrastructure near Richards Bay consisted of wetlands on site, however no wetlands were determined to be at direct risk of being impact on by the project. Indirect impacts may be evident, however this was determined to be very unlikely, and thus the overall impact significance of the development was determined to be (Low Negative).

The overall cumulative impacts can be **measured as a (Moderate Low Negative) loss of wetlands**, which includes the KSA Gas to Power Project.

7.5.5.3 Mitigation Measures

Table 7-14: Pre-Construction phase mitigation measures.

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - PRE-CONSTRUCTION
Generic/Broad	- The footprint of the all laydown areas and the construction footprint must be kept to a minimum, to ensure there is no unnecessary intrusion into any watercourses. - All access points, roads and turning areas as per authorised footprint must be agreed by the engineer and Environmental Control Officer (ECO) prior to commencement of construction. No ad hoc haulage roads or turning areas may be created. - Stockpile areas of raw materials and other construction material must be clearly identified and demarcated prior to materials being brought onto site. None of these areas must be on or near slopes. All stockpiling areas must be approved by the ECO before stockpiling occurs. - Detailed planning, positioning and demarcation of onsite waste dump sites must be completed prior to any waste handling occurring (this includes rubbish). All onsite personal must also be trained in proper waste management techniques and shown the appropriate waste dumps for specific materials prior to any construction activities occurring (including site establishment). - The contractor must utilize a Stormwater Management Plan (which may form part of the construction method statement) to ensure that all construction activities do not cause, or precipitate, soil erosion which may result in sediment input into the surrounding environment. The designated responsible person on site, as indicated in the stormwater control plan (Site Manager) must ensure that no construction work takes place before the stormwater control measures are in place and must include post-construction/operational phase stormwater requirements. - Soft engineering (grassed swales (Teff Grass or Red Grass ideal for this climate)) instead of hard gutters should be used where possible. - All staff are to be trained on their environmental responsibilities before commencing work. All new staff are to be trained before they start work on site. This should be adequately covered within the site-specific EMPr and should not require input from a wetland assessment (above what is detailed within this report). - Restricted areas must be determined and demarcated and agreed upon by contractors, engineers and ECO before any construction activities occur onsite. Special attention must be given to the identified wetland systems (and their associated buffers) in the vicinity of the development activities. Unnecessary intrusion into these systems is prohibited and only those that are authorized should be conducted. These areas must be clearly demarcated onsite and indicated to all construction workers onsite before any construction activities (including site establishment) takes place. Where intrusion is required, the working corridor must be kept to a minimum and identified and demarcated clearly before any construction commences to minimize the impact. Wetland areas that should not be accessed are FP01, FP02 and CVB01.
Site/Project Specific	- Existing access/haulage routes must be utilised during construction as far as possible. - Crossing structures utilised be wide enough to allow diffuse, unhindered through-flow of the wetland systems and avoid impoundment upslope.

Table 7-15: Construction Phase Mitigation Measures

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - CONSTRUCTION
Generic/Broad	- A construction method statement is required to be compiled by the applicant/contractor for all activities associated with the proposed development. This method statement must include the phases of the project, activities associated with the construction and all mitigation measures stipulated within this report and the site-specific EMPr. The applicant, engineer, contractor and ECO must agree and approve the statement as this will become a binding document which must be implemented onsite. The independent ECO must monitor that this document is continuously implemented onsite to ensure no unnecessary disturbance. - A serial plan of construction must be developed: • Construction must be immediately followed by rehabilitation; • Excavation of any soils in the wetland system must be done to allow the storage of soil in sequence; • Soil replacement must be conducted in same sequence as excavated; • Soil surfaces must not be left open for lengthy periods to prevent erosion. • Affected surface vegetation must be removed, appropriately stored then reinstated, immediately post-construction, as close to their original position as possible, to reduce the possibility of longer-term change to the vegetation community. The vegetation must be removed keeping the root systems intact as far as possible. • If required vegetation plugs can be sorted from areas adjacent to the construction site, under the supervision of the Environmental Control Officer or appointed landscaper. - Environmental inductions and training must include the contents of the above method statement. - During the necessary removal of the natural vegetation for the development of the associated infrastructure (e.g. site camp, access roads) any protected species which are recorded must be safely relocated to an adequate habitat within the same catchment area. An independent botanist must be consulted during this process. - Excess dust observed in the vicinity of the proposed development must be noted and the appropriate dust suppression techniques implemented to ensure no excess sediment input into the surrounding wetlands. - Cut and fill must be avoided where possible during the set-up of the construction camp. The utilization of the already heavily disturbed areas should be encouraged. - Removal of vegetation must only be done when essential for the proposed development. Do not allow any disturbance to the adjoining natural vegetation cover or soils. All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO. - Where feasible, construction activities should be conducted during the drier months of the year (April – August) to minimize the possibility of erosion, sedimentation and transport of suspended solids associated with disturbed areas and rainfall events. No construction activities must be conducted during storm events. - All potential stormwater contaminants must be bunded in the site camp to prevent run-off into the surrounding environment. A drainage system must be established for the construction camp. The drainage system must be regularly checked to ensure an unobstructed water flow.

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - CONSTRUCTION
	- Establish cut off drains and berms to reduce stormwater flow through the construction site. - The contractor must prepare a Stormwater Control Plan (which may form part of the construction method statement) to ensure that all construction activities do not cause, or precipitate, soil erosion sediment which may result in sediment input into the surrounding environment. - The designated responsible person on site, as indicated in the stormwater control plan (Site Manager) must ensure that no construction work takes place before the stormwater control measures are in place and must include post-construction/operational phase stormwater requirements. - No contaminated runoff or grey water is allowed to be discharged from the construction camp. - The demarcated wetlands systems must be protected from erosion and direct or indirect spills of pollutants, e.g. sediment, refuse, sewage, cement, oils, fuels, chemicals and wastewater. - All exposed surfaces within the construction site must be checked for AIPs monthly and any identified alien species must be removed by hand pulling/uprooting and appropriately disposed of. Herbicides should **only** be utilised where manually removing is not possible. Herbicides utilised are restricted to products which have been certified safe for use in wetland areas by an independent testing authority. The ECO must be consulted before the purchase of any herbicide. - Stockpiles and topsoil storage areas must not be located within the wetlands and/or riverine channels or within the 1:100-year flood lines. The furthest threshold must be adhered to. Stockpiles should not be placed in vegetated areas that will not be cleared. Stockpile areas can be placed in the proposed material laydown area. - Erosion control measures including silt fences, low soil berms and/or shutter boards must be put in place around the stockpiles to limit sediment runoff from stockpiles. - Water used on site must be from an approved source. - The digging of pit latrines is not allowed under any circumstances. - None of the open areas or the surrounding environment may be used as ablution facilities. - Material Safety Data Sheets (MSDSs) must be readily available on site for all chemicals and hazardous substances to be used on site. Where possible and available, MSDSs should additionally include information on ecological impacts and measures to minimize negative environmental impacts during accidental releases or escapes. - Hazardous material must be stored in designated areas with adequate pollution prevention. Hazardous material should be stored at the material laydown area which does not fall within a delineated wetland. Should any spills of hazardous materials occur on the site or in the storage area, the relevant clean-up specialists must be contacted immediately. Materials that absorb fuel & oil, such as spill kits or earth should be placed over the spill. This contaminated material must be uplifted, placed within impermeable container and disposed of at a recognized disposal site. - In the event of a spillage that cannot be contained and which poses a serious threat to the local environment, the following Departments must be informed of the incident in accordance with Section 30 of the National Environmental Management Act, Act 107 of 1998, within forty-eight (48) hours: • The Local Authority; • DWS; • The Department of Economic Development, Tourism and Environmental Affairs

<table>
<tr><th>MITIGATIVE MEASURES</th><th>PHASE OF PROPOSED DEVELOPMENT - CONSTRUCTION</th></tr>
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The Local Fire Department when relevant; and
Any other affected departments.
- An incident record must be completed for all spills that do occur onsite. Minor incidents will include small spills of less than 5 litres (L) that do not enter a watercourse, stormwater drains, housekeeping issues and general small non-compliances with the requirements of this report, method statements, EA and/or EMPr. The record of incidents is to be included in the reporting to the authorities. Major incidents must be reported to the authorities, which include spills larger than 5L and all incidents involving contamination of water resources, stormwater or other reportable incidents. Minor incidents: small spills less than 5L that do not enter stormwater, minor non-compliance with EMPr that does not cause major environmental impact i.e. Housekeeping issues. Action: Supervisor and staff on site to record and address and notify ECO. ECO to advise on remediation measures and to follow up on actions taken to address incident. Records: On site incident register. Major incidents: Large spills or any spills that enter watercourses, stormwater, contamination of soil, fires, explosions. Action: Report immediately to ECO, action to be taken to prevent further damage and incident to be reported to authorities. ECO to advise on remediation measures and to follow up on actions taken to address incident. Records: On site incident register and report to authorities as listed above.
- The harvesting of firewood, medicinal plants, tree bark, flowers or other natural materials is forbidden on the site and surrounding environment.
- The Contractor must, as an initial and on-going exercise, implement erosion and sedimentation control measures (e.g. sediment capture/silt fences) to the satisfaction of the ECO. Stabilisation of cleared areas to prevent and control erosion and/or sedimentation must be actively managed.
- Sediment control: construct silt fences/traps in areas prone to erosion, to retain sediment-laden runoff. (i.e. place silt traps strategically on the periphery of freshwater resources, remove sediment on a regular basis (weekly) and transport to designated dumping site, ensure silt fences/traps are adequately maintained).
- A designated waste area, which must be located outside of the wetland constructional buffer and the 1:100 year floodline, must be utilised at all times. Bins must be provided and emptied at no less than monthly intervals. The material laydown and site office can be utilised for this activity.
- All solid waste generated during the construction process (including packets, plastic, rubble, cut plant material, waste metals) must be placed in the waste collection area in the construction camp and must not be allowed to blow around the site, be accessible by animals, or be placed in piles adjacent the skips / bins.
- Burying of waste, rubble on site, or dumping in drainage lines/rivers is strictly prohibited.
</td></tr>
<tr><td>Site/Project Specific</td><td>
- The impoundment of water upslope due to 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 (preferred alternative) and following wetlands: FP03 and UVB04.
- 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.
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MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - CONSTRUCTION
	- Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor and ECO must check the site for erosional damage and rehabilitation must occur immediately if damage is found. - During the period when heavy machinery (e.g. Tractor Loaded Backhoe (TLB), truck, 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 areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.

Table 7-16: Post-construction/rehabilitation phase measures

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - POST-CONSTRUCTION/REHABILITATION
Generic/Broad	- Rehabilitation is not the static endpoint of a recipe-like process (Kusler & Kentula, 1990). Rather, it is a process in its own right, whereby the wetland/riverine system is given an opportunity for a new beginning (Grenfell, *et. al*., 2007). - Rehabilitation requires that there is an attempt to imitate natural processes and reinstate natural ecological driving forces in such a way that it aids the recovery (or maintenance) of dynamic systems so that, although they are unlikely to be identical to their natural counterparts, they will be comparable in critical ways so as to function similarly (Jordan, et. al., 1987). - It must be recognised that rehabilitation interventions may have different ecological starting points (ranging from totally degraded to slightly degraded) and different goal endpoints (ranging from a state that is close to the pristine to one which is still far from pristine, but nonetheless an improvement on the state of the system without any rehabilitation intervention). The chosen goal endpoint depends on what is achievable, given the site conditions, and those ecosystem attributes and services that are considered most important. Any rehabilitation project should therefore be based on an understanding of both the ecological starting point and on a defined goal endpoint, and should accept that it is not possible to predict exactly how the wetland/riparian system is likely to respond to the rehabilitation interventions. - The most typical rehabilitation interventions designed to assist in the recovery of degraded wetland ecosystems are ‘plugs’. The ‘plugs’ are placed with the intention of reinstating a more natural hydrology. Typical interventions for maintaining the health wetland ecosystems that are in the process of degrading are the placement of erosion control structures which assist in halting the advance through a wetland of an erosion headcut. However, rehabilitation is not confined to physical structures, and rehabilitation may include interventions such as reducing livestock grazing-pressure or reducing the frequency of burning. - All post-construction building material and waste must be cleared in accordance with the EMPr, before any re-vegetation may take place.

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - POST-CONSTRUCTION/REHABILITATION
	- Erosion features that have developed as a result of construction related disturbance are required to be stabilised. This may also include the need to deactivate any erosion head cuts/rills/gullies that may have developed by either compacted soil infill, rock plugs, gabions or any other suitable measures. - If the gradient of the banks is greater than 1:1.75, the banks must be stabilised with a biodegradable cover such as Geojute which must be secured to the steep slope with wooden (biodegradable) pegs. This will reduce soil erosion potential. - Any areas, which fall outside the direct construction footprint, that have been compacted are required to be ripped to allow for the establishment of vegetation. This ripping must not result in the mixing of sub - and topsoil. - No imported soil material may be utilised for rehabilitation, unless it can be ensured that it is free of any AIPs seeds. - Before adding the topsoil weeds and AIPs must be removed. - Additional stabilisation of cleared areas to prevent and control erosion must be actively managed. The method of stabilisation should be determined in consultation with the ECO and engineer. The following methods (or a combination) may be considered, depending on the specific conditions of the site: • Brush packing • Mulch or chip cover • Terracing • Straw stabilising (at the rate of one bale/m² and rotated into the top 100mm of the completed earthworks) • Watering • Planting / sodding • Hand-seeding / Hydro-seeding • Mechanical cover or packing structures (Geofabric, Hessian cover, Armourflex, Log / pole fencing) - The landscape architect/horticulturist must supervise the handling, maintenance and planting of the plant/trees. No trees must be planted within the authorised/agreed transmission servitudes. - No AIPs may be utilised during the rehabilitation process. - Rapidly germinating indigenous species (e.g. fast growing, deep rooting, rhizomatous, stoloniferous) known to bind soils in terrestrial, riparian and/or wetland areas must be utilised where there is a strong motivation for stabilisation over reinstating similar plant communities to that being disturbed. This should be informed by a qualified specialist. - Exposure of plant root systems to drying winds, high temperatures or water logging must be avoided. - Where possible, revegetation must take place at the start of the spring rains to maximise water availability and minimise the need for irrigation. This will ensure optimal conditions for germination and rapid vegetation establishment. If not possible during the correct season, revegetation can start immediately with regular irrigation to assist with revegetation growth, under the guidance of a qualified horticulturist. - If this is not possible, irrigation of planted areas may be necessary during dry periods (external sources of water must be utilised e.g. Joe-Joe tanks). - Water utilised for irrigation must be free of any chlorine or contaminants that may negatively affect the plant species. - The use of irrigation may be halted where hydro-seeding shall be utilised, until seeds have germinated and growth has commenced. - It is the contractor's responsibility to continuously monitor the area for AIPs during the contract and establishment period, and any AIPs encountered must be removed.

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - POST-CONSTRUCTION/REHABILITATION
	- Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas. - AIPs shall not be stockpiled, they should be removed from site and dumped at an approved site. - Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use, for the necessity, type proposed to be used, effectiveness and impacts of the product on aquatic biota.
Site/Project Specific	- Rehabilitation must commence immediately or 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 unauthorised haulage or 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. - 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. - 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 (Plant species lists can be sourced from the Ecological Impact Assessment and Estuarine Impact Assessment).

Table 7-17: Operational phase mitigation measures

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - OPERATIONAL
Generic (Broad)	- The establishment and infestation of AIPs must be prevented, managed and eradicated in the areas impacted upon by the proposed construction activities by a horticulturist for the period stipulated in the Wetland Rehabilitation Plan (T4-WRP-RB, Oct 2022). The type of species and location of that species will determine the type of methodology required for its management and eradication. This methodology should target all lifecycle phases and propagules of the specific species, e.g. seedlings/saplings, seeds, roots. - Indigenous vegetation within the site must not be removed or damaged, where possible, during the alien plant control, increasing the probability of indigenous species propagating and preventing the re-establishment of alien species. - As stated above, any use of herbicides in removing alien plant species is required to be investigated by the ECO before use, for the necessity, type proposed to be used, effectiveness and impacts of the product on aquatic biota.

MITIGATIVE MEASURES	PHASE OF PROPOSED DEVELOPMENT - OPERATIONAL
Site/Project Specific	- The monitoring of the overhead powerlines and associated infrastructure (e.g: foundation) 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 (Section 12) below.

7.5.5.3.1 Monitoring Requirements

The monitoring of the proposed development is essential to maintain and/or improve the PES of the surrounding wetland/riverine systems. The mitigative recommendations stated above must be incorporated into the project-specific EMPr and compliance with the requirements/recommendations must be audited by a suitability qualified independent ECO. The key to a successful EMPr is appropriate monitoring and review to ensure effective functioning of the EMPr and to identify and implement corrective measures in a timely manner. Monitoring for non-compliance must be undertaken on a daily basis during the construction phase by the contractors under the guidance of the Project Manager / ECO / Engineer. An appropriately timed audit report should be compiled by the independent ECO. Paramount to the reporting of non-conformance and incidents is that appropriate corrective and preventative action plans are developed and adhered to. Photographic records of all incidents and non-conformances must be retained. This is to ensure that the key impacts on the watercourses are adequately managed and mitigated against and that the rehabilitation of any disturbed areas within any system is successful.

- A monitoring programme must be in place not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts during the vegetation establishment phase. Compliance against the EMPr must be monitored during the construction phase monthly by an independent ECO. The period and frequency of monitoring required post-construction must be determined by the competent authorities or from ESKOM generic documentation and implemented by the ECO. Once the initial transplants / plugs are planted, the landscaper must conduct weekly site visits to remove AIPs (in accordance with the latest revised NEM:BA requirements) and address any re-vegetation concerns until re-vegetation is considered successful (i.e. >80% indigenous cover). An accepted monitoring period of re-vegetated areas after this initial period is monitoring every 3 months for the first 12 months and every 6 months thereafter until the vegetation has successfully been established. If the re-vegetated areas have inadequate surface coverage (less than 30% within 9 months after re-vegetation) the area should be prepared and re-vegetated again.
- The cost-effective qualitative monitoring of the rehabilitation area may be time based through the use of periodic photographs taken from permanent photo points. These points are required to be established during site inception. The timeline created between the pre- and post-rehabilitation photos will provide an invaluable visual representation of the progress that is conveyed in a straightforward manner. The photographer should be an environmental scientist therefore allowing an expert assessment of the site adding to the qualitative information gathered from the photographs.
- The below mentioned criteria must be adhered to, ensuring the quality of the information collected:
  - Establishment of the photo points must be completed during site inception/establishment. This will allow for pre-rehabilitation imagery spanning more than a once off photograph.
  - These points should be permanently marked and assigned a unique identify number to ensure continual relocation and accuracy of the photographs. GPS co-ordinates should be recorded of each site. This is to ensure if any markers are removed or vandalised then they can be replaced.
  - Photo point locations should be easily relocated and accessible and must not be obscured by future vegetation growth.
  - The level of detail captured must be appropriate to the area that has undergone rehabilitation.
  - Photo record forms must be developed and utilised for every photo taken. The information required will be project name, location, unique identity number, directional point (e.g. North, South), date, time, photographers name and additional comments.

- Qualitative ecological information that must be visually interpreted and recorded at the same time as taking the photograph include:
    - Evidence of any channelling.
    - Extent of the site vegetation ground cover.
    - General level of plant growth, substrate levels, and water levels.
    - General observations of water quality such as clarity and presence of litter.
    - Evidence of anthropogenic presence
    - Vegetation condition, extent of AIPs; and
    - Evidence of erosion and close monitoring of the post-construction erosion-control measures which must be implemented.

This is to ensure that the key impacts on the watercourses are adequately managed and mitigated against and that rehabilitation of any disturbed areas within the system is successful.

7.5.5.4 Specialist's Conclusion

Upon the site visit and conducting the assessments, the **specialist support the proposed Transmission Line Preferred Route** and all of the associated construction activities and temporary laydown areas, and is not in support of the proposed Transmission Line Alternative Route (Alternative 2), as this route was deemed to impact on a major portion of wetlands within the study.

The mitigation measures outlined in the Wetland Assessment report are to be included in the EMPr, and must be followed. Due to certain portions of the proposed development occurring within the at risk wetlands, the Wetland Rehabilitation Plan (Appendix 9-A7) must be implemented to ensure no net loss of biodiversity occurs.

7.5.6 Heritage Impacts

No heritage sites were identified, and on that basis, the specialist concluded that **heritage sites will not be impacted** by the proposed development, and no heritage mitigation is required. In addition, since no heritage sites were noted, there is no cumulative impact.

A chance find protocol must be initiated during construction. 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. Although not anticipated, should maritime archaeology be discovered, SAHRA, as the contacting authority which deals with underwater cultural heritage, must be contacted immediately, and approval must be obtained should there be a need to demolish or remove such maritime archaeology site. Demolition / construction work may only commence or continue once SAHRA's approval has been obtained.

7.5.7 Terrestrial Biodiversity 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 indigenous vegetation. Impacts are medium to medium-low and can be reduced to low with the recommended mitigation measures.

The preferred route of the transmission line will be located as much as possible in the low sensitivity transformed, modified and degraded areas of the site. In addition, the location of the laydown area is in modified habitat, with the proposed switching station located in medium sensitivity bushveld vegetation. Some loss of moderate sensitivity areas will occur and is restricted to the loss of invaded reed beds within wetlands, the impacts of which are dealt with in more detail in the wetland assessment. There are three issues and eight impacts overall, and mitigation measures are recommended for each of the impacts.

As any loss of mangrove and/or swamp forest is not acceptable, and the alternative route of the transmission line (i.e. Alternative 2) proposed for the transmission line traverses both, the alternative route is considered fatally flawed and therefore was not assessed further, and the impact ratings are for the preferred route, laydown area, site office, stringing yard and switching station.

The summary of impacts associated with the development can be seen in Table 7-18.

Table 7-18: Summary of impacts associated with the transmission line and ancillary infrastructure.

Impact	Without Mitigation	With mitigation
Construction phase		
Issue 1: Loss of vegetation communities		
1: Loss of modified habitat	Medium-Low	Low
2: Loss of reed beds	Medium	Low
3: Loss of bushveld	Medium-Low	Low
Issue 2: Loss of Species of Special Concern and Biodiversity		
4: Loss of flora SCC	Medium	Low
5: Loss of fauna SCC	Medium	Low
6: Loss of biodiversity in general	Medium-Low	Low
Issue 3: Ecosystem function and process		
7: Fragmentation	Medium-Low	Low
8: Invasion of alien species	High	Low
Operational phase		
Issue 1: Loss of vegetation communities		
1: Loss of modified habitat	Medium-Low	Low
2: Loss of reed beds	Medium-Low	Low
3: Loss of bushveld	Medium-Low	Low
Issue 2: Loss of Species of Special Concern and Biodiversity		
4: Loss of flora SCC	Medium-Low	Low
5: Loss of fauna SCC	Medium-Low	Low
6: Loss of biodiversity in general	Medium-Low	Low
Issue 3: Ecosystem function and process		
7: Fragmentation	Medium-Low	Low
8: Invasion of alien species	High	Low

*7.5.7.1 Impact assessment findings (with and without mitigation): **Transmission Line Alternatives 1 and Laydown Area***

7.5.7.1.1 Issue 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.

Impact 1: Loss of modified habitat

Cause and comment: 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 for fauna.

This impact is rated based on the construction methodology of excavating the area, as well as clearing a linear footprint approximately 3m wide and constructing foundations where necessary to host the poles of the transmission lines. It is assumed that this construction footprint will then be allowed to grow vegetation, which will be mowed on a continual basis to allow for access to the transmission lines.

Significance statement: The impact in the construction phase will be short-term, limited to the surrounding area and definite, with a small severity resulting in a medium-low negative overall significance. With mitigation measures, this impact can be reduced to a definite small impact over a brief term, with a significance of low negative.

In the operational phase, the impact will be small, long term and restricted to the surrounding area occurring once a year likely resulting in a medium-low impact. This can be reduced to a low impact with mitigation.

Reversibility: This impact is reversible, as rehabilitation with indigenous plants would result in the restoration of ecosystem services as well as biodiversity and would return these areas of modified habitat to one better than prior to the development.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-19: Scoring of Impact 1: Loss of modified habitat

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 1: Loss of modified habitat														
Construction Phase														
Without mitigation	Small	2	Short term	2	Surrounding area	2	2	Once a year	1	Definitely	5	3	6	Medium-Low
With mitigation	Small	2	Brief	1	Immediate	1	1.3	Once a year	1	Definitely	5	3	3.9	Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once a year	1	Likely	4	2.5	6.5	Medium-Low
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Unlikely	3	2	4.6	Low

Mitigation and Management:

- In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction must not 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 must 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 will 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.

Impact 2: Loss of Reed beds

Cause and comment: It should be noted that this area, is effectively a wetland, and any recommendations made in the wetland assessment should overrule any made in the ecological report. This impact deals with the loss of vegetation in particular, and not the loss of wetland functionality and changes in water regimes.

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.

This impact is rated based on the construction methodology of excavating only foundations necessary for the erection of individual monopoles and a linear access footprint will not be excavated or constructed. It is assumed that berms are likely to be required in this section due to the wetland nature of the area, however, avoidance of berm construction should be investigated as a mitigation measure.

Significance statement: The impact in the construction phase will be great over the short term and restricted to the surrounding area, it will definitely occur once a year resulting in an overall significance of medium negative. Application of the mitigation measures will result in the reduction of the impact to a low negative.

In the operational phase, the impact will be significant over the long term and restricted to the surrounding area. It will occur once or more in 6 months and will be likely. This will result in an overall impact of medium-low which can be reduced to low with the application of mitigation measures.

Reversibility: This impact is reversible, as rehabilitation with indigenous plants and reeds within the wetland would result in the restoration of ecosystem services as well as biodiversity and would return these areas of degraded habitat to one better than prior to the development.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-20: Scoring of Impact 2: Loss of Reed Beds

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 2: Loss of Reed Beds														
Construction Phase														
Without mitigation	Great	4	Short term	2	Surrounding area	2	2.6	Once a year	1	Definitely	5	3	7.8	Medium
With mitigation	Significant	3	Brief	1	Immediate	1	1.6	Once a year	1	Possible	4	2.5	4.1	Low
Operational Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	2.3	Once or more in 6 months	2	Likely	4	3	6.9	Medium-Low
With mitigation	Significant	3	Medium term	3	Immediate	1	2.6	Once a year	1	Highly unlikely	2	1.5	3.9	Low

Mitigation and Management:

- In wetland areas including reed beds the construction measures must consist of the least impactful individual erection of monopole structures. No linear 3m footprints should be cleared of vegetation in these areas but individual drilled foundations used.
- No construction or storing of materials will be located outside of the defined construction area. These areas must 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 must 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.

Impact 3: Loss of Bushveld

Cause and comment: 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.

Significance statement: The impact in the construction phase will be significant over the short term and restricted to the surrounding area. It will definitely occur once a year and results in an impact rating of medium-low. This can be reduced to low with mitigation measures.

In the operational phase, the impact will be insignificant over the long term and restricted to the immediate area. It will be unlikely and occur once or more over 6 moths resulting in an overall impact rating of medium-low which can be reduced to low with mitigation measures.

Reversibility: This impact is not reversible as the structure constructed will be permanent in nature.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-21: Scoring of Impact 2: Loss of Bushveld

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 3: Loss of Bushveld														
Construction Phase														
Without mitigation	Significant	3	Short term	2	Surrounding area	2	2.3	Once a year	1	Definitely	5	3	6.9	Medium-low
With mitigation	Small	2	Brief	1	Immediate	1	1.3	Once a year	1	Definitely	5	3	3.9	Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once or more in 6 months	2	Unlikely	3	2.5	6.5	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Highly unlikely	2	1.5	3	Low

Mitigation and Management:

- No construction or storing of materials should be located outside of the defined construction area. These areas must 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 will be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.

7.5.7.1.2 Issue 2: Loss of flora Species of Conservation Concern (SCC)

Impact 4: Loss of flora Species of Conservation Concern

Cause and comment: The construction of the transmission line, laydown area and switching station will possibly result in the loss of protected plants including, but not limited to some protected trees (no mangroves will be lost) and the orchid *Eulophia speciosa*. However, no SCC will be lost as none have been recorded from the site. The disturbance levels associated with the site make it unlikely that any SCC will be found on site. It is recommended that prior to any clearance of vegetation comprising indigenous elements, this be walked over by a qualified botanist to ensure no protected species are present. This must be done as removal or destruction of any protected species requires permits from the relevant authorities.

Significance statement: The impact in the construction phase will be small over the long term and restricted to the surrounding area. It will definitely occur once a year. The overall significance is a medium negative which can be reduced to low with the application of mitigation measures.

In the operational phase, the impact is small over the long term and is restricted to the surrounding area it will be unlikely and occur once or more over 6 months resulting in an overall impact of medium. This can be reduced to low with mitigation measures.

Reversibility: This impact is reversible no mangroves will be lost as a result of the proposed development, and most other tree species can be avoided. Where these can't be avoided, a minimum number will be destroyed. Any destroyed species will then be planted to recoup lost species numbers.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-22: Scoring of Impact 4: Loss of Species of Conservation Concern and Biodiversity

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 4: Loss of Species of Conservation Concern and Biodiversity														
Construction Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once a year	1	Definitely	5	3	7.8	Medium
With mitigation	Insignificant	1	1 month to 3 months	2	Immediate	1	1.3	Once a year	1	Definitely	5	3	3.9	Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once or more in 6 months	2	Unlikely	3	2.5	6.5	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Highly Unlikely	2	2	3	Low

Mitigation and Management:

- Construction measures must consist of the least impactful individual erection of monopole structures and all protected species avoided where possible. No linear 3m footprints should be cleared of vegetation in these areas but individual drilled foundations used.
- No use of the surrounding vegetation will 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 protected species and associated permits should be obtained for their removal or transplantation. This was completed in 2021 and permits were applied for.

Impact 5: Loss of fauna Species of Conservation Concern

Cause and comment: The construction of the transmission line, may possibly result in the loss of SSC, however, it is anticipated that the majority of the faunal species will be able to move out of the way of construction. A qualified ecological expert must be present during construction to relocate any slow-moving (such as chameleons or tortoises) or burrowing (moles, lizards and snakes) species should they occur.

The impacts associated with loss of SCC are associated primarily with the construction phase of the development.

Significance statement: The impact in the construction phase will be small over the long term and restricted to the surrounding area, it will definitely occur once a year resulting in an overall medium negative impact. This can be reduced to low with mitigation measures.

In the operational phase, the impact will be small over the long term and restricted to the surrounding area. It will be unlikely and occur once or more over 6 months resulting in an overall impact of moderate-low which can be reduced to low with mitigation measures.

Reversibility: This impact is reversible, as faunal SCC can be relocated to alternative habitat that is actively conserved, particularly the Richards Bay Game Reserve.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-23: Scoring of Impact 5: Loss of faunal Species of Conservation Concern

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 5: Loss of faunal Species of Conservation Concern														
Construction Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once a year	1	Definitely	5	3	7.8	Medium
With mitigation	Small	2	Brief	1	Immediate	1	1.3	Once a year	1	Likely	4	3	3.9	Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once or more in 6 months	2	Unlikely	3	2.5	6.5	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Highly Unlikely	2	1.5	3	Low

Mitigation and Management:

- Construction measures must consist of the least impactful individual erection of monopole structures in areas of intact indigenous vegetation avoided where possible. No linear 3m footprints should be cleared of vegetation in these areas but individual drilled foundations used.
- No use of the surrounding vegetation will be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- No hunting will be allowed.
- A qualified specialist should be on site during construction to safely remove all slow-moving (chameleons and tortoises) and burrowing (moles, lizards and snakes) species from the path of the excavator and relocated to a conservation area, should they occur.

Impact 6: Loss of biodiversity in general

Cause and comment: 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, and related infrastructure.

Significance statement: The impact in the construction phase will be small over the short term and restricted to the surrounding area. It will be likely and occur once a year. This will result in an overall impact of medium-low which can be reduced to low with mitigation.

In the operational phase, the impact will be small over the long term and restricted to the surrounding area. It will be unlikely and occur once or more in 6 months resulting in an overall significance of medium-low which can be reduced to low with mitigation.

Reversibility: This impact is reversible, as rehabilitation with indigenous plants would result in the reduction of erosion risk and maintenance and restoration of ecosystem services.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-24: Scoring of Impact 6: Loss of biodiversity

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 6: Loss of biodiversity in general														
Construction Phase														
Without mitigation	Small	2	Short term	2	Surrounding area	2	2	Once a year	1	Likely	4	2.5	5	Medium-Low
With mitigation	Small	2	Brief	1	Immediate	1	1.3	Once a year	1	Likely	4	2.5	3.25	Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once or more in 6 months	2	unlikely	3	2.5	6.5	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Highly unlikely	2	1.5	3	Low

Mitigation and Management:

- Boundaries must be strictly maintained, and impacts retained within the boundary of the site.
- Alien species must be controlled.
- Areas of indigenous vegetation should be incorporated into the open space management plan of the Port/ Harbour Zone in conjunction with Transnet where practicable.

7.5.7.1.3 Issue 3: Ecosystem function and Process

Impact 7: Fragmentation

Cause and comment: This site is prone to fragmentation due to its location within the Port/ Harbour zone 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. Where possible, Karpowership should work with Transnet to establish and manage open space within the Port/ Harbour zone to reduce overall fragmentation. 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.

Significance statement: The impact in the construction phase will be small over the short term and restricted to the surrounding area. It will be definite and occur once a year resulting in an overall significance of medium-low which can be reduced to low with mitigation.

In the operational phase, the impact will be significant and permanent over the surrounding area and be unlikely to occur once a year resulting in an overall significance of medium-low which can be reduced to low with mitigation measures.

Reversibility: This impact is reversible, as rehabilitation with indigenous plants would result in the reduction of erosion risk and maintenance and restoration of ecosystem services.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-25: Scoring of Impact 7: Fragmentation

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 7: Fragmentation														
Construction Phase														
Without mitigation	Small	2	Short term	2	Surrounding area	2	2	Once a year	1	Definitely	5	3	6	Medium-Low
With mitigation	Small	2	Brief	1	Immediate	1	1.3	Once a year	1	Likely	4	2.5	3.25	Low
Operational Phase														
Without mitigation	Significant	3	Permanent	5	Surrounding area	2	3.3	Once a year	1	Unlikely	3	2	6.6	Medium-Low
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Highly Unlikely	2	1.5	3.45	Low

Mitigation and Management:

- 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 Port/ Harbour zone.
- Boundaries of the site must be adhered to, and no additional loss of vegetation should occur.
- Alien species within the site must be controlled.
- The land beneath the transmission line, and any other areas required for construction, but not for the operational phase, must be rehabilitated with indigenous species to retain connectivity within the system.

Impact 8: Invasion of alien species

Cause and comment: The development of the proposed transmission line and ancillary infrastructure 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.

Significance statement: The impact in the construction phase will be great, permanent and restricted to the surrounding area. It will be definite and occur once or more in 6 months resulting in an overall significance of high which can be reduced to low with mitigation.

In the operational phase, the impact will be permanent, great and restricted to the surrounding area. It will be definite and occur once or more in 6 months resulting in an overall significance of high negative which can be reduced to low with mitigation measures.

Reversibility: This impact is reversible, if the site is continually managed for the removal of existing and new alien invasive species.

Irreplaceable Loss of Resources: The impact causes a loss of resources that can be replaced.

Table 7-26: Scoring of Impact 8: Invasion of alien species

	Consequence							Likelihood					Total Score	Significance
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 8: Invasion of alien species														
Construction Phase														
Without mitigation	Great	4	Permanent	5	Surrounding area	2	3.6	Once or more in 6 months	2	Definitely	5	3.5	12.6	High
With mitigation	Insignificant	1	Brief	1	Immediate	1	1	Once a year	1	Definitely	5	3	3	Low
Operational Phase														
Without mitigation	Great	4	Permanent	5	Surrounding area	2	3.6	Once or more in 6 months	2	Definitely	5	3.5	12.6	High
With mitigation	Insignificant	1	Brief	1	Immediate	1	1	Once a year	1	Definitely	5	3	3	Low

Mitigation and Management:

- The area of construction and operation must 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.

7.5.7.2 Cumulative Impacts

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the area; and general habitat loss and transformation resulting from other activities in the area.

Several projects are currently underway, or in the environmental authorisation phase and include the following:

- Richard’s Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

Port expansion is planned for 10 to 20 years in the future which will result in the conversion of terrestrial areas into marine areas. The cumulative impacts of increased port development prior to this expansion will result in continued loss of the terrestrial ecosystems. However, currently there is no evidence of management of the terrestrial systems within the port area. Threats include destruction of swamp and mangrove forests, both Critically Endangered ecosystems as well as the loss of the remaining natural vegetation (the majority of the site is transformed or secondary).

Protection of existing mangroves and swamp forest is critical, and these should in no way be harmed by any planned future development within the port area.

Cumulative impacts **without mitigation are expected to be High**.

A joint venture including TNPA and all port users (including current and future users, including Karpowership) should ideally be actioned as soon as possible to allow for the following (critical management systems) to take place:

- Management and control of alien and invasive plants
- Definition and maintenance of a Conservation and/or Open Space Management Plan
- Development and implementation of a rehabilitation plan.

Each of these aspects cannot be taken on by one individual user, as overall management is critical to such an important ecosystem and management in isolation will be ineffective.

7.5.7.3 Specialist’s Conclusion

It is the opinion of the specialist that **the proposed development go ahead**, provided the mitigation measures are put into place. The following conditions should also be met:

- A walk through of the site prior to any construction to determine the presence of any Protected Species.
- Application for permits for removal of any Protected Species where required (this was completed in 2021 and permits were applied for).

- The development of a rehabilitation plan in line with TNPAs rehabilitation plans, if no such plan exists, Karpowership should have input into the overall plan for the TNPA area.
- The development of an alien invasive plant management plan in line with the plan and implementation protocol of the TNPA. If no such plan exists, Karpowership should have input into such a plan for the overall TNPA area.

7.5.8 Avifauna Impacts

Current Impacts

Due to the anthropogenic developments and activities within the study area, bird habitats have already been reduced and compromised through:

- Reclamation and modification of estuarine habitats and indigenous terrestrial vegetation for harbour development and farming;
- An increase in the area of mangroves (replacing intertidal habitat) after the splitting of the original estuary system into two;
- High levels of disturbance in some areas due to fishing, recreational boating and shipping;
- Excessive nutrient pollution of aquatic habitats;
- Pollution from coal dust, a relatively recent problem which can be seen throughout the estuary area, but which is most visible on plant foliage;
- Noise associated with current port activity as well as activity associated with an army testing facility within the Port area (such as the detonation of explosive devices);
- Litter; and
- Undocumented, uncontrolled illegal exploitation of fish and possibly birds, particularly within the uMhlathuze Estuary.

7.5.8.1 *Impact assessment findings (with and without mitigation):* ***Powerships Positions and Transmission Line Routes Alternatives 1 and 2: Construction and Operational Phase***

7.5.8.1.1 Habitat loss

The project footprint is relatively small, involving the loss of a small amount of open water habitat, as well as clearing of terrestrial bush to construct the powerlines and access roads. This will have a negligible impact on the availability of habitat for estuarine waterbirds, but may lead to greater levels of human disturbance by providing more access to the shoreline.

Fragmentation of terrestrial habitats will likely have some impact on terrestrial bird populations. The impact on bush birds is likely to be small, but should be minimised by avoiding routes that involve clearing indigenous vegetation. During the operational phase, footprint areas are often kept free of indigenous vegetation or mowed, further reducing habitat and creating fragmentation. Placing transmission lines in intact habitat should be avoided wherever possible. While mitigation is possible by restoring habitats after the construction phase, it can take decades to fully restore coastal forest habitats, therefore it is best to avoid their destruction in the first place.

Table 7-27: Scoring of impacts –habitat loss (Powerships and infrastructure)

Powership: habitat loss		Phase: Construction and operation			
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	1		1	
B	Duration	3		3	
C	Spatial	1		1	
D	**Consequence (A+B+C)/3**	**1.7**		**1.7**	
E	Frequency	1		1	
F	Probability	5		5	
G	**Likelihood (E+F)/2**	**3**		**5**	
H	**Significance = DxG**	**5.1 (Med-Low)**		**5.1 (Med-Low)**	
Mitigation:		**N/A**			

Project infrastructure: habitat loss		Phase: Construction and operation			
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	1	1	3	
B	Duration	3	3	3	
C	Spatial	1	1	1	
D	**Consequence (A+B+C)/3**	**1.7**	**1.7**	**2.3**	
E	Frequency	1	1	1	
F	Probability	5	1	5	
G	**Likelihood (E+F)/2**	**3**	**1**	**3**	
H	**Significance = DxG**	**5.1 (Med-Low)**	**1.7 (Very Low)**	**7 (Med)**	
Mitigation:		Select alternative 1. Do not place transmission lines or access routes for their construction in functional natural habitat, and do not clear natural vegetation in the process of construction of project infrastructure.			

7.5.8.1.2 Collisions with transmission lines

Power lines in South Africa pose a substantial danger to birds, especially larger species. Impacts on their populations tends to be particularly severe, since larger birds also tend to be long-lived species that reproduce slowly. Of particular concern are birds that tend to fly in low light or at night.

The best way to mitigate these threats is by placing power lines underground, or away from areas with high collision rates (such as water bodies). A next best option is to make them as low as possible with thick, made more visible with markers. Eskom has a standard for line marking, when required. Such measures can reduce collisions by 50-60%, but may not be effective to all bird species.

The proposed routes are in proximity to other existing major transmission line routes which increases their visibility. Staggering the pylons relative to the existing ones and setting the lines at the same height as existing lines would help to increase their visibility. Where they are not linked to existing routes, the lines should be set as low as possible. All lines should be well marked to make them visible, using diurnal-nocturnal markers (with lights that are fairly dim, to avoid confounding light pollution impacts).

Table 7-28: Scoring of impacts – Collisions

Project infrastructure: collisions			Phase: Operation		
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	3	2	3	2
B	Duration	3	3	3	3
C	Spatial	3	3	3	3
D	**Consequence (A+B+C)/3**	**3**	**2.7**	**3**	**2.7**
E	Frequency	3	2	3	2
F	Probability	4	3	4	3
G	**Likelihood (E+F)/2**	**3.5**	**2.5**	**3.5**	**2.5**
H	**Significance = DxG**	**10.5 (Med-High)**	**6.8 (Med-Low)**	**10.5 (Med-High)**	**6.8 (Med-Low)**
Mitigation:		Follow existing routes where possible, staggering pylons and aligning transmission lines with existing lines, or setting the lines low. Mark all transmission lines for diurnal and nocturnal visibility.			

7.5.8.1.3 Electrocution

Larger birds are more prone to electrocution by powerlines as they can create a link between two phases or an earthed element and one phase, resulting in a short circuit. One way to mitigate this risk is to create large gaps between the phases and/or between phases and earthed elements. This way, even birds with larger wingspans will not be able to bridge the gap. A number of species such as crows, various raptors, Egyptian Geese and Hadeda Ibises have taken to nesting on transmission towers or polls (de Goede and Jenkins, 2001). This increases their risk of electrocution (as well as collision). To prevent electrocution of birds, all the parts of the infrastructure should be either nest proofed and anti-perch devices placed on areas that can lead to electrocution, or should have the conductors slung below the towers. Any nests that have been made by birds should be removed when inactive, to discourage re-use.

Table 7-29: Scoring of impacts – Electrocution

Project infrastructure: electrocution			Phase: Operation		
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	2	1	2	1
B	Duration	3	3	3	3
C	Spatial	3	3	3	3
D	**Consequence (A+B+C)/3**	**2.7**	**3.5**	**2.7**	**3.5**
E	Frequency	2	1	2	1
F	Probability	3	2	3	2
G	**Likelihood (E+F)/2**	**2.5**	**1.5**	**2.5**	**1.5**
H	**Significance = DxG**	**6.7 (Med-Low)**	**5.3 (Med-Low)**	**6.7 (Med-Low)**	**5.3 (Med-Low)**
Mitigation:		All the parts of the infrastructure to be nest proofed and anti-perch devices placed on areas that can lead to electrocution. Remove nests built on powerline structures when not in use, to discourage re-use.			

7.5.8.1.4 Light pollution

While the project is located in a developed port with existing light pollution, it is likely to increase the level of light pollution in the study area. By law, the vessel will need to have certain lights on at night to indicate the size of the vessel and that it is at anchor. However, the vessel could be kitted out to have a much higher degree of light for night operations, which would be far greater than the current levels of lighting in the area.

Light pollution disorientates nocturnally-flying birds, increasing their risk of collision, and may interfere with nocturnal foraging. Most of the charadriiform waders on the estuary are adapted for nocturnal foraging, with highly sensitive vision. Irregular loud noises could impact the foraging behaviour of shorebirds and roosting seabirds, affecting their energy budgets and capacity to gain weight for migration.

According to the light measurement report, illumination of the Powership will range from 53.80 Lux to 322.80 Lux. The latter is brighter than a high-quality hunting or gamespotting spotlight. Lights will be pointed at work areas and will not be used to illuminate surrounding areas as they will be pointed towards the deck of the ship. However, if these spotlights are mounted up on masts, then this could disorient flying birds, especially those trying to navigate by the moon.

To mitigate the impact, it is suggested that only essential lighting is on at night, lumens are kept to a minimum, and that lights are installed as low as possible. Lit up windows should be shuttered at night. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) motion detection lights should be used wherever possible.

Table 7-30: Scoring of impacts – Light Pollution

Powership: light pollution			Phase: Operation		
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	2	1	2	2
B	Duration	3	3	3	3
C	Spatial	2	2	2	2
D	**Consequence (A+B+C)/3**	**2.3**	**2**	**2.3**	**2.3**
E	Frequency	1	1	2	1
F	Probability	3	2	4	3
G	**Likelihood (E+F)/2**	**2**	**1.5**	**3.0**	**2.0**
H	**Significance = DxG**	**4.6 (Low)**	**3.0 (Low)**	**7.0 (Med)**	**4.6 (Low)**
Mitigation:		Essential lighting is on at night, lumens are kept to a minimum, lights are installed as low as possible. Lit up windows are shuttered at night			

7.5.8.1.5 Noise and vibration disturbance

The project is likely to result in increased disturbance of birds due to increased noise and vibration. As the project is located within the port area adjacent to existing ships with machinery already permanently running, these impacts will likely add to the existing effects of noise and vibration.

The Powerships are fitted with a number of noise and vibration attenuation devices. With these sound attenuation measures, at the closest distance from the Powership to the Sandspit, the sandspit will experience a sound level of <60 dB(A) dB(A), and the sound levels at the closest distance from the Powership to the Kabeljous flats will be <60 dB(A). It is considered likely that the presence of the land adjacent to the ship will further attenuate the noise levels reaching the sand spit and Kabeljous flats. Current noise noted from the site included the engines of several ships currently running creating a consistent low-level noise, as well as the noise from the coal terminal including ship movement, and conveyer belt sounds comprising consistent low-level sounds. The coal terminal also produces a noticeable high pitched intermittent screech as well as intermittent high beeping. All of which can be heard clearly from the centre of the sandspit.

At low tide, the area of the sandspit closest to the Powership will experience noise levels of <60 dB(A). At high tide, when much of the spit is underwater, sound levels are likely to be much less as the sand above water at high tide is approximately 500m away. Noise limits for busy urban areas are set for 60 dB(A), there is currently no legislation for noise limits in environmentally sensitive areas. Cutts *et al.* (2013) have developed a waterbird disturbance mitigation toolkit that informs estuarine planning and construction projects. Although applicable largely to the UK, the presence of migratory bird species (especially as these are considered the most sensitive for this project) means that this toolkit is applicable to this project and can be used to determine the impacts associated with noise on the avifauna of the Project Area of Influence. This toolkit rates regular noise from 50 to 70 db as a moderate to low impact to estuarine avifauna, with noise below 50 db as a low impact to estuarine avifauna (Cutts *et al*. 2013). There is no feasible mitigation other than to move the ships further from the sensitive bird areas.

Table 7-31: Scoring of impacts – Noise and Vibration

Powership: noise and vibration impacts			Phase: Operation		
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	2		2	
B	Duration	3		3	
C	Spatial	2		2	
D	**Consequence (A+B+C)/3**	**2.3**		**2.3**	
E	Frequency	5		5	
F	Probability	2		3	
G	**Likelihood (E+F)/2**	**3.5**		**4.0**	
H	**Significance = DxG**	**8.1 (Med)**		**9.2 (Med-High)**	
Mitigation:		Choose Alternative 1.			

7.5.8.1.6 Increased human disturbance

The increased activity of people in natural areas could lead to disturbance of foraging, roosting or breeding birds. Usually, a flight response is triggered at a distance of 100 – 150 m across a mudflat, with a response (heads up) associated with movement further away (Cutts *et al.* 2013). Frequent disturbances of Palearctic migrants during the summer months can affect their energy budgets and capacity to gain weight for migration and can lead to a decline in bird numbers on estuaries. Human movements on board a large vessel or the movements of vessels themselves are not likely to be a significant problem, and birds will quickly habituate to these. Richards Bay is already a working port with a lot of vessel movement. Disturbance will be higher during construction, with avifauna likely becoming habituated during the operational phase (Cutts 2021).

In general, construction activities should be scheduled as far as possible during the least sensitive periods (May – August), to avoid migration, nesting and breeding seasons. Construction activities could detrimentally affect an African Fish Eagle pair that have a nest close to where the Powership connects to the planned transmission line. This can be avoided by avoiding land-based construction activities in the area while the pair is actively tending the nest. Fish eagles typically return to the same nest each year, but if construction activities continue into the next breeding season, there is chance that the pair will relocate their nesting site, or may fail to breed. Based on past records, the breeding season is not fully predictable in this area but is more likely to be in summer.

Some of the Karpowership infrastructure is located within 200 m of the sandspit, with more located within 300 m (Figure 7-8). To mitigate disturbance, approach and general access to these ships should be from the north side, and no activities (post construction) should occur between the ships and the sandspit, other than activities in direct contact with the vessels, such as ship maintenance.

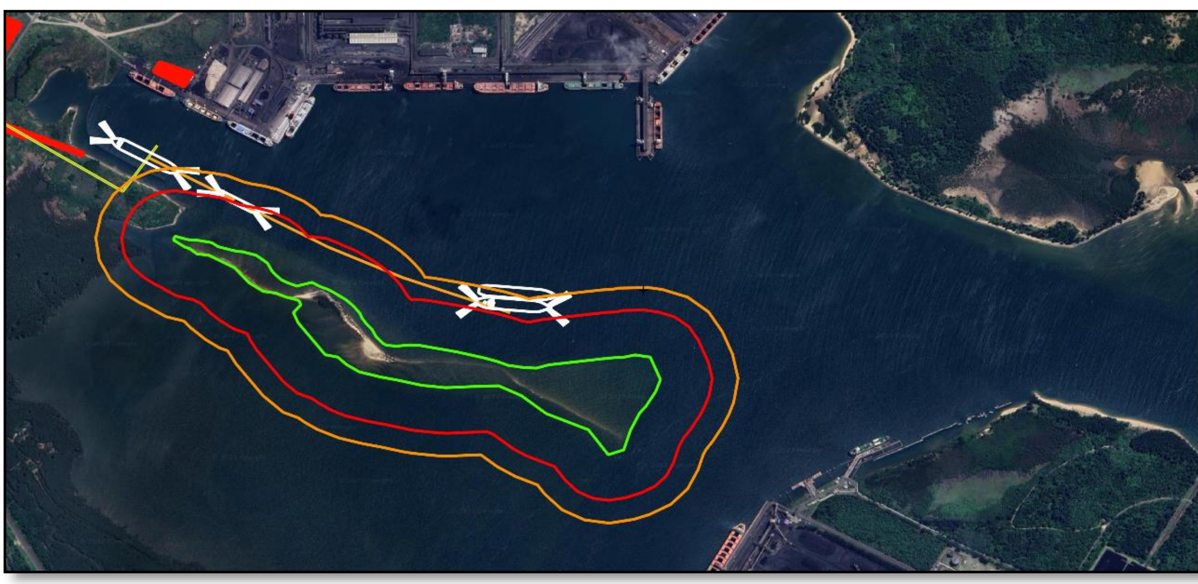

Figure 7-8: Map showing the location of the project infrastructure in relation to the 200 m buffer (red) and 300m buffer (orange) from the sand spit, outlined in green.

Table 7-32: Scoring of Impacts – Human Disturbance

Powership and infrastructure: human disturbance		Phase: Construction			
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	2	2	2	2
B	Duration	1	1	1	1
C	Spatial	2	2	2	2
D	**Consequence (A+B+C)/3**	**1.7**	**1.7**	**1.7**	**1.7**
E	Frequency	5	5	5	5
F	Probability	4	2	4	2
G	**Likelihood (E+F)/2**	**4.5**	**3.5**	**4.5**	**3.5**
H	**Significance = DxG**	**7.7 (Med)**	**6.0 (Med-Low)**	**7.7 (Med)**	**6.0 (Med-Low)**
Mitigation:		Channel workers and vehicles to minimise access to natural habitats, keeping them to limited designated areas. No access to sandspit.			

Powership: human disturbance		Phase: Operation			
		Alternative 1		**Alternative 2**	
		No mitigation	**With mitigation**	**No mitigation**	**With mitigation**
A	Severity	2	2	2	2
B	Duration	3	3	3	3
C	Spatial	2	2	2	2
D	**Consequence (A+B+C)/3**	**2.3**	**2.3**	**2.3**	**2.3**
E	Frequency	3	1	3	1
F	Probability	2	1	3	1
G	**Likelihood (E+F)/2**	**2.5**	**1**	**3**	**1**
H	**Significance = DxG**	**5.8 (Med-Low)**	**2.3 (Very Low)**	**6.9 (Med-Low)**	**2.3 (Very Low)**
Mitigation:		Approach and general access to these ships should be from the north side, and no activities (post construction) should occur between the ships and the sandspit, other than activities in direct contact with the vessels, such as ship maintenance			

7.5.8.2 Cumulative

Cumulative impacts are assessed in context of the extent of the proposed assessment area; other developments in the area; and general habitat loss and transformation resulting from other activities in the area.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for avifauna.

Several projects are currently underway, or in the environmental authorisation phase and include those listed in Table 7-2.

The cumulative impacts of these developments alone, particularly the NIFPP, would amount to a very high impacts on birds. These would collectively result in a large area of habitat loss, and it increases the risk of collisions and electrocutions for avifauna. This risk is especially high as a number of species expected and recorded is in a high risk category for collisions and electrocutions. Notably, however, the EA for the NIFPP, which would have the greatest direct impact due to its location, has not been granted. The existence of the remaining projects does not diminish the impacts described for the proposed Karpowership development, which will simply add to them.

These similar proposed developments, including that of the Karpowership development, will all have an indirect effect on birds not only of the study area, but nationally and globally, through their contribution to climate change.

7.5.8.3 Management Plan

The aim of the management outcomes is to present the mitigations in such a way that they can be incorporated into the environmental management programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines. Table 7-33 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators for the avifaunal study.

Table 7-33: Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
Areas of already fragmented indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and	Life of operation	Project manager, Environmental Officer	Areas of indigenous vegetation	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
avoided where possible. Clearing beneath transmission lines should be avoided.				
Where possible, existing access routes and walking paths must be made use of.	Construction/Operational Phase	Environmental Officer & Design Engineer	Roads and paths used	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species.	Closure Phase/Rehabilitation phase	Environmental Officer & Contractor	Assess the state of rehabilitation and encroachment of alien vegetation	Quarterly for up to two years after the closure
Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.	Closure Phase/ Post Closure Phase	Environmental Officer & Contractor	Road edges and project area footprint	During Phase
Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.	Operational /Closure Phase	Environmental Officer & Contractor	Road edges and footprint	During Phase
Erosion control and alien invasive management plan must be compiled.	Life of operation	Environmental Officer & Contractor	Erosion and alien invasive species	Ongoing
Environmentally friendly dust suppressants need to be utilised	Operational phase	Environmental Officer & Contractor	Water pollution	During Phase
A fire management plan needs to be compiled and implemented to restrict the	Life of operation	Environmental Officer & Contractor	Fire Management	During Phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
impact fire might have on the surrounding areas.				
The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments. Signs must be put up to enforce this.	Construction/Operational Phase	Project manager, Environmental Officer	Infringement into these areas	Ongoing
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
Construction of the Powerships including any piling on the land adjacent to the planned Powerships or within 200 m of the sandpit or Kabeljous flats, should be limited the period from mid-April to mid-September to avoid disturbance to breeding and migratory species.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Construction/Closure Phase	During Phase
Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) motion detection lights should be used wherever possible.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Light pollution and period of light.	During Phase
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of	Life of operation	Health and Safety Officer	Compliance to the training.	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.				
Schedule activities as much as possible during least sensitive periods (May – August), to avoid migration, nesting and breeding seasons	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Activities should take place during the day in winter.	During Phase
All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project manager, Environmental Officer	Noise	During Phase
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Planning, Construction and Decommissioning	Project manager, Environmental Officer	Presence of Nests and faunal species	During Phase
The design of the proposed transmission line must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins *et al.*, 2017).	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds or bird strikes	During Phase
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of bird collisions	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and operation	Environmental Officer & Contractor, Engineer	Presence of chemicals in and around the project area	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase

7.5.8.3.1 Monitoring Plan

Monitoring is to take place monthly for 1 year pre-construction and then monthly for 1 year post construction so that mitigation measures can be adapted to ensure the development does not have a long-term impact on the SCCs and migratory waders in the area. A follow-up assessment on avian biodiversity and species abundance within the assessment area and surrounding areas must be conducted within one year after the facility has been in operation and should be repeated every 3-5 years. A monitoring plan has been developed for the site and monitoring is currently ongoing. Information obtained from the monitoring must be provided to BirdLife Renewable Energy Programme on energy@birdlife.org.za. The data must be presented as described in Jenkins *et al.,* 2017.

7.5.8.4 Specialist's Conclusion

The proposed development will take place within an already developed zone within an estuary ecosystem of very high conservation value. As such it will make a small incremental impact on the ecological integrity of the site, but this needs to be minimised so as to avoid any further compromise of the area's biodiversity. The original development of the Port of Richard's Bay was undertaken before the conservation value was fully understood. The development is also taking place against a backdrop of recent deterioration in the environmental conditions of the area, with dramatic increases in pollution, and an apparent lack of protection of the bird sanctuary area in the neighbouring uMhlathuze Estuary. The latter problems are reversible, and should not be taken as justification for relaxing environmental standards.

While the development is near the working harbour, it does extend the development footprint into the estuary. The ships are to be within 2-300 m of one of the most important parts of the estuary for birds – the sandspit and adjacent mudflats, while the transmission lines will also extend the development footprint into the surrounding bush that not only provides habitat for birds and other wildlife, but helps to buffer the important estuarine habitat from anthropogenic pressures. Layout option 1 is far better than option 2 in terms of the risks it poses to estuarine avifauna. Similarly, the layout of the proposed transmission lines has less incursion into natural habitats under option 1 than under option 2. As is shown in the impact assessment for this and other specialist studies, option 1 is a clear choice.

The risks posed by the proposed development include habitat loss, collisions, electrocution, light and noise pollution and disturbance by the movement of people, machinery and vessels. Of these, the elevated risk of mortality due to collisions with overhead powerlines are a major concern for larger species, particularly waterbirds that are likely to be flying in the area, including threatened species such as flamingos and pelicans. The other risks may contribute to a decline in the abundance and diversity of birds in this important area. Provided the mitigation measures are undertaken, the anticipated impacts do not constitute a fatal flaw.

It is recommended that the following actions be taken to ensure the continued monitoring and protection of these habitats:

- Monthly avifaunal monitoring of the sandspit and Kabeljous flats should continue for at least the next 3 years;
- Waterbird counts of the full site including both Richards Bay Port and the Richards Bay Game Reserve should resume and continue annually in both summer and winter;
- The monitoring plan for the avifauna should speak to the existing monitoring plans of the port, if no such documents are available, Karpowership can contribute to them.
- Monitoring must be done in conjunction with all port users and the TNPA as cumulative impacts are likely to be the most detrimental to such habitats.
- Conservation of the sandspit and Kabeljous flats is recommended, and no development should take place in these areas. An adaptively managed conservation plan should be developed for these areas in particular that aligns with the existing TNPA conservation management plan for the port. If no such document exists, KPS partnership with SANPARKS and EZEMVELO should have input into its development.

Based on the impacts considered in this report as potentially affecting the birds of Richards Bay Estuary, uMhlathuze Estuary, the nearby freshwater wetlands and terrestrial habitats, there are **no fatal flaws that would prevent the proposed Gas to Power project from proceeding**, on condition that:

- the preferred powership layout and transmission line route are adopted;
- all mitigation measures and recommendations provided are strictly implemented; and
- the construction and operational phases of the project are undertaken accordance in with a stringent environmental management programme (EMPr), which contains all the mitigation measures put forward and which is monitored by a suitably qualified environmental control officer (ECO).

7.5.9 Underwater Noise Impacts

In order to identify any significant risks from underwater noise that could arise due to this proposed project and to determine the noise impacts, a baseline noise survey was carried out in the Port of Richard's Bay, which identified noise levels to which the harbour and surrounding area are already exposed.

A survey was also carried out at the location of a large Khan class Powership in Ghana, of a similar class specification, albeit larger, to that of the Powerships planned at the Port of Richard's Bay. This was to sample the noise levels that such a vessel produces at various distances and power outputs. In addition an FSRU with a single engine running was assessed. This data was applied to the baseline data using standard methodology to calculate the noise levels that would be present if all proposed ships were installed and operated at a maximum capacity. Calculations were considering the Sound Exposure Level, cumulative, i.e. single value for the collected, combined total of sound exposure over a specified time or multiple instances of a noise source.

An assessment of the underwater noise due to construction was also undertaken, primarily to consider the potential impacts of vibropiling and drilling for Powership mooring piles, and breaking rock on the pipeline route. As per the relevant guidelines, any impacts would require an individual marine mammal to remain within 520 m of vibropiling for its entire duration of 2 hours in a day, or within 950 m from rock breaking for 6 hours. This range is for the VHF cetacean marine mammal category (porpoises), which are not present in this location. Other marine mammal groups are less sensitive, and would need to be within 400 m for a significant period. Fish would need to remain within 50 m of the activity. Impacts from any other noise source are significantly lower.

Any risk to marine mammals or fish, as per the relevant guidelines will be negligible. The lower order of effect defined in the guidelines, temporary threshold shift (TTS), would only occur when marine mammals of the most sensitive species (VHF cetaceans, i.e. porpoises) remained within 850m of the Powerships operating at maximum capacity for a full 24 hours. These are not expected to be present. All other species had a TTS impact range of less than 350m from the Powerships with the same worst-case assumptions.

The effect on baseline noise will be negligible where the Powership is operating at a low power, which was found to be typical during the survey of the operational Powership in Ghana.

Predictions of the noise outside of the port will be less than 3 dB above baseline with the Powerships operating at maximum power, unless within approximately 1km of the Powerships, although this is expected to be an overestimation in practice.

Any risk to marine mammals or fish, as per the relevant guidelines will be negligible. This condition of extended presence of marine mammals close to the ships in the port and maximum output is highly unlikely to occur in practice, especially considering that the Powership operations are only permitted for 16.5 hours per day. The most sensitive species of fish would need to remain directly adjacent to the Powership for the same full 24 hour period.

7.5.9.1 *Impact assessment findings (with and without mitigation): **Preferred Powership and FSRU Positions: Construction Phase***

Table 7-34 below provides a summary of the various noise producing sources expected to be present during the construction of the infrastructure required for the Powerships and supporting vessels.

Table 7-34: Summary of the possible noise making activities

Activity	Description
Vibropiling	This will be required to install the first stage of the piled anchors for the Powerships and FSRU
Drilling	Drilling will be necessary to install the piles for the remainder of the required depth into bedrock
Rock clearance	Potentially required on site for installation of pipelines

Vibropiling and Drilling

The impact ranges during vibropiling are smaller than those for the operation of Powerships and auxiliary vessels, even though the vibropiling itself is a louder source, as the calculations assume a two hour maximum vibropiling operation, whereas the Powerships could operate (in theory) for 24 hours a day as a worst case. This leads to the difference in noise exposure.

The Permanent Threshold Shift (PTS) impact ranges for all marine mammal species and noise types are less than 50m. All impacts are expected to be negligible where the individual does not remain static and within the vicinity, e.g. <520m at most for Very high-frequency (VHF) cetaceans marine mammal hearing group, from the vibropiling for two hours. It must be noted that VHF cetaceans are not expected in this location.

Rock Breaking

The shallow water right next to land in which the rock breaking will take place is beneficial to reduction of underwater noise levels, as noise is more readily attenuated in the shallower water.

For prediction of noise transmission, the specialist had previously measured rock breaking using a 4.2 tonne, 10.4 kJ hydraulic hammer, which had a calculated source noise level of 175.1 dB SPLRMS at 1 m. The duration in a day that this hammer may be used for is expected to be less than 6 hours, and will not be prolonged due to the relatively small area of rock that would need to be levelled, and the intermittent nature of this equipment. However, a precautionary 6 hours a day has been applied to the noise predictions.

The maximum distance for potential Temporary Threshold Shift (TTS) onset for VHF cetaceans is 950 m, where there is line of sight. As previously, this would still require a marine mammal to remain present for the entire duration, presuming six hours of rock breaking. This species is not expected in this location. Any other species group would need to be considerably closer. A fish would also need to remain in the near vicinity (<50m) of the breaking for an extended period to reach the requirements for TTS exposure.

7.5.9.2 Impact assessment findings (with and without mitigation): ***Preferred Powership and FSRU Positions: Operational Phase***

All calculated noise levels are based on the distance of each source to the relevant receiver position. Attenuations are based on the measurements in Ghana directly where available or using the best fit from the measurements at 420 MW (approximately 14.log(R) geometric attenuation). Calculated noise levels with the Powerships and auxiliary vessels are shown in Figure 7-9. All decibel noise values in Figure 7-9 below are combined with simple logarithmic addition, where the contributing noise added to the baseline noise equals the total combined levels. Noise levels shaded in red in Figure 7-9 denote an increase in the baseline of over 10 dB, which could occur nearby to the ships. Noise levels shaded in yellow denote an increase in the baseline of 3-10 dB. Noise levels remain unshaded for increases of less than 3 dB.

Based on measurements taken during the baseline monitoring exercise at Port of Richard's Bay, it is demonstrable that the noise levels shown (that represent the effect of Powership operations) will be exceeded any time a container or bulk carrier vessel transits into or out of the port, since noise levels from those existing operations were measured to be higher. The increase of over 10 dB on the south side of the sand bar is expected to be a significant overestimate, due to the worst-case assumptions explained in the Underwater Noise Assessment Report (Appendix 9-B2). As there should be no 'line of sight' to the larger Powership and the passage of sound will be restricted by the shallow water at the west end of the sand bar, the **actual contribution is expected to be of the order of 6 dB lower than those predictions**. To provide a precautionary assessment however, this worst-case calculation has been used.

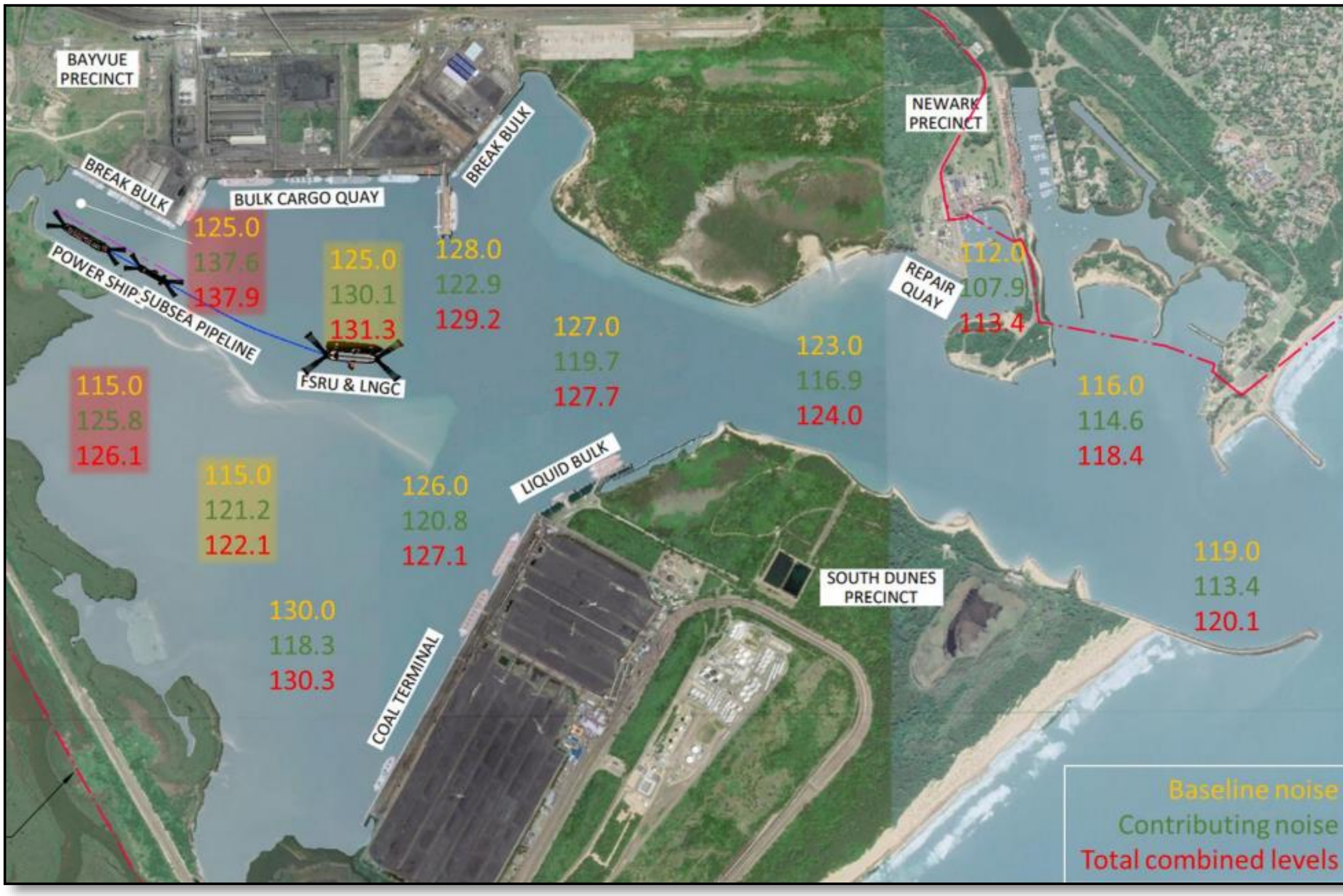

Figure 7-9: Calculated noise levels based on the introduction of a Powership and auxiliary vessels operating at full power. "Contributing noise" is the noise at each location exclusively from the Powership and auxiliary vessels in isolation. "Total combined levels" is the total noise level on site as a result of addition of the Powerships and auxiliary vessels to the existing baseline noise level

7.5.9.2.1 Impact of underwater noise on marine mammals

Based on the high durations of exposure required and full power operation in excess of expected maximum load for the entire duration, no impact is expected on any marine mammal species from the installation of the Powership in the Port of Richard's Bay.

As the noise levels produced by the ships associated with this project are also not substantially different to the noise levels produced by ships typically using the harbour, no significant disturbance effect to marine mammals as a result of underwater noise outside of the normal operational port noise is anticipated, except potentially if directly adjacent to the ships.

Please refer to section 7.5.11 for further assessment on noise impacts on coastal and marine ecology.

7.5.9.2.2 Impact of underwater noise on fish

The calculated noise levels in the Port of Richard's Bay shown in Figure 7-9 do not reach this threshold in any position. All noise measurements at any range from the Ghanian Powership were at least 10 dB below this value.

No risk to fish in the Port of Richard's Bay is expected as a result of underwater noise from the Powership installation.

7.5.9.3 Cumulative Impacts

Based on measurements taken during the baseline monitoring exercise at Port of Richard's Bay, it is demonstrable that the noise levels shown (that represent the effect of Powership operations) will be exceeded any time a container or bulk carrier vessel transits into or out of the port, since noise levels from those existing operations were measured to be higher.

Any risk to marine mammals or fish will be negligible. The lower order of effect defined in the guidelines, temporary threshold shift (TTS), would only occur when marine mammals of the most sensitive species remained within 850 m of the Powerships operating at maximum capacity for a full 24 hours. These are not expected to be present. All other species had a TTS impact range of less than 350 m from the Powerships with the same worst-case assumptions.

7.5.9.4 Specialist's Conclusion

Based on underwater noise assessment, no significant underwater noise impacts on fish or marine mammals are predicted as a result of the operation of the Powership in Port of Richard's Bay as it will not materially change existing underwater noise associated with the port. **No additional noise mitigation is deemed necessary, and this project is thus supported from an underwater noise assessment perspective.**

7.5.10 Underwater Archaeology Impacts

There is an **extremely low probability of Maritime and Underwater Cultural Heritage resources** being found in the Port of Richards Bay.

The specialist recommended the need for input in the EMPr on mitigation of impacts to maritime and underwater cultural heritage resources should they be discovered during the pipeline laydown area survey.

A chance find protocol must be initiated during construction. 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. Although not anticipated, should maritime archaeology be discovered, SAHRA, as the contacting authority which deals with underwater cultural heritage, must be contacted immediately, and approval must be obtained should there be a need to demolish or remove such maritime archaeology site. Demolition / construction work may only commence or continue once SAHRA's approval has been obtained.

7.5.11 Coastal, Estuary and Marine Ecology Impacts

Although estuarine ecosystems are considered key environmental assets, they are one of the most threatened ecosystems in the country. 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, namely the intertidal and subtidal sand and mudflats, the sandspit, and mangrove forests, as described earlier in this report.

The preferred and alternate layout options were selected based on optimal positions relative to port operations and engineering intervention to eliminate the requirement for large scale dredging (*i.e.*, areas where depths were appropriate), which in itself will reduce environmental impacts (PRDW, 2020). Only these locations were assessed as per the approved Scoping Report and Plan of Study. Although this section of the port includes a sacrificial working area and is also earmarked for future port expansion (600 Berth 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, to assist in improving the port environment where possible, until the long-term plans are realised.

Scoring of impacts, after mitigation measures are applied, is summarised in the table below.

Table 7-35: Summary of Coastal, Estuary and Marine Ecology Impacts (after mitigations)

Impact (after mitigation)		Impact Description	Significance
	CONSTRUCTION PHASE		
1	Alternate layout 1&2	Effect on surrounding estuarine/marine ecology as a result of water-based construction activities	**Low**
2	Alternate layout 1&2	Changes in water quality as a result of water-based construction activities	**Medium-low**
3	Alternate layout 1&2	Disturbance to surrounding estuarine ecology due to increased noise levels from construction	**Medium-Low**
4	Alternate layout 1&2	Effect on ecosystem services (fisheries and mariculture) due to increased noise levels from construction	**Medium-Low**
5	**Effect on terrestrial fauna (including avifauna) as a result of construction activities**		
	Disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles.	Summary of potential impacts on avifauna associated with the construction phase of the Karpowership project – ships	**Medium-Low**
	Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)		**Medium-Low**
	Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA	Summary of potential impacts on avifauna associated with the	**Very-Low**

Impact (after mitigation)		Impact Description	Significance
	habitat, ultimately displacing avifauna)	construction phase of the Karpowership project – transmission lines and ancillary infrastructure	
	Disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles.		**Medium-Low**
	Loss of fauna Species of Conservation Concern	Summary of potential impact of loss of fauna Species of Conservation Concern during construction	**Low**
6	**Effect on macrophyte habitats as a result of construction within the estuarine functional zone**		
	Loss of modified habitat	Summary of impacts associated with the construction of the Karpowership transmission line, and ancillary infrastructure on the terrestrial ecology of Richards Bay estuary	**Low**
	Loss of reed beds		**Low**
	Loss of bushveld		**Low**
	Loss of flora SCC		**Low**
	Loss of biodiversity in general		**Low**
	Fragmentation		**Low**
	Invasion of alien species		**Low**
	Establishment of a construction site camps and erection of ablution facilities within a previously disturbed area.	Summary of potential impacts of the proposed development on the surrounding watercourses/ wetlands within the Richards Bay estuary	**Negligible**
	Establishment of a construction site camps for the material laydown area, site office and concrete coating area and stringing yard.		**Low**
	Demarcation of buffer zones and restricted areas and the allocation/ preparation of spoil sites (topsoil separate from subsoil), waste dump sites and construction vehicle routes		**Negligible**
	Construction vehicle movement throughout the lifespan of the proposed development.		**Low**
	Direct destruction of vegetation and topsoil layer within the footprint of the Overhead Powerlines and temporary material laydown area, site office		**Low**

Impact (after mitigation)		Impact Description	Significance
	and concrete coating area and stringing yard		
	Construction of the 132kV Overhead Lattice Steel Structure and Switching Station		**Low / Moderate**
	Construction and installation of the gas pipeline		**Negligible**
	De-establishment of the site camp, spoil sites, waste dumps and the rehabilitation of the temporary access/haulage roads		**Negligible**
	Utilisation of the Overhead Powerlines and Switching Station		**Low/ Moderate**
7	General Construction	Effect of solid waste pollution generated during the construction period	**Low**
8	General Construction	Effect on chemical pollution arising from construction related spills of hazardous substance	**Medium-low**
	OPERATIONAL PHASE		
9	Alternate layout 1&2	Effect on surrounding estuarine/marine ecology due to seawater intake for cooling purposes	**Medium-low**
10	Alternate layout 1&2	Effect of powership cooling water discharge on estuarine/marine ecology	**Medium**
11	Alternate layout 1&2	Effect on surrounding estuarine/marine ecology due to increased underwater noise and vibrations	**Medium**
12	Alternate layout 1&2	Effect on surrounding estuarine/marine ecology due to light pollution	**Medium-low**
13	Alternate layout 1&2	Effect of the combined operational impacts on ecosystem services (fisheries and mariculture)	**Medium**
14	Loss of modified habitat	Effect on macrophyte habitats and terrestrial fauna	**Low**
	Loss of reed beds		**Low**
	Loss of bushveld		**Low**
	Loss of flora SCC		**Low**
	Loss of fauna SCC		**Low**
	Loss of biodiversity in general		**Low**
	Fragmentation		**Low**

Impact (after mitigation)		Impact Description	Significance
	Invasion of alien species		Low
	Loss of fauna Species of Conservation Concern	Summary of potential impact of loss of fauna Species of Conservation Concern during operation	Low
15	Habitat loss (Destroy, fragment and degrade CBA, ultimately displacing avifauna)	Effect on coastal and estuarine avifauna associated with overhead transmission lines and ancillary infrastructure	Very-Low
	Collisions with transmission lines and associated infrastructure		Medium-Low
	Electrocution by infrastructure and connections to transmission lines		Medium-Low
16	Light pollution	Effect on coastal and estuarine avifauna due to operation of powerships (disturbance, noise and light)	Low
	Noise and vibration impacts		Medium
	Human disturbance		Very-Low
17	General operation	Effect of chemical pollution arising from spills and leaks to hazardous substances, and day-to-day shipping practices	Medium-Low
18	Alternate layout 1&2	Effects of catastrophic accidents on estuarine/marine ecology, avifauna and ecosystem services	Low

7.5.11.1 Impact assessment findings (with and without mitigation): ***Construction Phase***

The activities involved in the construction of the proposed Gas to Power project components will result in interactions with receptors in the estuarine / marine environment. Disturbances that have the potential to result in significant impacts are assessed below.

7.5.11.1.1 Impact 1: Effect on surrounding estuarine / marine ecology as a result of water-based construction activities

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, capital 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 disturbed macrobenthic community.

Installation of mooring facilities (*i.e.,* heavy chain, vertical anchor system) and laying of the subsea pipeline will result in localised disturbance of the intertidal and subtidal soft-sediment environment through vibro-piling, drilling and rock clearance.

The installations will disturb approximately 15 000 m^2 (1 500 m pipeline multiplied by approx. 10 m servitude + the mooring blocks) of benthic habitat within the site-specific area of about 78.5 ha .This will result in the modification of approximately 1.9% of the benthic community structure on site.

In general, the intertidal zone is inherently dynamic, being exposed to constant daily changes and in the active port areas, exposed to 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 as the fauna are likely to be adapted to such environmental conditions. In addition, the shoreline adjacent to the mooring location is already disturbed by ship movement in this area and the immediate shoreline around the dead-end basin provides limited habitat value for large numbers of waterbird species in terms of nesting, feeding, and roosting, and thus disturbance in this regard is expected to be relatively low.

Disturbance to benthic and littoral habitats and fauna is an unavoidable consequence of the proposed development. However, disturbance to potentially sensitive habitats should be minimised, *e.g.* sandspit and assembly basin, which must be considered restricted areas. If minimised, the probability of estuarine/marine biota being impacted is reduced.

Table 7-36: Impact ratings for disturbance or loss of estuarine and marine fauna as a result of water-based construction activities

<table>
<tr><th></th><th>Duration</th><th>Extent</th><th>Severity</th><th>Consequence</th><th>Probability</th><th>Frequency</th><th>Likelihood</th><th>Significance</th></tr>
<tr><td>Alternative layout 1 &2</td><td>1</td><td>2</td><td>2</td><td>1.7</td><td>4</td><td>4</td><td>4.0</td><td>6.8 Medium-low</td></tr>
<tr><td colspan="9"><u>Mitigation measures:</u>
• Disturbance must be kept to a minimum by confining the pipeline laying activity, working barge and/ or excavation/levelling equipment to within the project area and designated access routes/paths.
• The assembly basin area and the sandspit must not be disturbed or utilised during construction or during mooring activities. These are restricted areas.
• Mooring of the FSRU must maintain a minimum distance of 230 m from the sandspit.
• Construction activities must be restricted to daylight hours.
• No animals (birds, fish, reptiles, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason.
• A comprehensive environmental awareness programme must be conducted 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 and audited by an ECO.
• In the unlikely event that Zostera is discovered within project area (i.e., 600 Berth Basin), an offset is proposed replacing like-with-like should it be affected by the powerships and associated infrastructure.</td></tr>
<tr><td>Alternative layout 1 &2</td><td>1</td><td>1</td><td>1</td><td>1.0</td><td>3</td><td>4</td><td>3.5</td><td>3.5 Low</td></tr>
<tr><td colspan="3">Reversibility</td><td colspan="6">The impact is reversible</td></tr>
<tr><td colspan="3">Irreplaceability of Resources</td><td colspan="6">No, the impact does not cause a loss of resources that cannot be replaced</td></tr>
<tr><td colspan="3">Fatal flaw</td><td colspan="6">No, this impact does not result in a fatal flaw</td></tr>
</table>

7.5.11.1.2 Impact 2: Changes in water quality as a result of water-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 a temporary increase in TSS and turbidity of the water column. This may have negative implications in the case of light penetration and the primary productivity of microalgae (phytoplankton and microphytobenthos), and for invertebrates and fish. Overall, the area of disturbance is small and the quantity of sediment disturbance that will take place for this Gas to Power project is minimal in comparison to periodic 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, mostly during low tide levels.

In respect of dissolved oxygen concentrations of the water column, 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. The presence of sediment contaminants, specifically heavy metals, is a common occurrence and expected within ports given the nature of port activities and materials handled.

Table 7-37: Impact ratings for changes in water quality as a result of water-based construction activity

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 &2	2	2	2	**2.0**	4	4	**4.0**	**8.0 Medium**

Mitigation measures:

- Disturbance must be kept to a minimum by confining the pipeline laying 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 inclement weather conditions where risk of disturbance to adjacent areas would be greater.
- The sandspit must not be disturbed or utilised during mooring activities. This is a restricted area.
- Mooring of the FSRU must maintain a minimum distance of 230 m from the sandspit.
- 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 construction activities and site camp/laydown area must be undertaken in accordance with a site specific EMPr.

Alternative layout 1 &2	2	2	1	**1.7**	3	4	**3.5**	**6.0 Medium-low**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced							
Fatal flaw	No, this impact does not result in a fatal flaw							

7.5.11.1.3 Impact 3: Effect on surrounding estuarine/marine ecology due to increased noise levels from construction

The proposed Gas to Power project in the Port of Richards Bay is surrounded by important habitats such as the mangroves, seagrass beds, intertidal and shallow subtidal mud and sand flats, the subtidal benthic zone and the water body itself. Depending on their distance from the proposed Gas to Power project location, the biota in the nearby area could be impacted by underwater noise from the construction activities. The most noise-sensitive groups in Richards Bay are expected to be mammals and fish. Juveniles are considered more susceptible to noise disturbances as they are less mobile, while adult fish (and marine mammals) can move out of affected areas. Other important marine receptors in the area are the various seabird and waterbird species. Marine invertebrates may also be impacted by underwater noise; however, evidence is limited (de Soto 2016).

The effect of weighting using a frequency spectrum for a Powership output of 420 MW at 200 m from the hull (in a harbour) on the sound perception of the various species groups, as calculated by Subacoustech Environmental (2022).

A moving animal model is typically used for SEL_{cum} exposure thresholds for marine mammals, which assumes that the receptor will swim away from the source of high noise levels. Continuous noise sources will not necessarily cause this kind of reaction, although it is unlikely that a species would remain still for the duration of the noise exposure. However, the assumption of a static mammal is used as a worst-case scenario.

The noise producing activities expected to be present during the construction of the infrastructure required for the Powerships and supporting vessels includes vibro-piling, drilling, and rock clearance. Vibro-piling will be required to install the first stage of the piled anchors for the Powerships and FSRU. Drilling will be needed to install the piles for the remained of the required depth into bedrock, and rock clearance is potentially required for the installation of the pipelines. High intensity impulsive piling will not be used.

Subacoustech Environmental (2022) predicted the subsea noise levels produced by construction activities based on data from measurements of similar equipment, scaled to relevant parameters for the site and to the specific noise sources used. Underwater noise transmission loss for non-impulsive sources was calculated based on an empirical analysis of the noise measurements taken along transects around these noise sources (Subacoustech Environmental 2022).

The impact ranges for vibro-piling show that an individual of the most sensitive group of marine mammals, VHF cetaceans, would need to remain stationary at 520 m from the noise source for 2 hours in order to experience the onset of TTS. VHF cetaceans are not expected to be found in Richards Bay and all other groups of marine mammals would need to be 200 m or nearer to meet the TTS threshold. The Indo-Pacific humpback dolphins that occur in the Port are HF cetaceans and would therefore need to be within 50 m of the vibro-piling or drilling for the duration of the activity to experience the onset of TTS. The likelihood of this occurring is considered to be low.

The PTS impact ranges for all marine mammal species and noise types was calculated to be less than 50 m.
For fish, all impact ranges will be less than 50 m, based on the 158 dB SPL_{RMS} threshold for TTS in fish from continuous noise sources. This also requires 12 hours of continuous exposure for an individual. TTS and PTS thresholds are not available for invertebrates or diving seabirds. However, threshold levels for marine mammals are generally considered appropriate for seabirds as well.
It is possible that some of the hard rock substrate under the route of the pipeline at the Powerships will be cleared, to avoid the risk associated with the pipeline "riding" on a rock outcrop. There have been no specifications of equipment that will be used for clearing rock, but a mechanical breaker would be expected. The site where rock may be broken is in shallow water north of the Powerships and north of the FSRU.
The shallowness of the water in which the rock breaking will occur is beneficial in reducing underwater noise levels, as noise attenuates more readily in shallow water.

The noise produced by construction of the Gas to Power project is not anticipated to contribute meaningfully to the existing noise levels in the Richards Bay estuary. Furthermore, the construction noise is not anticipated to produce noise to the extent that it will cause direct harm to marine organisms, based on current understanding and available research. Marine mammals and fish would need to be very close, in the order of tens of metres, for the duration of the construction activities within a day, in order to experience the onset of a temporary reduction in hearing ability (TTS), and this is considered to be unlikely to occur.
However, it is possible that estuarine/marine organisms within hundreds of metres of the construction site will experience noise levels that interfere with ecologically relevant sounds, or which cause behavioural changes, which could have negative impacts over time. There is limited research available on the sensitivity of invertebrates to construction noise. Considering these factors, the severity of the noise produced by the construction activities is considered to be "Site-specific and wider natural processes and functions are slightly altered". Noise produced by the construction will increase the ambient underwater noise levels within hundreds of metres of the source, so it will impact a greater area than the immediate site. It is unclear as to how frequently the noise-producing construction activities will take place, but over the course of the duration it is assumed that they will occur once or more in a week. The likelihood of the marine ecology experiencing an impact from the construction noise is considered as being possible. Accordingly, the assigned overall environmental significance rating is "Medium-Low" without mitigation and with mitigation remains at "Medium-Low". As there is limited research into the impacts of continuous low-level noise on marine organisms, the confidence of this assessment is Medium.

Table 7-38: Impact ratings for disturbance to surrounding estuarine ecology due to increased noise levels from construction

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 &2	1	2	2	**1.7**	2	4	**3.0**	**5.1 Medium-low**
Mitigation measures: • See below.								

Alternative layout 1 &2	1	2	2	**1.7**	2	4	**3.0**	**5.1 Medium-low**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced							
Fatal flaw	No, this impact does not result in a fatal flaw							

Mitigation measures:

In order to ensure that the noise levels produced by construction are not higher than predicted in this report, the equipment used should be similar or less powerful than the equipment used as a model by Subacoustech Environmental (2022). No unnecessary production of noise should take place, to minimise the exposure of the estuarine/marine biota to noise and help to avoid disturbances and potential harm to estuarine/marine organisms. If a marine mammal is observed in the near vicinity of the construction activity, construction should be halted until the marine mammal is outside the range of hundreds of metres from the noise source, as a precaution. These measures will reduce the probability of the estuarine/marine biota being impacted by construction noise but does not reduce it enough to change the score.

A noise impacts monitoring programme should be implemented to validate the predictions made of the impacts of the noise produced by the construction operations on the marine ecology. Monitoring of the ecology in the immediate vicinity of the project should be undertaken following a before-after-control-impact (BACI) approach. This should include monitoring of the local macrofauna, and video surveys and fish sampling to understand the fish community in the area of the port where the powerships will be moored, as well as use of the project area by marine mammals. Monitoring of the distribution and behaviour of diving seabirds in the vicinity of the powerships should also be undertaken.

These surveys should be ongoing and following a sampling methodology that is robust when assessing the impacts of the noise produced by construction on the distributions of benthic macrofauna, fish, seabirds, and marine mammals. The results of such monitoring will be valuable in informing other developments and contributing to the international understanding of the effects of noise from construction activities on marine biota.

7.5.11.1.4 Impact 4: Effect on ecosystem services (fisheries and mariculture) due to increased noise levels from construction

The mooring of the Powerships and FSRU will involve the construction of infrastructure and will include noise-producing activities such as vibro-piling, drilling, and rock clearance. Fish would need to stay within 50 m of these noise sources for 12 hours, continuously, to experience the onset of TTS, in which a temporary reduction in hearing sensitivity can be expected. Therefore, it is unlikely that any fish will experience harm from the noise from the construction activities, so impacts on fisheries from this source are considered to be unlikely.

Currently, there is no active aquaculture in Richards Bay, but an Aquaculture Development Zone (ADZ) has been proposed and is being investigated (DFFE 2020). As a result, the location of the proposed ADZ is unknown. Considering the spatial extent of the impacts of construction noise, the ADZ would need to be within hundreds of metres of the Powerships for there to be any potential impact. As there is limited space around the proposed Gas to Power project location, the likelihood of this occurring is considered to be low.

The noise produced by construction will raise the ambient underwater noise levels within hundreds of metres of the vessel. It is unclear as to how frequently the noise-producing construction activities will take place, but over the course of the duration it is assumed that they will occur once or more in a week. The likelihood of this noise having an impact on ecosystem services is considered to be possible. The scoring results in a "Medium - Low" Overall Environmental Significance, which will remain Medium-Low even with mitigation. The research gaps in the understanding of the effects of noise on the local fisheries means that the assessment is given a Medium confidence.

Table 7-39: Impact ratings for Disturbance to ecosystem services (fisheries and mariculture) due to increased noise levels from construction

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 &2	1	2	2	**1.7**	2	4	**3.0**	**5.1 Medium-low**
Mitigation measures: • See mitigation measures for the effects of construction are provided in Table 7-36 and 7-38. These are mitigation measures for the estuarine/marine ecology that underpin the ecosystem services.								
Alternative layout 1 &2	1	2	2	**1.7**	2	4	**3.0**	**5.1 Medium-low**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced							
Fatal flaw	No, this impact does not result in a fatal flaw							

7.5.11.1.5 Impact 5: Effect on terrestrial fauna (including avifauna) as a result of construction activities

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 through the presence of heavy machinery, vehicles and generators both on the shoreline and in the more terrestrial habitats in respect of the transmission routes.

Despite the degraded state of the landscape and frequent disturbances associated with the port, such as shipping and vehicular traffic, and harbour operations, the area between the port and the Manzamnyama Canal is still provides some (albeit modified) habitat value. The project footprint is relatively small, involving the loss of a small amount of open water habitat, as well as clearing of terrestrial bush to construct the powerlines and access roads. This will have a negligible impact on the availability of habitat for estuarine waterbirds. Furthermore, some of the species inhabiting the port habitats are not likely to be significantly impacted by noise, light, dust, vehicular traffic as they would be somewhat tolerant of such disturbances or are expected to temporarily evade the unfavourable conditions.

Overall, the significance of impacts related to the construction of the ship components on avifauna are rated as being medium-low post-mitigation, and for the transmission lines, medium-low to very low significance (Anchor Environmental and TBC, 2022). For terrestrial fauna, the impact significance rating post-mitigation is low (de Wet, 2022).

Table 7-40: Summary of potential impacts on avifauna associated with the construction phase of the Karpowership project – ships (adapted from Anchor Environmental and TBC, 2022)

Impact		Pre mitigation	Post mitigation
		Significance	Significance
Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)		Medium-Low	Medium-Low
Powership: human disturbance		Medium	Medium-Low
Reversibility	The impact is reversible		
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that nests of avifauna SCC are avoided.		
Fatal flaw	No, this impact does not result in a fatal flaw		

Table 7-41: Summary of potential impacts on avifauna associated with the construction phase of the Karpowership project – transmission lines and ancillary infrastructure (adapted from Anchor Environmental and TBC, 2022)

Impact		Pre mitigation	Post mitigation
		Significance	Significance
Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna)		Medium-Low	Very Low
Infrastructure: human disturbance		Medium	Medium-Low
Reversibility	The impact is reversible		
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that nests of avifauna SCC are avoided.		
Fatal flaw	No, this impact does not result in a fatal flaw		

* ESA = ecological support areas; ONA = other natural areas

Table 7-42: Summary of potential impact of loss of fauna Species of Conservation Concern during construction (taken from De Wet, 2022)

Impact		Without Mitigation	With mitigation
Construction phase			
Issue 2: Loss of Species of Special Concern and Biodiversity			
5: Loss of fauna SCC		Medium	Low
Reversibility	The impact is reversible		
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that faunal SCC are relocated to alternative habitat that is actively conserved (*e.g.* Richards Bay Nature Reserve), and that nests of avifauna SCC are avoided.		
Fatal flaw	No, this impact does not result in a fatal flaw		

Measures (adapted):

- Select alternative transmission route 1.

- Do not place transmission lines or access routes for their construction in functional natural habitat, Intact indigenous vegetation must be avoided.
- Do not clear natural vegetation in the process of construction of project infrastructure. No linear 3m footprints should be cleared of vegetation in these areas but individual drilled foundations used.
- Construction measures must consist of the least impactful individual erection of monopole structures.
- No use of the surrounding vegetation will be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- No animals (birds, reptiles, and mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught/hunted for any reason.
- A qualified specialist should be on site during construction to safely remove all slow-moving (chameleons and tortoises) and burrowing (moles, lizards and snakes) species from the path of the excavator and relocated to a conservation area.
- Construction activities, specifically excavation and moving/transporting of large components, must be restricted to daylight hours to prevent potential disturbance to roosting bird populations
- Restrict vehicles to clearly demarcated access routes, construction areas and contractor areas only.
- Keep vehicle access to the shoreline to a minimum. Only allocated access points to the beach be used.
- 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 be cordoned off.
- Regarding the African Fish Eagle nest on site, construction activities should be initiated during winter, when the nest is not in use, and after which the breeding pair will hopefully relocate their next nest to a safer area.
- Beyond the headland of the 600 Berth Basin, movement of supporting vessels must be restricted to the main channels only.
- The sandspit and Kabeljous Flat must be designated restricted areas, *i.e.* these areas may not be utilised in any way to support or facilitate construction/mooring activities, storing of materials, etc.
- Laying of the gas pipeline and mooring legs of the FSRU must be undertaken during the winter months to reduce disturbance of birds utilising the sandspit.
- Construction vehicles, plant and machinery must be well maintained and fitted with silencers.
- Regular maintenance on vehicle and equipment must be undertaken.

7.5.11.1.6 Impact 6: Effect on macrophyte habitats as a result of construction within the estuarine functional zone

The stringing yard for assembly of the gas pipeline and the first land-based connection, that is the terminal tower, will be located in, and traverse, the disturbed / modified wetland (reedbeds)/mixed grassland/shrubland, which is characteristic of much the vegetation along the harbour arterial road (except for the distinct mangrove and saltmarsh areas). The location of the terminal tower for the alternative layout 1 and alternative layout 2 options for the powerships is presumably the same, *i.e.* within the disturbed vegetated area of the mainland promontory. The vegetation of the laydown area adjacent to the 600 Berth basin is highly disturbed, on a continuous basis, with limited species diversity.

The site office complex and stringing yard are in relatively close proximity to the shallow intertidal area at the head of the dead end-basin, where *Zostera* beds were reported to occur but this area as well as the assembly basin will not be infringed upon. 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 towers between the port and the Manzamnyama Canal. Given the degraded state of the vegetation and landscape modification, the loss of functional estuarine habitat is likely to be insignificant. It is important to note however, that swamp forest species, namely *Hibiscus tiliaceus* and few individual mangroves (*A. marina*) line the assembly basin and the eastern/southern shoreline of the dead-end basin. As protected species and threatened ecosystem type, these must be avoided. Permits will be required for removal/destruction of individual trees.

Integrating the findings of the Terrestrial Ecology Specialist Report (section 7.5.7 of this report), areas of modified estuarine habitat as well as reed beds will be lost. All of the impacts identified in the Terrestrial Ecology Specialist Report can be mitigated to low overall environmental significance (Table 7-42).

Table 7-43: Summary of impacts associated with the construction of the Karpowership transmission line, and ancillary infrastructure on the terrestrial ecology of Richards Bay estuary (taken from De Wet, 2022)

Impact	Without Mitigation	With mitigation
Construction phase		
Issue 1: Loss of vegetation communities		
1: Loss of modified habitat	Medium-Low	Low
2: Loss of reed beds	Medium	Low
3: Loss of bushveld	Medium-Low	Low
Issue 2: Loss of Species of Special Concern and Biodiversity*		
4: Loss of flora SCC	Medium	Low
6: Loss of biodiversity in general	Medium-Low	Low
Issue 3: Ecosystem function and process		
7: Fragmentation	Medium-Low	Low
8: Invasion of alien species	High	Low

Reversibility	The impact is reversible
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that floral and faunal SCC are relocated to alternative habitat that is actively conserved (*e.g.* Richards Bay Nature Reserve), and that nests of avifauna SCC are avoided.
Fatal flaw	No, this impact does not result in a fatal flaw

A specialist Wetland Delineation and Functional Assessment was undertaken, and a total of twenty-six (26) watercourses were identified within the 500m assessment radius, covering eight different categories, including an artificial dam, the estuary/port waters, channelled valley bottom wetlands, depression wetlands, floodplain wetlands, unchannelled valley bottom wetlands, hillslope seepage wetlands and river riparian systems. Only seven of the identified 26 watercourses would be impacted by the proposed development. These systems have undergone moderate to moderately high disturbance from historic and current land use practices. The majority of the impacts would manifest during the construction phase as these systems would be affected or modified by construction activities, however, the majority of the impacts (all phases) can be reduced to overall low environmental significance, some requiring additional, stringent mitigation measures.

Table 7-44: Summary of potential impacts (post-mitigation) of the proposed development on the surrounding watercourses/wetlands within the Richards Bay estuary. Pre-C = Pre-construction Phase, C = Construction Phase, O = Operational Phase, R = Rehabilitation

Phase). Adapted from the Wetlands Specialist Report DWS Risk Assessment Matrix (Triplo4, 2022b).

Nr.	Activity	Phases	Aspect	Risk Rating	Borderline LOW MODERATE Rating Classes
1	**Establishment of a construction site camps and erection of ablution facilities within a previously disturbed area.**	Pre-C	Increase in surface-area of hardened surfaces	Low	Negligible
		Pre-C	Clearing and grubbing	Low	Negligible
		Pre-C & C	Potential application of herbicide to clear land	Low	Negligible
2	**Establishment of a construction site camps for the material laydown area, site office and concrete coating area and stringing yard.**	Pre-C	Increase in surface-area of hardened surfaces	Moderate	Low
		Pre-C	Clearing and grubbing	Moderate	Low
		Pre-C	Access roads and stringing yards	Moderate	Low
3	**Demarcation of buffer zones and restricted areas and the allocation/preparation of spoil sites (topsoil separate from subsoil), waste dump sites and construction vehicle routes**	Pre-C & C	Erection of silt fencing around all waste dumps and downslope of watercourses (including coverage sails).	Low	Negligible
		Pre-C & C	The dumping of waste and spoil at the designated sites using haulage routes	Low	Negligible
		Pre-C & C	Input of dropper, or wooden poles to extend danger tape on, or paint poles	Low	Negligible
4	**Construction vehicle movement throughout the lifespan of the proposed development.**	Pre-C & C	Movement of construction vehicles over loose soil particles.	Low	Negligible
		Pre-C & C	Different soil structures baring excess weight of the large construction vehicles.	Low	Negligible
		Pre-C & C	Accidental spills (*e.g.* hydrocarbons, chemicals, oil).	Low	Negligible
		Pre-C & C	Movement of vehicles and large construction vehicles on watercourses	Moderate	Low

7.5.11.1.7 Impact 7: Effect of solid waste pollution generated during construction period

5	**Direct destruction of vegetation and topsoil layer within the footprint of the Overhead Powerlines and temporary material laydown area, site office and concrete coating area and stringing yard.**	Pre-C & C	Loss of biodiversity within the site and disruption and/or destruction of faunal habitats.	Moderate	Low
		Pre-C & C	Reduction of groundcover and increased surface-area of exposed bare-ground and impermeable-surfaces.	Moderate	Low
		Pre-C & C	Reducing the soil cohesion created by the plant roots.	Moderate	Low
6	**Construction of the 132kV Overhead Lattice Steel Structure and Switching Station**	Pre C & C	Setup a concrete batch plant onsite (if contractor does not utilise a commercial ready mix concrete supplier)	Low	Negligible
		C	Piling and creation of footings (depending on soil baring capacity) (Preferred Route)	Moderate	Low
		C	Piling and creation of footings (depending on soil baring capacity) (Alternative Route)	Moderate	Moderate
		C	Excavation and trenching for concrete bases (Preferred Alternative)	Moderate	Low
		C	Excavation and trenching for concrete bases (Alterative Route)	Moderate	Moderate
		C	Construction of steel sections and plates (Preferred Route)	Moderate	Low
		C	Construction of steel sections and plates (Alternative Route)	Moderate	Moderate
		C	Construction of circuits required for overhead powerlines (Preferred Route)	Moderate	Low
		C	Construction of circuits required for overhead powerlines (Alternative Route)	Moderate	Moderate
		C	Hardened surfaces in the catchment for switching station and associated infrastructure	Moderate	Low

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

7	**Construction and installation of the gas pipeline**	C	Pipeline assembly and welding in stringing yard	Moderate	Low
		C	Pipeline installation	Moderate	Low
8	**De-establishment of the site camp, spoil sites, waste dumps and the rehabilitation of the temporary access/haulage roads.**	R	Tillage of areas of bare-soil and revegetation using a mixture of indigenous species typical of the area	Low	Negligible
		R	Reshape local topography to natural slope if necessary.	Low	Negligible
9	**Utilisation of the Overhead Powerlines and Switching Station**	O	Increased risk of pollution and change in watercourse characteristics (Preferred Route)	Moderate	Low
		O	Increased risk of pollution and change in watercourse characteristics (Alternative Route)	Moderate	Moderate
		O	Increased risk of vehicles creating unauthorised tracks during repairs (Preferred Route)	Moderate	Low
		O	Increased risk of vehicles creating unauthorised tracks during repairs (Alternative Route)	Moderate	Moderate

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 port and ocean may have a lethal/sublethal impact on marine fauna, with potentially severe consequences for rare and endangered species (*e.g.* turtles and dolphins). Poor management of the laydown area, the stringing yard and its operations (*e.g.,* waste management facilities), and construction areas (*e.g.* towers) may also lead to contamination of the immediate surrounding environment.

Waste management, in terms of the handling, storage and disposal of general, construction and hazardous waste, must continue for the duration of the construction phase. The possibility of impacts occurring is high if waste is not properly managed, and the intensity of these impacts may be severe and expensive or time consuming to mitigate.

Table 7-45: Impact ratings for solid waste pollution generated during construction period

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance

General construction	2	3	2	**2.3**	3	3	**3.0**	**6.9 Medium-low**
Mitigation measures: • 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 of the intertidal area and surrounding port waters. • 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.								
General construction	2	2	1	**1.7**	2	2	**2.0**	**3.4 Low**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that correct and appropriate pollution responses are implemented, and rehabilitation is undertaken where necessary.							
Fatal flaw	No, this impact does not result in a fatal flaw							

7.5.11.1.8 Impact 8: Effect of 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 into other sensitive areas of the harbour or out to sea during strong winds coinciding with spring high tides. This will affect sediment and water quality with toxic and potentially lethal/sun-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 depending on weather conditions and dilution. Accidental spills, regardless of volume or concentration, could lead to significant environmental damage.

Table 7-46: Impact ratings for chemical pollution arising from construction related spills of hazardous substances

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
General construction	2	3	4	**3.0**	3	3	**3.0**	**9.0 Medium-high**

Mitigation measures:

- The establishment and operation of the site office complex, laydown area and stringing yard must follow a stringent Environmental Management Programme, monitored by an ECO.
- 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.
- Correct handling, storage and disposal procedures must be 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.
- A comprehensive environmental awareness programme must be conducted amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances.
- In the event of a spill, a penalty must be issued and the 'Polluter Pays' principle must be applied for clean-up operations and rehabilitation, if necessary.

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
General construction	2	3	4	**3.0**	2	2	**2.0**	**6.0 Medium - low**

Reversibility	The impact is reversible
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that correct and appropriate pollution responses are implemented, and rehabilitation is undertaken where necessary.
Fatal flaw	No, this impact does not result in a fatal flaw

7.5.11.2 Impact assessment findings (with and without mitigation): ***Operational Phase***

7.5.11.2.1 Impact 9: Effect on surrounding estuarine/marine ecology due to seawater intake for cooling purposes

Seawater abstracted by the powerships will entrain some small to medium bodied planktonic/pelagic organisms (*e.g.*, phytoplankton, larval stages of invertebrates and fish, juveniles and adults), including reproductive material (eggs) from the surrounding water body into the condenser cooling systems. These fauna constitute food resources for higher trophic levels and also “stocking material” for the disturbed areas of the port. Also, areas subject to propeller wash from passing vessels may experience agitation of the bottom sediments and in these instances, soft sediment invertebrates, including juveniles and adults, may be placed into suspension and may also be abstracted. 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 estuarine/marine organisms, especially larger and 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 a maximum of 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.

Relatively high phytoplankton biomass (exceeding 20 µg/L) has been measured in the vicinity of the proposed Gas to Power project, indicating the potential for phytoplankton blooms to occur within the port.

There is a lack of project-specific literature on intake and entrainment, *i.e.*, plankton mortality data. However, phytoplankton biomass recovers quickly due to short generation times (~0.3/day) and populations are also quickly replenished via tidal mixing processes from the wider port water body. Additionally, it is reported by Poornima *et al.* 2005, amongst others, that the mortality rate from thermal and mechanical stress of phyto- and zooplankton entrained is not 100%. Thus, survivors are returned to the receiving environment. Carcasses are also returned where they may be consumed or decomposed so the biological material is not lost to the system. Accordingly, and considering that there is low zooplankton biomass in the 600 Berth Basin and ichthyoplankton mainly occurs in undeveloped areas of the port, *i.e.*, not the 600 Berth Basin, it is anticipated that the volumes of plankton entrained will not affect broader ecosystem functioning of the estuary.

The seawater abstraction process also affects other generally larger marine organisms such as juvenile fish through impingement on the intake pipes' screens. Notable organisms that may be impinged in the port of Richards Bay include juvenile fish and several shark species. Given that important loggerhead and leatherback nesting sites occur along the sandy beaches north of the Port of Richards Bay, individuals may therefore occur in the port on occasion. These groups of organisms are generally highly mobile and will be expected to avoid the overall disturbance. Key habitat areas for macrocrustaceans, specifically prawns, are located on the Kabeljous Flats and within the Bhizolo-Manzamnyama Canal complex. Macrocrustacean populations are thus not likely to be affected by seawater abstraction.

Although the cooling water intake velocities are large (2.4 to 11.4 m^3/s), in comparison to the approximate total volume of water in the berth basin (>10million m^3; site-specific area multiplied average depth), volume intake per time by the powerships is low. Overall, the impact on sensitive habitats, species, or important food resources will be minimal. Larger organisms will likely swim away from intake pipes so that entrainment will have a negligible impact.

The spatial scale of this impact will be site-specific with minor intensity as natural functions are hardly altered. The duration of the effect will be up to 20 years as the intake of cooling water and the consequent entrainment and impingement of organisms will last for the project's duration. The ecological effect, however, will be temporary as plankton biomass recovers quickly due to short generation times. However, the likelihood of impact occurring is probable, and this will be taking place on an hourly basis. Accordingly, the assigned overall environmental significance rating is Medium-low.

Table 7-47: Impact ratings for the intake of cooling water on marine organisms in the surrounding water body

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 & 2	3	1	2	**2.0**	3	5	**4.0**	**8.0 Medium**
Mitigation measures: • See below								
Alternative layout 1 & 2	3	1	1	**1.7**	2	5	**3.5**	**6.0 Medium-low**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that correct and appropriate pollution responses are implemented, and rehabilitation is undertaken where necessary.							
Fatal flaw	No, this impact does not result in a fatal flaw							

Mitigation measures:

The intake of cooling water is an unavoidable impact of the operation of Powerships. However, intake velocities can be reduced through the use of footer valves— these increase the area of intake, resulting in a decrease in intake velocity to safe levels. The following mitigation measures are proposed:

- Intake velocities must be kept as close to 0.15 m/s to ensure that fish and other mobile organisms can escape the intake current. Intake velocities can be reduced through the use of footer valves;
- Intake structures must not draw in water from the upper meter of the water column; and
- Intake structures must ensure the horizontal intake of water.

7.5.11.2.2 Impact 10: Effects of powership cooling water discharge on estuarine/marine ecology

Sensitive receptors of concern regarding this impact are seagrass beds, plankton, fish larvae and juveniles (unable to swim away), and benthic crustaceans, since larger organisms, such as fish can swim out of the thermal plume.

Richards Bay is classified as 'sheltered nearshore waters', and therefore a 100 m mixing zone is applicable (Anchor 2015).

A three-dimensional (3D) hydrodynamic modelling study was undertaken by PRDW (2022) to predict the extent of the thermal plume generated by the Powerships at the Port of Richards Bay (Appendix 10.2). This included environmental conditions such as currents and ambient water temperature for winter and summer. The modelling study assumed some worst-case scenarios:

- It was assumed that the Powerships would be running with all engines and generators at 100% load, with the freshwater generators also in use. This uses an estimated total intake/outlet flow rate for both vessels (all generators combined) of 8.49 m3/s;
- The modelled ΔT values for the engines in the Khan class Powership were 13.0°C, which corresponded to the maximum of the measured range; and
- It was assumed that the Powerships would be operating for 24 hours a day, whereas they are planned to operate for only 16.5 hours a day. As a result, the actual thermal plume will be smaller than the modelled plume.

Based on previous marine ecology assessments, a site-specific threshold of ΔT = 1°C at 100 m from the discharge point was recommended and was used to present the model results. The results at a distance of 300 m from the Powerships was also presented but is not applicable in Richards Bay.

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 increase in seawater temperature predicted by the model is compared to ecological thresholds discussed below.

The discharge simulations predict that, at the worst location along the 100 m boundary, the 99th percentile temperature (*i.e.*, worst case, for 1% of the time) in winter will be 22.0°C and in summer will be 28.2°C, which are increases above the baseline of 1.3°C and 0.2°C respectively. At the worst location along the 300 m boundary, the 99th percentile temperature in winter was predicted to be 21.8°C in winter and 28.3°C in summer, representing increases above the baseline of 1.1°C and 0.2°C respectively. The largest ΔT's are generally found at or near the surface, while the bottom is much less affected by the temperature change due to the buoyancy of the discharge. Minimal effects on benthos are thus expected.

The model results show that when the discharge depth of cooling water is 8 m, the thermal plume exceeds the recommended guidelines by 0.3°C. Nevertheless, the absolute temperature of the plume did not exceed any of the biological thresholds detailed in 'Applicable Guidelines and Thresholds' as captured in the assessment report. Deleterious effects within the Zone of Initial Dilution (ZID) are expected, but these should be limited to non-acute levels. Where exceedance of the guideline was observed (between the 100 and 300 m boundaries), seagrass habitat is present within the intertidal habitat in the assembly cove. If we assume that the water temperature within the cove during discharge increases to between 28 and 29°C (worst case scenario as modelled), the thermal threshold for *Zostera capensis* is not exceeded (as per the above guidelines and thresholds). Given that the seagrass beds in the intertidal area are able to withstand periods of exposure and high air temperatures (Cyrus and Vivier 2014b), it is likely that they will be resilient to these temperature changes. It is however recommended that measurement of the water temperature within the intertidal area of the assembly cove is undertaken before commencing the operational phase of the project to confirm the absolute temperatures in this area.

Of potential concern is the adjacent shallow area, namely the Kabeljous Flats, which is greatly significant ecologically in terms of the maintenance of Richards Bay as a functioning estuarine-type ecosystem. The modelling results show that the 95th percentile ΔT near the surface results in increases of 1.00-1.25°C extending into the narrow, shallow channel between the promontory and the sandspit connecting the Kabeljous Flats to the basin, and partially into the mangrove-lined cove. Additionally, the central area of the Kabeljous Flats was predicted to experience temperature increased of up to approximately 0.75°C during winter, and 0.50°C during summer, with warmer waters covering a larger proportion of the Kabeljous Flats relative to the baseline condition. The sensitive biota on the Kabeljous Flats are anticipated to experience some thermal effect, but considering the biological thresholds, these are not considered to be significant to cause harm.

As the largest temperature increases occur near the surface, benthic organisms are unlikely to be affected by the thermal plume, except for those residing in a narrow area immediately beneath the discharge points. Furthermore, the macrofaunal density in the region of the proposed location of the Powerships is relatively low and has species reflecting its status as a disturbed habitat that is not particularly sensitive. In addition, larger and highly mobile species (fish, sharks, dolphins) will likely avoid unfavourable habitat conditions. Thus, any potential impacts to the marine biota in the immediate vicinity of the discharge are of relatively low concern.

The spatial scale of this impact will be slightly beyond on the project footprint with low severity as natural functions should slightly altered beyond the zone of initial dilution. No irreplaceable loss of marine fauna or flora is expected, although this needs to be confirmed by temperature measurements within the intertidal area in the assembly cove. The duration of the effect will be up to 20 years as the discharge of heated cooling water and the consequent effect on organisms in the receiving water body will last for the project's duration. The ecological effect, however, will be more temporary. Furthermore, the impact will be reversed once the project infrastructure is removed. The frequency of the impact is continuous (daily/hourly), and the probability is rated as probable. Accordingly, the assigned overall environmental significance rating is Medium-High.

Table 7-48: Impact rating of the of powership cooling water discharge on the estuarine/marine ecology

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 & 2	3	2	2	**2.3**	3	5	**4.0**	**9.2 Medium-high**
Mitigation measures: • See below								
Alternative layout 1 & 2	3	2	2	**2.3**	2	5	**3.5**	**8.1 Medium**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced							
Fatal flaw	No, this impact does not result in a fatal flaw							

Mitigation measures:

The results show that a smaller footprint of temperature increase (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. The following mitigation measured are suggested:

- Cooling water is discharged into the sea at a depth of 8 m, as recommended in the modelling report (PRDW 2022); and
- To reduce the risk of recirculation of the discharge back to the intakes, it is 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.

A water quality monitoring programme should be implemented to validate the predictions of the hydrodynamic modelling study and monitor constituents of the effluent. Adaptive management, informed by monitoring results must be implemented to ensure compliance with water quality guidelines.

7.5.11.2.3 Impact 11: Effect on surrounding estuarine/marine ecology due to underwater noise and vibrations

The noise generated by the Gas to Power project operations is expected to be semi-continuous, up to 16.5 hours a day. In order to identify any significant risks from underwater noise that could arise due to this project, a study was undertaken to model the underwater noise from the proposed Gas to Power project operations in Richards Bay. A baseline noise survey was conducted in Richards Bay, identifying the noise levels to which the receiving environment is already exposed (Subacoustech Environmental Report No. P292R0501, 2022). Additionally, a survey was carried out in Ghana at the location of a large Khan class Powership that has similar specifications (a sister ship) to that of the Khan class Powership planned for Richards Bay, in order to sample the noise levels produced by such a ship at various power outputs and distances. The data from the Ghanaian survey was applied to the baseline data via standard methodology to predictively model the noise levels that would be present in Richards Bay if all the proposed ships were installed and operating at maximum capacity.

Based on the measurements of the noise produced by other large vessels in Richards Bay, it is evident that the noise levels resulting from the introduction of the Powerships will be exceeded by a transiting container or bulk carrier vessel moving into or out of the port, since noise levels from those existing operations were measured to be higher at equivalent distances.

Due to the worst-case assumptions listed above, the increase of more than 10 dB on the south side of the sand bar is anticipated to be a significant overestimate. As there will be no “line of sight” to the larger Powership and the shallow water at the west end of the sand bar will restrict the passage of sound, the realistic contribution is anticipated to be of the order of 6 dB lower than the predictions. However, this worst-case calculation is used as a precaution.

In cases where the Powership is operating at a low power, which was found to be typical during the survey of the operational Powership in Ghana, the effect on baseline noise levels will be negligible.

The most noise-sensitive groups in Richards Bay are expected to be mammals and fish. Juveniles are considered more susceptible to noise disturbances as they are less mobile, while adult fish (and marine mammals) can move out of affected areas. Other important marine receptors in the area are the various seabird species.

Particularly in consideration of the long durations of exposure and full power operation in excess of the expected maximum load, there is no expected impact from the noise produced by the proposed Richards Bay Powerships on marine mammals. As the noise produced by the Powerships is similar to the noise produced by other large vessels in the port, the Powerships are not anticipated to produce any significant additional disturbance to marine mammals unless a marine mammal is directly adjacent to the ships.

As the density of fish within the intermediate field of the proposed Powership location is unknown, the extent to which fish will be affected in this vicinity is unclear. If the location of the Powerships and FSRU is regularly inhabited by fish important to the local fisheries, especially sound-sensitive species such as Sciaenid Dusky kob (*A. japonicus*), it is possible that the fisheries may experience shifts in the physical distribution of populations of their target species. However, overall catches will not necessarily be affected as any displacement would only occur over a relatively short range, expected to be of the order of hundreds of metres. It should be noted that the noise from the Powerships is of a similar level to that of existing ships using the port, and the FSRU much lower, so will not change the existing soundscape of the bay.

Given the low underwater hearing threshold and importance of hearing in foraging for some diving seabirds, it is possible that some species will experience masking in the near vicinity of the Powerships, which could interfere with their ability to forage. However, resident seabirds recorded in Richards Bay, which could be impacted by the Powerships, are infrequent and limit to the grey-headed gull (*Chroicocephalus cirrocephalus*) and the common tern (*Sterna hirundo*). Given that the Powerships will not contribute meaningfully to the overall soundscape of the Port, this effect will be localised and should not affect these birds' general feeding abilities.

The noise produced by the Gas to Power project operations is not anticipated to contribute meaningfully to the existing noise levels in Richards Bay. Furthermore, when considering an "above worst-case" scenario, the Powerships do not produce noise to the extent that will cause direct harm to marine organisms, based on current understanding and available research. Marine organisms within hundreds of metres of the ship will experience noise levels higher than the general background noise of the Port, and these will be similar to those noise levels experienced within similar distances to the typical large vessels that transit the Port, however, noise associated with the Powerships will be continuous (16.5 hours a day). It is possible that marine organisms within hundreds of metres of the Powerships will experience noise levels that interfere with ecologically relevant sounds, which could have negative impacts over time. Sound-sensitive marine organisms would need to stay within a few hundred metres of the Powerships for 24 hours in order to experience the onset of TTS (where a temporary reduction in hearing sensitivity may occur).

Considering these factors, the severity of the noise produced by the Gas to Power project is considered to be "Site-specific and wider natural processes and/or functions continue albeit in a modified way (general integrity maintained)". The duration of the effect will be from 2 to 20 years as noise will be produced by the vessel for the duration of its operation. Noise produced by the Gas to Power project will increase the ambient underwater noise levels within hundreds of metres of the source, so it will impact a greater area than the immediate site. The Powerships are expected to run hourly, for up to 16.5 hours a day, making the frequency of the impact hourly. The likelihood of there being an impact of project-induced noise on the estuarine/marine ecology is considered "Possible". No irreplaceable loss of marine fauna or flora is expected. The impact of noise will stop when the project is finished. Accordingly, the assigned overall environmental significance rating is Medium-High without mitigation and with mitigation is reduced to

Medium. As there is limited research into the impacts of continuous low-level noise on marine organisms, the confidence of this assessment is Medium.

Table 7-49: Impact ratings for effects on surrounding estuarine/marine ecology due to increased underwater noise and vibrations

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 & 2	3	2	3	**2.7**	2	5	**3.5**	**9.5 Medium-high**
Mitigation measures: • See below								
Alternative layout 1 & 2	3	2	2	**2.3**	2	5	**3.5**	**8.1 Medium**
Reversibility	The impact is reversible							
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced							
Fatal flaw	No, this impact does not result in a fatal flaw							

Mitigation measures:

Mitigation measures must ensure that the worst-case scenario assumptions made in this assessment are not met, so that noise levels created by the Gas to Power project are lower than what is predicted. This will help to avoid disturbances and potential harm to marine organisms, and may include the following:

- The Powerships must not be operational for 24 hours a day, to reduce chronic exposure of noise to marine organisms. It is expected that the Powerships will operate for 16.5 hours a day;
- Maximum power output from the Powerships must be avoided – contracted capacity of 450MW must be complied with. Noise levels produced by the Powerships are proportional to the amount of power output, so lower noise levels will be achieved with lower power capacity;
- In the case that a marine mammal, especially a baleen whale, is in the near vicinity *i.e.*, within hundreds of metres of the Gas to Power project, the Powerships should not operate at maximum power output, to reduce the noise level produced and thus the chances of disturbing the animal; and
- When moving in and out of the port, the LNGC must not move at maximum speed, so as to reduce the amount of noise produced by its engines.

A noise impacts monitoring programme should be implemented to validate the predictions made of the impacts of the noise produced by the Gas to Power project on the marine ecology. Monitoring of the ecology in the immediate vicinity of the Gas to Power project should be undertaken following a before-after-control-impact (BACI) approach. This should include monitoring of the local macrofauna, and video surveys and fish sampling to understand the fish community in the region associated with the Powerships, as well as use of the project area by marine mammals.. Monitoring of the distribution and behaviour of diving seabirds in the vicinity of the Powerships should also be undertaken.

These surveys should be ongoing and following a sampling methodology that is robust when assessing the impacts of the noise produced by the Powerships on the distributions of benthic macrofauna, fish, seabirds, and marine mammals. If an effect if observed, adaptive management informed by monitoring results must be implemented. The results of such monitoring will be valuable in informing other developments and contributing to the international understanding of the effects of noise from large vessels on marine biota.

7.5.11.2.4 Impact 12: Effect on surrounding estuarine/marine ecology due to light pollution

The powerships and the FSRU will be moored within an active area of the port, namely the 600 Berth Basin, and on the margin of the 700 Berth Basin respectively. In line with various maritime health and safety policies and regulations, operational areas within the port must have adequate lighting to ensure safe working conditions. Thus, dependent on the nature of the work, artificial lighting on the quaysides, at night or during poor visibility or weather conditions, can range from non-directional low intensity lighting, to high intensity, directional lighting (*e.g.* spotlights) at areas of high risk or particularly hazardous activities (*e.g.* loading), whatever is deemed necessary to meet the minimal light levels required.

Vessels moving within the port, or those that are berthed, must comply with applicable maritime laws and regulations, pertaining to standard navigational lighting and lighting in respect to general health and safety requirements and emergencies.

It is evident from the above, that the mooring location of the proposed Gas to Power project within the Port of Richards Bay is already impacted by artificial lighting related to the port operations. This includes the nearby undeveloped and ecologically sensitive areas of the port, mangroves, the Kabeljous Flats and the sandspit.

Artificial light at night (ALAN) is a significant source of light pollution that interferes with the natural cycles of light and darkness and modifies the intensity, spectra, frequency and duration of light reaching and penetrating the natural water bodies, including the ocean's surfaces, and natural landscapes.

In the context of the Richards Bay estuary, which serves as a critical nursery area for fish, the impact of ALAN on predator-prey relationships as a result of the Gas to Power project is of particular concern. Nonetheless, mitigation measures can be put in place to reduce light pollution reaching the natural environment and its ecological impacts. Baseline light level measurements must be undertaken prior to construction and operation of the powerships in the vicinity of the powerships and at the sensitive habitat receptors

Table 7-50: Impact ratings for effects on surrounding estuarine/marine ecology due to increased light pollution

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 &2	3	2	3	**2.7**	3	5	**4.0**	**10.8 Medium-high**
Mitigation measures (taken from CWA, 2020 -* National Light Pollution Guidelines for Wildlife*):								

<table>
<tr><th></th><th>Duration</th><th>Extent</th><th>Severity</th><th>Consequence</th><th>Probability</th><th>Frequency</th><th>Likelihood</th><th>Significance</th></tr>
<tr><td colspan="9">
Only add light for specific purposes. Remove excess/unnecessary lights, and turn off lights in areas not in use.
Restrict uplighting and water illumination.
Use adaptive light controls to manage light timing, intensity and colour.
Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill.
Use the lowest intensity lighting appropriate for the task.
Use non-reflective, dark-coloured surfaces.
Use lights with reduced or filtered blue, violet and ultra-violet wavelengths. Avoid high intensity light of any colour.
Implement actions when birds are likely to be present. This includes peak migration periods (flyway locations).
No light source should be directly visible from foraging or nocturnal roost habitats, or from migratory pathways.
Install screening/shielding with appropriate materials along the starboard side of the vessels.
Do not install fixed light sources in nocturnal foraging or roost areas.
Use curfews to manage lighting near nocturnal foraging and roosting areas in coastal habitats. For example, manage artificial lights using motion sensors and timers from 7pm until dawn.
Use flashing/intermittent lights instead of fixed beam.
Use motion sensors to turn lights on only when needed.
Reduce deck lighting to minimum required for human safety on vessels moored near nocturnal foraging and roost areas.
Prevent indoor lighting reaching migratory shorebird habitat, by using blinds, curtains, or shutters.
In facilities requiring intermittent night inspections, turn lights on only during the time operators are moving around the facility.
Use appropriate wavelength, explosion proof LEDs with smart lighting controls and/or motions sensors. LEDs have no warmup or cool down limitations so can remain off until needed and provide instant light when required for routine nightly inspections or in the event of an emergency.
Industrial site/plant operators to use personal head torches.
Undertake a night light audit on a moonless night and 24-hour noise audits in accordance with SANS 10103:2008 on the sandspit and Kabeljous Flats before operations commence to determine the baseline, once operations start and annually thereafter.
</td></tr>
<tr><td>Alternative layout 1&2</td><td>3</td><td>1</td><td>2</td><td>2.0</td><td>2</td><td>4</td><td>3.0</td><td>6.0 Medium-low</td></tr>
<tr><td colspan="2">Reversibility</td><td colspan="7">The impact is reversible</td></tr>
<tr><td colspan="2">Irreplaceability of Resources</td><td colspan="7">No, the impact does not cause a loss of resources that cannot be replaced</td></tr>
<tr><td colspan="2">Fatal flaw</td><td colspan="7">No, this impact does not result in a fatal flaw</td></tr>
</table>

7.5.11.2.5 Impact 13: Effects of the combined operational impacts on ecosystem services (fisheries and mariculture)

The operational-phase impacts assessed here are the effects of the intake of cooling water, the discharge of cooling water, and increased noise produced as a result of the Gas to Power project on fisheries and mariculture.

The fisheries that take place directly in Richards Bay are the recreational shore angling fishery, the recreational boat angling fishery, and the (currently illegal) gill net fishery. The shore anglers mainly use locations outside of the commercial port, on the eastern side of the harbour (Beckley *et al.* 2008). They are far enough from the Gas to Power project location that any additional noise will have attenuated to the level that it is negligible above the background noise, on the level of 1 dB. Also, this is far outside of the range of influence of the discharged cooling water. Therefore, it is unlikely that the Gas to Power project operations will impact shore angling. The locations that the gill net fishers use is unknown, but it is unlikely that gill net fishing will take place within the sphere of influence of the Gas to Power project operations, which is in the order of hundreds of metres from the Gas to Power project location and within a busy commercial port.

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). Any impact on juvenile fish will influence the fisheries they recruit to. As juvenile fish have less physical capacity to move out of the way of impacts such noise, discharged warm water, or a water intake pipe, they may be more prone to by impacted by the Gas to Power project. There remains a concern regarding displacement of fish populations occur as a result of impacts arising from Powership operations. A reduction in the available suitable habitat for juvenile and adult fish may lead to the concentration of fish within the more heavily fished areas of Richards Bay, increasing the risk of over-exploitation by commercial and recreational fisheries.

Due to the lack of research into the effects of the type of noise produced by the Gas to Power project on fish, and the uncertainty around the extent to which fisheries will be affected by the operation of the Gas to Power project, the severity of the impacts is considered as “Site-specific and wider natural processes and functions are slightly altered”. The duration of these impacts will be as long as the planned operation of the project, which is 20 years. The noise produced by the Gas to Power project will raise the ambient underwater noise levels within hundreds of metres of the vessel. The operational impacts will take place semi-continuously, on a daily basis. The scoring results in a “Medium” Overall Environmental Significance, which will remain “Medium” even with mitigation. The research gaps in the understanding of the effects of noise on the local fisheries means that the assessment is given a Medium confidence.

Table 7-51: Impact ratings for effects of the combined operational impacts on ecosystem services (fisheries and mariculture)

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layout 1 & 2	3	2	2	**2.3**	2	5	**3.5**	**8.1 Medium**
Mitigation measures: • See below								

Alternative layout 1 & 2	3	2	2	**2.7**	2	5	**3.5**	**8.1 Medium**

Reversibility	The impact is reversible
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced
Fatal flaw	No, this impact does not result in a fatal flaw

Mitigation measures:

The mitigation measures for the intake and discharge of cooling water and for the additional noise produced, as provided in this section, are mitigation measures for the estuarine/marine ecology that underpin the ecosystem services.

7.5.11.2.6 Impact 14: Effect on macrophyte habitats and terrestrial fauna

As per the issues described under Impact 5 relating to the construction phase, similar impacts would be prevalent during the operational phase. This attributed to ongoing maintenance and potential repairs to the transmission line infrastructure.

Table 7-52: Summary of potential impacts associated with the operation of the Karpowership on the terrestrial ecology of Richards Bay estuary, as taken from De Wet (2022)

Impact	Without Mitigation	With mitigation
Operational phase		
Issue 1: Loss of vegetation communities		
1: Loss of modified habitat	Medium-Low	Low
2: Loss of reed beds	Medium-Low	Low
3: Loss of bushveld	Medium-Low	Low
Issue 2: Loss of Species of Special Concern and Biodiversity		
4: Loss of flora SCC	Medium-Low	Low
5: Loss of fauna SCC	Medium-Low	Low
6: Loss of biodiversity in general	Medium-Low	Low
Issue 3: Ecosystem function and process		
7: Fragmentation	Medium-Low	Low
8: Invasion of alien species	High	Low

Reversibility	The impact is reversible
Irreplaceability of Resources	No, the impact does not cause a loss of resources that cannot be replaced provided that flora and fauna SCC are relocated to alternative habitat that is actively conserved (*e.g.* Richards Bay Nature Reserve), and that nests of avifauna SCC are avoided.
Fatal flaw	No, this impact does not result in a fatal flaw

7.5.11.2.7 Impact 15: Effects on coastal and estuarine avifauna associated with overhead transmission lines

In general, powerlines pose a significant threat to birds, primarily through collisions and electrocutions.

The impact of the transmission lines on coastal and estuarine birds is specifically addressed in the Avifaunal Specialist Report (Anchor Environmental and TBC, 2022) and all mitigation measures and conditions provided must be adopted. The summary impact table below is provided for ease of reference.

Table 7-53: Summary of potential impacts on avifauna associated with the operational phase of the Karpowership project – transmission lines and ancillary infrastructure, adapted from Anchor Environmental and TBC (2022)

Impact	Pre mitigation	Post mitigation
	Significance	Significance
Habitat loss: Infrastructure	Medium-Low	Very-Low
Project infrastructure: collisions	Medium-High	Medium-Low
Project infrastructure: electrocution	Medium-Low	Medium-Low

Reversibility	The impact is reversible
Irreplaceability of Resources	The impact may result in irreplaceable loss of resources (*e.g.* disturbance/harm/displacement of threatened/migratory bird species), however mitigation measure may prevent complete loss or provide a suitable substitute (*e.g.* flight deterrents, utilising existing servitudes- alternative 2 not supported).
Fatal flaw	No, this impact does not result in a fatal flaw

Mitigation measures (Anchor Environmental and TBC, 2022):

- Approach and general access to the ships should be from the north side.
- No activities (post construction) must occur between the ships and the sandspit, other than activities in direct contact with the vessels, such as ship maintenance.
- Align transmission lines with existing transmission lines
- Mark the lines for visibility.
- Remove any nests built on powerline structures when not in use, to discourage their re-use.

7.5.11.2.8 Impact 16: Effect on coastal and estuarine avifauna due to operation of the powerships (disturbance, noise and light)

The proposed Gas to Power project will be located within an industrial and commercial port where disturbance, noise and light pollution is already prevalent. Anchor Environmental and TBC (2022) indicates that visual disturbance (movement) related to the manning of the powerships and associated infrastructure is an important consideration in establishing the impacts of the project. Various waterbird species exhibit visual disturbance at varying distances. A disturbance threshold of 200 m from the sandspit and Kabeljous Flats is suggested for the Gas to Power project within the Richards Bay estuary (Anchor Environmental and TBC, 2022). While a static powership is likely to cause low levels of disturbance, visual impacts on avifauna making use of the sandpit for roosting or feeding are expected (Anchor Environmental and TBC, 2022), given that parts of the vessels fall within the suggested buffer. Visual disturbance may result in some species taking flight, whilst most species will likely exhibit behaviour changes, such as reduction in feeding and feeding efficiency. Disturbance would be higher during construction, with some species becoming habituated during the operational period (Anchor Environmental and TBC, 2022).

In respect to noise, ambient noise levels within the port are 45 dB(A) with a variety of noises being noted emanating from vessel engines, loading of coal, port terminal operations, etc. as reported in the terrestrial noise generation study (Safetech, 2022). These were all audible from the sandspit and thus current noise impacts for this area are moderate to high (Anchor Environmental and TBC, 2022). Once in operation, the powerships will operate throughout the day and part of the night (16.5 hours), with noise emanating from power generation and supporting activities. The dead-end basin and part of the adjacent shoreline and promontory will be subject to industrial noise at 60-70 dB(A), all areas within an approximately 650 m radius including a portion of the mangrove stand and shallow Kabeljous Flats, the landward third of the sandspit, mangrove-swamp forest of the intertidal cove, and grassland and scrubland will experience 50-60 dB(A) (levels similar to busy urban areas) (Safetech, 2022). The greater Kabeljous Flats and sandspit, broader mangrove and grassland/shrubland and wetlands, Manzamnyama and Lower Bhizolo Canal, as well as small portion of the Mhlathuze Sanctuary /Richards Bay Nature Reserve, will experience 40-50 dB(A) (levels similar to rural and quiet suburban areas) (Safetech, 2022). Beyond these areas, noise levels will decrease from 40 dB(A) to 30 dB(A) (Safetech, 2022). Avifauna foraging on the water line of the sandspit at low tide will be subject to greater noise disturbance as they may be in closer proximity to the vessels, while at high tide when the water line is a further 500m away, noise disturbance reaching the exposed sandflats will be less (Anchor Environmental and TBC, 2022). As there are no legislated noise limits for environmentally sensitive areas or protected areas (Martin, 2022; Safetech, 2022), a conservative approach should be adopted.

Light pollution, noise and vibrations emanating from the operation of the powerships will add to the existing effects on avifauna caused by vessel berthed and operating at the break bulk/multipurpose terminal and related port activities, and vessels in transit. As reported by Anchor Environmental and TBC (2022), the port has seen a measurable decrease in the number of waterbirds and this is attributed to the presence of the IDZ, the port infrastructure and associated activities.

The Alternative layout 2, which entails mooring of all vessels adjacent to the sensitive sandspit, will result increased impacts to the avifauna utilising this area and is therefore not supported, and is consequently not rated.

The impact of the Gas to Power project on coastal and estuarine avifauna is specifically addressed in the Avifaunal Specialist Report and all mitigation measures and conditions provided must be adopted. A summary impact table below is provided for ease of reference.

Table 7-54: Summary of potential impacts on avifauna associated with the operational phase of the Karpowership project – ships, as taken from Anchor Environmental and TBC (2022)

Impact	Pre mitigation	Post mitigation
	Significance	**Significance**
Powership: light pollution	**Low**	**Low**
Powership: noise and vibration impacts	**Medium**	**Medium**
Powership: human disturbance	**Medium-Low**	**Very-Low**
Reversibility	The impact is reversible	

Irreplaceability of Resources	The impact may result in irreplaceable loss of resources (*e.g.* disturbance/harm/displacement of threatened/migratory bird species), however mitigation measure may prevent complete loss or provide a suitable substitute (*e.g.* screening, reducing personnel movements).
Fatal flaw	No, this impact does not result in a fatal flaw

Mitigation measures (Anchor Environmental and TBC, 2022):

- In respect to noise impacts, layout option 1 must be selected to reduce noise and vibration impacts to surrounding avifauna
- Essential lighting is on at night
- Lumens are kept to a minimum
- Lights are installed as low as possible
- Lit up windows are shuttered at night

7.5.11.2.9 Impact 17: Effect of chemical pollution arising from spills and leaks of hazardous substances, and day-to-day shipping practices

During the operational period, 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 of the port directly 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 ecologically significant habitats of the bay, and potentially the open ocean under severe circumstances. Accidental spills, regardless of volume or concentration, could lead to significant environmental damage.

Leakage of LNG into the surrounding water body is not anticipated to cause harm to estuarine marine life or alter water column characteristics. 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 estuarine/marine life.

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 water, etc.) as a result of the proposed gas to power project is considered to be high. However, 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. Furthermore, the 'Polluter Pays' principle whereby those responsible for the spill are held liable for the clean-up and rehabilitation costs, will apply in any pollution incident.

The potential impact is likely to be reversible and no irreplaceable resources are expected to be lost, provided the correct and appropriate pollution responses are implemented timeously and rehabilitation is undertaken where necessary.

All mitigation measures provided in the Risk Assessment for Major Hazard Installations (MHR, 2022) must be adopted.

Table 7-55: Impact ratings for chemical pollution arising from construction related spills of hazardous substances and shipping activities

<table>
<tr><th></th><th>Duration</th><th>Extent</th><th>Severity</th><th>Consequence</th><th>Probability</th><th>Frequency</th><th>Likelihood</th><th>Significance</th></tr>
<tr><td>General Operation</td><td>3</td><td>5</td><td>4</td><td>4.0</td><td>3</td><td>3</td><td>3.0</td><td>12.0 High</td></tr>
<tr><td colspan="9"><u>Mitigation measures:</u>
• Only specialist personnel who are well trained on the standard protocols for preparation, coupling and decoupling of the gas pipeline between vessels, may undertake these operations.
• 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;
• Correct handling, storage and disposal procedures must be 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.
• 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 must be issued and the ‘Polluter Pays’ principle must be applied for clean-up operations and rehabilitation, if necessary.</td></tr>
<tr><td>General Operation</td><td>3</td><td>3</td><td>4</td><td>3.3</td><td>2</td><td>2</td><td>2.0</td><td>6.6 Medium-low</td></tr>
<tr><td colspan="3">Reversibility</td><td colspan="6">The impact is reversible</td></tr>
<tr><td colspan="3">Irreplaceability of Resources</td><td colspan="6">No, the impact does not cause a loss of resources that cannot be replaced provided that correct and appropriate pollution responses are implemented, and rehabilitation is undertaken where necessary.</td></tr>
</table>

Fatal flaw	No, this impact does not result in a fatal flaw

7.5.11.2.10 Impact 18: Impacts of catastrophic accidents on estuarine/marine ecology and ecosystem service

The introduction of the Powerships and FSRU vessels increase the risk of the likelihood of catastrophic accidents occurring. The following are considered to be a catastrophic accident:

- Large hydrocarbon spills above Tier 3 as outlined in the "Coastal Oil Spill Contingency Plan No. 24: Richards Bay Zone" (DEA 2012);
- Explosion/flash fires;
- Major vessel collision/sinking;
- Unintentional removal of vessel from moorings; and/or
- Introduction of toxins, biocides or alien species considered extremely harmful to marine ecology.

According to MHR (2022), the greatest risk during the operation of the powerships is the possible rupture of one of the transfer hoses between the LNGC and FSRU. In terms of the types of risks, both a vapour cloud explosion and flash fire would have the greatest predicated area of impact, followed by a jet fire caused by rupture of a transfer hose (MHR, 2022). The impact area of both the explosion and flash fire was modelled to extend in a north-easterly direction toward the finger-jetty and mangrove/sandflat habitat adjacent to the Balloon Rail area. The largest jet fire emanating from the FSRU/LNGC ships extends in the same direction. However, the greatest extent of predicted thermal radiation (255m) will not reach the sandspit or the Kabeljous Flats; similarly, the closest zone of risk does not intercept the sandspit. With respect to the powership, a jet fire emanating from a transfer hose rupture, with a flame length of 83m, is directed toward the 600 Berth quayside and will not reach the adjacent shoreline. No mortalities of fauna utilising the estuary or shoreline are anticipated, unless flying directly over or within the impact area when the incident occurs, which is highly unlikely but not impossible.

Overall, the level of risk on sensitive areas is low, with 1: 10 000 risk area confined to the two ships and 160m around the hose connections, the 1: 1 million risk area stretching for a maximum distance of 295 m from the FSRU/LNGC ships and approximately 36 m around the powership hose connection, 1: 30 million risk area stretching for a maximum distance of 310 m from the FSRU/LNGC ships and approximately 40 m around the powership hose connection (MHR, 2022).

Although highly unlikely yet also unpredictable, the risks will reach the distal third of the sandspit which would result in significant habitat disturbance and disturbance or harm to marine /estuarine fauna, specifically birds on the sandspit. There is no difference in risk between the two layout options because the primary risk revolves around the FSRU/LNGC ships, which remain in the same location for either layout option.

All these catastrophic events have protocols in place to avoid incidents, therefore the probability and overall significance score for catastrophic accidents in Low. These catastrophic accidents have been assessed together with the consideration of impacts on marine ecology and the provision of ecosystem services.

Table 7-56: Impact ratings for effects of catastrophic accidents on estuarine/marine ecology, avifauna and ecosystem services

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layouts 1&2	4	4	5	**4.7**	1	1	**1.0**	**4.7 Low**

Mitigation measures:

- All mitigation measures provided in the Risk Assessment for Major Hazard Installations (MHR, 2022) must be adopted.
- Only specialist personnel who are well trained on the standard protocols for preparation, coupling and decoupling of the gas pipeline between vessels, may undertake these operations. All applicable certificates of conformance must be on site.
- An emergency plan that is compliant with the Major Hazardous Installation Regulations must be compiled and implemented.
- 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.
- Good housekeeping to be done daily.

	Duration	Extent	Severity	Consequence	Probability	Frequency	Likelihood	Significance
Alternative layouts 1&2	4	4	5	**4.7**	1	1	**1.0**	**4.7 Low**

Reversibility	The impact is NOT reversible
Irreplaceability of Resources	Yes, the impact causes a loss of resources that cannot be replaced.
Fatal flaw	No, this impact does not result in a fatal flaw

7.5.11.2.11 Impact 19: Effect on the Mhlathuze Estuary/ Sanctuary

The natural Richards Bay was divided into two separate water bodies during the construction of the Port of Richards Bay in the early 1970's. Richards Bay and the uMhlathuze Estuary have remained hydrologically disconnected for nearly 50 years due to the early failure of the tidal gates. Thus, the project will not directly affect the functioning of the uMhlathuze Estuary by virtue of this permanent separation.

According to the noise generation study (Safetech, 2022), average ambient noise levels in the port were 45 dB(A) and reached a maximum of 52.9 dB(A) during the course of the noise study. While the noise generation study does not provide an indication of current noise levels within the uMhlathuze Estuary, when the powership is in operation, a very small portion of the uMhlathuze system (2%), comprising predominantly mangrove habitat on the margin of the Richards Bay Nature Reserve, will be subject to noise disturbance between 30 - 50 dB(A) (Safetech, 2022). This is within the range for rural districts and quiet suburban areas.

However, this area is located immediately adjacent the harbour railway line and Harbour Arterial Road, and thus experiences noise disturbance from trains and traffic, including heavy vehicles, en route to the coal terminal and South Dunes Precinct. Given that the source of the noise is not within the nature reserve and that the noise received at the margin will be ≤50 db(A), overall, noise disturbance within the uMhlathuze Estuary is predicted to be minimal. The presence of the mainland promontory adjacent to the preferred location will likely contribute to noise attenuation.

As reported by Safetech (2022) on SANS 10103, noise levels produced "*by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum sound pressure level of 50 dB(A) at a distance of 15 m from each individual source*". As per the recommendations of the Avifauna specialist (Anchor Environmental and TBC, 2022), monitoring of noise levels at the sandspit and the Kabeljous Flats is recommended at least monthly during operation so these can be compared to the changes in bird populations, if any. In any instance of detectable change, additional means of reducing airborne noise from the powerships must be implemented to prevent lasting impacts on the birdlife.

7.5.11.3 Cumulative Impacts

By definition, cumulative marine environmental impacts emanating from the proposed Gas to Power project are related to the overlap with various other sources of anthropogenic disturbance in the vicinity of the powership and FRSU. This "zone of impact" where cumulative impacts may be of concern has been defined by the operational thermal and noise modelling results. Under the worst-case scenario, the thermal zone of impact extends 100 m from the powership location, and the underwater noise zone of impact extends hundreds of metres each of the powership and FSRU. Cumulative thermal and underwater noise impacts are only of concern within this area, however, additional cumulative impacts that could occur outside of this area are detailed below. The high impact areas for both thermal and underwater noise operational impacts do not currently overlap with other developments with expected similar impacts (*i.e.*, discharge of cooling water, underwater noise generation).

The project site is located within an existing and operational port. Any development or maintenance activity in the Port of Richards Bay (in close proximity to the proposed project) involving the disturbance of sediments, the intake of large volumes of water, the increase in vessel traffic, the occupation of space, along with the proposed Gas to Power project, may have cumulative impacts on the surrounding marine ecology through increased underwater noise, vessel collision risk, hydrocarbon spill, invasive alien species transfer (via ballast water release), increased pollution of Richards Bay through maintenance and repair activities, and storm water runoff.

Four power production developments have been proposed (or have had approval) in the area surrounding the Gas to Power Powership Project site. The four developments under consideration are:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).

- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

The Nseleni development, in combination with the proposed KSA Gas to Power project, may result in cumulative impacts on the surrounding estuarine ecology which will need to be considered. The following cumulative impacts provided through a high-level, qualitative assessment may arise, but are not limited to:

- A positive impact on the port function and the economic activities related thereto by providing for short-term provision of power to the Richards Bay IDZ and 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 even at times of power shortfalls and during load shedding;
- Contribution to the potential polluting activities in the Richards Bay, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Richards Bay Estuary, the avifauna and the system's critically important nursery function. 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;
- Greater negative impacts are anticipated for the sensitive receptors of Richards Bay (specifically the biological communities of the Kabeljous sand and mudflats, the sandspit and the adjacent mangrove habitat) if the significantly larger Nseleni project is implemented simultaneously with the KSA Gas to Power project. It is possible that sensitive bird populations will be displaced as a result of significantly greater noise and light disturbance, and underwater noise impacts could affect both the nursery function and the productivity of the intertidal and subtidal areas. Overall, the critical ecosystem functions, and biodiversity value of Richards Bay, could be diminished. Cumulative impacts without mitigation are expected to be high;
- Increased risk to all vessels (possible collision etc.) and port operations as a result of dynamic coastal processes related to climate change (increased storminess, tidal surge etc.). Again, this would be part of normal shipping practices controlled by the TNPA; and
- The transient nature of the KSA Gas to Power proposal (as well as the Nseleni project), in comparison to permanent infrastructural development, landscape transformation and longer-term environmental impacts associated with the proposed land-based operations within the RBIDZ 1D and 1F zones.

Given the major modifications of the natural environment due to port development, the estuarine space in Richards Bay is already limited. The addition to the proposed powership development further reduces the space available to estuarine and marine organisms that use the environment of Richards Bay. Considering this it is reasonable to assume that a threshold will exist where an exceedance of which (in terms of disturbance space) will have substantial negative effects on the estuarine environment as a whole. Estuarine and marine organisms will be displaced to elsewhere in the Bay until a lack of available habitat causes significant spatial changes to their distribution *i.e.*, vacation of the Bay entirely. The Richards Bay open water area is 13 km^2 and the proposed powerships will further reduce available space within the Bay by 0.42 km^2, equivalent to 3.2%.

The comprehensive, quantitative assessment of cumulative impacts requires extensive input from government departments, regulating authorities and other stakeholders. The impact studies for the Nseleni

NIFPP project were recently completed (2021) and revealed ecological impacts in terms of wetland and terrestrial vegetation communities, noise, dredging of the Kabeljous Flats, routing of power evacuation pipeline and cabling bridge piles across the Kabeljous Flats (with unknown consequences for hydrodynamics and sediment deposition), moderate impacts to estuarine fauna (including fish), whereas the impact on avifauna was considered a fatal flaw (SE Solutions, 2021). The environmental authorisation was refused. The cumulative impacts of these two Gas to Power projects (KSA Gas to Power and NIFPP) if operating simultaneously, are expected to be highly negative, from an ecological perspective.

Of critical importance to this application and all the other power generating applications either already approved or proposed, relates specifically to the key informants (Section 5 of the Coastal, Estuary and Marine Ecology Report – Appendix 9-B4). These informants direct that the responsible authority is unable to approve an application for environmental authorisation if the said activity is not aligned with the key objectives of the uMhlathuze/Richards Bay EMP (DEA, 2017a). The cumulative impacts of the KSA Gas to Power project, in conjunction with the significantly larger Nseleni Gas to Power project (if both are simultaneous approved) are anticipated to reduce the current state of the estuarine environment making the approval of both projects unworkable.

7.5.11.4 Management and Monitoring

Long term monitoring of the receiving water body and estuarine ecology must be implemented during construction and operation of the proposed Gas to Power project. Monitoring must follow a BACI (before/after control/impact) approach.

The following monitoring programmes are recommended:

- Monitoring of turbidity levels must be undertaken daily during the pipe laying and anchorage operations. Total suspended solid levels may not exceed 20 mg/l.
- Undertake a night light audit on a moonless night and 24-hour noise audits in accordance with SANS 10103:2008 on the sandspit and Kabeljous Flats before operations commence to determine the baseline, once operations start and annually thereafter.
- A water quality monitoring programme must be implemented to validate the predictions of the hydrodynamic modelling study and monitor constituents of the effluent.
- At a minimum the temperature of the receiving water body in the vicinity of the discharge must be monitored to validate the modelling results and to ensure compliance with the stipulated water quality guidelines.
- A noise impacts monitoring programme must be implemented to validate the predictions made of the impacts of the noise produced by the proposed project on the estuarine ecology. Benthic macrofauna, fish, birds and megafauna communities surrounding the proposed powerships, FSRU and pipeline locations must be monitored (e.g. using grab survey techniques for benthic macrofauna, video monitoring and fish sampling, visual observation) to provide pre-, during, and post- operation scenarios. This must also include areas on the Kabeljous Flats, sandspit and adjacent mangroves.
- Monitoring of the distribution and behaviour of diving seabirds in the context of the powerships should also be undertaken.
- The long-term monitoring of underwater noise in Richards Bay must be conducted.

- Avifauna monitoring is to take place monthly for one (1) year pre-construction and then monthly for one (1) year post construction so that mitigation measures can be adapted to ensure the development does not have a long-term impact on the avifauna Species of Conservation Concern and migratory waders in the area.
- A follow-up assessment on avian biodiversity and species abundance within the assessment area and surrounding areas must be conducted within one year after the facility has been in operation and should be repeated every 3-5 years.
- A monitoring plan has been developed for the site and monitoring is currently ongoing. Information obtained from the monitoring must be provided to BirdLife Renewable Energy Programme on energy@birdlife.org.za. The data must be presented as described in Jenkins *et al.,* 2017.
- 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. All records of discharge volumes and quality are to be kept for auditing purposes.

These surveys should be ongoing and following a sampling methodology that is robust when assessing the impacts produced by the powerships on the distributions of estuarine biotic communities. Importantly, adaptive management, informed by monitoring results must be implemented to reduce negative impacts and also to ensure compliance with applicable guidelines (*e.g.* water quality guidelines). Participation in and contribution of data to external, long-term monitoring programmes currently being undertaken in Richards Bay is encouraged.

During construction, general environmental compliance monitoring must be undertaken by a suitably qualified environmental control officer (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 observed. The presence of an on-site environmental officer is essential to monitor daily activities.
It is recommended that these monitoring requirements are included in any subsequent EMPr. These monitoring activities will make an important contribution to environmental monitoring of the Richards Bay Estuary as whole, especially if undertaken in alignment with uMhlathuze/ Richards Bay EMP. The resultant report must be submitted to TNPA for integrated and adaptive environmental management of the port overall

The Wetland specialist report (Triplo4, 2022a) indicated that several impacts could not be mitigated lower the moderate risk rating and therefore a Water Use License Application would be required.

In support of De Wet (2022) and Anchor Environmental and TBC (2022), it is recommended that a joint venture including TNPA and all port users (including current and future users, including Karpowership) should ideally be actioned as soon as possible to allow for the following (critical management systems) to take place:

- Management and control of alien and invasive plants;
- Definition and maintenance of a Conservation and/or Open Space Management Plan; and
- Development and implementation of a rehabilitation plan.

Each of these aspects cannot be taken on by one individual user, as overall management is critical to such an important ecosystem and management in isolation will be ineffective.

This is to ensure that sensitive, ecologically important habitats, which support threatened species and species of conservation concern, *e.g.* the Kabeljous Flats, mangroves, sandspit etc., are duly acknowledged by all current and prospective operators/stakeholders within the port. This will help to instate collective stewardship of these areas such that they are preserved and rehabilitated and/or enhanced to mitigate the impacts of industrial development and port activities in general.
If a conservation management plan does not already exist, KPS in partnership with TNPA, SANPARKS and Ezemvelo should have input into its development.

7.5.11.5 Specialists' Conclusion

Based on the impacts considered in this report as potentially affecting the Richards Bay Estuary, which integrates assessments from various specialist fields (*i.e.* estuarine/marine ecology, avifauna, terrestrial ecology including wetlands), **there are no highly negative impacts or fatal flaws that would prevent the proposed Gas to Power project from proceeding**, on condition that:

- the preferred powership layout and transmission line route are adopted;
- all conditions, mitigation measures and recommendations provided, and those provided in the supporting specialist reports are strictly implemented;
- the construction and operational phases of the project are undertaken accordance in with a stringent EMPr, which contains all the mitigation measures put forward by the various specialists and which monitored by a suitably qualified ECO(s);
- the project must comply with the relevant environmental standards and thresholds throughout its lifespan, *i.e.,* water temperature thresholds, noise emissions standards, air emissions standards, etc.;
- the project must comply with TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation, regulations and policies for the storage and handling of LNG, and power generation processes,
- the Wetland Rehabilitation Plan developed for the project is implemented; and
- a conservation plan/ open space management plan be developed by the TNPA for the conservation of sensitive species and habitats, such as the sandspit and Kabeljous Flats. If no such document exists, KPS in partnership with TNPA, SANPARKS and Ezemvelo should have input into its development.

7.5.12 Atmospheric Impacts

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). 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 PM.

Emission rates from the point sources on the Powership and the FSRU are presented in the table below. The annual emissions presented above assume that operations are continuous, i.e. 24 hours per day for 365 days. This is a worst-case assumption as operations are likely to be for 16.5 hours per day.

Table 7-57: Annual emissions from the Khan and Shark Powerships and the FSRU (tonnes/annum)

Source	SO_2	NO_X	PM_{10}
Powership (Khan)	36.7	917.1	183.4
Powership (Shark)	10.5	262.0	52.4
FSRU	7.0	174.7	34.9

Power will be generated for up to 16.5 hours per day. This implies start-up and shutdown 365 times a year (minimum) and up to 800 times a year (maximum). The engines utilized on the Powerships are designed for maximum efficiency during stop / start scenarios. As the dispatch of the power is scheduled in advance from National Control. Heat loss and emission calculations in the AIR? take into consideration all start / stops as per the Bid requirement.

The engines, using LNG during start-up and ramp-up to full power takes a maximum of 10 minutes from cold start. It is not possible with the available dispersion models to assess or predict ambient concentrations during the 10-minute start-up. Furthermore, only SO_2 has a 10-minute standard, but SO_2 concentrations resulting from the combustion of LNG have been shown to be extremely low to negligible. Emissions of SO_2, NO_X and PM during the maximum 10-minute ramp-up will not exceed the emissions during LNG combustion at full power for 16.5 hours, which is what has been assessed in the AIR? as a conservative worst case scenario. Shutdown is instantaneous, equating to switching an engine off. Emissions to the atmosphere will stop immediately.

LNG supply vessels will restock the FSRU approximately once every 20 to 30 days. The supply vessel will dock alongside the FSRU during the transfer which will take approximately 24 hours. For the purposes of this assessment the emissions from the LNG resupply are regarded as fugitive emissions. Emissions from the ship manoeuvring from the port entrance to the berth, and during the LNG transfer are presented in Table 7-58. Ship manoeuvring assumes main engines while auxiliary engines are assumed during LNG transfer.

Table 7-58: LNG supply ship emissions (tonnes/annum)

Source	SO_2	NO_X	PM_{10}
Ship manoeuvring	2.1	18.4	0.4
At berth	0.6	3.7	0.1
Total	2.7	22.1	0.5

The air quality impacts associated with the proposed Karpowership Project is assessed based on the predicted ambient SO_2, NO_2 and PM_{10} concentrations.

7.5.12.1 *Impact assessment findings (with and without mitigation):* ***<u>Powership and FSRU: Operational Phase</u>***

The air quality impacts associated with the proposed Karpowership Project is assessed based on the predicted ambient SO_2, NO_2 and PM_{10} concentrations and the methodology described above. The Karpowership Project is assessed alone, and the cumulative effect of the project to ambient air quality in Richards Bay is assessed. Impact scores are presented in the table 7-59 below.

Impact status

Emissions of SO_2, NO_X and particulates from the sources associated with the Karpowership Project result in an increase in ambient concentration of SO_2, NO_2 and PM_{10}. Exposure to air pollutants through inhalation poses a health risk, regardless of the concentration.

The status of the impact is therefore negative for Karpowership alone and cumulatively with other sources.

Impact confidence

The assessment is based on reliable emissions data, reliable meteorological data and applies the recommended dispersion modelling principles (DEA, 2014b). The assessment team has significant experience and is familiar with the project site and the powership concept.

The confidence in the impact assessment is therefore high for the Karpowership alone and cumulatively with other sources.

Severity

The severity of the impact of the Karpowership Project emissions on ambient air quality is assessed by comparison of the predicted SO_2, NO_2 and PM_{10} concentrations with the health-based NAAQS.

The predicted ambient SO_2 concentrations are very low relative to the NAAQS. The severity of the impact associated with SO_2 for the Karpowership Project is therefore predicted to be insignificant.

The predicted ambient NO_2 concentrations are low relative to the NAAQS. There are no predicted exceedances of the NAAQS. The severity of the impact associated with NO_2 for the Karpowership Project is therefore predicted to be low.

The predicted PM_{10} concentrations are very low relative to the limit value of the NAAQS. The severity of the impact associated with PM_{10} for Karpowership alone is therefore predicted to be insignificant.

Monitoring has shown ambient SO_2, NO_2 and PM_{10} concentrations as relatively low in the Richards Bay and below the NAAQS. The additive effect of the contribution from the Karpowership Project is predicted to be very small and the potential increase in ambient SO_2, NO_2 and PM_{10} concentrations is highly unlikely to result in exceedances of the NAAQS.

The severity of the cumulative impact associated with SO_2, NO_2 and PM_{10} is therefore predicted to be insignificant for the Karpowership project with other sources.

Duration

The duration of the impact of the Karpowership Project emissions on ambient air quality depends on the life of the project. The impacts will exist while the project is operational. It is assumed that this is long-term, i.e. more than 10 years. The duration will be long-term for the cumulative impact, i.e. while the Karpowership Project and other sources are in operation.

Spatial scale

The spatial scale of the impact of the Karpowership Project emissions on ambient air quality is assessed by evaluation the spatial extent of predicted SO_2, NO_2 and PM_{10} concentrations. In all cases the predicted ambient concentrations are low relative to the NAAQS and the highest predicted concentrations occur over the Port of Richards Bay, the industrial area to the northeast and naturally vegetated areas to the southwest. The spatial scale of the impact is limited to the Port of Richards Bay and the immediate surrounding areas for the Karpowership project alone, as well as the cumulative impact with other sources.

Consequence

Consequence is a function of the severity, duration, and spatial scale. The severity is very low for SO_2 and PM_{10}, and low for NO_2. The duration will be for life of the project, and the spatial scale is limited to the Port of Richards Bay. The consequence of ambient concentrations of SO_2, NO_2 and PM_{10} resulting from emissions from the Karpowership Project is therefore predicted to be low. The consequence of the addition to existing ambient concentrations, i.e. the cumulative effect, is also low.

Frequency

The predicted ambient concentrations of SO_2, NO_2 and PM_{10} are very low. The highest predicted concentrations are well below the respective NAAQS. Impacts are unlikely to occur and the frequency is therefore predicted to be very low. The addition to existing ambient concentrations is unlikely to result in exceedances of the NAAQS. The frequency rating is therefore also low for the cumulative effects.

Probability

The predicted ambient concentrations of SO_2, NO_2 and PM_{10} are very low. The highest predicted concentrations are well below the respective NAAQS and occur over the Port of Richards Bay. The probability of impacts occurring is unlikely and is therefore predicted to be almost never for Karpowership alone and cumulative with existing sources.

Likelihood

Likelihood is a function of frequency and probability. These are both low for SO_2, NO_2 and PM_{10} so the likelihood of air quality impacts occurring is also low for Karpowership alone and cumulatively with existing sources.

Reversibility

The predicted ambient concentrations of SO_2, NO_2 and PM_{10} are very low and well below the respective NAAQS. Air quality impacts occurring in the ambient environment are therefore expected to reverse with minimal rehabilitation and negligible residual effects, and is therefore considered to be completely reversible for Karpowership alone and cumulatively with existing sources.

Irreplaceability

The predicted ambient concentrations of SO_2, NO_2 and PM_{10} are very low and well below the respective NAAQS. Air quality impacts occurring in the ambient environment are therefore not expected to incur a loss of any resources for Karpowership alone and cumulatively with existing sources.

Significance

Significance is a function of consequence and likelihood. For SO_2 and PM_{10} the consequence of impacts is very low, and is low for NO_2. With a low likelihood of occurrence of impacts associated with SO_2, NO_2 and PM_{10}, the significance of any impacts is predicted to be very low for all three pollutants.

Table 7-59: Air quality impact scores

Description	Pollutants	Severity	Duration	Spatial scale	Consequence	Frequency	Probability	Likelihood	Significance	Status	Confidence	Reversibility	Irreplaceability
Karpowership Project	SO_2	1	4	1	2	1	1	1	2 – Very low	-ve	High	Completely reversible	No loss
	NO_2	2	4	2	2.7	1	1	1	2.7 - Very low	-ve	High	Completely reversible	No loss
	PM_{10}	1	4	1	2	1	1	1	2 – Very low	-ve	High	Completely reversible	No loss
Cumulative assessment with other sources	SO_2	1	4	1	2	1	1	1	2 – Very low	-ve	High	Completely reversible	No loss
	NO_2	2	4	2	2.7	1	1	1	2.7 – Very low	-ve	High	Completely reversible	No loss
	PM_{10}	1	4	1	2	1	1	1	2 – Very low	-ve	High	Completely reversible	No loss
Cumulative assessment with other G2P projects	SO_2	2	4	3	3	1	2	1.5	4.5 – Low	**-ve**	High	Completely reversible	No loss
	NO_2	2	4	3	3	1	2	1.5	4.5 – Low	**-ve**	High	Completely reversible	No loss
	PM_{10}	2	4	2	2	1	1	1	2 – Very low	**-ve**	High	Completely reversible	No loss

7.5.12.2 Cumulative Impacts

The Department of Mineral Resources and Energy launched the Risk Mitigation Independent Power producers Programme (RMI4P) in August 2020 to procure 2 000 MW of new generation from a range of energy technologies. The objective being to fill the short-term supply gap, alleviate the current electricity supply constraints and reduce the extensive use of diesel-based peaking generators.

Besides the Karpowership Project, it is reasonable to expect that other electricity generation project may be procured in Richards Bay as part of the RMI4P. It is therefore relevant to assess the potential cumulative effects of these project on ambient air quality in Richards Bay. Three potential projects have been identified for the assessment of cumulative impacts, namely –

- RBGP2 400MW gas to power project at the RBIDZ 1F
- Nseleni Independent Floating Power Plant in the Port of Richards Bay near the old Bayside complex
- Eskom 3 000 MV CCPP and associated infrastructure on Portion 2 of Erf 11376 and Portion 4 of Erf 11376 within the RBIDZ Zone 1D

The cumulative impacts on air quality of the three potential gas-to-power projects and the Karpowership Project may be assessed if it is assumed that the four project operate together.

The significance of the impacts resulting from operations of the individual projects are presented in Table 7-59.

The highest rating for an individual project is used to assess the potential cumulative impact of the four gas-to-power projects (Table 7-60).

For NO_2 and PM_{10} the significance of the cumulative impact of Karpowership with other gas-to-power projects is rated as low.

For SO_2 the significance of the impact is rated as medium because of the predicted exceedances of ambient SO_2 concentrations during Emergency 2 simulation using diesel and emitting via the main stack (Airshed, 2019).

Table 7-60: Significance of project and cumulative impacts

Project	SO_2	NO_2	PM_{10}	Reference
Karpowership	Very low	Very low	Very low	uMoya-NILU (2020a)
RBGP2	Low	Low	Low	uMoya-NILU (2016a)
NIFPP	Very low	Low	Very low	Professional opinion
Richards Bay CCPP	Medium	Low	Low	Airshed (2019)
Cumulative impact	Medium	Low	Low	Highest rating

Contribution of the Karpowership Project to the existing ambient concentrations is very small. The cumulative effect of the Karpowership Project with existing sources is **likely to be very low**.

7.5.12.3 Mitigation Measures

Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation. Further interventions to reduce emissions are deemed to be unnecessary considering the low impact of the project on air quality.

7.5.12.4 Specialist's Conclusion

From an air quality perspective, it is the reasonable opinion of the air quality specialist that the Karpowership **Project should be authorised** considering the findings of the Atmospheric Impact Report.

7.5.13 Terrestrial Noise Impacts

This section only addresses the human impact of the terrestrial noise emissions, and not the natural environment receptors such as birds, marine animals etc. which are addressed by other specialists and captured in other sections within this chapter.

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 results of the noise impact assessment show that at none of the terrestrial receptors will the SANS 10103:2008 rating limits be exceeded. The construction related noise impacts will be of Low significance after mitigation measures are implemented. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation measures are implemented.

7.5.13.1 Impact assessment findings (with and without mitigation): ***Transmission Line Alternatives 1 and 2: Construction Phase***

The impact of the construction noise that can be expected at the proposed site can be extrapolated from Table 7-61. As an example, if several pieces of equipment are used simultaneously, the noise levels can be added logarithmically and then calculated at various distances from the site to determine the distance at which the ambient level will be reached (Tables 7-62 and 7-63).

Table 7-61: Combining Construction Noise Sources – Worst Case

Description	Typical Sound Power Level (dB)
Overhead and mobile cranes	109
Front end loaders	100
Excavators	108
Bull Dozers	111
Piling machines (mobile)*	115
Total	**117.7**

Table 7-62: Combining Different Construction Noise Sources – Low Impact

Description	Typical Sound Power Level (dB)
Front end loaders	100
Excavators	108
Truck	95
Total	**111.8**

Table 7-63: Attenuation by distance of a 118dB(A) Noise Source

Distance from noise source (metres)	Noise level dB(A)
10	90
20	84
40	78
80	72
160	66
320	60
640	54
1280	48
2560	42
3000	40

The field study results showed that the ambient noise levels in the area of the proposed development was 45 dB(A). NSA 2 (Seafarer's Club) is approximately 520m away from the nearest major noise source (The Powership). Taking this distance 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.

Table 7- 64: Noise Impact Statement for the Construction Phase

	Severity	Duration	Spatial Scale	Consequence	Frequency	Probability	Likelihood	Significance	Status	Confidence	Reversibility	Irreplaceability	Fatal Flaw
Before Management	2	4	2	2.6	2	2	2	5.2	Medium -Low	High	Yes	No	No
Management Measures													
Measures related to the construction phase: • 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. A noise survey should be conducted at the noise sensitive receptors during the construction phase.													
After Management	2	4	2	2.6	2	1	1.5	3.9	Low	High	Yes	No	No
No-go Option	-	-	-	-	-	-	-	-	-	High	-	-	-

7.5.13.2 *Impact assessment findings (with and without mitigation):* ***Powership and FSRU: Operational Phase***

The operational noise levels of the proposed project are below the SANS 10103:2008 recommended levels for all the human receptors within the Port of Richards Bay. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation in the Port of Richard's Bay. The terrestrial environmental noise impact statement for the operational phase rating is presented in Table 7-65 below.

Table 7- 65: Noise Impact Statement for the preferred alternative 1 (Operational Phase)

	Severity	Duration	Spatial Scale	Consequence	Frequency	Probability	Likelihood	Significance	Status	Confidence	Reversibility	Irreplaceability	Fatal Flaw
Before Management	2	5	2	3	1	3	2	6	Medium Low	High	Yes	No	No
Management Measures													

<table>
<tr><th></th><th>Severity</th><th>Duration</th><th>Spatial Scale</th><th>Consequence</th><th>Frequency</th><th>Probability</th><th>Likelihood</th><th>Significance</th><th>Status</th><th>Confidence</th><th>Reversibility</th><th>Irreplaceability</th><th>Fatal Flaw</th></tr>
<tr><td colspan="14">Measures related to the construction phase:
The noise impact from the proposed project should be measured during the operational phase, to ensure that the impact is within the required legal limits.
Ensure that any acoustic enclosures or attenuators that are installed on the vessel are permanently in place during operations.
If possible, position the ship so that the port side that contains the air inlets is positioned away from the very sensitive receptors such as residential communities.</td></tr>
<tr><td>After Management</td><td>1</td><td>4</td><td>2</td><td>2.3</td><td>1</td><td>2</td><td>1.5</td><td>3.45</td><td>Low</td><td>High</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td>No-go Option</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>High</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Figure 7-10 below shows the noise level contours in relation to the layout and the identified NSAs.

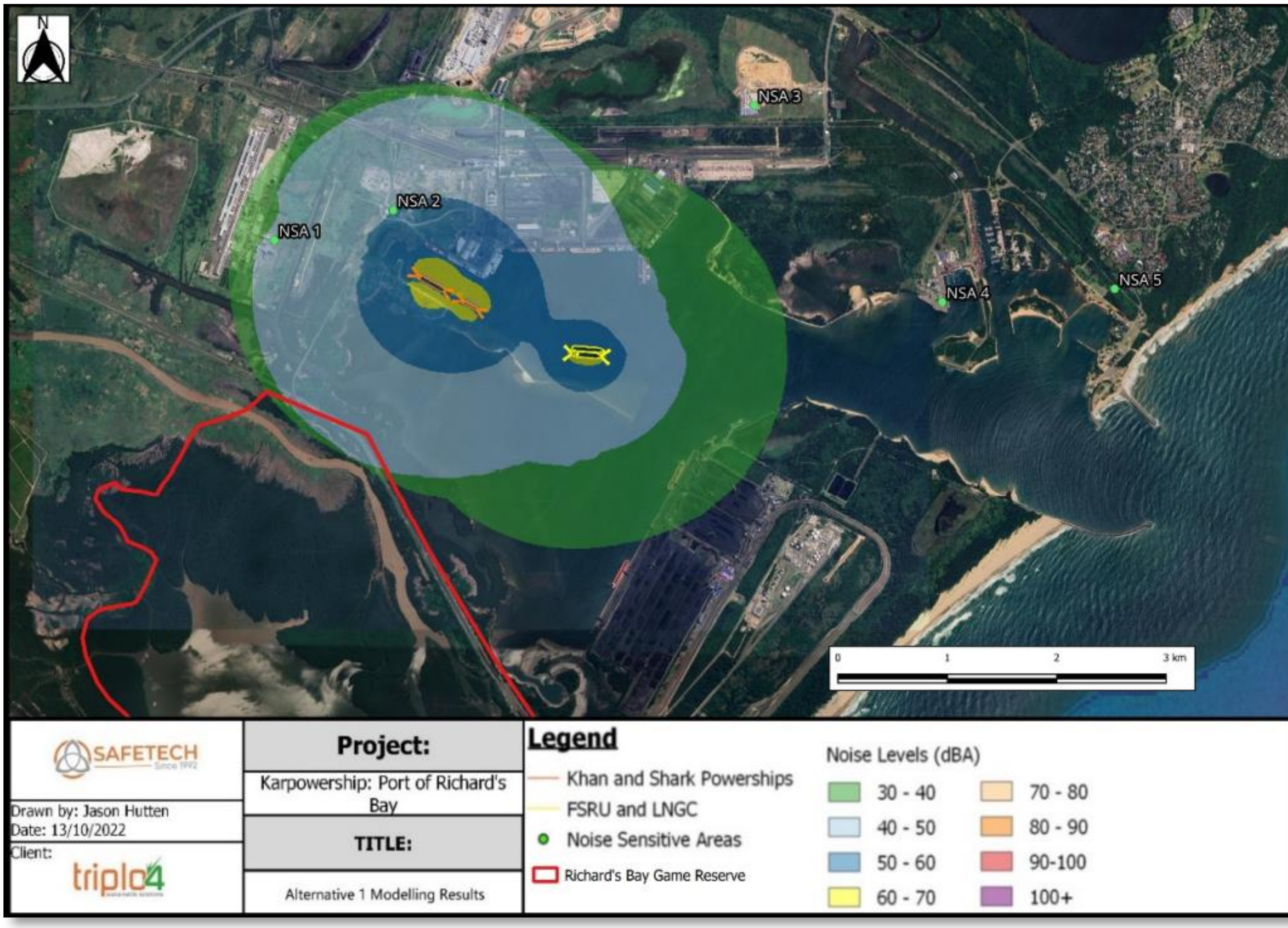

Figure 7-10: Predicted noise levels during the operational phase of the project.

Figure 7-10 above shows that a small portion of the Richard's Bay Game Reserve will receive noise above 50db(A). This area is however highly disturbed by trains which travel through the same area. It is thus highly unlikely that the Richard's Bay Nature Reserve will be impacted severely as the noise is predicted to dissipate readily once reaching its boundary.

Table 7-65 shows the modelling results from the 2021 modelling data as well as the latest data from the Subacoustech report. It will be noted that the results differ significantly due to the following:

- The 2021 modelling did not take into account the attenuation of the noise due to the vessel structure. The sound emissions in this updated report are thus significantly lower than previously modelled and contained in previous versions of this report.
- The 2021 survey did not take into account that all of the air intakes are only on one side of the vessel (the port side).

Table 7- 66: Noise Level at receivers during operational phase (Alternative 1 – Preferred)

NSA No.	Name	SANS 10103:2008 District	SANS 10103:2008 Limits dB(A)		2021 Alternative 1 Predicted Noise Levels dB(A)	2021 Comment on Alternative 1 Results dB(A)	2022 Alternative 1 Updated Predicted Noise Levels dB(A)	2022 Alternative 1 Updates Comment on Results dB(A)
			Day	Night				
NSA 1	Bayside Aluminium	Industrial	70	60	61,3	Exceeds Night Limit	30.6	Within Limits
NSA 2	Seafarer's Club	Industrial	70	60	73,9	Exceeds Day and Night Limit	44.6	Within Limits
NSA 3	SPS Manufacturing	Industrial	70	60	0.0	Within Limits	0.0	Within Limits
NSA 4	Small Craft Harbour	Industrial	70	60	0.0	Within Limits	0.0	Within Limits
NSA 5	Meerensee Residential	Suburban	50	40	0.0	Within Limits	0.0	Within Limits
NSA 6	Gubhethuka Residential	Suburban	50	40	0.0	Within Limits	0.0	Within Limits

7.5.13.3 Cumulative Impacts

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.

Four power production developments have been proposed (or have had approval) in the area surrounding the Gas to Power Powership Project site. The four developments under consideration are:

- Richard's Bay Gas Power 2 (RBGP2) 400 MW Gas to Power project.
- Nseleni Independent 2 800MW Floating Power Plant;
- Eskom 3000MV Combined Cycle Power Plant (CCPP).
- Phinda Power Producers 320MW Emergency Risk Mitigation Power Plant.

No noise specialist study was conducted during the Environmental Authorization Phase of the Eskom CCPP project, therefore it is unclear whether the project will contribute to the overall noise impacts of the Karpowership Project. The Eskom CCPP project is situated approximately 4 400m north-west of the Gas to Power Powership project and is therefore unlikely to contribute to the noise impacts in the project area assessed in this report.

The Richard's Bay Gas Power 2 project is situated further away, approximately 5 700m to the north of the Gas to Power Powership Project. The study found that the noise impacts on the surrounding receptors would be of "low risk" during the operational phase. This, in conjunction with the distance between the two project sites, suggests that the Richard's Bay Gas Power 2 project will have no significant contribution to the cumulative noise impacts of the area.

The specialist noise assessment (conducted by Airshed Planning Professionals) found in the Nseleni Independent Floating Power Plant Final Scoping Report concluded that the noise impacts would be of "low significance".

Limited information is available on the Phinda Power Plant. The location of the proposed development is approximately 3 500m away and will therefore have little cumulative effect on the Noise Sensitive Receptors.

7.5.13.4 Specialist's Conclusion

The specialist had concluded, that if the recommended mitigation measures (tables 7-64 and 7-65) are implemented, it is **recommended that the project receive environmental authorisation**.

7.5.14 Climate Change Impacts

Several scenarios are assessed in terms of the generation and resulting emissions from the Project. The emissions are calculated for three scenarios where the Project is run at 100%, 50% and 25% of the full 16.5hrs/day at the contract capacity. The results are shown in Table 7-67 below. The scenarios indicate that the impact intensity of the project falls into the high threshold when the Project is not operated at 100% of the contracted capacity.

Table 7- 67: Emissions by generation scenario

Scenario	Operating hours/day	Annual emissions	Lifetime emissions	Impact Intensity
100%	16.5 hrs/day	1 536 078 tCO_2e	30 721 561 tCO_2e	High
50%	8.25 hrs/day	768 039 tCO_2e	15 360 781 tCO_2e	Medium
25%	4.125 hrs/day	384 020 tCO_2e	7 680 390 tCO_2e	Medium

Table 7- 68: Operation emissions (100% scenario)

Emission category	Emission source	Operation phase – Annual emissions	Total over life of project (20 years)
Category 1: Direct GHG emissions and removals	Natural gas combustion	1 388 200 tCO_2e	27 763 994 tCO_2e
Total Direct emissions		**1.4 million tCO_2e**	**27.8 million tCO_2e**
Category 3: Indirect GHG emissions from transportation	Natural gas transport	49 082 tCO_2e	981 642 tCO_2e
Category 4: Indirect GHG emissions from products used by organization	Purchased steel	Not significant	Not significant
	Purchased cement	Not significant	Not significant
	Natural gas production	99 174 tCO_2e	1 983 480 tCO_2e
	Total Category 4 emissions	**99 174 tCO_2e**	**1 983 480 tCO_2e**

Emission category	Emission source	Operation phase – Annual emissions	Total over life of project (20 years)
Total indirect emissions		**148 ktCO_2e**	**3.0 million tCO_2e**
Total emissions		**1.5 million tCO_2e**	**30.7 million tCO_2e**

The lifetime operational emissions from the project could result in emissions lock in, also known as carbon lock-in. However, the emissions lock in is considered a low risk from the project due to both the emissions avoided from using more carbon-intensive technologies such as coal as well as the enabling of additional renewable energy capacity on the grid. Furthermore, the actual lifetime emissions may be much lower further reducing the carbon lock in.

The lifetime emissions in this report assume that the project operates for a full 16.5 hours a day for the full lifetime duration. This represents a worst-case scenario for the lifetime emissions. However, the actual emissions are directly proportional to the dispatch instructions received from the System Operator. The RFP for the RMIPPP states "*dispatchable and flexible generation"* as a performance requirement. This means that the project will only export electricity, thus combusting natural gas for its generation, upon receipt of a dispatch instruction. As a result, the actual emissions from the project may be much lower depending on these instructions.

The use of natural gas as an energy source in electricity generation is less emissions intensive than coal-based power. Natural gas combustion releases approximately half the emission of that of coal (if coal is not used as a feed product in the production of the natural gas and that the fugitive emissions during extraction are well managed). Thus, the use of natural gas for electricity generation could reduce the amount of GHG emissions and pollutants produced in the generation of electricity in South Africa.

The combustion of natural gas also results in lower emissions than the combustion of diesel. This is a relevant comparison as Eskom operates its peaking plants on diesel. The combustion of diesel results in approximately 74.1 tCO_2e/TJ in comparison to natural gas which emits approximately 56.1 tCO_2e/TJ.

The combustion of natural gas is also cleaner than that of diesel and coal in terms of air quality and pollution prevention. Natural gas combustion does not release particulate matter, nor does it emit as many harmful nitrates (NO_X) and sulphates (SO_X) as are emitted during the combustion of coal.

A comparison of the emissions per unit of energy from alternative power sources is provided in Table 7-69 below. Using coal as a feedstock will result in the largest emissions while renewables have minimal operational emissions. Natural gas has an emission factor that is much lower than coal and diesel resulting in less emissions during operation.

Table 7- 69: Alternative generation sources

Power source	Emission Factor
Coal	96.1 tCO_2/TJ
Diesel	74.1 tCO_2/TJ
Natural Gas	56.1 tCO_2/TJ

Power source	Emission Factor
Renewables	0 tCO_2/TJ

Avoided emissions

The implementation of the project may result in avoided emissions. These are emissions that may be emitted if the project is not implemented. These emissions are calculated in accordance with the GHG Protocol's guidance document for comparing products. In accordance with this guidance, the baseline technology for calculating the avoided emissions is Eskom's coal fleet.

The avoided emissions are only calculated as the emissions avoided from the switch to gas from coal. The grid emission factor from the IRP has been used to calculate the avoided emissions to reflect the anticipated change in the energy mix as set out by national policy. The emissions are only calculated for the period up to 2030, thereafter it is assumed that the majority of the energy mix will be renewables and there will be no avoided emissions from a coal fleet.

The avoided emissions from the Karpowership Project at Richards Bay are shown in Table 7-70 below. The total avoided emissions between 2023 and 2030 is approximately 17 million tCO_2e.

Table 7- 70: Avoided emissions

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
IRP Grid EF	tCO_2e/MWh	0.85	0.86	0.85	0.83	0.81	0.77	0.73	0.67
Avoided emissions	Million tCO_2e	2.27	2.3	2.27	2.2	2.2	2.1	2.0	1.8

Measures to reduce the impact of the Project on Climate Change

There are a few measures that could reduce the impact of the project on climate change through mitigation. These measures result in lower GHG emissions and therefore reducing its impact.

The first measure is shortening the duration of the PPA. This would result in fewer lifetime emissions from the project as the power plant would be run for a shorter duration. However, this measure may affect the financial viability for the project.

It is noted that the nature of the RfP for the RMIPPP is for power to be dispatched at the request of Eskom. In the case that Eskom does not require the dispatch of power, no GHGs will be emitted from the project. It is assumed that Eskom will have increasing access to renewable energy over the duration of the project, and that more renewable energy plus battery storage projects will come on line. This may result in the project emitting significantly less emissions than what has been estimated above.

The other measure is switching the feedstock of the powership to a renewable energy source such as green hydrogen. This would eliminate the GHG emissions associated with the production, transport and combustion of natural gas. Within the current economic circumstances in South Africa, the use of green hydrogen is not considered an economically viable option for mitigation.

Carbon Capture

Carbon Capture Storage has not been considered because there is not provision in SA law, or regulations for the environmental approval of carbon storage. Reference is made to "The proposed CO_2 Test Injection Project in South Africa" (Vincent et al., 2013).

As it is unlikely that the CO_2 will be retrieved or considered useful after storage, then it is likely in law to be considered to be disposal of a hazardous waste and so the National Environmental Management: Waste Act 56 of 2008 (NEM: WA) may also apply to the Test Injection (Vincent et al., 2013). As there are no specific CCS regulations, for this project it as assumed that CO_2 would be classified as a hazardous waste as this has the strictest regulations and will allow SACCCS to prepare for the Test Injection with these restrictions in mind. The terms of NEM:WA will affect which regulations apply to the Test Injection. In terms of NEM: WA it is expected that the Test Injection will require a waste management license for the handling and storage of the CO_2 prior to injection (Vincent et al., 2013).

*7.5.14.1 Impact assessment findings (with and without mitigation): **<u>Powership and FSRU: Operational Phase</u>***

The proposed Karpowership Project would result in approximately 1.5 million tCO_2e/annum and 31 million tCO_2e over the PPA duration assuming that the project operates 16.5hours per day per year. This falls within the medium intensity as assessed against the impact category thresholds. The emissions from the project would have a negative climate change impact.

The Project can offer load following capability required to stabilise additional renewable energy capacity until sufficient battery storage is added to the grid. The additional renewable energy that this enables would result in avoided emissions that exceed the operational emissions of the project. These avoided emissions are in addition to the avoided emissions from switching from the coal fleet in the national grid. This would be a positive impact from the Project on climate change.

Natural gas power plants offer a transitional option to switch from a predominantly coal based grid system to a lower emission option. This enables electricity generation to allow economic growth while sufficient renewable generation with battery storage is brought online. Operating the natural gas power plant would allow for less emissions than generating the same electricity from a coal fired power station. The natural gas power plant further offers dispatchable power as required unlike renewables without battery storage.

The lifetime operational emissions of the Project, 31 million tCO_2e, can be compared to the impact category thresholds as well for a cumulative impact analysis. The emissions over the 20-year lifetime of the project are comparable to 2 years of running a new coal fired power station which the upper threshold is based on. This supports the paragraph above that natural gas can be used as a transitional technology to move away from reliance on coal. If the operational emissions of the Project are analysed for just a 5-year period, the emissions total 8 million tCO_2e which remains in the high category but below the emissions from operating a coal fired power station for a year. This can be considered a positive impact allowing for economic growth while reducing the reliance on coal fired power stations.

When considering all impacts related to the project, it can be considered to have a low positive impact. Despite having a high intensity impact from operational emissions, the project enables significant reductions through avoided emissions and enabled renewables. Furthermore, it allows for economic development to occur by providing dispatchable power onto the grid which is critical for the economy.

7.5.14.2 Specialist's Conclusion

The impact of the project on climate change was assessed in the context of both GHG emissions from the project, as well as the potential positive impact the project will have for the transition to a low-carbon economy.

In accordance with the findings of the Climate Change Impact Assessment, the specialist advised that the proposed Karpowership Project at Richards Bay **should not be refused environmental authorisation** based on climate change related issues.

7.5.15 Socio-Economic Impacts

Figure 7-11 shows the potential areas of impact of the proposed Karpowership project and provides a more detailed identification of the socio-economic areas of impact. The radius of one kilometre covers the site of the three ships as well as other berths in the harbour and the Coal Terminal. The rest of the port of Richards Bay is covered within the 5 km radius, whereas the 7 km radius includes Richards Bay Central Business District (CBD). Beyond the 7 km radius are some formal urban residential areas but more less-formal semi-urban community settlements and rural communities.

The socio-economic impacts of the Karpowership project will be mainly within the local area as shown in the Figure below. Except for the supply of electricity and the higher skilled personnel that will be sourced from the local, national, and international markets, all other impacts will be local. Although the impact on the juvenile fish in the harbour will impact on the fish population, the socio-economic impact will be local on the small-scale fishers. Likewise, and additional housing, facilities and amenities will be in the local area and not extend to regional, KZN or national levels. The minor impact on the sense of place that the Karpowership project will have, will be local. Some of the socio-economic impacts such as the training and capacity building that will take place will be local but may spread to a regional and national levels as the future dispersion of trained persons take place. Such impact could however not be prescribed to the Karpowership project. The areas of impacts and description of the activities in these areas are shown in Table 7-71 below.

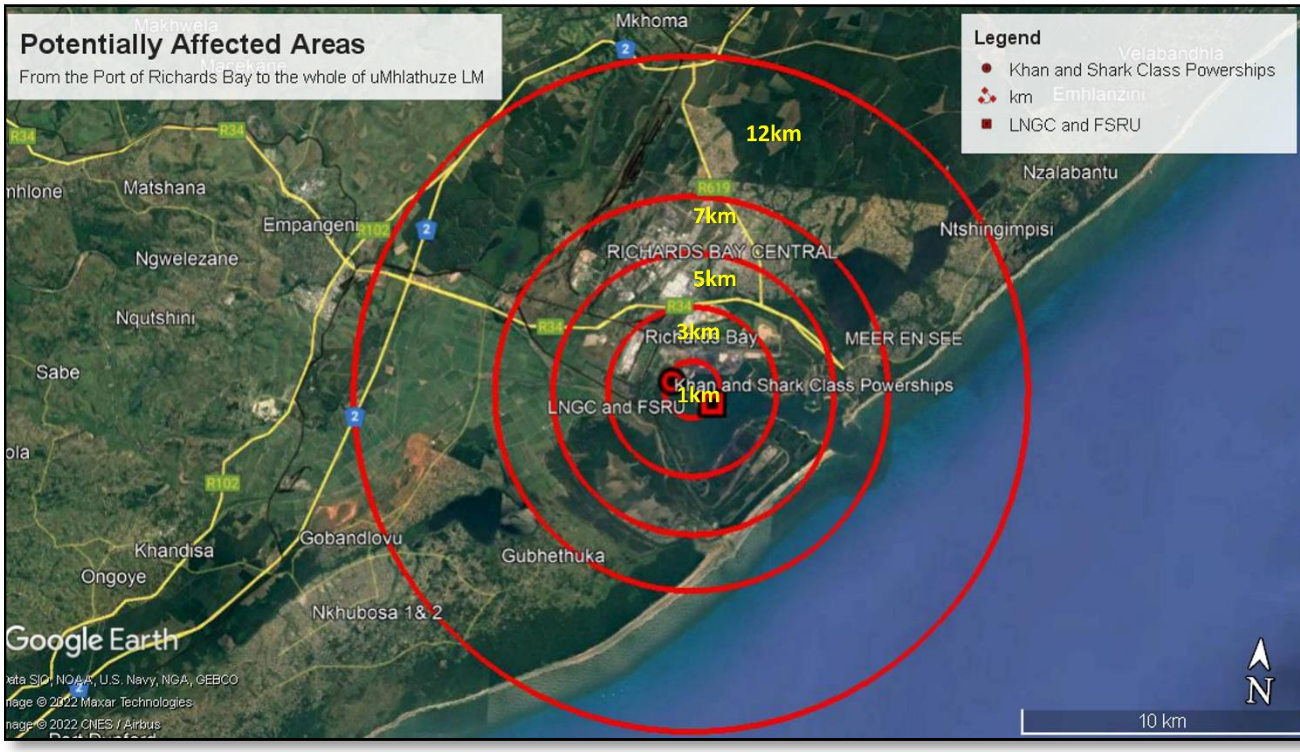

Figure 7-11: Potentially affected areas in terms of Socio-Economic impacts

Table 7- 71: The main geographical areas of impact

	AREA OF IMPACT	AREA OF IMPACT	ACTIVITIES IN THE AREA OF IMPACT
1.	**The Port of Richards Bay Less than 1 km**	350m away from the nearest harbour berths and immediate back of port activities	Cargo Commercial Ship Operations (loading and offloading) at operating berths; storage and warehousing
		Adjacent to the Project: Sandspit and the Kabeljous flats	Habitat for wading birds that supports a range of marine and bird life
2.	**Richards Bay industrial areas and CBD Between 1 and 3 km**	The Richards Bay IDZ	Industrial operations
		The coal terminal	On and off-loading and storage of coal
		Other industrial sites	1.9km away from Foskor/Alusaf site
		Various offices and social clubs within the harbour area	1km away from the Transnet Permit Offices 1.1km away from the current TPT offices 2.1km away from Bayview Offices 800m away from the Richards Bay Seafarers Club
3.	**Richards Bay Between 3 and 5km**	Richards Bay CBD	Commercial offices and retail
		Industrial	3.1km away from South 32 Hillside Aluminium. Altron - Light industrial areas adjacent to the Richards Bay CBD
		Residential suburbs	4km away from nearest residential areas (Arboretum)
		Tourism and recreational related	4.4km away from the cruise terminal; small craft harbour, restaurants, hotels, and marina
4.	**Richards Bay**	Residential suburbs	Wild en Weide

	AREA OF IMPACT	AREA OF IMPACT	ACTIVITIES IN THE AREA OF IMPACT
	Between 5 and 7km	5.3km to 7km away from the residential zone	Veld en Vlei
			Birdswood
		Education and training	5.6km away from the Richtek College
			5.7km away from the Umfolozi College
		Sport and recreation	6.3km away from Alkantstrand Beach with angling and boat clubs, picnic sites, pier.
		Tourism	Guest houses and hotels.
		Various mixed-use activities	Retail Netcare the Bay Hospital Magistrate's Court South African Police Service Administrative buildings Logistics Commercial Manufacturer (Mondi)
		Harbour mouth – 6 km	Off-share angling, illegal poaching
5.	**Richards Bay More than 7 km**	Residential	7.5km away from Meer En See
		Off-shore angling from the beach outside the harbour but inside Port Authority area	Recreational and communities of Ntshingimpisi and communities further north with beach access
		Aviation	9km away from the existing airport site
		Community - Residential	7.5km away from Gubhethuka
			9km away from Bhiliya
			10.5km away from Mzingazi
6.	**uMhlathuze LM More than 7km**	Empangeni – 12 km	Residential, industrial, commercial, and retail
			Townships of Ngwelezane
		Communities: semi-urban and rural	Esikhawini, Madlanghala, Ntshingimpisi, Nzalabantu, Buthulezi and others

The negative impacts of load shedding on the economy and society are extensive and cuts through all the economic sectors and impacts on education, health, welfare, crime and security of South Africa and communities.

The following potentially affected communities are identified: the recreational and livelihood fishing and small crafts community and the tourism stakeholders surrounding Alkantstrand and Naval Island area. Naval Island, Pelican Island and Alkantstrand beach form a tourism node at the harbour entrance. The Alkantstrand area specifically is marked for 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 fishers' area and the tourism node are more than 4 km from the site where the Karpowership will be located.

The following areas of socio-economic impact were identified bases on the preceding analysis of the specialist reports, the stakeholder engagements and the analysis of the project and receiving environment,

- Indirect socio-economic impacts due to changes in biodiversity and climate change.
- Indirect impacts on small scale fishers.

- Indirect impacts on tourism and recreational activities.
- Impacts on the in-migration of people and social and infrastructure needs.
- Impacts on education, training, and skills development.
- Impacts on a sense of place.
- Impacts on the economy, employment, and new investment.

7.5.15.1 Socio-economic impacts due to changes in biodiversity and climate change.

It is assessed that, based on the findings of the Climate Change specialist report, Karpowership will have no to very little socio-economic impacts due to climate change. Mitigations are nevertheless suggested.

Table 7- 72: Socio-economic indirect impacts due to changes in biodiversity and climate on the livelihoods of communities

Nature: Socio-economic impacts due to changes in biodiversity and climate on the livelihoods of communities.		
	Without mitigation	**With mitigation**
Extent	Based on the specialist reports: Very low 1	Based on the specialist reports: Very low 1
Duration		
Severity		
Consequence	1	1
Frequency	1	1
Probability	2	2
Overall likelihood	3	3
Significance	Low 3	Low 3
Reversibility	Medium. Karpowership is only one of the activities taking place in the Port and the industrial areas of Richards Bay. Karpowership will work all the other stakeholders in the area to address the changes in biodiversity and climate change. This will be a long-term programme.	
Status (positive or negative)	Negative	Positive
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation/Enhancement: Combined with active labour market policies and skills development opportunities, social protection can facilitate the transition to greener economies, favouring social acceptability. This can be done mainly through: • Karpowership implements its Skills, Enterprise, Supplier, and Socio-economic Development Programmes as well as well as activate a CSI and economic development programme in collaboration with existing organisations and the Municipality of uMhlatuze.		
Cumulative impacts: • Karpowership is one operator in the harbour amongst all shipping activity in the busy working harbour. The cumulative impact of the Port activities and the industrial areas has an impact on		

Nature: Socio-economic impacts due to changes in biodiversity and climate on the livelihoods of communities.
biodiversity and climate change. It is therefore advisable that Karpowership work with the Municipality and other stakeholders on the economy to address the impacts in the long-term.
Residual Impacts:
• The Karpowership impacts are insignificant, and no permanent impact will be caused. .

7.5.15.2 Impacts on Small Scale Fishers

It is unlikely that the Karpowership operations will have any direct impact on the recreational or illegal fishers. However, due to the potential impacts of the Karpowership Project on the marine ecology and estuaries which may impact on the juvenile fish habitat, fish breeding may be disturbed and impact on the fish population in the harbour and further afield. This in turn may have an impact on the livelihoods of the illegal small-scale fishers.

Karpowership may make a positive impact on the fishers and especially on the community fishers and the unemployment and poverty-stricken communities. For example, Karpowership will assist (see Section 2.6) in the development, education, and upskilling of the fishers so that they are able to access alternative employment opportunities so that the need for illegal fishing is reduced. Karpowership may also liaise with other organisations such as the Municipality, Port Authority and NGOs involved in addressing the problems and challenges of the fishers.

Table 7- 73: Socio-economic indirect impacts on small scale fishers

Nature: Impacts the spawning of fish and the crustacean populations; and in turn, the economics, and livelihoods for local fishermen in the region, not just fishermen within the harbour location.		
	Without mitigation	**With mitigation**
Extent	Surrounding area (1)	Local area (1)
Duration	Long-term (5)	Medium-term (3)
Severity	Low (2)	Very low (2)
Consequence	8	6
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation
Probability	2 – Very seldom / highly unlikely	2 – Very seldom / highly unlikely
Overall likelihood	3	3
Significance	13 (Medium)	9 (Medium)
Reversibility	Medium	
Status (positive or negative)	Negative	Positive
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement:		

Nature: Impacts the spawning of fish and the crustacean populations; and in turn, the economics, and livelihoods for local fishermen in the region, not just fishermen within the harbour location.
Combined with active labour market policies and skills development opportunities, social protection can facilitate the transition to greener economies, favouring social acceptability. This can be done mainly through: • Karpowership implements its Skills, Enterprise, Supplier, and Socio-economic Development Programmes as well as well as activate a CSI and economic development programme in collaboration with existing organisations and the Municipality of uMhlatuze. • Interact and work with NGOs and other community-based organisation to address the poverty plight of the fishers. • Work with other shipping companies and the Port authorities as part of a Port CRI programme to address the illegal fishing and address alternative development prospects for the fishers.
Cumulative impacts: • Karpowership is one operator in the harbour amongst all shipping activity in the busy working harbour. The cumulative impact of the Port activities and the industrial areas has an impact on biodiversity and climate change. It is therefore advisable that Karpowership work with the Municipality and other stakeholders on the economy to address the impacts in the long-term.
Residual Impacts: • The illegal fishing has been taking place for a long-time and is likely to be resolved in the long-term.

7.5.15.3 Impacts on Tourism

It is unlikely that Karpowership will have a direct negative impact on the tourism sector within uMhlatuze and the wider regional economic area. However, due to the cumulative impact of Karpowership and other activities in the harbour on biodiversity and climate change, there may be an indirect cumulative impact on tourism in the area. Karpowership is one of the activities taking place in the harbour and therefore contributes to an indirect impact on tourism. Karpowership may, for example, make a positive contribution to tourism by creating a new tourism attraction in the form of maritime and industrial tourism routes and tours, and of course would contribute to a stable supply of electricity to support the tourism and hospitality industries. The Municipality identified tourism as one of its priority areas and to development local tourism attractions, routes, and tours. This is particularly relevant to the cruise ships that dock at the Port from time to time.

Table 7- 74: Socio-economic indirect impacts on Tourism

Nature: Impact on biodiversity and climate change leading to a reduction of tourism and related activities in the Municipal area and in the broader region.		
	Without mitigation	**With mitigation**
Extent	Surrounding area (2)	Local area (1)
Duration	Long-term (4)	Short-term (2)
Severity	Very low (3)	Minor (2)
Consequence	9	5
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation

Nature: Impact on biodiversity and climate change leading to a reduction of tourism and related activities in the Municipal area and in the broader region.		
Probability	Improbable (1)	Very improbable (1)
Overall likelihood	10	6
Significance	10 (Medium)	6 (Low)
Reversibility	Yes	
Status (positive or negative)	Negative	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • Karpowership, in working with the Municipality and the tourism organisations in uMhlatuze, development marine and industrial tourism attractions, routes and tours. • Karpowership, in working with through the Mayor's Multi-stakeholder Forum and tourism organisations and in assist in the establishment of marine and industrial tourism routes, may make contributions to the tourism marketing initiatives of the City and tourism associations. • Karpowership, in working with the Municipality and tourism organisations contribute to the tourism education and skills development of the tourism sector, and the establishment of tourism guides.		
Cumulative impacts: • Karpowership, as one operator in the harbour, with other shipping and harbour operators and the surrounding industrial stakeholders, jointly have an impact on tourism. Karpowership should engage with the Municipality and other stakeholders involved with tourism to implement pro-active positive mitigation actions.		
Residual Impacts: • None foreseen		

7.5.15.4 Impacts Related to the In-Migration of People and Social and Infrastructure Needs

The direct construction and operations employment of Karpowership will be 108 and 166 respectively. The total direct, indirect, and induced employment that Karpowership will generate are 1 001 and 367 during construction and operations respectively. Total employment in uMhlatuze is in the order of 104 000 persons meaning that the direct employment that will be created by Karpowership is less than 0.2% while the combined direct, indirect, and induced employment created by Karpowership is less than 1% of the current workforce in the area. It is therefore not expected that the impact will be significant given that the Project is taking place in an already fully developed urban environment.

Based on the above, it is expected that the housing and accommodation situation, basic service provision, health facilities and road infrastructure will be under minor additional pressure during the construction period as additional people will be working in the area. These impacts can however be mitigated if the developer formulate its plans together with the local municipality and contractors beforehand.

Addressing the challenges related to potential social impacts is best done in partnership with all stakeholders in the area, specifically the affected and adjacent property owners, ward councillor and municipality. This would promote transparency; information sharing and help build good relationships between all affected parties.

Table 7- 75: Socio-economic impacts on the in-migration of people and social and infrastructure needs.

Nature: Increase in employment leading to an increase in demand for municipal infrastructure, social services and crime associated with the construction workers and job seekers		
	Without mitigation	**With mitigation**
Extent	2 – Surrounding area (< 2km)	2 – Surrounding area (< 2km)
Duration	Construction: 1 year (1) Operation: 20 years (4)	Construction: 1 year (1) Operation: 20 years (4)
Severity	Insignificant (1)	Insignificant (1)
Consequence	7	7
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation
Probability	Unlikely (2)	Highly unlikely (1)
Overall likelihood	8	8
Significance	Construction: 6 (Low) Operations: 9 (Medium)	Construction: 5 (Low) Operations: 8 (Medium)
Reversibility	Reversable; Well implemented HR management practices and employment protocols will address the challenges	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation/Enhancement:

- 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.
- Institute a complaint lodging system and addressing concerns of affected parties.

Cumulative impacts:

- Karpowership is one of the operators in the harbour and well-known industrial area where new employment and recruitment drives takes place continuously. The total number of job seekers in the area are therefore large with new persons coming from other (rural) areas in search of employment.

Residual Impacts:

- Contribution towards social conflicts in the area by construction workers and job seekers who decide to stay in the area after construction.

7.5.15.5 Impacts on Enterprise Development, Skills Development and Supplier Development

The construction phase of the Powerships and its related infrastructure is likely to have a positive impact on the skills development in the Municipality. The construction crew involved in the project will gain knowledge and experience in respect of the development of gas and electrical infrastructure related to the gas industry. Some of the construction workers will be drawn from local communities, it is therefore highly probable that these workers will be able to use these new skills in future developments in uMhlathuze and further afield.

The direct effects of the project on skills development could contribute to the development of the local Research & Development and manufacturing industries associated with the gas industry. This could be achieved through partnerships with the University of Zululand and TVET colleges in Richards Bay. Partnerships of this nature could further enhance the development of new skills and expertise.

During the operational phase it is likely that highly skilled personnel would need to be recruited to operate the Powerships, likely from outside of uMhlathuze. These employees would include skilled "mechatronics" engineers (specialised in both electrical and mechanical engineering) to be trained by Karpowership; as well as less skilled services such as safety and security and mechatronic assistants. Opportunities therefore exists for skills transfer to the local uMhlatuze workforce and the upskilling and training of local staff.

Table 7- 76: Socio-economic impacts on education, training, and skills development.

Nature: Skills transfer and development during construction and operation of the Karpowership project.		
	Without mitigation	**With mitigation**
Extent	4 – Within municipal area	4 – Within municipal area
Duration	Construction: 1 year (1) Operation: 20 years (4)	Construction: 1 year (1) Operation: 20 years (4)
Severity	3 – Significant	3 – Significant
Consequence	11	11
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation
Probability	4 – Often / regularly / likely / possible	4 – Often / regularly / likely / possible
Overall likelihood	5	5
Significance	Construction: 7 (Low) Operations: 10 (Medium)	Construction: 10 (Medium) Operations: 13 (Medium)
Reversibility	Yes, skills can be lost if not practiced	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	Yes
Mitigation/Enhancement: • Implementation of the Karpowership Economic Development Plan. • 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 and operational staff especially to local workforce.		

Nature: Skills transfer and development during construction and operation of the Karpowership project.
Cumulative impacts: • Improved labour productivity and employability of construction workers for similar projects. • Possible development of local skills and expertise in R&D and manufacturing industries related to the marine, gas and power generation industries through partnerships with the University of Zululand and other tertiary institutions.
Residual Impacts: • Skill retained in the local economy.

7.5.15.6 Impacts on Sense of Place

The proposed development of the Karpowership in Richards Bay might be perceived as one of those activities that may impact on the sense of place due to its impact on the physical environment.

The proposed Karpowership project is an industrial-like activity taking place on a ship located in an operating harbour. The visual and noise impacts of Karpowership during construction and operation are assessed as being low taking place within an area where the ambient noise and visual impacts are already disturbed. The visual impact assessed by the specialist considers the impact in Richards Bay to be minimal. The tourism specialist report indicates that there may be some negative impacts on the sector. However, the introduction of industrial and maritime tourism routes and packages may mitigate negative impacts.

Table 7- 77: Socio-economic impacts on Sense of Place

Nature: Impact on the sense of place experienced because of visual and noise effects that appear during construction and operational phases		
	Without mitigation	**With mitigation**
Spatial Scale	2 – Surrounding area (< 2km)	2 – Surrounding area (< 2km)
Duration	One year during construction (1) and beyond 10 years operation (4)	One year during construction (1) and beyond 10 years operation (4)
Severity	1 – Insignificant / Non-harmful	1 – Insignificant / Non-harmful
Consequence	7	7
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation
Probability	Highly unlikely (2)	Highly unlikely (2)
Overall likelihood	3	3
Significance	**6 (Low)**	**5 (Low)**
Reversibility	Possible to fully reverse with decommissioning	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: Noise disturbances during construction should be limited to business hours.		
Cumulative impacts:		

Nature: Impact on the sense of place experienced because of visual and noise effects that appear during construction and operational phases		
	Without mitigation	**With mitigation**
The proposed Project will be located within a Port that is surrounded by industry. Therefore, the proposed Project will not extend the industrialisation of the area. The cumulative contribution to the overall impact of industry within the area during construction and operations are anticipated to be low.		
Residual Impacts: None identified.		

7.5.15.7 Impacts on the Economy, Employment and New Investment

The construction phase of the Project and its related local infrastructure creation is likely to have a positive impact on the creation of economic value, new business production, income generation and employment in the economy. The economic benefits of the building of the Powerships, the FSRU and the LNG Carrier are not considered in the economic impact assessment. They are already fully constructed overseas and delivered as complete units to the Port. The construction of the mooring and related pipeline and transmission line infrastructure in the Port are produced locally and the economic impact of their building and construction activities are considered in the estimate. Similarly, only the local expenditure of the Karpowership operations is accounted for in the economic impact assessment.

The following Tables show the updated 2022 economic multiplier impacts of the Karpowership Project during the construction and operational phases for new additional production, GVA, income and employment. The values are expressed in present day 2022 values for the 1-year construction period and the 20-year operational period. The employment figures are expressed in Full Time Equivalent values. In overall terms Karpowership will make less than a 1% direct new contribution to economic values and employment in uMhlatuze.

Table 7- 78: Socio-economic impacts on the economy, employment, and new investment

Nature: Increases in economic production, value, income and employment during construction and operations		
	Without mitigation	**With mitigation**
Extent	4 – Within municipal area	4 – Within municipal area
Duration	Construction 1 year (1) Operation 20-years (4)	Construction 1 year (1) Operation 20-years and beyond (5)
Severity	Low to moderate (4)	Low to moderate (4)
Consequence	3 – Significant	3 – Significant
Frequency	1 – Once a year, or once or more during operation	1 – Once a year, or once or more during operation
Probability	Highly likely (4)	Highly likely (4)
Overall likelihood		
Significance	**16 (High)**	**17 (High)**
Reversibility	The combined construction and operational benefits will be for at least 20 years and with mitigations beyond the life of the project.	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement:		

Nature: Increases in economic production, value, income and employment during construction and operations
The impacts of the Karpowership project will last for only 20-year unless longer-term mitigation actions are put into place to ensure that the impact of the project will extend beyond the life-time of the project. Karpowership will implement socio-economic and CSI programmes that can have a lasting positive impact on the community and the environment. The preceding impact assessments pointed to the socio-economic impacts due to biodiversity and climate changes, impacts on small fishers, tourism, skills development, supplier development and enterprise development. The cumulative impact of the mitigation programmes already suggested in those assessments are designed to have a lasting positive impact beyond the 20-year life of the project. Additional interventions should be: • Karpowership is to implement local procurement practices, as required and promote the employment of people from local communities to maximise the benefits to the local economy. • Procuring construction materials, goods, and products from local suppliers where feasible to further local suppliers and enterprises.
Cumulative impacts: The impact of the Projects will establish Richards Bay as a node with expertise in gas to power generation. Use innovatively and in combination with each other, this could lead to the strengthen of the Oil and Gas Hub that the RB IDZ is in the process of establishing (see Section 3.4). Karpowership is in the Richards Bay Port adjacent to the IDZ and other industrial areas in the City. As such Karpowership will be aligned to and integrated with the other port and industrial activities thereby increasing the demand for industrial-related support services augmenting supplier and enterprise support development programmes. The location of Karpowership in Richards Bay should be integrated and to the support services and economic and socio-economic development initiatives of the Municipality and other stakeholders in the area. The priority projects and programmes of the Municipality have been reported on in this report.
Residual Impacts: • Positive residual impacts due to the long-lasting mitigation actions.

7.5.15.8 Polycentric Impacts

A summary is provided in this section of the findings of other specialists' assessments undertaken as part of this project, as it relates to the socio-economic impacts of each.

7.5.15.8.1 Economic Impact of rolling blackouts

CONSTRUCTION AND OPERATIONAL PHASES	Operational
KEY IMPACT	Rolling loadshedding
SUMMARY CONCLUSION IMPACT IDENTIFIED	The economic impacts of loadshedding are significant and need to be addressed urgently to minimise its impact on the economy and mitigate the risk to energy security in South Africa. It is therefore reasonable to conclude that an expansion in electricity generation through IPP purchase agreements, for both baseload and intermittent supply, is

CONSTRUCTION AND OPERATIONAL PHASES	Operational
	necessary in the short-term to address the energy crisis, which will facilitate improved economic growth and development in South Africa.
SIGNIFICANCE OF THE IMPACT	Not indicated
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.2 Energy Security

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Gas is transitional energy source
SUMMARY CONCLUSION IMPACT IDENTIFIED	It is very clear that gas is a necessary transitional energy source (and has been declared as 'green' by the EU) and that all arguments against gas such as cost, environmental impact, etc., have no grounds to stand on.
SIGNIFICANCE OF THE IMPACT	Rather than advocate either of the two extremes, policymakers should aim to establish environmental priorities and goals that are consistent with the real trade-offs that all regulatory activities inevitably require, that is, policymakers should base environmental goals on the careful balancing of benefits and costs
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.3 Gas Power vs. Renewables

CONSTRUCTION AND OPERATIONAL PHASES	Operational
KEY IMPACT	Reliance on Open Cycle Gas Turbine (OCGT)
SUMMARY CONCLUSION IMPACT IDENTIFIED	An over-reliance on OCGT poses an economic- and energy security risk to the South African economy. OCGT is comparatively more expensive than the alternatives including, Karpowership. The speed of response of Karpowership with power being dispatchable within minutes of receiving the dispatch instruction
SIGNIFICANCE OF THE IMPACT	Not indicated in the specialist report
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.4 Political Economy

CONSTRUCTION AND OPERATIONAL PHASES	Operational
KEY IMPACT	Just Transition
SUMMARY CONCLUSION IMPACT IDENTIFIED	Gas-to-power may have a limited role to play in the just transition to net zero, the diversification of energy demand away from fossil fuels such as firewood and paraffin will have a lasting impact. Providing the alternative of natural gas or any other renewable energy option will therefore have an invaluable role and lasting impact towards energy security and environmental conservation.
SIGNIFICANCE OF THE IMPACT	The Karpowership projects, despite their perceived shortcomings, are the quickest way to provide South Africa with the needed dispatchable power (all technologies have shortcomings). No impacts identified.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.5 Ambient Noise

CONSTRUCTION AND OPERATIONAL PHASES	Operation and construction
KEY IMPACT	The results of the noise impact assessment of the proposed Gas to Power - Powership Project, within the Port of Richard's Bay in Kwazulu-Natal, shows that at none of the terrestrial receptors will exceed the SANS 10103:2008 rating limits.
SUMMARY CONCLUSION IMPACT IDENTIFIED	The results of the noise impact assessment of the proposed Gas to Power - Powership Project in the Port of Richard's Bay indicates that noise levels during the operational phase will most likely be below the ambient noise levels and therefore be of Low significance after mitigation from a human impact perspective. The construction related noise impacts will be of Low significance after mitigation.
SIGNIFICANCE OF THE IMPACT	Construction and operation. Low after mitigation. Noise impact areas are within the harbour and do not extend into the surrounding town or settlements.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.6 Noise Assessment - Underwater and Vibration

CONSTRUCTION AND OPERATIONAL PHASES	Construction and Operations
KEY IMPACT	High durations of exposure are required at full power operation in excess of expected maximum load for the entire duration. The ships associated with this project are not substantially different to the noise levels produced by ships typically using the harbour.
SUMMARY CONCLUSION IMPACT IDENTIFIED	No impact is expected on any marine mammal species from the installation of the Powership in the Port of Richard's Bay.

SIGNIFICANCE OF THE IMPACT	No significant underwater noise impacts on fish or marine mammals are predicted because of the operation of the Powership in Port of Richard's Bay as it will not materially change existing underwater noise associated with the port. No additional noise mitigation is deemed necessary, and this project is thus supported from an underwater noise assessment perspective.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.7 Air Quality

CONSTRUCTION AND OPERATIONAL PHASES	Operation and construction
SUMMARY CONCLUSION IMPACT IDENTIFIED	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.
SIGNIFICANCE OF THE IMPACT	The cumulative effect of the contribution PM10 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.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.8 Aquatic

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operations
KEY IMPACT	The proposed project is located within a Sub-Quaternary Reach (SQR) that is already within a modified state. 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.
SUMMARY CONCLUSION IMPACT IDENTIFIED	The impact of the proposed project ranges from medium to low pre mitigation and impacts can be further reduced with appropriate mitigation.
SIGNIFICANCE OF THE IMPACT	Considering the project type and that impacts are of low significance with mitigation measures applied the project can be considered for approval.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required.

7.5.15.8.9 Terrestrial Avifauna

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operations
SUMMARY CONCLUSION IMPACT IDENTIFIED	Impacts of noise from the running Powership on the nearby sandspit and adjacent Kabeljous flats is a moderate negative after mitigation, but it is vital that monitoring be done both pre- and post-construction for birds utilising these habitats. Visual disturbance impacts are critical without mitigation, and it is recommended that screening as per Cutts (2021) is investigated as a mitigation option to further reduce this impact along with habituation and reduction of movement of staff on the outside of ships
SIGNIFICANCE OF THE IMPACT	The Karpowership noise and visual impacts do not constitute a fatal flaw, it is recommended that the following actions be taken to ensure the continued monitoring and protection of these habitats: Avifaunal monitoring of the sandspit and Kabeljous flats should begin immediately and be done monthly for at least the next 3 years. CWAC surveys of the full site including both Richards Bay Port and the Richards Bay Game Reserve should resume this year (2021) and continue annually in both summer and winter. The monitoring plan for the avifauna should speak to the existing monitoring plans of the port, if no such documents are available, Karpowership can contribute to them. Monitoring must be done in conjunction with all port users and the TNPA as cumulative impacts are likely to be the most detrimental to such habitats. Conservation of the sandspit and Kabeljous flats is recommended, and no development should take place in these areas. An adaptively managed conservation plan should be developed for these areas in particular that aligns with the existing TNPA conservation management plan for the port. If no such document exists, Karpowership should have input into its development.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	The direct socio-economic impacts is likely to be minimal. Impacts on the potential tourism or recreational activity is important.
MITIGATIONS – SOCIO-ECONOMIC	See the Avianua tourism section.

7.5.15.8.10 Marine Avifauna

CONSTRUCTION AND OPERATIONAL PHASES	Operation and construction phases
SUMMARY CONCLUSION IMPACT IDENTIFIED	Impacts of noise from the running Powership on the nearby sandspit and adjacent Kabeljous flats is a moderate negative after mitigation, but it is vital that monitoring be done both pre- and post-construction for birds utilising these habitats. Visual disturbance impacts are critical without mitigation, and it is recommended that screening as per Cutts (2021) is investigated as a mitigation option to further reduce this impact along with habituation and reduction of movement of staff on the outside of ships.
SIGNIFICANCE OF THE IMPACT	The Karpowership noise and visual impacts do not constitute a fatal flaw, it is recommended that the following actions be taken to ensure the continued monitoring and protection of these habitats: Avifaunal monitoring of the sandspit and Kabeljous flats should begin immediately and be done monthly for at least the next 3 years. CWAC surveys of the full site including both Richards Bay Port and the Richards Bay Game

	Reserve should resume this year (2021) and continue annually in both summer and winter. The monitoring plan for the avifauna should speak to the existing monitoring plans of the port, if no such documents are available, Karpowership can contribute to them. Monitoring must be done in conjunction with all port users and the TNPA as cumulative impacts are likely to be the most detrimental to such habitats. Conservation of the sandspit and Kabeljous flats is recommended, and no development should take place in these areas. An adaptively managed conservation plan should be developed for these areas in particular that aligns with the existing TNPA conservation management plan for the port. If no such document exists, Karpowership should have input into its development.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	Indirect knock-on effects on avi-tourism. Visual impact from the Sandspits and Kabeljou Flats
MITIGATIONS – SOCIO-ECONOMIC	Birding South Africa: Birding view sites and maintenance Support to the development of birding information brochures and website. Thulasihleka Pan Bird Sanctuary: support of research and protection the sand spits and the Kabeljou Flat s Research

7.5.15.8.11 Biodiversity assessment (Terrestrial Ecological Assessment)

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operations
KEY IMPACT	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 indigenous vegetation. Impacts are medium to medium-low and can be reduced to low with the recommended mitigation measures.
SUMMARY CONCLUSION IMPACT IDENTIFIED	The following conditions should also be met: • A walk through of the site prior to any construction to determine the presence of any Species of Conservation Concern • Application for permits for removal of any SCC where required (this was completed in 2021 and permits were applied for). • The development of a rehabilitation plan in line with TNPAs rehabilitation plans, if no such plan exists, Karpowership should have input into the plan for the TNPA area. • The development of an alien invasive plant management plan in line with the plan and implementation protocol of the TNPA. If no such plan exists, Karpowership should have input into such a plan for the overall TNPA area.
SIGNIFICANCE OF THE IMPACT	It is the opinion of the specialist that the proposed development goes ahead, provided the mitigation measures are put into place.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	The specific specialists' reports are referred to especially the marine ecology and avifauna reports.
MITIGATIONS – SOCIO-ECONOMIC	See the Marine ecology and Avifauna assessments.

7.5.15.8.12 Climate Change assessment

CONSTRUCTION AND OPERATIONAL PHASES	Operation

SUMMARY CONCLUSION IMPACT IDENTIFIED	The project will emit 31 million tons of CO2e over its lifetime if it runs at 100% of the contracted capacity.
SIGNIFICANCE OF THE IMPACT	The proposed Karpowership Project at Richards Bay should not be refused environmental authorisation based on climate change related issues.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	Within the context of energy needs and promoting justifiable economic and social development, the proposed project is deemed as desirable. The proposed activity promotes justifiable economic and social development
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigation required

7.5.15.8.13 Coastal, Estuarine and Marine Ecology Impact

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT AREA	The broader Richards Bay/ uMhlathuze estuarine complex is one of only three extremely rare estuarine bays in the country, with complex marine/riverine interaction and extensive wetlands and mangrove swamps.
SUMMARY CONCLUSION IMPACT IDENTIFIED	Impacts were identified and assessed in the construction phase and the operational phase. The Moderately High impacts identified are the potential impacts on avifauna associated during the construction and operational phases of the Karpowership project. The ecological importance of the Richards Bay Estuary cannot be overemphasised.
SIGNIFICANCE OF THE IMPACT	During the construction phase, the most significant of the identified impacts range from medium-high to high negative prior to mitigation; the highest-ranking being noise and visual disturbance to avifauna and displacement/death of species of conservation concern, followed by potential chemical spills. With mitigation, these impacts were rated to be of moderately-high, moderate, and moderately-low negative significance, respectively. During the operational phase, the most significant impacts prior to mitigation were noise and visual disturbance to avifauna and powerline fatalities, followed by chemical pollution, and the discharge of cooling water, underwater noise, and light pollution. These are rated as medium-high to critically negative but can be mitigated to be of medium and medium-high significance, respectively, through the implementation of the applicable measures. Several of the operational impacts remained of medium negative significance even after mitigation largely due to the ongoing/continuous daily effects on the surrounding environment. The proposed Gas to Power project has the potential to impact various abiotic and biotic attributes of the Richards Bay estuary, that contribute to its overall high biodiversity, structure, and function, but which are already in a highly- to critically modified condition. Notwithstanding the above, no impacts were identified as resulting in fatal flaws that would prevent the project from proceeding.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	Socio-economic implications for tourism and small-scale fishers.
MITIGATIONS – SOCIO-ECONOMIC	Karpowership could provide support for scientific research, e.g. monitoring programmes for bird species (terrestrial and aquatic), fish, etc. This should focus on understanding the importance of these

	habitats for species including ecosystem dynamics and importance, relative to other habitats. Research / monitoring programmes could contribute to better management of activities in these ecologically important habitats. See the tourism impact assessment. See the tourism impact assessment

7.5.15.8.14 Geohydrology assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Transmission line
SUMMARY CONCLUSION IMPACT IDENTIFIED	There are very few groundwaters and surface water related risks associated with this project. No permanent monitoring is proposed nor is dedicated groundwater monitoring.
SIGNIFICANCE OF THE IMPACT	No permanent monitoring is proposed nor is dedicated groundwater monitoring. Regular (monthly or during maintenance runs) visual assessments of the transmission lines and switching station should be sufficient (i.e. signs of oil spills, sediment runoff, switching station leakages etc.) to monitor potential pollution.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

7.5.15.8.15 Heritage Richards bay assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction
KEY IMPACT	Heritage sites
SUMMARY CONCLUSION IMPACT IDENTIFIED	No heritage sites were noted along the route, switching station site or proposed construction lay-down areas.
SIGNIFICANCE OF THE IMPACT	Since there are no heritage resources in the study area there is no impacts to heritage resources and the reversibility and irreplaceability of these resources are not applicable.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations. Integration into tourism opportunities should any heritage finds be made during construction. See tourism recommendations.

7.5.15.8.16 Hydrological assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Transmission line
SUMMARY CONCLUSION IMPACT IDENTIFIED	The risks associated with the project is low to neutral, limited monitoring is proposed.

SIGNIFICANCE OF THE IMPACT	The proposed monitoring will specifically be required during the construction phase, with only visual observations proposed for the operational phase of the transmission line.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

7.5.15.8.17 Major Hazard Installation (MHI) assessment

CONSTRUCTION AND OPERATIONAL PHASES	Operational phase
KEY IMPACT	LNG has the potential to cause onsite and offsite incidents.
SUMMARY CONCLUSION IMPACT IDENTIFIED	The main risk contributing part of the operation is the possible rupture of one of the transfer hoses.
SIGNIFICANCE OF THE IMPACT	The risks were found to be acceptable for the Port and normal port operations can continue at the other berths while LNG is being offloaded at the facility. There must be an Operations Manual for the transfer process. • The operations site must be considered an MHI. • The Emergency Plan must be approved by the Port Authorities. The risks will not impact on any other neighbouring flammable installations. • Only suitably qualified people must be used for all operations. • Visiting Ship Captains must provide Port Management with detailed STS operations manual before offloading. • All equipment, including radios used within the operations area, must be intrinsically safe. • Service Logbooks must be kept for all hoses and pipelines and checked regularly. • The Port Fire Department will handle all firefighting and emergencies.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	LNG has the potential to cause onsite and offsite incidents. The risks were found to be acceptable for the Port and normal port operations can continue at the other berths while LNG is being offloaded at the facility.
MITIGATIONS – SOCIO-ECONOMIC	All actions required in terms of law must be implemented including an emergency plan. Emergency communication plans to inform the public should be introduced.

7.5.15.8.18 Traffic assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction
KEY IMPACT	Public transport
SUMMARY CONCLUSION IMPACT IDENTIFIED	The proposed development is expected to generate a high amount of public transport user trips during the construction stage of the project.
SIGNIFICANCE OF THE IMPACT	This will however translate to a low amount of vehicle trips and a low impact on the broader road network. Traffic mitigations recommended.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact when traffic mitigations are addressed.
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

CONSTRUCTION AND OPERATIONAL PHASES	Construction
KEY IMPACT	Trucks (construction)
SUMMARY CONCLUSION IMPACT IDENTIFIED	The development is not expected to generate a high amount of truck trips during the construction stage of the project.
SIGNIFICANCE OF THE IMPACT	The trucks trips will largely remain within the footprint of the construction area
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

CONSTRUCTION AND OPERATIONAL PHASES	Operations
KEY IMPACT	Commuter traffic
SUMMARY CONCLUSION IMPACT IDENTIFIED	During the operational stage, the gas to power project is expected to generate some 34 trips onto the broader road network during the commuter peak hour.
SIGNIFICANCE OF THE IMPACT	Very low impact
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

CONSTRUCTION AND OPERATIONAL PHASES	Operations
KEY IMPACT	Truck and service vehicle
SUMMARY CONCLUSION IMPACT IDENTIFIED	During the operational stage, the gas to power project will only generate ad-hoc truck and service vehicle trips for maintenance and replenishment of supplies. These trips will occur primarily outside the normal commuter peak hours.
SIGNIFICANCE OF THE IMPACT	Very low impact
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impact
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations

7.5.15.8.19 Underwater Heritage assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction
KEY IMPACT	Maritime and Underwater Cultural Heritage (MUCH).

SUMMARY CONCLUSION IMPACT IDENTIFIED	There is an extremely low probability of maritime and underwater cultural heritage resources being found.
SIGNIFICANCE OF THE IMPACT	Findings and Recommendations as regards Cultural Heritage, including archaeology and palaeontology, to note the need for input on mitigation of impacts to maritime and underwater cultural heritage resources should they be discovered during the pipeline laydown area survey.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No socio-economic impacts.
MITIGATIONS – SOCIO-ECONOMIC	No socio-economic mitigations at this stage. Integration into tourism opportunities should any maritime and underwater cultural heritage finds be made during construction. See tourism recommendations.

7.5.15.8.20 Visual Impact assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Visual impact of the Powership and the transmission lines
SUMMARY CONCLUSION IMPACT IDENTIFIED	The visual influence of the proposed Powerships and FSRU is largely limited to active areas within the Port and adjacent industrial areas. It will also be visible from the undeveloped areas to the south to the same extent that existing Port and adjacent industrial development is visible. The proposed project is therefore unlikely to extent the area over which existing Port operations and industry are visible from.
SIGNIFICANCE OF THE IMPACT	The proposed Powerships and the FSRU are unlikely to be visible to most land-based areas that are important for tourism or recreation. The exception to this is the Inner Northern Breakwater which is a popular fishing location and is also used by the public for walking. Powerships and FSRU will be visible and will be seen in the context of Port operations, other shipping, and heavy industry within the IDZ.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	The Powerships are located next to the sand spits, the kabeljou flats and may have an impact on birding sites. Sense of place impacts
MITIGATIONS – SOCIO-ECONOMIC	See the tourism section

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Transmission lines
SUMMARY CONCLUSION IMPACT IDENTIFIED	The proposed 132kV overhead power line will be routed through the existing industrial area at back of Port. It is possible that sections of the proposed switching station could be visible from the John Ross Highway, however, this will also be largely screened by existing vegetation.
SIGNIFICANCE OF THE IMPACT	It is unlikely to be visually obvious from outside the industrial area. It will be screened by existing vegetation from the John Ross Highway. If sections of the substation are visible, they will be viewed in the context of heavy industry that is visible on either side of the road.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	The transmission lines are located next to the sand spits, the kabeljou flats and may have an impact on birding sites. Sense of place impacts

MITIGATIONS – SOCIO-ECONOMIC	See the tourism section

7.5.15.8.21 Thermal Plume and Marine Traffic assessment

CONSTRUCTION AND OPERATIONAL PHASES	Operation
KEY IMPACT	The model results show that when the cooling water is discharged 8 m below the water surface, the thermal plume exceeds the recommended
SUMMARY CONCLUSION IMPACT IDENTIFIED	Results to be referred for use to inform the marine ecology assessment
SIGNIFICANCE OF THE IMPACT	NA
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	Refer to the marine ecology assessment
MITIGATIONS – SOCIO-ECONOMIC	Refer to the coastal, estuarine and marine ecology impact assessment

7.5.15.8.22 Small Scale Fishers' Assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction and operation
KEY IMPACT	Small scale fishers
SUMMARY CONCLUSION IMPACT IDENTIFIED	Overall, no impact directly associated with small-scale fishing activities was noted. This is attributed to the fact that the attendees confirmed that no fishing is taking place in the Port. The port is an industrial zone, for which the small-scale fishing cooperatives are not registered to fish in.
SIGNIFICANCE OF THE IMPACT	The community be further informed about the actual impacts of the Powerships arising from the findings from the specialist studies; and the measures that prevent negative environmental impacts that will be adopted and the opportunities for local communities associated with this project.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	No impact directly associated with small-scale fishing activities
MITIGATIONS – SOCIO-ECONOMIC	See Marine ecology

7.5.15.8.23 Tourism assessment

CONSTRUCTION AND OPERATIONAL PHASES	Construction and Operations
KEY IMPACT	Marine tourism impacts Avifauna Marine
SUMMARY CONCLUSION IMPACT IDENTIFIED	Negative impact. The noise and visual impacts have been found to be negligible and therefore no impact on tourism in Richards Bay is expected. Positive impacts. Hotels in Richards' Bay may benefit from this development as they are in the vicinity of this development and integrate the energy or industrial tourism as one of their tourism

	attractions will potentially attract more visitors (average of 6. 3 km from the port). The Zululand Birding Route includes Richards Bay Harbour and the Game Reserve, known also as New Mouth, on its route. This part of the route covers sandbanks, mud flats, extensive mangroves, freshwater pans and forest areas and bird watchers can spot several rarities such as the cuckoo hawk and pygmy goose. New Mouth features several aquatic birds as well as hippos and crocodiles.
SIGNIFICANCE OF THE IMPACT	Reduce the noise levels and visual impacts. Development and integrate the energy or industrial tourism as one of their tourism attractions will potentially attract more visitors. The tourism products are not packaged in such a way to promote energy or industrial tourism. Low negative impact. High potential impact with mitigation. The reduction of loadshedding has been identified as a key issue in reducing the recovery of the tourism sector.
SOCIO-ECONOMIC IMPLICATIONS OF THE IMPACT	Note that the noise and visual specialist report determined that the impacts from those sources on tourism will be negligibly small. The Karpowerships are hidden from the sight of the hotels and tourism areas and forms part of the backdrop of the existing port operations. The visual impacts are unlikely to contribute negatively on the tourism and hospitality establishments.
MITIGATIONS – SOCIO-ECONOMIC	Karpowerships may work with the Municipality and other tourism stakeholder to assist in the establishment of a marine tourism industry. Birding view sites and maintenance. Support to the development of birding information brochures and website. Thulasihleka Pan Bird Sanctuary Support of research and protection the sand spits and the Kabeljou Flats Research. Integration into tourism opportunities should any heritage finds be made during construction. See tourism recommendations.

7.5.15.9 Mitigation Measures

In anticipation of the positive and negative socio-economic impacts of the Karpowership Project several mitigation measures are recommended and captured in the socio-economic impacts assessments tables above. These include:

- Karpowership implements its Economic Development Programme as well as well as activates a CSI and economic development programme in collaboration with existing organisations and including the Municipality of uMhlatuze.
- Interaction with other stakeholders to provide support, education, and training to the small-scale fishers enable them to find alternative employment opportunities and additional sources of income (given the seasonal nature of fishing).
- Interact and work with NGOs and other community-based organisation to address the poverty plight of the fishers reducing the need for illegal fishing.
- Karpowership, in working with the Municipality and the tourism organisations in uMhlatuze, contributes to the development of marine and industrial tourism attractions, routes and tours.
- Karpowership, in working with the Municipality through the Mayor's Multi-stakeholder Forum and tourism organisations to establish tourism-related products such as marine and industrial tourism routes and may assist in the tourism marketing initiatives of the City and tourism associations.
- Karpowership, in working with the Municipality and tourism organisations contribute to the tourism education and skills development of the tourism sector, particularly tourism guides.

- 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 per the requirements.
- 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.
- Institute a complaint lodging system and addressing concerns of affected parties.
- 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 and operational staff especially to local workforce.
- Noise disturbances during construction should be limited to business hours.

7.5.15.10 Specialist's Conclusion

No fatal flaws have been identified as part of this socio-economic assessment. Based on the findings of the socio-economic assessment report, it is **recommended that the Karpowership Project be implemented** in Richards Bay.

7.5.16 Tourism Impacts

A polycentric approach and holistic consideration of all relevant factors was adopted, inclusive of potential impacts that the proposed project could have on the local as well as the broader community. Relevant specialists' assessments reports were considered for a holistic assessment of the project, and this impact assessment focuses only on the impacts on Tourism activities.

*7.5.16.1 Impact assessment findings (with and without mitigation): **Construction and Operational Phases***

7.5.16.1.1 Noise Impacts on Marine Wildlife and Tourism Activities

In relation to the expected impact on marine wildlife, the results of the underwater noise assessment of the proposed Gas to Power Powership Project in the Port of Richards Bay indicate that noise levels during the operational phase will be below the ambient noise levels.

The construction-related noise impacts will also be of very low significance and the effect on baseline noise will be negligible where the Powership is operating at low power, which was found to be typical during the survey of the operational Powership in Ghana. Based on this assessment, no significant impacts on fish or marine mammals are predicted because of the operation of the Powership as it will not materially change existing underwater noise associated with the port.

The significance impact on marine tourism is low to insignificant (Table 7-79). The noise levels produced by the ships associated with the Karpowership project are not substantially different to the noise levels produced by ships typically using the harbour and will not negatively affect the wider bay or the species of marine mammals and fish in it (as per the underwater noise assessment report). No mitigation measures required.

Table 7- 79: Potential negative noise impacts on the marine tourism activities in the Port of Richards Bay

Ranking	Without Mitigation	No Mitigation Required
Magnitude	Minor (1)	
Reversibility	Completely reversible (1)	
Extent	Site bound (1)	
Duration	Immediate (1)	
Probability	Extremely remote (1)	
Consequence = Magnitude + Reversibility + Extent Duration	= 1+1+1+1 = 4	
Significance = Consequence (Magnitude + Reversibility + Extent Duration) x Probability	**= (1+1+1+1) x 1** **= 4**	
Can impacts be mitigated	No	

7.5.16.1.2 Visual and Noise Impact on Hospitality and Tourism Industry

Richards Bay Hotels offers various types of accommodation, and most are rated to at satisfactory standards. The Richards Bay Bon Hotel Waterfront, Premier Hotel, the Richards, Imvubu lodge, and Indaba Lodge are some of the hotels closer to the Port of Richards Bay, approximately 6.3 km away.

The closest reserves to the Port of Richards Bay are Enseleni Nature Reserve and Richards Bay Game/Nature Reserve. Richards Bay Game/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 are two nature reserves within 20km to the City of Umhlathuze (Richards Bay and Empangeni) that allows easy access to the general public.

In terms of visual and noise impacts as related to tourism, the impact is low to insignificant (Table 7-80) as the Powerships are placed in an existing operational port and views of the harbour and ships are part of the port landscape. The tourists from the reserves and the hotels cannot see the vessels in the Port of

Richards Bay and therefore the sense of place won't be negatively impacted. No mitigation measures are required.

Table 7- 80: Potential visual and noise impacts from the Port of Richards Bay on the Hospitality and Tourism Industry

Ranking	Without Mitigation	No mitigation Required
Magnitude	None (0)	
Reversibility	Completely reversible (1)	
Extent	Site bound (1)	
Duration	Immediate (1)	
Probability	Extremely remote (1)	
Consequence = = Magnitude + Reversibility + Extent Duration	= 0+1+1+1 = 3	
Significance = Consequence (Magnitude + Duration +Extent +Reversibility) x Probability	= (0+1+1+1) x 1 = 3	
Can impacts be mitigated	No	

7.5.16.1.3 Electricity Provision on Hospitality and Restaurant establishments

Several studies on the impact of load shedding on the tourism sector suggest that the health and viability of the tourism and hospitality industry is key for the stimulation of national economic growth (Steenkamp *et al*. 2016). Small businesses such as Bed and Breakfasts (B&B's) and Guesthouses are therefore most likely to be negatively affected by load shedding as their survival was regarded as hanging in the balance (Mokwena, 2021, Banda *et al*., 2020 and van Niekerk, 2020).

The continuous power outages may also have a negative impact on the tourism and hospitality industry, resulting in a decline in both local and international visitors (Sefako-Musi 2019). The continuous power outages brought about by Eskom in the country are having adverse impacts on Small to Medium Enterprises (SMMEs), especially in the accommodation and restaurant sectors. The majority of these businesses do not have sufficient financial reserves to absorb the losses incurred through load shedding and more often have had to resort to extreme measures to remain viable and competitive (i.e., job cuts and business closure). The usage of alternative power supplies such as generators and solar power are options for few businesses but in general, the cost implication for these businesses is unsustainable over the long term

The biggest concerns from the Small to Micro Medium Enterprises (SMMEs) are that small businesses in the hospitality sector already face the uncertainty of seasonal revenue fluctuations and the power outages are worsening the situation as they now need to contend with the added insecurity of load shedding. These factors paint an accurate picture of the stresses faced by the larger SMME community in South Africa.

This assessment focuses mainly on the impact of the Karpowership development of gas-to-power Powerships at the Port of Richards Bay on the hospitality and tourism sectors. However, impact assessments such as the socio-economic, noise on fauna, and underwater noise, are interlinked.

Table 7- 81 below summarises the consequence and significant impacts. The provision of energy will have a **very high positive impact** in the hospitality and tourism industry (i.e., savings on fuel for generators) and a general increase in Gross Domestic Product (GDP) in the province as tourists will stay longer in the establishments and dine for longer periods as there will be no power cuts. During the construction phase, it is likely that construction workers coming from outside of the area may wish to be accommodated in the B&B's, hotels, or self-catering accommodation, resulting in a positive impact on tourism.

Table 7- 81: Potential positive impacts of Karpowerships electricity provision on the hospitality and tourism industry in Richards Bay

Ranking	Without Mitigation	With Mitigation
Magnitude	Low (2)	Moderate (3)
Reversibility	Completely reversible (1)	Moderate (3) – Reversible with human intervention
Extent	Local (2)	Provincial (3)
Duration	Immediate (1)	High (4) – 15 years and more
Probability	Can occur (3)	Can occur (3)
Consequence = Magnitude + Duration +Extent +Reversibility	**2+1+2+1 = 6**	**= 3+3+3+4 = 12**
Significance = Consequence (Magnitude + Duration +Extent +Reversibility) x Probability	**= (2+1+2+1) x 3 = 18**	**= (3+3+3+4) x 3 =39**
Can impacts be mitigated	Yes	

7.5.16.1.4 Energy and Industrial Tourism

In addition to marine tourism activities such as charters and conservation tourism products, the demand for tourism with special interest (such as energy tourism) is likely to increase across the globe (Alekseeva & Katarína Hercegová 2021). Energy tourism for example is one of the less-researched fields of tourism. The area proposed for the development, as well as its surrounds, is currently an industrial area with several, large buildings and surrounding powerlines. These structures have a similar visual footprint to the proposed Powerships and their related infrastructure. Energy tourism includes visits to the energy facilities and locations such as factories, mines, renewable energy sites and power stations such as in the Richards Bay port.

The majority of South Africans across the cultural divide have never seen a Powership and do not know what it looks like. There is a strong possibility that some segments of tourists would want to view a Powership and its associated FSRU when they are in the harbour. This might be a promising and emerging type of tourism that will likely grow due to the ongoing industrialization and expenditure of energy-generating facilities envisaged for meeting the growing demand for energy all around the world (Alekseeva & Katarína Hercegová 2021).

Table 7-82 below reflects the positive effects that can be brought about by marketing the highly developed industrial (i.e., Port of Richards Bay) as part of the marine tourism sites. For example, Volga River in Russia, is the only hydropower station in the world that has a highway built over its roof and is one of the local tourist attractions visited by thousands of people every year in Russia.

The significant impact of Karpowerships on energy and industrial tourism is low to insignificant (Table 7-82) as visitors are not allowed into the port to view the Powerships because of the breakwater and vessel traffic entering and leaving the port. However, the limited view from the ocean side may still have positive spinoffs.

Table 7- 82: Potential Positive Impacts of Energy and Industrial Tourism on Hospitality and Tourism Industries in Richards Bay

Ranking	Without Mitigation	With Mitigation
Magnitude	Minor (1)	Minor (1)
Reversibility	Completely reversible (1)	Completely reversible (1)
Extent	Site bound (1)	Local (2)
Duration	Immediate (1)	Medium term (3)
Probability	Extremely remote (1)	Extremely remote (1)
Consequence = Magnitude + Reversibility + Extent Duration	**= 1+1+1+1** **= 4**	**= 1+1+2+3** **= 7**
Significance = Consequence (Magnitude + Reversibility + Extent Duration) x Probability	**= (1+1+1+1) x 1** **= 4**	**= (1+1+2+3) x 1** **= 7**

7.5.16.2 Mitigation Measures

Mitigation measures include changing people's perception of traditional tourism (visiting national parks, reserves, and beaches) to embracing new tourism products such as energy tourism. Energy tourism can have a remarkable positive impact on the economy of the Kwa-Zulu Natal Province.

7.5.16.3 Cumulative Impacts

Cumulative impacts were not assessed.

7.5.16.4 Specialist's Conclusion

For the Port of Richards Bay, the assessment results indicate the following conclusions against the elements that were assessed (Table 7-83).

Table 7- 83: Summary of Tourism impacts' assessment

No	Assessed element	Conclusion
1	Noise impacts on marine wildlife and tourism activities	No significant impact found
2	Visual and noise impact on the hospitality and tourism industry	No significant impact found
3	Electricity provision in hospitality and restaurant establishments	No significant impact found
4	Energy and industrial tourism	Potential product development (long-term)

While acknowledging the time limitations in conducting the Tourism survey, it can be concluded that there are **no negative impacts on the tourism industry should the Karpowership SA initiative be implemented**. Instead, it can be assumed that the generation of an alternative power supply will be an added advantage to the product owners as the majority are dependent on Eskom for power provision.

7.5.17 Traffic Impacts

The construction stage of the project is expected to generate 61 peak hour trips. These trips would not be concentrated in one area, rather they would be assigned to the different construction sites and therefore the impact is diluted.

The development is not expected to generate a high amount of truck trips during the construction stage of the project. The trucks trips will largely remain within the footprint of the construction area.

During the operational stage, the gas to power project is expected to generate some 34 trips onto the broader road network during the commuter peak hour.
Development that generate less than 50 trips in the peak hour do not require a Traffic Impact Assessment.

During the operational stage, the gas to power project will only generate ad-hoc truck and service vehicle trips for maintenance and replenishment of supplies. These trips will occur primarily outside the normal commuter peak hours.

Vehicular movement routes within the port were established through engagement with Transnet.

7.5.17.1 Recommendations

The following are the recommendations of the Traffic and Transportation Evaluation:

1. During the construction stage and operational stage of the project dedicated off-street parking should be provided as per Transnet's requirements.

2. During the construction and operational stage of the project, if general public transport is being used, then the designated Transnet public transport pick up and drop off area should be utilised. Alternatively, if there is a dedicated Transnet shuttle available for staff working at the port, then permission may be sought to utilise such as service.

   Trucks that need to access the N2 should utilise the John Ross Highway interchange only as this route has the necessary traffic capacity and is located away from sensitive areas such as the Richards Bay CBD and neighbouring residential areas.

7.5.18 Visual Impacts

The Western Cape Guideline is the only relevant South African guideline, setting various levels of assessment subject to the nature of the proposed development and surrounding landscape.

A Level 1 input is generally undertaken when little or no visual impact is anticipated. It requires the following:
Identification of issues and site visit;
Brief comment on visual influence of the project and an indication of the expected impacts / benefits.

Consideration was given that the proposed location of the project is within the working area of the Port and near to the IDZ, and following a site visit, it was concluded that little or no visual impact was anticipated. On that basis, a level 1 input was undertaken, as per the Western Cape Guideline.

The visual influence of the proposed Powerships and FSRU is largely limited to active areas within the Port and adjacent industrial areas. It will also be visible from the undeveloped areas to the south to the same extent that existing Port and adjacent industrial development is visible.

The proposed project is therefore unlikely to extent the area over which existing Port operations and industry are visible from.

The landscape in which the proposed ships and infrastructure are located is such that it can accommodate and absorb these elements without increasing current levels of landscape and visual impact on the character of the surrounding landscape or the views of potential sensitive receptors. Because of this, potential future development of recreational and or tourism uses should not be compromised within the established recreational and tourism related areas within and around the port.

The proposed Powerships and the FSRU are unlikely to be visible to most land based areas that are important for tourism or recreation.

The exception to this is the Inner Northern Breakwater which is a popular fishing location and is also used by the public for walking. It is noted that there are numerous memorial plaques attached to structure which underlines is popularity with local people. From this breakwater views out to sea are possible as are long views down the length of the port.

The proposed Powerships and FSRU will be visible and will be seen in the context of Port operations, other shipping and heavy industry within the IDZ.

The ships will be viewed roughly head on and so their length is unlikely to be obvious. The details of the ship are also unlikely to be obvious from this location due to distance although the profile will be.

The proposed 132kV overhead power line will be routed through the existing industrial area at back of Port. It is unlikely to be visually obvious from outside the industrial area. It will be screened by existing vegetation from the John Ross Highway.

It is possible that sections of the proposed switching station could be visible from the John Ross Highway, however, this will also be largely screened by existing vegetation. If sections of the substation are visible they will be viewed in the context of heavy industry that is visible on either side of the road.

Figure 7-12: View from the Inner Northern Breakwater looking down the length of the Port.

Figure 7-12 above shows where the proposed Powerships and FSRU will be seen moored immediately to the left of ships that can be seen at the back of the picture (centre / right side), approximately 4.5km away.

7.5.18.1 Specialist's Conclusion

The proposed location of the project within the working area of the Port and near to the IDZ will mean that the proposed ships and infrastructure are visually in keeping with the surrounding landscape.

It will also mean that sections of the Port and waterfront that are used for or have potential for recreation and tourism are largely unaffected by visual intrusion.

Where views are possible from these areas they will be at sufficient distance that detail will not be obvious and they will be seen as part of Port activities.

It is the assessor's view that elevating the level of the assessment will not change these conclusions. Therefore from a Landscape and Visual Impact perspective, **the proposed project should proceed**.

7.5.19 Major Hazard Installation Impacts

Specific Individual Risk Levels

The likelihood that a person in some fixed relation to a hazard (e.g., at a location, level of vulnerability, protection and escape) might sustain a specific level of harm. The frequency at which an individual may be expected to sustain a given level of harm from the realisation of specified hazards. For example, there may be an individual risk of one-in-a-million that a person would be killed by an explosion at a major hazard near their home for every year that a person lives at that address.

Employee Risk

Scenarios considered regarding risk to employees are toxic vapour clouds from Ammonia and chlorine plant failures, vapour cloud explosions and BLEVEs from gas vessel failures, and pool fires from fuel installations. Employees and the public are indoors and outdoors during the day and major events associated with these installations would occur outside of the building near the installation areas. When exposed to hazards such as toxic clouds, people who are indoors (sheltered) will generally be less vulnerable than those outdoors (unsheltered). The risks should not be more than one-in-a-thousand (1.0e-3 per year).

Individual Risk

The proposed LNG operations were modelled for this Risk Assessment. The results were presented in Figure 7-13 and as follows:

- The 1.0e-4 (one in a ten thousand) red contour, is confined to the two ships and 160m around the hose connections;
- The 1.0e-5 (one in a hundred thousand) orange contour, is confined to the two ships and 230m around the hose connections;

- The 1.0e-6 (one-in-a-million) yellow contour, stretches for a maximum distance of 295m from the generator barge hose;
- The 3.0e-7 (one-in-thirty million) green contour, does not reach any sensitive populations. The contour stretches for a maximum distance of 310m from the generator barge hose connection.

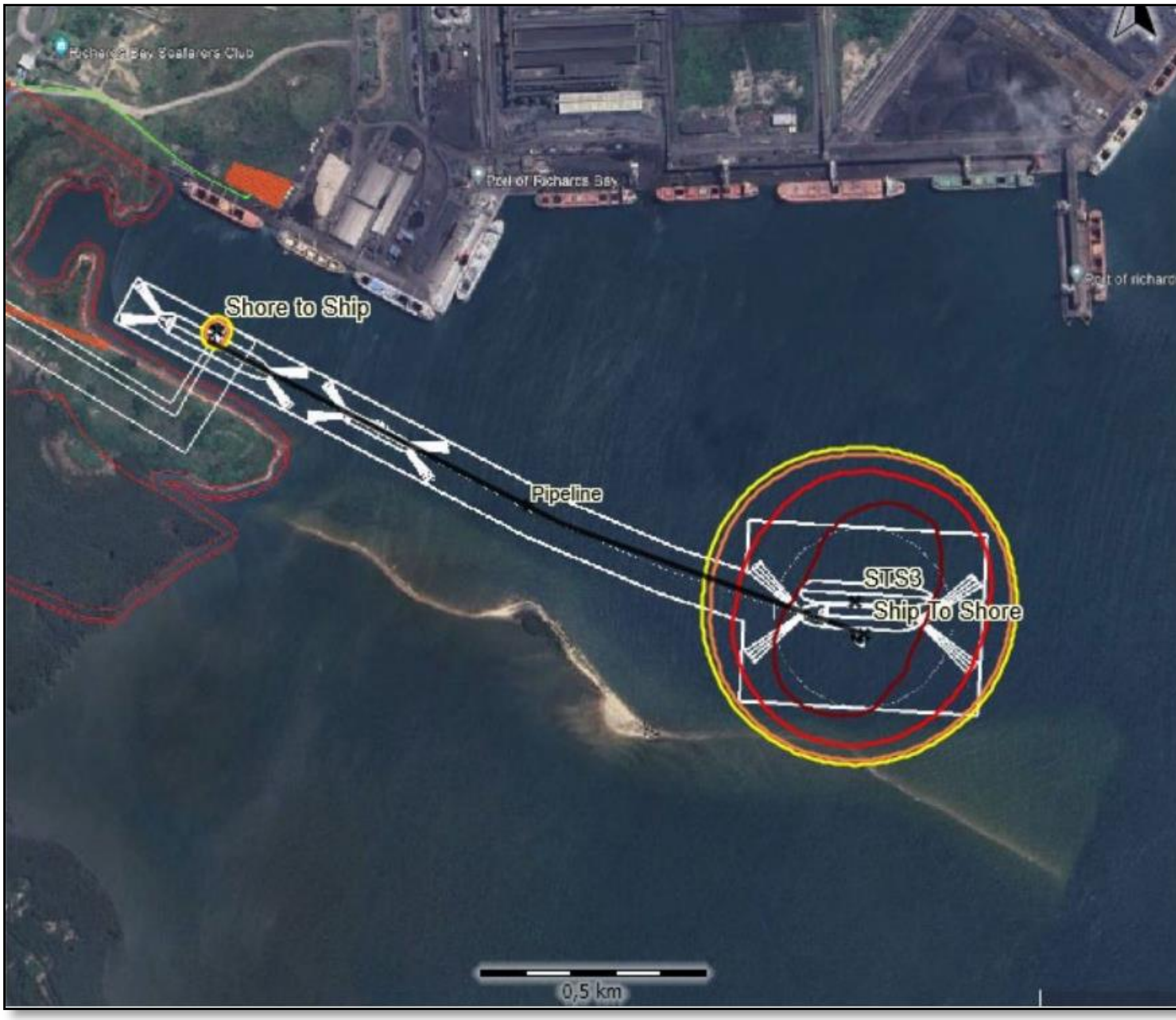

Figure 7-13: Individual Risk

Risk Levels and Ranking

Individual risk levels at several important points around the operations at the Port are tabulated below.

Population	Risk Level
Risks on the Break Bulk Quay	No risks
Risks at Closest Quay	No risks
Risks at Closest Shoreline	No risks

No one 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-04 (one-in-ten-thousand). These risks are acceptable for persons operating in a national port.

Societal risk is defined as the relationship between frequency and the number of people suffering from a specified level of harm in each population from the realisation of specified hazards. Societal risk evaluation is concerned with estimation of the chances of more than one individual being harmed simultaneously by an incident. The societal risks were determined to be less than 1.0e-6 of one fatality and are therefore acceptable.

The specialist determined that individual risks at the Gas to Power facility are 'Tolerable' as they fall within the 'As Low as Reasonably Practicable' (ALARP) range. The risks off site are 'Broadly Acceptable'.

7.5.19.1 *Mitigation Measures*

The following is recommended to reduce the risks associated with the installations at the site:

- 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 Operations Manual for each operation.

7.5.19.2 *Specialist Conclusion*

This 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**.

A site is deemed to be an MHI if more than the prescribed quantity is stored as per the General Machinery Act or if a product is stored, handled or produced which has the potential to cause a major incident as per the Major Hazard Installation Regulations.

7.5.19.3 Minor Safety Incident – Indonesia 2018

Karpowership operate in several countries that each have unique coastlines and incorporate an array of challenges, and have not had any significant safety or other incidents. One minor incident occurred in November 2018 in Indonesia which was a single failure of boiler drum. The Powership involved, which was operating there since January 2016, had an unplanned discharge of pressurized steam from the Steam Drum situated on top of the Exhaust Gas Boiler located at the top part of the Powership. The Exhaust Gas Boiler (EGB) uses hot exhaust gases from the engines to convert water into steam (in the boiler drum operating at a pressure of 15 bars) and then uses the steam to power a steam turbine to produce additional electricity without using additional fuel. It was an isolated failure of a pressurised component which caused release of pressurised steam and damage to the boiler drum. There were no casualties or injuries due to this single incident. The effect was fully remedied within a couple of hours and the operation resumed immediately thereafter with full contractual capacity. Remedial actions included the replacement of all drums by the manufacturer concerned on all Powership and reducing the maximum operational pressures to 7 bars for all boiler drums on all vessels. Additional quality check procedures with welded components were also put in place as added preventative measure. In summary, the incident was not a gas, fuel, oil or otherwise flammable material explosion, but a pressurized steam release from a boiler drum.

7.5.20 Marine Traffic

The marine vessel traffic assessment assessed the potential risks posed by the additional marine vessel traffic associated to the proposed Powership project and the anticipated vessel traffic in the short term (i.e. 7-year horizon) and medium term development (i.e. 7-year to 30-year horizon) of the Port of Richards Bay. In the identification of the preferred site in the Port of Richards Bay, the sites of 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 Powership solution will therefore make use of its own class-approved mooring system.

The existing and anticipated vessel traffic in the Port of Richards Bay in 2020 is 2,019 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 million tonnes per annum (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.

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.

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.

7.6 DECOMMISSIONING PHASE IMPACTS

Karpowership has prepared this decommissioning report to outline the methods and means to decommission the Richards Bay Project at the end of the Power Purchase Agreement (PPA). The project has a potential life time of approximately 20 years. At the end of the 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 Project Company will give landowners sufficient notice prior to the commencement of the decommissioned activities.

Legal Context

The RMI4P requires the decommissioning of all assets which are owned and operated by the Project Company to be safely decommissioned and the land reinstated after the PPA has ended. The decommissioning process needs to comply with all relevant environmental legislation inclusive of any conditions contained within the lease agreements entered into.

GENERAL DEMOLITION APPROACH:

Switching station

Disassembly of the switching station, should future use by Eskom not be viable, would include the removal of the steel, transformers, circuit breakers, conductors, and other materials that could be reconditioned and reused or sold as scrap.

In addition to steel structures, the control building will be disassembled and removed from the site. Fencing around the substation will be broken down and removed. The gravel or aggregate surface at the substation will loaded onto trucks and removed for sale and reuse

Transmission lines

Transmission lines are often reconditioned and used to facilitate the reliable delivery of energy, however, if the transmission line need to be removed, above-ground elements of the transmission line, such as the overhead monopoles, conductor and fibre would be removed and the materials would be disposed, recycled, or sold. Underground equipment such as stay wires buried less than 1 m below ground would be removed.

Foundations

Foundations would be exposed using backhoes, bulldozers, and other heavy earth moving equipment. Monopole foundations would be excavated to a depth sufficient to remove anchor bolts, rebar, conduits, cable, and concrete to a depth of at least 1m below ground. After removal of noted foundation materials, the areas would be filled with clean compatible subgrade material compacted to a density similar to the surrounding sub- grade material. All disturbed areas will be restored to pre-existing conditions and contours

Gas pipeline

Once the Project vessels have been demobilised the decommissioning and removal of the gas pipeline can commence. The pipeline will be pigged clean then divers will disconnect the pipeline end manifold (PLEM) flanges and insert blank flanges. Once disconnected the PLEMs can be lifted off the seabed using marine equipment. The offshore pipeline will then be cut into sections using subsea tools and either floated and pulled to shore using lift bags or lifted onto a material barge for transport to shore for disposal. The seabed disturbance during removal will be minimal as the pipeline is sitting on the seabed and not buried. The onshore portion of the pipeline the will be dug up in sections and all crossings removed. The existing hard stand, road siding or revetment rock will be replaced and the affected areas returned to their initial condition. The beach at the shore crossing will be instated to its natural condition.

Reseeding, revegetation, backfilling and grading

After the powerlines, ancillary structures and associated substation equipment have been removed, site rehabilitation will commence. This includes reseeding and revegetation, including the use of plants endemic to the site. To the extent necessary, topsoil would be removed prior to removal of structures from all work areas and stockpiled and separated from other excavated material. The topsoil would be de-compacted to match the density and consistency of the immediate surrounding area. The topsoil would be replaced to original depth, and original surface contours re-established where possible. If the disturbed areas will not be used for agricultural purposes, then the areas will be reseeded with native grasses. All disturbed areas will be restored to pre-construction conditions including topography, native grasses and/ or land use. Stabilization measures will be implemented in disturbed areas to control erosion and sedimentation during reclamation of the site. To prevent the introduction of undesirable plant species into reclaimed areas and ensure slope stability, seeding and site reclamation efforts will utilize seed for grasses native to the area and free of noxious weeds. If mulch is used, the mulch will be certified weed-free prior to use in reclamation efforts. Agricultural seed will be secured from a local source.

All disturbed soil surfaces within agricultural fields would be seeded with a seed mix agreed upon with the landowner to maintain consistency with the surrounding agricultural uses. All other disturbed areas would be restored to a condition and forage density reasonably like original conditions. In all area’s restoration shall include levelling, terracing, mulching, and other necessary steps to prevent soil erosion, to ensure establishment of suitable grasses and to control noxious weeds and pest. Reseeding will occur on all disturbed surfaces.

Restoration methods and Best Management Practices to minimize wind and water erosion will be implemented where practical to maximize revegetation success. The topsoil will be placed in a roughened condition to prevent erosion and additional erosion control and soil stabilization measures may be required on steeper slopes, areas of erodible soils or areas adjacent to streams and creeks. Topsoil will be scarified, tilled, or harrowed to a depth of approximately 10cm below ground surface to create a suitable seedbed for germination and establishment of seed. In areas not conducive to this method (e.g., steep slopes, rocky areas, etc.), the soil will be dozer- tracked perpendicular to the slope or left with sufficient roughness following topsoil placement to provide microsites for seed germination, capture and retention of available precipitation and reduce soil movement or erosion. Grading activities will be limited to the minimal area required to complete site restoration of disturbed areas using a bulldozer, grader or similar earth moving equipment. Disturbed areas will be graded and contoured to restore the natural topography and drainage of the site prior to construction of the grid connection equipment.

Debris, waste management and clean-up

Following clean-up and seeding, vegetative debris (woody and non- woody) will be reused as mulch over reclaimed areas. Trees and other shrubs will not be permanently windrowed along the edge of disturbed areas. Solid waste management will include the provision of trash containers and regular site clean-up for proper disposal of solid waste (scrap metal, food, containers, etc.) during decommissioning and site reclamation. Trash and bulk waste collection areas with containers (dumpsters, roll off containers or similar waste receptacles) will be designated at the site and materials will be recycled when possible (paper, wood, concrete, etc.). Litter, bottles, and assorted trash will be removed daily from decommissioning areas and placed in designated trash containers for disposal. Trash, debris, and any other solid waste generated during decommissioning will be minimized and managed in accordance with applicable regulations and routinely removed from the site, as needed.

7.7 NO-GO ALTERNATIVE IMPACTS

Should the Karpowership gas-to-energy project not be implemented, the benefits of the proposed activity will not be realised and neither will the associated negative impacts/risks i.e. the status quo will remain. This means that the supply of additional electricity to the national grid will not be supplemented by Karpowership as a preferred RMI4P bidder.

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 until additional supplies can be secured. The potential negative impacts as a result of the project 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.

The No-go alternative entails that the proposed gas-to-power facility would not become part of the RMI4P to provide dispatchable power to the national grid in order curtail the disastrous effects of loadshedding, resulting in the down-wind spiralling effect on the economy and general decline of individual well-being. Continuous power outages may have a negative impact on the tourism and hospitality industry, resulting in a decline in both local and international visitors, which impact on Small to Medium Enterprises (SMMEs), especially in the accommodation and restaurant sectors. The majority of these businesses do not have sufficient financial reserves to absorb the losses incurred through load shedding and more often have had to resort to extreme measures to remain viable and competitive (i.e., job cuts and business closure).

In terms of GHG emissions, the implementation of the Project may result in avoided emissions. These are emissions that may be emitted if the project is not implemented. These emissions are calculated in accordance with the GHG Protocol's guidance document for comparing products. In accordance with this guidance, the baseline technology for calculating the avoided emissions is Eskom's coal fleet. The avoided emissions are only calculated as the emissions avoided from the switch to gas from coal. There may be further avoided emissions from the enabling of additional renewables due to gas power plants load following capabilities. However, these emissions have not been estimated in the Climate Change specialist's report, as there is insufficient evidence to support this increased renewable capacity.

The grid emission factor from the Integrated Resource Plan (IRP) has been used to calculate the avoided emissions to reflect the anticipated change in the energy mix as set out by national policy. The emissions

are only calculated for the period up to 2030, thereafter it is assumed that the majority of the energy mix will be renewables and there will be no avoided emissions from a coal fleet.
The avoided emissions from the Karpowership Project at Richards Bay are shown in Table 7-84 below. The total avoided emissions between 2023 and 2030 is approximately 17 million tCO_2e.

Table 7- 84: Avoided emissions

	2023	2024	2025	2026	2027	2028	2029	2030
IRP Grid EF (tCO_2e/MWh)	0.85	0.86	0.85	0.83	0.81	0.77	0.73	0.67
Avoided emissions (million tCO_2e)	2.27	2.3	2.27	2.2	2.2	2.1	2.0	1.8

In terms of the biodiversity, the baseline findings reveal that the area is transformed, degraded and modified to most parts within the proposed footprint. Not implementing the project may prevent from further potential negative impacts on the biodiversity to occur, however, with adequate mitigation measures, it will also prevent opportunities to improve and better manage this environment, though rehabilitation and monitoring plans. For example, in terms of wetland rehabilitation, should the project go ahead and the rehabilitation measures implemented successfully, approx. 23.3 ha equivalent of wetlands will be improved in comparison to the current state.

The following table presents the key Local and National considerations for the no-go option at the proposed Port of Richards Bay:

Table 7- 85: Local and National considerations for the no-go option

Considerations For the No-Go:	Considerations Against the No-Go
• Medium to low impacts (after mitigations) to coastal and marine ecosystems will not occur. • Medium to very low impacts (after mitigations) to Avifauna will not occur. • Low risks from ship-to ship transfer of LNG and NG will be avoided. • Climate change impacts originating from the generation of gas to power as per the proposed project will not occur. • Medium-low impacts of the overhead transmission line between the ships and the proposed switching station will not occur. • High socio-economic impacts from influx of people looking for work opportunities may not occur.	• Port operations will continue to seek economic development and levels of impacts will occur irrespective of the presence or absence of the project due to the nature and intent of the Port. • Impacts to the environment will occur as a direct result of loadshedding and poverty resulting in the destruction of flora and uncontrolled release of fugitive emissions. • Climate change and air quality impacts due to reliance on coal based power generation as well as the use of wood, paraffin or coal based fires for cooking and heating and diesel-powered generators to sustain business and individual households and living will continue. • No additional dispatchable power will be generated and supplied to the National grid and

Considerations For the No-Go:	Considerations Against the No-Go
	loadshedding that could have been reduced will be present. • The significant economic losses (approximately R1 billion rand for 1 day of loadshedding) will not be reduced. • The opportunity through new technology gas to power electricity generation, that can pave the way to a just transition, aligned with South Africa needs as a developing country, will be lost. • No direct skilled and unskilled employment opportunities will be created during the construction and operation phase. • Opportunities for research to improve environmental understanding through dedicated and ongoing monitoring with continued and long term strategies to improve biodiversity will be lost. • Socio-economic and enterprise development initiatives with the generation of new business and social upliftment will not be realised. • Opportunity to rehabilitate and improve wetlands will not be realised. • Further ecological research opportunities will not be realised.

While the no-go alternative will not result in any direct negative environmental impacts from the gas-to power project, it will also not result in any positive indirect environmental benefits or direct and indirect socio-economic benefits. The status quo cannot be assumed to be environmental and socio-economically neutral as the micro and macro environmental and economic conditions will continue to result in both positive and negative impacts to the environment, economy and society regardless of whether the proposed project is developed or not.

When the minimal potential environmental and socio-economic risk with mitigation is measured against the potential environmental and socio-economic benefits, there is simply no contest. **The environmental benefits are significant and the social and economic benefits vastly outweigh the mitigated environmental and socio-economic impacts.**

The no-go option 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. It will also not contribute further to the local economy by provide employment opportunities. Hence **the "no-go" alternative is not recommended.**

7.8 POLYCENTRIC APPROACH

7.8.1 Overview

The intention of this Sustainability Report is to support the findings of the EIA with a focus on facilitating a transdisciplinary approach in a manner that assists with understanding holistically the dynamics of the Karpowership SA Projects and the associated impacts. Furthermore, this approach enables the development of appropriate mitigation and management recommendations.

A polycentric approach to the proposed Project requires the holistic consideration of all relevant factors, inclusive of potential impacts that the proposed Project could have on the local as well as the broader community. Section 2(4)(b) of NEMA states that *Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in* the *environment by pursuing the selection of the best practicable environmental option.* Sustainable development as per NEMA requires the integration of social, economic, and environmental factors in the planning, implementation, and evaluation of proposed projects, to ensure that development serves the needs of present and future generations.

This specialist assessment therefore considers both the positive and negative impacts of actual and potential impacts on the geographical, physical, biological, social, economic, and cultural aspects of the environment in a polycentric and holistic approach that:

- Acknowledges that this environment is a complex and dynamic system
- Acknowledges the interrelated socio-ecological and socio-economic relationships
- Identifies the risks and consequences of alternatives and options for mitigation of activities, to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management as set out in section 2 of NEMA.

7.8.2 Transdisciplinary specialist integration

To facilitate co-learning and co-creation of knowledge amongst the specialist team, towards the development of holistic specialist assessments the following approaches were employed:

- ***Specialist integrative workshop*** and weekly meetings were held during the EIA process where specialists raised matters to be considered by the team and verified technical information to prevent any discrepancies and where relevant, to co-ordinate approaches. This approach assisted with addressing gaps in specialist reports and the development of a holistic assessment of the project – thus allowing for a polycentric assessment of environmental and socio-economic impacts. Critically, this enabled the identification of appropriate practical mitigations and recommendations for potential negative impacts, and maximisation of positive impacts and the value of the Project to society.
- ***Thematic specialist engagements*** were encouraged amongst the specialist team to share information (co-learning) and debate various applicable topics, potential connections and cross-sectional issues, and the related impacts and potential mitigation and management recommendations. Specialist contact details were shared openly amongst the team, and specialists were encouraged to set-up their own meetings, preferably but not necessarily including the Environmental Assessment Practitioner. Meetings which the author for the Sustainability Report attended of this nature included thematic discussions regarding:

  - Corporate social investments, job creation and capacity development, enterprise development and supplier development.
  - Vulnerable communities, including small scale fishers, and the potential impacts (positive and negative) associated with the Powerships.
  - Links between the visual assessment and socio-economic impacts, including tourism
  - Links between the impacts on marine ecology and local mariculture and fisheries.
- ***Integration of specialist findings*** where overlaps and connections were identified, and/or considered applicable, specialists reviewed each other's reports and integrated findings into their own work. Please refer to the EIA document and associated appendices for the list of specialist studies.

Critically, for the sustainability report, the findings of the specialist assessments were used to inform three methods that assist with synthesizing and conceptualizing technical information for decision making purposes, namely: 1. Matrix of strategic issues and thresholds, 2. systems maps, and 3. 1st to 4th Order Framework. These methods are described below, and the findings are discussed thereafter. The specialists assisted in some instances with providing input directly to each tool, review and comment, and engagement at team strategic integration workshops. The outcomes of these methods haves assisted with strengthening of impact mitigation / management recommendations, and the inclusion of adaptive management principles from a transdisciplinary perspective.

7.8.3 Matrix of strategic issues and thresholds

Two matrices were developed to assist with summarising the key findings of the specialist assessments, and highlighting critical variables, mitigation and management recommendations, and interconnections and overlaps in the specialist areas. This is a valuable tool for any project, and especially so for this EIA because of the numerous specialist studies that were undertaken.

The integration matrix presents the list of specialist studies across both axes. This matrix has facilitated transdisciplinary specialist study understanding across all specialist studies, and identification of cascading impacts (Appendix A of the Sustainability Report).

The strategic issues matrix provides a synthesis of the key findings from each specialist assessment undertaken for the relevant site, into one comprehensive table. This includes, where relevant, limits of acceptable change or ecological thresholds, mitigation or management recommendations and a final risk rating in line with that provided under the NEMA Overall Environmental Significance Impact Rating (Table 7-1). These issues have been arranged into overarching themes for ease of reference, namely: physical, ecological, socio-economic and heritage (natural, cultural, tangible, intangible).

7.8.4 Mapping system dynamics

Drawing from the findings of the specialist studies, a systems map of the operational phase of the proposed Project was developed drawing on knowledge from literature associated with social-ecological systems and complex adaptive systems (CAS). The systems map attempts to illustrate the complex human-environment dynamic at the site scale, with potential causal links or cause-and-effect relationships illustrating potential shift arising because of the Karpowership SA Project operating in the Port. This 'map' is intended to provide a simplified conceptual understanding of the site as a dynamic and complex system.

In applying this framework, the general organising principles of CAS as described in Table 7-86 is relevant to understanding the site.

Table 7- 86: A summary of the general organising principles of complex adaptive systems, and implications for research and planning.

Organising principles of Complex Adaptive Systems (CAS)		Conceptual implications for social-ecological systems (SES)
Constituted relationally	• Complex adaptive systems are constituted relationally - complex behaviour and structures emerge because of the recursive and aggregate patterns of relations that exist between the component parts of systems. • These relations usually give rise to rich interactions within the system, meaning that any element in the system influences and is influenced by many other ones either directly, or indirectly via positive (reinforcing) or negative (balancing) feedbacks.	• The nature and structure of relationships in a SES have to be considered explicitly. • Diversity and redundancy is key and allows for different kinds of SES interactions to take place.
Adaptive	• CAS have adaptive capacities - they self-organise and co-evolve in relation to contextual changes. • Self-organisation happens when a system develops complex structures from unstructured beginnings without the intervention of an external designer or the presence of some centralised form of internal control. • Coevolution describes the recursive patterns or relations of influence that result from ongoing exchanges between components of evolving systems, practices, knowledge, beliefs and values, and the biophysical environment that mutually influence one another.	• The function and structure of SES changes with temporal and spatial changes. • Multiple modes of reorganisation are possible when systems undergo change. • Adaptive capacity results from a system's ability to learn and have memory. • Change happens through adaptation, evolution and transformation. • Control is not located in one isolated element of the system but is spread throughout the nodes and relations of the system.
Dynamic	• CAS are characterised by dynamic relations - the relationships in a system are constantly changing in rich and unexpected ways. • These relations are mostly non-linear. • Non-linearity can be the result of feedbacks, path dependencies, time lags or multiple time scales, which suppress or magnify processes and interactions, both internally and between the system and its environment. • Non-linear dynamics also arise because the relations between variables constantly change, which renders them uncertain and unpredictable and makes these systems difficult to predict.	• System behaviour is amplified or dampened by feedback loops and can lead to tipping points and regime shifts. • Feedback structures are responsible for the changes we experience over time. • Structures are responsible for the changes we experience over time. • SES are characterised by inherent unpredictability and uncertainty.

Organising principles of Complex Adaptive Systems (CAS)		Conceptual implications for social-ecological systems (SES)
	• Change and not stability is the norm in CAS, shifting the focus from analysing stable states to analysing transient processes (the behaviour of the system in between equilibria), and from analysing outcomes to focusing on the trajectories or processes of the system.	
Radically open	• Complex adaptive systems are radically open – the activity of the system in relation to the environment that constitutes the system itself. • We cannot clearly discern the boundary between the system and its environment because the environment co-constitutes the identity of the system. • Our definitions of systemic boundaries are the product of physical properties (e.g. a watershed boundary that signals a system boundary), mental constructions (i.e. where we choose to draw the line between the system and the environment or the problem or research question we want to address (including the temporal and spatial scales of interest).	• Delimiting SES problems and systems is challenging as real-world problems have no natural boundaries. • External variables could have important influences on system behaviour but cannot be included in the models of the system. • Any modelled system is embedded in a larger system.
Contextual	• CAS are context dependent - the function(s) of CAS are contingent on context. • Changing the context will have an impact on the function of the system, i.e., the environment suppresses or enhances possible systemic functions and are contingent on the level of analysis that we employ to understand a system.	• SES are context sensitive. • SES components have multiple functions that change when the context changes. • Context is not passive backdrop to a system, but an active agent in itself, which enables or inhibits systemic agency. • Many contested problem definitions exist simultaneously and the various stakeholders involved in a SES will have different mental models or beliefs that inform values and understandings of both the causes and the possible actions that could be taken to find possible pathways for action.
Complex causality and emergency	• CAS are characterised by complex causality and emergence. • Cause-and-effect interactions in CAS are not unidirectional or linear but marked by complex recursive causal pathways that are non-linear and dynamic. • Emergence occurs when entities are observed to have systemic properties that are different and non-reducible to the properties of the constituent elements. It is not that the sum is greater than the	• Cause-and-effect cannot be traced in linear causal trajectories • Emergent phenomena arise from multiple recursive patterns and unintended outcomes.

Organising principles of Complex Adaptive Systems (CAS)		Conceptual implications for social-ecological systems (SES)
	parts, but rather that the system's effects are different from those of its parts. • Emergent phenomena have causal agency and are real, i.e. they have ontological status.	

Given the CAS organising principles, it is important to highlight the following associated with the application of this method to the proposed project:

- As an active port there is a strong and complex relationship between the community for livelihoods in a variety of ways, e.g. subsistence and commercial fishing, jobs associated with the industrial zone and the nearby tourism industry.
- The Port is zoned as industrial, and therefore includes associated infrastructure and activities on the landside and associated maritime activities in the Port.
- This is a complex ecological transition zone considering the Port is an interface of the terrestrial habitat, the riparian, estuarine and lagoon environments, and the ocean.
- For the systems maps generated for the Karpowership projects it is important to acknowledge that the boundary of the map will be set at the site scale.
- The maps were developed to consider the operational phase of the proposed project, and the likely consequences in system shifts related thereto.
- Each map is developed considering an imposed change to the environment. In this instance the change to the environment will be the addition of the powership, and its operations associated with the provision of peaking power in line with the 20 year contract.
- These maps synthesis and illustrate the socio-ecological and socio-economic shifts (positive and negative) that the Karpowership SA projects will likely bring about at each site. But will also anecdotally acknowledge wider system impacts, e.g. to nearby protected and/or sensitive natural environments, local communities, and tourism activities.
- The operation of the Powerships is in response to the country's energy crisis, and therefore the provision of electricity generated by the Powership(s) influences a greater system associated with the country's energy stability and the consequences for the economy – although this important trend is acknowledged, this will, however, not be mapped here.
- The operation of the Powership(s) will result in greenhouse gas emissions, which will contribute to global stock of emissions — although this important trend is acknowledged, this will, however, not be mapped here.

Overall, the map presents an understanding of the site as a CAS, as a holistic transdisciplinary perspective of shifts to the system that may be realised because of the Powership. The systems map represents both positive and negative shifts. In addition, it attempts to highlight the significance of these anticipated shifts with alignment of the impact ratings provided by the specialist team. This impact and risk rating further informed the development of the systems map, providing perspective on the likelihood and significance of the impacts and/or system shifts.

7.8.5 Cascading impacts of climate change

The 1st to 4th Order Framework assists with organising our experiences of the cascading impacts of climate change into a logical framework of cause-and-effect related impacts, based on work done by the World Bank. It is a conceptual framework based on the findings in the Climate Impact Assessment Report and influenced by other specialist findings and specialist team discussions.

It is critical to note that this tool is presenting the modelled projections of potential climatic changes to a particular region and attempts to understand how the cascading direct and indirect impacts of climate change may impact on the site. These projections do not make causal links to the presence of the Powership influencing climate change, in a positive manner through any rehabilitation of natural habitats of social investments, or negatively through emissions, etc. It is therefore based on climate change projections, as well as the anecdotal inputs of specialists, and is anticipated to be associated with global climatic shifts.

The framework presents four ‘orders’ or categories of interrelated direct and indirect impacts of climate change (Figure 7-14 and Figure 7-15). The first order summarises the anticipated or modelled direct impacts that are anticipated for the general area. For example, increase in average temperatures and number of hot days. The second order explains the cascading physical impacts that may arise because of the first order basic climatic changes, e.g. water scarcity. Third order impacts are experienced as impacts to ecosystem health and functioning, including the consequences for human activities that rely on these ecosystem goods and services. Examples may include decreased agricultural yield. Lastly, the fourth order impacts relate to social and economic systems, e.g. local community decline in health because of reduced access to adequate nutrition and clean drinking water sources; this may further have an impact on productivity. Each of these orders are interrelated, and therefore are likely to have numerous interconnections and cascading systems impacts between the orders. This may also include consideration of adaptive practices or what may be described as ‘positive’ such as advances in technology, pharmaceuticals, farming practices, etc.

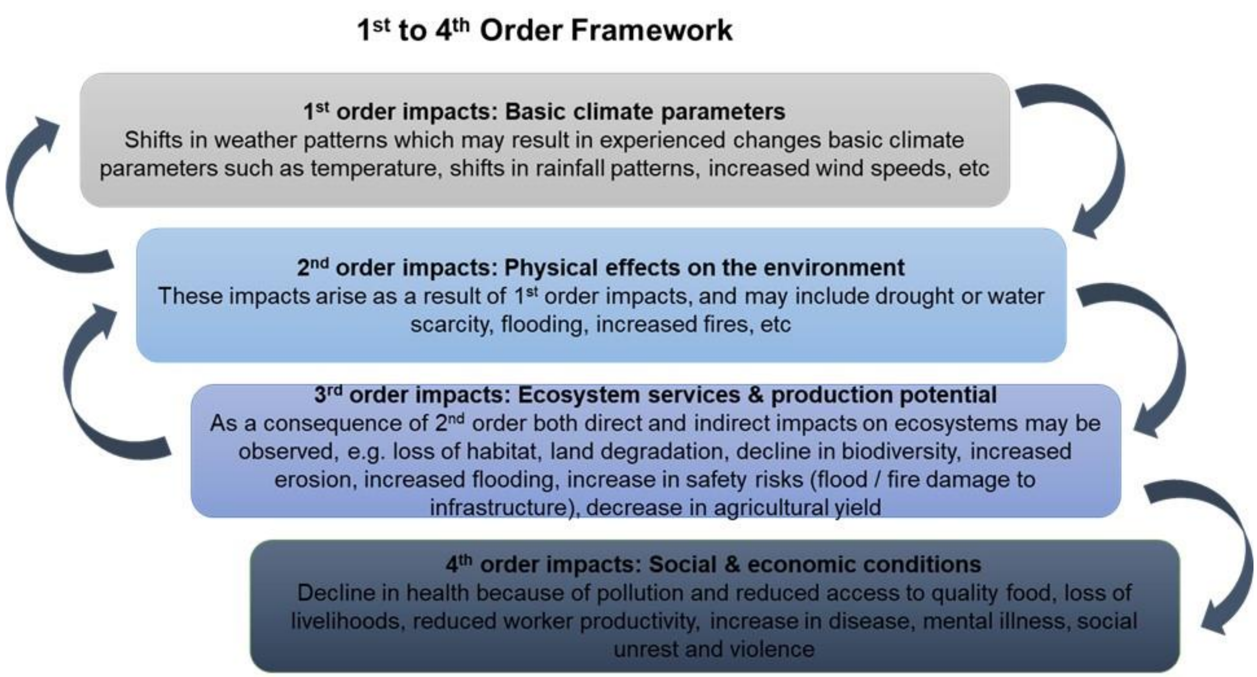

Figure 7-14: Description of the 1st to 4th order framework

As a conceptual framework, this tool provides a valuable means to deepen the understanding of climate change, vulnerability, risk and impacts to communities by making the connections between potential direct and indirect environmental pressures and the link to societal impacts. Some less obvious drivers include socio-economic and community-based factors, such as education, literacy, gender, poverty and access to public health care (amongst others). A key component of this framework is that communities and socio-economic systems are viewed as central to broader ecological, geographical and biophysical systems. This framework is therefore useful for translating technical information in a means that informs our understanding of how impacts may be experienced on the ground. It therefore enables decision makers and stakeholders and raises awareness and understanding of particularly of the less tangible drivers of climate vulnerability. The foresight provided by identifying how we may indirectly and directly experience climate change influences how we prepare, thus enabling more appropriate decision making for infrastructure, adaptive management, disaster risk response and preparedness.

These insights are useful for the Karpowership SA Projects because it provides an understanding of the site and potential changes because of climate, for which Karpowership SA can ensure that it considers in design and disaster risk management – this may be for the Karpowership SA related infrastructure and operations, as well as the investments that are made in local communities.

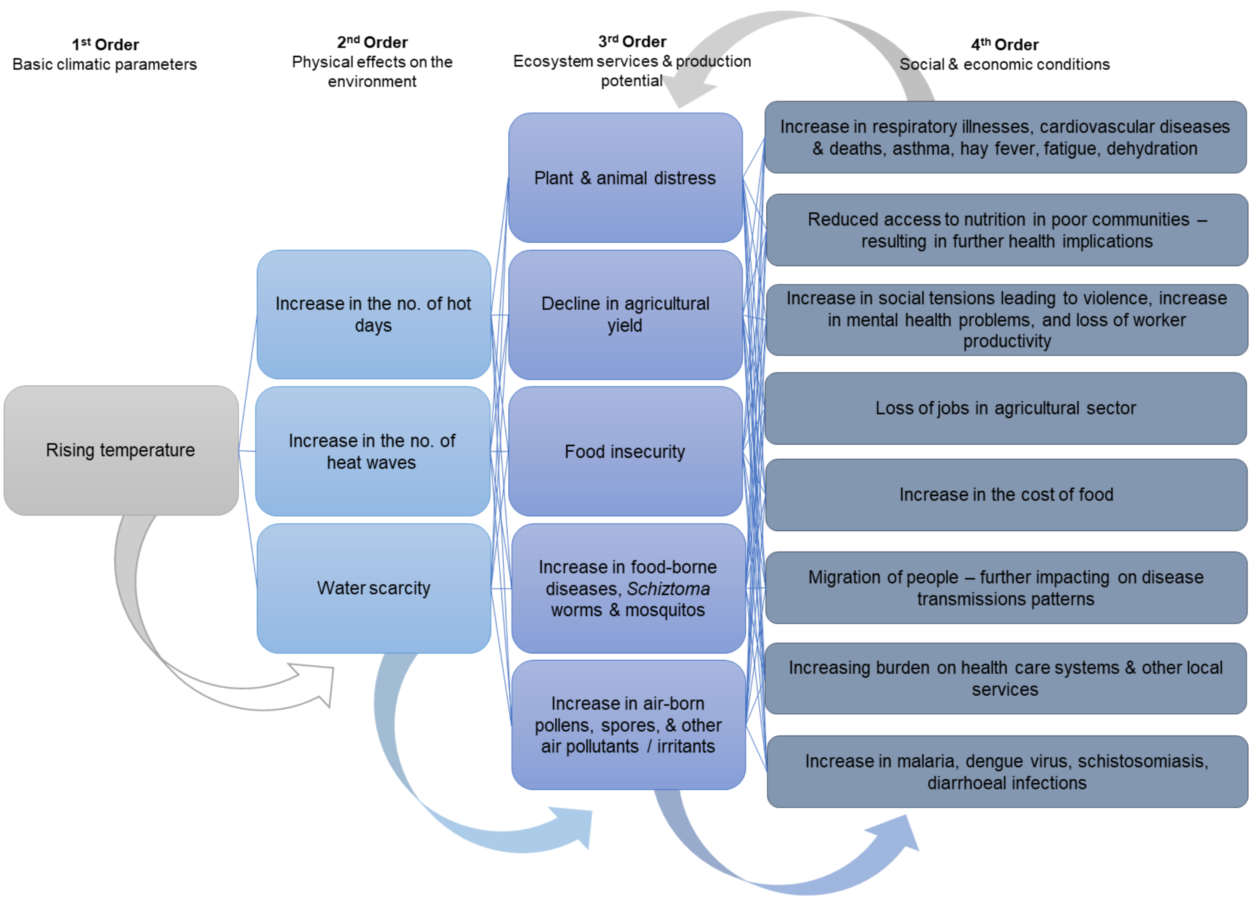

Figure 7-15: Anticipated cascading direct and indirect impacts of climate change

The Promethium Carbon report (2022) concludes that this project will assist in alleviating the socio-economic pressures caused by South Africa's electricity supply crisis, and the benefit associated with this outweighs the contribution of the project to global GHG emissions. The assessment of the climate change impact of this project has been done on the impact of the project on climate change, the resilience of the project to climate change, as well as the options for mitigation of the impacts. The Climate Impact Assessment should be referred to for further detail. However, this chapter provides a supplementary discussion to this assessment, providing a lens through which direct and indirect cascading impacts of climate change can be understood at the project site.

A direct causal relationship between the proposed project and climate change impacts that will be experienced in Richards Bay cannot be established. This is because of the transboundary nature of greenhouse gases, and the fact that climatic systems are global systems. Therefore, it is the global stock driving the climatic changes that are being experienced in a range of ways across the world. However, this chapter illustrates how we may understand these cascading impacts at the site scale to further interrogate the climate readiness of the proposed project, and better inform management and mitigation recommendations.

Key aspects that the Climate Change Impact Assessment report highlights for this chapter include anticipated climate shifts that are expected to be experienced in Richards Bay over the next 30 years, based on climate change modelling (Promethium Carbon, 2022):

- Mean annual temperature is expected to increase by at least 0.5°C over the next 30 years whilst very hot days is likely to increase by up to 18 days per year.
- Despite mean annual precipitation increasing in small amounts, there does not appear to be an increase in extreme rainfall days. Although, this is not to suggest that rainfall amounts during storms will not increase, increasing the potential for flooding.
- By 2050, drought and coastal flooding risks are classified as extreme relative to the current/near-historic baseline, whilst the fire risk are classified as medium.
- With regards to storm surges and wave height, Richards Bay is vulnerable to tropical storms and cyclones, with data showing increasing intensity and westward movement of these low-pressure systems. In combination with sea level rise, the risk of storm surges and intense wave action increases. These risks are difficult to quantify and require further research to elaborate on the risks to region, or the site. However, this has been considered in the project design and impacts are anticipated to be low and will not affect core operations. Although, this may still affect the surrounding environment and local communities.
- Ocean pH levels have consistently declined since at least the middle of the 20th century and will continue to do so. This will not have a material impact on the project but could impact marine biota. The impacts thereof should be informed by the relevant specialist(s).
- There is little information on changes in wind in under future climate scenarios. Research suggests generally stronger winds by small percentages over current speeds. Any increases in wind speeds will, however, amplify the impacts during storm events due to the interaction with waves and ocean currents.

- Sea level has increased by ±4.2 cm since the late 1970s and is likely to rise by 10-40 cm by the middle of the 21st century. Again, this is not likely to have a material impact on the project but could act to amplify storm surges during storm events.
- Mean sea surface temperature has increased by ±0.89˚C since 1900 and is currently around 24.3˚C. This could increase to up to 25˚C by 2030 and 25.3˚C by 2050. The warming of temperatures in the Richard's Bay region and further north into the Mozambique Channel may result in more favourable conditions necessary for the formation of tropical cyclones.

Based on the above-mentioned points, a 1st to 4th Order Framework was prepared for the Port of Richards Bay. As described in the methodology chapter this approach is based on work done by the World Bank and tries to categorise impacts in 4 groups: 1. Basic climatic parameters; 2. Physical effects on the environment; 3. Ecosystem services and production potential; 4. Social and economic conditions. Increase in mean annual precipitation and mean annual temperature were taken as the two most prominent changes that will be experienced as basic climatic parameters over the next 30 years. This influenced the understanding of the remaining orders.

Water scarcity and drought are anticipated to be an extreme risk because of reduced rainfall, and the increased number of very hot days by as much as 18 days. This is a risk to the municipality, local industry and local residents that will need to be managed with foresight and careful planning. This challenge is not unfamiliar to South Africa, with several towns and cities experiencing drought and day-zero scenarios over the past few years. These experiences, and responses thereto, can be drawn on in strategic planning for baseline conditions and emergency responses.

Increasing water scarcity and increasing temperatures increases the risk of fires, which is anticipated to be a medium risk in the region over the next 30 years. This risk has likely been compounded by the drought conditions and increased number of very hot days. Similar to the flooding response, this should be carefully considered in terms of disaster risk management and emergency responses. This may include early warning systems, and community preparedness programmes.

The Promethium Carbon (2022) report further found that there is potential for increased exposure to tropical storms and cyclones, with a high impact and low probability of occurrence. This risk may be further exacerbated if coupled with the increased risk of storm surges and intense wave action. This will also increase the likelihood of localised flooding events – this is anticipated to be marginal in the port because it is a relatively sheltered environment. While the proposed project has considered this in the design and operations, and therefore the impact is low and will not affect core operations, it is not clear to what extent the surrounding environment and community may be affected. This should be carefully considered in terms of disaster risk management and emergency responses. This may include early warning systems, and community preparedness programmes, which could be aligned with corporate social investment of the Karpowership project.

Cascading effects on ecosystem services and production potential will likely be experienced as heat and water security related stresses; enhanced evaporation rates, furthering the water security challenges; infrastructure and ecosystem damage, declining agricultural yield and consequently food insecurity; increase in food-borne diseases, worms and mosquitoes; increased air-born pollens, spores and other irritants; and increased reliance on cooling systems, furthering greenhouse gas emissions. This in turn could yield an increase in respiratory illnesses, cardiovascular diseases and deaths, increased malaria, dengue virus, schistosomiasis, and diarrhoeal infections; rising cost of food, water shortages and potentially a 'day-zero' scenario; reduced productive work days and job losses; reduced access to nutrition, particularly in the lower income households, resulting in further health implications; Overall, there is likely to be an increased burden on the various healthcare services, basic services and infrastructure; with increased social tensions leading to increased violence, mental health problems, and further loss of worker productivity. Through foresight in planning and service delivery this could be well managed. There is also potential for Karpowership SA to identify related specific community needs which they can invest in through its CSI projects.

7.9 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 use during 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;
- 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 restricted 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;
- Monitoring of the avifauna and noise impacts on the sandspit and adjacent Kabeljous flats are implemented 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 MOTIVATION, NEED AND DESIRABILITY

8.1 STATUTORY REQUIREMENTS

The 2014 EIA Regulations (as amended), (see: Appendix 3 – section 3(1)(f)) require "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". Subsection (1)(g) further requires "a motivation for the preferred development footprint within the approved site (Port of Richards Bay), as contemplated in the accepted scoping report".

Guidance on how to assess "Need and Desirability" (N&D) is set out in Integrated Environmental Management Guideline "Guideline on Need and Desirability", Department of Environmental Affairs, 2017. Section 24O of NEMA requires that the CA must have regard for any Guidelines published in terms of section 24J of NEMA and the Guideline on Need and Desirability is such a guideline.

At its core, addressing N&D is a way of ensuring that a development is sustainable and that a development is ecologically sustainable and socially and economically justifiable, ensuring the simultaneous achievement of the triple bottom-line N&D and thus also necessitates the assessment of the "broader community's needs and interests" within the context of the proposed project, its location and alternatives.

One of the ways that this is done is by considering applicable national strategy as developed from the broader global agreements and collaborations as well as locally adopted policies, programmes and plans:

- National Development Plan 2030 (NDP) (2012);
- The Integrated Resource Plan (IRP) 2019;
- The Framework for a Just Energy Transition (JET) in South Africa (2022);
- SADC Regional Gas Master Plan (2022).
- Regional and Municipal and Sectoral Planning e.g. SEA, IDP, SDF and TNPA Port Planning.

Assessment of N&D in the EIA context involves the consideration and application of the principles set out in section 2 of NEMA. (Guideline on Need and Desirability; Sections 1 - 4). The guideline on Need and Desirability sums up the above conveniently as follows: "The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately development must not exceed ecological limits in order to secure ecological integrity, while the proposed actions of individuals must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development – i.e. ensuring the simultaneous achievement of the triple bottom-line. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the "most practicable environmental option", which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term".

The Guideline accordingly identifies two fundamental questions, broken down into numerous sub-questions, to be investigated and assessed in considering the N&D of a proposed project. These are:

- How will it secure the ecological sustainable development and use of natural resources?"; and
- How will it promote justifiable economic and social development?

For the purposes of this report, the authors have made every effort to comply as fully as possible with the Guideline on Need and Desirability, as modified by the context of the application, by considering the above questions (and sub-questions) posed in the Guideline on Need and Desirability.

The authors provided detailed discussions on the macro and micro related aspects of the project as well as a summary of those aspects of the project which demonstrate that the proposed project is both necessary and desirable (Section 8). Many may constitute a repeat of material in other sections of the report but have been replicated in order to ensure the fullest compliance with NEMA and its regulations.

Considering the NGOs and green lobbyist groups that fundamentally oppose gas as a transition fuel or a desirable option within the current energy crisis, information regarding the geopolitical context, gas-to-power projects and the Just Energy Transition in the South African political economy as well as loadshedding was provided, based on independent contributions as per below (refer to Appendix 8 for CV, Independence Declarations and full reports):

- Gas-to-Power Projects and the Just Energy Transition from Fossil Fuels in the South African Political Economy by the team of experts from Political Economy Southern Africa (PESA),
- South Africa Country Specific Energy Security Assessment by Noqazo Group;
- The economic Impacts of Loadshedding and by Afro Development Planning;
- Sustainability Report – a synthesis of the impacts of the proposed Powership at the Port of Richards Bay, South Africa by Afro Development Planning

These contributions contextualised the need as well as desirability from which it is concluded that the project is both needed for South Africa as well as being a desirable technology to alleviate loadshedding and climate change impacts associated with avoidance of impacts due to the replacement of coal or diesel with gas.

The latter part of this chapter addressed the need and desirability from a local perspective in terms of the alternatives as well as ecological perspective. Chapter 7 further showed that the project is environmentally acceptable (desirable) from a polycentric perspective having given due consideration to the local as well as broader social-ecological factors. The summary and conclusion is repeated for completeness purposes.

8.2 PROPOSED DEVELOPMENT WITHIN THE GLOBAL, SOUTH-AFRICAN LOCAL SETTING

This section contextualises the macro (global, national and strategic) as well as micro (local) political, socio-economic, environmental and planning setting within which the Project is being proposed.

8.2.1 United Nations Sustainable Goals

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 – The economy is sustained or growing with job security or creation ensuring social upliftment;

3: Good Health and Well-Being – Waste water treatment systems are working and raw sewage is not polluting watercourses causing cholera and diarrhoea to those without waterborne sewage. Rural communities, healthcare services and poor households without alternative energy back-up systems may sustain lives and air quality improvements from cleaner burning fuel or renewable alternatives may ensure improved health;

4: Quality Education – Energy for modern training (internet, computers) and studying with adequate light is available;

5: Gender Equality – Women is not required to collect wood and to “cook down” over open fires;

8: Decent Work and Economic Growth – Work and economic development opportunities (direct and indirect);

9: Industry, Innovation and Infrastructure – New technology; and

13: Climate Action – Improved technologies, transition and mitigations ensuring progress to meeting targets.

Figure 8-1: United Nations Sustainable Development Goals (Source: UN General Assembly, 21 October 2015).

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).

8.2.2 Paris Agreement, National Development Plan (NDP) (2030) and IRP 2019

South Africa is a signatory to the Paris Agreement on Climate Change and has ratified the agreement. In line with Intended Nationally Determined Contributions (INDCs) (submitted to the UNFCCC in November 2016), South Africa's emissions are expected to peak, plateau and from year 2025 decline. The energy sector contributes close to 80% towards the country's total greenhouse gas emissions of which 50% are from electricity generation and liquid fuel production alone. There is action to reduce emissions with investment already in renewable energy and energy efficiency (IRP, 2019).

The NDP envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution. In formulating its vision for the energy sector, the NDP took as a point of departure the Integrated Resource Plan (IRP) 2010–2030 promulgated in March 2011.The IRP is an electricity infrastructure development plan based on least-cost electricity supply and demand balance, taking into account security of supply and the environment (minimize negative emissions and water usage (IRP, 2019)).

The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development (IRP, 2019).

Natural gas is an efficient and relatively widely available alternative to other fossil fuels and produces roughly half of the amount of CO2 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 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 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).

As stated by DMR, *"Emissions will peak as South Africa completed Medupi and Kusile, plateau for a while and then decline from about 2025 as South Africa decommissions some of the old coal fire power plants and replaces them with cleaner energy forms. There will, of course, still be some emissions, but South Africa is going to curb them, and cannot necessarily eliminate them. Even as we include gas to power going forward, as well as the much criticised 1,500 MW of new coal fired power in terms of the IRP, South Africa's projections show that emissions will remain well below peak plateau decline commitments South Africa has made in terms of the Paris agreement.* ***The gas to power we (South Africa) are now procuring in terms of the RMIPPP program will actually displace coal fired power that is not necessarily being decommissioned right now. So, emissions will reduce as less coal is burned, because the burning of gas is cleaner and has lower emissions than that of coal (DMR, www.esi-africa.com).***

8.2.3 Integrated Resource Plan (IRP) 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 objective of the policy which is as follows: *"**The energy mix. South Africa continues to pursue a diversified energy mix that reduces reliance on a single or few primary energy sources.** The extent of decommissioning of the existing coal fleet due to the end of design life, could provide space for a completely different energy mix relative to the current mix. In the period prior to 2030, the system requirements are largely for incremental capacity addition (modular)* ***and flexible technology****, to complement the existing installed inflexible capacity.*

In the policy document, **natural gas** is specifically referred to as follows: *"**Gas to power technologies in the form of CCGT, CCGE or ICE provide the flexibility required to complement renewable energy.** While in the short term the opportunity is to pursue gas import options, local and regional gas resources will allow for scaling up within manageable risk levels. Exploration to assess the magnitude of local recoverable shale and coastal gas are being pursued and must be accelerated."*

Gas to power is furthermore part of the Integrated Resource Plan 2019 at clause 5.3.5 which states: *"Whilst the plan indicates a requirement for 1000 MW in 2023 and 2000 MW in 2027, at a 12% average load factor, this is premised on certain constraints that we have imposed on gas, taking into account the locational issues like ports, environment, transmission, etc. This represents lower gas utilisation, which will not likely justify the development of new gas infrastructure and power plants predicated on such sub-optimal volumes of gas.*

Consideration must therefore be given to the conversion of the diesel powered peakers on the east coast of South Africa, as this is taken to be the first location for gas importation infrastructure and the associated gas to power plants.

It must be noted that the unconstrained gas is a "no regret option" because the power system calls for increased gas volumes when there are no constraints imposed." The risk assessment associated with the policy should also be incorporated in the environmental impact assessment and is identified as follows: *"The availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post-2030 when a large number of coal fired power stations are decommissioned."*

In terms of the mitigation measures adopted in the policy pursuant to gas, it is stated: *"For the period up to 2030 gas to power capacity in the IRP has realistically taken into account the infrastructure and logistics required around ports/pipelines, electricity transmission infrastructure. The IRP has therefore adjusted the lead times. As proposed in the draft IRP update, work to firm up on the gas supply options post 2030 is ongoing. This work will inform in detail the next iteration of the IRP."*

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.

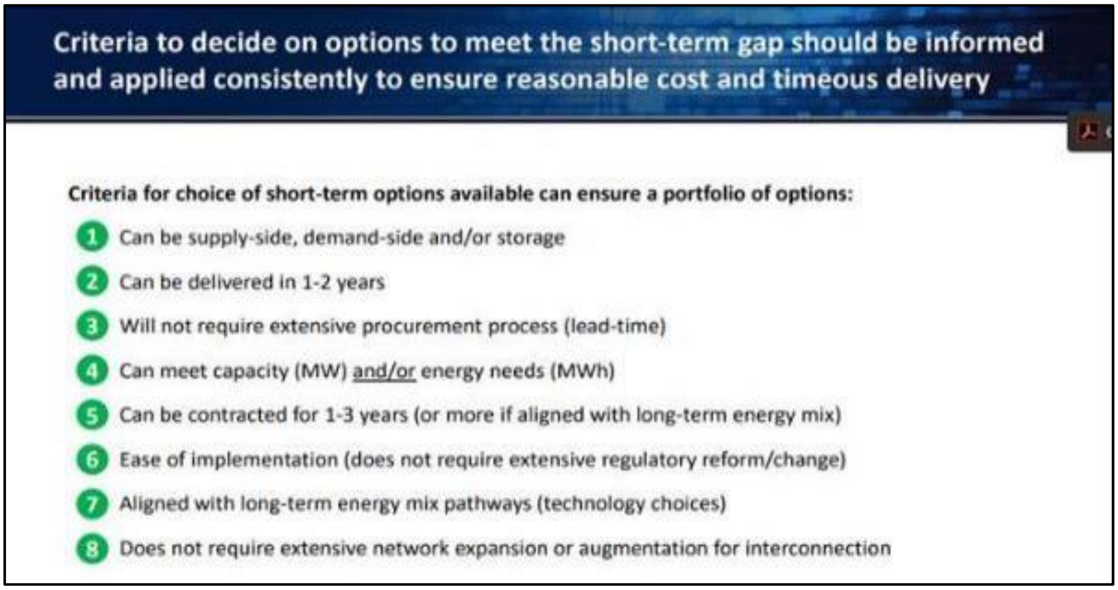

Figure 8-2: Extract from the CSIR Report (Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020).

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 Integrated Resource Plan (IRP) 2019 identifies the necessary generation mix of technologies to respond to the demand for electricity. Inherent in the planning process is the commitment to energy security, cost efficiency and effectiveness, and environmental sustainability. The Risk Mitigation IPP Procurement Programme succeeded in attracting project proposals featuring a variety of technology combinations. These determinations facilitate the process of procuring the required electricity capacity. The preferred bidders in the (RMI4P) were awarded to ACWA Power Projects DAO, Oya Energy, Umoyilanga, with two projects for Mulilo Total and three for Karpowership SA and three for Scatec. The Gas to Power Karpowership forms part of the solutions provided by the RMI4P preferred bidders that provides for a combination of a range of technologies that include, solar PV, wind, liquefied natural gas and battery storage.

Gas, as per the DMRE, has been identified as one of the most affordable forms of power. From the preferred bidders, only 1 bidder provided a lower cost, confirming the affordability of the gas to power project. Karpowership, projects will meet and exceed Economic Development qualification criteria stipulated within the RMI4P. Reference is made to Appendix D1 detailing the Economic Development Plan. Karpowership is committed to supporting Local Economic Transformation processes and as such, once the project has achieved Financial Close (FC), it will finalise local jobs and local procurement procedures. A comprehensive and transparent Community and Stakeholder Engagement process will be implemented once the project is confirmed. This will include engagements via local media such as the local newspaper, local radio stations and through whatever local communication channels exist. All businesses will have the opportunity to apply for tenders, provided that they meet the necessary criteria and all persons will have the opportunity to apply for jobs provided they have the necessary skill.

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 260 000+ direct employees, 10000+ indirect 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 (excluding vessels) operation period which will exceed the Economic Development criteria that must be met in terms of the RMI4P.

Considering all the above, Karpowership SA has committed to invest at least R18 billion directly into local economies. This R18 billion investment includes contributions to skills transfer and socio economic, local supplier, SME and women empowered enterprise development. 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. 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.

8.2.4 New Generation Capacity and Risk Mitigation Independent Power Producer 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 RMI4P 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:

- The RMI4P 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 decommissioning of the existing coal fleet (due to end of design life) will 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 acquiring 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).

8.2.5 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.

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.

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.

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. Models developed by the CSIR indicate how an increase in flexibility of the grid would occur with increased gas technology uptake. In their modelling on least-cost renewable energy uptake scenarios, more than 70% of the energy mix should be renewable energy by 2050 to be cost-optimal. The International Renewable Energy Agency (IRENA) was specific in their modelling, proposing that is it possible to have 85% renewable by 2050, to reach the 2°C scenario. Gas-to-power technologies hold a key role in the abovementioned models regarding the uptake of renewable energy onto the South African grid. The CSIR model proposes that gas-powered electricity should have an installed capacity of approximately 6GW by 2030 and 14GW by 2050. The proposed project could contribute to maximising the renewable energy uptake of the national grid, as well as decrease the emissions from electricity generation for South Africa.

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. 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.”

The RMI4P 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.

8.2.6 Economic Recovery and Energy Requirements

Sustainable energy provision is a 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).

8.2.7 South Africa Country Specific Energy Security Assessment by Noqazo Group

This section provides an overview of the geopolitical environment regarding renewables, decarbonation and the current energy crisis, as well as the context thereof for South Africa in view of the loadshedding being experienced in South Africa and the intended purpose of the RMI4P to reduce the energy deficit.

As stated in the Noqazo Group Report, (referenced from the CSIR, 2022) South Africa has been plagued by energy insecurity, manifesting itself particularly in electricity shortages, for well over a decade. This has led to loadshedding that is estimated to cost the economy approximately R87.5/kWh of unserved energy (CSIR, 2022), with losses to the economy of between 1 and 4 Billion Rand per day.

During 2022 the shortages reached the highest level ever, with the highest level of loadshedding being introduced over the longest period and for the most days per year so far. When considering that 84.4% of the South African population have access to electricity, it means that loadshedding directly and negatively impacts the lives and wellbeing of the 84.4% of the population. The economic cost of loadshedding is however experienced by everyone, although it is not felt equally due to the greater financial resilience of the affluent and their ability to invest in alternatives such as solar power and gas-powered appliances.

The impacts of loadshedding can be categorised as follows:

- Direct impacts are those which are most visible, for example a firm relying on electricity to power the machines required for operation.
- Indirect impacts are those related to the cost of coping with unreliable power supply.

(Coping costs are those costs incurred to mitigate the impact of loadshedding on operations).

The extent of the impact of loadshedding on businesses depends on a number of factors including, the sector in which business operates, the geographic location of the business, its operations and the ownership structure (i.e., state owned, domestic owned or foreign owned), etc (Rentschler et al., 2019).

At national level the impact of loadshedding would, for instance, be a function of electrification, population density and urbanisation. These factors, amongst other contextual variables, have a bearing on the extent of adverse effects of loadshedding on the South African economy.

Loadshedding has had a significant impact on the entire South African economy, from the largest energy consumers such as mines and manufacturers to SMMEs, increasing the risk for both international and local investors and impacting consumer sentiments. It is estimated that every day of Level 6 loadshedding in 2022 costs the South African economy R4bn (BusinessTech, 2022), while loadshedding in 2021 is estimated to have resulted in up to a 3.1% decrease in GDP growth, eliminating the opportunity for up to 400 000 potential jobs to be created (BusinessTech, 2022).

Studies conducted across 23 African countries found that a 1% increase in the frequency of power outages results in up to a 3.3% decrease in business output (Rentschler et al., 2019). These impacts are felt more significantly by small firms (Alby et al., 2013), as large firms tend to be better equipped to withstand electricity disruptions due to their ability to invest in back-up generation and due to their improved ability to cope with reduced sales and revenue attributed to interrupted production or service provision (Rentschler et al., 2019).

In addition to the direct impact on businesses, loadshedding has a tangible impact on investor confidence, reducing investment from both international and local sources.

Loadshedding has placed additional strain on economic growth, further hindering the economic recovery after significant economic contractions experienced during the COVID-19 pandemic (Statistics South Africa, 2022a). This impact on economic recovery is set to continue, given that as of the 14th of September 2022, 38% of 2022 experienced loadshedding (Whitfield, 2022), and Eskom expects at least level 2 loadshedding to continue intermittently for the remainder of 2022 (BusinessTech, 2022d). Furthermore, access to sufficient reliable energy is a fundamental driver of any country's economy – South Africa has a 35% overall unemployment rate, an unemployment rate of 63,9% for those aged 15-24 and 42,1% for those aged 25-34 years (StatsSA, 2022). Besides providing much needed electricity, the Karpowership projects are estimated to create 2287 job years per project (Other RMIPPP projects average 1341).

Considering that the energy demand gap is likely to widen over the next five to eight years as old coal-fired plants are decommissioned, the operational challenges associated with the older coal-fired power stations are likely to increase, and there is a delay in new energy provision relative to the timing presented in the IRP 2019 outlook, it is likely that loadshedding will continue until 2025 and possibly until 2030, with at least stages two to seven and possibly higher (Cruise, 2022; Davis, 2021).

The lack of electricity furthermore impedes the quality of service delivery such as health care, education, and other public services (Blimpo & Cosgrove-Davies, 2019). When considering the risk associated with intermittent power supply to medical facilities, the potential for loss of human life cannot be understated or quantified.

While most medical equipment can manage the switch between grid fed power and back-up generators some crucial equipment such as those required for ventilation is not able to do so (Mkize, 2019). Furthermore, the cost of utilising back-up generators for medical facilities can be costly, with Netcare reporting spending an average of R800 000 over a 6-month period on the diesel required to power their generators (de Wet, 2019). With approximately, 80% of South African citizens reliant on public health facilities, medical facilities will continue to be under significant stain during periods of loadshedding (Laher et al., 2019). Liberty Energy (2022) states that there is a clear correlation between energy access and the state of public health care.

8.2.7.1 Global Trends and Decarbonisation

As of 2021, primary energy consumption by source comprised coal which accounted for 25%, oil which accounted for 29% and gas which accounted for 23% of electricity generation globally.

Since 2005 the use of oil and gas has increased in the US. This was driven particularly by the increased use of and investment in shale gas, which was a clear and deliberate U.S. policy to delink their economy from Middle East oil and gas. Since the increase in domestic gas production, the U.S. has moved from being a net energy importer to a net producer of gas. Coal-burning in the U.S. is in the midst of its biggest revival in a decade, while China is reopening shuttered mines and planning new ones (Bloomberg, 2022).

The increase in production and consumption of oil and gas is not isolated as North America as a region also shows an increase. The picture in Europe is no different, as it has made energy security a priority ahead of its climate commitments. Europe continues to use more and more oil and gas and has now also increased its use of coal, energy security being the key driver.

Although Europe has significantly reduced its hydrocarbon production and has invested massively in wind, solar, and biofuel based energy, it has become more dependent on imported energy, primarily from Russia. As a result Europe is in the unenviable position of heavy reliance on Russia for natural gas, oil, and coal.

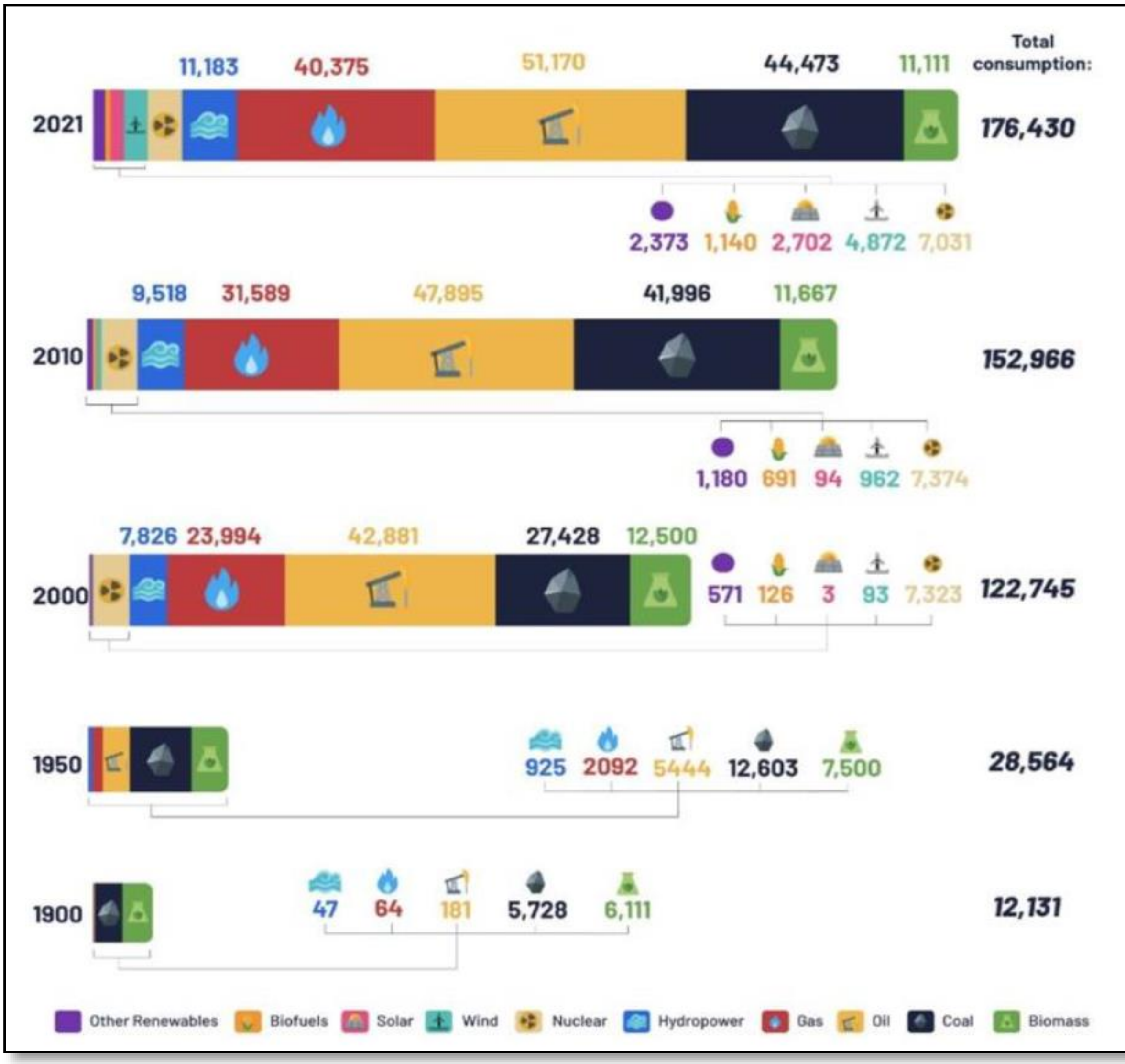

Figure 8-3: Global primary energy consumption by source (OurWorldInData, 2022a) (Noqazo, 2022)

Although Africa is being encouraged into decarbonisation by those who have benefited and continue to benefit from fossil fuels, the developed world has failed to set the example. The EU is buying up African gas from countries like Algeria, Nigeria, Senegal, Mauritania, and Mozambique (ABC News, 2022, FurtherAfrica, 2022) and is also buying up coal in large quantities (coal exports from South Africa are currently at very high levels) to secure their own energy needs. The polluting effect of coal exports is being especially experienced in Richards Bay, with a fine coal dust polluting the marine and adjacent ecosystems and having an impact on residents within the area. Several European countries have very recently stated that they are seeking Powerships from Karadeniz Holdings or other floating gas to power solutions to meet their energy needs this winter and beyond.

The UK government has placed the importance of energy security above environmental considerations stating: "the consequences of the Ukraine crisis have made the task of achieving net zero, while ensuring energy security and affordability, more complex. To help avoid a disorderly transition and to provide clarity to investors, the Government should publish a net zero delivery plan which takes account of energy security, making clear what decisions and operational actions are needed, and by when. Any such plan will need to incorporate the flexibility required by a three-decade, economy-wide transition" (House of Lords Economic Affairs Commitee, 2022). The report continued: "In the short term, Europe needs alternative sources of oil and gas to replace supply from Russia; and the UK will continue to require gas during the transition."

In Germany and Italy, coal-fired power plants that were once decommissioned are now being considered for a second life and the amount of coal exported from SA to Europe has increased. In the US coal-burning is in the midst of its biggest revival in a decade, while China is reopening shuttered mines and planning new ones (Bloomberg, 2022).

Global geopolitics and global geopolitical risks need to be considered in energy making security decisions making. During times of conflict, global energy prices has been shown to rise due to global energy interdependencies and nations looking to safeguard their own energy security. History has also shown that the access to energy is a weapon of war and "disruptions in energy supply chains has the potential to adversely affect the economies of nations that have not developed their own indigenous sources" (Noqazo Group, 2022).

The data presented as per Figure 8-3 shows that despite industrialised nations paying lip service to regarding their commitment to the decarbonisation of their energy systems, the demand for coal, oil and gas has continued to grow globally. Furthermore the EU has declared nuclear and gas to be green (Deutsche Welle, 2022).

South Africa should heed the international warnings and mitigations arising from energy security concerns within the complexities of decarbonisation agendas and programs for the developed and developing countries.

8.2.7.2 The Renewable Energy Myth

One of the most common myths in renewable energy circles entails the assumption that all necessary materials, global manufacturing capacity and supply chains are available. The IEA however estimates that supply of lithium, graphite, nickel and rare earths will have to increase by 4 200%, 2 500%, 1 900% and 700% respectively by 2040 to cope with the increased demand. The table below shows the most important materials required for the energy transition.

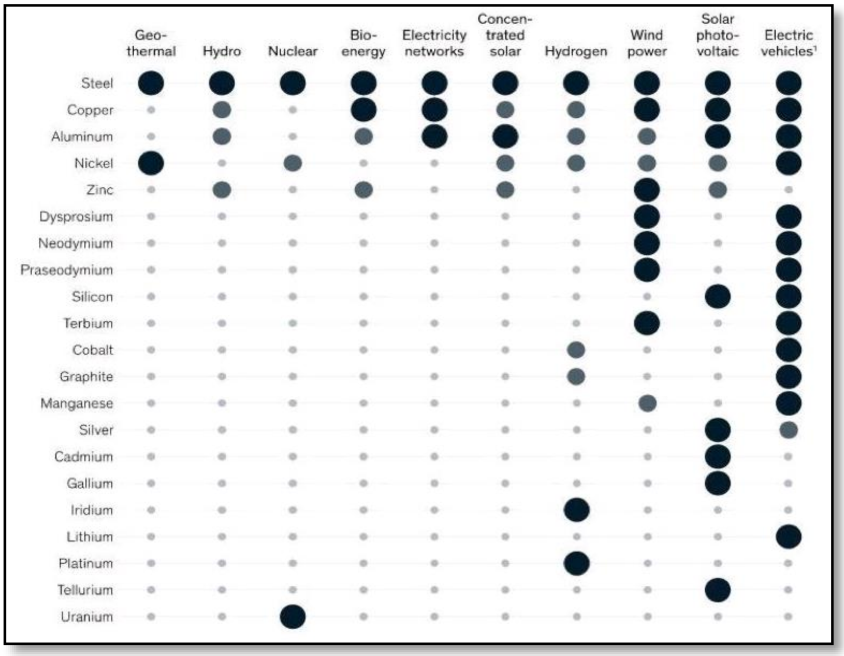

Figure 8-4: Materials critical for transition to a low carbon economy (Bobba et al., 2020)

Should South Africa continue a shift to reliance on renewables, instead of a wider mix exposure to global geopolitics and supply chain limitations may impact the economy, should geopolitics shift.

Renewable energy is often lobbied for being cheaper, however, Germany and Britain who have progressed much further in the transition have experienced electricity rate increases of 60% - 110% over the last two decades.

From an environmental perspective, the environmental and socio-economic impacts of obtaining the required materials via mining activities should be considered together with climate change impacts (inclusive of those generated through mining). In many countries therefore, gas has been accepted as a transitional fuel to provide dispatchable, reliable grid connected generation capacity as it has a lower greenhouse gas impacts than coal, diesel and other similar alternatives.

8.2.7.3 South Africa

The issues of energy access, sustainable development goals (SGDs) and justice cannot be separated, especially in light of the tremendous pressure put on Africa by the developed world to decarbonise and not make use of indigenous fossil fuels which ironically is in direct contrast to their own decisions to focus on their energy security. Significant discrepancies exist between electricity consumption in Africa that in the EU, confirming the developed world's hypocrisy, since per capita, the average EU citizen uses as much as 10 times more electricity than the average African user.

The United Nations' Human Development Index (HDI) is used as an indicator for human condition, combining life expectancy at birth, years of education received, and per capita gross national product.

Globally it has significantly increased from 62% of the global population scoring low in 1990 to currently only 12% scoring low – many of these people are however from Africa.

As with child mortality, there seems to be a clear correlation between energy consumption and an improved HDI. South Africa and the African continent need to improve access to affordable energy, to be able to improve the HDI. The impact and consequences of loadshedding on health has already been referred to earlier.

Another important measure of SDG 7.1 is access to clean cooking, which can be facilitated by both gas and electricity. Approximately 13% of the population is without access to clean cooking. As a percentage of the population, this number may seem relatively small, but this equates to a staggering 7.8 million people in South Africa without access to clean cooking. During loadshedding, this percentage increases dramatically as most of the lower income and disadvantaged population of South Africa does not have alternative means and revert primarily to wood fed open fires and paraffin use.

Although South Africa has done very well to improve electricity access (SDG 7.1) to about 95% of the population, this however is insufficient since access alone without the security of supply and accompanying affordability does not guarantee energy equity.

South Africa's energy mix (Total Energy Supply) is currently dominated by coal at about 75%, followed by oil at around 15%, with gas currently playing a minor role in the region of 5%. The renewable energy sector currently plays a very limited role in South Africa's energy mix, with only about 6GW installed to date.

Natural Gas (which can be imported in LNG form), is preferred over LPG for industrial and electrification applications due to higher available efficiency and lower environmental impact.
The South African situation can be summarised as follow:

- The country depends heavily on fossil fuels, primarily coal, and this cannot be abandoned overnight.
- Decarbonising the economy rapidly will undoubtedly lead to increased loadshedding and even lower energy security, stifling the economy and causing major job losses in the country, potentially leading to increased crime, political and social upheaval.
- Dependence on Mozambiquan gas exposes South Africa to single source political risk in Mozambique.

8.2.7.4 South Africa's Just Transition

According to the Presidential Climate Commission, 2022 South Africa's "just transition" framework is based on 3 principles of justice: distributive justice (e.g. equipping South Africans with skills, assets and opportunities for the future), restorative justice (e.g. acknowledging the health and environmental impacts to communities in coal and other fossil fuel impacted areas and supporting all South Africans' constitutional rights to a healthy environment, shifting away from resource intensive sectors and fossil fuels, creating a more decentralised(net-zero-emissions) economy, and procedural justice (e.g. empowering and facilitating transition with all stakeholders).

It is important to note the above core principles of the Just Transition framework because in reality the implication is that for South Africa's transition to be "just" it needs to:

- Be centred on Energy security, which is embodied in the principles of Distributive and Restorative Justice. This includes Ownership of:
  - Energy Resources
  - South Africa driving its own energy agenda, making own decisions on the energy mix
  - South African energy Policy needs to be owned and driven by and in South Africa's national interests
- Energy security also must include the principle of Energy Equity, which speaks to:
  - Availability which includes all energy sources available to the country
  - Accessibility and
  - Affordability

The critical role of energy has also been highlighted by the former United Nations Secretary-General Ban Ki-moon: "energy is the golden thread that connects economic growth, social equity, and environmental sustainability".

8.2.7.5 The Karpowership SA Projects

Insofar as the Karpowership SA projects are concerned, the average bid cost was R1,55/kWh for the 3 winning projects while the other winning bidders, offering primarily renewable energy technologies backed up with battery and fossil fuel technology to provide the required benefit of dispatchability, averaged about R1,63/kWh per project (DMRE, 2020a).

This clearly shows that renewable energy is not consistently cheaper and cannot presently provide dispatchable power at scale, which Gas to Power is able to do.

Spatially, a typical Karpowership will utilise 15 000m^2 to generate 470MW and that in the sea with minimum use of land for connection infrastructure whilst the footprint for a similar gas to power plant on land would be approximately four time as much.

8.2.7.6 Conclusion

South Africa, like most of the rest of the world, is experiencing an energy security crisis and the SA government has acknowledged the need to create additional energy sources and has amended some legislation accordingly.

It is necessary that the solutions be sought and implemented:

- in a holistic manner,
- taking into consideration global trends and experience and lessons learnt from other countries,
- taking cognisance of all related aspects and their various inter-relationships
- considering various options open-mindedly without being brainwashed or coerced by other countries & organisations.

It is evident that gas is a necessary transitional energy source (and has been declared as 'green' by the EU) and that not all arguments against gas such as cost and environmental impact are founded within the context of the project within South Africa's energy crisis and policy frameworks for climate change and renewable energy.

8.2.7.7 Salient Points

- SA is in an energy crisis like many other countries
- Other countries have progressed further in energy transition and have experience and expertise
- It is not for other countries, organisations or individuals to be prescriptive to SA while not following the same agenda in practise, or acting with ulterior motives
- A number of myths exist regarding decarbonisation
- A number of myths exist regarding gas as a source of energy
- These myths should be dispelled and true facts disseminated and considered
- It is not a matter of "the one or the other", rather obtaining the ideal energy mix
- The UN has declared gas to be "green"
- LNG is a cleaner gas than LPG and is cleaner than coal and oil
- The Karpowership projects:
    - meet the criteria of affordability
    - provide positive solutions to the energy crisis
    - reduce the negative impact of loadshedding on the citizens of SA
    - reduce the negative impacts of loadshedding on the economy
    - improve the wellbeing of the country and its people.

8.2.8 Gas-to-Power Projects and the Just Energy Transition from Fossil Fuels in the South African Political Economy by the team of experts from Political Economy Southern Africa (PESA)

8.2.8.1 Introduction

There are many areas of debate regarding the global transition away from fossil fuels, including the potential impact of the transition on existing livelihoods that are dependent on fossil fuels and related value-chains, the correct pathways towards achieving net zero, or even the feasibility and reliability complete dependence on renewable energy. The many competing arguments also struggle with balancing between the need to resolve energy shortages versus minimising the adverse impacts on the environment. This is certainly the case in South Africa due to the necessary interventions needed to deal with the severe energy shortages, transform the economy away from long-term dependence on raw mineral commodities, and reducing environmental degradation impacts.

South Africa takes an integrated approach to economic planning, environmental management and sustainable development. This approach requires the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations. The approach takes a polycentric view to sustainable development and emphasises social, economic, environmental and political economy factors that are crucial for sustainable development.

A polycentric view allows for more than one centre of development or control, which allows various stakeholders to play their part or cooperate towards the central objective of sustainable development. Hence, the integrated approach to environmental management and economic planning has led to the development of the just transition approach to the global transition from fossil fuels as a way to ensure that the many diverse developmental needs can be consolidated around a common objective of sustainable development.

8.2.8.2 The Political Economy of the Just Energy Transition in South Africa

In South Africa, the energy sector contributes close to 80% towards the country's total greenhouse gas emissions of which 50% are from electricity generation and liquid fuel production. More than 90% of South Africa's electricity is generated from coal and it is anticipated to remain the main fuel source for power generation for the foreseeable future. South Africa's National Development Plan (NDP) prioritised the need for energy infrastructure to be robust, extensive, and affordable to the meet the needs of industry, the commercial sector as well as households. As part of addressing the goals of the NDP and simultaneously addressing the need for South Africa to lower its GHG emissions, the Integrated Resource Plan (IRP) 2019 was developed, and numerous independent power producer (IPP) procurement programmes launched to procure additional generation capacity through renewable energy, coal fired power, and more recently, generation capacity from a range of dispatchable energy technologies, through the RMI4P.

The RMI4P was designed to procure new generation capacity from a range of source technologies to address the electricity capacity supply gap as identified in the IRP2019; and to reduce the extensive utilisation of expensive diesel-based peaking open cycle gas turbine (OCGT) generators in the medium-to-long-term.

The DMRE envisaged the RMI4P being based on the following qualifying criteria:

- Job creation, Local content, Preferential Procurement, Enterprise Development, Socio-economic development requirements being met
- The minimum dispatch commitment under the RMIPPPP is for a 50% load factor in a year
- Provide different charge rates for a load factor of 100% and at 75%
- Provision of ancillary services
- There is no take or pay, buyer will issue a dispatch notice

The key benefits of this programme are not having to sign take or pay PPAs however one should be cognisant that without the certainty of take or pay contracts and without a 20-year PPA, the tariff could have easily increased threefold.

The balance was designed to transition South Africa's energy mix while recognising the limitations of the coal fleet and balancing that with renewables, gas and lesser extent batteries. World over, transitions are taking place with the increased use of gas for balancing the electricity generation system, as is seen below from the sample countries:

Figure 8-58-5 depicts the use of gas by Germany, Great Britain and Ireland in June 2020. Gas is preferred for nations undergoing an energy transition and who also have a growing variable renewable energy penetration. Figure 8-68-6 shows how 2 years later there is an ever-growing need for gas and it makes up a significant part of the energy mix.

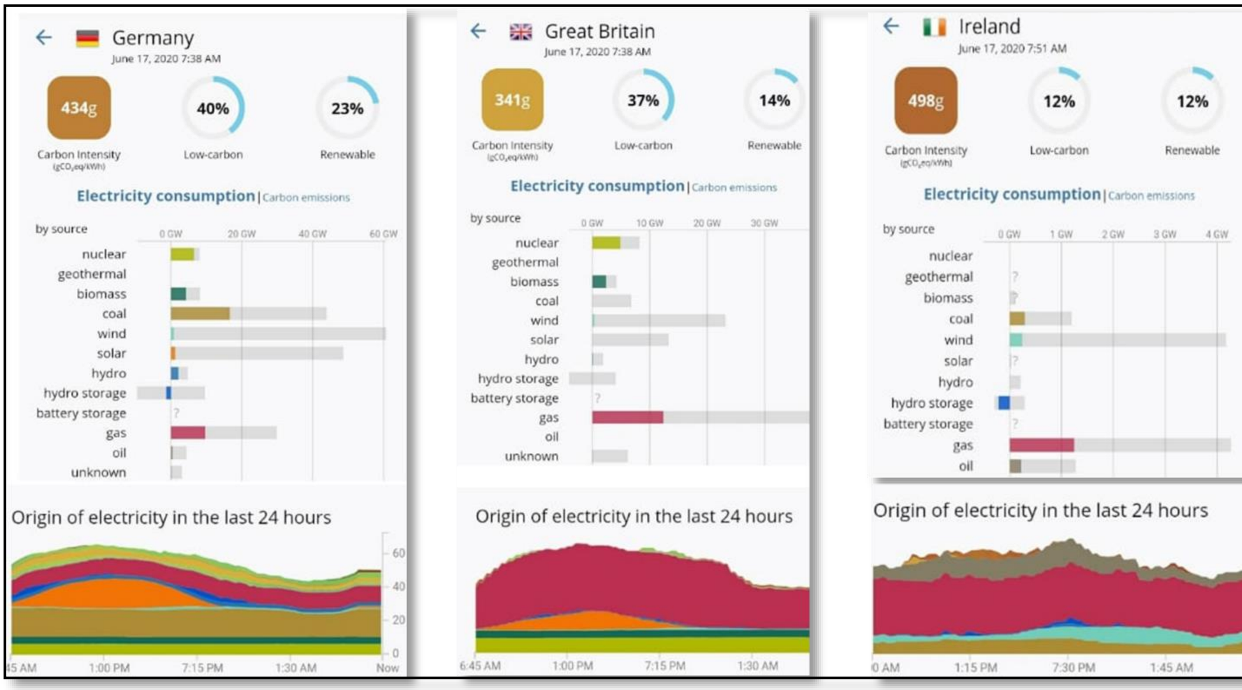

Figure 8-5: Electricity Map (June 17 2020)

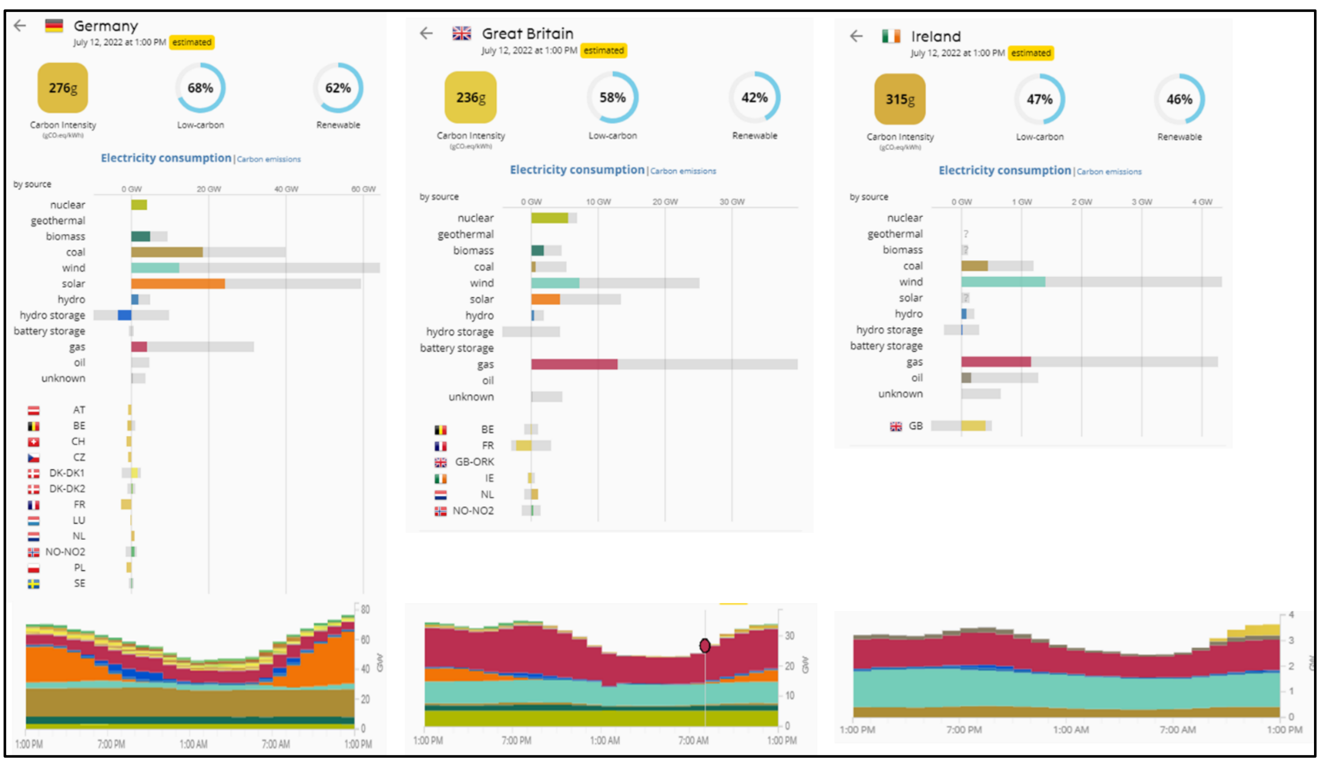

Figure 8-6: Electricity Map (July 12 2022)

The greyed-out bars on both Figure 8-5 and 8-6 indicate the installed capacity of the technology and the colour indicates what was dispatched. In both instances we see the low dispatch of renewables necessitating the need for the dispatching of nuclear (Germany and Britain), coal and gas. The need for dispatchable technologies is an immutable fact given the variance of renewable energy that could threaten energy security. Governments worldwide are considering various technologies to ensure energy security however in gas constrained Europe, Germany has decided to keep their nuclear plants opened and are considering Powerships.

8.2.8.3 Role of Gas-to-Power in the South African Energy Mix

As South Africa increases its renewable energy penetration through further renewable bid windows, it is evident that dispatchable and flexible generation is required – which is found in gas and to a much lesser extent, battery technology. The role of gas is indisputable in the just energy transition as it provides additional dispatchable capacity at scale that enables the large exploitation of renewable resources.

The oft mentioned costs of gas and lack of infrastructure are the two main inhibitors to the mass adoption of gas infrastructure. It has become acceptable to quote the declining costs of renewables and their offering as the least cost of energy however this basis of comparison with dispatchable technology is factually incorrect. As what is found in the Meridian Economics Report titled “Resolving the Power Crisis Part A: Insights from 2021 - SA’s Worst Load Shedding Year So Far. The Meridian report states that had South Africa installed 5GW of renewable capacity, it would have reduced loadshedding significantly in 2021.

However, least-cost as a measure of comparison leaves out the cost of service from the tariff, thus inappropriate comparisons lead to inappropriate expectations. The cost of service includes frequency and voltage control, transmission, synchronous power, dispatched ramping, system balancing and last mile connections. In developing and maintaining energy systems, optimisation outcomes of energy modelling must not be confused with the technical requirements of operating an energy system.

In South Africa, continuous renewable bid windows have resulted in decreased tariffs over the last decade. The REIPPPP bidders bid on a per unit energy costs and not the cost of the actual service. The service costs are borne by Eskom with no compensation from the renewable IPPs. The closest the system costs have been reflected was with the RMIPPPP tariffs, which included energy, dispatchability, voltage stability and storage costs.

It is for this reason that when technologies are modelled for the IRP2019, they include a multitude of parameters such as system and transmission constraints, load following, dispatch costs and energy costs amongst others.

8.2.8.4 South Africa’s energy demands

With the likely demand profile for electricity in South Africa being uncertain, the amount of generation required will remain unknown. However, for portions of generation that will be provided by variable sources, provision must be made for supplying all the generation from dispatchable resources in the times where the variable sources do not provide the required energy. Energy technologies are classified as dispatchable or non-dispatchable. Both these technology groupings play an important role in meeting baseload and peaking demand and thereby ensuring security of supply. Non dispatchable technologies provide capacity and intermittent energy.

Dispatchable technologies such as gas, coal, nuclear, oil and even hydro play a pivotal role in ensuring security of supply globally. Dispatchable technologies provide the following benefits:

- Peak Capacity
- Dispatched Ramping
- Energy
- Synchronous Power
- System Strength
- Frequency moderation
- Voltage stability

When considering energy supply options, the continuous delivery of customer requirements needs to be achieved. Typically, the morning and evening peak as well as daytime load needs to be catered for with a sufficient reserve margin and peaking capacity. A typical daily load profile graph is given below, the lines indicate the continuous delivery of the customers' requirements. The orange line, residual demand, is the hourly average demand that needs to be supplied by all resources that can be dispatched by Eskom National Control. It includes Eskom generation, international imports, dispatchable IPPs and Interruption of Supply. The grey line indicates South Africa's contracted daily demand which includes residual demand as well as supply from all sources such as IPPs.

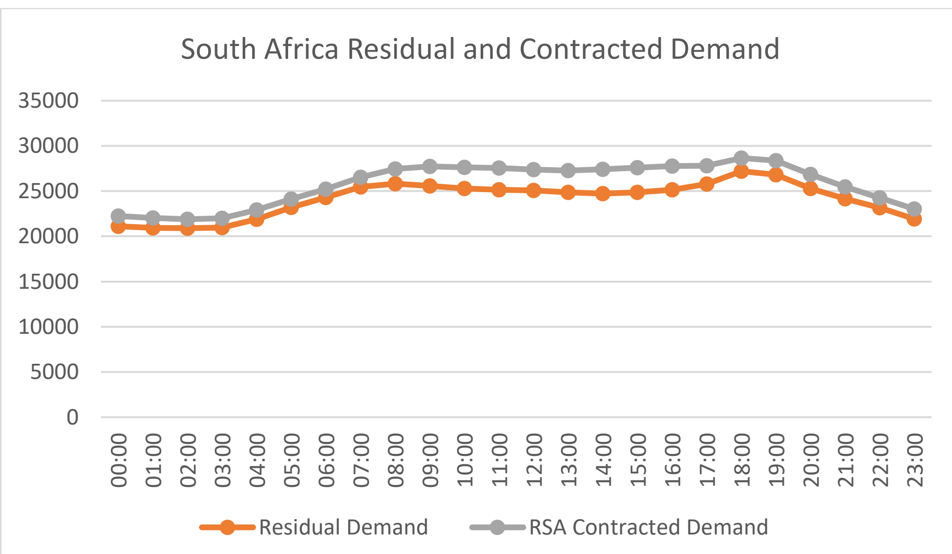

Figure 8-7: Typical Daily Load Profile (01/04/2022)

When comparing energy supply options, the 6 Cs need to be considered (LCOE cake):

- Cost;
- Convenience;
- Continuity;
- Consistency;

- Choice; and
- Consciousness.

Dispatchable technologies typically meet these requirements and thus meet the needs of the customer. Generators must meet two criteria to ensure security of supply – dispatch and energy. The question then arises of what the optimal energy mix is to ensure security of supply. The illustration below points to a diversified grouping of technologies that will ensure an optimal mix, however people only want to focus on the levelised cost of energy (LCOE) element as the only determinant of technology selection. LCOE includes the initial capital, discount rate, as well as the costs of continuous operation, fuel, and maintenance over the life of the project. However, it does not address energy security. An optimal energy mix considers the needs of the system throughout the day, it is technology agnostic and considers grid limitations.

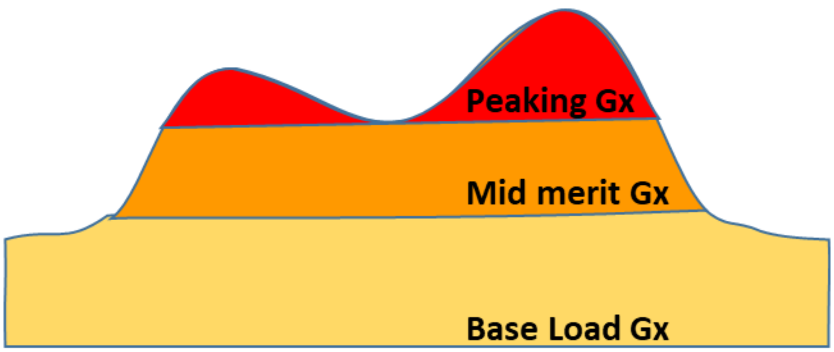

Figure 8-8: Optimal Energy Mix

A system that needs to meet customer requirements cannot be based on dominant discrete services. This does not mean that non-dispatchable technologies are good or bad, they are just different.

Figure 8-7 illustrates how wind and solar provide energy during their typical hours, albeit intermittently however they are not able to provide all the other requirements for a functional energy system. Figure 8-9 however looks at the benefits of a stacked product offering which considers both dispatchable and non-dispatchable technologies. In that instance, all the elements to ensure energy security are met.

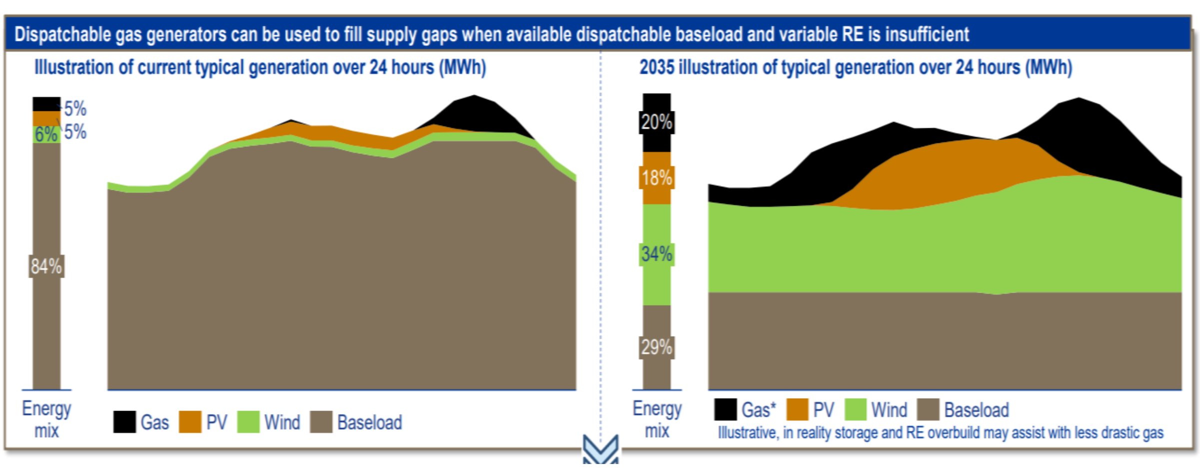

Figure 8-9: Stacked Product Offering (Eskom)

This stacked product offering is premised on the following insights:

- Increasing levels of variable renewable energy (RE) in an energy system will result in the increased need for balancing resources to supply energy when non-dispatchable renewable energy is not available
- Montecarlo simulations run by Eskom system modelling indicate a need for dispatchable power to achieve an operable system
- Based on available technology, gas plants are viable solutions for grid balancing because of their relatively low capital costs and fast ramp rates
- Commodity pricing, political risk and forex exposure present significant risks to gas investment - price and exchange rate volatility associated with gas (EU gas up >400% y-o-y)
- While the technology developments and decreasing costs of alternative or supplementary resources (BESS) is promising - indigenous and regional gas development will mitigate the risks related to commodity pricing and forex

Techno-economic and social considerations, as well as long term sustainability should guide technology selection decisions. The following considerations should be made when assessing technologies:

- Short Term: Lowest cost option with viable technology delivery mechanisms that enable energy security, accessibility, affordability, and sustainability, and
- Long Term: Mitigate risks associated with stranded assets.

8.2.9 Risks and Opportunities for Gas-To-Power in the Just Transition

While most of the gas is currently supplied and distributed by Sasol, further development of a gas economy and infrastructure in South Africa will require significant planning and investment in the context of South Africa's NDC commitments. The required infrastructure includes LNG import terminals, storage and regasification facilities, primary high-pressure gas transmission pipelines and secondary distribution pipeline networks. As to ensure stronger regional integration and sustainable development the planning and implementation of gas-to-power infrastructure in the SADC region should follow a carefully considered collaborative and partnership approach. This has already been evidenced by the partnership between South Africa and Mozambique on the ROMPCO pipeline. A similar approach will also serve to advance a just transition by supporting the creation of new economic activity around the gas-to-power value chain. The table below summarises a cost-benefit analysis of developing a sustainable gas-to-power industry in SADC:

Table 8-1: Cost-Benefit Analysis of Gas-to-Power in SADC

Approach / Cost-Benefits	Gas-to-Power	JET	Renewables Reliant
Costs	Environmental – While gas is a cleaner energy source that oil and coal, it remains a source of GHG emission	Extensive socio - economic impact that requires meaningful consultation of all key stakeholders.	Flexibility component in the form of new dispatchable power or storage required to

Approach / Cost-Benefits	Gas-to-Power	JET	Renewables Reliant
	especially when the entire value chain is considered.		ensure continue stability of the grid.
	High cost of developing and upgrading gas infrastructure.	Investment in reskilling and upskilling of staff employed in existing coal fired stations.	Investment required to resuscitate local manufacturing capacity for components and research and development in enhancing technologies.
	Gas price indexed to global oil prices, and as such exposed commodity price shocks.	Gradual and phased process that may require detailed industrialisation and beneficiation components to be built.	Constrained transmission capacity, particularly in the Northern Cape will require investment in capacity expansion an identification of new sites.
Benefits	Supports transition towards lower carbon future.	Existing connection and transmission infrastructure which reduces deployment cost construction time relative to new renewable plants.	Short time frame of 18 to 24 months in getting renewable power onstream.
	Strong demand for gas in South Africa and the SADC region.	Potential for creation of new local industries in the repurposing of old power stations. Allows for shift to community ownership models	Established technologies with well mapped resources.
	Collaboration supports regional integration, diversification of gas sources and ultimately regional energy security by developing already discovered resources.	Unlocks access to Just Energy Transition Partnership (JETP) funding and other financing opportunities.	Cost of technologies have declined over time with established financing framework.

Approach / Cost-Benefits	Gas-to-Power	JET	Renewables Reliant
	Established regulatory framework requiring minor amendments.	Preserves energy security but may be limited in term of scale and speed of implementation.	Can incorporate battery storage technologies to enhance security of supply.
	Gas as an alternative to diesel fuel with the conversion of existing/decommissioned plants.	Maintains livelihoods of affected individuals.	Established framework in the form of the REIPPPP.

The key economic consideration for gas-to-power is to ensure the sustainability of gas as an energy source given the requirements of the South African economy. South Africa's IRP2019 provides details in terms of the sources of gas supply and required supporting infrastructure. Government has however identified the development of Coega LNG Hub and/ or Richards Bay LNG Hub in partnership with Transnet, which will facilitate the importation of LNG to South Africa. To increase the access to gas and support the gas-to-power industry, the government of South Africa through the Central Energy Fund and its subsidiaries looks to strengthen the downstream gas market increase the utilisation of some of its underutilised assets including:

- Repurposing of aging coal fired power plants with 5,000MW planned for decommissioning by 2024 (and another 5,000MW by 2030);
- Planned 3,000MW Gas Power Plant which will require connection loop to the pipeline network;
- Current OCGTs which can be switched from diesel to Gas;
- Develop industrial/commercial markets with limited access supply from Sasol;
- Collaboration with Transnet, which operates the Lilly Gas Pipeline which connects Secunda and Durban and presents opportunity to connect the pipeline to Coega LNG terminal;
- Development of a Gas Trading capability, focusing in the Short-Medium Term on Mozambican gas supply and in the Long Term on Southern African gas supply.

The national power utility Eskom remains under significant financial pressures and operational challenges. This has resulted in the delay of major projects while the breakdowns within its aging coal fleet have resulted in long running rolling blackouts. The economic impact caused by the impact of loadshedding, and a lack of clear policy co-ordination will further slow the achievement of a just energy transition. More especially as Eskom battles to implement the repurposing of its old power stations such as the Komati Power Station.

8.2.9.1 Why Gas-to-Power Supports Sustainable Development

Despite underinvestment in oil exploration activities, gas discoveries on the African continent have increased with proven natural gas reserves seeing a significant increase of 37% to 625.6 trillion cubic feet (tcf) in 2022. An estimated 175 tcf of proven gas reserves across Africa have not been able to proceed to production. Gas consumption and gas pipeline exports have increased by 7.1% and 45% respectively which demonstrates to potential for gas to sustain economic developments on the journey towards decarbonisation. In the South African context these discoveries including its own Luiperd-Brulpadda gas condensate discovery, expected to produce its first gas by 2027 present further opportunities for regional integration as well as diversification benefits in terms of the energy mix. The key positive for gas to power remains in its ability to provide flexibility to the power system and complement renewable energy sources as the JET is implemented, Gas to power also presents significant job creation opportunities both upstream and downstream. Gas to power is an important cog that addresses the economic social and environmental considerations within the South African and region context wherein the impending decommissioning of aging coal plants needs to be balanced with the need to solve South Africa's energy crisis with the least possible disruption the livelihoods of the otherwise affected parties.

8.2.10 The economic Impacts of Loadshedding by Afro Development Planning

The report presents the global energy landscape and current trends, the local energy context in which the Karpowership project has significant relevance, the economic challenges and impacts of loadshedding on the South African economy, and the various responses to loadshedding.

This includes perspective on the Karpowership proposed project by setting the context for this proposed project and providing an explanation of the contribution that the Karpowership Project makes towards the Risk Mitigation Independent Power Producer Procurement Programme (RMI4P).

To address loadshedding within the next few years the current baseload capacity challenges needs to be addressed through, among others, replacing this with similar generation technologies, or dispatchable power plants which have the flexibility to address both baseload and load following needs.

Few generation technologies are able to provide both consistent and stable baseload power, as well as load following capabilities. Karpowership's floating power fleet is able to provide both, effectively.

Understandably, one company being awarded the majority of generation capacity of the RMI4P highlights the potential risk that the country faces should Karpowership be unable to deliver the required energy - especially given the urgent need to remedy the energy crisis in South Africa which has been precipitated by an ailing national utility, namely Eskom. While Karpowership is confident that it is extremely unlikely that it will fail to deliver on its contractual obligations, there are other externalities that may result in Karpowership being unable to deliver, e.g., legal processes, permitting and licensing requirements, sabotage, etc.

Gas-to-power plants play a critical role in providing dispatchable electricity, which neither coal nor renewable energy can provide. This is important to understand as gas-to-power can provide stabilisation to the energy mix, and Karpowership more specifically, can provide baseload, mid-merit and peaking power. Furthermore, and given the role of gas-to-power in the energy mix it serves to enable and support the deployment of large-scale renewable energy, while still significantly reducing emissions by reducing the reliance on electricity produced by coal-fired plants.

In the South African context, the IRP 2019 provision has been made for gas in the energy mix. Coupled with the urgent need to respond to the energy crisis makes it clear that due consideration is to be made for the Karpowership Project. The Karpowership Project has significant relevance given the following:

- The Karpowership fleet can be deployed immediately, and the Karpowership Project can reach commercial operation in 12 months, given the infrastructural requirements on the landside. This allows for additional generation capacity coming online timeously, given the urgency to resolve loadshedding.
- Karpowership can provide dispatchable baseload, mid-merit and peaking power, it can respond in minutes when the energy supply is under strain.
- Given the nature of the RMI4P, and the associated purchase agreements, Karpowership will only generate electricity after being issued a dispatch instruction by the system operator.
- Because Karpowership is a floating powerplant, there is little risk of stranded assets or lengthy decommissioning timeframes.
- The Karpowership Project will create thousands of new jobs over the construction and operational phases of the Project. During the operational phase Karpowership will also contribute to skills and capacity development which will benefit locals and that contribute to South Africa's just transition.
- The Karpowership Project will produce less than half the GHG emissions, and a fraction of the particulate emissions to that of coal. It is therefore expected to directly result in more emissions avoided (from coal-fired plants) than it will contribute to the global stock of greenhouse gas emission and will have a positive climate change impact by supporting the deployment of renewable energy in the country (Promethium Carbon, 2022).
- Powerships should not be considered a replacement of renewable energy, but rather a complementary technology to renewable energy, which supports the transition away from coal. A full transition to renewable energy will require a significant increase in battery manufacturing and deployment – a 44 times increase internationally by 2030 (IEA, 2022) is required to achieve renewable energy providing baseload. This significant increase in demand is highly likely to see developed, richer countries, out bidding and securing battery capacity ahead of developing countries. The Powerships provide a highly feasible alternative through its ability to provide rapidly dispatchable electricity which can make up any shortfalls in renewable energy's intermittent electricity production which might arise.
- Development of a gas industry in South Africa is already underway, and will continue, and thus the skills, supply, and enterprise development undertaken by Karpowership will further contribute to establishing a more efficient and viable domestic industry. This will ultimately lead to increased job creation activities.

While coal-based electricity generation has decreased relative to other technologies, 2021 saw the highest amount of power generation from coal as economies began to recover from the strict lockdowns implemented to deal with the height of the COVID-19 pandemic (IEA, 2021).

Beyond the COVID-19 pandemic and the Russian invasion of Ukraine, the global transition from coal has seen increases in gas-based generation (IEA, 2019). Gas based electricity generation results, on average, in 50% less CO2 emissions than coal fired plants (Shuai et al., 2018). It is therefore an attractive alternative to coal during the transition to renewable energy - although this is context specific (Roff et al., 2022).

When simply comparing the cost of fossil fuels to renewable energy, fossil fuels are significantly higher, but when accounting for the impact on human health (Vohra et al., 2021), the cost of coping with the impacts of the climate crisis, and the potential economic growth and job creation from switching to renewable energy (Wood, 2021), the gap between renewable energy and fossil fuels continues to grow. However, the impact of intermittent supply, especially in the South African context cannot be ignored, as the economic impact of loadshedding has been significant. In other words, it's not a question of cost alone, but the generation technology's dispatchability in conjunction with the cost as energy security (among others) is crucial for economic activity to take place.

Reliable infrastructure - water, sanitation, energy and transport - are universally accepted to be crucial for facilitating progress toward raising the quality of life of people (Rentschler et al., 2019). Access to clean, reliable, and affordable energy is widely acknowledged as the foundation to addressing developmental needs especially in the developing world context and is fundamental to economic - growth and development. Understanding the challenges and impact of rolling blackouts in South Africa is fundamental to contextualising the appropriateness of generating electricity through various energy generation technologies. This is of relevance in a country where the national power utility, namely Eskom, has failed to deliver stable electricity for more than a decade.

For the financial year end March 2021, Eskom, heavy dominated by coal-fired power, with the average age of those power stations (excluding Medupi and Kusile) being approximately 40 years, generated 191,852 GWh from their 30 power stations with a capacity of 46,466 MW (Eskom, 2021d). Despite this, Eskom also implemented 47 days of loadshedding over the same period, at an estimated cost of R942 million per day to the South African economy (Eskom, 2021d) **with loadshedding in 2022 already exceeding this** (Bloomberg, 2022b).

PWC estimates that loadshedding in 2021 resulted in up to a 3.1 percentage point decrease in Gross Domestic Product (GDP) growth, costing the economy up to 400,000 potential jobs (BusinessTech, 2022a). In an article by BusinessTech (2022b), chief economist at Alexforbes estimates that the stage 6 loadshedding in mid-2022, cost South Africa approximately R4 billion in GDP per day. The Council for Scientific and Industrial Research (CSIR), found that 2021 was the worst year of loadshedding at the time with a 37% increase in electricity unserved relative to 2020, with a total of 2,455 GWh of generation lost, and an estimated cost of unserved energy amounting to R215 billion (CSIR, 2021).

In the South African context, the failure to deliver stable electricity is a function of numerous factors including corruption, non-payment by citizens, public entities and private sector firms, demand inelasticity, misallocation of resources, lack of infrastructure maintenance, a stagnation in the demand for electrical energy in South Africa since 2007, and the inflexible construction programme marred with delays and cost over-runs (i.e., Medupi and Kusile) (Department of Public Enterprises, 2019).

The reduction in Eskom's electricity supply has been driven by an aging coal-fired fleet, and decommissioning of old coal-fired plants, that will account for a 33,364 MW reduction in capacity by 2030 (DMRE, 2019b). This aging coal fleet has put significant pressure on Eskom's ability to provide consistent electricity, and in late September 2022 roughly 21,878 MW (BusinessTech, 2022d) of Eskom's total 46,466 MW (Eskom, 2021a) was offline due to maintenance issues, meaning that only 53% of Eskom's generation capacity was available. This has forced Eskom to increasingly rely on <diesel fired> OCGT, which is significantly more costly than coal for instance, and as of the 18th of September 2022 already cost Eskom R7.7bn for its financial year-to-date (Fin24, 2022), while costing Eskom approximately R54bn since 2012 (Msomi, 2022).

Over the last decade the price of electricity generated by Eskom increased by more than 350% (Moolman, 2017). The increase in electricity tariff is a direct result of Eskom's capital expansion programme, driven almost exclusively by the construction of Kusile and Medupi and to a lesser extent, the Ingula pump storage scheme. These significant price increases have been higher than annual inflation since 2005 (excluding 2007), and have been, in part, used to meet the increasing costs of Eskom maintaining their aging coal fleet (NERSA, 2021).

Coupled with steadily increasing electricity tariffs which have significantly outpaced inflation (Labuschagne, 2020; Moolman, 2017), Eskom's inflexible construction programme marred with delays and cost over-runs (partly driven by design flaws see: Labuschange (2022b)), and previous delays in Eskom signing power purchase agreements with new independent power producers (IPPs)(Moyo, 2016) and more recently the delays in achieving financial close (Mavuso, 2022), South Africa's electricity crisis is set to continue. Beyond the issues listed above, there have been two additional drivers of the South African energy crisis, namely the delay of new IPP deals, i.e., the Renewable Energy Independent Power Producer Programme (REI4P) and the RMI4P – and Eskom's continued monopoly in the electricity market leading to inadequate and mismanaged supply.

Dispatchable power is critical for stabilising the supply of electricity, as Eskom's current generation capacity is unable to service the demand. This necessitates an expansion and continuation of the IPP programmes, which beyond increasing the energy supply will likely result in significant cost savings to the consumer, and public purse. This as electricity generation costs in South Africa have followed global trends with decreasing cost of renewable energy, which has already demonstrated renewable energy plants producing electricity at a lower cost than coal-fired and gas plants in South Africa (Eberhard & Naude, 2016). What is important to understand however is that the c/kWh cost of the REI4P BWs is not the cost of the service itself, as it does not account for the transmission and distribution costs (for instance, phase shifting, system balancing, voltage control, capacitive and inductive effects, dispatched ramping etc.). However, the RMI4P tariffs do reflect dispatchability, voltage stability and storage cost.

Finally, to appreciate the South African energy context, it is critical to examine the issues pertaining to Eskom's monopoly on electricity-generation, transmission, and distribution. While Eskom's monopoly predates a democratic South Africa, the 1998 White Paper on the Energy Policy of the Republic of South Africa, outlined the need to unbundle Eskom and transform it into a modern electricity utility and create opportunities for IPPs and alternate sources of energy. This in an effort to reduce fossil fuel pollution, and to address the shortfall in electricity supply which was anticipated to commence in 2007 (PARI, 2013).

8.2.10.1 Economic Impacts

What are the economic impacts of rolling blackouts (or loadshedding) in South Africa? Or put differently, loadshedding is bad, but how bad is it really? This question is tackled by presenting the economic impact of loadshedding to the individual, big business (incl. energy intensive users), small, micro and medium enterprises (SMMEs), and investors relative to the direct, indirect, and macro-economic impacts to these groups. Similarly, the coping cost will briefly be discussed. Thereafter, the response to the energy crisis, by Eskom, government, and the customer, is discussed.

The impact of loadshedding is not felt equally by all firms and individuals, but it is felt by all to some extent. The extent of the impact of loadshedding on firms is a function of a number of factors including the sector within which said firm operates, the geographic location of the firm itself and its operations, and the ownership structure (i.e., state owned, domestic owned or foreign owned), etc. (Rentschler et al., 2019). Moreover, a lack of electricity impedes and lowers the quality of service delivery such as health care, education, and other public services (Blimpo & Cosgrove-Davies, 2019). More importantly, if one considers the risk associated with intermittent power supply to medical facilities, the potential for loss of human life cannot be understated or quantified.

South Africa is considered an upper-middle income country (World Bank, 2020), has both very high inequality, but also high human development (2018; UNDP, 2020; World Bank, 2020). South Africa, until 2012, was also considered the largest economy in Sub-Saharan Africa in terms of GDP (World Bank, 2021). However, the country is riddled with economic challenges, including growing unemployment, stagnant economic growth (macrotrends, 2022a), ballooning public debt (Statista, 2022b) and fiscal constraints, and corruption (Foley & Swilling, 2018). South Africa has been struggling to achieve, at the very least, economic growth experienced in the mid-2000s (macrotrends, 2022a). One of the culprits to stifling economic growth is loadshedding.

Loadshedding has added additional strain on economic growth, and further hindering the economic recovery after significant economic contractions experienced during the height of the COVID-19 pandemic (Statistics South Africa, 2022a). This impact on economic recovery is set to continue, given that as of the 14^{th} of September 2022, 38% of 2022 had loadshedding (Whitfield, 2022), and Eskom expects at least level 2 of loadshedding to continue intermittently for the remainder of 2022 (BusinessTech, 2022d). Furthermore, and considering that: 1) the energy demand gap is likely to widen over the next five to eight years, as old coal-fired plants are decommissioned, coupled with the 2) likely increased operational challenges with the older coal-fired power stations, and 3) due to the delay in new builds relative to the timing presented in the IRP 2019 outlook, it is likely that loadshedding will continue until 2025 and possibly until 2030, with at least stages two to seven and possibly higher (Cruise, 2022; Davis, 2021).

This needs to be viewed in the context of Eskom’s current decommissioning schedule, where a total of 8,087MW of generation capacity will be decommissioned by 2030 (DMRE, 2019b). This will be offset by commissioning of energy from IPPs (REI4P BW5 - 2,600 MW (DMRE, 2021b), BW6 – 4,200 MW (IPP Office, 2022), and RMI4P – 2,000 MW (IPP Office, 2021b)) totalling 8,800 MW. While in terms of capacity there is a marginal difference between what is decommissioned and what is commissioned, it is important to understand that baseload is being replaced by intermittent capacity through the REI4P BWs, which is likely to only partly supply the required energy, and therefore not resolve the generation constraint which requires dispatchable power.

Studies conducted across 23 African countries found that a 1% increase in the frequency of power outages results in up to a 3.3% decrease in firms output (Rentschler et al., 2019).

8.2.10.2 Impact on Business

These impacts are felt more significantly by small firms (Alby et al., 2013), as large firms tend to be better equipped to withstand electricity disruptions due to their ability to invest in back-up generation and due to their improved ability to cope with reduced sales and revenue attributed to interrupted production or service provision (Rentschler et al., 2019). This results in reduced competition in the market, and therefore an increase in prices, and reduction in demand; a reduction in sales places pressure on businesses to manage their cost, with labour often being reduced as a cost cutting measure, thus reduced employment (Mensah, 2018).

Mining, manufacturing-including the concrete and steel industry which are critical for infrastructure development - and large-scale commercial agriculture, as represented by the Energy Intensive Users Group (EIUG) make up a significant portion of the South African economy, contributing over 22% to GDP and accounting for 40% of the electricity bought from Eskom (EIUG, 2020). By firm type, firms in the manufacturing – particularly those fabricating metal products or refining minerals – and mining tend to be more vulnerable to electricity disruptions (Rentschler et al., 2019). Loadshedding significantly impacts this group of businesses, which has resulted in a reduction of operations and significant retrenchments, with some big businesses closing down South African operations (EIUG, 2020).

Firms are less likely to upgrade machinery to more productive technologies under the threat of blackouts, which over time can reduce the economy's ability to remain internationally competitive, and generate wealth (Rentschler et al., 2019). Loadshedding causes significant disruptions to mining operations, forcing several hour delays as miners exit mines, while smelters and refineries are unable to run given that they need a constant supply of electricity to operate (Van der Nest, 2015). The significance of exporting precious metals and other mining products to the South African economy means that power disruptions can result in a depreciation of the local currency (i.e., the ZAR), increasing the cost of imports and the cost of doing business internationally (Van der Nest, 2015).

SMMEs are regarded as key drivers of economic growth in South Africa, accounting for the majority of businesses in South Africa, and employing 64% of the South African labour force as of Q1 of 2021 (SEDA, 2021). SMMEs are therefore key drivers of economic growth, job creation, and innovation in the economy (Bruwer et al., 2018). Infrastructure disruptions, such as loadshedding, reduces competitiveness of small business to a greater extent (than comparatively larger businesses) given their lower coping cost capacities (Mensah, 2018). In other words, SMMEs are particularly vulnerable to loadshedding, given that many cannot afford alternate sources of electricity or backup generators, and are forced to either limit or stop operations during loadshedding periods (Mbomvu et al., 2021). Given that South Africa already has a harsh economic environment for SMMEs, with 75% of SMMEs failing after operating for less than three years (Bruwer & Coetzee, 2016), persistent loadshedding further compounds the existing operations - and business environment challenges placed on these businesses, reducing their viability and decreasing their chances of long-term success and survival (Mbomvu et al., 2021).

Beyond the direct impact on businesses, loadshedding continues to have a tangible impact on investor confidence, reducing investment from both international and local sources. International credit ratings agencies have indicated that while current levels of loadshedding are unlikely to lead to a credit downgrading, if there is persistent and more severe loadshedding then this could contribute to a downgrading of South Africa's investment grade by credit rating agencies (Fin24, 2019a; Investec, 2022; Smit, 2021). South Africa had its credit rating downgraded in 2020 by both Fitch and Moody's, which while not triggered by loadshedding, have placed South Africa in an already difficult position (Cronje, 2020). The downgrading of a country's credit rating increases the cost of borrowing money on the international debt market – both for firms and the state – and reduces the amount of foreign direct investment flowing into a country (Elkhoury, 2008).

8.2.10.3 Gas to Power Vs OCGT

Eskom has made use of OCGT to generate electricity during peak periods for a number of years now, and given the cost associated thereto the utilisation is tracked very closely (Eskom, 2020). It is evident that Eskom has utilised OCGT to a greater extent for the financial year to date, than the previous period, with September 2022 illustrating a stark contrast and demonstrating a reliance on OCGT that is financially unsustainable. This cost is then passed on to the customer, and Eskom in its most recent updated assumptions for its tariff application, for 2023, indicated that it intends to use R16.8bn of diesel in the next financial year – up from the R5bn initially applied for, which has, in part, driven the potential electricity increase to 38% (Businesstech, 2022; Moneyweb, 2022). This amounts to approximately five percent of the allowable revenue applied for in the financial year 2023/24 (Businesstech, 2022), but contributed to less than one percent of electricity supplied the previous financial year (Eskom, 2021d).

As expected, an over-reliance on OCGT poses an economic - and energy security risk to the South African economy. This is because of two factors, firstly, the cost, and secondly because of the divergence from its intended application as a peaker. OCGT is comparatively more expensive than the alternatives, including Karpowership, coal-fired power, onshore wind, utility scale PV, nuclear and CCGT, but more importantly it's evidently more than the South African consumer can afford. Considering the LCOE, Karpowership is situated between solar PV and OCGT, making it an ideal candidate as a cost-effective consideration for South Africa's energy mix. OCGT is also vulnerable to volatility associated with the supply and demand of the primary energy source (in this case diesel), and the volatility of the local currency (ZAR) relative to the USD – which has been depreciating over the same period. Perhaps more concerning, is the application of the OCGT peaker being utilised to supplement baseload electricity supply constraints far above the 1% (load factor) emergency reserve requirement. This is evident from both the (over) utilisation of the OCGT and the load factor for the financial year to date hovering around 16%. What is further evident is the speed of response of Karpowership with power being dispatchable within minutes of receiving the dispatch instruction.

Apart from this, OCGT is more harmful in terms of emissions and human toxicity, than onshore wind, solar PV, and gas power (whether terrestrial or Powership). Natural gas provides a reduced emissions factor when compared to diesel, however it is still far higher solar PV and onshore wind. In terms of human toxicity, coal continues to have the highest impact due to higher levels of arsenic This is followed by natural gas (mostly to the materials used in gas-to-power plants), and then by solar PV, the latter of which is higher than other renewables due to its high use of copper as an input material, where arsenic is released during copper mining (United Nations Economic Commission for Europe, 2021).

Regarding land use and the associated impact on urban or agricultural land as well as the overall land quality considering aspects of erosion resistance, mechanical filtration, physicochemical filtration, groundwater regeneration, and biotic production. Coal mining will have a higher score with high land occupation during the extraction phase (open pit or underground), and the use of timber braces in mines which impacts forestry. In perspective, natural gas plants generally having a lower land-use impact than other fossil fuels, which is due to the nature in which natural gas is extracted from underground. Solar PV on the other hand has a significantly high score (6 times that of gas peaking for instance) for two reasons, firstly there are large amounts of copper utilised in solar PV panels, which leads to a high mining impact during material sourcing. Secondly, solar PV plants are typically built over a larger geographic area than most power plants as multiple panels are required. Given the nature of the Powership, the land-based impact is minimal as the land utilised is mostly land that is already transformed (like a port, including its bulk infrastructure), with a small footprint required for the transmission lines, and to store replacement parts for instance.

The largest number of jobs are created in solar PV and is a key argument behind the growth creating potential of a transition to renewable energy. Onshore wind, and utility scale solar PV technologies create the largest portion of jobs during the construction and instillation period, with the next largest amount concentrated in maintenance and operation (although maintenance and operations employment is expected to exceed construction past 2030), with a lower amount in manufacturing (Ram et al., 2020).

Solar PV and wind resources fall under baseload, but are intermittent energy sources due to their dependence on weather conditions at any given time. Secondly, load-following plants are ones which provide varying electricity output dependent on fluctuating electricity demand, these generation technologies include: OCGT, floating Powerships that utilise combined cycle reciprocating gas engines, and CCGT.

Solar PV, onshore wind and OCGT have similar lead times to commercial operation, which are longer than that of Powerships, and once operational OCGT is far more responsive to demand than onshore wind and solar PV, although it is only marginally more rapid than Powerships with a few minutes' discrepancy. Considering the comparison presented above, a balanced energy mix is required to ensure that energy security is maintained, economic productivity is facilitated, and environmental impacts are minimised. An imbalance in the energy mix will inevitably compromise one or more of these three factors. At the moment, an over reliance on OCGT is a symptom of an imbalance in the energy mix and a deficit of baseload, coming at a significant cost to the consumer. Within this context the Powerships provide a strong alternative to OCGT.

Table 8-2: Conventional generation vs alternative energy generation technologies

Parameters	New build coal-fired	Existing coal-fired	Nuclear	Onshore Wind	Solar PV (Utility scale)	Gas peaking	Karpowership	Gas - Combined cycle gas turbine (CCGT)	Hydro
LCOE (c/kWh)	96 – 225* (Lazard, 2021a)	55 – 70* (Lazard, 2021a)	194 – 302* (Lazard, 2021a)	68 – 105** (Lazard, 2021a)	65 – 203** (Lazard, 2021a)	296 – 355** (Lazard, 2021a)	More than Solar PV, but less than low-end gas peaking	105 – 149** (Lazard, 2021a)	78* (International Renewable Energy Agency, 2019)
Capex (ZAR/kW)	43 634 – 92 075* (Lazard, 2021a)	N/A	115 371 – 189 327* (Lazard, 2021a)	15 160 – 19 968* (Lazard, 2021a)	11 832 – 14 051* (Lazard, 2021a)	10 353 – 13 681* (Lazard, 2021a)	Lower than Gas peaking and CCGT	10 353 - 19 228 (Lazard, 2021a)	Significant variability (Context specific)
Decommissioning cost (c/kWh)	212.99 **** (Raimi, 2017)	212.99 **** (Raimi, 2017)	R42bn ***** (Kings, 2016; Winkler, 2018)	92.84 **** (Raimi, 2017)	103.76 **** (Raimi, 2017)	27.31 **** (Raimi, 2017)	0.5% - 1.3% of Capex	27.31 **** (Raimi, 2017)	
Commercial operational lead time (Financial Close to operation)	96 -120 months (Eskom, 2022a)	N/A	96 -120 months (Eskom, 2022a) 84 months (Statista, 2022a)	12 – 18 months (Heneghan, 2019) 15 – 28 months*** (IPP Office, 2021a)	12 – 18 months (IFC, 2022) 15 – 28 months*** (IPP Office, 2021a)	12 – 36 months (Eskom, 2022a)	12 months	36 Months (Gross & Lyons, 2015)	
Typical Design life or Useful life	50 years (Kusile and Medupi) (Blignaut, 2012)	N/A	40 years (Koeberg - without refurbishment) (Fin24, 2019b)	20 – 25 years (Kis et al., 2018; NREL, 2016)	25 – 40 years (NREL, 2016)	30 years (Fathi et al., 2016)	20 years (contract period in South Africa) Similar to onshore wind	34 years (Kis et al., 2018)	60 years (Kis et al., 2018)
Capacity Factor (% of available power)	85% (Medupi) (SA Government News Agency, 2022)	76.8% (Kriel) – 93.8% (Matla) (Eskom, 2021b)	85-92% (Yellend, 2016)	39% (IPP Office, 2021a)	24% (IPP Office, 2021a)	6-12% (Eskom's OCGT usage) (Creamer, 2022e)	96.4%	Significant variability (Context specific)	69% (IPP Office, 2021a)
Speed of response to load changes (% capacity/minute)	4-6 ****	4-6 ****	0.26-2 ****	Weather dependent	Weather dependent	NGCC: 0.66-8 ****	12-20	0.66-8 ****	15-25 ****

Parameters	New build coal-fired	Existing coal-fired	Nuclear	Onshore Wind	Solar PV (Utility scale)	Gas peaking	Karpowership	Gas - Combined cycle gas turbine (CCGT)	Hydro
	(Ramirez-Meyers et al., 2021)	(Ramirez-Meyers et al., 2021)	(Ramirez-Meyers et al., 2021)	(Ramirez-Meyers et al., 2021)	(Ramirez-Meyers et al., 2021)	NG Boiler: 7 **** NGCT: 25 **** (Ramirez-Meyers et al., 2021)		(Ramirez-Meyers et al., 2021)	(Ramirez-Meyers et al., 2021)
Application	Baseload (Lazard, 2021a)	Baseload (Lazard, 2021a)	Baseload (Lazard, 2021a)	Intermittent (Lazard, 2021a)	Intermittent; Peaking (Lazard, 2021a)	Peaking; Load-following (Lazard, 2021a)	Baseload; Peaking; Load-following	Load-following; Baseload (Lazard, 2021a)	Baseload, Peaking (Clarke, 2012; Eskom, 2021c)
Employment (job-years/ GWh)	0.11**** (NICE, 2021)	N/A	0.14**** (NICE, 2021)	0.16**** (NICE, 2021)	0.87**** (NICE, 2021)	Significant variability (Context specific)	0.02	Significant variability (Context specific)	0.27 – 0.9 (Wei et al., 2010)
Emissions (gCO2/kWh)	341*[2] (United Nations Economic Commission for Europe, 2021)	1003.5* (United Nations Economic Commission for Europe, 2021)	5.5* (United Nations Economic Commission for Europe, 2021)	11.9* (United Nations Economic Commission for Europe, 2021)	52.5* (United Nations Economic Commission for Europe, 2021)	458* (United Nations Economic Commission for Europe, 2021)	508.5	458* (United Nations Economic Commission for Europe, 2021)	8.55* (United Nations Economic Commission for Europe, 2021)
Land use (Points/kWh)	3.1* (United Nations Economic Commission for Europe, 2021)	2.15* (United Nations Economic Commission for Europe, 2021)	0.06* (United Nations Economic Commission for Europe, 2021)	0.105* (United Nations Economic Commission for Europe, 2021)	2.85* (United Nations Economic Commission for Europe, 2021)	0.45* (United Nations Economic Commission for Europe, 2021)	Not available	0.45* (United Nations Economic Commission for Europe, 2021)	0.165* (United Nations Economic Commission for Europe, 2021)
Human Toxicity (non-carcinogenic)	123,5*	82,5*	5,3*	2,9*	11,45*	12,35*	Assumed to be similar to other	12,35*	1,1*

Parameters	New build coal-fired	Existing coal-fired	Nuclear	Onshore Wind	Solar PV (Utility scale)	Gas peaking	Karpowership	Gas - Combined cycle gas turbine (CCGT)	Hydro
(CTUh/TWh)	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)	gas-based generation technologies	(United Nations Economic Commission for Europe, 2021)	(United Nations Economic Commission for Europe, 2021)

8.2.10.4 RMI4P Project Duration

Dispatchers have a minimum commitment of a 50% load factor in a year, with 95% of the price comprising of the electricity cost calculated at 100% load factor and at 75% load factor, the cost of grid connections, carbon taxes if applicable, operation and maintenance costs, variable costs, and fuel charge rates, with the remaining 5% accounting for the ancillary services (DMRE, 2021a). These two sets of requirements also provide the reasoning for the 20-year RMI4P contract; because dispatchers provide electricity at the request of Eskom and are not providing constant electricity, they have a higher risk in operating as they are remunerated based on their provision of electricity (DMRE, 2021a). Hence, the DMRE has stated that the 20-year contract will allow for dispatchers to service the costs of operating and establishing, as well as debt, equity, and other obligations, and without which the price would have been triple its current amounts (DMRE, 2021a). Thus, the RMI4P successful bidders operate in a fundamentally different paradigm to those of the REI4P, and are more comparable to battery storage, hydroelectric pump storage, renewable plants paired with battery storage, or the diesel-fired generators currently being used to address peaking demand in South Africa.

8.2.10.5 Key findings

It has been acknowledged in the IRP2019 that gas to power technologies provide the flexibility required to complement renewable energy (National Department of Energy, 2019), when designed to operate flexibility contribute to optimising energy systems in response to demand patterns given the variable supply of renewable energy. In other words, gas power does not serve to replace renewable energy in the energy mix, but rather supports the further penetration of renewable energy.

While coal has been the main source of electricity generation both globally and in South Africa, there is an active and steady transition to alternative energy, including gas and renewables. This transition has been driven by the need to reduce greenhouse gas emissions to mitigate the climate crisis, and the improvement in cost efficiency of renewable energy relative to fossil fuel-based electricity generation. This transition has further been emphasised in the South African context, given the necessity of addressing the energy crisis and the persistent loadshedding. Loadshedding has had a significant impact on the South African economy, reducing economic growth and recovery post Covid-19 restriction, and limiting firms' ability to operate and forcing businesses to bear the burden of coping costs, increasing the cost of living to individuals, and negatively impacting on investor sentiment. The impacts of loadshedding are either direct or indirect and have a long-term implication. For instance, loadshedding affects business directly through increasing production costs and reducing their ability operate optimally. Indirectly these businesses competitiveness is negatively impacted due to lower sales and increased operational cost, or the need to incur coping cost. In the long term, the cumulative impact of loadshedding results in decreased international competitiveness, reduced demand for labour, and stifling of expansion of key industrial sectors. The impact of loadshedding has resulted in a reduction in economic growth (estimated at 3.1% in 2021) and decrease in employment (estimated at 400,000 jobs lost in 2021 alone) with the impact being more significant for SMMEs relative to larger firms, although mining and manufacturing companies have been hard hit too. For South African consumers loadshedding has resulted in interruptions to the service of medical support, interruptions to both private and working lives, including interrupted work, increased time spent planning for and finding alternate solutions during loadshedding.

Loadshedding has had a significantly negative impact on the South African economy which has resulted in the loss of jobs and a loss of potential jobs, and reduction in economic growth which has reduced the economy's ability to recover from the Covid-19 pandemic.

Finally, investor confidence in South Africa has been reduced, which has reduced the amount of both international and local investment into the South African economy, while loadshedding has had a negative impact on credit rating agencies outlook for South Africa. Given this significant impact of loadshedding on the South African economy, Eskom and the government has embarked on several measures in an attempt to remedy the energy crisis. Eskom has attempted to meet the shortfall in electricity supply with diesel-fired open cycle gas turbines which has proven to be an expensive solution, costing Eskom approximately R54bn since 2021. These measures, however, have failed to mitigate loadshedding as there have already been 100 days of loadshedding in 2022 by September 2022 (Bloomberg, 2022b). The government has attempted to address the shortfall in electricity supply by procuring power from IPPs under the REI4P, CI4P and RMI4P, the former of which has concluded four successful BWs and has seen significant cost declines for renewable generation technologies. BW-5 and 6, and the RMI4P will continue to add to balancing South Africa's energy mix, if these reach financial close. However, if Eskom's current maintenance issues persist, and the coal-fired plant decommissioning schedule is followed, it seems likely that loadshedding will continue until 2030.

Gas-based electricity production has an important role to play in the energy transition, as it provides a near term replacement for coal, with reduced GHG and particulate emissions, and able to provide similar baseload energy production, with the advantage of being highly effective in providing load following and peaking power output. This provides an important synergy with renewable energy, reducing the fluctuations in electricity availability, as energy storage technologies advance to the point where they can smooth out the variability in energy provision which wind and solar experience. In the interim however, Karpowership is able to provide dispatchable power within minutes of receiving a dispatch instruction and can do so at a cost less than Eskom's diesel-fired OCGT. Moreover, and should the need arise, Karpowership can provide stable baseload power while emitting almost half the GHG emissions of coal-fired power.

More importantly, the Karpowership fleet can be deployed immediately with the 12-month timeframe to commercial operation being contingent on the construction of the infrastructure required (i.e., transmission lines, gas pipes, mooring etc.). It is within this context that the RMI4P bids by Karpowership should be considered, along with the other interventions already discussed. The economic impacts of loadshedding are significant and need to be addressed urgently to minimise its impact on the economy and mitigate the risk to energy security in South Africa. It is therefore reasonable to conclude that an expansion in electricity generation through IPP purchase agreements, for both baseload and intermittent supply, is necessary in the short-term to address the energy crisis, which will facilitate improved economic growth and development in South Africa

8.2.11 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.

8.2.11.1 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.

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 short (2019-2028), medium (2029-2048) and long-term (beyond 2048) Port Development Framework Plans (PDFPs) for the Port of Richards Bay in terms of the National Ports Plan 2019 was considered.

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 has been assessed by PRDW in relation to the proposed Port Plans, and together with Karpowership is in ongoing engagements with TNPA to ensure that its project is aligned with Port planning and operational requirements.

8.2.11.2 Provincial Planning

<u>KwaZulu-Natal Provincial Spatial Development Framework (2021- draft)</u>
The provincial Spatial Development Framework of KwaZulu-Natal provides 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.

Most of the electricity consumed in KwaZulu-Natal is sourced from the power stations in Mpumalanga via 400 kV Transmission lines. There are three peaking plants in the province. Richards Bay has been identified as one of the potential sites for the planned gas-to-power programme in accordance with the Draft IRP 2018. Currently, the Port of Richards Bay is the largest coal exporter and the largest Dry Bulk terminal in South Africa.

8.2.11.3 Municipal Planning

<u>UMhlathuze Municipality Integrated Development Plan (IDP) 2022 – 2027 (May 2022)</u>
The IDP aims 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.

In line with the Sustainable Development Goals, the municipality's vision is to reduce the dependency on coal for electricity generation by 30%.

The city of uMhlathuze is a licensed electricity provider, however in rural areas electricity is still supplied by ESKOM. The main objective of the City's Electricity Master Plan is to

- To ensure the best possible technical solution;
- To provide input to the bulk energy supplier on future bulk energy needs;
- To avoid unnecessary refurbishment costs on equipment which could be made redundant in the future ; and

- To ovoid constriction of economic growth in the region due to infrastructure constraints.

The 2022 IDP further indicates that a study on exploring Gas as the source of Energy within City of uMhlathuze has been made and the recommendations are being investigated for future usage.

UMhlathuze Local Municipality Spatial Development Framework (2022)

The SDF provides strategic guidance on locations of development and land use, which feeds into strategic decisions of the local municipality.

In line with the planned expansions of the Port (as per the National Ports Plan, 2019), the port expansion is also captured in the SDF, as per Areas of Economic Growth and Development Map (SDF, May 2022).

It is noted that the Port and harbour area falls within environmental management zones of the Environmental Management Framework (EMF), and potential conflict between conservation and Port expansion would require strict development control. It is further discussed that Port expansion with associated industrial development is the single most significant opportunity in the area with tremendous potential to grow the local, regional and national economy. Existing planning approaches in the area also present opportunities for to enhance conservation and hence tourism objectives.

UMhlathuze Land Use Scheme Regulations (April 2021)

According to the uMhlathuze Land Use Scheme Regulations, the study area is situated within an area zoned as Harbour, with 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. In addition, the proposed project located adjacent to a large-scale aluminium smelter (Bayside), within an area zoned as General Industry, which permits industrial activities.

The uMhlathuze Local Economic Development Strategy (not dated)

This Strategy document is not dated, and contains information and stakeholders meetings dated in 2021. The document mentions the City's response to the Sustainable Development Goal of affordable and clean energy by building sustainable energy generation infrastructure, including gas to power energy. Further, in terms of Manufacturing, Industry and Logistics, the City will work with the private sector to develop manufacturing plants in the various projects, including Gas to Power Project. The City will explore mechanisms to improve business opportunities and, in partnership with Transnet, will work towards the improvement of Richards Bay Port.

8.3 NEED AND DESIRABILITY AS PER GUIDELINE

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 "development must be socially, environmentally and economically sustainable".

8.3.1 Cumulative Impacts

The cumulative impacts of the proposed project have been considered in this report, taking into consideration the multidisciplinary specialist studies that have been undertaken. It is also important to note the cumulative impacts of the existing developments and new projects in the study area. Many of the environmental specialist assessments considered these cumulative impacts when undertaking the impact assessments, and therefore they have already been accounted for. However, it is also worth noting that given that the project site is the active port of Richards Bay, which is also an industrial zone, in line with land use planning and zoning the project will be located in an appropriate site for the proposed activities. This is not to overlook the ecological importance of the site, and the impacts of the proposed project thereon. However, it must be noted that this is not a greenfields project, and that many of the impacts that will be associated with the project, such as light pollution, air pollution, underwater and terrestrial noise, and visual impacts have been carefully considered, as these will provide little cumulative impact to the existing industrial activities and port infrastructure.

Given the ecological importance of the site, numerous mitigation and management recommendations have been provided by the specialists for both construction and operational phases. These recommendations should be carefully considered and implemented. In addition, research and monitoring programmes will go a long way to informing improved port management, given the significant economic importance that the port holds for the country, and the future plans for expansion

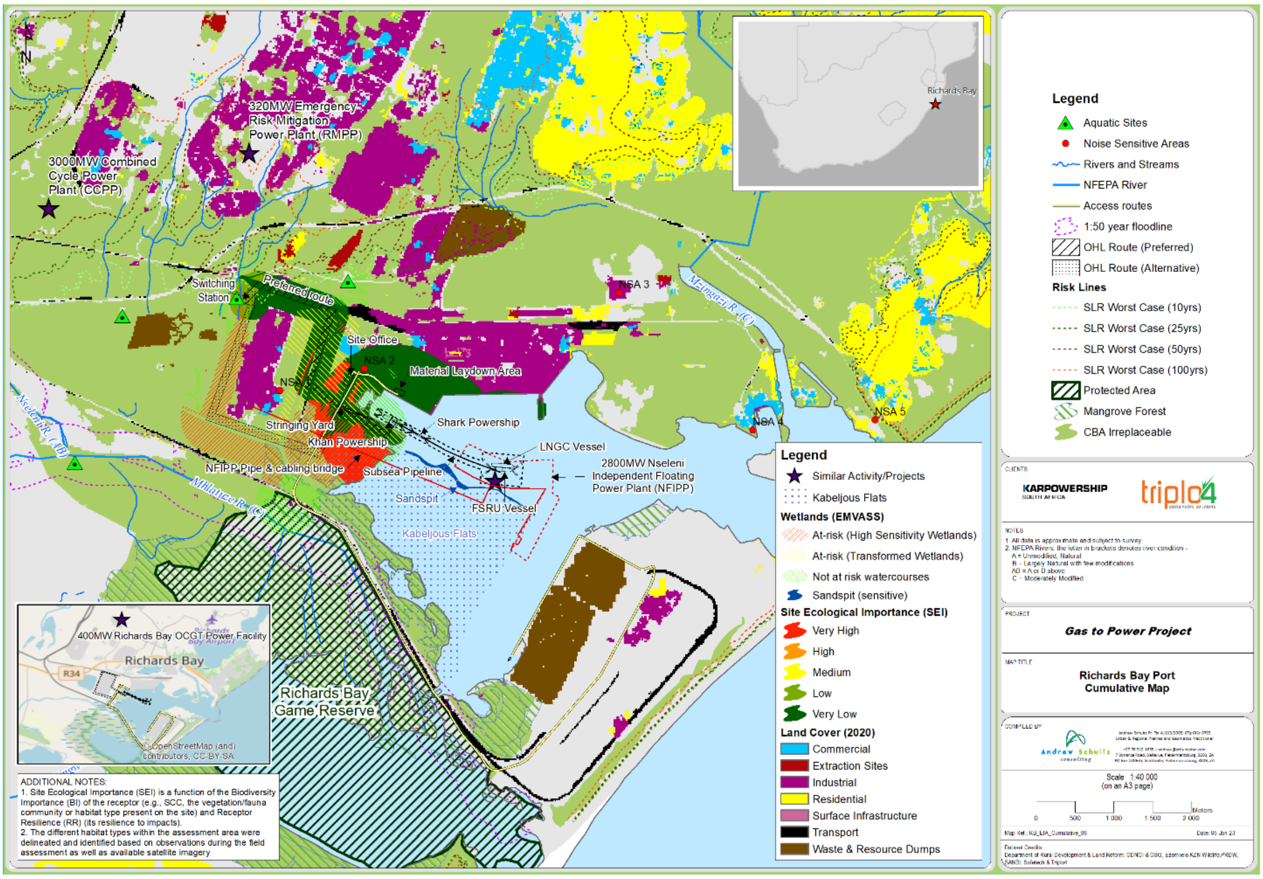

Figure 8-10: Port of Richards Bay Cumulative Map

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 were conducted 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. These studies were done integratively and assessed independently by the Sustainability Consultant. The findings were discussed in detail in section 7. For completeness the following is repeated:

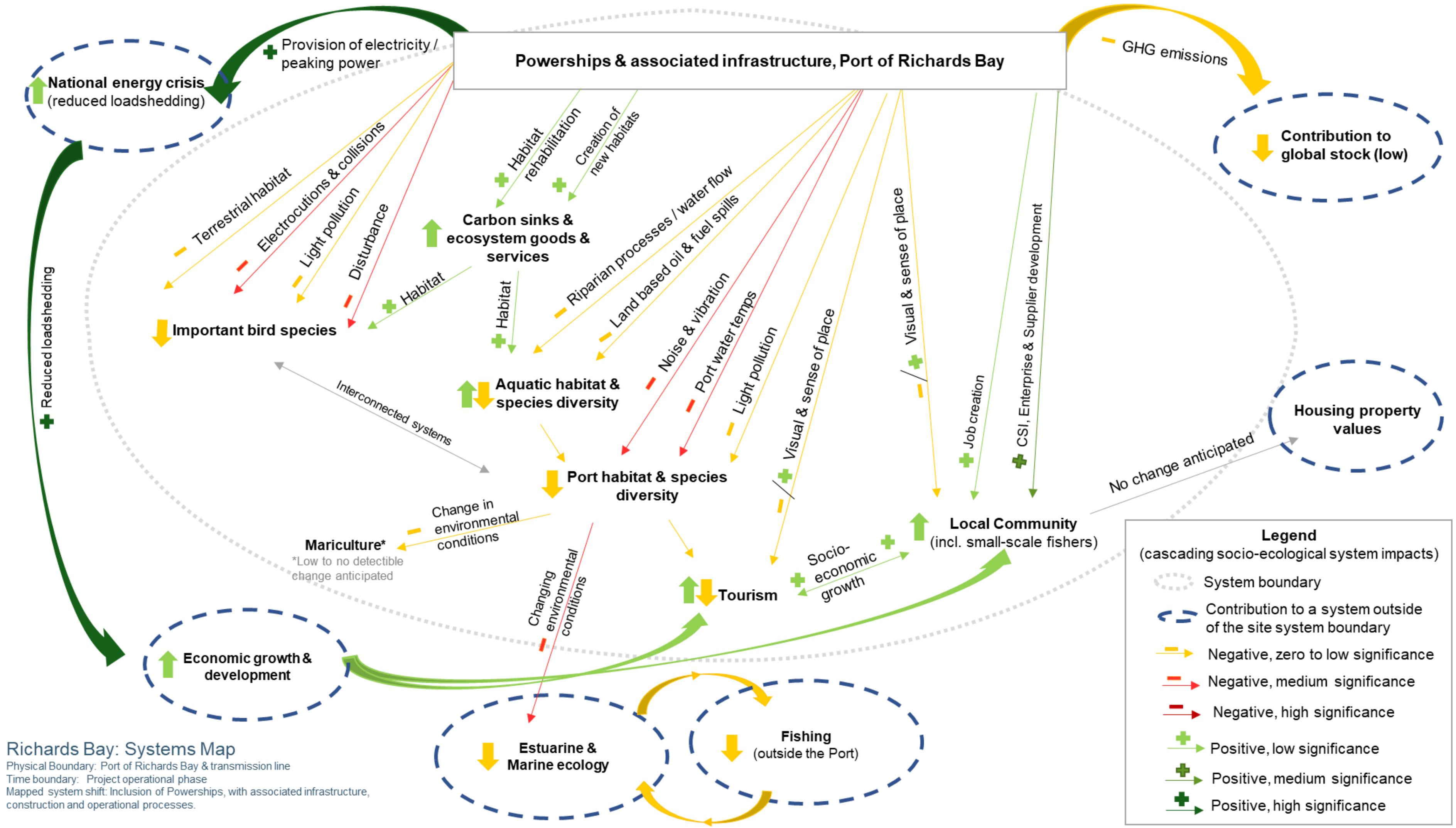

Figure 8-11: System map illustrating the anticipated shifts to the socio-ecology system following the inclusion of the Powership and associated infrastructure in Richards Bay

From the integrative, polycentric perspective adopted in conducting the EIA, the following key findings gathered from the matrices regarding identified impacts, and the systems map regarding anticipated system shifts, include:

- The key contribution that the proposed project will provide, is to reduce the burden of loadshedding on the country. There are several consequences of this, including opportunities for economic recovery and transition to the energy mix as proposed in the IRP 2019. Please see the Economic Impacts of Loadshedding discussion paper and the Socio-Economic Impact Assessment Supplementary report for further details.
- There is opportunity for the small-scale fishers and the rest of the community to benefit from corporate social investments, skills development, and supplier and enterprise development because of Karpowership SA's local content commitments (medium-low impact). In addition, there will be jobs created associated with the construction and operational phases of the project (low impact). Please see the Socio-Economic Impact Assessment Supplementary report and the Enterprise and Supplier Development report for further details.
- There is industrial and value chain development potential for the gas industry through increased economies of agglomeration. Please see the Economic Impacts of Loadshedding discussion paper and the Socio-Economic Impact Assessment Supplementary report for further details.
- There are several important habitats near the proposed project site that fall within the estuarine, marine, aquatic and to a limited extent terrestrial environments. While it is acknowledged that the site is an active port and industrial zone, the cumulative impacts of port activities and the impacts of the powership operations is anticipated to negatively impact of medium significance on estuarine and marine ecology, including important bird species. Consequently, this will affect fish populations that fishers (commercial and small-scale) depend on, and which are already under strain from over-fishing.
- Construction and maintenance of the gas pipeline, transmission line and switching stations is anticipated to result in a loss of important fauna and flora. Mitigation recommendations and rehabilitation have been proposed to limit the overall environmental significance.
- The terrestrial noise caused by the Powership during electricity generation, should not extend into residential areas and therefore is not anticipated to affect local communities. Limited impacts on fauna and flora are expected.
- Tourism is not anticipated to be negatively affected by the presence of the Powership, and associated infrastructure. This is largely because the Powership will be located in the port and will blend in with other ships and port infrastructure. The tourism sector may further benefit from peaked interest in the Powerships, yielding 'energy tourism'. This may further stimulate maritime recreational themed economic opportunities.
- Tropical cyclones are typically high impact low probability hazards and are generally quite difficult to manage due to their unpredictable nature. This has been considered in the design of the project and impacts are anticipated to be low and not to affect core operations. However, these storms can have detrimental impacts as an environmental disaster that will impact surrounding communities and ecosystems.
- Operation of the Powerships will contribute only marginally to the global GHG stock. Operation of the Powership cannot directly be tied to the experience of climate change impacts at this site, as this is a dynamic function of the global climate system and GHG stock.
- Major hazards were identified around fire risks associated with gas leaks - which was also found to be normal, and operation can continue with appropriate mitigation and emergency responses. This could

also provide opportunity for skills development in the area relating to monitoring and evaluation as well as emergency risk response.

- It is not anticipated that ambient SO_2 and NO_2 particulate concentrations will exceed NAAQS, and therefore is not anticipated to impact on the local community.
- Underwater archaeology will not be affected if underwater archaeology mitigation measures are followed in the case of an archaeological find. It is however, not anticipated that there will be a find. However, an archaeologist should be on site during the construction phase.
- Riparian zones provide a range of ecological goods and services to communities, fortunately no impact is anticipated on any watercourse because of the Powership.
- No heritage and palaeontology impacts are anticipated.
- No significant findings were noted regarding impacts to geohydrology and hydropedology.
- There is potential for the Karpowership SA project to contribute positively to natural habitats through creation of habitats and rehabilitation, although marginal. This could include removal and management of alien invasive plant species; and mooring structures may provide hard structures for benthic communities to colonise. There is also further potential that may be identified through corporate social investment programmes.

No fatal flaws have been identified by the specialist assessments for the preferred alternatives, and therefore no fatal flaws are noted here.

The Karpowership SA is an important response under the RMI4P to the country's ongoing energy crisis and will provide much needed relief to industry and households alike. There are also numerous socio-economic benefits that will be realised at a site scale because of the local content requirements DMRE bid process, as described earlier in this report. There are further opportunities for enhanced scientific research and ecological monitoring of the port and the impacts of the operations of the Powership on the environment, which will enhance our understanding and management abilities relating to port dynamics and the associated estuarine ecology.

Acknowledging the identified impacts, and the strong socio-ecological relationships associated with this site, the following recommendations relate to opportunities that can be taken forward by Karpowership SA as part of their corporate social investments, which align with issues identified in this report, to maximise their positive contribution to local communities and lessen the identified negative impacts on the environment. It is hoped that through these recommendations the legacy of Karpowership SA, at the end of its contract, will be to leave behind a socio-ecologically resilient, and economically thriving community.

Given that the professionals who undertook the specialist studies have supported / not opposed to the granting of the environmental authorisation, with various requirements for mitigation and management, the sustainability specialist supports this project being granted the environmental authorisation, provided the necessary mitigation and management recommendations are upheld. The recommendations provided in this report offer further opportunity to reduce the negative impacts of this project on the environment and enhance the positive contributions and legacy that Karpowership SA can contribute to this community.

8.3.2 SUMMARISED TABLE FOR THE NEED & DESIRABILITY

Table 8-3: Summarised table of need and desirability

Ref No:	Question	Response
1.	Securing ecological sustainable development and use of natural resource	
1.1.)	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management, Framework, Spatial Development Framework (SDF) and local and international responsibilities	Numerous independent specialists studies were commissioned in terms of terrestrial and marine environments: ▪ Wetland Delineation and Functionality ▪ Terrestrial Ecology ▪ Avifauna ▪ Heritage & Palaeontology ▪ Underwater Heritage ▪ Estuarine and Coastal ▪ Marine Ecology & Fisheries ▪ Climate Change ▪ Project Sustainability ▪ Geohydrology ▪ Hydropedology ▪ Hydrology (incl. 1:100 Year Floodline) ▪ Aquatic ▪ Major Hazard Installation Risk ▪ Air Quality ▪ Socio-Economic, Tourism, Small-Scale Fishers & Energy ▪ Underwater & Terrestrial Noise ▪ Visual ▪ Thermal Plume No fatal flaws were identified from the specialists and provided supportive conclusions. The site falls within a Critical Biodiversity Area (CBA) listed as irreplaceable, and out of Ecological Support Areas and Protected Areas, according to findings based on desktop research. The specialists considered the status (sensitivity, vulnerability and threatened) of the ecosystems, as well as their site verifications, and the following was determined regarding the sensitivities on site. Estuary and Marine: The development site and development footprint falls within an Estuarine Functional Zone (EFZ) of the Richard Bay estuary, with areas notably transformed and currently

Ref No:	Question	Response
		impacted by port development and ongoing activities. The Present Ecological State of the Richards Bay Estuary was identified as Heavily Modified. Notwithstanding the above, the importance of the transformed Richards Bay Estuary in supporting critical ecosystem services, such as habitat provision and feeding grounds for fish and crustaceans, have been identified. The estuary supports habitats of conservation significance including the nearby sandspit and Kabeljous flats, located out of the project's footprint. The uMhlathuze Estuary, adjacent to the site, is a formal protected area (Richards Bay Game Reserve) and an important bird area, and excluded from future development. The proposed development site falls within the area marked as Development Areas within the Richards Bay Estuarine. Wetlands: Wetlands in risk, where the preferred alternative route of the Transmission line is proposed, were identified as transformed wetlands with law sensitivities (ranging from Slightly Modified to Seriously Modified. Terrestrial: 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 preferred transmission line route primarily within transformed or modified habitat, resulting in little overall loss of indigenous vegetation. The proposed development is keeping out of the mangrove area, as well as the nearby sandspit and Kabeljous flats. An independent project sustainability assessment was conducted that considered the individual ecological as well as integrated ecological, socio-economic aspects and impacts (positive and negative) to ensure the

Ref No:	Question	Response
		project was sustainable from an ecological perspective. Based on the strategic plans for the Port of Richards Bay (the National Ports Plan, 2019 and TNPA plans for Port expansion), the proposed development is situated within an area that is planned for development, and out of the demarcated open space area. In line with the planned expansions of the Port (as per the National Ports Plan, 2019), the port expansion is also captured in the uMhlathuze Local Municipality: Spatial Development Framework (SDF), as per Areas of Economic Growth and Development Map (SDF, May 2022). The proposed development will reduce the pressure on other alternative to other fossil fuels and produces roughly half of the amount of CO2 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 is a signatory to various international treaties and each specialist considered the project and its potential impacts in terms of the international commitments, national and local requirements. Mitigations were provided to ensure negative impacts can be managed to acceptable levels and positive impacts can be optimised.
1.2.	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The proposed development takes into consideration the principle of avoidance by not supporting the transmission line alternative route, in order to prevent impacts to the sensitive at-risk floodplain and Channelled Valley Bottom Wetlands. This alternative route also traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest, and therefore was regarded as fatal flaw. The preferred route traverse transformed

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		at-risk wetlands with low sensitivities, and the majority of the route is aligned within disturbed areas and existing servitudes. Wetland that may directly be impacted by the proposed development do not require any offsetting due the potential improvement of the Wetland Functionality Targets and no change value for the Ecosystem Conservation Target. Other delineated wetlands are indirectly impacted and therefore did not fall part of the offsetting consideration. In terms of wetland rehabilitation, should the project go ahead and the rehabilitation measures implemented successfully, approx. 23.3 ha equivalent of wetlands will be improved in comparison to the current state. The preferred positions of the Powerships are located further away from the sensitive adjacent sandpits. The alternative positions of the Powerships was screened out due to its location closer to the sandspit, and further away from the shore, which will require longer and taller transmission line, and thus not supported from both the engineering and environmental perspectives. Modelling confirmed that the impacts to air emissions, ambient noise and underwater noise were low as were the overall potential impacts to hydrology, geohydrology, hydropedology. Mitigations were provided to reduce negative impacts as specified by the specialists incorporated into the EMPr (refer to Appendix 6). These included for e.g. the use of dynamic reflective bird flappers, preferably with lights that flash at night, on the most sensitive spans of the transmission line significantly reduce the risk of collisions. The Applicant committed to formal agreements and collaboration with Ezemvelo Wildlife to not only assist with monitoring, but also contribute

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		to research and funding to conserve and promote biodiversity. An EA may be granted subject to the condition that, inter alia, ecological compensation is delivered. Should the application for environmental authorization be accepted conditional on an offset, then a detailed Offset Report and Offset Agreement would need to be prepared, together with an Offset Management Plan, providing details of how the offset site would be secured, financial requirements and provision, and implementation arrangements. These documents would need to be reviewed and accepted by Ezemvelo KZN Wildlife and the Competent Environmental Authority before the proposed activities could commence.
1.3.	How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The use of natural gas avoid the SO_2 and PM_{10} pollution associated with the generation of power utilsing coal or LPG. Discharge of biocides and chlorine will be avoided into the marine environment through the use of appropriate technology and closed-loop FSRU.
1.4.	What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Being operational within the Port, all TNPA and MARPOL requirements will be relevant and complied with to prevent marine pollution. Hull cleaning will also be conducted in accordance with the Port's authorisations and 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. 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 ejected from the engines via exhaust gasses. In order to utilise this waste heat, Powerships use Exhaust Gas Boiler Equipment to convert waste heat to superheated steam which is redirected to the

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		Steam Turbine Generators to generate electricity.
1.5.	How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impact?	All activities will be located within a busy commercial Port and in proximity to the surrounding Richards Bay Industrial Development Zone area. The landscape in which the proposed ships and infrastructure are located is such that it can accommodate and absorb these elements without increasing current levels of landscape and visual impact on the character of the surrounding landscape or the views of potential sensitive receptors.
1.6.	How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts.	The Powerships are located within the operational Port (marine environment). Therefore, the use of freshwater resources that is generally constrained in a water scarce country with frequent water restrictions, will unlike land-based Power Plants, be avoided. The natural gas will be sourced from Shell SA with relevant licenses and permissions for the supplier's full supply/value chain. The Applicant has also indicated that they have received assurances from the LNG supplier that the natural gas will not be sourced from fracking. Natural gas usage is optimised through the use of steam turbine generators. The control room of the Powership monitors an extensive range of parameters to ensure the efficient generation of power from natural gas.
1.7.	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What	Karpowership SA through its Economic Development contributions and Economic Development Plan (EDP) will support the development of renewable energy projects and Blue Oceans Economy.

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	measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impact?	
1.7.1.	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The Department of Mineral Resources and Energy launched the Risk Mitigation Independent Power producers Programme (RMIPPPP) in August 2020 to procure 2 000 MW of new generation from a range of energy technologies. The objective being to fill the short-term supply gap, alleviate the current electricity supply constraints and reduce the extensive use of diesel-based peaking generators.
1.7.2.	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?	The Powerships will provide dispatchable power to the national grid in response to the ESKOM's requirements to reduce load shedding and the significant economic impacts to country.
1.7.3.	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The concept of generating power on the sea has several benefits over land-based power plants, including 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 construction facilities.
1.8.	How were a risk-averse and cautious approach applied in terms of ecological impacts?	
1.8.1.	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Numerous independent specialists' studies were commissioned in terms of terrestrial and marine environments comprising of consultation of databases (e.g. SANBI), conducting of site visits and modelling of data. South African as well international standards, specialist experience and site-specific knowledge contributed to informed decisions.
1.8.2.	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low.

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1.8.3.	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
1.9.	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	
1.9.1.	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts	As per the independent specialist studies and sustainability report, the negative impacts on environmental rights from an ecological perspective is by large low. This is as a result of the type of technology and location of the project as well as the avoidance measures implemented in terms of this Project. Climate change will have a low impact on the Project. The CCIA (Climate Change Impact Assessment) considered the impact of the project on the environment and reduced use of diesel generators, paraffin and natural wood combined with plastic which is burned due to load shedding. Natural gas has an emission factor that is much lower than coal and diesel resulting in less emissions during operation.
1.9.2.	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts	As a result of the type of technology and location of the project as well as the avoidance measures implemented in terms of this Project, the following positive impacts: ▪ Improved air quality as coal, LPG, diesel generators, paraffin and natural wood will not be burned to generate energy; ▪ No discharge of biocides and chlorine into the marine environment and water temperature will be within acceptable limits; ▪ No freshwater will be extracted and therefore no competing use in terms of the ecological reserve and no impact will occur during times of drought. ▪ Limited impacts to terrestrial ecology due to sea-based Powership concept.
1.10.	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-	The linkages and dependencies were accessed in an integrated manner by all specialists. As per the Project Sustainability Report, Under the Constitution, the right to access to electricity flows from the constitutional and statutory obligations of Eskom, South Africa's power

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	economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	utility, to provide reliable electricity supply and to ensure just administrative action when taking actions that result in the deprivation of electricity. From a Bill of Rights perspective, the cases show that the right to electricity, albeit not expressed in the text of the Constitution, is a condition for the exercise of other rights, including the rights to human dignity and access to adequate housing, water, and health care. The positioning of the Powerships in the Port and the associated transmission route will ensure the availability of dispatchable power via the ESKOM substation in an equitable manner.
1.11.	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/ targets/ considerations of the area?	It is the Specialist's opinions that with mitigations the Project will not impact negatively on ecological integrity objectives of the area. This Project will positively impact through collaborative partnerships to further conservation and research related to improved ecosystems.
1.12.	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	The preferred alternative considers adequate navigational routes, sufficient water depth making, available grid capacity to accommodate the project and utilsing existing infrastructure where possible and uses the least ecologically sensitive transmission route from the Powership to the proposed switching station, by the Bayside Substation, which feeds electricity into the national grid. Please refer Section 3 – Alternatives and 8.3 Need and Desirability of the Activity in the Context of the Preferred Development Footprint.
1.13.	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Negative cumulative impacts of the development are Low/Moderate and the same as the direct impacts (after mitigations) due to the locality of the project and the impacts being confined to the area. This Project has been located in the operational Port of Richards Bay, and adjacent to the RBIDZ, which is associated and has been earmarked for energy and gas development.

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2.	Promoting justifiable economic and social development	
2.1.	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations	
2.1.1.	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area	uMhlathuze Municipality Integrated Development Plan (IDP) 2022 – 2027 (May 2022) The IDP aims 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. In line with the Sustainable Development Goals, the municipality's vision is to reduce the dependency on coal for electricity generation by 30%. The city of uMhlathuze is a licensed electricity provider, however in rural areas electricity is still supplied by ESKOM. The main objective of the City's Electricity Master Plan is to • To ensure the best possible technical solution; • To provide input to the bulk energy supplier on future bulk energy needs; • To avoid unnecessary refurbishment costs on equipment which could be made redundant in the future ; and • To ovoid constriction of economic growth in the region due to infrastructure constraints. The 2022 IDP further indicates that a study on exploring Gas as the source of Energy within City of uMhlathuze has been made and the recommendations are being investigated for future usage. The proposed project is proposed within the operational Port of Richards Bay, and adjacent to the RBIDZ - Special Economic Zones (SEZ). Furthermore, In line with the planned expansions of the Port (as per the National Ports Plan, 2019), the port expansion is also

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		captured in the uMhlathuze Local Municipality: Spatial Development Framework (SDF), as per Areas of Economic Growth and Development Map (SDF, May 2022).
2.1.2.	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.)	Land is an asset, often with multiple environmental considerations and possible beneficial uses, from agriculture to industry, tourism to nature reserve and so on. There is also the added dimension of history and sensitivity around land use, ownership, and land claims/reparations in South Africa. One Khan Class Powership, capable of delivering up to 450MW of dispatchable power reliably and consistently, has a footprint of circa 15,000m2. It is important to keep in mind however that this footprint is based in the sea, with minimal use of land for minor connection infrastructure. To generate a similar scale of power from a land-based gas to power plant, the footprint would be approximately four times larger. This Project being linked to socio economic development and energy security, therefore supportive of spatial developments.
2.1.3.	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	uMhlathuze Local Municipality Spatial Development Framework (May 2022) The SDF provides strategic guidance on locations of development and land use, which feeds into strategic decisions of the local municipality. In line with the planned expansions of the Port (as per the National Ports Plan, 2019), the port expansion is also captured in the uMhlathuze Local Municipality: Spatial Development Framework (SDF), as per Areas of Economic Growth and Development Map (SDF, May 2022). It is noted that the Port and harbour area falls within environmental management zones of the Environmental Management Framework (EMF),

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		and potential conflict between conservation and Port expansion would require strict development control. It is further discussed that Port expansion with associated industrial development is the single most significant opportunity in the area with tremendous potential to grow the local, regional and national economy. Existing planning approaches in the area also present opportunities for to enhance conservation and hence tourism objectives. According to the uMhlathuze Land Use Scheme Regulations (April 2021), the study area is situated within an area zoned as Harbour, with 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. In addition, the proposed project located adjacent to a large-scale aluminium smelter (Bayside), within an area zoned as General Industry, which permits industrial activities. Transnet has 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.

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2.1.4.	Municipal Economic Development Strategy ("LED Strategy").	KwaZulu-Natal Provincial Spatial Development Framework (2021) provides 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. Most of the electricity consumed in KwaZulu-Natal is sourced from the power stations in Mpumalanga via 400 kV Transmission lines. There are three peaking plants in the province. Richards Bay has been identified as one of the potential sites for the planned gas-to-power programme in accordance with the Draft IRP 2018. Currently, the Port of Richards Bay is the largest coal exporter and the largest Dry Bulk terminal in South Africa. The uMhlathuze Local Economic Development Strategy (document is not dated, with information and stakeholders meetings dated in 2021). The document mentions the City's response to the Sustainable Development Goal of affordable and clean energy by building sustainable energy generation infrastructure, including gas to power energy. Further, in terms of Manufacturing, Industry and Logistics, the City will work with the private sector to develop manufacturing plants in the various projects, including Gas to Power Project. The City will explore mechanisms to improve business opportunities and, in partnership with Transnet, will work towards the improvement of Richards Bay Port.
2.2.	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Karpowership is committed to supporting Local Economic Transformation processes and as such, once the project has achieved Financial Close (FC), it will finalise our local jobs and local procurement procedures. Currently, the project is still being finalised and all Local Economic commitments such as jobs and procurement will need to be approved by the Independent Power Producers Office (IPPPO) of the South African
2.2.1.	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	

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2.3.	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Department of Minerals Resources and Energy (DMRE). A comprehensive and transparent Community and Stakeholder Engagement process will be implemented once the project is confirmed. This will include engagements via local media such as the local newspaper, local radio stations and through whatever local communication channels exist. All businesses will have the opportunity to apply for tenders, provided that they meet the necessary criteria and all persons will have the opportunity to apply for jobs provided they have the necessary skill. Skills development and transfer will also take place, however the implementation time-frame of this is yet to be confirmed. The same applies to enterprise and supplier development opportunities. 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 2,60000+ direct employees , 10000 + indirect 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 (excluding vessels) operation period which will exceed the Economic Development criteria that must be met in terms of the RMIPPPP. They also believe that the job creation, including within the power generation function, will be comparatively more
2.4.	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short-and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	

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		than a renewable energy project should the project be selected to proceed. Considering all the above, Karpowership SA has committed to invest at least R18 billion directly into local economies. This R18 billion investment includes contributions to skills transfer and socio economic, local supplier, SME and women empowered enterprise development. 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. 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.
2.5.	In terms of location, describe how the placement of the proposed development will	
2.5.1.	result in the creation of residential and employment opportunities in close proximity to or integrated with each other	The development will create employment opportunities during the construction and operational phase, and will provide employment opportunities to the local communities.
2.5.2.	reduce the need for transport of people and goods	During the operational, some 200 staff will be employed across all the shifts. Of the 200 staff, 30% of staff (60 people) will reside on ship and therefore, won't need to commute to work. Therefore, 140 people will commute to work
2.5.3.	result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and	

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	the achievement of thresholds in terms of public transport)	across all shifts. The site will operate with 2 shifts and therefore 70 people will commute to the site per shift. It was assumed that 50% of staff would arrive using private vehicles and 50% would arrive using public transport. The LNG will be delivered via an LNG Carrier and due to the volumes via ship and will be only acquired once in every 20-30 days – contributing approx. 1% in marine traffic.
2.5.4.	compliment other uses in the area,	Compliment port activities and provision of electricity into the national grid, support socio-economic activities
2.5.5.	be in line with the planning for the area	The proposed development of the site is in line with the Municipality's Spatial Development Framework and Port's Plans.
2.5.6.	for urban related development, make use of underutilised land available with the urban edge,	This project has limited usage of land and this positive aspect of the project as land within the operational port, industrial complex and urban edge is retained for development and future port planning can be supported in terms of the technology employed.
2.5.7.	optimise the use of existing resources and infrastructure,	Existing infrastructure from the Port is utlised together with portions of existing services servitude for the evacuation of power have been selected for use as far as possible.
2.5.8.	opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No bulk services will be required or constructed as part of the development.
2.5.9.	discourage "urban sprawl" and contribute to compaction/densification,	The location of the project is within the operational Port and adjacent to the RBIDZ - Special Economic Zones (SEZ), which is specifically designed to allow for related industries to be based in an Industrial Zone to ensures optimum development.
2.5.10.	contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	
2.5.11.	encourage environmentally sustainable land development practices and processes,	
2.5.12.	take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	The Project ensures the optimum location within the Port providing for efficient delivery of LNG via LNG Carrier and secure evacuation of power to the proposed switching station, next to the existing Bayside substation.

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2.5.13.	the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	Positive socio-economic impacts in the form of employment creation and the indirect benefits of economic growth are anticipated in the construction and operational phases. Karpowership has, as a key strategic element of its Economic Development programme, identified priority areas that they will specifically focus on in ensuring long-term sustainable impacts of the initiatives that they will support. The stated objective of the Karpowership Economic Development Plan for Richards Bay is “to contribute towards progressing social and economic transformation in the societies that we operate in, through the creation, and support of societal initiatives that flourish and grow in an inclusive and sustainable South African economy”. The four areas of commitment in terms of this Plan are: • Socio-economic development; • Enterprise development; • Supplier development; and • Skills development.
2.5.14.	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	The proposed development has been assessed and will not impact on any heritage resources. It will also will not increase the current levels of landscape and visual impact on the character of the surrounding landscape or the views of potential sensitive receptors.
2.5.15.	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The nature, scale and location of the development does not directly create a more integrated settlement, but rather consider natural gas attractive as a potential ‘bridge’ or transitional fuel in the global shift toward renewable energy. Considering gas as a transitionary fuel on our path to decarbonisation of the South Africa’s economy.
2.6.	How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	
2.6.1.	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated	Numerous independent specialists’ studies were commissioned in terms of ecological as well socio-economic environments. These include local (micro) aspects as per IDP, TNPA

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		and RBIDZ plans, small-scale fishers, tourism and macro aspects on e.g tourism and the economic aspects of load shedding and social economic considerations of LNG and renewables. The extent of these studies and these conclusions enabled informed decisions on the need and desirability of the project
2.6.2.	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	This Project as a risk mitigation project is to redress the unacceptable level of risk experienced by all citizens as a result energy crisis and extensive levels of load shedding. It is especially the poor that is vulnerable as they do not have the financial resources to provide alternatives in the form of generators and solar to provide for livelihood and wellbeing. The potential impact on small scale fishers and tourism as well as heritage and visual impacts were thoroughly investigated by various specialists together with ecological aspects (integrative) and all risks were deemed acceptable. The benefits of project clearly demonstrated the overall risk reduction to the vulnerable and society at large.
2.6.3.	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The cautious approach include collaborative partnerships, participation in TNPA forums with monitoring and reporting in accordance with the EMPr and landowner requirements.
2.7.	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1.	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	The Powership is designed to use Natural Gas, a cleaner burning fuel for the generation of power, as opposed to coal or diesel-fired power generation. The Project is situated within the Port with secured access and high safety measures. The EMPr specifies conditions for social impacts typically associated with construction, power generation projects.
2.7.2.	Positive impacts. What measures were taken to enhance positive impacts?	Providing dispatchable power at scale into the South African grid.

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		Transporting gas into the country which has been accepted by developed nations as a transitional fuel to provide dispatchable, reliable grid connected generation capacity, as it has a lower greenhouse gas impact than coal, diesel and other similar alternatives. The alleviation load shedding by providing readily available and on-demand produced power will benefit the entire country. Operational phase and establish contracts with suppliers to provide sustainable supplies, ensuring continued employment. Tourism opportunities may be created as per the concept of industrial tourism where people may be attracted to visit the area in order to view this unique technology, similar to people visiting the harbours to view ships and harbor activities. The indirect impact on tourism of alleviating load shedding is positive, as tourism requires reliable energy and tourists with money to spend Establish contracts with competent companies during the construction phase to maximize local employment. Local skills development will be further enhanced through a Skills Development Programme which will be implemented during the operations phase of the project. This has an allocated budget of R32.5 million over the 20 years, or approximately R1.6 million per annum. A dedicated Supplier Development Programme is also planned, with R650k allocated for the construction period, and R1.1 million per annum for the 20 years of operations.
2.8.	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological	Given the tech and location within the Port, is it not anticipated that socio economic aspects will result in ecological impacts The ED plan may look at capacitating the small scale fishers which may encourage fishing in

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	impacts (e.g. over utilisation of natural resources, etc.)?	excess of available quotas and increased small craft in the area may impact on local fauna. It must be noted that fishing is prohibited within the Port. Awareness of legal and local requirements will form part the ED Plan.
2.9.	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	In terms of the Powership positioning, it allows for normal port activities that support social requirements and the economy that support the intent of the Port and adjacent SEZ. Similarly the preferred evacuation route was selected with portions aligned with the existing servitude and outside sensitive areas of highly sensitive wetlands and Critically Endangered vegetation types.
2.10.	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered	The positioning of the Powership in the Port and the associated transmission route will ensure the availability of dispatchable power via the ESKOM substation in an equitable manner. As per the various specialist studies, there is no unfair discrimination against any person or vulnerable and disadvantaged persons. This project will particularly benefit the vulnerable and disadvantaged communities that does not have the financial means to provide generators with fuel or solar solutions to minimise the effects of frequent load shedding. In addition, work opportunities will be provided to the local communities, and as per the ED plan, benefits will also accrue to the local communities.
2.11.	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination	The power will be evacuated to ESKOM which will be equitable be distributed to the South African citizens and businesses. Please refer to the ED Plan that will provide access to resources and improved services.
2.12.	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has	Specialist studies considered health and safety. These included the Air Emissions Impact Report as well as Major Hazardous Installation. These

Ref No:	Question	Response
	been addressed throughout the development's life cycle	reports show the impacts to be of low significance. In addition, being situated within the Port and adjacent to the RBIDZ, the relevant TNPA and SAMSA requirements will be adhered to.
2.13.	What measures were taken to:	
2.13.1.	ensure the participation of all interested and affected parties,	Refer to Section 5 of this report, describing the enhanced public participation process undertaken for the proposed project which complies with the NEMA, EIA Regulations 2014 as (as amended) and DEA (2017), Guideline on Need and Desirability, Department of Environmental Affairs.
2.13.2.	provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Refer to Section 5 of this report, describing the public participation process undertaken for the proposed project. The BID, advertisements, knock and drop flyers, radio announcements, notification letter and site notices have been made available in English, isiZulu, Afrikaans and isiXhosa to assist in understanding of the project. In addition the EIA report executive summary will be made available in all four of these languages. Further public consultation will be held during the review period of the EIA report for the project. Capacity building included the development of a flyer as well as specific stakeholder workshops inclusive of the small-scale fishers. In addition, the Applicant distributed a booklet containing the company and project information.
2.13.3.	ensure participation by vulnerable and disadvantaged persons,	
2.13.4.	promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means	
2.13.5.	ensure openness and transparency, and access to information in terms of the process	
2.13.6.	ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge	
2.13.7.	ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted	Capacity building, which forms part of the public participation process, is seen as an ongoing, multi-pronged approach to improve the abilities and skill of marginalised, vulnerable and previously disadvantaged groups to understand the proposed project. By utilising capacity building and participatory techniques, marginalised, vulnerable and previously disadvantaged groups are better equipped to meaningfully contribute to engagements and the wider public participation process. Capacity building therefore is an approach to PP which

Ref No:	Question	Response
		seeks to involve communities and people who do not have access to resources or have not been afforded the opportunity to higher levels of education. Steps were taken to take information to the I&APs personally via door-to-door distribution and in-person discussions and at a level more understandable for the relevant I&AP. This is done with the goal of promoting equitable and effective participation across different sectors and communities in society. KSA undertook various steps in addition to the formal PP arranged by the EAP, in order to commence fostering relationships with I&APs and to further add to the steps with capacity building: The Applicant appointed two community liaison officers (CLO's), one being a woman, from the local communities in order to facilitate engagement and further build capacity within the community. Distributions of information leaflets and booklets were also completed. As per the Socio, ED and EMPr "woman in youth" were identified / recognized and employment and capacity building promoted.
2.14.	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	The nature of this project is to combat the debilitating effects of load shedding from all segments of society and sectors (e.g. business, tourism, entertainment, households). It is especially the marginalized and disadvantage that will benefit as the option of alternative energy is not financially feasible.
2.15.	What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected	The EMPr included compliance with applicable legislation such as Occupational Health and Safety Act as well as environmental awareness and monitoring.

Ref No:	Question	Response
2.16.	Describe how the development will impact on job creation in terms of, amongst other aspects	The proposed project will have a positive impact on job creation during the construction and operational phases. In addition, indirect job creation will be created as result of the implementation of the ED plan and support to local suppliers.
2.16.1.	the number of temporary versus permanent jobs that will be created,	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 260 000+ direct employees , 10000 + indirect 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 (excluding vessels) operation period which will exceed the Economic Development criteria that must be met in 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. Considering all the above, Karpowership SA has committed to invest at least R18 billion directly into local economies. This R18 billion investment includes contributions to skills transfer and socio economic, local supplier, SME and women empowered enterprise development. Aside from the above positive effects, the project will contribute to skills
2.16.2.	whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3.	the distance from where labourers will have to travel	
2.16.4.	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
2.16.5.	the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	

Ref No:	Question	Response
		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. Refer to the Appendix 9 – D1 SEIA, Nov 2022 – ED Plan.
2.17.	What measures were taken to ensure:	
2.17.1.	that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and	The EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP.
2.17.2.	that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	
2.18.	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage	The EIA process, including the public participation that is an integral and ongoing part of an EIA, is a means of managing potential impacts on environmental resources and determining whether the proposed use of resources is in the public interest. Furthermore, the project is that of the Risk Mitigation Independent Power Producer Procurement Programme (RMI4P), as a complement of the country's Renewable Energy Independent Power Producer Procurement Programme (REI4P) to generate electricity and ensure dispatchable energy (reliability) to the national grid. This will ensure the citizens right to electricity, as per the Bill of Rights perspective, the cases show that the right to electricity, albeit not expressed in the text of the Constitution, is a condition for the exercise of other rights, including the rights to human dignity and access to adequate housing, water, and health care.
2.19.	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	
2.20.	What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid	The applicant will be responsible for the rehabilitation and implementation as well as compliance with any authorisations which would take into account the appropriate mitigation measures included in the EMPr as assessed and recommended by the specialists and EAP.

Ref No:	Question	Response
	for by those responsible for harming the environment?	
2.21.	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations	The preferred transmission alternative is located within transformed at-risk wetlands with low sensitivities, and the majority of the route is aligned within disturbed areas and existing servitudes. The proposed Powership and FSRU position allows for existing and future Port activities and the technology prevents discharge of pollutions to the marine environment. The Powership is designed to use Natural Gas, a cleaner burning fuel for the generation of power, as opposed to coal or diesel-fired power generation or LPG that is more flammable. The nature of this project is to combat the debilitating effects of load shedding and ensure dispatchable to the national grid that will benefit society at all levels. Refer to Section 3 – Alternatives and Section 8.3.
2.22.	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area	The cumulative impacts of the project considered both the micro (e.g. noise) as well macro components (e.g. climate change, socio-economic). As per chapter 7 and all specialist reports, the negative cumulative impacts are acceptable can be adequately managed and reduced to lower significance ratings.

8.3.3 CONCLUSION

"In conclusion, the authors have approached this motivation regarding Need and Desirability by initially focussing on high level (macro) economic, social and environmental considerations relevant to the proposed project and then, as required by the Guideline on Need and Desirability, assessing fine grained (micro) impacts (both positive and negative). In doing so, the authors were obviously also guided by the contents of the various specialist reports and additional contributors referred to and annexed to the dEIAR.

All relevant impacts – social, economic and environmental - have been assessed as thoroughly as possible, although it is only possible in this section to summarise those that relate to the motivation of N&D. The result is a development in respect of which the socio-economic benefits far outweigh any adverse environmental impacts which in most, if not all cases, can be minimised considerably by the adherence to the stipulated mitigation measures propose in the dEIAR and accompanying specialist reports.

All things considered, the authors are satisfied, using the wording from section 1 of the "Guideline on Need and Desirability", that the development is ecologically sustainable and socially and economically justifiable – and that the project will result in the simultaneous achievement of the triple bottom-line. The authors invite the CA to find likewise that the proposed development is both necessary and desirable".

9 CONCLUDING STATEMENT AND RECOMMENDATIONS

9.1 KEY PROJECT COMPONENTS

9.1.1 Context of the Project

The proposed Project arose in response to the Request for Proposals (RFP) for new generation capacity of 2,000 megawatts of dispatchable power from a range of technologies, under the Risk Mitigation Independent Power Producer Procurement Program (RMI4P). This request was issued by the DMRE on 07 July 2020 to alleviate the immediate and future capacity deficit and the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts, as identified in the Integrated Resource Plan (2019).

The energy crisis has had a significant impact on the South African economy over the past 15 years and is anticipated to continue well into the future without an adequate emergency risk response such as the RMI4P. Accordingly, the RMI4P has been declared a Strategic Integrated Project (SIP) in terms of the Infrastructure Development Act 23 of 2014, by the Presidential Infrastructure Coordinating Commission Council on 24 July 2020 under SIP 20, as set out in Government Gazette 43547.

The RMI4P is different to the REI4P and the wider development of the electricity generation in South Africa in that it was established to address the current, and critical shortfall in electricity supply and grid instability which has resulted in South Africa's energy crisis. The procurement thus seeks to address the short-term deficit in electricity supply, rather than determining the future energy mix. It is part of an attempt by government to procure a net increase of more than 23,900 megawatts (MW) of energy over the next eight years (i.e., short term addition of capacity) during which time, and as assumed in the IRP 2019, Eskom will decommission 8,000 MW of power from its coal fleet (Steenkamp & Weaver, 2022; Futuregrowth, 2021). The speed at which projects can come online after financial close is a critical consideration. The RMI4P is to satisfy the short-term electricity supply gap, ease the current electricity supply constraints and reduce the wide-scale usage of diesel-based peaking electrical generators using alternative energy technologies ((Steenkamp & Weaver, 2022; DMRE, 2021a).

The RFP stipulated stringent environmental, social and economic criteria, BBBEE criteria and skills development. In particular, the request for proposal contained mandatory Economic Development requirements (for enterprise development and local procurement) and thorough assessment of Value For Money, defined to mean that "the new generation capacity project results in a net benefit to the prospective buyer or to the Government having regard to cost, price, quality, quantity, risk, transfer, or a combination thereof".

The Value for Money requirement involved an assessment of multiple issues and considerations, none of which are dominant or pre-eminent to another. All issues and considerations were of importance in the assessment but might not necessarily bear equal weight.

Karpowership SA Pty Ltd was announced by the DMRE, as one of the eleven successful bids in 2021. Karpowership SA is a South African company that is a 49% owned Black Empowered Company and 51% owned by Karpowership, a member of Karadeniz Energy Group that owns, operates and builds Powerships (floating power plants). Since 2010, 36 Powerships have been completed with total installed capacity exceeding 6,000 MW globally with additional Powerships either under construction or in the pipeline in response to worldwide concerns on energy security. Impressively, at the time of publication, no environmental incidents have been reported in any of the countries where Powerships are operated.

Karpowership SA will provide 1,220 megawatts of the total 2,000 megawatts sought through the RMI4P, with the Richards Bay Project making up 450MW of that total, for a contractual term of 20 years (a standard stipulation for all RMI4P projects), as-and-when required to support the national grid. This electricity will be generated by two fully integrated floating Powerships, fuelled by natural gas whilst being moored in the Port of Richards Bay in KZN.

The proposed technology for generation of electricity is natural gas-fired reciprocating engines and heat capture steam turbines designed to improve efficiency of energy generation. Construction is limited to transmission and gas supply lines as the ships are built internationally and arrive fully equipped in the Port, ready for operation.

In the South African context, and as presented in the IRP 2019, provision has been made for gas in the energy mix. Coupled with the urgent need to respond to the energy crisis it is clear that due consideration is to be made for the Karpowership SA Project. The Project has significant relevance given the following, as described by the report by Steenkamp and Weaver (2022) on the Economic Impacts of Loadshedding:

- The Karpowership fleet can be deployed immediately, and the Project can reach commercial operation in 12 months given the infrastructural requirements on the landside. This allows for additional generation capacity coming online timeously, given the urgency to resolve loadshedding.
- Karpowership can provide baseload, mid-merit and peaking power and because Powerships provide flexible dispatchable power, it can respond in minutes when the energy supply is under strain.
- Given the nature of the RMI4P, and the associated purchase agreements, Karpowership will only generate electricity upon being issued a dispatch instruction by the system operator. In other words, Karpowership will operate only when required to do so.
- The Project has a contract duration of 20-years as per the standard stipulation of the RMI4P for all bidders and will therefore be a temporary power generator in the energy mix in South Africa.
- Because Karpowership provides floating power, there is little risk of stranded assets or lengthy decommissioning timeframes.
- The Karpowership SA Project will create thousands of direct and indirect new jobs over the construction and operational phases of the Project. During the operational phase Karpowership will also contribute to skills and capacity development which will benefit local individuals and contribute to South Africa's just transition.
- The Karpowership SA project will produce less than half the GHG emissions, and a fraction of the particulate and other emissions to that of coal and diesel. It is therefore expected to directly result in more emissions avoided (from coal-fired plants) than it will contribute to the global stock of greenhouse gas emission and will have a positive climate change impact by supporting the deployment of renewable energy in the country (Promethium Carbon, 2022).

- Powerships should not be considered a replacement of renewable energy, but rather a complementary technology to renewable energy, which supports the transition away from coal. A full transition to renewable energy will require a significant increase in battery manufacturing and deployment - a 4,400% increase internationally by 2030 (IEA, 2022) is required to achieve renewable energy providing baseload. This significant increase in demand is highly likely to see developed, richer countries, out bidding and securing battery capacity ahead of developing countries. Powerships provide a highly feasible alternative through its ability to provide rapidly dispatchable electricity which can make up any shortfalls in renewable energy's intermittent electricity production.
- Development of a gas industry in South Africa is already underway, and will continue, and thus the skills, supply, and enterprise development undertaken by Karpowership will further contribute to establishing a more efficient and viable domestic industry. Ultimately this will lead to wider increased job creation activities.

9.1.2 Proposed Project Description

The proposed floating power generating facility comprises Khan and Shark Powerships with gas reciprocating engines and a floating storage regasification unit (FSRU) which will store LNG and regassify and deliver NG to the Powerships. These vessels will, as per TNPA be moored within the operational Port of Richards Bay during the project's 20-year lifespan with the following associated infrastructure:

- A 132 kV transmission lines comprising overhead monopole transmission towers, from the Powerships to the proposed switching station
- A proposed subsea gas pipeline from the FSRU to the Powership; and
- Temporary construction facilities (stringing yard, laydown area and site office and concrete coating).

The Project has a total electrical output capacity of 540 MW, and a contracted capacity of 450 MW which cannot be exceeded. The Powership uses 27 reciprocating engines (GEN-SET) that run on gas. These can run in a simple cycle configuration or a combined cycle with 3 steam turbine generators (STG) that utilise exhaust heat from the engine to create the steam. The on-board high voltage substation then converts the power generated from this to be compatible with transmission. The electricity is evacuated to the National Grid via a 132 kV overhead transmission line that runs to the Impala substation, via a connection point (necessitating a new switching station), approximately 3.6km away. The Powerships also have freshwater generators (FW GEN) to produce freshwater for operational purposes.

The operation of the Powership involves the abstraction of seawater for cooling of the power generators and the subsequent discharge of heated water back into the receiving environment. The total intake/outlet flow rates at 100% load are 8.49 m^3/s. The temperature of the discharged seawater (ΔT) ranges from 10.0 to 15.0°C within the Powerships process water, depending on the cycle configuration in use. The total flows will be discharged at depth (8m) through multiple outlets on the vessel hulls. Discharges will operate continuously while the ships generate power as per dispatchable instruction, and no other constituents, such as biocides or brine, will be added to the cooling water discharge.

The Powership and the FSRU are assembled off-site and delivered fully equipped and operational to the Port of Richards Bay, whereas the gas and powerline and the switching station will need to be constructed.

9.2 MITIGATION HIERARCHY

In accordance with 3(1)(n) in Appendix 3 of GN 982 the mitigation hierarchy (avoid, reduce, rehabilitate and offset impacts) was implemented to arrive at the final proposed alternatives with impact management measures and mitigation as follows:

9.2.1 Avoid

The following key measures are intended to avoid specific impacts:

- Screening out Alternative 2 of the transmission line asthis route option 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 which should be avoided.
- The positioning of the 2 Powerships closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and a higher tower. This feasible alternative was screened out as was considered less suitable from engineering and environmental perspectives.
- Alignment of the transmission line along transformed or disturbed areas, and existing servitudes.
- The use of close-loop water systems that exclude the use of biocides chlorine and thus any potential pollution within the marine environment.

9.2.2 Reduce

The following key mitigation measures are intended to reduce specific impacts:

- The design of the Powerships provides for built-in noise mitigation e.g. double hull and anti-vibration mounts.
- Management of water intact velocities and placement of intake outside the benthic environment to reduce impacts within the marine ecosystem.
- Navigational simulations and TNPA agreements regarding FSRU and Powership positioning ensured the optimal location of the vessels to avoid marine traffic collisions and align with TNPA Port planning.
- Various measures were stipulated as per the EMPr for the construction and operational phase to reduce impacts.

9.2.3 Rehabilitate

Rehabilitation is stipulated for any areas disturbed during construction as per the measures provided in the EMPr and rehabilitation plan. For example, in terms of wetland rehabilitation, should the rehabilitation measures implemented successfully, approx. 23.3 ha equivalent of wetlands will be improved in comparison to the current state. In addition, the EMPr and the rehabilitation plan also provides for the maintenance of areas to prevent degradations during the operational phase.

9.2.4 Offset

Given the locations as well as specialist findings and recommendations, no offset was applicable to the proposed alternatives. An EA may be granted subject to the condition that, inter alia, ecological compensation is delivered. Should the application for environmental authorization be accepted conditional on an offset, then a detailed Offset Report and Offset Agreement would need to be prepared, together with an Offset Management Plan, providing details of how the offset site would be secured, financial requirements and provision, and implementation arrangements. These documents would need to be reviewed and accepted by Ezemvelo KZN Wildlife and the Competent Environmental Authority before the proposed activities could commence.

9.3 ALTERNATIVES

The project alternatives were considered in Chapter 3 and assessed in Chapter 7 based on technical and environmental aspects informed by technical information and input as well as specialist studies. These alternatives included site, layout, technology and no-go alternatives and are summarised as per Table 9-1 below:

Table 9-1: Summary of Alternatives

Alternative	Description	Status	Key reasoning	Report Section
Site Alternatives within KwaZulu-Natal Province	Port of Durban	Screened out	This not a feasible alternative	Section 3.1.1
	Port of Richards Bay	Assessed in EIA	This is a feasible and preferred alternative. Aligned with Port activities, sufficient depth and available grid infrastructure	Section 3.1.2
Layout Alternative Powership	Alternative 1: The Powerships are positioned within the dead-end basin, and located closer to the first tower of the transmission line	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.1
	Alternative 2: The 2 Powerships are located closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and a higher tower.	Screened out	This is a feasible alternative, however considered less suitable from engineering and environmental perspectives. Powerships and the mooring systems are placed closer to the sensitive sand bank, which is not supported in terms of underwater noise and temperature, as well avifaunal impacts. In addition, in terms of the evacuation line, it will require a much longer overhead transmission line, which will require a much taller tower. Adding a tower or moving the tower closer to the edge of the bay area will also have geotechnical conditions implications.	Section 3.2.1
Layout Alternative Gas Pipeline	Alternative 1: Subsea pipeline preferred route, as it is in line with the preferred	Assessed in EIA	This is a feasible and preferred alternative.	Section 3.2.2

Alternative	Description	Status	Key reasoning	Report Section
	positions of the Powerships			
	Alternative 2: Subsea pipeline relates to the second alternative of the Powerships' positions and not supported from engineering and environmental perspectives, as the vessels are closer to the sensitive sand bank and further away from the shore, which will require a longer transmission line and a higher tower.	Screened out	This is a feasible alternative, however considered less suitable from engineering and environmental perspectives. Powerships and the mooring systems are placed closer to the sensitive sand bank, which is not supported in terms of underwater noise and temperature, as well avifaunal impacts. In addition, in terms of the evacuation line, it will require a much longer overhead transmission line, which will require a much taller tower. Adding a tower or moving the tower closer to the edge of the bay area will also have geotechnical conditions implications.	Section 3.2.2
Layout Alternative: Transmission Lines	Alternative 1: Shorter route and the majority of the majority of the route is located in areas of low to moderate ecological sensitivity, and will be traversing high sensitive wetland and swamp forest. 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.	Assessed in EIA	This is a feasible and preferred alternative. 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.	Section 3.2.3
	Alternative 2: The route is located to a large extent of its length	Assessed in EIA	Considered as a fatal flaw from the wetlands and terrestrial	Section 3.2.3

Alternative	Description	Status	Key reasoning	Report Section
	within wetlands, and it traverses two Critically Endangered vegetation types: Mangrove Forest and Swamp Forest.		ecological aspects and therefore not supported	
Design Alternative: Transmission Lines	Lattice	Screened out	This is a feasible alternative but not preferred. ▪ larger excavations for their foundation; ▪ larger clearing of vegetation; ▪ Less visually appealing; ▪ higher vertical risk area to flying birds.	Section 3.2.4
	Monopole	Assessed in EIA	This is a feasible and preferred alternative with support from relevant specialists.	Section 3.2.4
Technology Alternatives: Fuel	Natural Gas	Assessed in EIA	This is a feasible and preferred alternative based on the existing technology proposed as per the RMI4P submission and awarded SIP.	Section 3.2.5
	Hydrogen	Not assessed in EIA	This is not a current feasible option, however, it is not an excluded option over the 20 years' timeframe of the project. When commercially viable for implementation on the utility scale of the Project, the relevant environmental processes will be completed as required.	Section 3.2.5
No-Go and Fatal Flaw		Assessed in EIA	While the no-go alternative will not result in any negative environmental impacts as there will be no change to the status quo, 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	Section 3.2.6, Chapter 7 and Appendix 9

Alternative	Description	Status	Key reasoning	Report Section
			providing employments opportunities. Hence the "no-go" alternative is not the preferred alternative. No fatal flaws were indicated by any of the Specialists and the proposed project is thus preferred.	

9.4 ENVIRONMENTAL IMPACT STATEMENT

In accordance with 3(1)(l) in Appendix 3 of GN326, this section contains:

(i) *A summary of the key findings of the environmental impact assessment (refer Section 9.2.3 below).*

(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 (refer to Section 9.2.1, Figure 9-1 and Appendix 1).*

(iii) *A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives (refer Section 9.2.2 below).*

9.4.1 Sensitivity Map

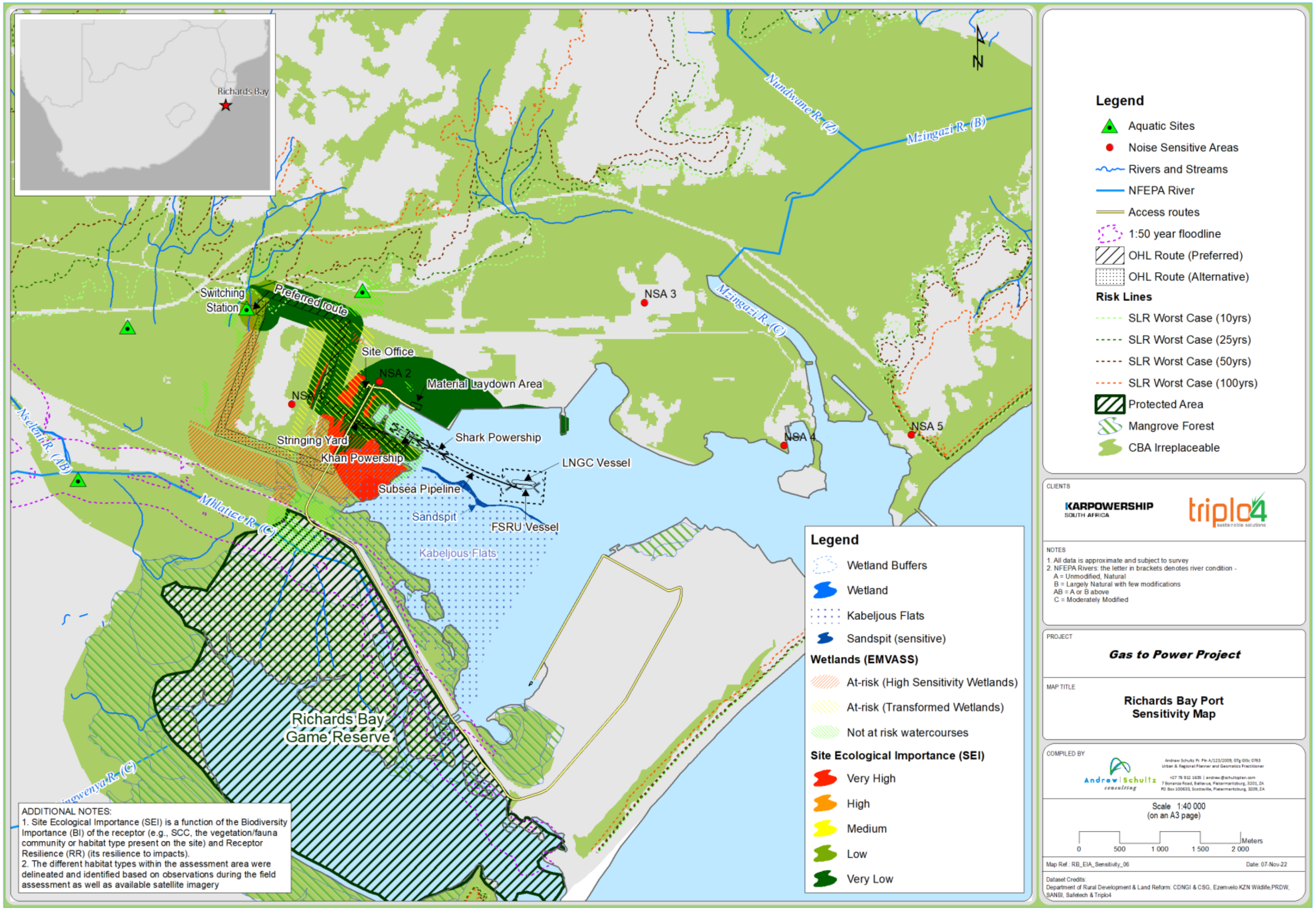

Figure 9-1: Sensitivity Map depicting sensitive environmental features in relation to the proposed activity in the Port of Richards Bay

9.4.2 Summary of positive and negative impacts and risks (of the proposed activity and alternatives)

9.4.2.1 Summary of Specialist Assessments

The table below provides a summary of the positive and negative impacts and risks of the proposed activities and identified alternatives as identified by the Specialists. It must be noted that the Specialists approached the assessments interactively.

Where not specifically indicated in the table, the risks and impacts are the same for the alternatives.

Table 9-2: summary of the positive and negative impacts and risks

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Hydrology Impacts (Section 7.5.1)		
Disturbing vadose zone during soil excavations / infilling activities	Neutral/ Negligible	Neutral/ Negligible
Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses	Low	Neutral/ Negligible
Surface water contamination and sedimentation	Low	Neutral/ Negligible
Soil disturbance & erosion and sedimentation of nearby watercourses (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Switching station spillages (incidents only; operational phase	Neutral/ Negligible	Neutral/ Negligible
Leakages from vehicles occurring during transmission line maintenance (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Aquatic Impacts (Section 7.5.2)		
Removal of riparian vegetation and habitat impacting bank stability; Disturbance of the natural soil profile resulting in the proliferation of invasive alien plant species; Loss of aquatic vegetation and habitat.	Medium	Low
Changes in natural drainage lines which may lead to ponding or increased runoff patterns.	Medium	Low
Leakages from vehicles and machines. Oil & fuel spills from vehicles (Construction phase)	Medium	Low
Leakages from vehicles and machines. Oil & fuel spills from vehicles (Operational phase)	Low	Low
Change in species composition due to loss of aquatic habitat, water quality changes.	Low	Low
Hydropedology Impacts (Section 7.5.3)		
Site preparation impacting on soil interflow processes, soil quality, soil structure and land capability	Neutral/ Negligible	Neutral/ Negligible
Disturbing vadose zone during soil excavations / infilling activities	Low	Neutral/ Negligible

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
In-situ placement of new soils, altering existing soil-flow processes impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Vegetation clearing & soil stockpiling impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Surface water (wetland) quality	Low	Neutral/ Negligible
Soil quality	Low	Neutral/ Negligible
Excavation will disturb soil interflow processes	Low	Neutral/ Negligible
Oil & fuel spills impacting on soil quality	Low	Neutral/ Negligible
Geohydrology Impacts (Section 7.5.4)		
Disturbing vadose zone during soil excavations / construction activities	Low	Neutral/ Negligible
Hydrocarbon contamination of the vadose zone (construction phase)	Low	Neutral/ Negligible
Surface water contamination and sedimentation from the following construction activities	Low	Neutral/ Negligible
Impacts to downstream groundwater users	Neutral/ Negligible	Neutral/ Negligible
Temporary dewatering of perched groundwater (if it occurs)	Low	Neutral/ Negligible
Hydrocarbon contamination of the vadose zone (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Impacts to downstream groundwater users (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Wetland Impacts (Section 7.5.5)		
Direct habitat modification – Direct impact	Medium-Low	Low
Water Quality (Pollution) – direct impact	Medium-Low	Low
Catchment modifications (land cover and surface runoff) – indirect impact	Low	Very Low
Water Quality (Pollution) – indirect impact	Low	Very Low
Archaeology and Palaeontology Impacts (Section 7.5.6)		
No impact		
Terrestrial Biodiversity Impacts (Section 7.5.7)		
Loss of modified habitat (Construction Phase)	Medium-Low	Low
Loss of reed beds (Construction Phase)	Medium	Low
Loss of bushveld (Construction Phase)	Medium-Low	Low
Loss of flora Species of Conservation Concern (SCC) (Construction Phase)	Medium	Low
Loss of fauna SCC (Construction Phase)	Medium	Low

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Loss of biodiversity in general (Construction Phase)	Medium-Low	Low
Fragmentation (Construction Phase)	Medium-Low	Low
Invasion of alien species (Construction Phase)	High	Low
Loss of modified habitat (Operational Phase)	Medium-Low	Low
Loss of reed beds (Operational Phase)	Medium-Low	Low
Loss of bushveld (Operational Phase)	Medium-Low	Low
Loss of flora SCC (Operational Phase)	Medium-Low	Low
Loss of fauna SCC (Operational Phase)	Medium-Low	Low
Loss of biodiversity in general (Operational Phase)	Medium-Low	Low
Fragmentation (Operational Phase)	Medium-Low	Low
Invasion of alien species (Operational Phase)	High	Low
Avifauna Impacts (Section 7.5.8)		
Powerships: Habitat Loss (Construction Phase)	Medium-Low	Medium-Low
Powerships: human disturbance (Construction Phase)	Medium	Medium-Low
Transmission Line: Habitat Loss (Construction Phase)	Medium-Low	Very Low
Infrastructure: human disturbance (Construction Phase)	Medium	Medium-Low
Habitat loss: Infrastructure (Operational Phase)	Medium-Low	Very-Low
Project infrastructure: collisions (Operational Phase)	Medium-High	Medium-Low
Project infrastructure: electrocution (Operational Phase)	Medium-Low	Medium-Low
Powership: light pollution (Operational Phase)	Low	Low
Powership: noise and vibration impacts (Operational Phase)	Medium	Medium
Powership: human disturbance (Operational Phase)	Medium-Low	Very-Low
Underwater Noise Impacts (Section 7.5.9)		
No impact		
Underwater Archaeology Impacts (Section 7.5.10)		
Extremely low probability of Maritime and Underwater Cultural Heritage resources	Neutral/ Negligible	Neutral/ Negligible
Coastal, Estuary and Marine Ecology Impacts (Section 7.5.11)		
Disturbance or loss of estuarine and marine fauna (Construction phase)	Medium-Low	Low
Changes in water quality as a result of water-based construction activity	Medium	Medium-Low
Disturbance to surrounding estuarine ecology, and fisheries and mariculture, due to increased noise levels	Medium-Low	Medium-Low
Avifauna Impacts (Powerships and Transmission line)	Medium	Medium-Low
Loss of fauna Species of Conservation Concern (Construction phase)	Medium	Low
Solid waste pollution (Operational Phase)	Medium-Low	Low
Chemical pollution arising spills of hazardous substance (Construction Phase)	Medium-High	Medium-Low
Intake of cooling water on marine organisms in the surrounding water body (Operational Phase)	Medium	Medium-Low

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Cooling water discharge on the estuarine/marine ecology (Operational Phase)	Medium-High	Medium
Effects on surrounding estuarine/marine ecology due to increased underwater noise and vibrations (Operational Phase)	Medium-High	Medium
Effects on surrounding estuarine/marine ecology due to increased light pollution (Operational Phase)	Medium-High	Medium-Low
Effects of the combined operational impacts on ecosystem services (fisheries and mariculture)	Medium	Medium
Chemical pollution arising from construction related spills of hazardous substances and shipping activities (Operational Phase)	High	Medium-Low
Effects of catastrophic accidents on estuarine/marine ecology, avifauna and ecosystem services (Operational Phase)	Low	Low
Atmospheric Impacts and Risks (Section 7.5.12)		
SO_2 ; NO_2 and PM_{10}	Low	Low
Terrestrial Noise Impacts and Risks (Section 7.5.13)		
Noise impacts from construction activities	Medium-Low	Low
Noise impacts from operational activities	Medium-Low	Low
Climate Change Impacts and Risks (Section 7.5.14)		
Contribution to climate change	Low (Positive)	Low (Positive)
Socio-Economic Impacts and Risks (Section 7.5.15)		
Changes in biodiversity and climate on the livelihoods of communities	Low	Low (Positive)
The economics, and livelihoods for local fishermen in the region (not just fishermen within the harbour location)	Medium	Medium (Positive)
Reduction of tourism and related activities in the Municipal area and in the broader region.	Medium	Low (Positive)
Increase in demand for municipal infrastructure, social services and crime associated with the construction workers and job seekers (Construction phase)	Low	Low
Increase in demand for municipal infrastructure, social services and crime associated with the construction workers and job seekers (Operational phase)	Medium	Medium
Skills transfer and development (Construction Phase)	Low (Positive)	Medium (Positive)
Skills transfer and development (Operational Phase)	Low (Positive)	Low (Positive)
Sense of place experienced due to visual and noise effects	Low	Low
Increases in economic production, value, income and employment during construction and operations	High (Positive)	High (Positive)
Tourism Impacts and Risks (Section 7.5.16)		

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Potential negative noise impact in the Port of Richards Bay on the marine tourism activities	Low	N/A
Potential negative visual and noise impacts on tourism at the Port of Richards Bay	Low	N/A
Potential positive impacts of Karpowerships electricity provision on the hospitality and tourism industry in Richards Bay	Very High (Positive)	Very High (Positive)
Potential Positive Impacts on Energy and Industrial Tourism in Richards Bay	Low (Positive)	Low (Positive)
Traffic Impacts (Section 7.5.17)		
No impacts.		
Visual Impacts (Section 7.5.18)		
No Impacts.		
Major Hazard Installation Risk (Section 7.5.19)		
Acceptable impacts.		
Marine Traffic Impacts and Risk (Section 7.5.20)		
No impacts		

Based on the above Specialist Studies, the following conclusions were reached on impacts and risk post mitigation:

Specialist studies found ‘No significant or negligible’ impacts or risks in terms of heritage, traffic, marine traffic, major hazard installation, hydrology, geohydrology, hydropedology, tourism and visual aspects.

Negative impacts and risks of very low and/or low significance were identified for wetlands, Terrestrial Biodiversity, atmospheric emissions and terrestrial noise. Socio-economic negative impacts ranged from low to medium.

The overall impact of the Project on the Richards Bay Estuary and coastal environment after mitigations will be medium to low, and medium to very low for Avifauna aspects (after mitigations).

Low to very high **positive** impacts were indicated for aspects related to the Tourism Industry and the socio-economic assessment indicated numerous positive impacts ranging from low, medium to high positive.

A polycentric approach to the proposed project requires the holistic consideration of all relevant factors, inclusive of potential impacts that the proposed project could have on the local as well as the broader community. Section 2(4)(b) of NEMA states that *Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in* the *environment by pursuing the selection of the best practicable environmental option.* Sustainable development as per NEMA requires the integration of social, economic, and environmental factors in the planning, implementation, and evaluation of proposed projects, to ensure that development serves the needs of present and future generations.

The independent sustainability specialist assessment therefore considered both the positive and negative impacts of actual and potential impacts on the geographical, physical, biological, social, economic, and cultural aspects of the environment in a polycentric and holistic approach that:

- Acknowledges that this environment is a complex and dynamic system
- Acknowledges the interrelated socio-ecological and socio-economic relationships
- Identifies the risks and consequences of alternatives and options for mitigation of activities, to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management as set out in section 2 of NEMA.

9.4.3 Summary of key findings and potential shifts in the socio-ecological system

The systems map for the proposed project at the Port of Richards Bay illustrates key shifts in the socio-ecological ecosystem as a result of the operation of the Powership operating in the Port. This understanding is based on fundamentals derived from definitions and methodologies developed under Complexity Science and Systems Thinking, which views the site and the proposed changes via the Karpowership SA Project as a complex adaptive system. The systems map illustrates cause-and-effect relationships to create understanding of complex systems and their interactions. The systems map provided below is intended to provide a simplified conceptual understanding of how the site may change as a consequence of the proposed project. This understanding allows for an enhanced perspective of the proposed project through the compound lens of the specialist assessment findings regarding how the site may be impacted. This perspective is further used for improved impact mitigation / management recommendations, with a focus on strengthening of adaptive management related recommendations at construction and operation phase.

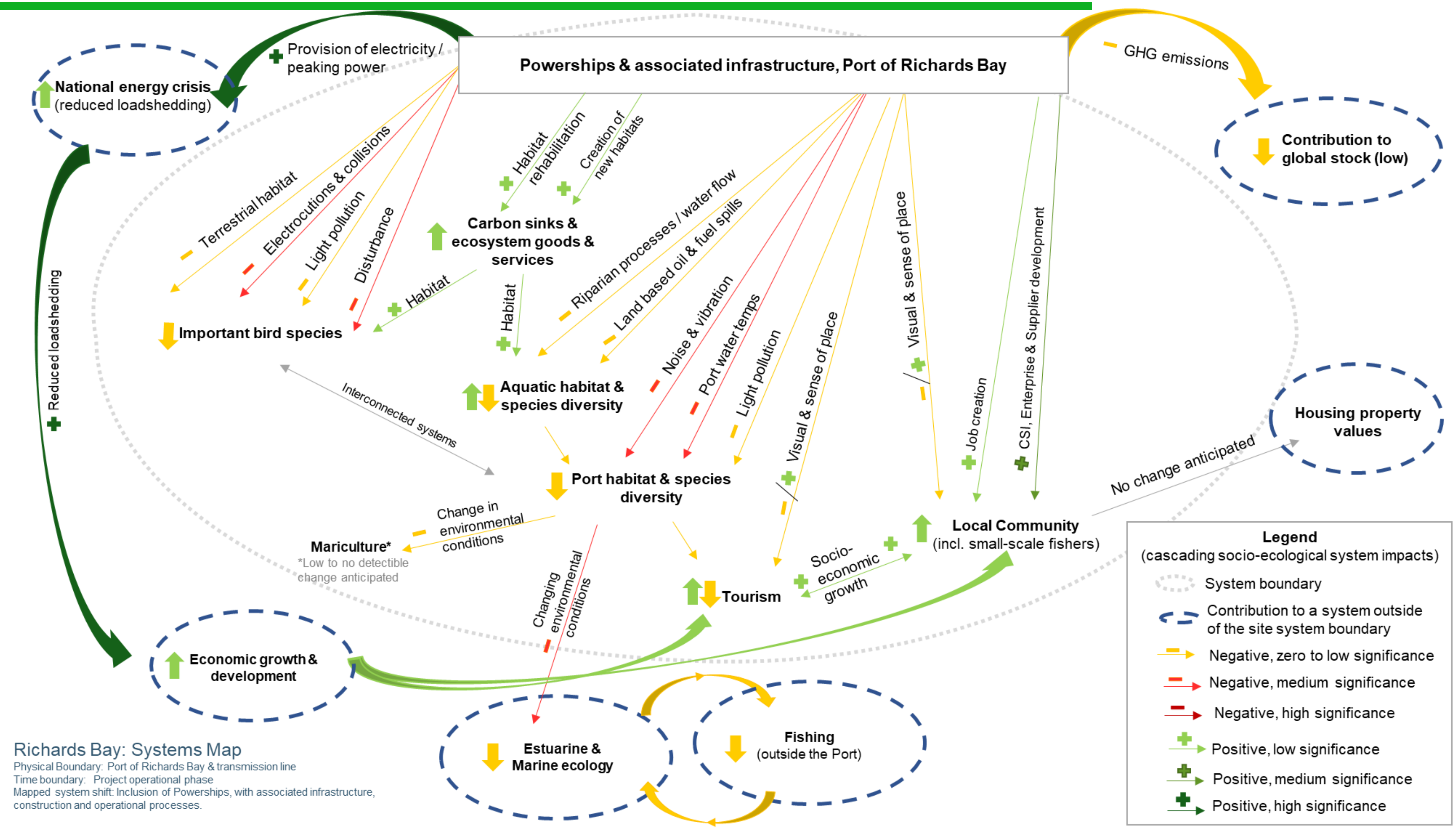

Figure 9-2: System map illustrating the anticipated shifts to the socio-ecology system following the inclusion of the Powership and associated infrastructure in Richards Bay

9.4.4 Summary of key findings from the holistic assessment

From the integrative, polycentric perspective adopted in conducting the EIA, the following key findings gathered from the matrices regarding identified impacts, and the systems map regarding anticipated system shifts, include:

- The key contribution that the proposed project will provide, is to reduce the burden of loadshedding on the country. There are several consequences of this, including opportunities for economic recovery and transition to the energy mix as proposed in the IRP 2019. Please see the Economic Impacts of Loadshedding discussion paper and the Socio-Economic Impact Assessment Supplementary report for further details.
- There is opportunity for the small-scale fishers and the rest of the community to benefit from corporate social investments, skills development, and supplier and enterprise development because of Karpowership SA's local content commitments (medium-low impact). In addition, there will be jobs created associated with the construction and operational phases of the project (low impact). Please see the Socio-Economic Impact Assessment Supplementary report and the Enterprise and Supplier Development report for further details.
- There is industrial and value chain development potential for the gas industry through increased economies of agglomeration. Please see the Economic Impacts of Loadshedding discussion paper and the Socio-Economic Impact Assessment Supplementary report for further details.
- There are several important habitats near the proposed project site that fall within the estuarine, marine, aquatic and to a limited extent terrestrial environments. While it is acknowledged that the site is an active port and industrial zone, the cumulative impacts of port activities and the impacts of the powership operations is anticipated to negatively impact of medium significance on estuarine and marine ecology, including important bird species. Consequently, this will affect fish populations that fishers (commercial and small-scale) depend on, and which are already under strain from over-fishing.
- Construction and maintenance of the gas pipeline, transmission line and switching stations is anticipated to result in a loss of important fauna and flora. Mitigation recommendations and rehabilitation have been proposed to limit the overall environmental significance.
- The terrestrial noise caused by the Powership during electricity generation, should not extend into residential areas and therefore is not anticipated to affect local communities. Limited impacts on fauna and flora are expected.
- Tourism is not anticipated to be negatively affected by the presence of the Powership, and associated infrastructure. This is largely because the Powership will be located in the port and will blend in with other ships and port infrastructure. The tourism sector may further benefit from peaked interest in the Powerships, yielding 'energy tourism'. This may further stimulate maritime recreational themed economic opportunities.
- Tropical cyclones are typically high impact low probability hazards and are generally quite difficult to manage due to their unpredictable nature. This has been considered in the design of the project and impacts are anticipated to be low and not to affect core operations. However, these storms can have detrimental impacts as an environmental disaster that will impact surrounding communities and ecosystems.
- Operation of the Powerships will contribute only marginally to the global GHG stock. Operation of the Powership cannot directly be tied to the experience of climate change impacts at this site, as this is a dynamic function of the global climate system and GHG stock.

- Major hazards were identified around fire risks associated with gas leaks - which was also found to be normal, and operation can continue with appropriate mitigation and emergency responses. This could also provide opportunity for skills development in the area relating to monitoring and evaluation as well as emergency risk response.
- It is not anticipated that ambient SO_2 and NO_2 particulate concentrations will exceed NAAQS, and therefore is not anticipated to impact on the local community.
- Underwater archaeology will not be affected if underwater archaeology mitigation measures are followed in the case of an archaeological find. It is however, not anticipated that there will be a find. However, an archaeologist should be on site during the construction phase.
- Riparian zones provide a range of ecological goods and services to communities, fortunately no impact is anticipated on any watercourse because of the Powership.
- No heritage and palaeontology impacts are anticipated.
- No significant findings were noted regarding impacts to geohydrology and hydropedology.
- There is potential for the Karpowership SA project to contribute positively to natural habitats through creation of habitats and rehabilitation, although marginal. This could include removal and management of alien invasive plant species; and mooring structures may provide hard structures for benthic communities to colonise. There is also further potential that may be identified through corporate social investment programmes.

No fatal flaws have been identified by the specialist assessments for the preferred alternatives, and therefore no fatal flaws are noted here.

The Karpowership SA is an important response under the RMI4P to the country's ongoing energy crisis and will provide much needed relief to industry and households alike. There are also numerous socio-economic benefits that will be realised at a site scale because of the local content requirements DMRE bid process, as described earlier in this report. There are further opportunities for enhanced scientific research and ecological monitoring of the port and the impacts of the operations of the Powership on the environment, which will enhance our understanding and management abilities relating to port dynamics and the associated estuarine ecology.

Acknowledging the identified impacts, and the strong socio-ecological relationships associated with this site, the following recommendations relate to opportunities that can be taken forward by Karpowership SA as part of their corporate social investments, which align with issues identified in this report, to maximise their positive contribution to local communities and lessen the identified negative impacts on the environment. It is hoped that through these recommendations the legacy of Karpowership SA, at the end of its contract, will be to leave behind a socio-ecologically resilient, and economically thriving community.

Given that the professionals who undertook the specialist studies have supported / not opposed to the granting of the environmental authorisation, with various requirements for mitigation and management, the sustainability specialist supports this project being granted the environmental authorisation, provided the necessary mitigation and management recommendations are upheld. The recommendations provided in this report offer further opportunity to reduce the negative impacts of this project on the environment and enhance the positive contributions and legacy that Karpowership SA can contribute to this community.

9.5 NEED AND DESIRABILITY

The Karpowership project has arisen in response to the need to address the current energy crisis experienced in South Africa. It is in response to a bid issued by DMRE as part of the RMI4P. The RMI4P is to satisfy the short-term electricity supply gap, ease the current electricity supply constraints and reduce the wide-scale usage of diesel-based peaking electrical generators using alternative energy technologies ((Steenkamp & Weaver, 2022; DMRE, 2021a). Loadshedding is currently estimated to cost our economy between R500 million and R4 billion per day of Stage 1-6 Loadshedding implementation. The energy generated through the Karpowership project will contribute towards alleviating the loadshedding burden and resultant negative socio-economic impacts by providing much needed dispatchable energy, which can be provided at baseload, mid-merit and peaking from the Project on demand.

The RMI4P, declared a Strategic Integrated Project, is an important response to the energy crisis, and in line with the mandate of the State to provide services that ensure socio-economic growth and well-being for the benefit of all of society. Karpowership SA's proposed Project is in accordance with the IRP 2019 where provision has been made for gas in the energy mix. Powerships should not be considered a replacement of renewable energy, but rather a complementary technology to renewable energy, which supports the transition away from coal and a reduction in the negative environmental impacts associated with coal and overuse of diesel peaking plants. Coupled with the urgent need to respond to the energy crisis, Karpowership SA's project offers a solution where electricity can be dispatched on instruction when the energy supply is under strain.

In addition, the Project will result in positive multiplier impacts on the local economy during both the construction and operational phases. Karpowership will play a positive role in the local economy through skills-, enterprise- and supplier development programmes. The direct, indirect, and induced economic impacts of the project on employment, income generation, new production and economic value will be positive. This will include skills development and capacity development towards the realisation of a just transition in South Africa. It is therefore anticipated that the Karpowership project will result in an overall positive socio-economic impact (refer to the ED Plan and Socio-economic report) when considering the host of economic and environmental impacts.

It is worth reiterating that the Karpowership SA Project is in an active port, and adjacent to the Richards Bay Industrial Development Zone, which is considered a key growth node catering specifically for the energy and maritime sectors.

However, a responsible and sustainable approach to the proposed project is still required, in line with the requirements of NEMA and the environmental management Acts Policies and Guidelines. Duty of care must be observed. Therefore, numerous multidisciplinary specialist impact assessments have been undertaken as part of the EIA process, integration of specialist findings was ensured and a polycentric view to the impact assessment was applied. Negative and positive impacts have been identified, and as far as possible all negative impacts have been avoided or mitigated to reduce the impact, and further management recommendations provided for as per the EMPr. All Specialists support the project and no fatal flaws were identified. The polycentric approach gave consideration to all relevant factors, inclusive of potential impacts that the proposed project could have on the local as well as the broader community. There is further positive opportunity for scientific research and monitoring programmes to inform adaptive management through the life cycle of this Project, and for similar port-based projects. The Sustainability Specialist, based on Specialists' inputs, independently assessed the project's geographical, physical, biological, social, economic and cultural aspect of the environment through the application of three methods that assisted with synthesizing and conceptualizing technical information for decision making purposes. The following conclusion was reached: *"Given that the professionals who undertook the specialist studies have supported the granting of the environmental authorisation, with various requirements for mitigation and management, I support this project be granted the environmental authorisation, provided the necessary mitigation and management recommendations are upheld. The recommendations provided in this report offer further opportunity to reduce the negative impacts of this project on the environment and enhance the positive contributions and legacy that Karpowership SA can contribute to this community*".

9.6 REASONED OPINION

In accordance with Regulation 3(1)(q) in Appendix 3 of GN 982 ("the NEMA EIA Regulations"), this section provides 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, the conditions in respect of such authorisation.

It is the opinion of the EIA project team, incorporating the signatories below, that all components of this application, including the EIR with attached independent specialist reports, EMPr, public participation process and supporting documentation, comply with the relevant guidelines and contain all the required information in terms of GN 982 to enable an informed decision by the competent authority.

It is the reasoned opinion of the EAP that the Gas to Power Powership project is acceptable, will not create unacceptable environmental impacts and can be reasonably authorised subject to the implementation of the mitigations and management measures set out in the EMPr. This opinion was reached with due consideration of:

- the independent specialist studies, with each and every specialist concluding their assessment with a supportive statement for the proposed development (i.e. no fatal flaws were identified),
- the independent contributions to the need and desirability,
- the impacts identified from a macro, micro, cumulative and polycentric (integrative) perspective in terms of the geographical, physical, biological, social, economic and cultural aspect of the environment,
- the potential to avoid or minimise negative impacts and maximise positive impacts through inter alia the socio-economic development plan and reduced loadshedding,

9.7 CONDITIONS OF AUTHORISATION

In accordance with 3(m, r and o) in Appendix 3 of GN 982 it is recommended that the following key management and mitigation conditions, as included in the EMPr, also be incorporated into the authorisation for the project:

- The recommended alternatives to be implemented.
- All mitigation measures specified within the EMPr (Appendix 6) are to be implemented.
- The EMPr (Appendix 6 and its appendices) for this EIA Report must be a binding document between Karpowership SA (Pty) Ltd and the appointed contactor(s) for construction, operations and maintenance, to ensure compliance with environmental specifications and management measures. This must be a living document to be updated based on monitoring and auditing recommendations.

- It is recommended that external EMPr monitoring takes place by an independent Environmental Control Officer (ECO) with appropriate environmental qualifications and relevant experience.
- ~~The period for the Environmental Authorisation to be 20 years and the date at which the activity will be concluded will be 20 years from the first commercial operational date following the construction and commissioning period of approximately 18 months.~~
- Construction on the project must commence no later than 18 months following: the granting of the authorisation, the date of any related appeal decision by the Minister, or the date of the final judgment of a competent Court, if the granting of the authorisation is taken on review. The applicant must inform the DFFE in writing 2 weeks before it intends commencing construction.
- The authorisation will last for a period of twenty (20) years from the date of the first commercial generation and supply of electricity by the applicant to ESKOM.

9.8 EAP DECLARATION AND UNDERSTANDING

In accordance with 3(1)(s) in Appendix 3 of GN 982, Triplo4 and the EAPs managing this project hereby affirm that

- To the best of our knowledge the information provided in the report is correct. Reference is made to the Disclaimer regarding Independent Specialists, Service Providers and Contributors information provided as well as technical input from the technical teams on the project and the client.
- All effort was made to provide an accurate reflection of the information, including the summarising of specialist studies and recommendations as captured in the report and EMPr. Where wording was changed, or paraphrased in summaries, this was intended to ensure clarity and enforceability without deviating from the original meanings.
- With respect to the EIA Report, Triplo4 took account of interested and affected parties' comments and, insofar as comments are relevant and practicable, these were considered during the Impact Assessment and Public Participation Process.
- Comments and inputs from and to stakeholders and interested and affected parties are included in this report as per the Public Participation Section Summary and Appendices as well as descriptions within relevant sections of the report. All comments received from I&APs with responses thereto are to be included in the final EIA in the form of a comments and responses report submitted to DFFE.

Any comments and inputs subsequent to the submission of this report for public participation will be captured and submitted with the Final EIR Report to DFFE.

Any comments and inputs subsequent to the submission of this report for public participation will be captured and submitted with the Final EIR Report to DFFE.

Signature of EAP

Signature of EAP

06 January 2023

Kindly refer to the Declaration of Interests and Undertaking under Oath attached in Appendix 4.

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