DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT:

The Proposed Gas to Power Powership Project at the Port of Saldanha Bay and associated evacuation route within Saldanha Bay Local Municipality, West Coast District, Western Cape

DFFE REF NO: 14/12/16/3/3/2/2006

A Project of Karpowership SA (PTY) Ltd

9 NOVEMBER 2022

KARPOWERSHIP

triplo4 sustainable solutions

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Compiled and Authorised by:

Compiled By:	**Date**	**Signature**
Nerita Venketasen Environmental Consultant	November 2022	
Zayd Hoosen (*Pri.Sci.Nat* | *Reg. EAP (EAPASA)*) Environmental Consultant	November 2022	
Reviewed By:	**Date**	**Signature**
Shanice Singh *Reg. EAP (EAPASA)* Senior Sustainability Consultant	November 2022	
Melissa Gopaul (nee Padayachee) (*Pri.Sci.Nat* | *Reg. EAP (EAPASA)*) Senior Sustainability Consultant	November 2022	
Authorised By:	**Date**	**Signature**
Hantie Plomp (*Pri.Sci.Nat* | *Reg. EAP (EAPASA)*) Director	November 2022	

COMPILED FOR:
Karpowership SA (Pty) Ltd

COMPILED BY:
Triplo4 Sustainable Solutions (Pty) Ltd
Suite 5, The Circle, Douglas Crowe Drive, Ballito, 4420
☎ +27 (0)3 946 3213
🖷 +27 (0)32 946 0826
✉ info@triplo4.com
www.triplo4.com

THIS REPORT WAS INDEPENDENTLY REVIEWED BY NORMAN BRAUTESETH AND ASSOCIATES ATTORNEYS

EXECUTIVE SUMMARY:
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT
Proposed Gas to Power Powership Project at the Port of Saldanha and associated evacuation within Saldanha Bay Local Municipality, West Coast District, Western Cape
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1. Introduction

Karpowership SA (Pty) Ltd proposes a Gas to Power via Powership Project at the Port of Saldanha and associated evacuation within Saldanha Bay Local Municipality, West Coast District, Western Cape.

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 Saldanha and associated evacuation route within Saldanha Bay has been formulated in response to the Request for Proposals (RFP) for technology agnostic New Generation Capacity under the Risk Mitigation Independent Power Producer 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 Power Purchase Procurement Programme (2000MW): National" has also been designated the status of a Strategic Integrated Project (SIP) under the Infrastructure Development Act 23 of 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 Saldanha and associated evacuation route within Saldanha Bay forms part of the solutions provided by the RMI4P preferred bidders that provides 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 1 bidder's project bid a lower cost per kWh than Karpowership SA, and all Karpowership SA Projects are significantly cheaper on evaluation than the average of the other 8 Preferred Bidders, confirming the affordability of the gas to power project as a fully dispatchable technology.

In total, 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 Saldanha 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 the required 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 Environmental Impact Assessment 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 needs to be 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 (BA) or a Scoping and Environmental Impact Assessment (S&EIR) process is required to obtain Environmental Authorisation (EA).

Triplo4 has determined that the proposed Gas to Power via Powership Project at the Port of Saldanha and associated evacuation route within Saldanha Bay triggered activities in Listing Notice 1-3 of the EIA Regulations and therefore requires a S&EIR process to be followed. For the purposes of this Report, this shall be referred to as the "EIA process".

Table 0-1-1: 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 (Western Cape)	
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.

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. This Draft EIR falls under the Impact Assessment Phase.

A Scoping and Environmental Impact Reporting (S&EIR) process was conducted during 2020-2021, 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 Integrated Environmental Authorisations Directorate within the Department Forestry, Fisheries and the Environment (DFFE), on 6 January 2021.
- A Final EIA Report (EIAr) and Environmental Management Programme Report (EMPr) were submitted to the CA on 26 April 2021. The CA refused the EA application and provided KSA with the Record of Refusal (RoR) on 23 June 2021.

- On 13 July 2021, KSA appealed the CA's refusal. On 1 August 2022, the Appeal Authority (the Minister of the DFFE) dismissed the appeal and exercised her powers in terms of Section 43(6) of NEMA. The application was therefore remitted back to the CA, with the instruction to the applicant to address various perceived gaps and defects through a new EIAr and associated Public Participation Process (PPP), in order for the application to be re-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 any 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 CA to decide whether (and under what conditions) to authorise the proposed Project.

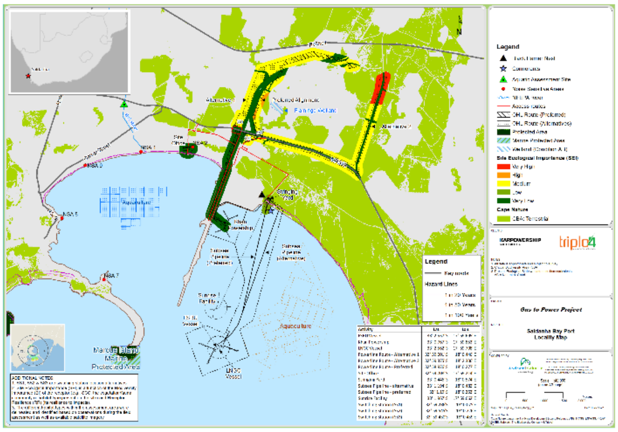

Figure 0-1-1: Overview of Project Site

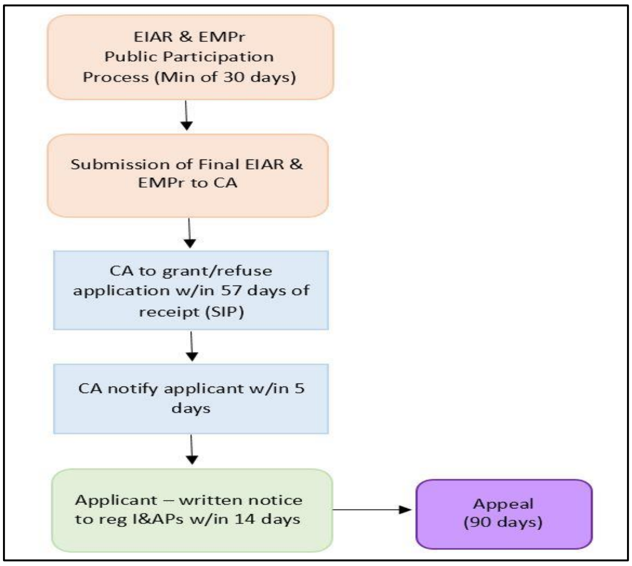

Figure 0-1-2: EIR Process

4. Description of the Site & Environment

The Project is located in the Port of Saldanha and properties leading to the tie in point at the Eskom Aurora – Saldanha Main transmission substation. It is located within Saldanha Bay Local Municipality, within the West Coast District Municipality in the Western Cape Province.

The proposed Powership, Floating Storage Regasification Unit (FSRU), temporary Liquefied Natural Gas Carrier (LNGC) and gas line will be located in the Port of Saldanha under the jurisdiction of TNPA. The transmission line traverses Transnet properties as well as industrial and undeveloped privately owned properties. The proposed Powership is located adjacent to the causeway near the iron ore terminal in Big Bay. The proposed FSRU is located is 3,8km seaward in Big Bay and it is positioned between the Aquaculture Development Zone and the Sunrise LPG mooring system.

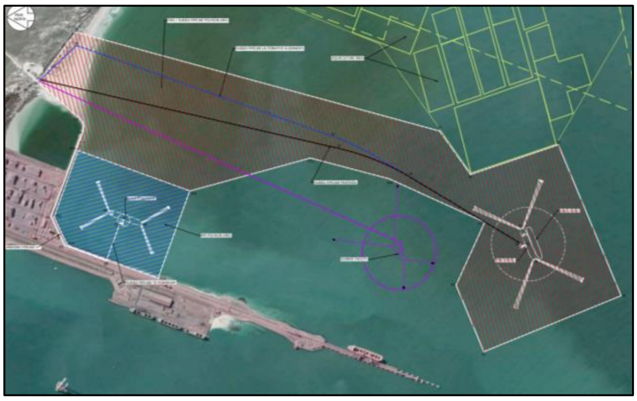

Figure 0-1-3: Overview of Port Site

Figure 0-1-4: Overview of Transmission Route

The most notable land uses adjacent to the project site are:

- The Port of Saldanha
- West coast coastal plain
- The area has a mixture of developments with majority of it being industrial, transport and logistics orientated.
- The agricultural landscape is largely comprised of pasture for livestock production, while the industrial development includes oil storage, paper production and steel production industries.

The two conservation areas which are located to the southeast of the project area include the West Coast National Park, a formally protected area, and the Saldanha Nature Reserve which is a provincial nature reserve. Such areas are predominately covered with natural Fynbos and shrubland.

The West Coast District (WCD) Municipality accounts for only 6.6% of the population, and is one of the three smallest municipalities in the Western Cape with the second lowest population densities.

The population of the WCD is 467 175 people in 2021, making it, outside of the metro, the third most populated district in the Province. This total is expected to grow to 491 515 by 2025, equating to an average annual growth rate of 1.3 per cent.

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 a reduction in the negative environmental impacts associated with coal. 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.

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 when considering the host of economic and environmental impacts.

It is worth reiterating that the Karpowership project is in an active port, and Saldanha 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. In addition, a 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 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. 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 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 from one Powership moored in the Port of Saldanha Bay, fueled with natural gas supplied from a second ship, a FSRU. The two ships will be moored in the port for the Project's contracted 20-year lifespan (as per the RMI4P requirements- Appendix 8.3). A LNGC will bring in 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 Powership via a subsea gas and overland pipeline. The Project's design capacity is 415MW. Electricity will be generated on the Powership by 24 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 two steam turbines that each have a heat input of circa 15.45MW. The contracted capacity of 320MW, which will be measured at the Point of Utility Connection located at the new switching station, and which cannot be exceeded under the terms of the RMI4P, will be evacuated via a 132 kV transmission line. This line of approximately 7.5km in length will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station.

7. Alternatives

The EIA Regulations require that all S&EIR processes must identify and describe feasible and reasonable alternatives, including a 'No-Go' option. Numerous alternatives were identified and considered to date.

Table 0-1-2: Alternatives Screened Out at Scoping Phase

Alternative	Screened Out Reason
Powership: Positioned in Small Bay	As a result of TNPA engagements
Overland gas pipeline routed behind the oyster dam	As a result of landowner engagements
Connection to Blouwater substation	

The following alternatives were considered in the EIA:

a. Layout Alternatives

Marine:

Preferred Gas Pipeline: The gas pipeline is connected from the FSRU via a subsea pipeline and onshore pipeline in Big Bay where it thereafter routed in front of the Oyster dam and along the causeway before it connecting via a subsea pipeline to the Powership. The route to the onshore pipeline is more direct than the alternative and the onshore pipeline traverses 400m less of the beach.

Gas Pipeline Alternative 1: The gas pipeline is positioned 400m east of the preferred route therefore traverses more of the beach. The alignment to the Powership from this point is aligned with the preferred route.

Transmission:

Preferred: The electricity generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line. This new transmission line of approximately 7,5km will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. The monopole transmission towers are proposed within a 60 metre corridor which includes the 31m working servitude. The servitude stretching approximately 7,5km from the port to the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station (SS2/SS3), will have a width of 31m as per Eskom safety specifications. This route is primarily based between Transnet and the Saldanha Steel property.

Alternative 1: The new transmission line of approximately 7,2km and the route to east of the preferred option. There is one switching station, (SS1) associated with this route. This route is primarily based between Transnet and the Saldanha Steel property and crosses properties owned by Afrisam and Duferco (where two local landowners are currently undergoing late stages of an arbitration process against one another, albeit with no definitive timeline).

Alternative 2: The new transmission line of approximately 8,6km and the route to east of the preferred option. There are two switching station, (SS2 and SS3) alternatives associated with this route. This route was not supported from an avifaunal and ecological perspective and is considered a no-go option due to the alignment occurring within the flight path or paths of three priority species including GPS-tracked single pair of Black Harriers present. Furthermore, the terrestrial ecologist indicated that this route traverses an area of critically endangered limestone strandveld which should be avoided.

b. Design Alternatives

The proposed transmission line can be constructed of either a 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 option.

c. 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.

d. 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 8 of the draft 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 prevented.

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 Saldanha. 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 320MW 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 summarised in Table 0-1-3:

Table 0-1-3: Summary of Stakeholder Engagement Activities

Activity	Date
Pre-consultation Meetings	20 October 2022
Initial Notification	
Advert, BID, Site Notices, Flyers, Leaflets, Radio Announcements	24 -28 October 2022
Consultation Meetings	24 October – 09 November 2022
Impact Assessment	
Draft EIAR Comment Period	10 November – 13 December 2022
Public & Virtual Meeting	25 November 2022

9. Assessment of Potential Impacts

a. 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 Impact Assessment Report
- Marine Ecology Assessment & Fisheries Impact Report
- Marine Avifaunal Assessment
- Estuarine and Coastal Assessment
- Traffic incl. Marine
- 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
- 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 Section 7.3.

b. Impact Significance

The significance of potential impacts and risks of the proposed Project was determined in order to assist decision-makers. The overall impact ratings, assuming mitigation measures (see Section 7.3) are effectively implemented, are presented in Table 0-1-4.

Table 0-1-4: Summary of Stakeholder Engagement Activities

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Hydrology Impacts (Section 7.4.1)		
No impacts		
Aquatic Impacts (Section 7.4.2)		
No impacts		
Hydropedology Impacts (Section 7.4.3)		
Site preparation impacting on soil interflow processes, soil quality, soil structure and land capability	Neutral/ Negligible	Neutral/ Negligible
Disturbing vadose zone, the in-situ placement of new soils, vegetation clearing & soil stockpiling impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Surface water (wetland) quality as well as possible oil & fuel spills impacting on soil quality	Low	Neutral/ Negligible
Geohydrology Impacts (Section 7.4.4)		
Disturbing vadose zone during soil excavations and possible hydrocarbon contamination (construction activities)	Low	Neutral/ Negligible
Impacts to downstream groundwater users (construction and operational phase); Perched water table dewatering	Neutral/ Negligible	Neutral/ Negligible
Hydrocarbon contamination of the vadose zone (operational phase)	Neutral/ Negligible	Neutral/ Negligible

Wetland Impacts (Section 7.4.5)		
Catchment modifications	Low	Very Low
Water Quality	Low	Very Low
Archaeology and Palaeontology Impacts (Section 7.4.6)		
Loss of fossil bones and shells during excavation of pylon foundations	Low	Very Low
Terrestrial Biodiversity Impacts (Section 7.4.7)		
Loss of Dune Strandveld	Medium-Low	Very Low
Loss of Flats Strandveld – Alternative route 1 or Preferred Alternative (Construction)	Medium-High	Medium-Low
Loss of Limestone Strandveld – Alternative route 1	Medium-High	Medium-Low
Loss of Flora SCC (Construction)	Medium-High	Low
Loss of Flora SCC (Operation)	Medium-Low	Very Low
Loss of Fauna SCC	Medium	Very Low
Loss of biodiversity in general (Construction)	Medium-High	Medium-Low
Los of biodiversity in general (Operation)	Medium-Low	Low
Fragmentation (Construction)	Medium	Medium-Low
Fragmentation (Operation)	Low	Very Low
Invasion of alien species	High	Medium-Low
Avifauna Impacts (Section 7.4.8)		
Negative impact of transmission line due to direct impact mortality (or avoidance of area) around any new power line for the Red-listed bird groups (operational phase)	High	Medium-high
Negative impact due to avoidance of the construction area for the transmission line (construction phase)	Low	Low
Major disturbance to (i) harrier breeding habitat and (ii) roosting habitat of the Cape Cormorants by the presence of the Stringing yard	High	Medium
Noise from power generation	Medium-High	Medium
Underwater Noise Impacts (Section 7.4.9)		
No impact		
Underwater Archaeology Impacts (Section 7.4.10)		
Impacts to underwater heritage resources	Low	Low
Marine Ecology and Marine Avifauna Impacts (Section 7.4.11)		
Effects of gas pipeline construction and installation and vessel mooring on the benthic community	Medium-Low	Low
Effects of the intake of cooling water on marine organisms in the surrounding water body	Medium	Medium-Low
The effects on the marine ecology in the receiving water body due to discharge of cooling water or increased noise and vibration levels	Medium-High	Medium
The effects of impacts on ecosystem services (operational phase)	Medium	Medium
Impact on dynamic coastal processes	Medium-Low	Low
Impact of coastal pollution	High	Low
Coastal and Estuary Impacts (Section 7.4.12)		
No impacts		
Atmospheric Impacts and Risks (Section 7.4.13)		
SO_2 ; NO_2 and PM_{10}	Low	Low
Terrestrial Noise Impacts and Risks (Section 7.4.14)		
Noise impacts from construction and operational activities	Medium-Low	Low
Climate Change Impacts and Risks (Section 7.4.15)		
Contribution to climate change	Low (Positive)	Low (Positive)
Socio-Economic Impacts and Risks (Section 7.4.16)		
Temporary increase in the GDP and production of the national and local economies during construction	High (Positive)	High (Positive)
Temporary increase in employment in local and national economies	High (Positive)	High (Positive)
Contribution to skills development in the country and in the local economy	Medium (Positive)	Medium (Positive)
Temporary improvement of the standard of living of the positively affected households or temporary increase in government revenue	Medium (Positive)	Medium (Positive)
Temporary increase in social conflicts associated with the influx of construction workers and job seekers to the area	Medium-Low	Low
Added pressure on economic and social infrastructure during construction as a result of increase in local traffic and in migration of construction workers	Medium-Low	Low
Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the construction phase	Medium	Low
Temporary increase in the GDP and production of the national and local economies during construction	High (Positive)	High (Positive)

Creation of sustainable employment positions nationally and locally	High (Positive)	High (Positive)
Skills development of permanently employed workers during operations phase	Medium-Low (Positive)	Medium-High (Positive)
Improved standard of living for benefitting households and provision of electricity for future development	Medium-High (Positive)	Medium-High (Positive)
Sustainable increase in national and local government revenue	Medium-High (Positive)	Medium-High (Positive)
Local community and social development benefits derived from the project's operations	Medium (Positive)	Medium-High (Positive)
Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase	Low	Low
Tourism Impacts and Risks (Section 7.4.17)		
Potential negative noise impact in the Saldanha Bay Port on the marine tourism activities.	Low	N/A
Potential negative visual and noise impacts on tourism at Saldanha Bay Port	Low	N/A
Potential positive impacts of Karpowership's electricity provision on the hospitality and tourism industry in the Saldanha Bay	Very High (Positive)	Very High (Positive)
Potential Positive Impacts on Energy and Industrial Tourism in the Saldanha Bay	Low (Positive)	Low (Positive)
Traffic Impacts (Section 7.4.18)		
No impacts.		
Visual Impacts (Section 7.4.19)		
Change the character and sense of place of the landscape setting (Landscape Change) - Powership & FSRU	Low	N/A
Change the character and sense of place of the landscape setting (Landscape Change) - Preferred and Alternative 1 & 2 Power lines	Low	Low
Change the character of the landscape as seen from the Saldanha urban area and beach - Powership Alternative 1	Medium	N/A
Change the character of the landscape as seen from • Saldanha urban area and beach - Powership Alternative 2 & Transmission Line • Mykonos - Power Ships Alternatives 1 & 2, FSRU and Transmission Line • Langebaan, Langebaan lagoon and the West Coast National Park - Powership Alternative 1, 2 and Transmission Lines	Low	N/A
Visual impact of operational, safety and security lighting of the facility at night on observers	Low	Low
Major Hazard Installation Risk (Section 7.4.20)		
Impacts are acceptable		
Marine Traffic Impacts and Risk (Section 7.4.21)		
No impacts		

c. 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

- Screening out of Alternative 2:
  - The avifauna assessment indicated the presence and activity of a black harrier with flight paths that would constantly cross the proposed powerline.
  - Critically endangered limestone strandveld located within an area for which offsets are not possible. Avoidance was the only option;
- The gas pipeline alternative selected the shortest route within the coastal dune area, avoiding pristine areas.
- The transmission line was proposed adjacent existing infrastructure associated with disturbance and transformation.
- The use of close-loop water systems that exclude the use of biocides and chlorine and thus prevent any potential pollution within the marine environment.

Reduce

- The design of the Powerships provide 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 on FSRU and Powership positions ensured the optimal position 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. The EMPr also provides for the maintenance of areas to prevent degradations during the operational phase.

d. Comparison of Alternatives

Powership and FSRU Position within Big Bay

No alternative mooring sites were initially considered as per the Scoping Report, as the preferred location is within the TNPA port limits and is aligned with the proposed Port plans. TNPA's preference for the Powership position within Big Bay instead of Small Bay (Figure 0-1-3) was an outcome of prior public participation and engagements between Karpowership and TNPA. This position has been assessed by the specialists and provided to all stakeholders and I&APs for comment.

Gas Pipeline

The Preferred Alternative is a shorter route to the overland gas pipeline connection. Following a more detailed bathymetry, it was possible to reorient the pipeline, position the shore crossing adjacent to the Sunrise LPG pipeline shore crossing and reuse the same area of the beach for the stringing yard as was used for the Sunrise installation. This relocation of the shore crossing results in 400m less of the pipeline route traversing the dune field. This is preferred by both the avifaunal specialist and the terrestrial biodiversity specialist as it is of an impact on the dune environment than Alternative 1.

Transmission Line Corridors

The Preferred Alternative Corridor has been selected as the preferred alternative based on the negative implications of the other 2 alternatives.

Alternative 1 Corridor is primarily based between Transnet and the Saldanha Steel property and crosses properties owned by Afrisam and Duferco (where two local landowners are currently undergoing late stages of an arbitration process against one another, albeit with no definitive timeline).

Alternative 2 Corridor is not supported as it was determined that this alternative is a no-go option by the avifaunal specialist as it cuts across the fight paths of three priority species including GPS-tracked Black Harriers, and the terrestrial ecologist indicated that this route traverses an area of critically endangered limestone strandveld which should be avoided.

10. Conclusion & Way Forward

This draft EIAR identified and assessed the potential biophysical and socio-economic impacts associated with the Proposed Gas to Power Powership Project at the Port of Saldanha and associated evacuation route within Saldanha 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 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.

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List of Abbreviations

BID	Background Information Document
BOG	Boil of Gas
CBAs	Critical Biodiversity Areas
CWDP	Coastal Waters Discharge Permit
dB	Decibel
DFFE	Department of Forestry, Fisheries and the Environment
DEA&DP	Department of Environmental Affairs and Development Planning
DFP	Development Framework Plan
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DOT	Department of Transnet
DWAF	Department of Water Affairs and Forestry
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EMS	Environmental Management Systems
G2P	Gas to Power
GG	Government Gazette
GN	Government Notice
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IEP	Integrated Energy Planning
IUCN	International Union for Conservation of Nature
IRT	Issues and Response Trail
MPA	Marine Protected Area
MBM	Multi-Buoy Mooring
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:ICMA	National Environmental Management: Integrated Coastal Management Act
NERSA	National Energy Regulator South Africa
NGO	Non-Governmental Organisations
NFEPA	National Freshwater Ecosystems Priority Areas
NIRP	National Integrated Resource Planning
NWA	National Water Act
PLEM	Pipeline End Manifold
PoS	Plan of Study
PPP	Public Participation Process
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
TOR	Terms of Reference
TNPA	Transnet National Ports Authority

THIS REPORT WAS COMPILED BY TRIPLO4 SUSTAINABLE SOLUTIONS (PTY) LTD IN TERMS OF APPENDIX 3 TO GNR 982 (AS AMENDED)

1 INTRODUCTION

1.1 PROJECT TITLE

The Draft Environmental Impact Assessment Report for the Proposed Gas to Power Powership Project at the Port of Saldanha and associated evacuation within Saldanha Bay Local Municipality, West Coast District, Western Cape (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 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 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 anticipated to continue well into 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 Saldanha 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 Saldanha and associated evacuation route within Saldanha 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 submitted bids in response to the RMI4P RFP, from which 11 Preferred Bidders were selected. From those 11 preferred bidders, only 1 bidder provided a marginally lower bid evaluation price than the lowest cost Karpowership SA offering, and all Karpowership SA Projects including Saldanha (with significantly more investment required to realise the Project) are significantly lower than the average offered by the other 8 Preferred Bidders (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.

Table 1-1: Summary of Preferred Bidders

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 capacity through further renewable energy 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 supports the transition away from coal.

1.2.3 Karpowership Overview

The applicant is Karpowership SA Pty Ltd, a South African company that is 49% owned by a 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 indirect jobs around the world. The company has generated approximately 70 billion kilowatt hours of power around the world.

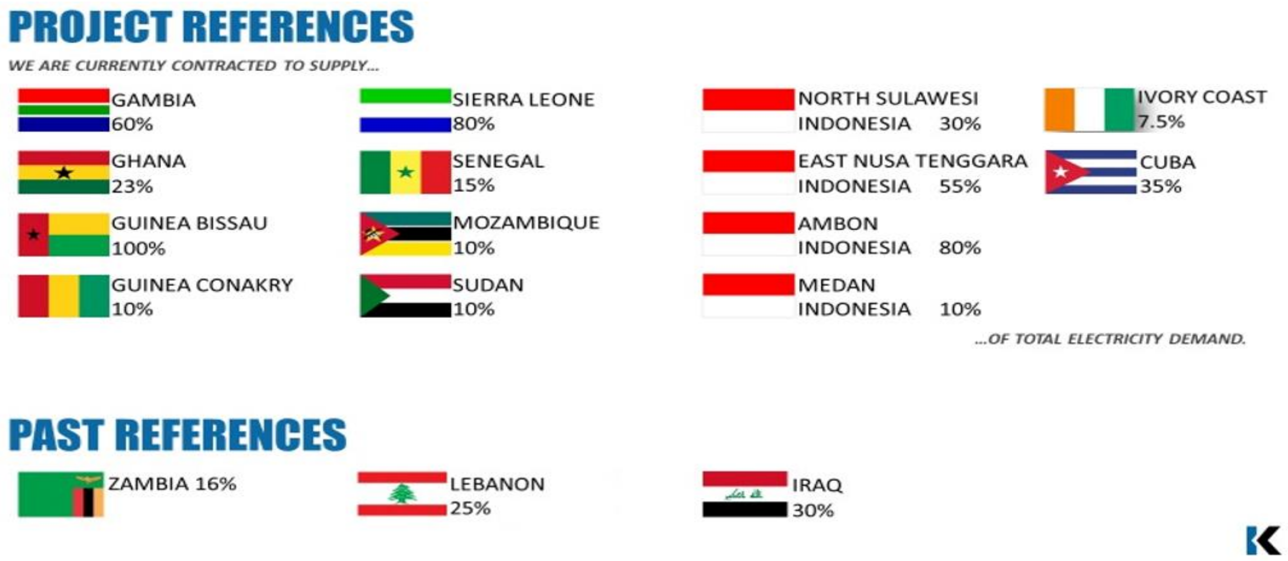


Figure 1-1: Karpowership's Project References

1.2.4 Summary on the Environmental Impact Assessment Processes

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 as the Atmospheric Emission Licence for the proposed Gas to Power Powership at Port of Saldanha and associated evacuation, located within ward 5 of the Saldanha Bay Local Municipality in the West Coast District Municipality.

The Competent Authority responsible for evaluating and deciding on the application for environmental authorisation is the Integrated Environmental Authorisations Directorate within Department of Forestry, Fisheries and the Environment (DFFE). 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 landowner associated with the activities within the Port is Transnet National Ports Authority (TNPA) and other landowners are associated with the evacuation route.

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 SA (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 pre-application meeting 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 report, 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. The Powership is a fully integrated floating power plant 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 a subsea and onshore gas pipeline and the electricity generated is evacuated via a transmission line to a substation on land. Refer to Figure 1-2 illustrating the concept and photos of the Powership, FSRU and LNGC in Table 1-2 below:

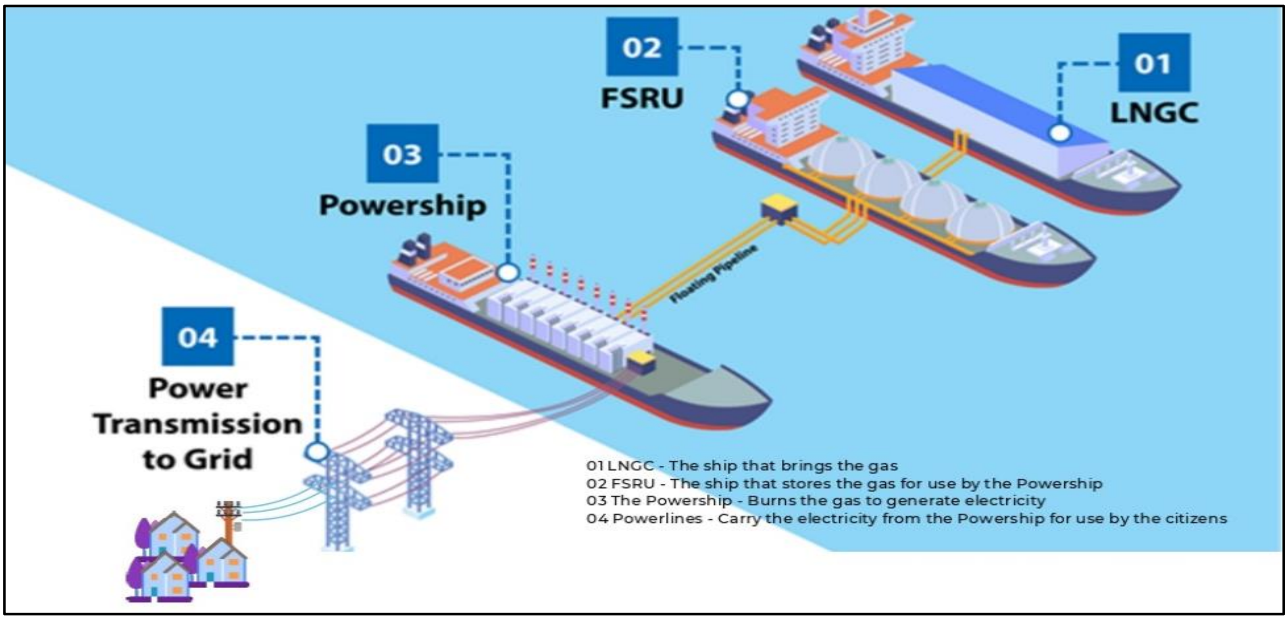


Figure 1-2: Generic image showing the Powership operations.

Table 1-2: Example of the Khan Powership, FSRU and the LNGC

Image 1: Powership – Khan Class	Image 2: : Floating Storage & Regasification Unit (FSRU)
	
Image 3: FSRU secured with vessel spread mooring system	Image 4: FSRU to LNG Carrier Ship to Ship (STS) mooring for cargo transfer (Source: MOL)

Karpowership proposes to moor a Powership and a Floating Storage Regasification Unit (FSRU), connected by a part sub-sea, part land-based gas pipeline in the Port of Saldanha to generate electricity which will be evacuated by means of a 132kV line. This transmission line will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. 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 design capacity for the Saldanha Powership is 415MW, which comprises a total of 24 reciprocating engines and 2 steam turbines. The contracted capacity of 320MW, which will be measured at the Point of Utility Connection, located at the new switching station, and cannot be exceeded under the terms of the RMI4P.

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 and 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.

1.3 SUMMARY OF “ENVIRONMENTAL LICENSING” REQUIREMENTS

Prior to the commencement of the proposed Gas to Power Project at Port of Saldanha Project, the following key “environmental licences” are required from the following competent authorities namely:

- Environmental Authorisation from the 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) from the DFFE. The AEL has been submitted and is currently under assessment.

1.4 PURPOSE OF THIS REPORT

EIA Regulations, Appendix 3. 1 the objective of the environmental impact assessment process is to, "through a consultative process:

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

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

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

Please see Appendix 4 for EAP Declaration and full Curriculum Vitae.

Table 1-3: Independent EAP Details

EAP	Triplo4 Sustainable Solutions
EAP	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
Cell Number	073 746 0992
Fax Number	032 946 0826
Email Address	saldanhabayksa@triplo4.com
Assisted by:	Ms. Melissa Gopaul
Educational qualifications	Honours in Environmental Management
Professional Registrations	SACNASP *(Pri.Sci.Nat)* | *EAPASA*
Voluntary Memberships	IAIAsa; IWMSA; WISA
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
Assisted By:	Zayd Hoosen
Educational qualifications	MSc Environmental Sciences
Professional Registrations	SACNASP (*Pri.Sci.Nat*)
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>6 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. Specialist studies have also recommended mitigation measures to minimise potential impacts or optimisation measures to enhance potential benefits as well as monitoring requirements, where necessary. These findings and recommendations have been incorporated into the assessment (Section 7) and the EMPr (Appendix 6). The methodologies applied to each specialist study are described in the specialist reports attached as appendices to this EIA and EMPr (Appendix 9 and 6). The Specialists and technical experts who provided input to the EIA process are listed in Table 1-4.

Table 1-4: Details of Specialist and Technical Team

SALDANHA SPECIALIST STUDIES, ASSESSMENTS AND TECHNICAL INFORMATION				
REPORT			SPECIALIST	CITATION
A TERRESTRIAL BIODIVERSITY & ECOSYSTEMS	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
	A4	Geohydrological Assessment	GCS (Pty) Ltd	A4 Geohydrology, 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	Archaeological Impact Assessment	Agency for Cultural Resource Management	A7 HIA, Oct 2022
	A8	Terrestrial Ecological Assessment	The Biodiversity Company	A8 Terrestrial Ecology, Oct 2022
	A9	Terrestrial Avifauna Impact Assessment	Dr Paul Martin	A9 Terrestrial Avifauna, Nov 2022
B MARINE , COASTAL & ESTUARINE BIODIVERSITY & ECOSYSTEMS	B1	Baseline Underwater Noise Assessment	Subacoustech Environmental Ltd	B1 Baseline Underwater Noise, Nov 2021
	B2	Underwater Noise Assessment	Subacoustech Environmental Ltd	B2 Underwater Noise, Oct 2022
	B3	Underwater Heritage Assessment	Contract Maritime Archaeologist	B3 Underwater Heritage, Oct 2022
	B4	Marine Ecology, Avifauna Fisheries and Coastal Assessment	Anchor Environmental, Coastwise Consulting & GroundTruth	B4 Marine & Coastal, Oct 2022
	B5	Estuary Compliance Statement Assessment	Coastwise Consulting & GroundTruth	B5 Estuary Statement, Oct 2022
C ATMOSPHERIC CONDITIONS	C1	Atmospheric Impact Assessment	uMoya-NILU Consulting (Pty) Ltd	C1 AIR, Oct 2022

SALDANHA SPECIALIST STUDIES, ASSESSMENTS AND TECHNICAL INFORMATION				
REPORT			SPECIALIST	CITATION
	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
	C3	Climate Change Impact Assessment	Promethium Carbon	C3 CCIA, Oct 2022
D SOCIAL CONDITIONS AND RISKS	D1	Socio-Economic Impact Assessment	Afro Development Planning Pty Ltd	D1 SEIA, Nov 2022
	D1.1	Small Scale Fishers Engagement	Afro Development Planning Pty Ltd	D1.1 SFF, Oct 2022
	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 Impact Assessment	Environmental Planning and Design	D2 VIA, Oct 2022
	D3	Major Hazard Risk Installation Assessment	Major Hazard Risk Consultants	D3 MHI, Sep 2022
	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 1-5 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 1-5 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 1-5: 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
	(ii) The expertise of the EAP, including a curriculum vitae;	Appendix 4
(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

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(g)	motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	
(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	(i) details of the development footprint alternatives considered;	Section 3
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 5 and Appendix 3 – Public Participation
	(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

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Not Applicable
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report	Section 9
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 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	
(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

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	(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 for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 7.5
(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	

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	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
(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 13 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 until date of release of the DEIR for public comments on 10 November 2022.
- 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

EIA Regulations, Appendix 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 from one Powership moored in the Port of Saldanha 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 8.3). A Liquefied Natural Gas Carrier (LNGC) will bring in Liquefied 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 Powership via a subsea gas and overland pipeline. The Project's design capacity is 415MW. Electricity will be generated on the Powership by 24 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 two steam turbines that each have a heat input of circa 15.45MW. The contracted capacity of 320MW, which will be measured at the Point of Utility Connection, located at the new switching station, cannot be exceeded under the terms of the RMI4P.

The electricity generated will be evacuated via a 132kV line of approximately 7.5km in length, which will interconnect the Powership to the National Grid utilising the existing Aurora-Saldanha Steel network via a new 132kV on shore switching station. The tie in point for all alternatives is the Aurora - Saldanha Steel 132 kV network situated within the Saldanha Steel property. This will allow a connection into the Eskom Aurora Main Transmission Substation.

The three transmission line alternatives for distribution to the National grid, follow a similar route out of the Port boundaries. There are three switching station alternatives considered, SS1 associated with Alternative 1 and SS2 and 3 which are suitable alternatives for the preferred and alternative 2 - see Chapter 3 for the assessment of these alternatives. The preferred transmission line route is situated within Transnet's services servitude where possible and runs through the ArcelorMittal (Saldanha Steel) property.

Refer to the figure below showing the overall project layout.

Figure 2-1: Overall Project Layout (Marine).

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

The sub-chapters which follow attempt to 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 Powership, FSRU, temporary LNGC, gas line and contractor areas will be located in the Port of Saldanha under the jurisdiction of Transnet Limited (refer to Figure 2.1). The proposed Powership is located in Big Bay adjacent to the causeway. The proposed FSRU is located seaward in Big Bay, approximately 3.8km away from the shore. The transmission line is across Transnet properties as well as privately owned properties currently underdeveloped or used for industrial activities.

Please refer to Chapter 2.3 for further detail on the project location and Chapter 3 for details on the alternatives considered which includes two gas line alternative routes, alternative transmission line routes, connections and switching station position.

2.1.3 Berthing, Mooring of the Powership 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 Powership and FSRU will each have between 16 and 20 mooring legs. Each mooring leg consists of a catenary mooring chain connected to a Drag Embedment Anchor (DEA), which will be embedded in the seabed. No other marine structures are planned. No dredging is envisaged.

Refer to Appendix 10.9 – PRDW Technical Information for further details on this technical aspect.

2.1.4 Gas Lines

A gas pipeline is required between the FSRU and Powership to ensure gas supply for power generation.

1. The FSRU discharges gas via two flexible risers to the FSRU pipeline end manifold (PLEM) on the seabed next to the FSRU.
2. The FSRU PLEM incorporates shutoff valves, an expansion spool and maintenance pigging connection (a typical PLEM is depicted in below)
3. The gas is then transported from the FSRU PLEM via a 24 inch steel pipeline with 50mm concrete weight coating, installed on the seabed, to the shore crossing. The gas pipeline will be buried through the shore crossing and the beach area and cross over the Sunrise LPG, the SFF crude oil and sea water pipelines as well as the OTMS (OilTanking MOGS Saldanha) HDPE sea water pipelines.

4. The gas pipeline is then installed on the existing oyster dam access road alongside the OTMS (OilTanking MOGS Saldanha) HDPE sea water pipeline and covered with a rubble mound along the length of the oyster dam within the existing pipeline servitude. From the end of the oyster dam, in front of the iron ore stockpiles and along the causeway access road at the top of the causeway revetment, the pipeline will be buried or mounted on pipe racks, as required to accommodate future pipelines within the identified pipeline servitudes.
5. At the point on the causeway, opposite the Powership manifold, the onshore 24 inch steel buried pipeline connects via the revetment crossing spool to the 24 inch steel subsea pipeline with 50mm concrete weight coating, installed on the seabed to the location of the Powership PLEM. The Powership PLEM incorporates shutoff valves, pigging connection, an expansion spool and two 12 inch flexible risers delivering gas to the Powership manifold.

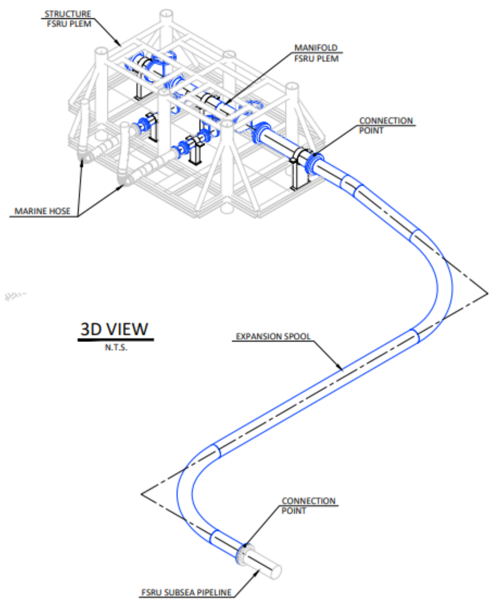


Figure 2-3: Typical PLEM and Tie-in Detail

For the gas pipeline, including the PLEM, there may need to be minor route rectification along the subsea pipe route to limit the free span length of any section of the pipeline. 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.

Alternative alignments for an onshore and offshore gas pipeline are proposed taking into consideration the existing infrastructure and recommendations from specialists. The onshore alternatives were selected so that the required crossing of the Sunrise LPG pipeline could be situated in the onshore buried section adjacent to the similar crossing of the SFF crude oil and OTMS pipelines. The continuation of the onshore pipeline is then routed within existing pipeline servitudes.

The original pipeline route (blue line in Figure 2-1 above and black line in Figure 2-4 below) positioned the shore crossing further from the oyster dam to avoid obstructions in the offshore bathymetry. However, with more detailed bathymetry it was possible to reorient the pipeline, position the shore crossing adjacent to the Sunrise LPG pipeline shore crossing and reuse the same area of the beach for the stringing yard as was used for the Sunrise installation. This relocation of the shore crossing results in 400m less of the pipeline route traversing the dune field.

The avifaunal specialist has highlighted the presence of a single pair of breeding Black Harriers landwards of the oyster dam and Cape Cormorants roosting along the beach beyond the oyster dam. The crossing of the Sunrise pipeline with a subsea pipeline crossing spool in line with the Powership manifold connecting the FSRU pipeline directly to the Powership PLEM would require close coordination to design the crossing spool and protection of the Sunrise LPG subsea pipeline. The subsea pipeline however will need to be assembled and launched from the stringing yard on the beach next to the Sunrise shore crossing.

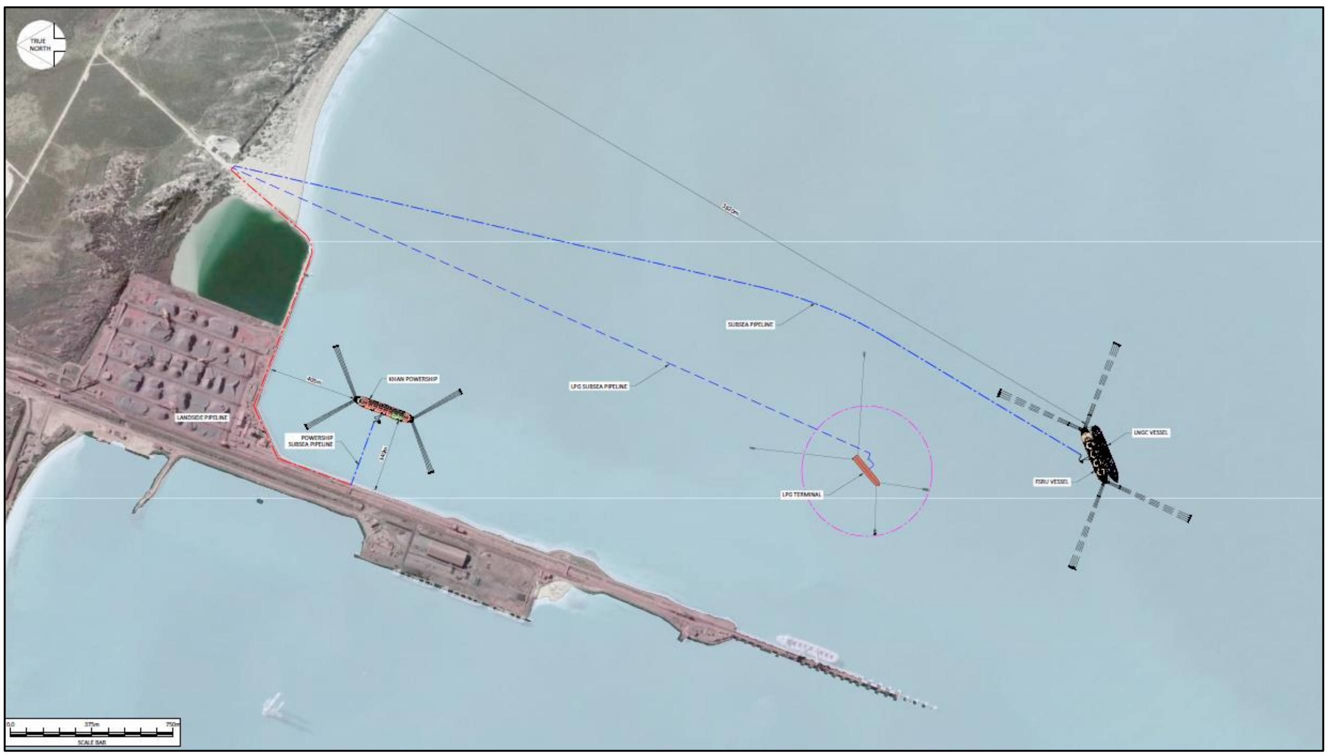


Figure 2-4: Image showing the proposed gas pipeline route from the FSRU to the Powership position in Big Bay.

The sea-based section of the pipeline will have a servitude of approximately 50m either side of the pipe centre line. The land-based buried pipeline will require an approximate servitude of 0.5m either side of the centre line. The gas pipeline will likely be mounted on small footings requiring minor civil works to construct and install.

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).

2.1.5 Transmission Lines

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

There are three potential options being considered for connection from the Powership to the National Grid that will ultimately be dependent on specialist input and landowner approval:

- The electricity generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line. This new transmission line of approximately 7,5km will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. The monopole transmission towers are proposed within a 60 metre corridor which includes the 31m working servitude. The servitude stretching approximately 7,5km from the port to the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station, will have a width of 31m as per Eskom safety specifications. This route is primarily based between Transnet and the Saldanha Steel property.
- Alternatively, the electricity generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line. This new transmission line of approximately 7.2 km will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. Approximately 37 towers are proposed within a 60 metre corridor which includes the 31m working servitude. The servitude, stretching approximately 7.2 km from the port to existing Aurora- Saldanha Steel network via a new 132kV on shore switching station the, will have a width of 31m as per Eskom safety specifications.
- For the third alternative, the electricity generated on the ship will be converted by the on-board High Voltage substation and transmitted along a conductor 132kV line which is the same as the preferred route. The transmission line of approximately 8.6 km traverses a different route on the southern boundary of the Saldanha Steel property but will interconnect the Powership to the National Grid utilising the existing Aurora - Saldanha Steel network via a new 132kV on shore switching station. The servitude has a width of 31m as per Eskom safety specifications within a 60 metre corridor. The roadway is used as a guideline and the transmission lines can be erected on either side of the roadway based on the negotiation and agreement from the landowners.

All options traverse properties owned by Transnet and other private industrial landowners. Each monopole tower will cover a maximum footprint of 2,95m x 2.95m which will necessitate the clearing of vegetation to allow for towers to be erected.

Access will be via the existing servitude, therefore no additional access roads will be required to be constructed.

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 Aurora-Saldanha Steel network.

The switching station will measure approximately 14 100m^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 power 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 Site Access, Construction Routes and Laydown Areas

The proposed location of the Project is situated within the existing and operational Port of Saldanha, therefore the existing access roads network will be used to access the Powership site. The position of the access road is indicated in the Figure 2-5 below.

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

Figure 2-5: Google map showing existing access road system to the Port of Saldanha and access to the stringing yard.

Figure 2-6: Google map showing existing access road system to the Port of Saldanha and contractor areas.

Construction Routes and Proposed Laydown Areas:

- Powership and FSRU
  Not applicable as the ships are built internationally and arrive fully equipped in the Port ready for operation.
- Onshore and Offshore Gas Pipeline
  There are two temporary contractor areas required. The first consists of a stringing yard required for the installation of the gas pipelines and the second consisting of the contractor’s site office, material laydown, concrete coating, loading and quay areas. The central co-ordinate of contractor area west of the quay is situated at 33°0'25.67"S 18°0'3.27"E and is approximately 0,9 Ha in size. The central co-ordinate of stringing yard on the east of the quay is situated at 33° 0'25.67"S 33°0'28.13"S and is approximately 0,7 Ha size.
- Transmission line and Switching Station
  For the evacuation route, the proposed switching station sites, approximately 14 100m^2, in size is located in the assessed transmission corridor alternatives will serve as the laydown area for the project. No additional area is required.

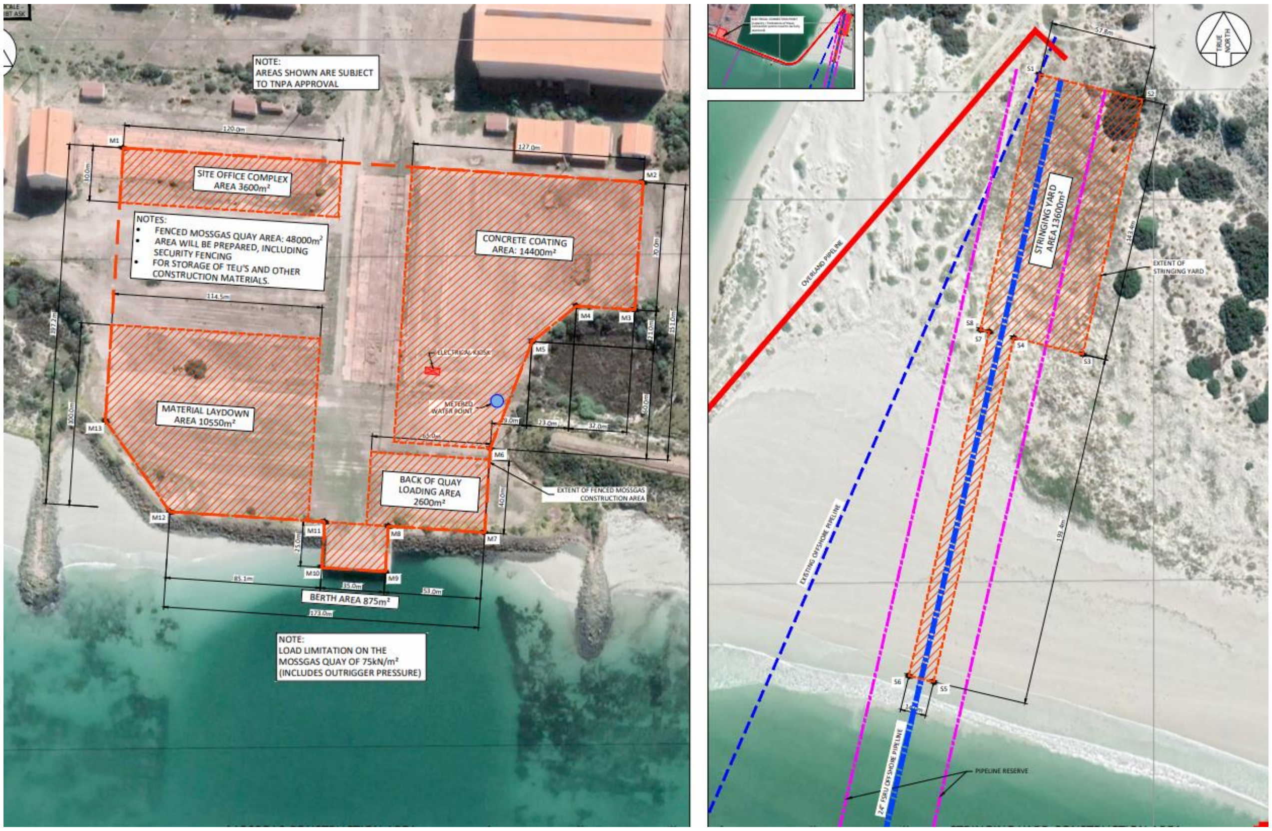


Figure 2-7: Google image showing the proposed contractor areas (stringing yards/laydown areas)

Refer to Appendix 1.8 - Construction Laydown Areas and Access Roads

2.1.8 Operational Processes and Associated Measures

The Powership is 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, the Powership 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 Powership can continue operating and meeting the full contracted capacity requirements. The Powership has an effective operating lifespan of more than 25 years, more than covering the 20-year PPA provided for under the RMI4P.

The Powership stores 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.

2.1.8.1 Water Usage

The Powership uses seawater and potable water for cooling the reciprocating engines, condensers and other auxiliaries. The Powership operate 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 6.61 m^3/s and the increase in temperature (ΔT) range from 12°C to 14°C. Part of the cooling water is processed into potable water through reverse osmosis / onboard water treatment units for use in the vaporization process for steam generation and non-process water consumption including domestic uses such as cleaning, crew hygiene etc. The conceptual process flow diagram (PFD) for the generation of electricity is shown in Figure 2-8 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 required from the Saldanha Bay Local Municipality for operations. The Powership also has a sewage treatment unit and oily bilge separator to be utilized while sailing to the Port of installation.

The following volume of water required daily is anticipated:

- 250 litres of drinking water will be required for onboard crew utilisation;
- 10000 litres technical water for continuous Steam Turbine Generator (STG) operation (processed from sea water intake) (5,000 litres per STG); and
- 25-30 litres of water per engine is required and 200 litres for STG consumption (processed from sea water intake).

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

Further details are captured in the Water Balance Report, attached as Appendix 10.6.

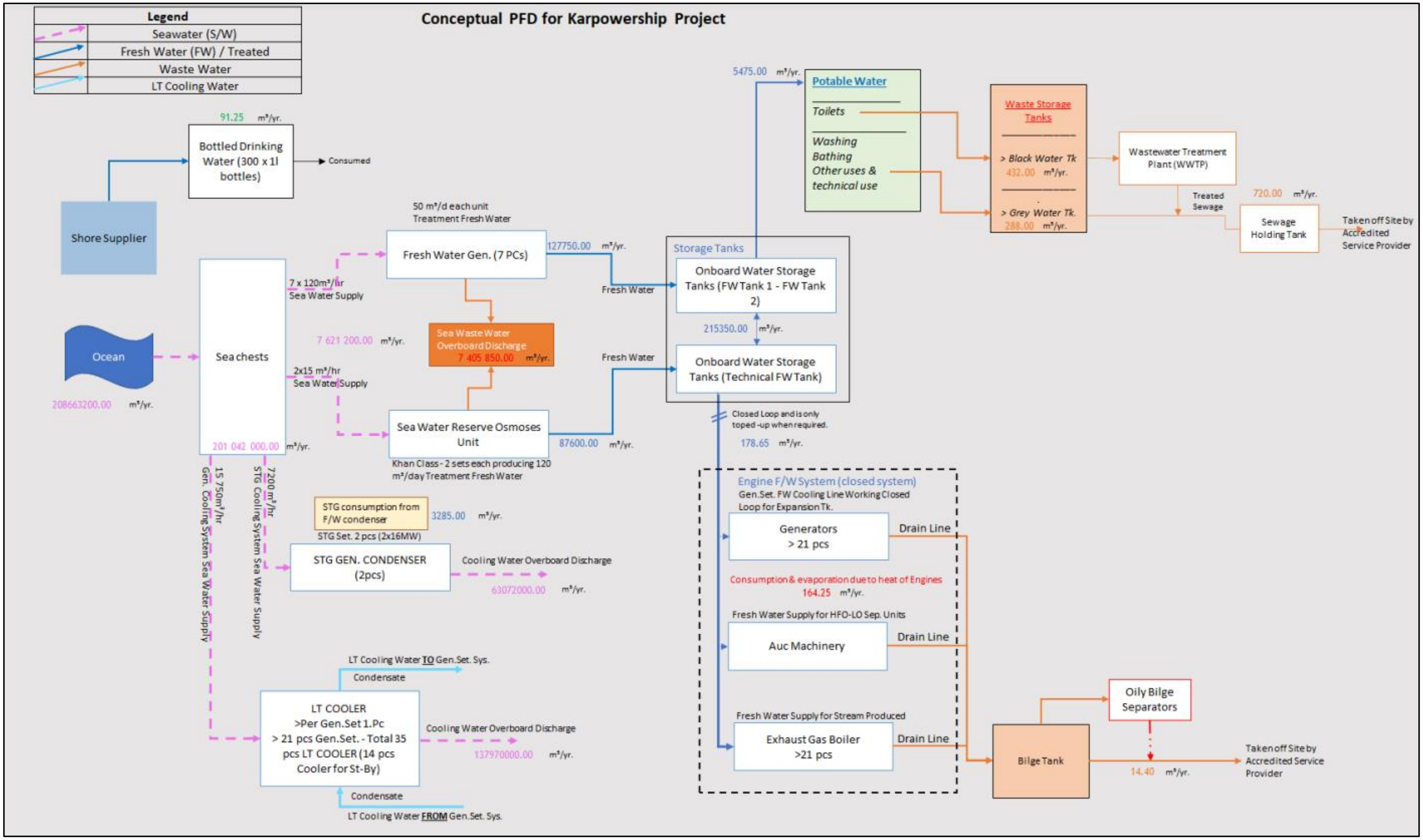


Figure 2-8: Conceptual Process Flow Diagram for the Project's operational Water Balance

2.1.8.2 Water Temperature

As above, the Powership 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 6.61 m^3/s and the increase in temperature (ΔT) range from 12°C to 14°C within the Powership process water.

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

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

To reduce the risk of recirculation of the discharge back to the intakes, it was recommended that the discharge pipeline running down the vessel hull has a second elbow to discharge horizontally away from the vessel, and that the discharge pipes be positioned as far from the intakes as possible. Further details are captured in the Integrated Dispersion Modelling of Thermal Plumes Report, attached as Appendix 10.2, and the Marine Ecology Report, attached as Appendix 9B4.

2.1.8.3 Risk and Possible Explosions

Safety performance is focused on risk and 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 Powership 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 for lightening 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 on a Powership through various methods which include permanently installed systems in the Powership that are able to fill the affected area with CO^2 or Hot foam as well as 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 any fire to speed the response. .

In addition to using the fixed fire-fighting systems and portable fire-fighting 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 fire-fighting 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.

2.1.8.4 Safety and Security Measures

The Powership is equipped with advanced CCTV systems monitoring all areas, inside and out, in addition to surrounding fencing and razor wires to protect against unauthorized entry to the project site from land. 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 local Disaster Management department 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 and 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.

2.1.8.5 Occupation Health and Safety

Oxygen Twenty one undertook a comprehensive legal compliance review for KSA to comply with all legal requirements and applicable international norms and best practices, which 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.

2.1.8.6 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 working environment and operations of the Powership as well as the Port operation at nights. The lighting aspects of the project were considered to ensure appropriate management in accordance with the Port's requirements where navigational vessels and other obstacles 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. Excessive 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; and
- High energy, short wavelength UV/violet/blue light that is strongly detected by wildlife.

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 light pollution and lighting effects on the natural environment. Light intensity and light trespass will be reduced by:

- Mounting lighting fixtures as low as possible or with shielding;
- Dimming lights where possible and turning off lights when areas are not in use or where lighting is not required;
- Where fixed lighting may not be 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 required footprint area.

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

2.1.8.7 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 Powership's Charge Air Systems are designed and equipped with both wet and dry filtration systems, so that the Powership can continue to operate in extreme environments, including the locations where high levels of organic or inorganic dusts exist 'such as coal dust, iron ore dust etc. 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.

2.1.8.8 Storage of Hazardous Goods

The LNG stored on the FSRU at any given time will not exceed 175 000m³. 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.

2.1.8.9 Fueling of the Powership

The fuel is supplied to the Powership 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. The FSRU has an overall length of approximately 272m with a breadth of 47,2m is made up of a series of pressurised containers.

The FSRU is refuelled through vessels specially fitted for the purpose of carrying LNG – a Liquid Natural Gas Carrier or LNGC. This LNGC will temporarily moor alongside the FSRU over a 1 to 2 day period, approximately every 20 to 30 days, 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 EIA 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 Powership.

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 no-go 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 see Appendix 11.

2.1.8.10 LNG Fuel Source

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. Shell is one of the global leaders in LNG supply. They are able to secure LNG from the global market. There is a fuel supply management team and LNG procurement will be arranged. The gas will be sourced from top 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 gas 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).

The benefits of running the engine on NG include emission reductions of NOx, SOx, CO2, particulates, no smoke, reduced waste streams to meet the requirements of local or international legislations.

2.1.8.11 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, as shown in the diagram below.

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

2.1.8.12 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.

2.1.8.13 Waste Generation and Management

Due to daily activities and 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 the legislation and TNPA and MARPOL requirements and will be treated and disposed of in authorised land-based treatment and disposal sites.

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.

2.1.8.14 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.

2.1.9 Construction of the Powership, FSRU and LNG Carrier

The Powership is assembled off-site and will be delivered fully equipped and functional to the Port of Saldanha. Powerships, through their modular generation capability, allow for greater technical flexibility for load cycling and shedding. The Khan Class Powership is approximately 289m in length with an approximate breadth of 45m. 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.

2.1.10 Construction of the Gas Pipeline

2.1.10.1 Site Access

The submarine 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.

Refer to section 2.1.7 Site Access, Construction Routes and Laydown Areas above for further details.

2.1.10.2 Pipeline Assembly

Sufficient space near the launch site will therefore be required to undertake the assembly of the pipeline. The proposed location of the stringing yard and launchway, adjacent to the old aquaculture basin behind the current iron ore stockyard, is shown on the drawings. A suitable area of hardstanding will be prepared in front of the sand dunes above the beach in the same position approved for the LPG pipeline project in 2017. At this stage it is estimated that an area of 100 m x 150 m will be required. The pipe stringing yard will be set up to assemble approximately 30 strings which will make up the 4,1km pipeline length. A launchway will be constructed with rollers to transfer the pipeline from the stringing yard to the sea. The launchway will be constructed on the west side of the stringing yard continuing down onto the beach. The launchway typically will consist of concrete 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.

Table 2-1: Typical images of the stringing yard and launchway

	
Image: Typical Stringing Yard	Image: Typical Launchway across beach

2.1.10.3 Pipeline Installation

The pipeline is to be installed by pulling it from the shore into position using a winch mounted on a barge moored temporarily offshore. As the pipeline is pulled, additional pipe sections are welded on in the stringing yard. The pipeline is placed on the seabed 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. Where necessary the pipeline will be covered with crushed rock to protect the pipeline. Although no dredging is required prior to installation of the pipeline, some seabed preparation in the form of levelling of high spots or placing of crushed stone founding material in low spots may be necessary prior to installing the pipeline. This procedure is similar to the methodology approved for the installation of the existing LPG pipeline within the Port of Saldanha.

Minor sea bottom preparation works are anticipated to receive the pipe and the PLEMs, with the intention to place both directly on the seabed, ideally with no work on the bottom. In cases where there may be a high point, some material might need to be moved to keep the pipeline profile and spans lengths within limits or the PLEM level.

Once the pipeline installation is complete, the laydown site and stringing yard 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 preferred proposal for the gas pipeline further detailed **in Appendix 10.10 Pipeline Methodology.** The methodology will also need to be approved by TNPA prior to construction start.

2.1.10.4 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.

2.1.11Socio-economic Commitments

The project is anticipated to make a notable contribution towards the national and local economy through commitments made in the Karpowership SA bid submissions. 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.

The Economic Development (ED) programme will be implemented over the ±12-month construction phase and the 20-year operations and maintenance phase of the projects.

The estimated budget for Socio-Economic Development (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 initiatives.

At the time this equated to the following Rand values:

- **R498 846 885 - Projected for 20-year Power Purchase Agreement**
- **R24 942 344 - Projected per annum**
- **R2.08m - Approx. per month projections**

Karpowership may allocate a maximum projected SED spend within the Western Cape Province of:

- **R124 711 721 - Projected for 20-year Power Purchase Agreement**
- **R6 235 586 - Projected per annum**
- **R519k - 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 in order 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.

The following SED projects have been identified as priority areas within the NMBMM, and will be the first SED Projects to be rolled out:-

- Primary and secondary school focus on building educator and learner capacity in (Science, Technology, Engineering and Math) STEM;
- Scholarships/Bursary Programme;
- Installation of Energy Efficient systems;
- Environmental sustainability;
- Support to Vulnerable Communities; and
- Sports and Recreation.

As part of it Enterprise Development Programme (EDP), 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. – *This criteria is aligned to compliance with the Broad-Based Black Economic Empowerment Act 53 of 2003 and the subsequent promulgated Codes of Good Practice. All further amendments shall be adhered to by Karpowership during the life-cycle of the implementation period of each Project / Beneficiary Programme.*

While the initial area of focus may be Karpowership' s supply chain, businesses that are supported under our EDP do not necessarily have to be part of the Karpowership value chain and could include a wide range of businesses, including the informal sector.

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

- **R199 538 754 - Projected for 20-year Power Purchase Agreement**
- **R9 976 937 - Projected per annum**

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

- **R49 884 688 Projected for 20-year Power Purchase Agreement**
- **R2 494 234 - Projected per annum**

Consideration for this projected Provincial spend will be in line with the sustainability of enterprises which have been established or developed within the Local Beneficiary Communities. For example, where a business has received beneficiation and now needs to expand its distribution chain or improve its supply chain from outside of the immediate communities.

Our strategy has further been defined to include the following focus areas:

- Vendor Kiosks for SMME's
- Supporting Fishing Communities, Aquaculture and Fish Farming
- Youth Enterprise Development; and
- Enterprise Development short term funding.

The projected budget for Supplier Development initiatives within the Saldanha Bay area is:

- **Approximate Projected Budget for the Construction Phase is R1 million, to be split over 12 months**
- **Approximate Projected Budget is R910k, projected as per annum, over the 20-year Power Purchase Agreement period (Operations Phase)**

Karpowership will implement a Skills Development Programme. Projected budget for Skills Development initiatives within the Saldanha Bay Municipal area is:

- **Approximate Projected Budget is R27 713 716 over the 20-year Power Purchase Agreement period (Operations Phase)**
- **Approximate Projected Budget is R1 385 686, projected as per annum**

Projected budget for Skills Development initiatives within the Western Cape Province shall be:

- **Approximate Projected Budget is R6 928 429 over the 20-year Power Purchase Agreement period (Operations Phase)**
- **Approximate Projected Budget is R346k, projected as per annum**

Karpowership recognises the importance Learnerships and Apprenticeships programmes. The Karpowership Academy, an in-house training institution will be established in South Africa 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 Appendix D1 SEIA, Nov 2022 and Section 8.3.1.5 of this report for further details on the findings from the Socio-Economic Impact Assessment.

2.1.12 Timeframes

2.1.12.1 Contract Period

The Risk Mitigation IPP Procurement 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 proposal to a delivered capacity of 450MW at the power station. The best suited configuration of the Powership generates an output of 415MW.

2.1.12.2 Operating Hours

Under the PPA the operating hours depend entirely on dispatch instructions from the Buyer, 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 in terms of required MW can range anywhere between 0MW – 320MW.

2.2 ALL LISTED AND SPECIFIED ACTIVITIES TRIGGERED IN TERMS OF NEMA AND NEM:AQA

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

The table below indicates activities that are deemed applicable to the proposed project, based on Triplo4's assessment and guidance sought from DFFE:

NEMA

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;*	The electricity generated on the Powership will be converted by the on-board High Voltage substation (110 – 170 kV) and transmitted along a conductor 132kV line. A switching station will be required to facilitate the supply of electricity into the national grid. A switching station will be required to facilitate the supply of electricity into the national grid. The transmission line and switching will be located within properties

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(c) within an existing transmission line servitude; and *will be removed within 18 months of the commencement of development.*	zoned as industry, agriculture, transport and government uses and its capacity falls below the threshold of 275 kV.
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* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —* *excluding—* *(dd) where such development occurs within an urban area;*	The preferred route of the transmission line, the locations of the proposed switching station and the temporary laydown area for the gas pipeline installation are not within 32m of a watercourse.
Activity 15	*The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding—* *(i) the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(ii) the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(iii) the development of temporary structures within the beach zone where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or* *(iv) activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.*	Structures in the coastal public property exceeding 50 square meters include: gas pipeline, transmission line and the temporary stringing yard/ laydown area for the gas pipeline installation. The development of these structures and infrastructure will occur within the Port of Saldanha, Transnet and other properties associated with the transmission route. Activity 14 in Listing Notice 2 of 2014 is applied for in terms of the gas pipeline and mooring structures within the sea /along the seabed and thus can be excluded from this activity.

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
		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;* *(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.*	The Powership and FSRU are not being developed. However, the mooring system, the gas pipeline, the proposed towers for the transmission line, the switching station and the temporary laydown area for the gas pipeline installation will cumulatively exceed a footprint of 50 square meters within the sea, and littoral active zone. In addition, these structures and infrastructure are proposed within the existing Port of Saldanha, Transnet property, which 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
Activity 18	*The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square metres, within the littoral active zone, for the purpose of preventing the free movement of sand, erosion or accretion.*	Sections of the gas pipeline and transmission line, where it comes on shore, need to be stabilised to prevent erosion on the substrate where the pipeline and transmission line is established. Furthermore, rehabilitation for the land-based portion will be required. Although the area has already been transformed due to port activity, it will require the planting of vegetation on exposed sand surfaces of more than 10 square meters to ensure environmental management.
Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, 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, gas pipeline installation and the temporary construction facilities, the development will take place within a watercourse and will require the infilling or depositing of material of more than 10 cubic meters into, and the excavation, removal or moving of soil or sand of more than 10 cubic meters from a watercourse. 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;*	The Powership mooring system, the gas pipeline, the erection of the towers for the transmission line, and the temporary laydown area for the gas pipeline installation will require the removal of more than 5 cubic

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or *(iii) the sea; —* *but excluding where such infilling, depositing , dredging, excavation, removal or moving—* *(e) will occur behind a development setback;* *(f) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(g) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(h) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *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.*	metres of sand, within 100 metres inland of the high-water mark. Installation of the subsea as well as land based portions of the gas pipeline and laydown areas will require excavation, levelling infilling and compaction. These structures and infrastructure are deemed to increase the development footprint of the port and thus are not excluded from this activity.
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 contractor facilities will cumulatively require clearance of more than 1 hectares 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.

<u>NEM:AQA</u>

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

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

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

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

Table 2-3: Applicable Listed Activities Details of the Listed Activity for the proposed Gas to Power Powership Project (GG No. 37054, GN 893 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 Air Quality Authorisations which is a sub-directorate within Directorate of Climate Change and Air Quality Management.

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

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

2.3.1 Location of the Activity

Table 2-5: Location of the proposed activity

Description	Location of the Activity
District Municipality	West Coast District Municipality
Local Municipality	Saldanha Bay Local Municipality
Ward	5
Area / Town / Village	Port of Saldanha Bay

Property Description & 21 Digit SG Code	See Table 2-6 below

Table 2-6: Property Description & 21 Digit SG Code – As per options presented in Section 3.

Property Description	**21 SG CODES**	**CENTRAL GPS-COORDINATE**	
		Longitude	**Latitude**
Preferred Alternative			
The Farm No.1185	C04600000000118500000	17°59'45.04881"E	33°00'15.49197"S
Remainder of the Farm No.196	C04600000000019600000	17°59'52.57616"E	32°59'57.06893"S
Portion 8 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700008	17°59'57.20190"E	32°59'46.60709"S
Portion 15 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700015	17°59'51.92853"E	32°59'53.01892"S
Portion 14 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700014	17°59'55.38643"E	32°59'45.83040"S
Portion 16 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700016	17°59'56.42286"E	32°59'43.46073"S
Rem of Erf 11945 Saldanha	C04600120001194500000	17°59'59.08473"E	32°59'37.14569"S
Portion 1 of the Farm No.1139	C04600000000113900001	18°00'1.967800"E	32°59'31.96338"S
Ptn 17 (of 13) of the farm Yzervarkensrug No.127	C04600000000012700017	18°00'9.690750"E	32°59'19.00099"S
Remainder of the Farm No.1139	C04600000000113900000	18°00'4.464690"E	32°59'23.86976"S
Proposed Portion A of the Farm No.1139	C04600000000113900000	18°00'7.027620"E	32°59'16.61008"S
Remainder of the Farm No.1139	C04600000000113900000	18°00'17.79248"E	32°58'54.37006"S
Portion 2 of the Farm No.1112	C04600000000111200002	18°00'31.05274"E	32°58'39.59486"S
Portion 3 of the Farm No.1112	C04600000000111200000	18°00'59.80223"E	32°58'25.43273"S
Remainder of Portion 3 of the Farm Yzervarkensrug No.129	C04600000000012900003	18°01'51.10385"E	32°58'25.97652"S
Remainder of the Farm No.1132	C04600000000113200000	18°01'58.73805"E	32°58'31.62552"S
Alternative 1			
The Farm No.1185	C04600000000118500000	17°59'45.04881"E	33°00'15.49197"S
Remainder of the Farm No.196	C04600000000019600000	17°59'52.57616"E	32°59'57.06893"S
Portion 8 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700008	17°59'57.20190"E	32°59'46.60709"S
Portion 15 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700015	17°59'51.92853"E	32°59'53.01892"S
Portion 14 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700014	17°59'55.38643"E	32°59'45.83040"S
Portion 16 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700016	17°59'56.42286"E	32°59'43.46073"S
Rem of Erf 11945 Saldanha	C04600120001194500000	17°59'59.08473"E	32°59'37.14569"S
Portion 1 of the Farm No.1139	C04600000000113900001	18°00'1.967800"E	32°59'31.96338"S

Remainder of the Farm No.1139	C04600000000113900000	18°00'4.066210"E	32°59'27.63156"S
Ptn 17 (of 13) of the farm Yzervarkensrug No.127	C04600000000012700017	18°00'8.354600"E	32°59'29.16113"S
Rem of Ptn 13 (of 1) of the farm Yzervarkensrug No.127	C04600000000012700013	18°00'11.25052"E	32°59'29.57282"S
The farm No.1239	C04600000000123900000	18°00'14.22142"E	32°59'31.69647"S
Ptn 66 (of 13) of the Farm Yzervarkensrug No.127	C04600000000012700066	18°00'12.48015"E	32°59'34.69121"S
Erf 16001 Saldanha	C04600120001600100000	18°00'26.52365"E	32°59'32.24260"S
Ptn 17 (of 2) of the Farm Yzervarkensrug No.129	C04600000000012900017	18°00'25.76932"E	32°59'30.59690"S
Remainder of Ptn 2 (of 1) of the Farm Yzervarkensrug No.129	C04600000000012900002	18°00'21.23727"E	32°59'18.72915"S
Remainder of the Farm No.1132	C04600000000113200000	18°00'33.10541"E	32°58'50.52471"S
Portion 7 (of 4) of the Farm Yzervarkensrug No.129	C04600000000012900007	18°00'48.54030"E	32°58'35.45773"S
Portion 3 of the Farm No.1112	C04600000000111200000	18°01'17.33045"E	32°58'21.50467"S
Remainder of Portion 3 of the Farm Yzervarkensrug No.129	C04600000000012900003	18°01'51.10385"E	32°58'25.97652"S
Remainder of the Farm No.1132	C04600000000113200000	18°01'58.73805"E	32°58'31.62552"S
Alternative 2			
The Farm No.1185	C04600000000118500000	17°59'45.04881"E	33°00'15.49197"S
Remainder of the Farm No.196	C04600000000019600000	17°59'52.57616"E	32°59'57.06893"S
Portion 8 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700008	17°59'57.20190"E	32°59'46.60709"S
Portion 15 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700015	17°59'51.92853"E	32°59'53.01892"S
Portion 14 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700014	17°59'55.38643"E	32°59'45.83040"S
Portion 16 (of 3) of the Farm Pienaars Poort No.197	C04600000000019700016	17°59'56.42286"E	32°59'43.46073"S
Rem of Erf 11945 Saldanha	C04600120001194500000	17°59'59.08473"E	32°59'37.14569"S
Portion 1 of the Farm No.1139	C04600000000113900001	18°00'1.967800"E	32°59'31.96338"S
Remainder of the Farm No.1139	C04600000000113900000	18°00'4.066210"E	32°59'27.63156"S
Ptn 17 (of 13) of the farm Yzervarkensrug No.127	C04600000000012700017	18°00'8.354600"E	32°59'29.16113"S
Rem of Ptn 13 (of 1) of the farm Yzervarkensrug No.127	C04600000000012700013	18°00'11.25052"E	32°59'29.57282"S
The farm No.1239	C04600000000123900000	18°00'14.22142"E	32°59'31.69647"S
Ptn 66 (of 13) of the Farm Yzervarkensrug No.127	C04600000000012700066	18°00'12.48015"E	32°59'34.69121"S
Erf 16001 Saldanha	C04600120001600100000	18°00'27.97350"E	32°59'32.62273"S
Erf 16000 Saldanha	C04600120001600000000	18°00'31.31533"E	32°59'33.50844"S

Remainder of Ptn 2 (of 1) of the Farm Yzervarkensrug No.129	C04600000000012900002	18°00'40.02381"E	32°59'35.43795"S
Ptn 17 (of 2) of the Farm Yzervarkensrug No.129	C04600000000012900017	18°00'39.49583"E	32°59'33.94604"S
Remainder of Ptn 2 (of 1) of the Farm Yzervarkensrug No.129	C04600000000012900002	18°00'39.93156"E	32°59'32.89725"S
Remainder of the Farm Yzervarkensrug No.129	C04600000000012900000	18°01'2.142730"E	32°59'38.17986"S
Portion 18 of the Farm Yzervarkensrug No.129	C04600000000012900018	18°01'1.651780"E	32°59'39.32648"S
Remainder of the Farm Yzervarkensrug No.129	C04600000000012900000	18°01'1.254670"E	32°59'40.76201"S
Remainder of Portion 2 of the Farm No.195	C04600000000019500002	18°01'33.06546"E	32°59'50.22357"S
Portion 9 (of 2) of the Farm No.195	C04600000000019500009	18°01'34.26616"E	32°59'48.60434"S
Remainder of Portion 2 of the Farm No.195	C04600000000019500002	18°01'35.94192"E	32°59'47.50938"S
Remainder of Portion 1 of the Farm No.195	C04600000000019500001	18°02'0.622230"E	32°59'52.65042"S
Portion 10 (of 1) of the Farm No.195	C04600000000019500010	18°02'0.814360"E	33°00'0.274000"S
Remainder of Portion 1 of the Farm No.195	C04600000000019500001	18°01'58.02385"E	33°00'0.664410"S
Portion 11 (of 1) of the Farm No.195	C04600000000019500011	18°02'3.731420"E	32°59'58.14320"S
Remainder of Portion 1 of the Farm No.195	C04600000000019500001	18°02'6.649240"E	32°59'55.50063"S
Remainder of Portion 2 of the Farm No.195	C04600000000019500002	18°02'14.01011"E	32°59'31.11986"S
Remainder of the Farm Yzervarkensrug No.129	C04600000000012900000	18°02'27.41848"E	32°59'1.196270"S
Remainder of the Farm No.1132	C04600000000113200000	18°02'25.31377"E	32°59'0.072630"S
Remainder of Portion 3 of the Farm Yzervarkensrug No.129	C04600000000012900003	18°02'34.06000"E	32°58'41.91965"S

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

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

2.3.2 Locality Plan of Activity (Marine & Transmission)

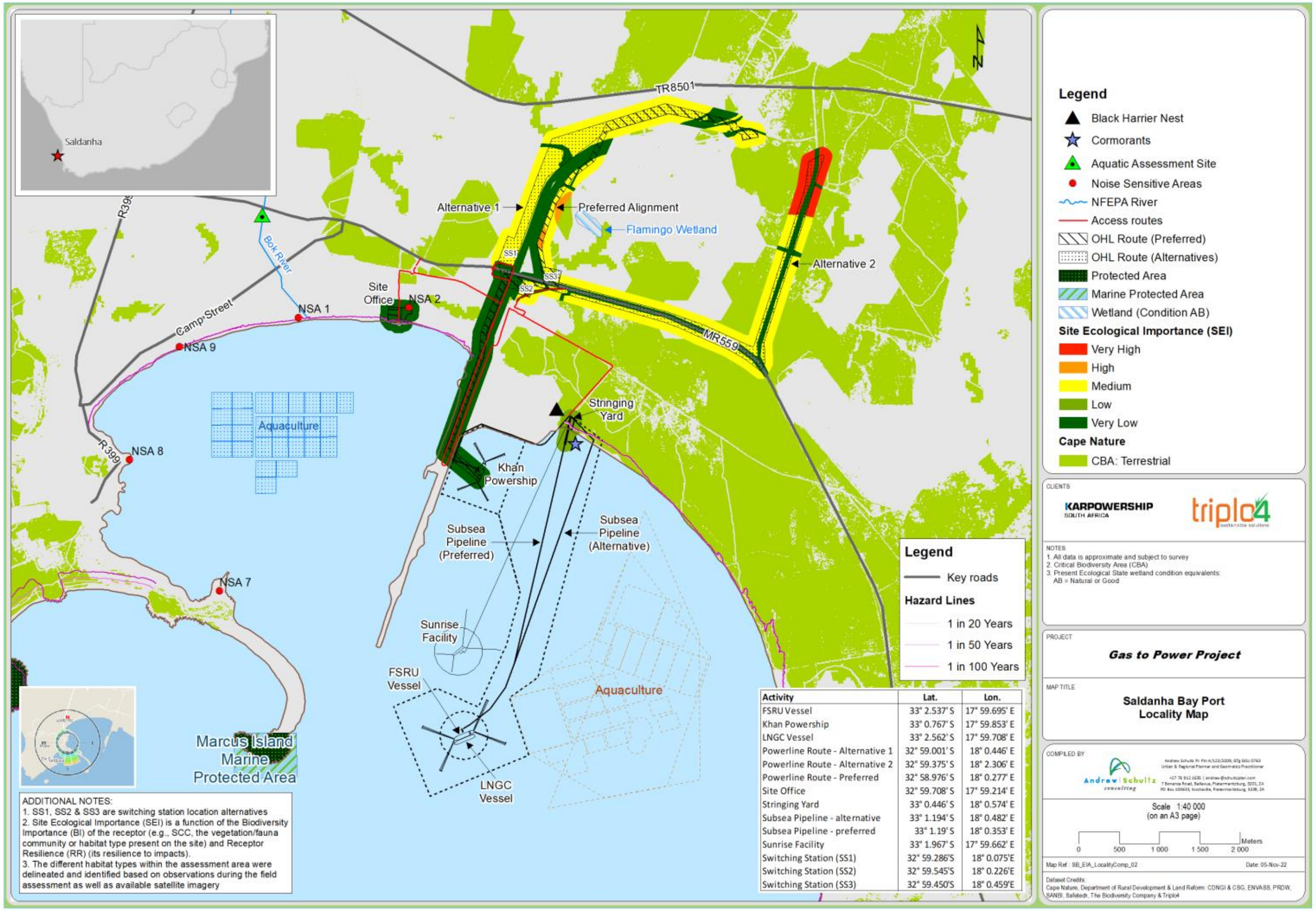


Figure 2-9: Locality Map (Marine & Transmission) – Refer to Appendix 1.1

3 ALTERNATIVES ASSESSED IN THE EIA PROCESS

The reasonability and feasibility of the alternatives have been considered in terms of Section 24O.

3.1 APPROVED SITE AND ALTERNATIVES ASSESSED IN EIA

2014 EIA Regulations (as amended), Appendix 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 Western Cape Province, which were Port of Saldanha and Port of Cape Town.

The selected Port by Karpowership was based on criteria such as adequate space for ship 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 Cape Town provides container, bulk and general cargo services to the Western Cape. According to the NPP (2010), the medium and long term development plans are focussed on its multi-purpose and container terminals Factors such as the depth of the Port and Port Planning resulted in the dismissal of this site as an option. The Port of Cape Town is supported by the Port of Saldanha Bay which is the region's primary dry bulk and liquid bulk port.

The Port of Saldanha is the deepest and largest natural harbour in the Southern hemisphere and is planned for oil and gas development. TNPA have already made provision for LNG import terminals in its long term planning. The Port of Saldanha and surrounding area for the evacuation route meet the requirements for the proposed Powership Project, therefore this is the preferred location, and no other sites within this region are considered to be suitable for the Project.

3.1.2 Current Port Site Selection

Considering the proposed project being a ship-based power generating operation (as opposed to land-based) requiring transmission of energy to land-based transmission connection points, locations that provide infrastructure associated with the proposed technology were identified. The Port of Saldanha has eight completed berths: two iron ore berths, four break-bulk berths and two liquid bulk berths comprising a fixed berth for crude oil and a multi-buoy mooring (MBM) facility for handling LPG cargoes.

A Special Economic Zone (SEZ) has been declared in Saldanha Bay and construction is well underway for the establishment of infrastructure to stimulate economic development in and around the Port (NPP, 2019). This site has been approved by DFFE following Scoping.

The following alternatives have been assessed as part of the EIA as per Section 3.2 below.

3.2 DEVELOPMENT FOOTPRINT (LAYOUT) ALTERNATIVES ASSESSED IN EIA

As a result of the engagements with Transnet, Eskom and landowners and specialist findings, the alternative layouts were assessed. The following table summarises the proposed alternatives presented in the Scoping Report, specifically the plan of study for EIA (and subsequently approved by DFFE for assessment in the EIA phase) and the current EIA:

Table 3-1: Summary of alternatives

Alternative	Description	Status	Key reasoning	Report Section
Layout Alternative Powership	Powership positioned in Small Bay	Screened out	• Not supported by TNPA • Not supported by Landscape and Visual specialist	Not applicable
	Powership positioned in Big Bay	Assessed in EIA	• This is a feasible and preferred alternative that is recommended by TNPA	Section 3.2.1
Layout Alternative Gas pipeline within proposed polygon	Overland gas pipeline routed behind the oyster dam	Screened out	• Not supported by landowner	Not applicable
	Alternative 1: Subsea line from FSRU to onshore pipeline to subsea pipeline to Powership	Assessed in EIA	• This is a feasible and preferred alternative that is supported by Avifaunal specialist with mitigation	Section 3.2.2
	Alternative 2: Gas pipeline routed from FSRU to Powership crosses further away from the oyster dam		• This is a feasible alternative but is not supported by the Avifaunal specialist and Terrestrial Biodiversity specialist.	
Layout Alternative Transmission Alternative	Alternative alignments connecting to Blouwater Substation	Screened out	• Not supported by Eskom and landowners	Not applicable
	Preferred Alignment approx. 7,5 km in length	Assessed in EIA	• A feasible and preferred alternative	Section 3.2.3
	Alternative 1 Alignment approx. 7,2 km in length		• A feasible alternative • Not supported by landowners	

	Alternative 2 Alignment approx. 8,6 km in length		• Not environmentally supported and considered to be a no-go option	
Design Alternative Transmission	Lattice	Screened out	• 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.	Section 3.2.4
Technology Alternative 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 year 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: Powership and FSRU Position within Big Bay

The Powership and FSRU are to be moored within the Port of Saldanha in Big Bay. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels have to be positioned in unused areas of the port and utilise their own mooring system comprising catenary mooring chains and anchors. No dredging is required as the mooring location is positioned in sufficient water depth to safely accommodate the moored vessels.

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 facility needs to be situated after the approach channel entrance and outside the turning circle so as to not to impede vessel traffic movement in the port. This will comply with 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, approximate 250-300m meters radius from STS manifold will be defined as no-go zone and 500 meters radius as controlled traffic zone.

No alternative mooring sites were initially considered as per the Scoping Report, as the preferred location is within the TNPA port limits and is aligned with the proposed Port plans (NPP, 2019). TNPA's preference for the Powership position within Big Bay instead of Small Bay (Figure 3-1) was an outcome of prior public participation and engagements between Karpowership and TNPA. This position has been assessed by the specialists and provided to all stakeholders and I&APs for comment.

No alternatives for the position of the proposed FSRU was viable as there as existing infrastructure and activities in the Port. In addition, the position was selected based on engagements with DFFE SAM on aquaculture activities within the Port and TNPA to ensure that there are no encroachments on existing or planned activities.

To accommodate potential minor adjustments to the position for the final detail design stage, a polygon for the proposed position was identified. There are no alternative Powership and FSRU positions and the only feasible positions are illustrated in the figure below.

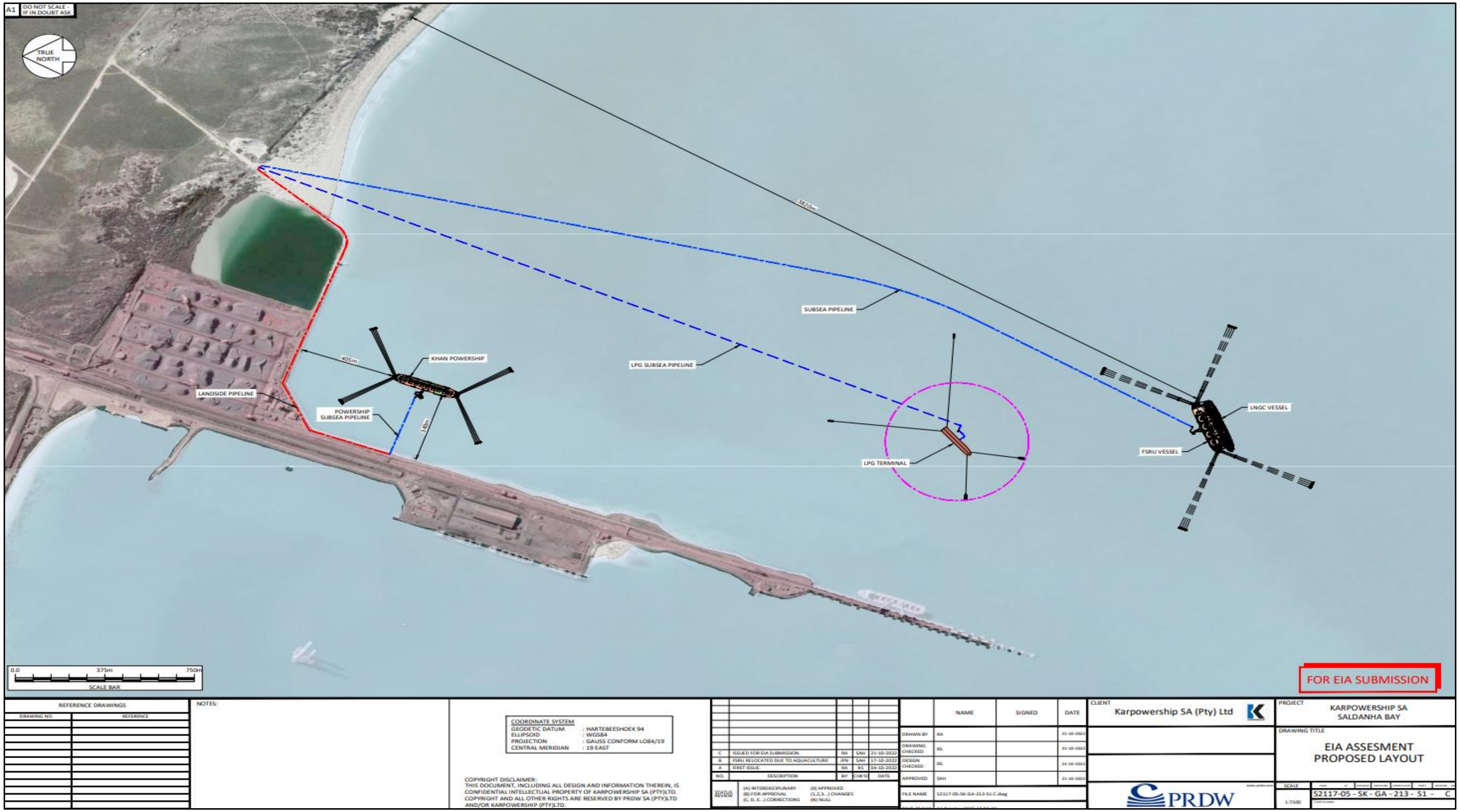


Figure 3-1: Preferred: Powership and FSRU Position within Big Bay of the Port

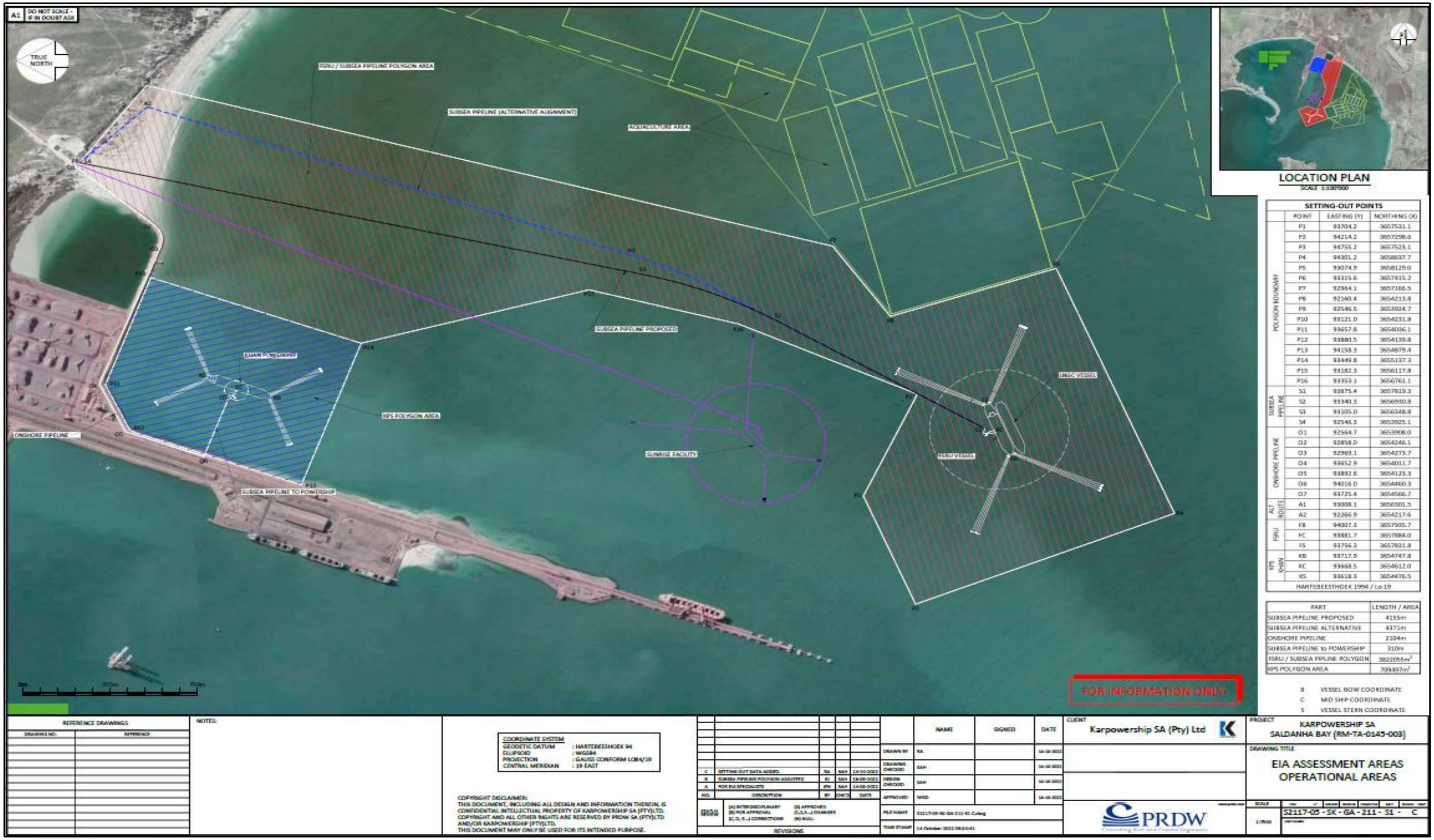


Figure 3-2: Overall layout including Polygon points for the marine aspects (Powership, FSRU, Preferred gas pipeline route (black) and alternative 1 (blue))

Table 3-2: Coordinates of Marine Powership and FSRU

SETTING-OUT POINTS		GPS (WGS84)(DEG)							
POINT		Lng(°E) Deg Dec	Deg	Min	Sec	Lat(°N) Deg Dec	Deg	Min	Sec
POLYGON BOUNDARY	P1	17,996892	17	59	48,81	-33,039095	-33	2	20,74
	P2	17,991458	17	59	29,25	-33,036955	-33	2	13,04
	P3	17,985644	17	59	8,32	-33,038932	-33	2	20,15
	P4	17,990389	17	59	25,40	-33,049020	-33	2	56,47
	P5	18,003567	18	0	12,84	-33,044539	-33	2	40,34
	P6	18,001064	18	0	3,83	-33,038083	-33	2	17,10
	P7	18,004851	18	0	17,46	-33,035872	-33	2	9,14
	P8	18,013750	18	0	49,50	-33,009320	-33	0	33,55
	P9	18,009648	18	0	34,73	-33,006681	-33	0	24,05
	P10	18,003470	18	0	12,49	-33,009401	-33	0	33,84
	P11	17,997746	17	59	51,88	-33,007590	-33	0	27,32
	P12	17,995353	17	59	43,27	-33,008506	-33	0	30,62
	P13	17,992304	17	59	32,30	-33,015149	-33	0	54,54
	P14	17,999860	17	59	59,50	-33,017535	-33	1	3,13
	P15	18,002622	18	0	9,44	-33,026399	-33	1	35,03
	P16	18,000729	18	0	2,62	-33,032183	-33	1	55,86
FSRU	FB	17,993607	17	59	36,99	-33,042716	-33	2	33,78
	FC	17,994956	17	59	41,84	-33,042261	-33	2	32,14
	FS	17,996304	17	59	46,69	-33,041801	-33	2	30,48
KPS KHAN	KB	17,997031	17	59	49,31	-33,014001	-33	0	50,41
	KC	17,997572	17	59	51,26	-33,012781	-33	0	46,01
	KS	17,998124	17	59	53,25	-33,011564	-33	0	41,63

Table 3-3: Sizes of layout alternative 1: Powership, FSRU, LNGC and gas pipeline Polygon

Description	Length / Area
FSRU / Subsea Pipeline Polygon	3822055m^2
KPS Polygon Area	709497m^2

3.2.2 Layout Alternatives: Gas Pipelines:

A gas pipeline is required between the FSRU and Powership to ensure gas supply for power generation as the Powership do not store any natural gas aboard.

To accommodate for minor changes during final design stage and further engagements with stakeholders, polygon for the proposed gas pipeline was identified.

Two alternative alignments for an onshore gas pipeline are proposed taking into consideration the existing infrastructure and recommendations from specialists (Figure 3-2). These recommended routes identified by the EIA process will be included in the commercial agreement to be entered into with Transnet National Port Authority (TNPA).

Preferred Alternative: is deemed the preferred option as the subsea to onshore pipeline follows a shorter route to the overland gas pipeline connection. Together with more detailed bathymetry, it was possible to reorient the pipeline, position the shore crossing adjacent to the Sunrise LPG pipeline shore crossing and reuse the same area of the beach for the stringing yard as was used for the Sunrise installation. This relocation of the shore crossing results in 400m less of the pipeline route traversing the dune field.

Alternative 1: is the original route proposed prior to the avifaunal specialist's findings. This route traverses 400m more the beach before connecting to the overland gas pipeline. Although feasible, this route is therefore not supported.

It must be noted that the avifaunal specialist recommended that the gas pipeline is to be routed directly to the stone causeway, thereby avoiding the breeding Black Harriers and roosting Cape Cormorants near the shore/beach. This alternative would remove the need for the shore crossing and onshore pipeline route, but would require close coordination to design the crossing spool and protection of the Sunrise LPG subsea pipeline. Should this become a viable option due to engagement, this subsea option within the assessed polygon would also be supported.

Figure 3-3: Google image showing the polygon for the gas pipeline (red), preferred alternative (black) and alternative 2 (blue).

Table 3-4: Coordinates of Subsea and Onshore Pipeline

SETTING-OUT POINTS		GPS (WGS84)(DEG)							
POINT		**Lng(°E) Deg Dec**	**Deg**	**Min**	**Sec**	**Lat(°N) Deg Dec**	**Deg**	**Min**	**Sec**
POLYGON BOUNDARY	P1	17,996892	17	59	48,81	-33,039095	-33	2	20,74
	P2	17,991458	17	59	29,25	-33,036955	-33	2	13,04
	P3	17,985644	17	59	8,32	-33,038932	-33	2	20,15
	P4	17,990389	17	59	25,40	-33,049020	-33	2	56,47
	P5	18,003567	18	0	12,84	-33,044539	-33	2	40,34
	P6	18,001064	18	0	3,83	-33,038083	-33	2	17,10
	P7	18,004851	18	0	17,46	-33,035872	-33	2	9,14
	P8	18,013750	18	0	49,50	-33,009320	-33	0	33,55
	P9	18,009648	18	0	34,73	-33,006681	-33	0	24,05
	P10	18,003470	18	0	12,49	-33,009401	-33	0	33,84
	P11	17,997746	17	59	51,88	-33,007590	-33	0	27,32
	P12	17,995353	17	59	43,27	-33,008506	-33	0	30,62
	P13	17,992304	17	59	32,30	-33,015149	-33	0	54,54
	P14	17,999860	17	59	59,50	-33,017535	-33	1	3,13
	P15	18,002622	18	0	9,44	-33,026399	-33	1	35,03
	P16	18,000729	18	0	2,62	-33,032183	-33	1	55,86
SUBSEA PIPELINE	S1	17,995031	17	59	42,11	-33,041678	-33	2	30,04
	S2	18,000849	18	0	3,06	-33,033714	-33	2	1,37
	S3	18,003426	18	0	12,33	-33,028488	-33	1	42,56
	S4	18,009650	18	0	34,74	-33,006685	-33	0	24,07
ONSHORE PIPELINE	O1	18,009455	18	0	34,04	-33,006529	-33	0	23,50
	O2	18,006282	18	0	22,62	-33,009552	-33	0	34,39
	O3	18,005091	18	0	18,33	-33,009792	-33	0	35,25
	O4	17,997801	17	59	52,08	-33,007371	-33	0	26,54
	O5	17,995225	17	59	42,81	-33,008356	-33	0	30,08
	O6	17,993870	17	59	37,93	-33,011384	-33	0	40,98
	O7	17,996969	17	59	49,09	-33,012368	-33	0	44,53
ALT ROUTE	A1	18,004468	18	0	16,09	-33,028069	-33	1	41,05
	A2	18,012610	18	0	45,40	-33,009345	-33	0	33,64

Table 3-5: Sizes of Subsea and Onshore Pipeline including alternative

Description	Length / Area
Subsea Pipeline Proposed	4155m
Subsea Pipeline Alternative	4371m
Onshore Pipeline	2104m
Subsea Pipeline To Powership	310m

3.2.3 Layout Alternatives: Transmission line route and switching station

Subsequent to the Scoping Phase, there has been engagements between Eskom and Karpowership SA which resulted in the connection to the Blouwater Substation originally proposed being screened from further assessment in the EIA. As a result, a connection to Aurora -Saldanha Steel transmission network via 132kV switching station is proposed. The power generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line and will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. There are three (3) potential options being considered for connection from the Powership to the National Grid that will ultimately be dependent on specialist input and landowner approval. A transmission line corridor will allow for technical construction requirements to be maintained on site, and the corridor was determined in consideration with sensitivities on site.

Preferred Alternative Corridor: The power generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line. This new transmission line of approximately 7,5 km will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. The monopole transmission towers are proposed within a 60 metre corridor which includes the 31m working servitude. The servitude, stretching approximately 7,5 km from the port to existing Aurora- Saldanha Steel network via a new 132kV on shore switching station, will have a width of 31m as per Eskom safety specifications

This alternative has been indicated as the preferred route.

Alternative 1 Corridor: The power generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line. This new transmission line of approximately 7.2 km will interconnect the Powership to the National Grid utilising the existing Aurora- Saldanha Steel network via a new 132kV on shore switching station. Approximately 37 towers are proposed within a 50 metre corridor which includes the 31m working servitude. The servitude, stretching approximately 7.2 km from the port to existing Aurora- Saldanha Steel network via a new 132kV on shore switching station the, will have a width of 31m as per Eskom safety specifications. This route is primarily based between Transnet and the Saldanha Steel property and crosses properties owned by Afrisam and Duferco (where two local landowners are currently undergoing late stages of an arbitration process against one another, albeit with no definitive timeline).

Alternative 2 Corridor: Alternatively, the power generated on the ship will be converted by the on-board High Voltage substation and transmitted along a 132kV line which is the same as the preferred route. The transmission line of approximately 8.6 km traverses a different route on the southern boundary of the Saldanha Steel property but will interconnect the Powership to the National Grid utilising the existing Aurora - Saldanha Steel network via a new 132kV on shore switching station. The servitude has a width of 31m as per Eskom safety specifications within a 60 metre corridor. The roadway is used as a guideline and the transmission lines can be erected on either side of the roadway based on the negotiation and agreement from the landowners. This alternative is not supported for the following reasons:

- According to the avifaunal specialist, it was determined that this alternative is a no-go option as it cuts across the fight paths of three priority species including GPS-tracked Black Harriers.
- Furthermore, the terrestrial ecologist indicated that this route traverses an area of critically endangered limestone strandveld which should be avoided.

Figure 3-4: Google image showing the transmission line and switching station alternatives.

Table 3-6: Details of the transmission line route alternatives:

Description		**GPS-COORDINATE OF POLYGON**			
		Left		**Right**	
		Longitude	**Latitude**	**Longitude**	**Latitude**
Preferred Line Route					
Preferred Alternative Route Length: 7,5km Approx. no. of towers:37 Corridor: 60m Working servitude: 31m	**Start**	17°59'49.78"E	33° 0'49.74"S	17°59'51.72"E	33° 0'47.09"S
	Bend 1	17°59'33.58"E	33° 0'38.25"S	17°59'36.84"E	33° 0'36.32"S
	Bend 2	17°59'50.85"E	32°59'58.42"S	17°59'53.41"E	32°59'59.22"S
	Bend 3	17°59'51.79"E	32°59'49.52"S	17°59'54.75"E	32°59'50.11"S
	Bend 4	18° 0'3.27"E	32°59'25.91"S	18° 0'3.87"E	32°59'31.24"S
	Bend 5			18° 0'10.00"E	32°59'33.08"S
	Bend 6			18° 0'9.79"E	32°59'34.09"S
	Bend 7			18° 0'15.37"E	32°59'35.72"S
	Bend 8			18° 0'17.56"E	32°59'30.84"
	Bend 9	18° 0'22.04"E	32°59'30.40"S	18° 0'28.35"E	32°59'33.42"S
	Bend 10			18° 0'30.62"E	32°59'25.16"S
	Bend 11			18° 0'23.16"E	32°59'23.66"S
	Bend 12	18° 0'19.01"E	32°59'14.17"S	18° 0'21.44"E	32°59'14.68"S
	Bend 13	18° 0'26.93"E	32°58'56.82"S	18° 0'28.85"E	32°58'57.66"S
	Bend 14	18° 0'35.23"E	32°58'46.04"S	18° 0'36.74"E	32°58'47.85"S
	Bend 15	18° 0'44.07"E	32°58'46.04"S	18° 0'47.04"E	32°58'41.30"S
	Bend 16	18° 0'52.86"E	32°58'25.20"S	18° 0'53.25"E	32°58'29.29"S
	Bend 17	18° 1'20.85"E	32°58'17.90"S	18° 1'22.83"E	32°58'22.29"S
	Bend 18	18° 1'55.01"E	32°58'25.55"S	18° 1'52.18"E	32°58'27.32"S
	Bend 19	18° 1'55.41"E	32°58'27.38"S	18° 1'52.19"E	32°58'29.02"S
	Bend 20	18° 2'4.79"E	32°58'29.63"S	18° 1'57.33"E	32°58'30.89"S
	End	18° 2'5.43"E	32°58'31.95"S	18° 1'57.91"E	32°58'33.31"S
	Alternative Line Route 1				
Alternative Line Route 1 Length: 7,2km Approx. no. of towers:37 Corridor: 50m Working servitude: 31	**Start**	17°59'49.78"E	33° 0'49.74"S	17°59'51.72"E	33° 0'47.09"S
	Bend 1	17°59'33.58"E	33° 0'38.25"S	17°59'36.84"E	33° 0'36.32"S
	Bend 2	17°59'50.85"E	32°59'58.42"S	17°59'53.41"E	32°59'59.22"S
	Bend 3	17°59'51.79"E	32°59'49.52"S	17°59'54.75"E	32°59'50.11"S
	Bend 4	18° 0'1.99"E	32°59'28.87"S		
	Bend 5	18° 0'0.67"E	32°59'20.38"S		
	Bend 6	18° 0'5.16"E	32°59'10.88"S		
	Bend 7	18° 0'8.29"E	32°59'11.98"S		
	Bend 8			18° 0'23.90"E	32°58'47.78"S
	Bend 9	18° 0'26.51"E	32°58'31.89"S		
	Bend 10			18° 0'52.15"E	32°58'29.57"S
	Bend 11	18° 1'20.85"E	32°58'17.90"S	18° 1'22.83"E	32°58'22.29"S
	Bend 12	18° 1'55.01"E	32°58'25.55"S	18° 1'52.18"E	32°58'27.32"S
	Bend 13	18° 1'55.41"E	32°58'27.38"S	18° 1'52.19"E	32°58'29.02"S
	Bend 14	18° 2'4.79"E	32°58'29.63"S	18° 1'57.33"E	32°58'30.89"S
	End	18° 2'5.43"E	32°58'31.95"S	18° 1'57.91"E	32°58'33.31"S
	Alternative Line Route 2				
Alternative Line Route 2 Length: 8,6km Approx. no. of towers 45 Corridor: 60m Working servitude: 31	**Start**	17°59'49.78"E	33° 0'49.74"S	17°59'51.72"E	33° 0'47.09"S
	Bend 1	17°59'33.58"E	33° 0'38.25"S	17°59'36.84"E	33° 0'36.32"S
	Bend 2	17°59'50.85"E	32°59'58.42"S	17°59'53.41"E	32°59'59.22"S
	Bend 3	17°59'51.79"E	32°59'49.52"S	17°59'54.75"E	32°59'50.11"S
	Bend 4	18° 0'1.56"E	32°59'29.21"S	18° 0'3.87"E	32°59'31.24"S
	Bend 5			18° 0'10.00"E	32°59'33.08"S
	Bend 6			18° 0'9.79"E	32°59'34.09"S
	Bend 7			18° 0'15.37"E	32°59'35.72"S
	Bend 8			18° 0'17.56"E	32°59'30.84"

	Bend 9	18° 0'22.04"E	32°59'30.40"S		
	Bend 10	18° 0'20.83"E	32°59'23.14"S		
	Bend 11	18° 0'30.74"E	32°59'25.14"S		
	Bend 12	18° 0'29.47"E	32°59'29.83"S		
	Bend 13	18° 1'20.93"E	32°59'41.91"S	18° 1'17.61"E	32°59'45.99"S
	Bend 14	18° 1'38.04"E	32°59'47.21"S	18° 1'49.11"E	32°59'56.69"S
	Bend 15			18° 2'5.60"E	33° 0'6.36"S
	Bend 16	18° 2'1.96"E	32°59'56.33"S	18° 2'7.70"E	33° 0'3.00"S
	Bend 17			18° 2'7.30"E	32°59'54.50"S
	Bend 18	18° 2'27.55"E	32°58'52.96"S		
				18° 2'36.98"E	32°58'40.03"S
	End	18° 2'29.29"E	32°58'42.15"S	18° 2'35.93"E	32°58'39.37"S

There is a proposed switching station required for each of the transmission line alternatives with an area of 14 101 m^2.

Table 3-7: Details of proposed switching station alternatives

SS1 Switching Station			
Corner	**Longitude**	**Latitude**	Area
1	18° 0'0.74"E	32°59'20.61"S	
2	18° 0'5.14"E	32°59'11.11"S	
3	18° 0'11.79"E	32°59'13.25"S	
4	18° 0'7.47"E	32°59'22.87"S	
Midpoint	18° 0'6.41"E	32°59'17.53"S	14 101 m^2
SS2 Switching Station			
Corner	**Longitude**	**Latitude**	Area
1	18° 0'9.81"E	32°59'34.04"S	
2	18° 0'12.22"E	32°59'28.87"S	
3	18° 0'17.95"E	32°59'29.70"S	
4	18° 0'15.47"E	32°59'35.64"S	
Midpoint	18° 0'13.92"E	32°59'32.08"S	14 101 m^2
SS3 Switching Station			
Corner	**Longitude**	**Latitude**	Area
1	18° 0'20.93"E	32°59'23.35"S	
2	18° 0'30.70"E	32°59'25.25"S	
3	18° 0'28.51"E	32°59'33.27"S	
4	18° 0'22.42"E	32°59'31.72"S	
Midpoint	18° 0'25.60"E	32°59'27.51"S	14 101 m^2

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.

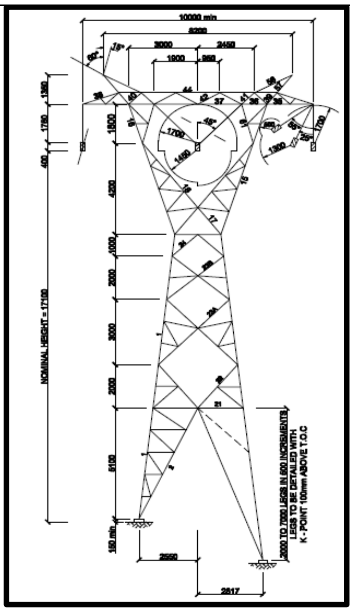
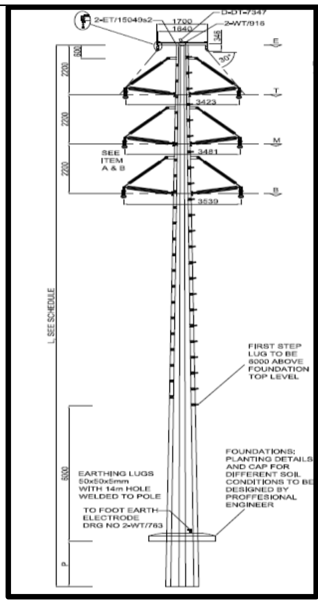
	

Figure 3-5: Typical 132kV single circuit lattice steel tower	**Figure 3-6: Typical 132kV Monopole Suspension**

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.
- 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 preferred 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 lesser 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.
- Since poles are more continuum-type structures, they offer more resistance to vandalism.

There are some disadvantages associated with the monopole design such as:

- Monopoles require heavy cranes for their deployment and installation.

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-wind 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 key positive impacts of not implementing the project relate to the avifauna, more especially the pair of Black Harriers, cormorants and flamingos that were identified as being impacted by the implementation of this project (Simmons, 2022). The currently proposed routing for the LNG pipeline from the FSRU to the Powership runs through a beach where 3000+ endangered Cape Cormorants were recorded roosting, as well as the nest site of endangered Black Harriers further west. The Flamingo wetland identified approximately 266m east of the preferred transmission line route. The proposed powerlines could cause collision fatalities for birds, with 0.33 fatalities observed every 1 km along the existing lines. As such there are three alternative powerlines proposed, which could result in 2.4 fatalities along the Preferred route, 2.3 fatalities along Alternative 1 and 2.8 fatalities along Alternative 2 (Simmons, 2022). Not implementing the project will reduce the disturbance and collision risks to these avifaunal species. However, one must also bear in mind that Saldanha Bay is an active port with existing disturbances and infrastructure such as transmission lines.

In contrast, the negative impacts are related to the socio-economic landscape, from local to national level. The Powership will be moored in Big Bay in the Port of Saldanha, adjacent to the Iron Ore jetty. The Port of Saldanha Bay is an important industrial zone and economic hub for the country. It is the largest and deepest natural anchorage port in the Southern Hemisphere. It provides crucial economic activities, and although it mainly handles iron ore exports, it is also home to the South African Naval Station of SAS Saldanha, the NSRI rescue station and fishing harbour. It is a unique port offering a rail link connected to a jetty bulk loading facility for the shipment of iron ore from mines in Sishen in the Northern Cape, and steel manufactured at the Saldanha Steel Mill. There are also plans to develop the port further, including the development of ship and oil rig repair facilities to service the local industry.

Climate change over the next 30 years will have several significant and far-reaching consequences. Based on the climate change modelling done by Promethium Carbon (2022), heat and water security related stresses will cause numerous direct and indirect effects in ecosystem services, food scarcity, illnesses, diseases, increased social tensions, and increased reliance on cooling systems, furthering greenhouse gas emissions (Steenkamp, 2022). The emissions over the 20-year lifetime of the Karpowership SA project are comparable to 2 years of running a new coal fired power station which reiterated the reasoning that natural gas can be used as a transitional technology to move away from reliance on coal. Avoided emissions are those that are emitted if the project is not implemented. The total avoided emissions from the Karpowership SA project between 2023 and 2030 is approximately 12 million tCO_2e.

It is also important to note that the Karpowership SA project's role in assisting the transition to a low carbon future is not limited to the reduction of GHG and particular emissions when compared to coal, but also its ability to support renewable energy plants coming online by making up for their intermittent energy generation. In the future, renewable energy plants paired with battery storage will preclude the need for fossil fuel-based generation, however this will only become a reality in the future when battery storage technology and manufacturing capacity has improved (Promethium Carbon, 2022b). By providing load following and dispatchable electricity which renewable energy cannot provide, the project will enable more renewable energy projects to come online than otherwise would have been be possible, providing the energy stabilisation needed until sufficient battery technology can be deployed (Promethium Carbon, 2022b). This will result in additional emissions saving, as it will allow a further reduction in demand for coal fired electricity as more renewable energy comes online (Promethium Carbon, 2022b). It is important to note that coal cannot fill the same role as LNG in supporting renewable energy because coal fired plants do not provide dispatchable energy. Coal fired plants have to run for extended periods of time with limited shutdown periods to remain efficient and operational, usually only implemented when maintenance is required. Gas-to-power plants by comparison are able to turn on and off at will, providing electricity as dispatch demands fluctuate, and only experiencing efficiency losses between cold and hot starts.

These avoidances in GHG emissions enabled by the project due to a direct avoidance of coal emissions, and an indirect reduction through the support of renewable energy means that the project will ultimately provide more GHG emissions avoidance than the total amount of GHG emissions it will produce over its lifetime, even when accounting for the worst-case scenario (Promethium Carbon, 2022b).

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.

Karpowership SA had developed and intends to implement an Economic Development Plan which is aimed at contributing to the local development in various ways. Local skills development will be further enhanced through a Skills Development Programme which will be implemented during the operational phase of the project, with an allocated budget of R27.7 million over the 20 years, or approximately R1.4 million per annum (Karpowership SA, 2022). The intention is for positions which are initially filled by foreign personal to be filled by South Africans who are trained through the skills development programme. School leavers and graduates will be supported through bursaries, and internships. Karpowership internal staff, and community members will be provided with learnership or apprenticeship opportunities, and informal and work-integrated learning. This will provide benefits outlined in the development of locally relevant skills and continue to develop the skills base in a manner which is relevant to the local industrial development plans, and increase the level of localisation of the project.

A dedicated Supplier Development Programme is also planned by Karpowership SA, with R1 million allocated for the construction period, and R910 000 million per annum for the 20 years of operations (Karpowership SA, 2022). This will involve the provision of seed or development capital, loans and credit facilities organised through partner financing companies, and assistance with training and mentoring (Karpowership SA, 2022). The development of a local supplier value chain which is centred around the maritime sector, and provision of Chandler Services will further increase the development of the SBIDZ, as it will increase local skills base, and production capacity which is geared towards industry relevant services and products. This will increase the likelihood of other vessels and international maritime companies planning maintenance, and restocking at the Saldanha Bay Port, rather than other locations, increasing local investment, and consumption spending.

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

Table 3-8: Local and National considerations for the no-go option

Considerations For the No-Go:	Considerations Against the No-Go
• Medium-Low impacts to loss of Strandveld, fauna, flora and biodiversity in general. • Medium-High impact of mortality around any new power line for the Red-listed bird groups. • Medium impact of major disturbance to the harrier breeding habitat and the roosting habitat of the Cape Cormorants by the presence of the Stringing yard. • Medium impacts of the effects of the discharge of cooling water and the effects of noise on the marine ecology. • Low risks from ship-to ship transfer of LNG and NG will be avoided. • Low visual impacts (due to shipping being aligned with the Port operations) will not occur. • Climate change impacts originating from the generation of gas to power as per the proposed project will not occur. • High socio-economic impacts from influx of people looking for work opportunities may not occur.	• The Karpowership fleet can be deployed immediately, and 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 baseload, mid-merit and peaking power and because Karpowership provides dispatchable power, it can respond in minutes when the energy supply is under strain. • Because Karpowership is a floating power, 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 the Karpowership will also contribute to skills and capacity development which will benefit local individuals 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). • The 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. • 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.

Considerations For the No-Go:	Considerations Against the No-Go
	• 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.

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 320MW Gas to Power Powership Project, should be authorised subject to the conditions proposed in Section 9, which include compliance with the EMPr. Hence the “no-go” alternative is not recommended.

4 POLICY AND LEGISLATIVE FRAMEWORK

4.1 NATIONAL REGULATORY FRAMEWORK

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

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.

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 (as amended) ("**EIA Regulations**") and informed by guidelines published in terms of Section 24J of NEMA as well as applicable protocols and minimum information requirements.

In addition, the Project triggers an activity listed under the National Environmental Management: Air Quality Act 39 of 2004 ("**NEMAQA**") which requires an atmospheric emission licence (AEL). The same EIA process prescribed by the EIA Regulations need to be applied to the AEL application, with a number of additional requirements set out in NEMAQA and its Regulations. As part of the Environmental Impact Assessment ("**EIA**") process, Regulation 3(1)(e) of the 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.

Table 4-1: 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><th colspan="3">Relevance to the Proposed Project, Compliance and Response:</th></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 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 of this report.

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)</td></tr>
</table>

("**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.
 	
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 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.

Table 4-2: 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 by 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.

Table 4-3: National Environmental Management: Air Quality Act 39 of 2004 ("NEMAQA") and its associated subordinate legislation

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td rowspan="7">National Environmental Management: Air Quality Act 39 of 2004</td><td colspan="2">Provides for the protection of the environment by regulating air quality in order to prevent air pollution.</td></tr>
<tr><td>Sections 21, 22, 22A</td><td>Listing of activities and Atmospheric Emission Licensing.</td></tr>
<tr><td>Sections 23-25</td><td>Controlled emitters</td></tr>
<tr><td>Section 32</td><td>Control of dust</td></tr>
<tr><td>Section 34</td><td>Control of noise</td></tr>
<tr><td>Section 35</td><td>Control of offensive odours</td></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="3">Relevance to the Proposed Project, Compliance and Response:</th></tr>
<tr><td colspan="3">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</td></tr>
</table>

- 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 which will specify conditions. The appointed specialist has applied the air dispersion modelling requirements and the impacts were assessed as very low. 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.

Table 4-4: 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:		
This 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.		

Table 4-5: 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 Act requires the sustainable utilisation of marine resources. Due to the project being located in the Port of Saldanha Bay, all reasonable measures must be taken to avoid marine pollution that may affect marine living resources.		

Table 4-6: 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 feeds assists in defining and identifying important I&APs in the PPP.		

Table 4-7: 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 the National Environmental Management: Integrated Coastal Management Amendment Act 36 of 2014	Section 2	Provides for the preservation, protection and enhancement of 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 Powership 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		

Table 4-8: 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 fresh water resources.
	Section 19	Prevention and remedying the effects of pollution
	Section 20	Control of emergency incidents
	Section 21	Permissible water use, including discharge & abstraction and development within 500m of a watercourse (including wetlands).
Relevance to the Proposed Project, Compliance and Response:		
The Wetland Specialist did not identify any watercourses at risk within close proximity to the proposed project, including routes of the proposed transmission and associated infrastructure therefore a Water Use Authorisation is not required. Measures to protect water resources by mitigating impacts and responding to emergency incidents are contained in the EMPr.		

Table 4-9: National Forest Act 84 of 1998

Legislation	Section	Relates to
National Forest Act 84 of 1998	Section 12	Provides for protection, control and licencing for cutting, disturbing, damaging or destroying protected trees
Relevance to the Proposed Project, Compliance and Response:		

If any protected trees in terms of this Act occur on site, the developer will require a licence from the DFFE to perform any of the above-listed activities. No protected trees have been identified on the proposed project site.

Table 4-10: National Environmental Management: Biodiversity Act 10 of 2004

Legislation	Section	Relates to
National Environmental Management: Biodiversity Act 10 of 2004: Threatened or Protected Species Regulations and lists (2007 & 2017 (marine)); Alien and Invasive Species Regulations and lists (2020)	Provides for the management and conservation of biodiversity, protection of species and ecosystems, and sustainable use of indigenous biological resources, including threatened and protected species and ecosystems, and invasive and alien species	
Relevance to the Proposed Project, Compliance and Response:		
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.		

Table 4-11: National Environmental Management: Protected Areas Act 31 of 2004

Legislation	Section	Relates to
National Environmental Management: Protected Areas Act (31 of 2004)	Provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. Promotes sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas.	
Relevance to the Proposed Project, Compliance and Response:		
The Project is situated within the Port of Saldanha, approximately 3.5 km from the Langebaan Lagoon MPA, and the sensitive marine and estuarine habitats therein.		

Table 4-12: National Environmental Management: Protected Areas Act (31 of 2004) - Strategy on Buffer Zones for National Parks (106 of 2012)

Legislation	Section	Relates to
National Environmental Management: Protected Areas Act (31 of 2004) - Strategy on Buffer Zones for National Parks (106 of 2012)	Defines buffer zones to protect important areas of high value for biodiversity and/or to society where these extend beyond the boundary of the Protected Area; and stipulate legal requirements for developments within formally established buffer zone.	
Relevance to the Proposed Project, Compliance and Response:		
The proposed project is situated within the Port of Saldanha, approximately 3.5 km from the Langebaan Lagoon MPA, and the sensitive marine and estuarine habitats therein, a part of the West Coast National Park Marine Protected Areas (MPA) Network. The project will be situated well outside the buffer zones.		

Table 4-13: 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 paleontological 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.		

Table 4-14: 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.

Table 4-15: 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.		

Table 4-16: 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.	

Table 4-17: Occupational Health and Safety Act 85 of 1993

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

Table 4-18: Hazardous Substances Act 15 of 1973

Legislation	Section	Relates to
Hazardous Substances Act 15 of 1973 as amended by	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances	

the Hazardous Substances Amendment Act 53 of 1992	
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.	

Table 4-19: 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 4-20:		
Provision is made in the EMPr to manage the Noise Impacts during in the construction and operational phases.		

Table 4-21: 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.		

Table 4-22: Infrastructure Development Act 23 of 2014

Legislation	Section	Relates to
Infrastructure Development Act 23 of 2014	▪ To provide for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the Republic; ▪ to ensure that infrastructure development in the Republic is given priority in planning, approval and implementation; ▪ to ensure that the development goals of the state are promoted through infrastructure development; ▪ to improve the management of such infrastructure during all life-cycle phases, including planning, approval, implementation and operations; and ▪ to provide for matters incidental thereto.	
Relevance to the Proposed Project, compliance and response:		
The Risk Mitigation IPP Procurement Programme has been designated as a Strategic Integrated Project, the importance of the project as a SIP should be balanced against environmental impacts and is relevant to need and desirability.		

Table 4-23: 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 provincial and conservation planning is discussed in Section 6.

Table 4-24: Applicable Provincial Plans, Strategies and Programmes

Legislation	Section	Relates to
Cape Nature and Environmental Conservation Ordinance (19 of 1974)	Regulation of natural conservation for the protection of biodiversity and natural resources	
Western Cape Biosphere Reserves Act 6 of 2011	Facilitation of the designation and management of biosphere reserves through framework plans	
Western Cape Land Use Planning Act (3 of 2014)	Provides for Provincial planning, regional planning and development. Urban and rural development, regulation. Support and monitoring of municipal planning and regulation.	
Western Cape Estuarine Management Framework and Implementation Strategy ("WCEMFIS"): Best Practice Activity Guidelines (October 2019)	Provides for guidance in terms of physical structures built in the littoral active zone, managing erosion and accretion in estuaries, erosion protection, bank stabilisation and management of due environments.	
Western Cape Provincial Spatial Development Framework (2014)	Framework for Western Cape province's urban and rural areas, supporting the municipalities planning mandate aligned to the national and Provincial agendas	
West Coast National Park Management Plan (SANParks, 2013)	To effectively manage the patterns and processes of the unique ecosystems of the Langebaan Lagoon, the offshore islands, the Marine Protected Areas and the terrestrial surrounds".	
Province of the Western Cape: Provincial Gazette Extraordinary 7141 – Western Cape Noise Control Regulations - PN 200/2013 (20th June 2013).	The measurement and rating of disturbing noise with respect to the end of a total period of at least 10 minutes, after such meter had been put into operation.	
Western Cape Climate Response Strategy (2014)	The Western Cape Climate Response Strategy acts as a provincial level strategy modelled on the NCCRP. The strategy sets out the priorities for the Western Cape with regards to climate change adaptation and mitigation.	
Western Cape Biodiversity Spatial Plan (2017)	This spatial tool comprises the Biodiversity Spatial Plan Map (BSP Map) of biodiversity priority areas, accompanied by contextual information and land use guidelines that make the most recent and best quality biodiversity information available for land use and development planning, environmental assessment and regulation, and natural resource	

Legislation	Section	Relates to
	management. The BSP Map covers both the terrestrial and freshwater realms, as well as major coastal and estuarine habitats.	

4.1.3 Local legislation and planning

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

Table 4-25: Applicable Legislation – Regional and Local Planning Frameworks

Legislation	Section	Relates to
Saldanha Local Area Plan (2014) (SSC WC Q 60/2013 DRDLR)	Acts as a medium to long term spatial plan (15-20 years) for the town of Saldanha, providing for decision-making in terms of future land use applications and spatial interventions	
Saldanha Bay Municipality Volume 2: Spatial Development Framework Report (28 May 2019)	Provides for informed spatially related management decisions for future growth, development and management of the Saldanha Bay Municipal Area.	
Environmental Management Framework for the Greater Saldanha Area (2021)	The Environmental Management Framework for the Saldanha Bay Municipality outlining Status Quo, Strategic Assessment and Strategic Environmental Management Plan.	
4th Generation Integrated Development Plan 2017 – 2022	Provides for guidance to municipal planning, budgeting and development in support of sustainable development	
Saldanha Bay Municipal Coastal Management Programme (2019)	The CMP is deemed to be a tool which should be used to manage the diverse range of activities that occur in the coastal zone, without compromising environmental integrity or economic development (SBM, 2019).	
Saldanha Bay Municipality Integrated Waste Disposal By-law	Deals with disposal of solid waste.	
Saldanha Bay Municipality Air Quality By-Law, 2018	Section 12 - No person may install, alter, extend or replace any fuel-burning equipment on any premises without the written authorisation of the Municipality.	
Saldanha Bay Municipality Fire Safety By-Law, 2018	Certificate for use, handling and storage of flammable substances prohibited in certain circumstances.	

4.2 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.
- International Convention on Civil Liability for Oil Pollution Damage, 1969
    - 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) – 1998This 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

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

5.1 BACKGROUND

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, as undertaken in accordance with the Public Participation Plan by DFFE, for the Scoping Phase was approved.

Triplo4 undertook an enhanced PPP for the EIA Phase, by procuring the services of an Independent Public Participation specialist as well as Independent Service providers to distribute and manage the PPP notifications and the Virtual Meeting. 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 including:
  - Actions taken before the public comment period of the DEIR
  - Actions taken during public comment period of the DEIR

Table 5-1: Summary of the PPP undertaken during the Scoping Phase in 2020

Item	Date	Stakeholders	Actions
1.	2020/09/15	DFFE	EAP submitted first draft of PPP to DFFE.
2.	2020/09/17	DFFE	EAP pre-application meeting with DFFE (Regulation 8 of EIA Regulations). DFFE communicated comments on PPP during meeting for the EAP to revise PPP.
3.	2020/09/18	DFFE	EAP submitted amended PPP to DFFE.
4.	2020/09/21	DFFE	**DFFE approved amended PPP.**
5.	2020/09/22	General	Advertisements in Cape Times and Cape Argus newspapers on 22 September 2020 in two languages (English and Afrikaans) – requests for I&APs to register (3 day campaign).

			Three A2 site notices were placed on 22 September 2020 within close proximity to the site area, in English and Afrikaans and were placed prominently at: - Location 1: along the transmission route; - Location 2: Entrance of the Port site; - Location 3: Entrance to the Port Registration Office A5 sized-posters ("flyers") were placed on 22 September 2020 at: - Location 1: Club Mykonos, Langebaan - Location 2: Pienaar Brothers at Trisano Centre, Saldanha Bay; - Location 3: Protea Hotel, Saldanha Bay, and - Location 4: Blue Bay Lodge and Resort, Saldanha Bay
6.	2020/09/22	General	Background Information Document ("**BID**") and Notice of Application ("**NOA**") with an invitation to register were distributed to relevant Stakeholders and I&APs; emailed in two languages (English and Afrikaans) to identified Stakeholders and I&APs on 2020/09/21, including landowners, the municipal ward councillor, the Ratepayers Association; Department of Mineral Resources & Energy (DMRE), Eskom, Department of Water and Sanitation, Department of Forest, Fisheries and the Environment (DFFE), Local Municipality, South African Heritage Resource Agency (SAHRA), South Africa Maritime Safety Authority (SAMSA), National Energy Regulator of South Africa (NERSA), South African National Roads Agency (SANRAL), Eastern Cape Provincial Heritage Resources Authority (ECPHRA), Eastern Cape Parks and Tourism Agency, Heritage Western Cape, Department of Agriculture, Forestry and Fisheries, Department of Environmental Affairs (DEA) Oceans and Coasts; Western Cape Government Environmental Affairs and Development Planning, Saldanha Bay Municipal Manager and DEA&DP: Biodiversity and Coastal Management. The opportunity to register as an I&AP for this project was not limited to an end date enabling I&AP's to register throughout the process.
7.	2020/10/06	General	EAP distributed the Draft Scoping Report for comment until 6 November 2020. Hard copies were delivered to and available at: - Cup of Cake restaurant, 37 Main Street, Saldanha, 7395 - Triplo4 Ballito Offices: Suite 5, The Circle, Douglas Crowe Drive, Ballito; Electronic copies were made available via:

			- Emails to registered I&AP's with a Google Drive Link to access the relevant documentation; - Triplo4 Website: www.triplo4.com.
8.	2020/10/15	General	Online Public Meetings/Webinars held 10h00–12h00 and 18h00–19h30
9.	2020/10/15	General	For all Online Public Meetings on 15 October 2020, the specialists presented independently on their specialised area and also responded to I&AP's queries raised after the specialist's presentation. In a few instances where the specialist was unavailable to present, a voiceover was prepared.
10.	2020/11/06	General	Period for receiving public comments closed. From the BID until the submission of the Final Scoping and Plan of Study ("**PoS**") to DFFE, comments and Responses Report was compiled and responses submitted to I&AP's.
11.	2020/11/17	DFFE	Final Scoping Report and PoS submitted to DFFE.
12.	**2020/11/18**	**DFFE**	**Scoping Report and PoS accepted by DFFE.**
13.		General	50 flyers were placed on 23 February 2021 at the following locations as recommended by the ward councillor on 16 February 2021: • Blue Bay Lodge Resort; • Club Mykonos; • Shoprite Saldanha; • Spar; • Franks Hardware; • Municipal Offices Saldanha; • OK Saldanha; • Saldanha Yacht Club and • Saldanha Chemist
14.	2021/02/26	General	DEIR was available for comment from 2021/02/26 until 2021/03/31. Online Access: DEIR uploaded for public comment to data site (Google Drive). Corresponding link emailed to all RI&APs on 26 February 2021. DEIR available via Triplo4 website as well. Physical Access: Physical copies were made available at: - Cup of Cake restaurant, 37 Main Street, Saldanha, 7395

			- Triplo4's Ballito office. Note: no comments were left at Cup of Cake restaurant and no requests were received to view hardcopy reports at EAP offices.
15.	2021/03/15	General	Online Public Meetings held on 15 March 2021 from 10:00 – 13:45 & 18:00 – 21:15 via MS Teams For all Online Public Meetings on 15 March 2021, the specialists presented independently on their specialised area and also responded to I&AP's queries raised after the specialist's presentation. In a few instances where the specialist was unavailable to present, a voiceover was prepared.
16.	2021/03/31	General	Period for receiving public comments closed.
17.	2021/04/14	DFFE	Email received from DFFE confirming landowner consent not needed.
18.	2021/04/19	Focus Group	A meeting for small scale fishers' representatives was held on 19 April 2021. Mr. Alistair Burt was appointed by Triplo4 Sustainable Solutions to facilitate the meeting in person and a presentation in the preferred language (Afrikaans) was made by Ms. Hantie Plomp via Microsoft Teams. Representatives from Coastal Links Saldanha and Langebaan, Green Connection and Masifundise were in attendance on behalf of small-scale fishers. The purpose of the meeting was to present a summary of the project, present specialist findings, discuss the fisher's concerns and queries and address where possible. A succinct memo on the project and specialist findings was captured in Afrikaans and provided to the attendees to be shared with the local fishers.
19.	2021/10/05	Focus Group	Saldanha Bay Industrial Zone (SBIDZ) was recognised as a key stakeholder and a preliminary discussion took place via Microsoft teams on 05 October 2021, prior to circulation of the Draft Scoping Report where the project was presented. It was determined that landowner consent was not required from SBIDZ as Transnet is the property owner. The need for a focus meeting with Saldanha Bay IDZ (now Freeport Saldanha IDZ) was identified upon receipt of comments on the Draft

			EIAR. The initial meeting took place via Microsoft teams on the 12 April 2021 and further engagements between SBIDZ, Triplo4 and the Karpowership SA's technical team had taken place.
20.	2021/04/26	DFFE	FEIR submitted to DFFE.
21.	2021/04/28	General	Notification via email with a Google Link to registered I&AP's for submission of FEIR.

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 desperations 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.

No	MAIN ISSUES RAISED DURING SCOPING PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE EIAR
1.	Socio-economic benefits and impacts	Chapters 7 and 9 Appendix 9
2.	Air Pollution and Emissions and GHG emissions	Chapters 7 and 9 Appendix 9
3.	Safety and Security Risks	Chapters 2 and 7 Appendices 6 and 9
4.	Coastal and Climate Change Risks	Chapters 2 and 7 Appendices 6 and 9
5.	Alternatives assessment, including the option of not implementing the activity and the proposed location for the infrastructure within beach and dune area	Chapters 3 and 7
6.	Leakage / spill risk from gas pipeline and potential impacts	Chapters 2, 3 and 7 Appendices 6 and 9
7.	Source of the LNG	Chapter 2
8.	Noise Impacts	Chapters 2 and 7 Appendix 9
9.	20 year commitment to non-renewable option	Chapter 1 Appendix 7
10.	Small-scale fisher communities	Chapter 5 Appendix 9
11.	Detailed Layout and Sensitivity Maps	Appendix 1
12.	Public Participation Process & Stakeholder Engagement in line with legal requirements	Chapter 5
13.	Cumulative Assessment	Chapter 7 Appendix 9
14.	Landowner Consent	Appendix 7
15.	Calcrete Reef in Big Bay	Appendix 9
16.	Saldanha Limestone Strandveld	Appendix 9

No	MAIN ISSUES RAISED DURING SCOPING PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE EIAR
17.	Underwater surveys for endangered species in the known potentially sensitive areas	Chapter 7 Appendix 9
18.	Need and Desirability	Chapter 8

5.2 ACTIONS TAKEN BEFORE THE PUBLIC COMMENT PERIOD (2022)

5.2.1 Meeting with DFFE

On 24 August 2022 an in-person authority consultation meeting was held between Triplo4 Sustainable Solutions, Karpowership SA and DFFE, confirming the approach to the EIA phase as well as the timeframe for the process.

5.2.2 Identifying and creating initial I&AP database

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

The database consisted of two main components, namely potential I&AP's with e-mail addresses and those with only cellphone numbers. At the time of submitting the I&AP notification and invitation to register, a total of approximately 700 e-mail addresses and 12 SMS notifications were submitted.

5.2.3 Developing and updating of I&AP database

The comprehensive database of I&APs which includes authorities, different spheres of government (national, provincial and local), traditional authorities, stakeholders, landowners, NGOs, local businesses, small scale fishers, education and research 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 and registered I&AP's and referrals from I&APs responding to the communications for participation, was added.

Triplo4 investigated soft and hard bounces from notifications as well as the "unsubscribe" lists, where possible and updated the database continually through-out the PPP process.

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 Western Cape Language Policy explicitly applicable only to state Departments, the policy was used to confirm the official provincial languages, in this case being Afrikaans, isiXhosa and English. This 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 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 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.

5.2.5.1 Small Scale Fisher (SSF) Workshops

Being a marginalized group, a workshop was held with small scale fishers to explain the aspects of the project and obtain viewpoints of how the project may impact on fishing and the fishing community. Taxis were arranged to transport the SSF's to the meeting held at Saldanha Bay at 1 Malva St, Louwville, Vredenburg, Western Cape from 14h00 – 16h00.

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

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

5.2.5.2 Community Liaison Officers (CLO)

Karpowership 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, KPS 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 ensure KPS 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 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 the Chairman, Secretary and other Executive Members of the BEST Forum;*
- *Engagements with representatives from Weslander;*
- *Representatives from West Coast Black Business Alliance;*
- *Engagements with representatives Saldanha Bay Municipality (Municipal Manager and Mayor);*
- *Engagements with the Community leader and representatives of the local fishing community;*
- *Engagements with Local community leaders from* Louvwille, George Carridge, Smarty Tow, Lapland, Yskor and Witteklip *;*
- *Engagements with representatives from Youth in Business;*
- *Engagements with the representative of the Tribal Council of the Khoi House, Chocoqua;*
- *Community engagement meetings held at the Vredenburg Community Hall and the Multipurpose Centre in Saldanha Bay;*
- *Engagement with the Local Church representative;*
- *Representatives from Wada Projects, Xesibe Aquaculture and Requa Enterprises, Aquaculture-based businesses;*
- *Various SMMEs including representatives from Africa Olive Trading;* Middlepos Business Forum; Chairman of the West Coast Business Alliance;
- *Engagements with the CEO of the Saldanha Bay Industrial Development Zone;*
- *Meeting with the Secretary of South Abay Black Women Association;*
- *SB LED Director and Project Management".*

5.2.5.3 Booklet

An information booklet was designed and circulated by the applicant. The aim of the booklet was 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 comprised of the following sections:

- Background of the Company;
- Project concept – How does a Powership work and how is power is 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.

1000 booklets were printed in English to be distributed per project site at the public in-person meetings for the three proposed KSA Projects (Port of Saldanha, Richards Bay and Port of Ngqura).

Refer to Appendix 3.6.

5.2.5.4 Information Leaflet

An Information leaflet was developed and distributed with the reminder e-mail notification of the public participation and registration notices as well as over 17 000 “knock-and-drop” notices that were delivered to individual properties as per the external services provider, Vibrant Direct. The English leaflet, translated in isiZulu, isiXhosa and Afrikaans comprised of information on the project, specialist aspects being assessed, the importance of public participation and how to engage in the PPP for the project.

5.2.5.5 Pre-consultation engagement

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

- Freeport Saldanha Industrial Development Zone (IDZ) (previously SBIDZ);
- Sachal and Stevens (Pty) Ltd;
- Saldanha Bay Local Municipality;
- Department of Environmental Affairs and Development Planning (DEA&DP);
- Department of Environment, Forestry and Fisheries Sustainable Aquaculture Management (DFFE SAM)
- Transnet National Ports Authority (TNPA);

Refer to Appendix 3.7 for approved minutes of the meeting with TNPA. Final minutes for the rest of the meetings will be appended to the final EIAr.

In addition, attempts for pre-consultation engagements were made with the following key stakeholders/landowners, and the status of the request at the time of going to print, is indicated below:

- Pindulo VDM – Meeting date scheduled;

- Eskom Distribution – Awaiting confirmation of meeting date;
- West Coast District Municipality – No response received;
- Duferco – No response received;
- ArcelorMittal - No response received;
- Tronox – No response received;
- Department of Transport/Road Trustees – No response received.
- AfriSam – Declined meeting request due to internal circumstances unrelated to Karpowership project. Input on existing authorisations associated with AfriSam's property was received;

5.2.6 Additional resources:

5.2.6.1 External PP facilitator/expert

An Independent and experienced PP facilitator, Afro Development Planning, 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&AP's.

5.2.6.2 Online platform specialists

Independent on-line platform specialist, WAHM, was appointed to set-up and manage the e-mail and SMS for PPP notifications via the MailerLite platform. The virtual meeting will also be managed via the AirMeet programme and registration for this meeting will also be managed by WAHM as well as the compilation of the minutes.

Refer to appendix 3.11.2 for information on the service provider.

5.2.6.3 Dedicated e-mail and cellphone contact details

A dedicated e-mail address saldanhabayksa@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&AP's that had not unsubscribed from the mailing list. The purpose was to remind potential I&AP's to register as an I&AP and submit comments as per the BID.

An SMS was submitted to potential I&AP's using the MailerLite platform. This SMS with characters not to exceed 169 characters count, was submitted to potential I&AP's 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 4 local newspapers and in 3 national newspapers, in 4 languages (official provincial languages and isiZulu as an additional language), as summarised in Table 5-3 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 newspaper advertisements

Local Newspapers	Language	Date of Publication
Cape Argus	English, Afrikaans,	25 October 2022
Cape Times	English, Afrikaans,	24 October 2022
Weslander	English, Afrikaans	27 October 2022
Dizindaba Iphepandaba lesiXhosa	IsiXhosa	27 October 2022
National Newspapers	**Language**	**Date of Publication**
Sunday Times	English	30 October 2022
Rapport	Afrikaans	30 October 2022
Ilanga	IsiZulu& IsiXhosa	27 October 2022

Refer to copy of:

- Advertisements, providing the displayed detail - Appendix 3.4: Advertisements;
- Proof of publications - Appendix 3.5: Proof of Adverts Publication.

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. 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 disability and the visually impaired.

Announcements to inform the local communities were read in selected local radio stations, in 3 languages, (official provincial languages) during the various dates and slots, as describe in Table 5-4 below. The announcements were read by the show hosts during peak time. 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 preferred listeners and direction provided by the CLO's that lives within the community and understand the societal dynamics.

Table 5-4: Summary of radio announcements

Radio station	Language	Date and time
Radio Houtstok	Afrikaans	24 October 2022 - 06h52
Weskus	Afrikaans	24 October 2022 – 08h40; 09h34; 11h03 25 October 2022 – 09h45; 10h38; 11h36 26 October 2022 - 09h16; 10h31
KFM 94.5	English	24 October 2022 - 17h56

5.2.7.3.1 Selected Radio Stations

The following present the profiles of the selected radio stations:

- **Radio Houtstok 100.6FM**
  The broadcasting area allocated to Radio Houtstok by ICASA is the West Coast Municipal District Council which consists of the regional municipalities of Matzikama, Swartland, Saldana, Cederberg and Berg River however signal also reaches surrounding areas such as the Cape Winelands (Boland) towns of Paarl, Stellenbosch, Paarl, Tulbagh, Wolseley, Ceres and Koue Bokkeveld. Then you can also listen to Radio Houtstok in large parts of the northern suburbs of the Cape Town Metropolitan districts such as Durbanville Kraaifontein, Milnerton, Tableview, Sunningdale Melkbostrand and Atlantis and Cape Town city center. It is a combined area of more than 100,000km² which is home to the almost 1 million Afrikaans speaking listeners.

- **Weskus 92.3 FM**
  Radio West Coast is a community radio station based in Vredenburg that aims to actively support the community through educational and informative content on youth and women protection, social issues and community development. According to the Broadcast Research Council of South Africa (BRCSA), radio is the most consumed form of media with approximately 38.3 million listeners tuning in every day. Radio West Coast is licensed to cover Saldanha, Swartland, Cederberg, Bergrivier and Matzikama municipal areas and typical daily listener figures vary between 20,000 - 25,000 listeners. Online streaming and a popular media platform ensures global reach. The station has a Facebook following of around 7,500 persons and have

noted as many as 30,000 shares per post. Average "tune-in-time" is 3.5 hours - making it one of the more popular stations in the Western Cape Province.

- **KFM 94.5**
  94.5 KFM's reception area includes the metropolitan area of Cape Town and towns such as Mossel Bay, George, Knysna, Hermanus, Caledon, Worcester, Malmesbury, Saldanha and Beaufort West. The reception area includes the West Coast as far as Alexander Bay and parts of the Northern Cape and even as far the Eastern Cape. KFM delivers up-to-date news and traffic Eyewitness News as well as other daily features.

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 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 community structures, committees and leaders with memberships 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:

- Eskom Distribution
- ArcelorMittal South Africa
- BEST Forum
- Club Mykonos Langebaan
- Jacobs Bay Rate Payers
- Salnet
- South Africal Deep Sea Angling Association
- Tronix Mineral Sands
- Weskus Sakekamer
- West Coast Fishers
- Paradise Beach Home Owner Association
- Westcoast Chamber of Commerce
- All Rise Attorneys
- East Cape Conservation Association
- Eastern Cape Environmental Network
- Ground work

- Organisation Undoing Tax Abuse
- South Durban Community Environmental Alliance
- West Coast Bird Club Conservancy
- Anti Gas Alliance
- BirdLife SA
- Black Women is Sustainable Development
- Centre of Environmental Rights
- Chief Christine Williams of Hamcumqua Cape Khoi Royal House
- Cochoqua Tribal House
- Coastal Links
- Green Connection
- Khoi First Nations Group and Chairperson of Saldanha Black Business council
- Masifundise Development
- National Clean Air Association
- Oceans not Oil
- Saldanha Bay Water Quality Forum Trust
- Save Langabaan Lagoon
- Southern African Foundation for the Conservation of Coastal Birds (SANCCOB)
- West Coast Bird Club
- Young Women in Business
- Frack Free SA

5.2.7.6 Site Notices and flyers

Over 18 locations were strategically selected along the site area, for the display of site notices (over 80 site notices), as well placements of public notices flyers. These locations were selected upon engagement with the Ward councillors and the local Community Liaison Officers (CLOs), to ensure wide reach. These notices were distributed in 4 languages, i.e. English, Afrikaans, isiXhosa and isiZulu. The site notices were printed in size A2 and the public notices flyers in A5.

Over 350 flyers and leaflets were placed at the selected sites.

Refer to copy 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, a “knock and drop” initiative was carried out, and a pack containing flyers and leaflets (in 4 languages) were distributed Vibrant Direct, the professional service provider, to over 17 000 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 Communities Liaison Officers, 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 of flyers

MAIN PLACE	SUBURB	HOUSEHOLD COUNT
Saldanha	Diazville	4881
	White City	851
	Middlepos	110
Langebaan	Hopland	780
Vredenburg	Ongegund	3489
	Witteklip	3024
Velddrif	Noordhoek	2133
St Helena Bay	Blueberry Hill	21
	Steenbergs Cove	284
	Laingville	2052
TOTAL		**17 685**

Refer to copy of:

- List ad 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. These included:

Please refer to Section 5.2.5.1 and the SFF workshop summary as per the independent Socio-Economic Specialist Assessment Report (Appendix 9).

Please refer to the minute of the meetings as per Section 5.2.5.5 above regarding the specific focus group engagements with:

- Transnet National Ports Authority (TNPA);

Final minutes of pre-consultation meetings with the following will be appended to the Final EIA Report:

- Freeport Saldanha Industrial Development Zone (IDZ) (previously SBIDZ);
- Sachal and Stevens (Pty) Ltd;
- Saldanha Bay Local Municipality;

- Department of Environmental Affairs and Development Planning (DEA&DP);
- Department of Environment, Forestry and Fisheries Sustainable Aquaculture Management (DFFE SAM).

5.2.9 Additional 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

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 a list of articles noted by Triplo4.		

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 Public meetings

Independent public participation specialist, Afro Development Planning, have been appointed to facilitate the public participation process. The meetings will be chaired by the independent PPP facilitators, and presentations will be 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 are 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 will be provided at both sessions and registered I&APs will receive the minutes of both sessions.

Transportation will be provided, where required, to ensure accessibility to the selected venue.

The meetings will be conducted in English, and independent interpreters have been appointed to attend both meetings, and provide translations or any question and/or response raised by the attendees (if and as required), in the following languages:

- Afrikaans
- isiXhosa
- isiZulu
- Sign Language

These capacity building measures, various methods of distribution and engagements together with the languages for communication, the selection of the venue within / 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 may be submitted in advance of these meetings, and during the virtual meetings, attendees will be given the opportunity to raise questions via a Q&A function. Detailed on the meetings and dates are captured in Table 5-7 below.

Table 5-7: – Pubic meetings details

Port	Meeting	Venue Address	Date	Time
Saldanha Bay	**In person**	White City Multi-purpose Centre 41 Trichart Street ,White City, Saldanha Bay Coordinates: 33° 0'35.02"S 17°56'34.16"E	**21 Nov 2022**	**10am-1pm**
Saldanha Bay	**Virtual**	The registration link will be emailed to all previously & newly registered I&AP's.	**21 Nov 2022**	**5pm-8pm**

5.3.2 Receiving and responding to comments received on DEIR

The minimum 30 day comment period is extended to 33 days, and no extensions will be provided thereafter.

The draft EIA Report is made available for review for a period of 33 days **(10 November 2022 – 13 December 2022)** and hard copies will be placed at the following venues, as advertised:

- Saldanha Library: Physical Address: Municipal Building, Berg Street, Saldanha
- Vredenburg Public Library: Physical Address: 2 Akademie Street, Louwville, Vredenburg

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 will be denied entrance in order to view the Draft EIAR.

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 will be denied entrance in order to view the Draft EIAR.

A hard copy of the Draft EIAR can also be found at Triplo4's Ballito Office: Physical Address: Douglas Crowe Drive, The Circle, Suite 5, Ballito.

In addition, electronic copies of the draft EIA Report can be accessed in the following manners:

- accessing the Triplo4 website, www.triplo4.com, which will take the reader to a link to access to Draft EIAR and;
- A link to the relevant GoogleDrive online platform will be emailed to all registered I&APs to access the Draft EIAR.

5.4 ACTIONS TAKEN AFTER THE PUBLIC COMMENT PERIOD (2022 – 2023)

5.4.1 Comments and Responses Trail Report

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

Issues raised will be summarised in the report.

5.4.2 Notification of outcome of CA decision

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

6 SITE DESCRIPTION OF SURROUNDING LAND USE

2014 EIA Regulations (as amended), Appendix 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 Regional Setting and Topography

The proposed transmission and gas line will be situated near and in the Port of Saldanha Bay, Western Cape Province. Saldanha Bay is a coastal bay located on the west coast of South Africa.

The main activity of the Port of Saldanha Bay is the export and import of goods. Current facilities at the Port of Saldanha Bay: The Port of Saldanha Bay is South Africa's deepest draft port and handles around 67 million tons of cargo per year (about 500 vessel calls).

- The site is a typical port with berths along the harbour's edge and the jetty extending into the bay:
- The iron ore export jetty provides berthing for two Very Large Bulk Carriers (VLCCs).
- The liquid bulk berth provides for Very Large Crude Carriers importing and exporting crude oil.
- The port has iron ore stockpiles on reclaimed land.
- The multi-purpose terminal with four berths and ship repair facilities for offshore rig servicing and fabrication
- The terminal has a diesel bowser which is used to fill up the diesel operated cranes and equipment.
- The general maintenance quay is just north of the multi-purpose quay.
- There is a MBM for LPG in the Port about 1000m away from the proposed gas to power operations.

The bay comprises three distinct areas: Outer Bay, which forms the approach to Saldanha Bay harbour between the North and South Heads and includes Malgas and Jutten Islands, Small Bay and Big Bay. To the south-east, approximately 9 km from the proposed Powership location, Big Bay is directly linked to the shallow, subtidal Langebaan Lagoon. The port facilities occur mainly within Small Bay, which is separated from Big Bay by the general cargo quay and the iron ore and oil terminal jetty.

The project is situated in Quaternary Catchment G10M of the Berg - Olifants (DWS, 2016) Water Management Area (WMA 9). Two (2) sub-catchments were delineated for the project area and describes the natural drainage of the area. No major or secondary rivers are associated with the study area, and ephemeral runoff of rainwater for the sub-catchments is expected. Elevations on the site typically range from 0 to 30 metres above mean sea level (mamsl). Thickets, bare soil, bushes, short grass, long grass, sparsely woodland grasslands, thickets, low shrubs and bushes dominate the sub-catchment (DEA, 2019).

A portion of the proposed development occurs on the existing pier within the Bay. Thereafter, the proposed powerline routes traverses northeast over generally flat lying topography towards the AccelorMittal Plant.

6.1.2 Landform and Eco-Region

The proposed development falls into the South Western Coastal Belt (24) Level 1 Ecoregion (Kleynhans et al., 2005). Level 1 ecoregions are derived primarily from terrain and vegetation, along with altitude, rainfall, runoff variability, air temperature, geology and soil. This region can predominantly be broken down into the following characteristics:

- Mean annual precipitation: Moderate in a limited area in the south, decreasing to low in the north.
- Coefficient of variation of annual precipitation: Moderate/high in the north with a restricted area being low in the south.
- Drainage density: Low.
- Stream frequency: Low/medium.
- Slopes 80%.
- Median annual simulated runoff: Very low in the north to moderate/high in the south.
- Mean annual temperature: Moderate/high.

Table 6-1: South Western Coastal Belt Eco-region (Kleynhans *et al.*, 2005)

Main Attributes	Description
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief; **Plains Moderate Relief**; Closed Hills; Mountains; Moderate and High Relief
Vegetation types (dominant types in bold) (Secondary)	Sand Plain Fynbos; Mountain Fynbos; **West Coast Renosterveld;** Dune Thicket; Strandveld Succulent Karoo
Altitude (above mean sea level – a.m.s.l)	0-300; 300-900 limited
MAP (mm)	0 to 1500
Coefficient of Variation (% of annual precipitation)	<20 to 40
Rainfall concentration index	30 to 60
Rainfall seasonality	Winter
Mean annual temp. (°C)	10 to 20
Mean daily max. temp. (°C): February	24 to 32
Mean daily max. temp. (°C): July	12 to 20
Mean daily min. temp. (°C): February	12 to 18
Mean daily min temp. (°C): July	4 to 10
Median annual simulated runoff (mm) for quaternary catchment	<5; 20 to >250

(ENVASS Triplo4 - Wetland Delineation and Functional Assessment, 2022)

6.1.3 Regional Climatic Conditions

The climate change projections for the Project indicate that the median annual mean ambient temperatures are likely to increase by up to 0.2˚C by 2030 and 0.1-1.1˚C by 2050 (with significant annual variability) under different climate scenarios.

Mean annual precipitation has shown a downward trend over the last few decades and is likely to continue to decline very gradually over the next three decades with significant year-on-year variability (Figure 9). The region experienced a multi-year drought from 2015-2017 leading to severe water shortages. The further declines will heighten the risk of water stress in the region. The region will be exposed to more extreme rainfall events and the number of hot days (temperatures exceeding 35˚C) per year is likely to increase by around 55% by 2040. Such climatic changes could impact on the Project in terms of its core operations, value chain and broader socio-economic and natural environment. The current and future changes in climate for the Karpowership Project at Saldanha Bay, are summarised in the below table below.

Table 6-2: Current and future climate projections for the Karpowership Project at Saldanha Bay within the Saldanha Bay Local Municipality. Data sources: Copernicus Climate Change Service (C3S) and Green Book Risk Profile Tool

		Projected change by 2040-2059 (median year 2050) relative to baseline		
Climate change impact	**Current/Near-historical**	**SSP1**	**SSP2**	**SSP5**
Mean annual temperature	15.9 ±0.2˚C; slight decreasing trend	Increase of 0-0.5°C	Increase of 0-0.5°C	Increase of 0-0.4°C
Very Hot Days	1.4 days/year (mean)	Not available	Increase by 0-23 days/year (mean increase of 2.2 days per year)	Increase by 0-26 days per year (mean increase of 17 days per year)
Mean annual precipitation	300 ±61 mm/year; decreasing trend	Mean decrease of 22 mm/year	Mean decrease of 47 mm/year	Mean decrease of 49 mm/year
Extreme Rainfall Days	1.3-2.1 days per year	Not available	Decrease ±0.6 days/year	Negligible change (<0.5 days)
Drought Risk	Moderate to high	Not available		Extreme risk of increase in drought conditions per decade compared to baseline
Coastal flooding risk	Not available	Not available		Medium risk
Fire Risk	Possible	Not available		Medium risk
Damaging wind risk	Not available			

(Promethium – Climate Change Impact Assessment, 2022)

6.1.4 Local Climatic Conditions

The Saldanha Bay area is characterised by a semi-arid Mediterranean climate that is strongly influenced by the cold Benguela Current and the relative position and strength of the Atlantic Ocean Anticyclone. The most climatologically representative data for the area is the South African Weather Service (SAWS) station at

Langebaanweg. Average daily temperatures at Langebaanweg range from 21 °C in summer to 12 °C in winter, with summer maximums reaching 28 °C in February and winter minimums reaching 7 °C (Figure 4-1). Rainfall occurs throughout the year, but the majority occurs in winter between May and August. The average annual rainfall at Langebaanweg is 278 mm.

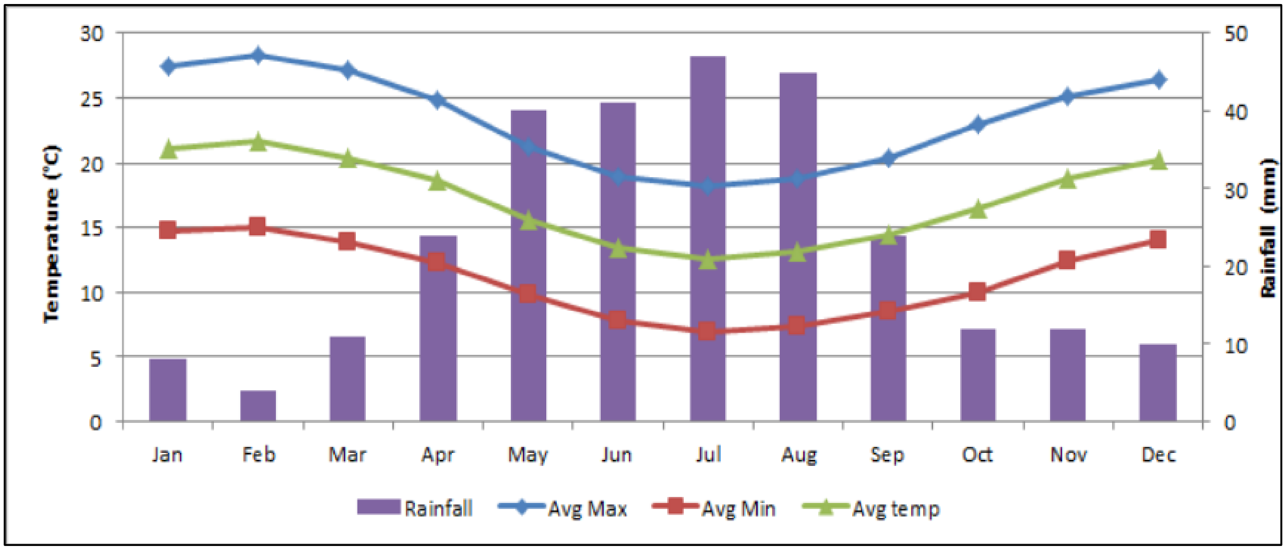


Figure 6-1: Average of daily minimum, maximum and mean temperatures (°C) and average monthly precipitation (mm) at Langebaan (SAWS, 1992).

The SAWS stations at Langebaanweg and Geelbek provide a good indication of the prevailing wind direction across the Saldanha Bay region. The wind data at these two stations are depicted as windroses in Figure 4-2. The prevailing winds are similar at the two sites considering the coastal location of Geelbek and Langebaanweg being more than 12 km inland. The annual wind roses at both sites indicate a dominant southerly wind, varying from southerly to southwesterly at Langebaanweg and southerly to south-southeasterly at Geelbek. The southerly winds can be strong and reaching more than 11 m/s on occasions.

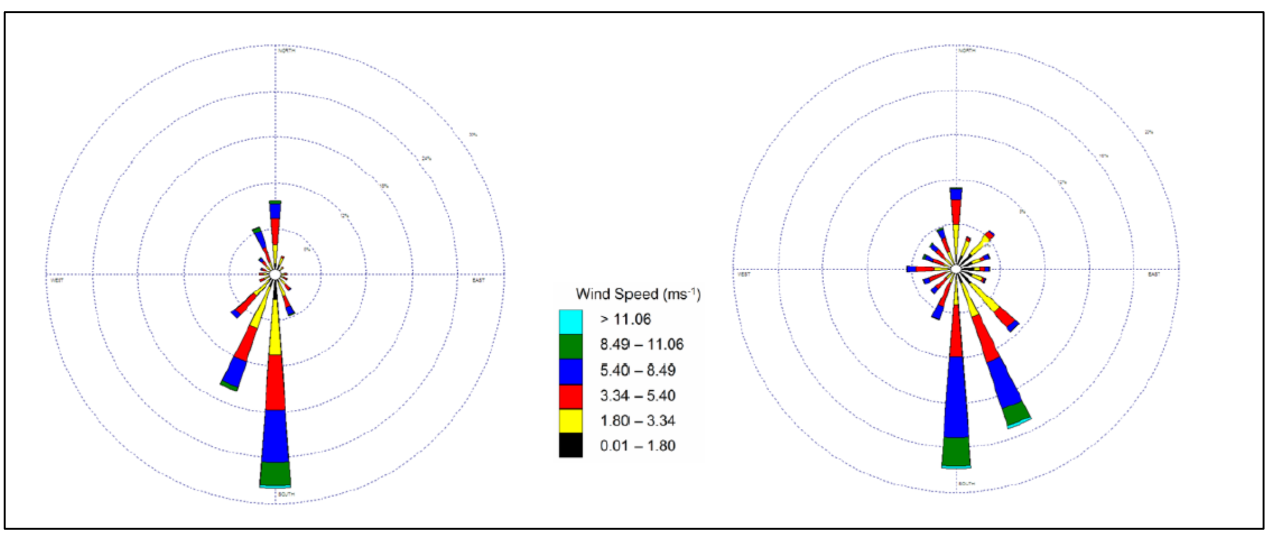


Figure 6-2: Annual wind roses for Langebaanweg (left) and Geelbek (right) (based on 2012 SAWS data)

6.1.5 Ambient Air Quality

The status of ambient air quality in Saldanha Bay is described here using data from the Saldanha Bay monitoring site. Monitoring data provided accurate measurement at a single point which may not be representative of the entire area of interest.

Ambient monitoring data for 2017 to 2019 at Saldanha Bay is analysed for SO2, NO2, and PM10. Monitored SO2 data show ambient levels for the monitoring period, with no exceedances of NAAQS. Monitored NO2 concentrations are elevated with higher concentrations observed in winter (i.e. June to August). Monitored PM10 concentrations are elevated year-round with limited exceedances of NAAQS in January 2017. An estimated background concentration of 5 to 10 µg/m^3 is observed.

Table 6-3: Annual Average Monitored Concentrations

Year	**SO_2**	**NO_2**	**PM_{10}**
	NAAQS 50 µg/m3	**NAAQS 40 µg/m3**	**NAAQS 40 µg/m3**
2017	4.8	12.2	20.5
2018	4.2	10.0	17.7
2019	2.5	12.8	ND

(uMoya-Nilu - Atmospheric Impact Report., 2022)

6.1.6 Storms and Storm Related Weather Impacts

Saldanha Bay experience storms associated with frontal systems primarily occurring in winter low pressure systems such as cut-off lows that can bring widespread rain. Saldanha Bay is less affected by these systems than areas further south, however, due to the flat topography surrounding much of the eastern part of the Bay and inappropriately sited development in Saldanha Bay and Langebaan, coastal flooding risk during extreme rainfall and storm events is considered very high and predicted to increase in the future.

Saldanha Bay is not impacted by tropical storms or cyclones due to its location.

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, extended onshore winds result 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. Although less vulnerable than sandy coastlines and coastal plains, harbours and ports 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 Saldanha Bay, the break extending to Marcus Island, the Iron Ore Terminal/Jetty and the northern part of Big Bay (dam and pumphouse south of the Iron Ore Terminal/Jetty) are the areas most likely to be affected by a combination of sea level rise, tides and storm surges. Coastal infrastructure including those associated with harbours and port will require increased maintenance to withstand increased storm surges. The coastal flooding risk for Saldanha Bay is classified as very high to extreme risk in the medium-term.

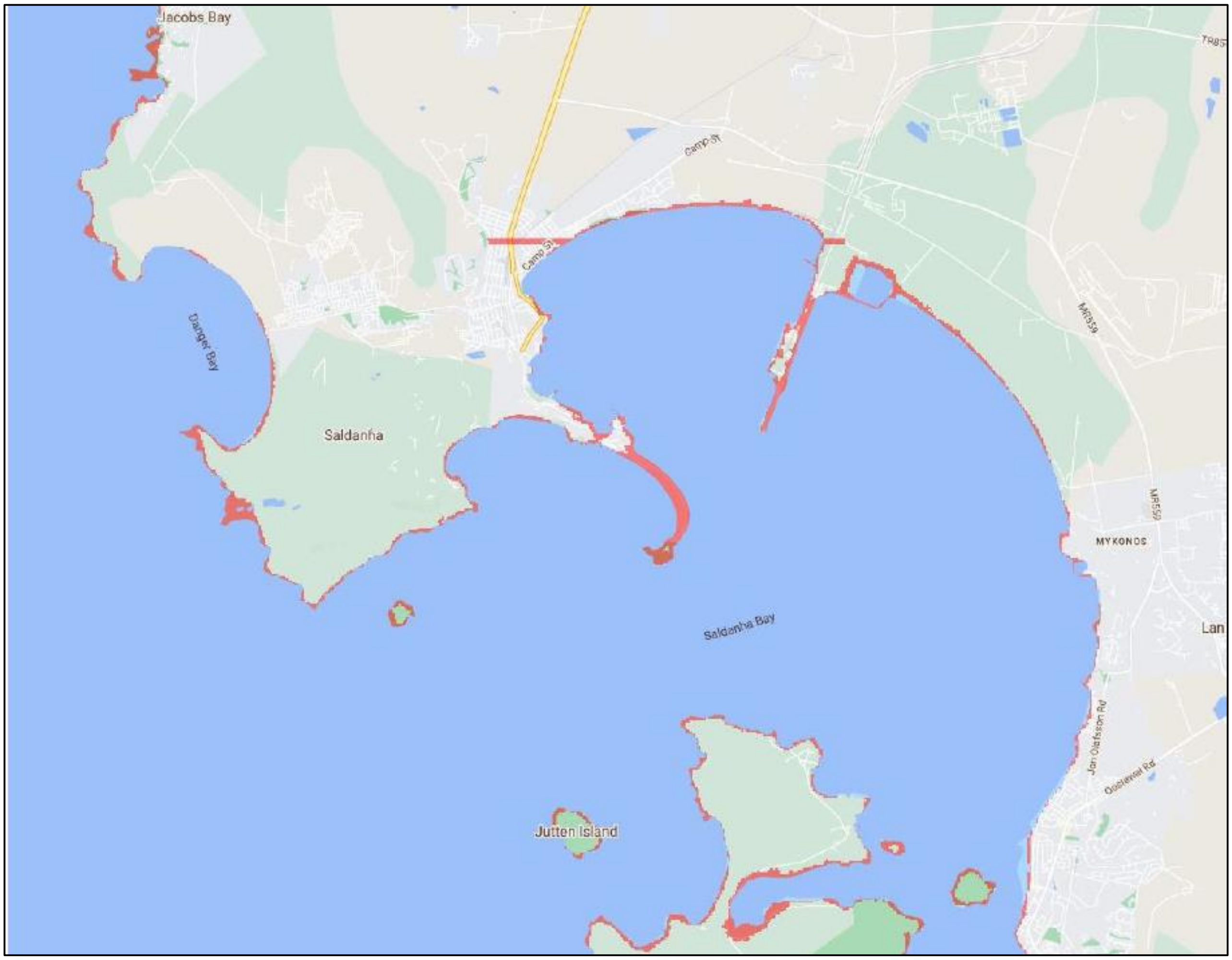


Figure 6-3: Area impacted (in pink) at and around the Saldanha Bay by a 1 m rise in water level through combinations of sea level rise, tides, and storm surge. Source: https://coastal.climatecentral.org/.

6.1.7 Ocean pH

At Saldanha Bay, surface sea water pH has declined from roughly 8.15 to 8.09

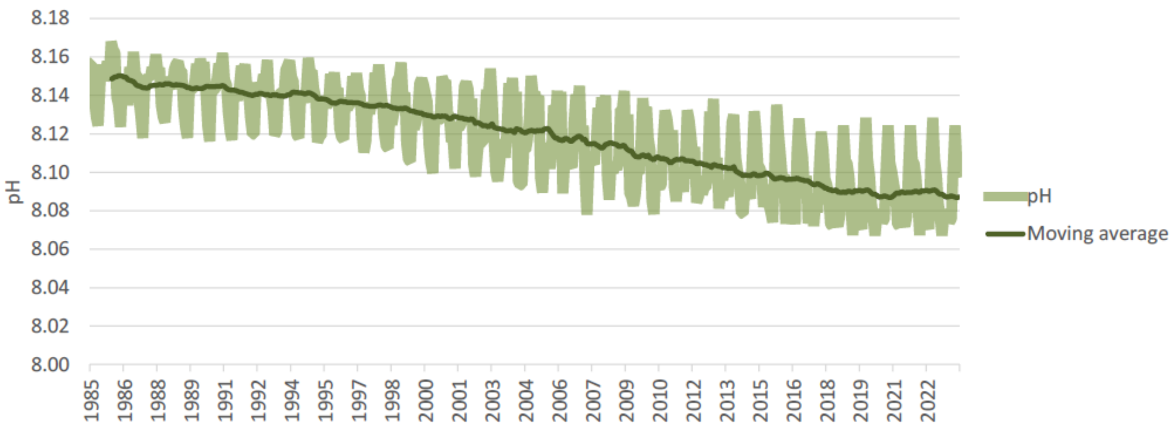
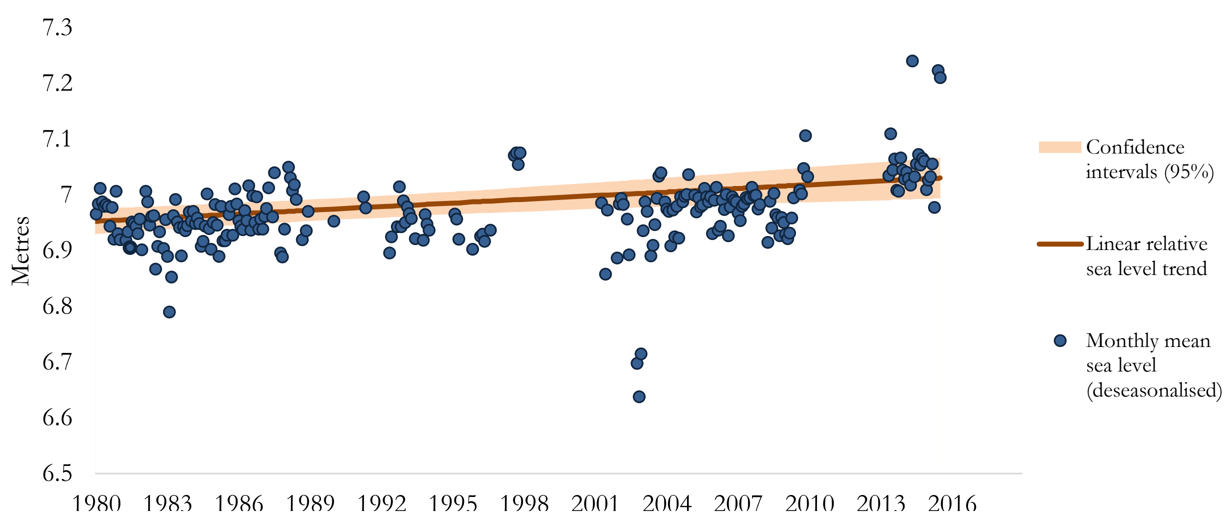


Figure 6-4: Surface Sea Water pH at Saldanha Bay between 1985 and 2023. Data source: Global Ocean Biogeochemistry Hindcast

6.1.8 Sea Level

Sea level has increased by varying degrees along the South African coastline.71 Data from the [South African] Hydrographic Office shows that mean sea level at Saldanha Bay has increased by ±6.4 cm (15.9 mm y-1) between 1978 and 2018 based on a linear trend (Figure 4).



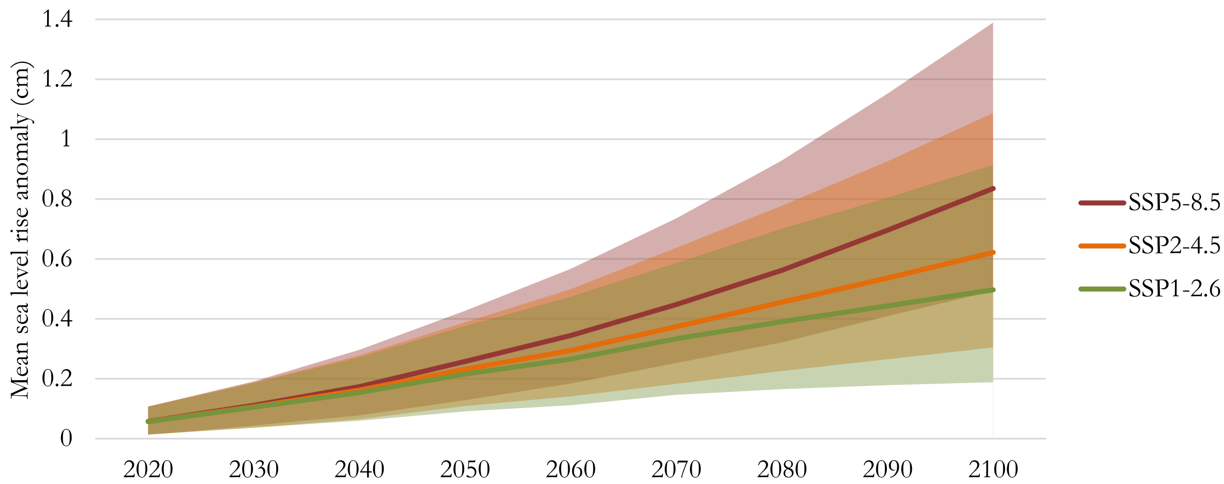


Figure 6-5: Measured monthly sea level at Saldanha Bay from 1978 to 2018. Data source: SAN Hydrographic Office (top) and sea level rise projections under SSPs 1, 2 and 5. Data source: IPCC AR6 (bottom).

6.1.9 Terrestrial and Underwater Noise

6.1.9.1 Terrestrial

The noise sensitive areas (NSA's) have been identified and illustrated in Table 5 and Figure 2 below. The distances are calculated based on the closest noise source in relation to the noise sensitive area.

Table 6-4: Location of Noise Sensitive Areas

#	Type of Receptor	Latitude	Longitude	Closest distance to the Powership (m)	Closest distance to the FSRU (m)
NSA 1	Suburban	32°59'43.10"S	17°58'24.65"E	2970	5700
NSA 2	Industrial	32°59'39.46"S	17°59'17.41"E	2235	5395
NSA 3	Suburban	33° 2'20.41"S	18° 2'16.21"E	4755	3660
NSA 4	Suburban	33° 2'35.48"S	18° 2'12.59"E	4985	3550
NSA 5	Suburban	33° 3'44.42"S	18° 2'28.85"E	6860	4570
NSA 6	Business Premise	33° 4'19.72"S	17°59'42.86"E	6600	3370
NSA 7	Business Premise	33° 1'33.02"S	17°57'45.58"E	3570	3825
NSA 8	Business Premise	33° 0'39.62"S	17°57'3.14"E	4370	5650
NSA 9	Suburban	32°59'54.41"S	17°57'27.49"E	4060	6180

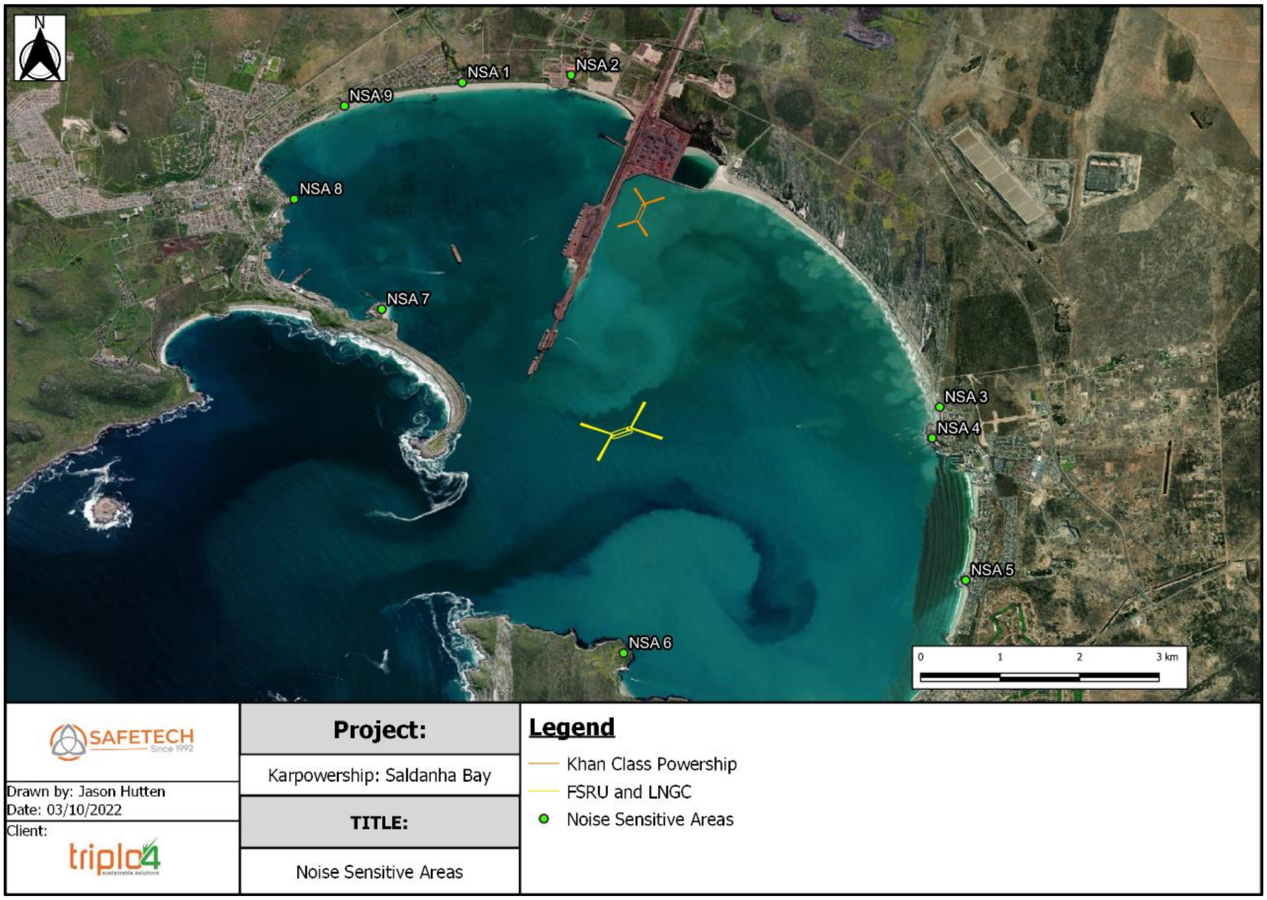


Figure 6-6: Noise Sensitive Areas

The nearest residential area to the proposed project location is Blue Bay Lodge (NSA 1).

The results of the residual noise monitoring at Blue Bay Lodge (NSA1) are shown in Figure 6 below and illustrates the relationship between wind speed and noise level.

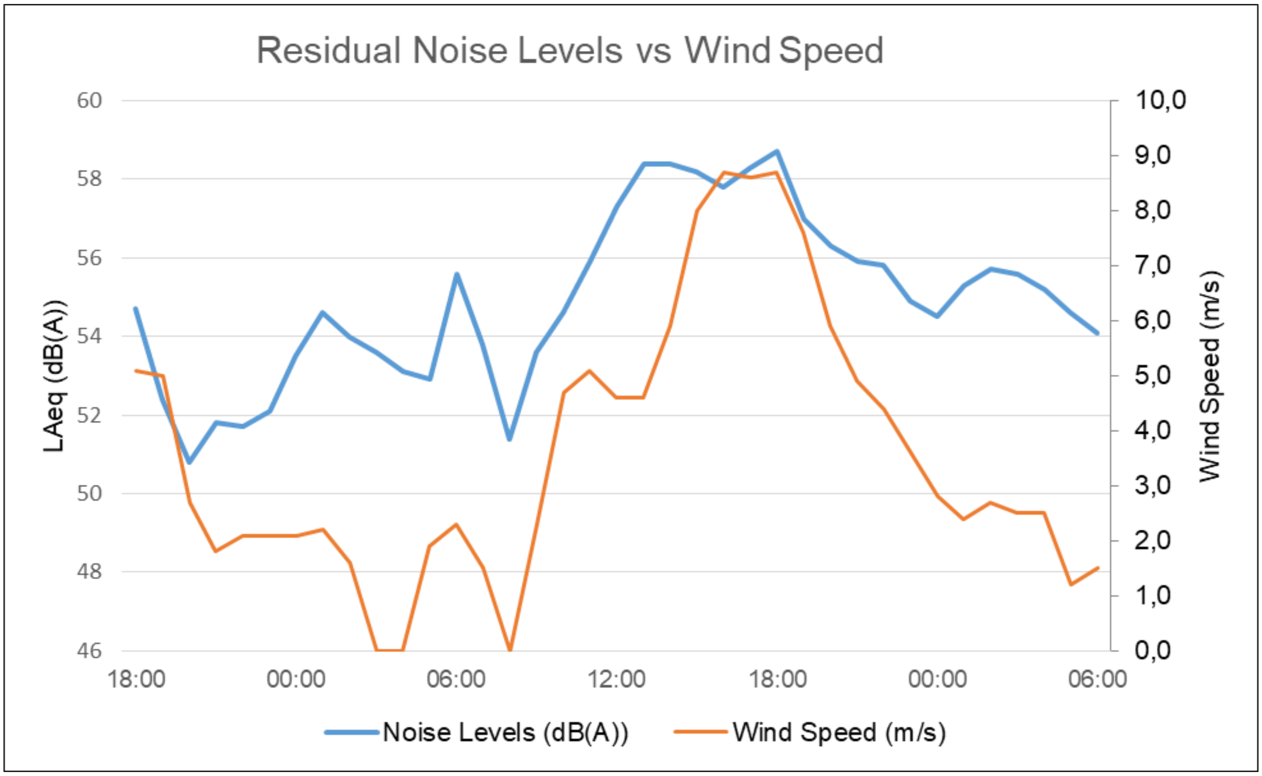


Figure 6-7: Residual Noise Levels vs Wind Speeds at Blue Bay Lodge

The most applicable standard for planning purposes used in this study is SANS 10103:2008 which provides typical rating levels for noise in various types of districts. Ideally, in such areas one does not want to experience any anthropogenic noise pollution. SANS 10103:2008 provides typical rating levels for noise in various types of districts, as described in Table 6-8 below:

Table 6-5: Typical rating level for noise in various district types.

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

The rating levels above indicate that in industrial districts (in the Port of Saldanha) the noise should not exceed 70 dB(A) during the day and 60 dB(A) at night. In Suburban areas such as BlouWater Bay, the noise should not exceed 50dB(A) during the day and 40dB(A) at night. There are however no rating levels for protected natural environments. These areas should ideally be free of any anthropogenic noise sources.

These rating levels can thus be seen as the target levels for any noise emissions from a nearby industrial facility. As can be seen from the residual noise monitoring results, the residual noise does not exceed the recommended day/night rating levels of industrial districts.

Furthermore, the South African Noise Control Regulations describe a disturbing noise as any noise that exceeds the residual noise by more than 7dB(A). The Western Cape Noise Control Regulations states that a disturbing noise (excluding unamplified human voice) is any noise that meets the following criteria:

a) exceeds the SANS 10103:2008 rating level by 7 dBA
b) exceeds the residual noise level where the residual noise level is higher than the rating level
c) exceeds the residual noise level by 3 dBA where the residual noise level is lower than the SANS 10103:2008 rating level OR
(d) in the case of a low-frequency noise, exceeds the level specified in Annex B of SANS 10103:2008.

This definition will be used to assess the noise impact.

6.1.9.2 Underwater Noise

6.1.9.2.1 Underwater Noise – Ghana

The Karadeniz Powership Osman Khan is a 470 MW capacity Khan class Powership currently installed in Sekondi Naval Base, Ghana. The Powership features 24 gas powered engines, each engine capable of producing 18.3 MW of electricity. The underwater noise survey was undertaken to measure the in-water noise produced by operational plant onboard the Powership, selected for its similarity with those proposed to be deployed (sister ship) in South Africa. Based on the maximum power output of the Osman Khan (470 MW), the harbour design and technical parameters considered, this Powership is of the same design class to study, in order to determine relevant noise information for the South African Project.

6.1.9.2.2 Baseline Underwater Noise – Port of Saldanha

Underwater noise levels at Saldanha Bay have been measured over a 48 hour period in November 2021, as an indicative sample baseline of the conditions prior to the proposed installation of Powership and FSRU. Noise levels at a static monitor located east of the Iron Ore Jetty, close to the position of a proposed Powership, remained fairly constant as few vessels have a reason to pass that position. Noise levels varied between 107 and 115 dB SPLRMS re 1 µPa.

In other locations, especially in the vicinity of the berthed bulk carrier vessels at the Iron Ore Jetty, noise levels were dominated by these vessels, whether moving or stationary. Noise levels varied with location and distance from the vessels, measured at 126 dB to 135 dB SPLRMS re 1 µPa at 800 m to 75 m respectively from a loading bulk carrier.

Outside the main port area and away from berthed vessels, noise levels were 103 to 131 dB SPLRMS re 1 μPa and the source of noise controlling the ambient conditions was biological snapping sound, thought to be caused by fish, shrimp or crustaceans

The location of each measurement is shown in Figure 6-8. The locations are provided as an approximate position rather than a specific point on the map, as there was always some drift in position during the measurements.

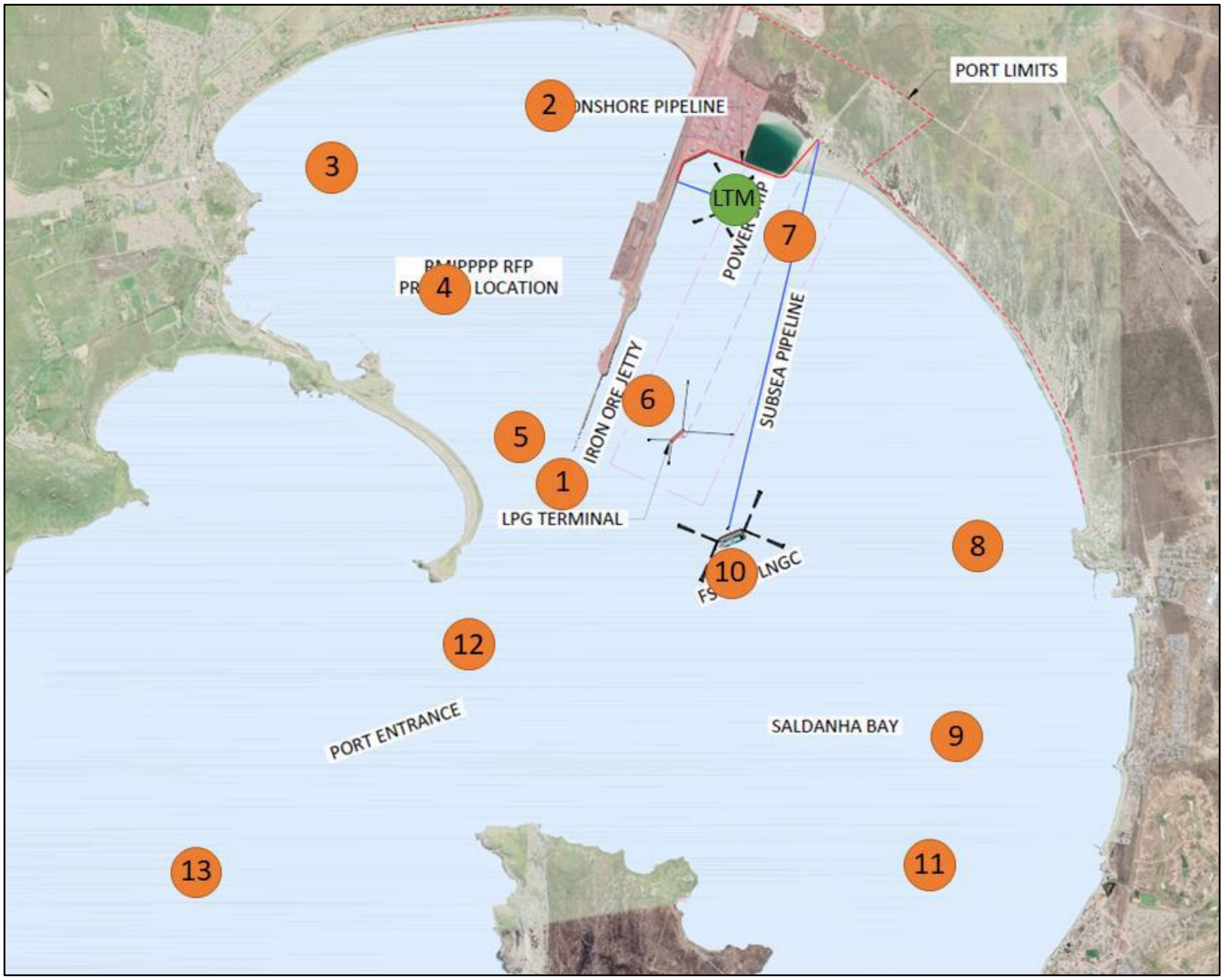


Figure 6-8: Measurement locations in Saldanha Bay, South Africa. The static monitor location is labelled "LTM"

6.1.9.2.3 Underwater Noise – Port of Saldanha

The Karadeniz Powership Osman Khan is almost identical in design specification, engine complement and electricity output to the Khan Class Powership that will be used in the Port of Saldanha.

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).

All decibel noise values are combined with simple logarithmic addition, where the contributing noise added to the baseline noise equals the total combined levels, e.g. (by the Powership) 119.0 dB + 127.0 dB = 127.6 dB.

6.1.10 Geology, soils and land morphology

6.1.10.1 Geology

According to the 3328 Clanwilliam-1:250 000 Geological map series (DMEA, 1998) the local geology at the site is characterised by quaternary deposits of the Langebaan series, of the Sandveld Group (refer to Figure 4-3).

The Saldanha Bay is situated in an area known as the Berg River Unit, which comprises the Adamboerskraal, Langebaan Road and Elandsfonteinn Aquifer Units. The Sandveld Group extends northward from Cape Hangklip in the south to Elands Bay. The group overlies a variety of pre-Mesozoic basement rocks and is thickest in structurally and lithologically controlled basement depressions (Lourens, 2013).

6.1.10.2 Soils and land morphology

According to the Land types of South Africa databases (ARC, 2006), the soils in the project area fall within Hb14 (deep grey sands subdominant [comprise >20% of land type]) land types.

The original concept of this land type was one of light and grey coloured soils having formed from such coloured parent materials without distinct influences of redox processes. This implies that these soils have the colours of reduction related to bleached soils but not the chemical formation processes – an aspect that causes significant confusion in terms of the interpretation of wetland characteristics. The split of the Fernwood soil form has clarified the dry vs wet light-coloured soil form. However, this development does not solve the challenge of identifying redox morphology in deep sandy profiles. It is generally accepted that mottling does not occur (or is very poorly discernible) in sandy soils due to the association of high chroma Fe accumulations with finer-textured material – that is absent in the sandy soils.

From the texture and porosity, it is evident that these soils and landscapes exhibit rapid drainage and percolation of water and therefore qualify as terrestrial soils. However, the presence of regional water tables leads to stagnation and shallow water tables in these landscapes. The essence is that these soils and land types are very difficult when trying to identify wetland features based on soil properties. The general assertion listed for the podzol soils, one of increasingly dark and elevated organic C levels with increasing wetness, also applies effectively in this land type but will require empirical observation, measurement and description (Der Waals, 2019); (Job, et al., 2019).

Generally, the same soil types are encountered in the study area, and this is mainly due to the sub-surface geology and local rainfall patterns (refer to Figure 4-2).

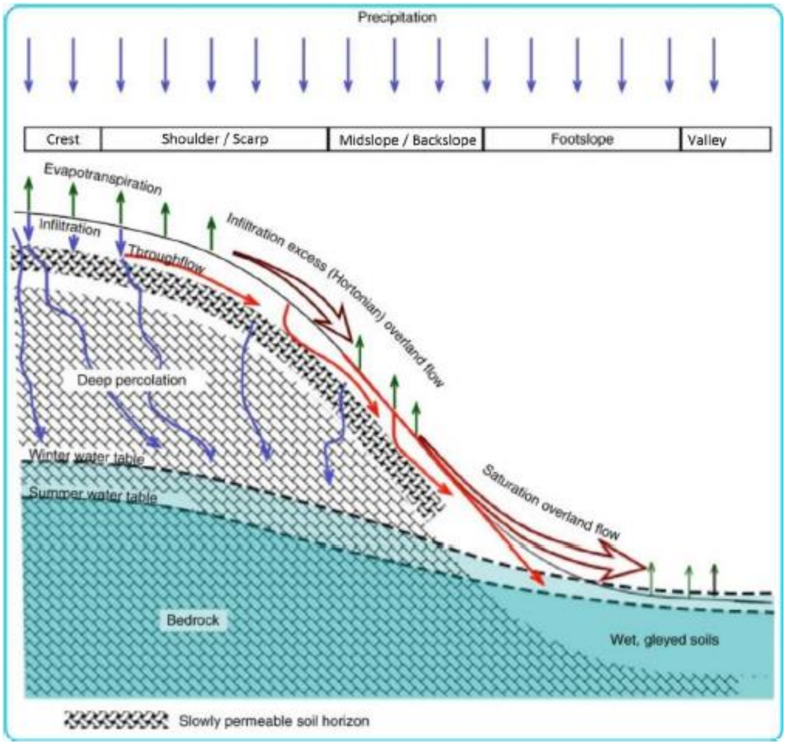


Figure 6-9: Land Morphology concept (Almond, 2016)

The soils in the project predominantly consist of fine to medium-grained sand of the Mispah and Fernwood soil forms (ARC, 2006). The combined average diagnostic depth of all the soils range from 100 to 1200 mm. Average clay content for footslope soils range from 4 to 10% (ARC, 2006), and less clay content (0 to 3%) is associated with soils on the crest and midslope position.

6.1.10.3 Soil distribution

Figure 4-3 provides an estimate of the soil distribution for the study area. Soil occurrences were derived from available field 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).

6.1.10.4 Soil permeability

Fine to medium-grained sand is expected for the study area. The permeability of the diagnostic soils in the area is 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).

6.1.11 Water Resources

6.1.11.1 Groundwater

According to DWAF (2006), the groundwater depth on a quaternary scale is in the order of 10.5 mbgl. WRC (2015) and NGA data suggest that the groundwater table ranges from 3 to 15 mbgl, for the sub-catchment associated with the development site (refer to Figure 4-2). Literature further suggests that the groundwater table mimics the surface topography. Shallower groundwater levels will typically be associated with low lying areas surrounding, or areas where clay lenses occur (i.e. perched groundwater). The literature further suggests that the groundwater table mimics the surface topography.

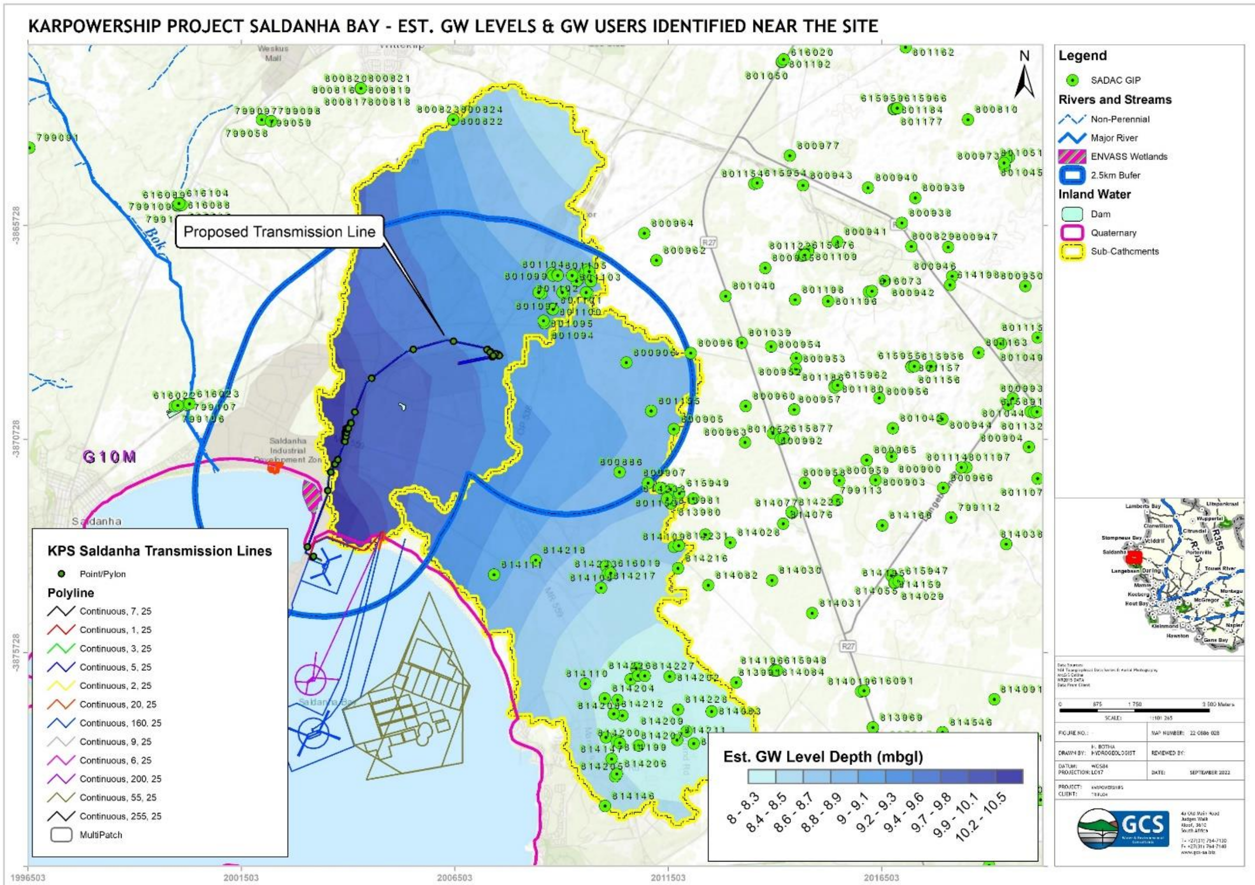


Figure 6-10: Groundwater users identified in the study area

6.1.11.2 Water Management Areas

The proposed development was observed to fall within the Water Management Area (WMA): Berg, which falls under the lesser sub-WMA's: Lower Berg and the quaternary catchment G20M. The aforementioned WMA is drained by several parallel rivers which flow in a south-westerly direction and eventually discharge into the Atlantic Ocean. The rivers which contribute to the highest flow within this WMA are the Berg, Diep and Steenbras rivers with several smaller coastal rivers that feed the aforementioned larger rivers (DWA, 2003).

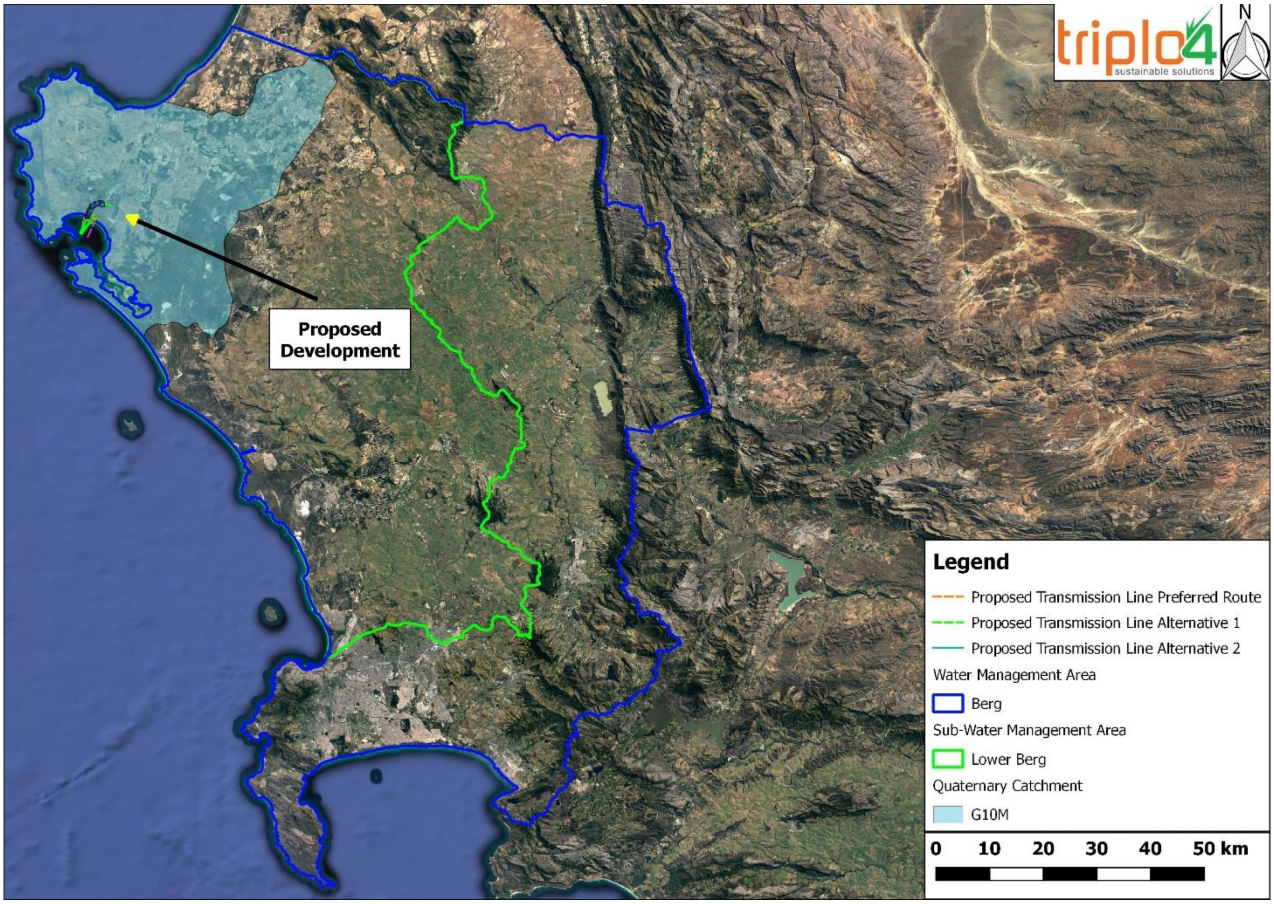


Figure 6-11: Map of the WMA, sub-WMA and Quaternary Catchment that fall within the proposed development.

6.1.11.3 Local and Surface Water

The sub-catchments for the site was delineated using 30m SRTM DEM (Farr & Kobrick, 2000). From this delineation, catchment characteristics, such as area, slopes and hydraulic parameters of the modelled river sections, were derived. The total surface area of the delineated sub-catchment is approximately 199 km^2. The delineated watershed for the farm is the entire quaternary catchment due to the river morphology and size of the rivers.

6.1.12 Wetland Environment

Based on the initial risk screening assessment, the Estuary/Port was the only watercourse identified and was assessed further in the Estuarine Impact Assessment. No wetland/riverine system will be at risk as a result of the proposed development.

6.1.12.1 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, there will be no FEPA rivers or wetlands at risk as a result of the proposed development. The closest FEPA wetlands are approximately 700m away and were classified as one natural depression and several artificial depressions.

6.1.12.2 Wetland Delineation

The watercourses within the study area were identified on a desktop level, classified and delineated in-field and subsequently mapped utilising GIS (QGIS 2.14 and Google™ Earth Pro) and available spatial data. After the application of the initial risk screening assessment, it was determined that the study area consists of a total of one (1) wetland which was classified as a depression wetland as shown in Figure below:

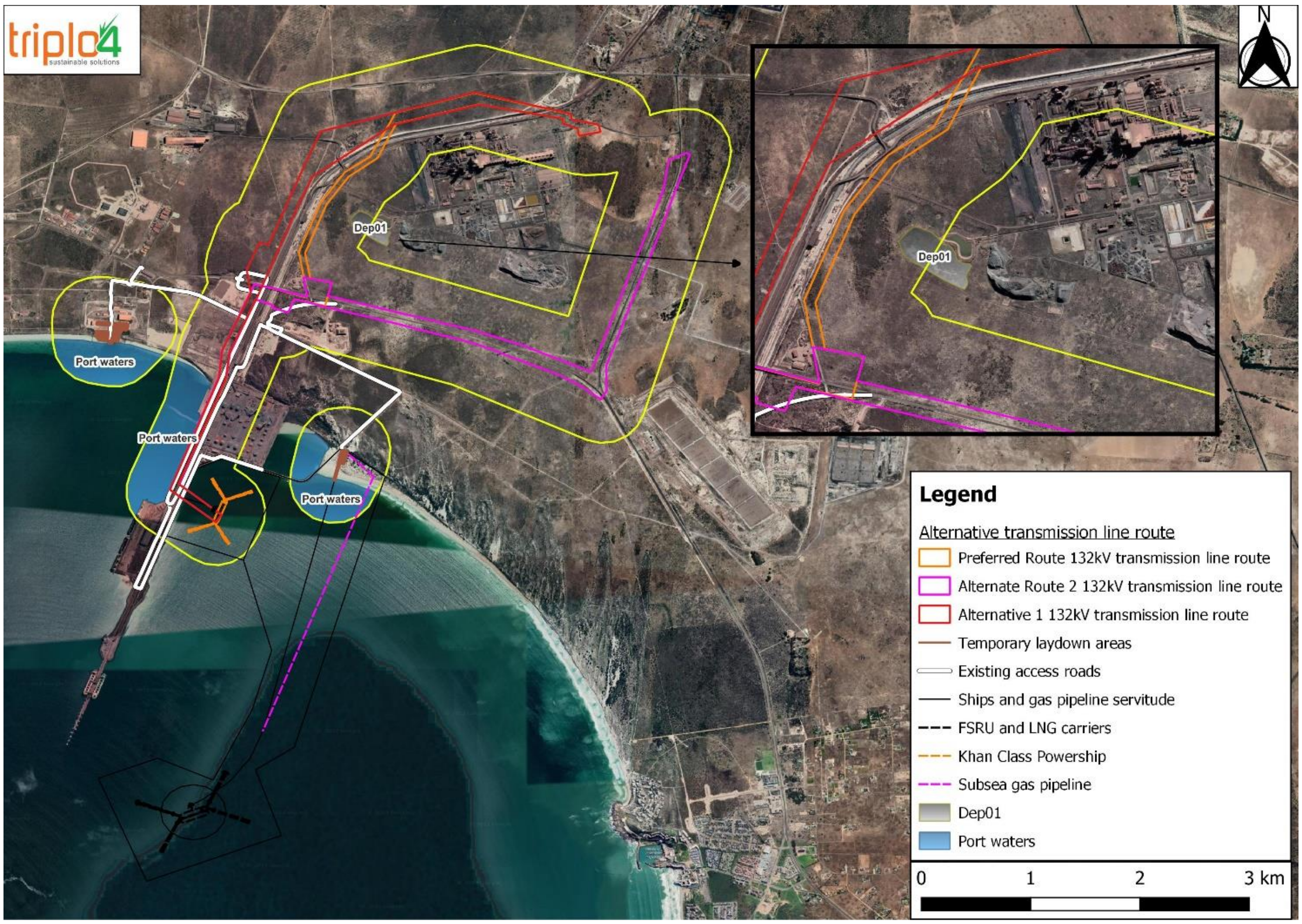


Figure 6-12: Map of the in-field delineations of the watercourses identified at the proposed development and 500m assessment radius

6.1.12.3 Aquatic Environment

The study area falls within the South Western Coastal Belt (Ecoregion 24) and extends across three vegetation units: Saldanha Flats Strandveld, Langebaan Dune Strandveld, and Saldanha Limestone Strandveld Vegetation units.

Based on the South African Screening tool, the northern section of the proposed development is situated within a strategic water source area. Which are areas that supply areas of geographic interest with a varying amount of water. However based on satellite data and data from the DWS (Department of Water and Sanitation) no rivers or areas displaying river characteristics fall within a 100 meters of the proposed development.

The location of one potential aquatic sampling site was investigated. Even though this site is quite a distance (approximately 3km west) from the proposed development and will not be impacted, it was considered in order to provide some regional context. The Bok River lying to the west of the proposed 132kV transmission line is classified as a Freshwater NFEPA, its present ecological state (PES) is Class C: Moderately Modified.

Even though the assessment event was undertaken in spring, directly after the winter rainfall season unique to the Western Cape, no water flow was present within the study site. Therefore, no aquatic assessment could be conducted, in accordance with the SASS5 protocol.

The width of the river channel was approximately 10-20m and there was no flowing water. The site is traversed by a road culvert. The riverbanks are sparsely vegetated with low shrubs and bushes. The surrounding land use comprised of fallow land and the Saldanha wastewater treatment works. Although being the nearest river to the proposed development this river is situated in a separate watershed, impacts to this river is therefore unlikely

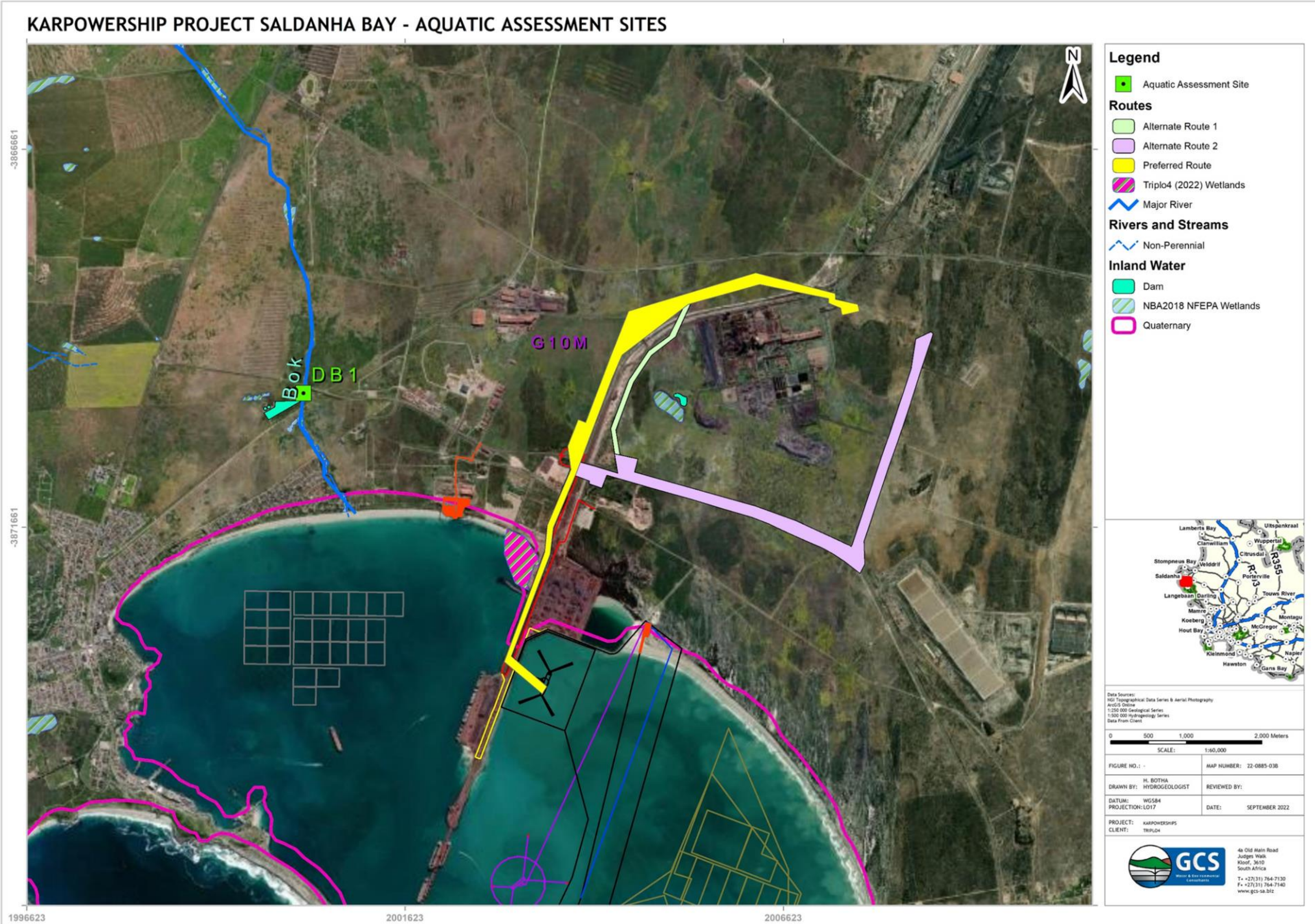


Figure 6-13: Aquatic assessment site in relation to the Proposed Transmission Lines

6.1.12.4 Estuarine Environment

The Langebaan Lagoon which is the defined estuarine area remains relatively unchanged with a few small-scale additions of important estuarine habitat above the 5m contour, and is referred in the most recent National Biodiversity Assessment (NBA) (CSIR, 2018; Van Niekerk, J. B. Adams, et al., 2019).

Figure 6-14: Location of the Langabaan Lagoon relative to the Port of Saldanha including the EFZ in blue

6.1.13 Fauna and Flora

6.1.13.1 Vegetation types

According to Mucina and Rutherford (2006), there are three vegetation types within the Karpowership site: Langebaan Dune Strandveld (FS 5), Saldanha Flats Strandveld (FS 3), and Saldanha Limestone Strandveld (FS 4). This vegetation is mapped in the National Vegetation Map Beta of 2018 (Mucina & Rutherford, 2018).

In terms of flora, some Species of Conservation Concern recorded from the site include *Arctopus dregei*, *Ferraria parva*, *Limonium capense* and Babiana nana (EN). Additional species including Aloe sp. are provincially protected.

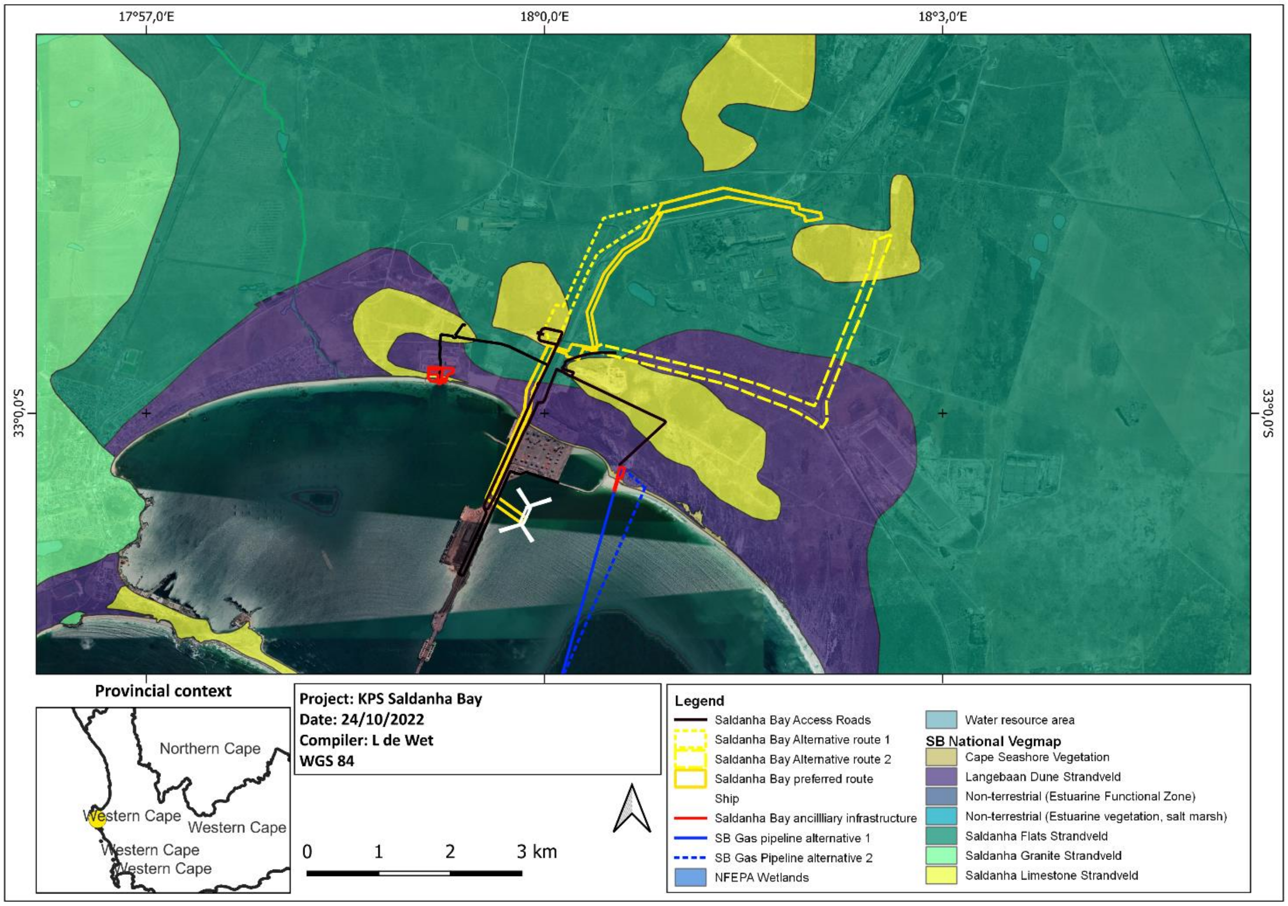


Figure 6-15: National Vegetation Map (Mucina & Rutherford, 2018)

6.1.13.2 Western Cape Biodiversity Spatial Plan (WCBSP)

The WCBSP has been developed by CapeNature Scientific Services Land Use Team in order to identify the priority biodiversity areas and ecological infrastructure that must be conserved to meet the provincial biodiversity mandate (Pool-Stanvliet *et.al.* 2017). The plan includes land use guidelines along with biodiversity priority areas, covering terrestrial, freshwater, coastal and marine areas. 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).

The powerline traverse primarily transformed areas, but in some areas traverse CBA1 and CBA2 (Table 6-6). Both CBA1 and CBA2 land use guidelines are to maintain in a natural state, with little to no biodiversity loss permitted. The majority of the preferred alternative is located within CBA1 and ESA1. However, much of these areas are degraded (as determined by the site visit) and are not supported as a CBA due to the proximity of existing infrastructure and associated disturbance. Alternative route 2 traverses primarily CBA1.

Table 6-6: Subcategories of CBA and ESAs

Map Category	Definition	Desired Management Objective
Protected Area	Areas that are proclaimed as protected areas under national or provincial legislation.	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity. A benchmark for biodiversity.
Critical Biodiversity Area 1	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low impact, biodiversity-sensitive land uses are appropriate.
Critical Biodiversity Area 2	Areas in degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a functional, natural or near-natural state, with no further loss of habitat. These areas should be rehabilitated.
Ecological Support Area 1	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.
Ecological Support Area 2	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs and CBAs, and are often vital for delivering ecosystem services.	Restore and/or manage to minimise impact on ecological infrastructure functioning, especially soil and water-related services.

*Adapted from Table 3.2, pg. 55 (Pool-Stanvliet *et. al.*, 2017)

6.1.13.3 Protected Areas

Formal protected areas are those that are included in the National Environmental Management: Protected Areas Act (Act 57 of 2003) and include nature reserves, national parks and protected environments. Protected areas provide protection against climate change and aid in ecological sustainability (Government of South Africa, 2008). Proximity to protected areas is important, as sites close to these areas may be ecologically sensitive, and buffers around protected areas should be maintained to preserve biodiversity and connectivity. The closest protected area is the West Coast National Park and the Marcus Island Marine Protected Area both of which are located within 5km of the study area.

Due to its recognised ecological importance, the area forms part of the West Coast National Park Marine Protected Area (MPA) Network. The network comprises several MPAs which were declared at various times, including the West Coast National Park MPA surrounding Langebaan Lagoon (proclaimed in 1985 and revised in 2000), Malgas Island MPA (proclaimed in 1985) and Jutten and Marcus Island MPAs (proclaimed in 2000). These are managed in terms of the National Environment Management: Protected Areas Act 57 of 2003 (WCNP 2013). Langebaan Lagoon is also a RAMSAR site declared in 1988, and the area eastwards of the North and South Heads is a rock lobster reserve in which no rock lobster may be caught.

The West Coast National Park, Malgas and Jutten Island MPAs do not occur within the proposed development's immediate area and are 9, 9.3 and 10.5 km away from the Powership and FSRU locations, respectively. However, Marcus Island is much closer, occurring at the entrance to Small Bay and Big Bay, 5.3 km from the proposed FSRU location. Conservation areas at the local scale are discussed further in Section 2.6.

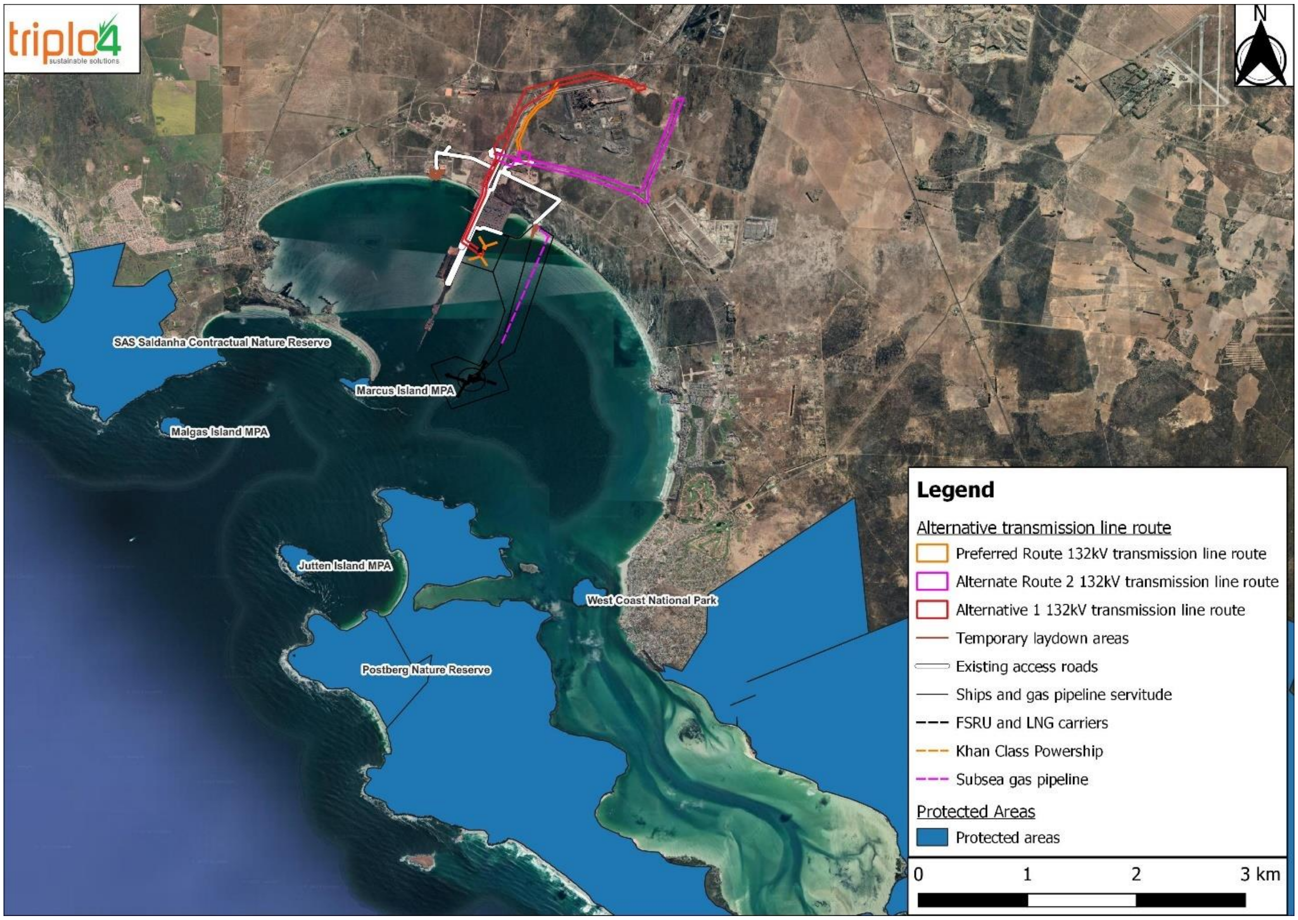


Figure 6-16: Map representing the Protected Areas a fair distance away from the proposed development

6.1.13.4 Fauna

The study area is known to house various faunal species, some of which are of conservation importance. It is important that as much natural space is conserved as possible. The taxa listed include mammals and herpetofauna (reptiles and amphibians). There are several Species of Special Concern (SCC) that are expected for the site. That is, they have been recorded from the same QDS into which the site falls. This does not necessarily mean that these species will occur on site, however, some may occur. The likelihood of occurrence is assessed for each of the conservation important (Red Listed Critically Endangered and Endangered species) species.

6.1.14 Avifauna

6.1.14.1 Terrestrially- associated birds

6.1.14.1.1 Important Bird Areas

According to a desktop assessment, there are two globally Important Bird Areas (green polygon in Figure 6-5 below) either side of the Saldanha Bay Gas to Power project. Bird surveys were undertaken both sides of the jetty and along the proposed power line to determine if the present power lines kill birds potentially commuting between these sites.

The West Coast National Park and Saldanha Island IBA holds up to 250 species (numerous Red Data species) and the West Coast up to 20 000 birds in summer. As such it is the richest wetland in South Africa (Marnewick et al. 2015).

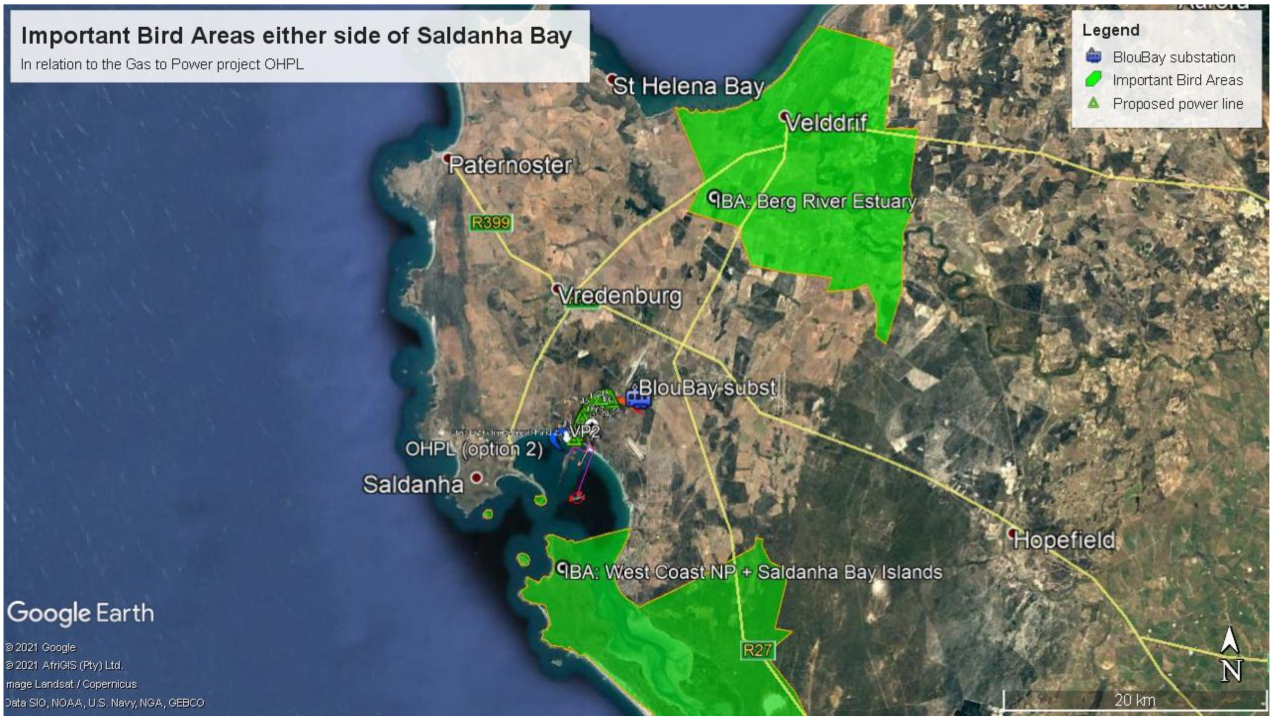


Figure 6-17: Important Bird Areas

6.1.14.2 Avian microhabitats

Bird habitat in the region can be divided into four sections:

- **Inland Saldanha strandveld** often highly modified adjacent to the steel works and Transnet port used by Sacred ibises, Yellow-billed Kites, and smaller passerine birds such as prinias and wheatears. Very low densities as this are highly industrialised, often compromised with a fine layer of iron ore dust (killing or stunting the vegetation).
- **The intertidal area** supporting a sandy beach of varying width and modified sections that create the pier and artificial embayments. Used by roosting gulls and terns, as well as shorebirds feeding on the intertidal areas. Probably used by flamingos at times, and definitely used by huge numbers of roosting cormorants (Figure 6-6). Some breeding of resident species occurs here
- **The deep marine environment** used by cormorants, penguins, terns, and gulls for foraging. The two closest islands, Jutten and Malgas both have protected status, are included in the Important Bird Areas (West Coast Park and Saldanha Bay Islands) and hold several Red Data species (Marnewick et al. 2015).
- A fourth (artificial) habitat is provided by the **existing power lines** themselves, and some species breed or perch on these structures.

Figure 6-18: Approximately 3000 Cape Cormorants (= black line at edge of wave) roosting in habitat along the same beach of the Saldanha Bay port and jetty. The planned emergence point of the gas pipeline from the offshore container ship is proposed to emerge

6.1.14.3 Seabirds

Saldanha Bay, Langebaan Lagoon and the associated islands provide important shelter, feeding and breeding habitat for at least 56 non-passerine waterbird species, 11 of which are known to breed on the islands alone (Clark et al. 2021). The sheltered deep-water marine habitats associated with Saldanha Bay itself, sheltered beaches in the Bay, islands that serve as breeding refuges for seabirds, and rocky shoreline surrounding the islands and at the mouth of the Bay are all important habitats for seabirds.

Waterbirds are counted annually on all the islands (Department of Forestry, Fisheries and the Environment — DFFE: Oceans and Coasts). Saldanha Bay and the islands are important not so much for the diversity of birds they support, but for the abundance of birds of a few species in particular. The islands of Vondeling (21 ha), Schaapen (29 ha), Malgas (18 ha), Jutten (43 ha), Meeuw (7 ha), Caspian (25 ha) and Marcus (17 ha), support important seabird breeding colonies and make up one of only a few such breeding areas along the West Coast of South Africa (Clark et al. 2021). The Malgas Island colony comprises 25% of the global Cape gannet Morus capensis population (Birdlife 2015).

The islands support important breeding colonies of African penguin (*Spheniscus demersus*), Cape gannet (*Morus capensis*), Cape cormorants (*Phalacrocorax capensis*), bank cormorants (*Phalacrocorax neglectus*), crowned cormorants (*Microcarbo africanus* – previously *Phalacrocorax africanus*), white-breasted cormorants (*P. carbo lucidus*), kelp gulls (*Larus dominicanus*), Hartlaub's gulls (*Larus hartlaubii*) and swift terns (*Sterna bergii*) (Clark *et al*. 2021). The former three species in addition to the rare African black oystercatcher (*Haematopus moquini*) are endemic to the Benguela region. The majority of these species are piscivorous and depend largely on a healthy population of fish for sustenance. The populations of most of these species breeding on the islands of Saldanha Bay were on an increasing trajectory from the start of monitoring in the 1980s until approximately the mid-1990s. Factors that probably contributed to these increases include the reduction and eventual cessation of guano collecting in 1991, banning of egg collecting, increases in the biomass of small pelagic fish (particularly sardines) over this period, and in the case of the African Oystercatcher, the increase in mussel biomass as a result of the spread of the Mediterranean mussel. However, populations of certain species, specifically Bank cormorants, Cape cormorants, Cape gannets and African penguins subsequently started to decline.

On the islands of Saldanha Bay, populations of all these species then started to decline, particularly, the penguins, gannets, crowned cormorants and kelp gulls, which have declined to 0.14%, 40% (in 2019), 23% and 20%, respectively of their populations at the turn of the century. These general declines can be attributed to several causes. These include (1) construction of the causeway linking Marcus Island to the mainland, (2) increased human disturbance, (3) emigration of birds to colonies further south and east along the South African coast in response to changes in the distribution and biomass of small pelagic fish stocks, (4) starvation as a result of a decline in the biomass of sardines nationally, and particularly along the west coast over the last decade, (5) competition for food with the small pelagic fisheries within the foraging range of affected bird species, (6) predation of eggs, young and fledglings by Great White Pelicans (*Pelecanus onocrotalus*), kelp Gulls and Cape fur seals (*Arctocephalus pusillus*), and (7) declines in local availability of their principal prey species (rock lobster and sardines). BirdLife International therefore lists African penguins, Cape cormorants, bank cormorants and Cape gannets as Endangered on the IUCN Red List (BirdLife International 2022).

Throughout South Africa, the African Penguin population declined from an average of 48 000 pairs over the period 1979-2004 to just 17 000 pairs in 2013, 13 600 pairs in 2019 and a record low of just 10 400 pairs in 2021 (Boersma *et al*. 2020, Crawford *et al.* 2014, Sherley *et al* 2020). The number of African penguins breeding in the Western Cape decreased in a similar fashion from some 92 000 pairs in 1956, to 18 000 pairs in 1996. There was a significant recovery to a maximum of 38 000 pairs in 2004, before another dramatic collapse to 11 000 pairs in 2009, equating to a total decline of 60.5% in 28 years (Crawford *et al.* 2008a, b). In Saldanha Bay the population initially grew from 552 breeding pairs in 1987 to a peak of 2 156 breeding pairs in 2001 and then underwent a severe and continuous decline to 190 pairs in 2021 (Anchor 2022). Although the decline in the number of breeding pairs on the Saldanha Islands appears to have stopped with similar counts in 2019 and 2021 the reduction in numbers since 2001 is consistent with the overall downward trend and strongly reinforces the argument that immediate conservation action is required to prevent further losses of these birds. In light of the ongoing decline in African Penguin numbers nationally, a Biodiversity Management Plan for the African Penguin was gazetted in 2013, with aims: "*To halt the decline of the African Penguin population in South Africa within two years of the implementation of the management plan and thereafter achieve a population growth which will result in a downlisting of the species in terms of its status in the IUCN Red List of Threatened Specie*s". This latest plan attributes population declines mostly to a scarcity of prey and recommends pelagic fishery exclusion zones around colonies, seasonal closures at penguin feeding grounds before and post moult, oil spill risk management and colony specific management such as predator control. Recent research in Algoa Bay has suggested that penguin declines are associated with increased vessel traffic (Pichegru *et al* 2022). There are also concerns that toxin loads influence individual birds' health, reducing their breeding success and/or longevity (Game *et al*. 2009). The changes in African Penguin population size at the islands in Saldanha is believed to be partially linked to patterns of immigration and emigration by young birds recruiting to colonies other than where they fledged, with birds tending to move to Robben and Dassen Islands (Whittington *et al*. 2005b). However, once they start breeding at an island, they will not breed anywhere else. On the 16 September 2022 the DFFE announced closures for small pelagic fishing around the major penguin breeding colonies of Dassen Island, Robben Island, Stony Point, Dyer Island, St Croix Island and Bird Island (www.gov.za/speeches/forestry-fisheries-and-environment). The closures around Dassen Island and Robben Island could benefit penguin colonies on the west coast as a whole and the Dassen Island closure may benefit penguins nesting on the Saldanha Islands as it is within the foraging range of the species (Pichegru *et al.* 2009, DFFE 2022).

For bank cormorants, breeding pair count data from the Saldanha Bay area shows the dramatic decrease in the population at Malgas Island, which was previously the most important island for this species. The number of breeding pairs of this species on Jutten, Marcus and Vondeling has declined steadily since 2003 on all the islands. Overall, the population of bank cormorants in Saldanha Bay has declined drastically by approximately 97% since 1990. For the white-breasted cormorant within Saldanha Bay, breeding effort has occasionally shifted between islands. White-breasted cormorants bred on Malgas Island in the 1920's, and low numbers of breeding pairs were counted on Marcus and Jutten Islands intermittently between 1973 and 1987 when they stopped breeding there and colonized Schaapen, Meeuw and Vondeling islands (Crawford *et al*. 1994). Most of the breeding population was on Meeuw in the early 1990s but shifted to Schaapen in about 1995. By 2000, the breeding numbers at Schaapen had started to decline and the breeding population had shifted entirely back to Meeuw by 2004, where it has remained since. Overall, numbers of breeding pairs were more or less stable until 2012 but have declined steeply since then. The last six annual counts (2015-2021) were substantially down from the 100-150 breeding pairs recorded in most years prior to 2012. Only 16 pairs were recorded in 2019 representing the lowest number recorded in the past 31 years. The 2021 count revealed 32 breeding pairs, an improvement on 2019 but very similar to the average post-2015 population size and well below earlier counts (Anchor 2022).

Because populations are so depressed, conditions at the islands in Saldanha, particularly predation by Cape Fur Seals, Pelicans and Kelp Gulls, have now become the major factors in driving current population decreases for many seabird species. Direct amelioration actions (*Pelican Watch*, problem seal culling) to decrease these impacts at the islands have had mixed results, with the former proving more effective than the latter. Cape Fur Seal and Kelp Gull predation continue to pose a major threat to seabird survival at the Saldanha Bay Island colonies.

Populations of the African black oystercatcher (*Haematopus moquini*) and crowned cormorants, on the other hand, have been recovering from low numbers, however, recent counts are still lower than previously recorded levels (Anchor 2022). These two species, previously classified as Near Threatened, are now classified as Least Concern (BirdLife International 2022).

African Oystercatchers are resident on the islands, where highest numbers are encountered at Marcus, Malgas and Jutten Islands. In Saldanha Bay there is no discernible upward or downward trend over time for crowned cormorant counts. The total number of breeding pairs recorded in 2018 was just 36 pairs on Jutten and Malgas Islands, whilst over the period 2019-2021 between 644-996 breeding pairs were recorded with the majority on Jutten, Malgas and Schaapen Islands (Clark *et al*. 2021).

Despite being one of approximately 50 of the world's rarest gull species, Hartlaub's gull (*L. hartlaubii*) is not classified as being of conservation concern (BirdLife International 2022). The numbers breeding on the different islands are highly erratic, as are the total numbers in the Bay. The total number of breeding pairs recorded in 2018 was just 36 pairs on Jutten and Malgas Islands, whilst over the period 2019-2021 between 644-996 breeding pairs were recorded with the majority on Jutten, Malgas and Schaapen Islands.

6.1.15 Marine Baseline

6.1.15.1 Local Oceanography and Hydrodynamics

The tides along the west coast of southern Africa, including Saldanha Bay, are semi-diurnal (two high and two low tides per tidal day). The tidal characteristics for Saldanha Bay are typical of a micro-tidal regime and indicate an approximate 2 m tidal range during spring tides (van Ballegooyen *et al*. 2007).

The hydrodynamics of the Saldanha Bay/Langebaan Lagoon system is complex. It is influenced by the cold, northward-flowing Benguela current that exerts large scale forcing functions in the Bay. Additionally, the circulation and currents within the system are influenced by the varied geometry of the bay and lagoon, winds and tides and the thermal stratification (CSIR 2014).

Current velocities within Small Bay are generally low, ranging between 0.05 and 0.15 m/s and tended to flow in a clockwise direction irrespective of the tidal or wind conditions. In Big Bay, current velocities range between 0.1 and 0.2 m/s have been observed, and current directions (anti-clockwise) within the main channels are mostly dependent on tidal conditions (CSIR 2014, Anchor 2020a).

Construction of the iron ore terminal and the Marcus Island causeway had a significant impact on the distribution of wave energy in Saldanha Bay, particularly in the area of Small Bay (Weeks et al. 1991). Wave conditions within the bay are sheltered compared to those outside the bay since all energy reaching the bay has to pass through the relatively narrow channel between Marcus Island and Elands Point

6.1.15.2 Port Water Quality

Table 6-7: Summary of the Port Water Quality

Temperature	Historical baseline data (before the development of the Bay as an industrial port) reported by Shannon and Stander (1977) indicate that surface water temperatures varied between 16 and 18.5 C during summer and between 14.5 and 16˚C during winter. Data collected from April 2014 to April 2020 in Small Bay (reported in Anchor 2020a) also showed a similar pattern to historical data, with warmer water temperatures during the summer and spring months ranging approximately from 10 (at 12 m) and 21°C (at the surface). During winter and autumn months, temperatures were cooler and ranged from approximately between 11 and 16°C.
Salinity	Salinity values recorded for Saldanha Bay usually fall within the range of 34.6 and 34.9 PSU, the range of salinities that typically occur in inshore waters along the west coast of South Africa (van Ballegooyen et al. 2007). During summer, the bay's salinity is usually slightly lower in summer than in winter when the upwelling front breaks down and warmer, more saline surface waters enter the bay (van Ballegooyen et al. 2008).
pH	Measurements of pH recorded by Shannon and Stander (1977) in Saldanha Bay were generally high, with values over 8.4 being recorded on several occasions. pH generally decreased with depth, and the mean levels within the bay ranging from 8.12 and 8.26. High levels are likely linked to primary production.
Dissolved Oxygen	Recent dissolved oxygen measurements (2020 measurements) in Small Bay and Big Bay (reported in Anchor 2020a) were comparable to those measured by van Ballegooyen et al. (2012) as they showed that hypoxic conditions (reflecting low oxygen upwelled water) in bottom waters (<2 ml/L) continued until autumn (late May) after which the onset of winter led to higher concentrations as a result of the decline in upwelling and turbulent mixing of the water column (Anchor 2020a).

	It was then noted that the significant increase in the frequency of Small Bay hypoxic events occurred after the significant harbour development in the 1970s, and the situation did not appear to have changed much since the development. Additionally, Big Bay's hypoxic events during autumn were of a lower magnitude seen in Small Bay. This was attributed to better mixing of the water column in Big Bay, lower retention times (enhanced flushing) and lower organic loading from anthropogenic sources (e.g. mariculture, fish factory effluent, wastewater treatment works) (Anchor 2015).
Turbidity	van Ballegooyen et al. (2012) describe Saldanha Bay's water as being “fairly turbid”, the turbidity comprising both organic and inorganic particulates that are suspended in the water column. Strong wind conditions in the bay result in a peak of turbidity values due to wind and wave action that suspends particulate matter in the water column, particularly Big Bay. Phytoplankton blooms and shipping movements have also been observed to cause significant increases in turbidity in the Bay. Turbidity data measured in Small Bay by van Ballegooyen et al. (2012) indicated that total suspended solids (TSS) concentrations were greatest near the seabed, particularly at the shallower areas. Concentrations generally did not exceed 10 mg/L, except for a few occasions where higher TSS of between 10 mg/l and 40 mg/l were observed typically in the near-bottom water at a Mussel Farm site in Big Bay and near the berths along with the iron ore terminal. A few values above 100 mg/L were recorded in the iron ore terminal's vicinity, attributed to shipping activities. The water column turbidity measurements reflected the same general trends as the TSS measurements, with turbidity in winter generally in the range of 5 to 12 NTU. In the other seasons, the turbidity typically ranged between 5 and 8 NTU (van Ballegooyen et al., 2012).
Nutrients	The water column in the bay becomes highly stratified in summer due to surface warming and the penetration of cold bottom water forced by coastal upwelling on the shelf (Monteiro and Largier 1999). The cold, upwelled water is rich in nitrogen, some of which enters the surface layer by advection. Phytoplankton biomass and productivity are primarily controlled by the physical state of the bay as determined by upwelling processes on the shelf, which control the advective exchange of phytoplankton and the input of nutrients from the coastal upwelling system and by local wind stress responsible for vertical mixing of the water column, thereby influencing the vertical distribution of phytoplankton and the entrainment of nutrients from bottom waters (Pitcher and Calder 1998).

6.1.15.3 Local Sediment Characteristics

The particle size of sediments occurring in the greater Saldanha Bay area is strongly influenced by wave energy and circulation patterns. Historically, surficial sediments in Big Bay and Small Bay comprised very fine (0.063-0.125 mm), fine (0.125-0.25 mm), or medium (0.25-0.5 mm) sand (Flemming 1977). Changes in the local wave climate and hydrodynamics due to the construction of port infrastructure have affected sediment particle size distributions.

Historical data show that, before any significant development, TOC levels in Saldanha Bay were mostly low (between 0.2 and 0.5%). With the construction of the iron ore terminal and the establishment of the mussel farms in Small Bay, there has been an increase in TOC levels, particularly at the yacht club basin, the Multi-Purpose Terminal and at the liquid petroleum gas facility. In the first survey of TON levels within Saldanha Bay conducted in 1999, concentrations were low (<0.2%) at most sites but were elevated at the yacht club basin and near the mussel rafts in Small Bay.

Accordingly, in recent surveys, the concentrations of organic content were highest where mud accumulates in Small Bay at the yacht club basin, near the mussel rafts and at the Multi-Purpose Terminal and in Big Bay near the LPG facility, in the vicinity of the proposed FSRU location.

All trace metal concentrations were below the probable effect concentrations as stipulated by the BCLME (CSIR 2006).

Trace metal concentrations in sediment at all sites in Big Bay, including those surrounding the proposed FSRU and subsea gas pipeline location, were below the respective recommended guideline levels.

6.1.15.4 Local Marine Ecology

Marine ecosystems comprise a range of habitats, each supporting a characteristic biological community. Small Bay and Big Bay's important habitats include the subtidal macroalgae beds, the subtidal benthic zone, and the water body itself.

6.1.15.5 Intertidal and Shallow Subtidal Habitats

Anchor Environmental has conducted annual sampling of Saldanha Bay's intertidal regions since 2005 as part of the annual State of the Bay monitoring. The majority of the Saldanha Bay system is characterised by relatively rocky intertidal shores where exposure to wave action is the primary driver of intertidal community assemblages. Exposed regions of the Bay are typically rocky and dominated by bivalves and filter feeders. In contrast, more sheltered areas are prone to sand and gravel accumulation and are generally dominated by seaweeds and macroalgae (Anchor 2019).

The rocky intertidal habitats in Saldanha Bay display typical zonation patterns, with total algal and biotic cover increasing from the high to the low shore. The species that occur are representative of rocky intertidal habitats in the southern Benguela (Anchor 2020a). For the most part, the high shore regions throughout the Bay are primarily barren rock with minimal algal cover. In sheltered areas, the high shore is typically dominated by the winkle *Oxystele Antoni* while in exposed areas, the winkle *Afrolittorina knysnaensis* and the anemone *Bunodactis reynaudi* are generally present (Anchor 2020a). In the mid-shore, prevalent within the smaller, sheltered rock pools are cushion starfish (*Parvulastra exigua*), the whelk (*Burnupena* spp.) and the periwinkle (*Oxystele antoni)*. Regions exposed to higher wave action are typically dominated by filter feeders, including four alien species: the Mediterranean mussel *Mytilus galloprovincialis*, and three barnacle species *Balanus glandula, Perforatus perforatus* and *Amphibalanus amphitrite* (Anchor 2019, 2020a). These species are typical of rocky intertidal habitats in the southern Benguela.

Sandy beach habitat also occurs in Big Bay and Small Bay, but beach erosion is a significant issue. The shallow intertidal beach area in Small Bay's northern section is essential for fish recruitment (Anchor 2020a).

Macroalgae

Subtidal macroalgae beds, dominated by the agarophyte *Gracilaria gracilis*, occur loosely attached to or drifting above sandy substrates in Small Bay's northern inshore area 1.5 km from the proposed Powership mooring location. These beds provide habitat and grazing opportunities for multiple sandy bottom marine fauna, including fish, limpets and urchins (Anderson et al. 1993). Commercially, beach-cast seaweed is collected and is processed for agar, dried and exported to foreign markets or unprocessed is used as abalone feed (Rothman et al. 2008, TNPA 2020). Wash-ups of *Gracilaria gracilis* has been very sporadic over the last several decades. An initial significant decline in the resource occurred in 1974, probably due to an increase in development in the Bay, including the iron ore jetty (Rotmann 1990, Rothman et al. 2008). Subsequently, another collapse, attributed to grazing by herbivorous fish and invertebrates, happened in the late 1980s (Anderson et al. 1993). Diver surveys conducted in 2006 and 2007 at 50 sites in Small Bay estimated the standing stock to be 538 tons fresh weight (Rothman et al. 2008). Due to the variable and declining abundance of this resource, future development occurring in Small Bay needs to be cognisant of these macroalgae beds' effect

Figure 6-19: Gracilaria gracilis washed up on beaches in Small Bay, Saldanha Bay

September 2015. Photograph provided by Dr R. Anderson, Department of Biological Science, University of Cape Town.

Subtidal rocky habitats within the Bay are dominated by kelp (*Laminaria pallida* and *Ecklonia maxima*). The kelp beds provide shelter for many species and are important for recruiting juvenile west coast rock lobster (*Jasus lalandii*) (CSIR 2014).

Benthic communities

The numerous anthropogenic activities in Saldanha Bay in the early 1970s, including the iron ore terminal construction, altered physical conditions and led to declines and changes in the benthic communities present (Kruger *et al*. 2005). Since then, the annual State of the Bay monitoring had revealed that the macrobenthic community in Small Bay and Big Bay has been relatively stable over the period 1999 to 2020, except for three instances in 1999, 2008 and 2012 when declines in species abundance and biomass were observed (**Error! Reference source not found.**), and shifts occurred in community composition (Anchor 2020a). There was a decrease in the abundance and biomass of more sensitive filter feeders and an increase in shorter-lived opportunistic detritivores. It has been suggested that these changes in community structure are linked to dredging events.

As per the 2020 State of the Bay survey , benthic community diversity was lowest in Small Bay in the vicinity of the yacht club basin and Sea Harvest (SH in Figure 6-20) discharge and Big Bay, near the proposed FSRU and subsea gas pipeline location, at the iron ore terminal and site BB26. This is attributed to the higher levels of anthropogenic disturbance, including dredging and a high proportion of mud content in these areas (Anchor 2020a). In 2019, reduced indices of abundance, biomass and diversity were observed at the LPG site, near the proposed FSRU location, which appears to be linked with the increased disturbance due to the installation of the single point mooring (SPM). In 2020, results showed evidence of recovery in this area (Anchor 2020a).

Benthos species/taxa frequently found in Saldanha Bay include detritivorous crustaceans such as *Spiroplax spiralis,* polychaetes *Polydora* spp. and *Orbinia angrapequensis*, the sea cucumber *Listriolobus capensis,* predatory whelks of the genus *Nassarius*, filter-feeding amphipods *Ampelisca* spp. and the mud prawn *Upogebia capensis;* these species were common in samples collected from Small Bay and Big Bay (Anchor 2020a).

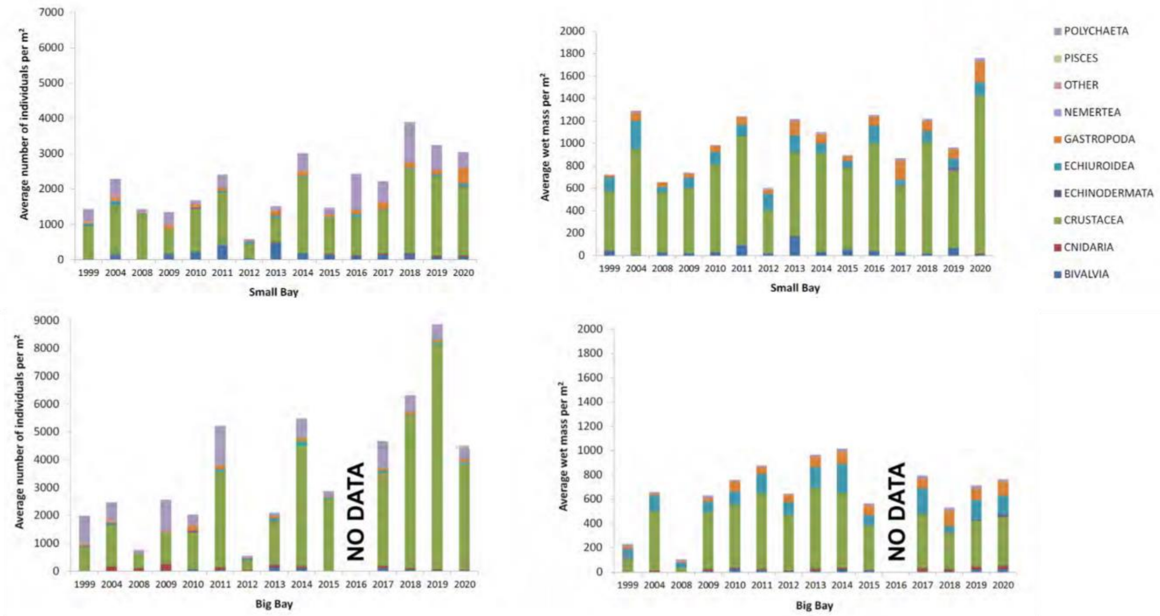


Figure 6-20: Annual trends in the abundance and biomass of benthic macrofauna in Small Bay and Big Bay, Saldanha Bay, from 1999 to 2020 (Anchor 2020a).

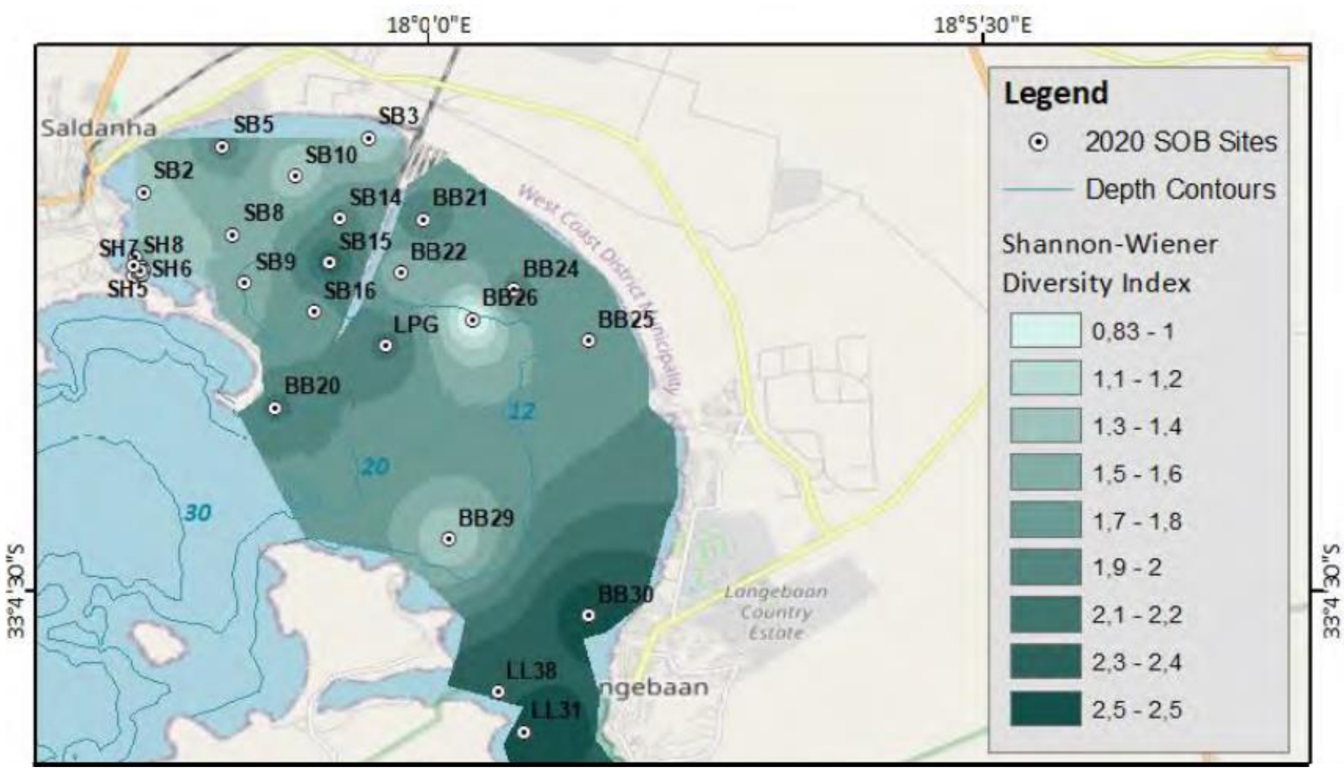


Figure 6-21: Variation in the species diversity of benthic macrofauna in Small Bay and Big Bay, Saldanha Bay, in the most recent State of the Bay survey reported by Anchor (2020b).

An extensive abrasion platform comprised of calcrete rock exists throughout much of Big Bay (Flemming 2015) and may occur in the vicinity of the proposed FSRU and gas pipeline. Historic surveys in 1977 indicated the platform is prominent in the western half of Big Bay (Flemming 2015) although this was prior to the construction of the multipurpose terminal which then altered the water circulation patterns and sediment deposition in the Bay. Consequently, the present-day extent of the calcrete reef in Big Bay and the benthic assemblages associated with it are not known as it is a largely unstudied habitat within Saldanha Bay (Anchor 2020b).

More recent surveys by Anchor (2020b) reported the presence of the calcrete reef at sites within Big Bay. The reef is described as approximately less than 1 m in height from the seafloor with a number of outcrops that have heights greater than 1 m. It was reported that reef may be subject to periodic, natural sand inundation and that the outcrops provide a habitat for upright epifauna such as basket stars (phylum Echinodermata), sponges (phylum Porifera) and possibly Bryozoans. The presence of West Coast rock lobsters (*Jasus lalandi*) was also noted during the survey (Anchor 2020b). A more recent assessment was submitted to the department (Dawson *et al*. 2022). Available bathymetry data was mapped and the degree of overlap with the ADZ Big Bay precinct was calculated.

The South African Navy Hydrographic Office (SANHO) collected side scan sonar data of Big Bay in 2020 and 2021. However, very little of the ADZ precinct was surveyed leaving a significant gap in the updated bathymetry data. The 2020/2021 SANHO bathymetry data, however, corresponds fairly well with Flemming's (2015) distribution of the abrasion platform created using data from a 1977 sidescan survey and there is a significant amount of overlap/agreement in the extent of reef/hard substrate between the two data sets. The georeferenced Flemming image was therefore used to determine the approximate area of reef within the Bay and the ADZ precinct.

Based on available bathymetry data there is approximately 5 047 890.99 m^2 of reef, 29.2% of this reef area falls within the boundaries of the ADZ precinct, i.e. 6.3% of the total Big Bay reef area is found in the finfish precinct and 22.9% in the Bivalve precinct. The majority of the sea floor below the designated Finfish area is covered by reef (~79.9%), while only 31.4% of the designated bivalve area consists of hard substrate, this concentrated in the SW of the section. Confirming this will require a similar resolution bathymetry survey of the ADZ precinct to be conducted in order to tie in with the 2020/2021 SANHO data.
A total of 54 taxa were recorded in the first video and photo survey of the reef habitat within and adjacent to the Big Bay precinct. These included numerous species of attached biota such as false corals, mussels, bryozoans, ascidians, sponges etc., as well as mobile taxa such as sea cucumbers, urchins, whelks, rock lobsters and starfish. These communities are not found on the dominant soft sediment habitats within Saldanha Bay (Dawson *et al*. 2022, Clark *et al* 2021). It is suggested that future surveys should include both video and photographic data and that the possible addition of lobster counts be included to monitor the health of this commercially important species.

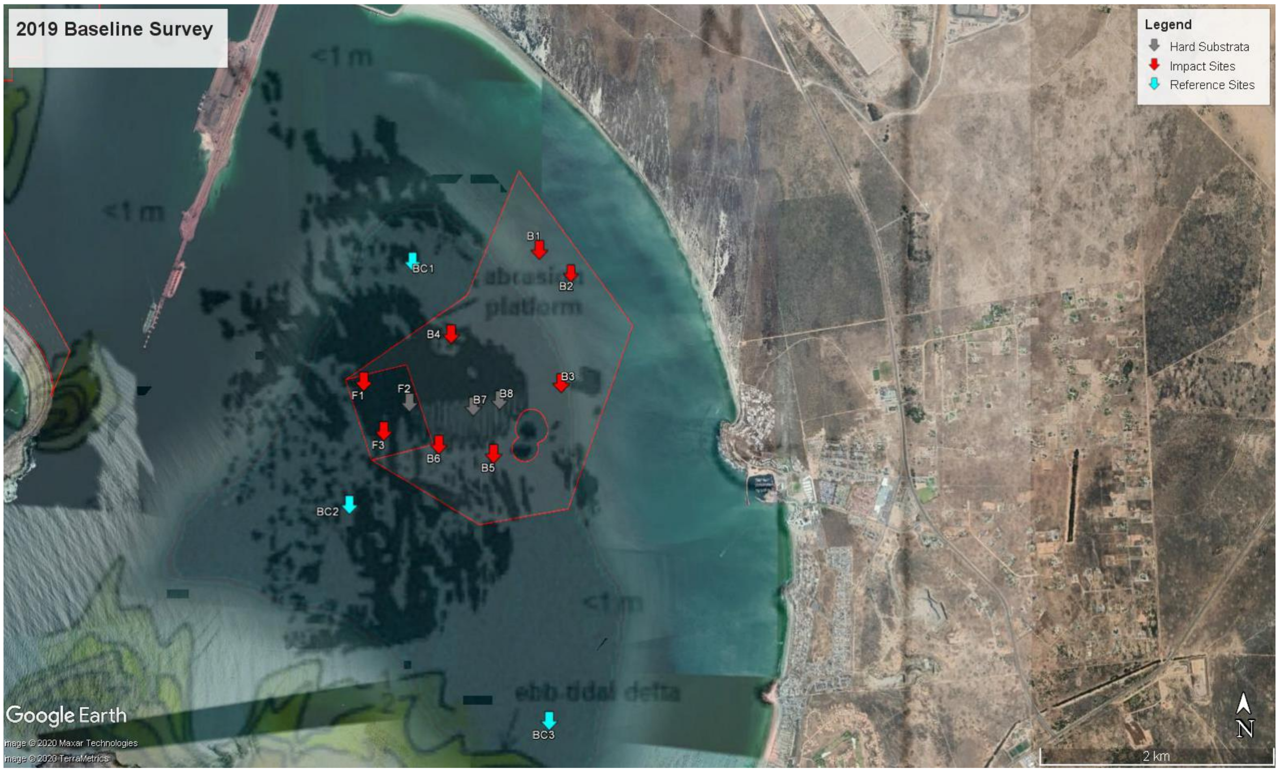


Figure 6-22: Map of Saldanha Bay showing the abrasion platform distribution (Flemming 2015) in Big Bay in relation to the sites sampled during the baseline survey of the Saldanha Bay ADZ.

Plankton

Saldanha Bay is a highly productive system owing to its link to the southern Benguela upwelling system. Phytoplankton comprises the bulk of microalgae biomass in the Bay (CSIR 2002) and can attain concentrations exceeding 40 mg Chl-a/m^3 (Pitcher *et al*. 2015). Mean water column concentrations in Small Bay and Big Bay, in waters surrounding the proposed FSRU and Powership locations, ranging from 5.4 to 31.5 mg Chl-a/m^3, with sites in Small Bay generally being characterised by lower Chl-a concentrations and biomass (Pitcher and Calder 1998; Pitcher *et al*. 2015). Phytoplankton production rates in the Bay have marked seasonal trends, peaking at the end of the upwelling season in summer (Henry . 1977).

Zooplankton

As seawater exchanges strongly influence Saldanha Bay with the adjacent continental shelf waters, the zooplankton species assemblage in the Bay strongly resembles that in the nearshore area of the southern Benguela upwelling system and is dominated by copepods (Grindley 1977; Shannon and Pillar 1986). Large numbers of meroplanktonic forms are present in the Saldanha Bay system represented by cirripede, polychaete and decapod larvae (Grindley 1977). On the eastern edge of Big Bay, at the head of Langebaan Lagoon, the zooplankton becomes more estuarine in character, as exemplified by the relatively high abundances of the copepod *Paracartia africana* (Grindley 1977).

Ichthyoplankton

The Saldanha Bay/Langebaan Lagoon complex supports diverse and abundant fish communities and provides important nursery habitat for many species essential to ecosystem functioning and integrity. There is evidence of pipefish (*Syngnathus acus*), harder (*Chelon richardsonii*), Cape silverside (*Atherina breviceps)* and white stumpnose (*Rhabdosargus globiceps*) utilising the area for spawning (Grindley 1977, Kerwath *et al*. 2009, Horton *et al*. 2019). During the spawning season, white stumpnose eggs and larvae are concentrated in the shallower areas around the margin of the Bay. Juveniles utilise the habitat provided by the *Gracilaria* beds in the northern inshore area of Small Bay (Arendse 2011).

Fish

As a part of the State of the Bay monitoring, seine-net sampling of nearshore fish assemblages (mainly juveniles) was started in 2008. The most recent survey results show some concerning trends in juvenile fish populations are provided below (Anchor 2020a, Anchor 2022):

Fish species diversity in Small Bay was the lowest recorded in the survey history but in Big Bay was equal to the long-term average. Fish abundance compared favourably to previous surveys conducted, but this mainly reflected the abundance of the two most abundant fish in the area, harders (*Chelon richardsonii*) and Cape silversides (*Atherina breviceps*). In Small Bay, there has been a declining trend in white stumpnose (*Rhabdosargus globiceps*), blacktail (*Diplodus sargus capensis*) and goby (*Caffrogobius* spp.) abundance, while in Big Bay, average harder abundance was comparable to earlier surveys, but the abundance of most of the other common species (white stump, gobies and black tail) in 2022 remained low, relative to earlier surveys. Fish diversity in Big Bay was way down in 2022, and due to the low abundance of Cape sole and elf, it is considered to be in poor condition. White stumpnose is the most important angling species in the Bay. However, recent studies show that the adult stock is overexploited (Parker *et al*. 2017), and the evidence from the seine net surveys conducted since then certainly suggested that recruitment overfishing has occurred. The significant declines in juvenile white stumpnose abundance that occurred throughout the system over the period 2007-2020 suggested that the protection afforded by the Langebaan MPA has not been enough to sustain the fishery at the historical high effort levels. The last five seine net surveys have recently revealed some concerning declines in elf recruitment to surf zone nurseries, and it is recommended that this should also be carefully monitored in the future. Not a single elf was caught at any of the other 15 sites sampled during the 2022 survey. This is concerning as adults of this species are also caught by the recreational fishery. Declines in the abundance of gobies in Small Bay cannot be attributed to fishery impacts; however, maybe as a result of a reduction in water quality.

The evidence thus suggests that fishing pressure is having a severe effect on some adult fish populations in Small Bay and Big Bay, which affects juvenile abundance, and that there may be a decrease in habitat quality for juvenile fish in the area.

Several shark and ray species also occur in the Saldanha Bay area, including the smooth hound shark (*Mustelus mustelus*), which is resident in the Bay (da Silva 2018). The species utilises the Langebaan Lagoon as a nursery area and mainly occurs in Small Bay and Big Bay during the winter months (da Silva 2018).

In an attempt to understand the Saldanha Bay fishery, comparisons have been drawn from assessments on similar systems on the east coast of South Africa (Durban and Richards Bay harbours) (Pradervand *et al*. 2003; Beckley *et al*. 2008). The most notable contrast was that Saldanha Bay is considerably more productive (141.2 tons y^{-1}) than either of the east coast bays. By comparison, the total harvest of all species in Durban Bay was approximately 17 tons y^{-1} (Pradervand *et al*. 2003), and in Richards Bay 8.5 tons y^{-1}(Beckley *et al*. 2008). Furthermore, the observed CPUE for boat and shore angling in Saldanha Bay is approximately an order of magnitude higher than in either of these comparably sized systems (Pradervand *et al*. 2003; Beckley *et al*. 2008) but this is to be expected as regions of Durban and Richards Bay are closed to fishing. There is an ecological component related to the varying primary productivity of the east and west coasts, with the Benguela upwelling ecosystem on the west coast being one of the most productive marine ecosystems in the world (Shannon 1989). Saldanha Bay being warmer than the surrounding ocean facilitates a particularly productive system, and as compared with fish on the central Agulhas Bank, white stumpnose grow faster and mature earlier in Saldanha Bay (Attwood *et al*. 2010). The lower catches observed at two estuarine systems in KwaZulu-Natal Province cannot be ascribed to lower angling effort, however. Durban Bay had 22 232 shore-angler outings and 6 661 boat trips (Pradervand *et al*. 2003), as opposed to 4 144 and 4 220, respectively, in Saldanha Bay.

Megafauna

Several species of cetaceans are known to visit Saldanha Bay regularly. While there are seasonal peaks in their abundance, individuals are present in all months in the area. Humpback Whales (*Megaptera novaeangliae*) have been observed within Small Bay and Big Bay. Individuals utilise the waters of the southern Benguela for feeding and usually migrate past Saldanha Bay (Barendse *et al*. 2010). However, a supergroup comprising ~200 individuals was observed feeding in the mouth of the Bay in 2019 (Elwen 2020) Southern right whales (*Eubalaena australis*) have been observed in Outer Bay between Malgas, Jutten and Marcus Islands (Barendse and Best 2014). However, they have also been observed south of the iron ore jetty in spring are known to feed in this area in spring and summer (Elwen 2020). Dusky Dolphins (*Lagenorhynchus obscurus*) and Heaviside's Dolphins (*Cephalorhynchus heavisidii*) have on occasion been observed in Outer Bay along the outer edge of the Marcus Island causeway. They are likely to occur in Small Bay and Big Bay (Elwen *et al*. 2010). Killer Whales (*Orcinus orca*) has also been observed within Small Bay and Big Bay (Best and Meyer 2010).

Although the Cape Fur Seal (*Arctocephalus pusillus*) no longer breeds or regularly "hauls out" on the islands within Saldanha Bay, a breeding colony occurs south of the entrance to Saldanha Bay, on Vondeling Island (Anchor 2020a). The species is regularly observed in Small Bay and Big Bay's waters in all months of the year.
Coastal and marine seabirds occurring within the local area are discussed in detail in Section 6.1.14.3 above.

6.1.15.6 Local Ecosystems Services

Fisheries

There is a long history of fishing in Saldanha Bay and Langebaan Lagoon, with commercial exploitation beginning in the 1600s (Thompson 1913). Presently, there is a traditional net fishery that targets mullet (or harders) *Chelon richardsonii*, while white stumpnose *Rhabdosargus globiceps*, white steenbras *Lithognathus lithognathus*, silver kob *Argyrosomus inodorus*, elf *Pomatomus saltatrix*, steentjie *Spodyliosoma emarginatum*, yellowtail *Seriola lalandi*, and smooth hound shark *Mustelus mustelus* support large shore angling, as well as recreational and commercial boat line-fisheries. These fisheries contribute significantly to the tourism appeal and regional economy of Saldanha Bay and Langebaan.

The two most important species in the fisheries in Saldanha and Langebaan are white stumpnose that are caught by commercial and recreational line fishers, and harders that are commercially harvested by 15 gill net permit holders Average annual recreational shore-angler count was last estimated to be 12 525 anglers, of which 10 646 (87%) were recorded as actively targeting white stumpnose. Saldanha Bay is the second-most-popular shore angling area after Langebaan lagoon (Parker *et al.* 2017). 68% of the 1 415 recreational boats surveyed were recorded as targeting white stumpnose and 88% of the observed recreational boat catch was white stumpnose. Of the boat outings surveyed only 104 (7%) were commercial (Parker *et al.* 2017) of which vessels targeting white stumpnose accounted for only 3% of all (commercial and recreational) trips. Despite this, the few commercial vessels make a substantial difference to the total catch of white stumpnose. The total annual catch of white stumpnose by commercial line fishers was estimated at 15.7 tonnes for the 2010 -2020 period (DFFE unpublished data).

Assuming a selling price of R40/kg, the landed catch value of the commercial sector's catch of 39 tonnes is approximately R630 000; the value of the recreational fisheries in the region has not yet been quantified, but undoubtedly exceeds the landed catch value of the commercial fisheries. Commercial white stumpnose catch-per-unit-effort has declined considerably in the last 15 years (Parker *et al.* 2017), however recent data (2017-2020) has shown a substantial increase in CPUE (DFFE unpublished data). Whilst recruitment had previously crashed due to recruitment overfishing (too many fish being caught before they had a chance to spawn) recent seine net data suggest a relatively good recruitment to juvenile nursery habitats took place during the summer of 2020-21 (Anchor 2022). Within Big Bay, average harder and white stumpnose abundance observed during the 2022 sampling compared favourably to earlier surveys (Figure 6-21). White stumpnose abundance within Big Bay over the period 2015-2018 had recovered somewhat from the very low 2013 and 2014 results, crashed again in 2019 and then recovered slightly in 2020 to levels similar to the 2013-14 period (**Error! Reference source not found.**). Reduction in fishing effort during the Covid 19 pandemic seems to have allowed some white stumpnose to spawn successfully, evidenced by an increase in the numbers of new recruits in the bay in 2022 (Anchor 2022, unpublished data). This recovery is likely to be short-lived though unless levels of fishing mortality are reduced through the implementation of more conservative catch limits (reduced bag limits and increased minimum size limits). This Saldanha - Langebaan white stumpnose stock is still clearly under threat but has shown signs of recovery, however, more stringent catch control measures are required.

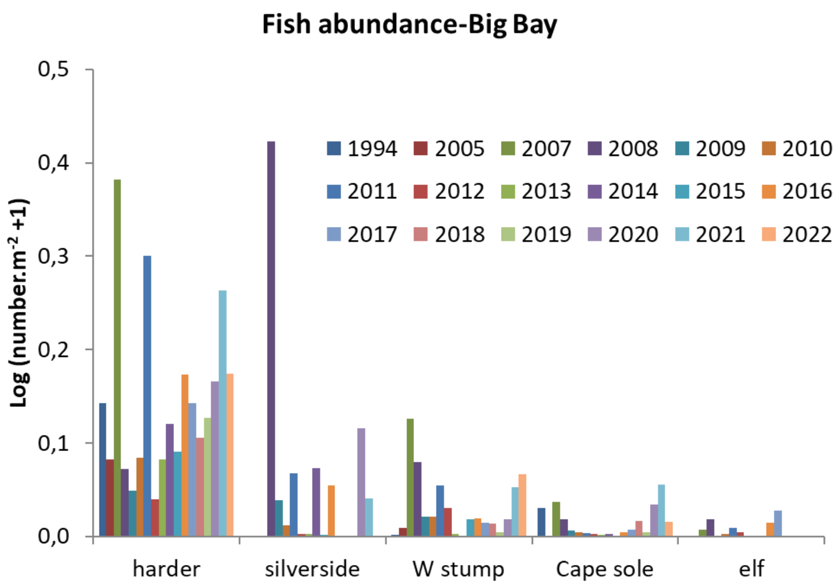


Figure 6-23: Abundance of the most common fish species recorded in annual seine-net surveys within Big Bay, Saldanha Bay (Anchor 2022).

Interpretation of the recruitment signal of exploited fish species would be greatly enhanced if there was ongoing monitoring of recreational catch and effort in the system. Only commercial line fishers are required to submit catch returns and as most of the white stumpnose and elf fishing effort is recreational, there is a substantial gap with respect to catch-per-unit-effort data for this sector. Such data would provide another direct line of evidence as to the status of exploited fish stocks in the Saldanha Bay-Langebaan lagoon system. The economic value of the recreational fishery in Saldanha-Langebaan should not be regarded as regionally insignificant as a lot of the expenditure associated with recreational angling is taking place within Langebaan and Saldanha itself.

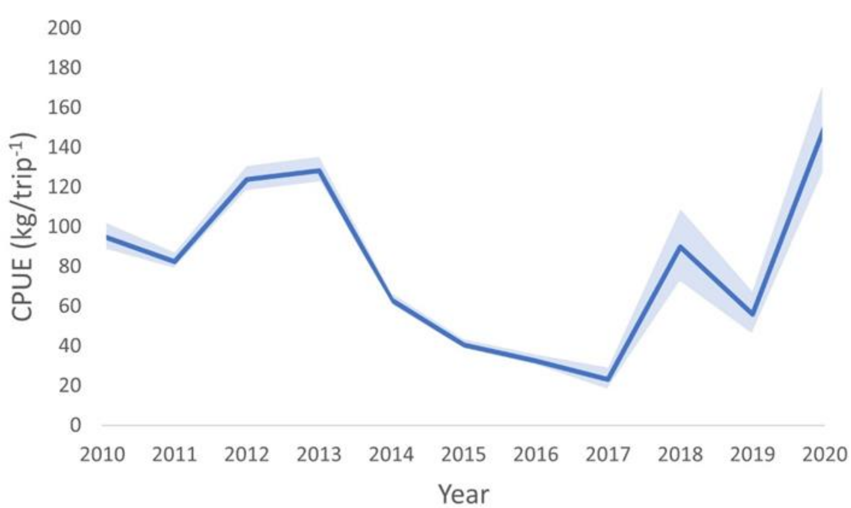
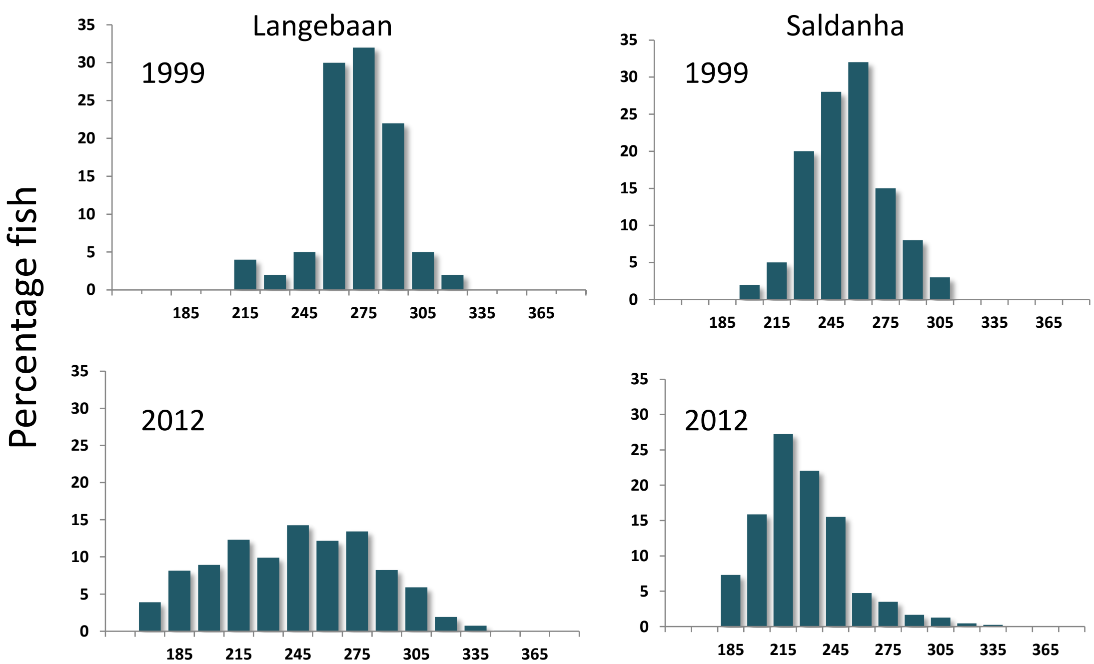


Figure 6-24: Annual Catch Per Unit Effort (CPUE) estimates (± 1 x Standard Error) of white stumpnose derived from commercial linefish catches (Data from DFFE 2022).

The commercial gill net fishery in Saldanha and Langebaan reports an average of approximately 20 tonnes per year with a landed catch value of around R 200 000 (DAFF, unpublished data). These fishers are considered to be the most active gill net fishers on the South African west coast, making an average of 4000 trips year^{-1} (Hutchings & Lamberth 2002).

The west coast net fishery is currently managed by a combination of Total Allowable Effort (TAE), gear restrictions and closed areas. The fishery is divided into 15 areas, each with regionally exclusive combinations of TAE and closed fishing areas. During the fishing year of 2017/2018, 27 beach seine and 162 gillnet permits have been allocated within these 15 areas. Specifically, Langebaan and Saldanha Bay are limited to 15 annual permits (DEFF 2018). In 2008, a new small-scale fisheries policy was created that brought in the production of interim relief (IR) permits. These are short-term permits allocated to small-scale fishers that are directed at their socio-economic needs, with an additional 3 interim relief concessions for the net fishery.

This stock also appears to be under pressure with a notable decline in the average size of harders landed in both Saldanha and Langebaan between 1999 and 2012 (Figure 6-24). These data show a substantial shift towards a smaller size class of harders being landed over the time period. This probably reflects increased fishing effort and "fishing down" (or reduction in numbers) of the larger size fish in the population due to the increase in the number of gill net rights allocated as part of the interim relief process. Healthy juvenile harder abundance was, however, still recorded in the recent State of the Bay surveys, which suggests that recruitment overfishing is not taking place (Clark *et al.* 2021). The observed shift towards a smaller size class of harders in catches does suggest though that growth overfishing is occurring and further increases in fishing pressure will probably lead to declines in overall yield (catch in terms of mass) from the fishery. Recent research suggests that the Saldanha bay harder stock is also overexploited with changes to management measures (increased mesh size, reduced fishing mortality) required to rebuild stocks (Horton *et al*. 2019).



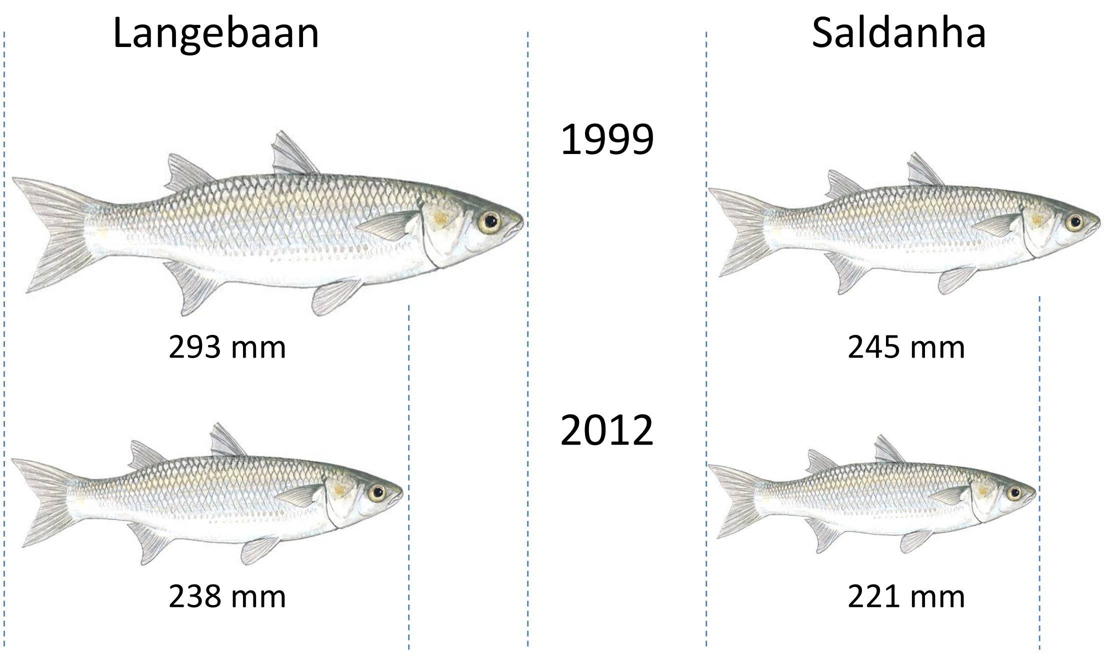


Figure 6-25: Evidence of a decline in the average size of harders *Chelon richardsonii* caught in the commercial gill net fishery in Saldanha Bay and Langebaan lagoon over the period 1999 to 2012. Source (S.J. Lamberth DAFF).

The reported annual catch of harders declined from around 130 tonnes per year over the period 2008-2012 to about 90 tonnes per year over the period 2013-2016, while effort remained fairly constant (Figure 6-24) ; Horton *et al*. 2019). Data on fishing effort in the last five years is lacking unfortunately.

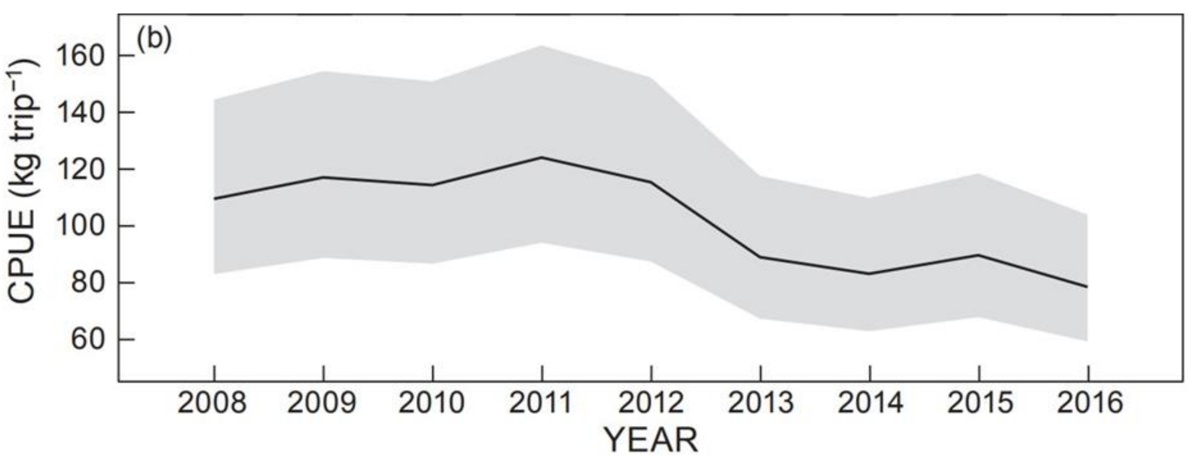


Figure 6-26: The standardised catch-per-unit-effort (CPUE) estimates for harders *Chelon richardsonii* (with 95% confidence intervals, grey area) derived from mandatory catch records kept between 2008 and 2016 (Source: Horton *et al* 2019).

Illegal gill net fishers also operate in Saldanha Bay/Langebaan Lagoon targeting linefish such as galjoen *Dichistius capensis*, kob, elf and hottentot as well as smooth hound sharks (Hutchings & Lamberth 2002). Both the legal and illegal fishers operate mostly at night and are active throughout the year. An estimated 400-500 illegal nets were being used annually (DAFF 2014).

A certain amount of small-scale/subsistence harvesting takes place in the Bay, particularly on the rocky shore areas close to the town of Saldanha. Small-scale fishing in South Africa has been considered to include various fishing methods targeting more than 30 species (Griffiths and Branch 1997) from a range of habitats (Branch *et al*. 2002, Clark *et al*. 2002). Although small-scale fisheries contribute less than 1% to South Africa's GDP, they play an important role in the provision of protein and employment for an estimated 136 coastal communities distributed along South Africa's 3 000 km coastline. The extent and spread of small-scale fishers covers the four provinces with coastlines, especially the Western Cape, where fishing has been an important source of protein among the coastal communities since the 1700s (Isaacs 2013). Small-scale fishers are found both in urban and rural coastal areas.

The Marine Living Resources Act, 18 of 1998 (MLRA), excluded small-scale and artisanal fishers who catch and sell fish to sustain livelihoods. In 2005, the government adopted long-term fishing policies that made no provision for small-scale fishers. South Africa's cabinet adopted a Small-Scale Fisheries Policy in June 2012, but implementation has not been fully realised due challenges in the ability to map and assess this pressure separately. The Small-Scale Fisheries Policy seeks to address imbalances of the past and ensure that small-scale fishers are accommodated and properly managed. For the first time, fishing rights will be allocated on a group, rather than an individual basis. The policy further aims to support investment in community entities to take joint responsibility for sustainably managing the fisheries resources and to address the depletion of critical fisheries stocks. In 2016, the former Department of Agriculture, Forestry, and Fisheries (DAFF) verified 8 488 individuals in fishing communities that had expressed interest in the Small-Scale Fishery sector. This was followed by the declaration of 2802 small-scale fishers. Several complaints regarding the justness and transparency of the process followed in the Western Cape were which has inhibited the implementation of the policy to date. In September 2022, the Minister of Forestry, Fisheries, and the Environment, Ms Barbara Creecy, announced that the process to verify and confirm small-scale fishers would be reopened.

The Small-Scale Fisheries Policy proposes that certain areas on the coast be prioritized and demarcated as small-scale fishing areas. 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 bask*et al*located 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).

<u>Mariculture</u>

Saldanha Bay is the only naturally sheltered embayment in the country and is considered a significant mariculture development area (Stenton-Dozey et . 2001). In January 2018 the then Department of Agriculture, Forestry and Fisheries (DAFF) was granted Environmental Authorisation to establish a sea-based Aquaculture Development Zone (ADZ) in Saldanha Bay and expand the total area available for aquaculture in the Bay to a maximum area of 884 ha from 464 ha allocated area, which is located within four precincts (Small Bay, Big Bay, Outer Bay North and Outer Bay South) (Figure 6-25). In 2018, it was reported that of the new established area, 151 ha was being actively farmed. More recently, as of July 2022, 30 entities have been granted marine aquaculture rights in the ADZ in terms of section 18 of the Marine Living Resources Act of 1998 (MLRA). Twenty-five of these right holders are currently operational, with two of these entities having more than one right allocated to them. The area of the ADZ actively being utilised is changing as new leases are being granted, new farms start, current lease holders expand their areas, or alternatively shrink in size, based on economic factors (Dawson *et al*. 2022).

Most established operators hold rights to farm mussels (*M. galloprovincialis* and *Choromytilus meridionalis*) and the pacific oyster *Crassostrea gigas*, while finfish rights (*Salmo salar* and *Oncorhynchus mykiss*) have only been issued to two farms since 2014. Abalone, scallops, red bait and seaweed are currently not cultured on any of these farms, although some of the farms have the right to do so (Refer to the 2014 and 2015 State of Saldanha Bay and Langebaan Lagoon Reports for details on individual farms). Most of the farming occurs in Small Bay, however, operations have expanded in Big Bay to include oysters and mussels, and mussels are being grown on lines in Outer Bay North.

Overall, the drive is to farm indigenous species as they do not require comprehensive risk assessments and are likely to have a lower impact on the marine ecology of Saldanha Bay and Langebaan Lagoon. However, in some cases indigenous species may be economically less viable. The Branch Fisheries Management therefore included alien trout species in their application for EA. Consequently, the Environmental Authorisation issued to for the ADZ includes the following alien finfish:

- Atlantic salmon (*S. salar*);
- Coho salmon (*O. kisutch*);
- King/Chinook salmon (*Oncorhynchus tshawytscha*);
- Rainbow trout (*O. mykiss*); and
- Brown trout (*Salmo trutta*).

Biodiversity Risk and Benefit Assessments have been conducted for all five salmon and trout species and generally the risk for establishment of this species is considered low due to the fact that these species will be farmed in the sea, and rivers in this region are not suitable for successful reproduction of salmonids. Arguably the greatest risk of salmonid cage culture is the transfer of diseases and parasites to indigenous fish species.

Other new indigenous species include Abalone (*Haliotis midae*), South African scallop (*Pecten sulcicostatus*), white stumpnose (*Rhabdosargus globiceps*), kabeljou or kob (*Argyrosomus inodorus*) and yellow tail (*Seriola lalandi*).

The following production methods are considered most viable for farming in the ADZ:

- Longlines for bivalve culture, comprising of a surface rope with floats and moored. The production ropes for mussels and ouster racks are then suspended from the surface
- Rafts for bivalve culture, comprising of a floating top structure moored to the seabed from, which mussel ropes are suspended
- Cages for finfish production, constructed of circular, flexible, high-density polyethylene with multi-mooring systems
- Barrel culture for abalone, deployed from raft and longlines

Raft culture of mussels has taken place in Saldanha Bay since 1985 (Stenton-Dozey *et al***.** 2001). Larvae of the mussels *M. galloprovincialis* and *C. meridionalis* attach themselves to ropes hanging from rafts and are harvested when mature. Mussels are graded, washed and harvested on board a boat. In 2015, the mussel sub-sector (based in Saldanha Bay) contributed 48.83% to the total mariculture production and was the highest contributor to the overall mariculture productivity for the country (DAFF 2016). Mussel production was fairly consistent between 2007 and 2011, after which it showed a steady increase, more than tripling from 2012 to 2019 when it peaked at 3 053 tonnes (Figure 6-25). In 2020, mussel production dropped by roughly 25% to 2276 tonnes, it is possible that the COVID-19 pandemic influenced the production, as the highest production values on record were reported in 2021 (3 459 tonnes). Oyster production has fluctuated around 250 tonnes per annum since 2000. Oyster production reached a peak in 2016 at 357 tonnes per annum before decreasing to 260 tonnes in 2019, 2021 production values increased slightly as 306 tonnes of Oysters were produced (Figure 6-27).

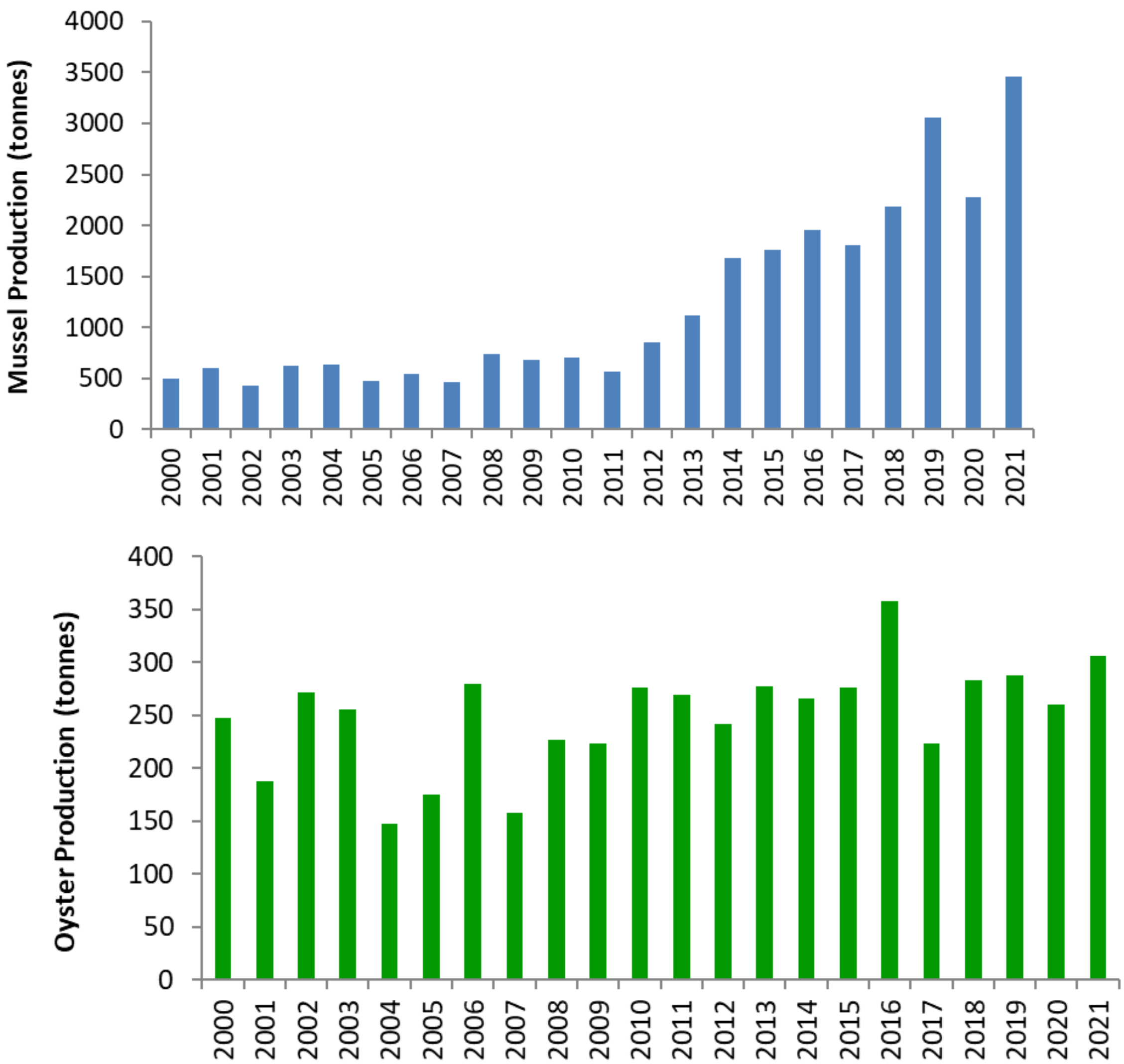


Figure 6-27: Annual mussel (top) and oyster (bottom) production (tonnes) in Saldanha Bay between 2000 and 2021 (source: Department of Forestry, Fisheries and the Environment 2022 unpublished data, which may be subject to change). Data represent production from January to December of each year.

A recent study by Olivier *et al.* (2013) investigated the ecological carrying capacity of Saldanha Bay with regards to bivalve (in particular mussels and oysters) farming. The findings indicate that the sector could increase 10 to 28-fold, potentially creating an additional 940 to 2 500 jobs for the region without compromising the environment.

Saldanha Bay is protected when compared to the exposed west coast of South Africa and has been identified as one of very few areas where finfish cages can be installed successfully (Ecosense CC 2017). Finfish cage culture has been pioneered in Saldanha Bay and was largely focused on the farming of salmonid species, including Atlantic salmon (*S. salar*) and rainbow trout (*O. mykiss*). Both species are non-native to South Africa; however, O. mykiss is farmed in many parts of the country in ponds and raceways but this has been severely impacted by the drought and is limited in terms of seasonality of rain and temperatures.

Molapong Aquaculture (Pty) Ltd (Molapong) piloted under 50 tonnes of finfish per annum in Big Bay within Saldanha Bay. This experimental phase was successful and Molapong appointed Ecosense CC to conduct a Basic Assessment process to obtain Environmental Authorisation for the phased installation of sea cages on 40 ha in Big Bay and 15 ha near Jutten Island for the production of finfish, mussels and seaweed in Saldanha Bay up to a total of 2000 tonnes per year over both lease areas. Environmental Authorisation was issued on 8 January 2018. The pilot phase within the bay was recently concluded and all finfish cages removed from the bay. Therefore, there is presently not active finfish mariculture in the Saldanha Bay ADZ and none planned for the foreseeable future. This is likely due to the fact that it has been determined that the majority of the sea floor below the designated Finfish area is covered by reef (~79.9%) suggesting that development of the finfish area within Big Bay is not advised. Southern Cross Salmon Farming (Pty) Ltd was also issued with an Environmental Authorisation on 8 January 2018 for the production of shellfish in the Outer Bay North Site (20 ha) to total production not exceeding 2 500 tonnes (graded) on long line. Furthermore, permission was granted to produce 1 000 tonnes of marine finfish per annum on 10 ha (at full production) within the Outer Bay South site by means of floating cages. Southern Cross Salmon Farming (Pty) Ltd is permitted to farm the same species that were authorised for the Aquaculture Development Zone. Southern Cross Salmon Farming has been focusing on the mussel production and have been farming mussels for roughly 2.5 years at the Outer Bay North Site, however, they have not yet commenced with finfish farming and given the constraints associated with COVID-19 are not likely to start in the foreseeable future (Barend Stander, *pers. comm.* 2020).

In June 2022, the final report of a Pre-feasibility study investigating the potential for commercial kelp cultivation along the West Coast was published (CSIR 2022). The project, which was a collaborative effort between the aquaculture industry, government, research institutions and academic institutions, aimed to review and summarise available biological, environmental, and economic information on kelp culturing and to set up facilities for conducting pilot experiments on kelp seeding. This, to investigate the available sea space, financial viability and appetite of the industry for such an enterprise, and to determine if it would be worthwhile to proceed to the feasibility study stage.

The project focused on three west coast kelp species, sea bamboo *Ecklonia maxima*, bladder kelp *Macrocystis pyrifera* and split fan kelp *Laminaria pallida*. Given that South Africa already has an existing industry for kelp, based on the harvesting of natural populations and the collection of drift kelp washed up on the shoreline, it was determined that the successful commercial cultivation of these three kelp species would provide access to the global market.

Research showed that kelp cultivation is possible at ten offshore areas, and inshore areas in the Saldanha Bay ADZ. A rope raft for the cultivation of kelp in the ADZ was designed and a pilot experiment will be run in the bay whereby this raft will be seeded using Sporophytes produced during laboratory trails (conditional on the receipt of further funding). An additional, potentially viable, option included the installation of 4 ha of kelp longlines within the bay, to be harvested twice annually. Overall, it has been recommended that investigations proceed to the techno-economic feasibility stage to facilitate the collection of further data and information to support a decision to invest in Kelp production mariculture.

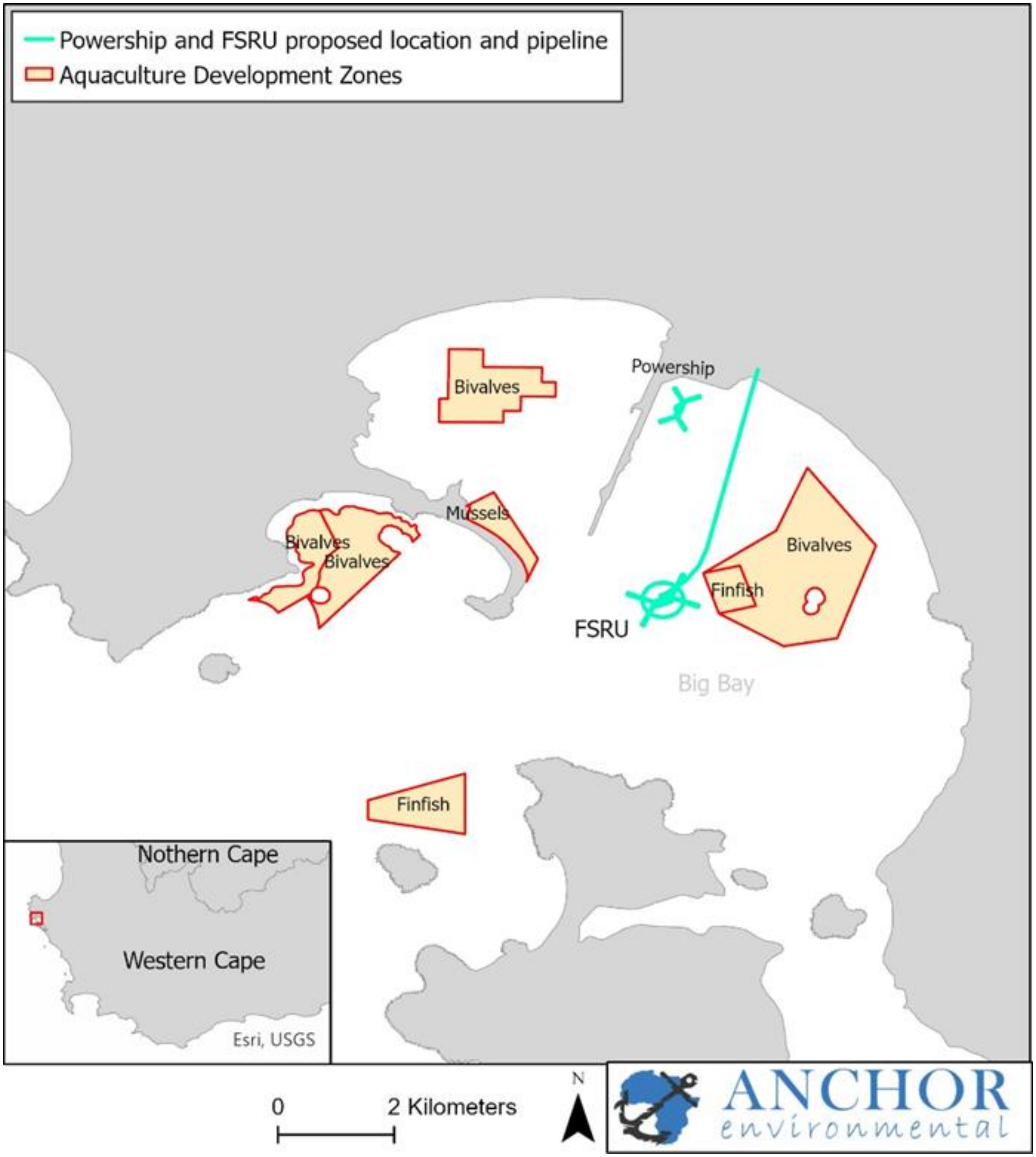


Figure 6-28: Aquaculture Development Zones within Saldanha Bay with cultured animals labelled. Powership and FSRU locations overlaid**.**

6.2 HERITAGE AND ARCHAELOGY

6.2.1 Heritage

Numerous surveys have been undertaken in the Saldanha Bay IDZ and surrounding area (Kaplan 1994, 1996, 1997, 1998). The majority of the resources comprise isolated tools, and occasionally dispersed (i.e. low density) scatters of Early Stone Age and Middle Stone Age tools (of low archaeological significance), mostly always in a highly transformed and degraded context (see also Kaplan 2006, 2010; Hart 2003; Hart & Pether 2008). Occasionally, Later Stone Age remains have also been recorded (Kaplan 2007a, b).

Exceptions are at Hoedjiespunt and Sea Harvest directly at the coast, where Middle Pleistocene archaeological occurrences and the recovery of human remains in the Langebaan Formation deposits has provided some of the earliest evidence in the world for the human exploitation of coastal resources, more than 100 000 years ago (Grine & Klein 1993; Volman 1978). Beside evidence of well-preserved bone, ostrich eggshell, ochre and MSA stone implements, the Hoedjiespunt limestone sediments in Saldanha Bay also contains evidence of early modern human about 125 000 years ago (Berger & Parkington 1995).

6.2.2 Palaeontology

6.2.2.1 Surface Geology

The hard granites form the hills such as around Darling, Saldanha and Vredenburg. Beneath much of the coastal plain the softer shale bedrock of the Malmesbury Group has been eroded away by ancient rivers to well below sea level and is buried beneath the sediments of the Sandveld Group (Hendey & Dingle, 1990). These sediments are of later Cenozoic age, deposited during the Neogene and Quaternary periods, i.e. during the last 23 million years.

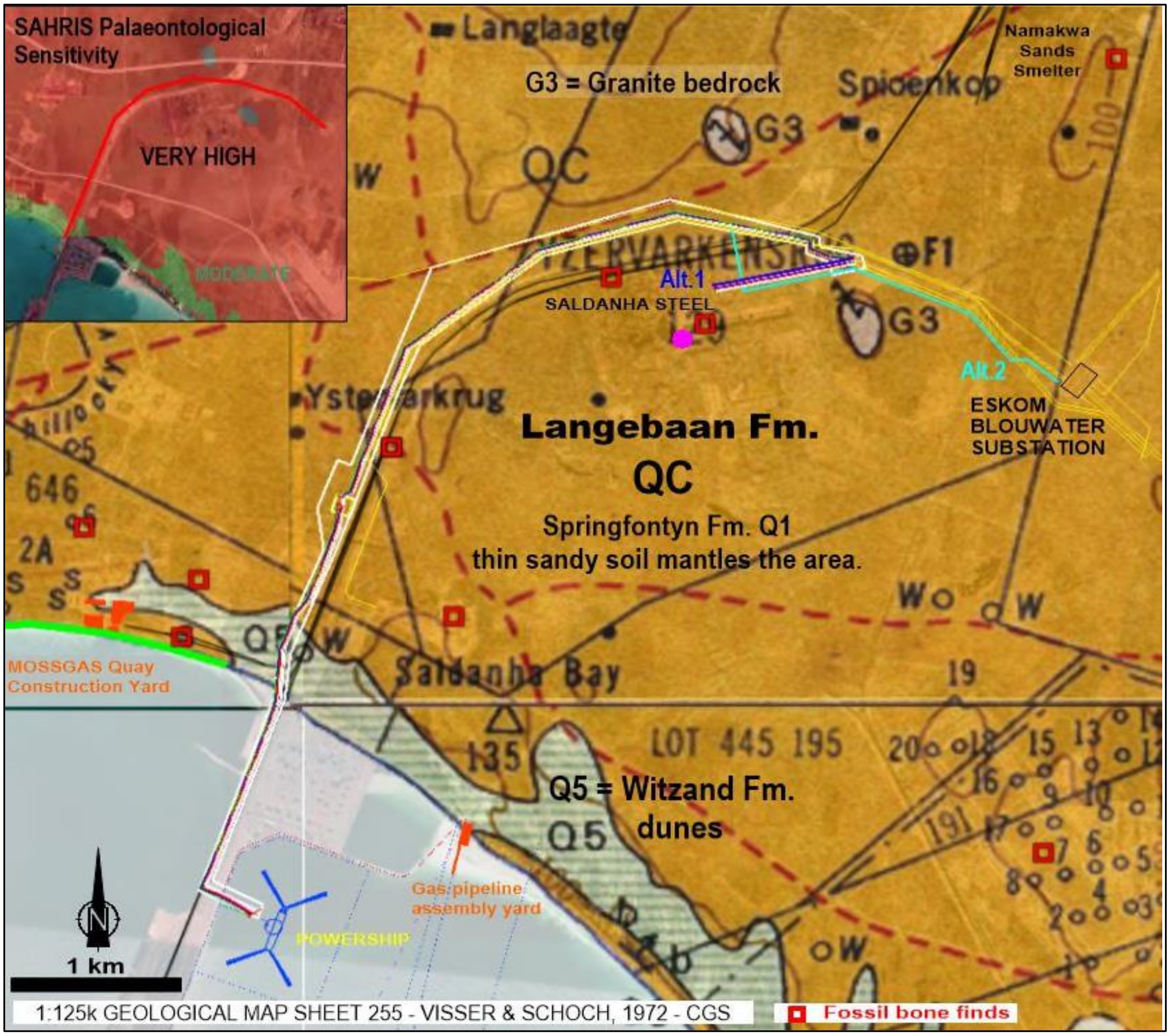


Figure 6-29: Surface Geology

6.2.2.2 Marine Fossils in the Velddrif formation

The shell fossil content of the Quaternary Velddrif Formation is essentially comprised of modern species that inhabit the West Coast today. In the lengthy time span between ~3 Ma and 0.4 Ma the open-coast warm-water fauna disappeared and many species became extinct as the modern Benguela upwelling regime became established, or evolved into our new endemic species.

6.2.2.3 Fossils in the Aeolin formation

In aeolianites such as the Langebaan Fm. the fossil material most commonly seen is the ambient fossil content of dune sands: land snails, tortoise shells and mole bones. The interdune areas between dune ridges may host deposits associated with small springs/seeps and marshy vleis which are richly fossiliferous, including fossil plant material, aquatic snails and frogs. The most spectacular bone concentrations found in aeolianites are due to the bone-collecting behaviour of hyaenas which store bones in and around their lairs.

6.2.3 Maritime Underwater Cultural Heritage (MUCH)

6.2.3.1 Bathymetry

The bathymetry of the Impact Zone has a maximum chart depth of 6.9 m Below Sea Level (BSL) sloping inshore to a depth of 1.5 m BSL. There are no indicated reef s or rocky areas, although the Roman Bank is to the east of the survey area (Figure 6-30).

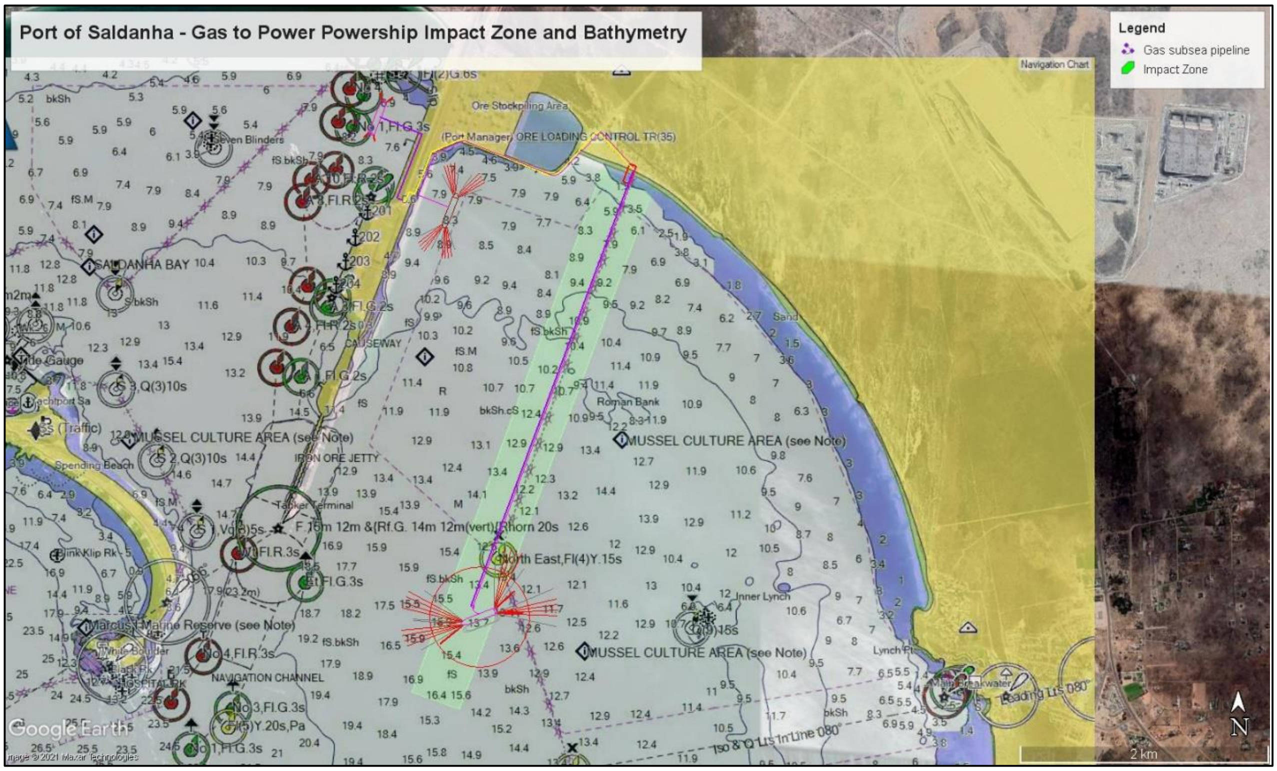


Figure 6-30: Bathymetry of the Impact Zone (Garmin BlueCharts: 2018)

6.2.3.2 Waves, wind and sediment

Although the wave heights are small, compared to coastal areas outside the protection of the Bay, the Big Bay area has high turbidity due to strong wind conditions. Currents, caused by predominant south-westerly winds in summer move in a strong anti-clockwise direction, and in winter the north-westerly winds cause the currents to move in a clockwise direction. The seabed has a high mud content mixed with some sand. The above information informs on the possible state of underwater cultural resources.

The Big Bay area is a “closed” environment. The current circulation reverses seasonally, and the wave action is insufficient to wash objects out to sea. The mud content of the seabed will tend to bury objects. From this certain assumptions can be made:

- Cultural resource material will likely be buried relatively rapidly
- Cultural resource material may be hard to discern as it is buried
- If cultural resources are uncovered during construction, they could be in good condition due to being buried in an anaerobic environment

6.2.3.3 Shipwreck database

The shipwreck database highlights the quantities of wrecks that may be in the area. Some of the wrecks, particularly from the early 19th century, are easier to allocate to a specific area within the bay as there was an official maritime presence in the area by then. Before the first settlers, the accounts of wrecks were often passed along by word of mouth and the information becomes less reliable. Additionally, it seems that the bay was used for decades with little archival presence, particularly by the French, therefore it is entirely possible there are unknown wrecks.

There are 46 wrecks, in various databases, in the Saldanha Bay area. Thirty-three were given a zero probability, as their locations were able to be narrowed down to specific sites. Twelve wrecks that have a possibility, albeit unlikely, of being uncovered during construction. Of these twelve wrecks, the Petronella Alida of 1738, would be of high significance, due to its age and the insights it could offer on VOC ship building.

6.3 Landscape and Visual

6.3.1.1 Landscape Character

Landscape Character is a composite of a number of influencing factors including;

- Landform and drainage
- Nature and density of development
- Vegetation patterns

6.3.1.2 Landform and Drainage

The study area is comprised of the west coast coastal plain. It is generally flat with limited undulations and ridgelines. The landform rises relatively rapidly from the coastline to 60 - 70m amsl which is maintained to the foot of more mountainous area approximately 70km inland.

The elevation does rise to approximately 150m amsl in the north around the town of Vredenburg and to the south of Langebaan. The Berg River is the main drainage feature located towards the north of the study area. This river has cut a broad valley through the landform reducing levels in the vicinity of the river channel to below 10m amsl.

The extent of open, relatively flat land surrounding the proposed development could mean that the proposed development may be visible over an extensive area.

6.3.1.3 Nature and Density of the Development

Built development within the study area can be divided into the following:

- Urban development including the towns of Langebaan, Saldanha and Vredenburg. These are relatively small towns with reasonably good infrastructure. Views of the broader landscape are probably only possible from the edges of urban development areas.
- Agricultural development in the study area is largely comprised of pasture for livestock production. This results in an open landscape within which the main elements that are likely to influence visibility of the proposed power line are the minor ridgelines located within the vicinity. Isolated farmsteads are located around the maize/wheat fields that include farmhouses, workers accommodation, storage and farm working

areas. The farm houses and accommodation areas are often surrounded by trees that were possibly planted as wind breaks as well as for ornamental reasons.

- Industrial Development including oil storage, paper production and steel production have all been attracted to the area around the port of Saldanha Bay. The necessary infrastructure to supply power and support these heavy industries is also evident throughout the landscape.
- The water space within Saldanha Bay which is a major national port. Its main functions include that of a base for the South African Navy as well as being a major industrial port. The port is particularly important for the export of iron ore as it is linked directly to inland mines by rail link. It is also becoming increasingly important for offshore oil exploration. Specialist drilling ships and rigs are not unusual in the port. As with all South African Ports, whilst shipping operations are the prime function, it is also important for coastal recreation / tourism, aquaculture and bio-diversity.

Coastal areas to the west of the study area are also developed as tourist destinations. Mykonos, Langebaan and areas to the south particularly around the lagoon are tourism areas of possible national importance. Two major conservation areas are located to the south east of the study area, these include:

- The West Coast National Park which is a formally protected area, and
- The Saldanha Nature Reserve which is a provincial nature reserve. These areas are largely covered with natural Fynbos which produces a very open landscape.

6.3.1.4 Vegetation Patterns

The natural vegetation cover type of the region is dominated by shrubland and low fynbos, homogenous in appearance and is typical of the arid Karoo biome. The natural vegetation of the area is generally not a limiting factor in terms of views and visibility.

6.4 SOCIO-ECONOMIC AND TOURISM CONDITIONS

6.4.1 Socio-Economic

The WCDM is situated in the Western Cape, and accounts for only 6.6% of the population, and is one of the three smallest municipalities in the Western Cape with the second lowest population densities (Urban-Econ, 2021b). Table indicates that the WCDM has a higher average than the national average – although by a very small margin – and is significantly lower than the rest of the Western Cape's. **Error! Reference source not found.** also provides a summary of key information on the primary, secondary, and tertiary areas of study:

Table 6-8: Overview of the primary, secondary, and tertiary study areas population structure

Indicator	WCDM	Western Cape	South Africa
Area (km^2)	31,119	129,462	1,220,813
Population	453,734	6,844,272	58,775,022
Number of Households	122,074	1,900,345	16,366,369
Population density (km^2)	14.6	52.9	48.1
Average household size	3.7	3.6	3.6
Annual population growth (2009-2019)	2.1%	2.1%	1.5%
Average monthly household income (2011)	R14,490	R19,750	R14,348

Source: (Urban-Econ, 2021b).

From **Error! Reference source not found.** it can be seen that the average monthly income in the WCDM is marginally higher than that of the national average, however it is significantly lower than that of the Western Cape. This indicates that while there are somewhat higher living standards than the national average, the standard of living is less favourable. It is important to note that is still an issue in the area with a poverty headcount of 2%, although the poverty headcount was still lower than that of the Western Cape (3.6%), the intensity of poverty is higher at 44.5% compared to 40.1% (StatsSA, 2016).

Table 6-9: Impact areas monthly household income

Indicator	Value	Page number
WCDM monthly household income	R15 937.98	27
Western Cape monthly household income	R21 723.62	27
South Africa average monthly household income	R15 094.16	27

Turning to the provision of basic services, the provision of water within the WCDM is higher than that of the Western Cape, and South Africa, however all other services fall behind the rest of the Western Cape, but are comparable to national average, or are better. This does indicate that there is scope for increased electrification in the district when compared to the rest of the Western Cape, alluding to the possible benefits of an expansion of the local electricity industry.

Table 6-10: Access to minimum basic services in 2019

Area	Total Number of Households	Percentage of Households with access to:			
		Water[6]	Electricity[7]	Sanitation[8]	Refuse Removal[9]
WCDM	122,074	98.3%	84.9%	87.2%	78.7%
Western Cape	1,900,345	96.6%	93.1%	90.1%	91.0%
South Africa	16,366,369	85.6%	84.9%	63.5%	64.9%

Source: (Urban-Econ, 2021b).

The employment characteristics of the WCDM are more favourable than that of the rest of the Western Cape, and South Africa, with the unemployment rate being just over half the Western Capes. These dynamics are also reflected in the labour force participation rate, which is marginally higher than the Western Cape, and higher than the national rate. The employment rates, and labour force participation rates suggest there are employment opportunities within the WCDM.

Table 6-11: Employment profile of the area - 2020

Indicator	WCDM	Western Cape	South Africa
Employed	172 910	2 308 500	15 061 500
Unemployment Rate	11.65%	20.4%	28.8%
Not Economically Active	121 573	1 834 000	15,516,188
Labour force participation rate	61.68%	61.3%	54.6%

Source: (StatsSA, 2020, 2021; Wesgro, 2021)

The level of educational attainment in the areas of impact is a significant determinant of the growth potential of an area, but also gives an indication of the local skill level which will help inform how many unskilled, semi-skilled, and skilled workers will be drawn from which areas. The full employment values of the project are explored later in this report. Based on the education levels of the WCDM it can be seen that skills levels are lower than that of the Western Cape, and country, as reflected by a tertiary education rate (7%) which is just over half that of the Western Cape (13.6%), and a matric education (22.7%) rate roughly 5 percentage points lower than that of the Western Cape (27.1%) and South Africa (27.9%). This indicates that the majority of workers in the WCDM likely are low- or semi-skilled, especially considering that close to 40% of the WCDM has not completed matric.

Table 6-12: Level of educational attainment in study areas in 2019

	WCDM	**Western Cape**	**South Africa**
No schooling	5.8%	3.3%	9.0%
Some Primary	17.0%	11.2%	12.3%
Completed Primary	8.5%	5.9%	4.7%
Some Secondary	38.9%	38.9%	34.2%
Matric	22.7%	27.1%	27.9%
Tertiary	7.0%	13.6%	12.0%

Source: (Urban-Econ, 2021b).

Turing to gross value added (GVA) in the impact areas, it can be seen that the WCDM grew by 18.18% over 10 years, which is marginally less than that of the Western Cape (18.56%), but higher than that of South Africa (16.71%). These values indicate that the WCDM is an important part of the Western Cape economy, however it is a small contributor to it as it constitutes only 4.8% of the Western Cape's total GVA.

Table 6-13: Gross value add of the Primary, Secondary, and Tertiary Impact Areas (Billions of Rands)

Indicator	WCDM	Western Cape	South Africa	Page number
Total GVA - 2009	R28.841	R596.668	R4 369.557	26
Total GVA - 2019	R34.610	R718.705	R5 166.316	26
Growth over 10 years	18.18%	18.56%	16.71%	26

Source: (Urban-Econ, 2021b).

The land use profile of the immediate area surrounding the Powership is dominated by the Port of Saldanha, which is the main hub for economic activity in the area, contributing to economic growth in both the immediate area and in neighbouring towns and nodes (Urban Dynamics, 2020). The area is considered a key growth node for unlocking manufacturing and trade opportunities for surrounding areas, with the Saldanha Bay Industrial Development Zone (SBIDZ) being registered as a Special Economic Zone (SEZ) in 2013, and catering specifically to the oil, gas, and maritime fabrication and repair industries, and is expected to be developed over the next 10 to 20 years (Saldanha Bay Industrial Development Zone, 2022).

<u>Fisherman and Mariculture</u>

The potential socio-economic impacts of the proposed project on the fisheries and mariculture sector are of importance given that the fisheries sector supports a large number of small-scale fishers in the area whose livelihood depends on continuing availability of near shore fish stocks. Further, the mariculture industry provides additional employment opportunities in the area, and provides important export income to the country as the sector supplies both the domestic and international market. This industry also provides indigenous peoples access to employment, which is supportive of their cultural and spiritual needs, as access to the sea has been outlined by local traditional leaders as being of cultural and spiritual importance

It is crucial to understand that no fishing is permitted within the port area. As an active port and industrial zone, Transnet National Port Authority (TNPA) does not grant access for fishing. DFFE have also confirmed that there are no registered small scale fishing cooperative associated within the port.

Small Scale Fishers

Saldanha Bay supports a strong small-scale fishers' industry that spans several communities in surrounding areas, which provides income, food, and cultural significance to these communities. Any negative impacts to the sector due to the proposed project could have significant socio-economic impacts. To understand how the proposed project may result in socio-economic impacts the Fisheries and Mariculture report by Lwandle and Anchor Environmental Consultants was referenced to unpack the marine impacts, while to understand the positions and concerns of small-scales fishers the engagements undertaken by Steenkamp and Rezaei from Afro Development Planning's resulting Stakeholder Engagement Report are referenced.

It is noted that the specialists from Afro Development Planning conducting the Socio-Economic Assessment for Saldanha Bay did not undertake a dedicated stakeholder engagement with the small-scale fishers. It was concluded that the scope of engagements undertaken by Steenkamp and Rezaei sufficiently covered the questions which the socio-economic team from Afro Development Planning had, and would reduce the engagement fatigue experienced by local stakeholders. As such it was decided that holding separate engagements on socio-economic impacts when an engagement had been held by the stakeholder engagement team would not be fruitful, especially considering that the same questions and topics would be raised with the stakeholders.

During the stakeholder engagements the following negative impacts of the Powership were raised:

- Changes to the water temperature could impact marine species, and mariculture
- Increased water temperatures could lead to oxygen level changes, and algae blooms which could negatively impact muscle growth.

The impact on water temperatures from the discharge of cooling water from the Powership will be isolated to the project site, with the ZID not extending more than 100m. This is more than a kilometre away from the closest edge of the ADZ, and as such there will be no impact on the bivalve mariculture. Thus, there are not expected to be any negative socio-economic impacts related to mariculture industry from the Powership.

It is also important to note that the previous socio-economic impact assessment received comments from small-scale fishers, as to the possible impacts which the project could have, and specifically noted the following:

- Small-scale fishers utilise small boats which cannot go fishing more than 5 miles (8km) from launch sites.
- White stumpnose are an important species for small-scale fishers, and the port is used as a breeding ground.
- Negative impacts which reduce small-scale fishers' incomes will leave families and communities stranded without an alternate income source.

Small-scale fishers have a much smaller range than commercial fishing operations, and Saldanha Bay provides an important, and safe, fishing area for these fishers. Hence there are obvious concerns about the exclusion zones around the Powership and FSRU which might reduce small-scale fishers range and thus livelihood opportunities. It is firstly important to note that all fishing activities raised during the stakeholder engagement were located outside of the Port, none were identified in the project area, and small-scale fishing cooperatives are not registered to fish in the Port as it is an industrial zone, with the majority of fishing identified as taking place in the lagoon and along the coastline (Steenkamp & Rezaei, 2022). Thus, the designated project site will not directly interfere with small-scale fishers by taking up the area where they can fish.

Secondly, the Powership will not indirectly reduce the small-scale fishers range as it is moored adjacent to the iron ore terminal, and thus not in the path of fishing from any of the harbours or boat launch sites in Saldanha Bay. The FSRU has an 800m exclusion zone surrounding it for safety reasons, which will result in small-scale fishers needing to take alternate routes which may have previously transversed the zone. The placement of the FSRU has been situated in such a manner not to interfere with the passage of vessels entering the Saldanha Port, and as such the alternate routes which small-scale fishers would need to take will require relatively small adjustments to course, and thus not meaningfully impact their range. Therefore the Powership and FSRU are not expected to reduce the effective range of small-scale fishers in a manner which will reduce their catch rates, and thus there are no negative socio-economic impacts which will arise from this.

Finally, regarding the breeding of white stumpnose, it is noted that the only area where these fish may be impacted is within the 300m of the Powership, where the increased noise may cause juveniles which utilise the area as a nursery to move further away from it. It is important to note that the white stumpnose stock is overexploited in the area and already under pressure, and that juveniles displaced from the Powership site could enter more heavily fished areas (Lwandle & Anchor Environmental Consultants, 2022). This is not expected to have a significant impact on the wider white stumpnose stock, however it was noted that more investigation into the Powership site is needed to establish if the project site is a nursery area. If it is identified to be one, then adequate mitigation measures will be put in place (Lwandle & Anchor Environmental Consultants, 2022). Thus, due to the localised nature of the impact, and the findings of Fisheries and Mariculture specialist there will not be a wider negative impact on the white stumpnose stock beyond a 300m zone around the Powership (Lwandle & Anchor Environmental Consultants, 2022), and therefore no negative socio-economic impacts are anticipated.

The negative socio-economic impact of the Powership and FSRU on small-scale fishers have been an area of contention since NERSA granted Karpowership SA its generating licence, however it is important to highlight the expected positive socio-economic impacts related to the small-scale fishers and the mariculture industry given the economic development projects outlined by Karpowership (in its Economic Development plan). One of the central issues raised during the stakeholder engagement undertaken by Steenkamp and Rezaei (2022) was the need for skills development, support for small and medium businesses, supporting local sports and recreation activities, and job creation opportunities, issues which were reflected in the comments received by Urban-Econ (2021b) in the initial Socio-economic Impact Assessment. As noted in section **Error! Reference source not found.**, unemployment, limited educational attainment and skills development, and poverty are issues which the local communities experience, and are issues which Karpowership SA (2022) has identified as a part of their economic development plan for the area.

From Section **Error! Reference source not found. Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.** it is clear that there are a number of positive socio-economic impacts which will be derived from the project for under privileged communities in SBM. The projects categorised under Student Skills Development are of particular interest given that they will improve skills levels in areas which are relevant to the industries present or being further developed in Saldanha, and as such will both contribute to increasing the level of local employment for future projects and development of the SBIDZ, increasing the areas attractiveness for further investments. This is what Levy (2014) describes as developing islands of efficiency, areas where collaboration between local stakeholders and industry, improved infrastructure, and workforce skilled towards particular industries increases both the productivity of an area, but also its attractiveness to investors.

Secondly, providing youth with skills training which are in demand in their community reduces the need for them to leave their communities to find employment. From a social perspective, this reduces youth migration from rural, and peri-urban areas to cities in search of work, reducing the breakup of communities, and providing youth with a support structure while they are trying to establish themselves in the workplace. Economically this provides significant advantages as it reduces transport, accommodation, and food costs for the youth, as well as the cost of transferring remittance to their families. Local employment will further increase the local multiplier effect of employment, as consumption spending will be undertaken within the local community, ultimately leading to increased local employment.

Finally, the Environmental Sustainability project will increase the amount of unskilled and low skilled labour in the area, increasing household incomes in local communities, and improve the ability for the SBM to adapt to the impacts of climate change. Coastal regions are expected to be significantly impacted by climate change due to rising sea levels, and increased storm intensity, which in turn increases coastal soil erosion which can be combated through nature-based solutions such as the planting of indigenous plants. This project will also further enhance the interests of indigenous peoples in the area, as comments from the traditional leaders of the Gorachouqua Kai Bi'a Council indicated that their main interests lie in the rehabilitation of the environment (Steenkamp & Rezaei, 2022). It is recommended that the programme be expanded to investigate the planting of mangroves and seagrass in areas where it is ecologically appropriate. These measures will further protect local coastal areas from storm surges driven by rising sea levels due to climate change, protecting coastal infrastructure, and reducing coastal erosion.

In addition to the Socio-economic Development Programme's contribution to local skills development, a dedicated Skills Development Programme will be implemented during the operations phase of the project. This will be allocated a budget of R27.7 million over the 20 years, at approximately R1.4 million per annum (Karpowership SA, 2022). The intention of this programme is for positions which are initially filled by foreign personal to be filled by South Africans who are trained through the skills development programme. School leavers and graduates will be supported through bursaries, and internships. Powership internal staff, and community members will be provided with learnership or apprenticeship opportunities, and informal and work-integrated learning. This will provide the same benefits outlined above regarding to locally relevant skills, and continue to develop the skills base in a manner which is relevant to the local industrial development plans, and increase the level of localisation of the project.

Limited employment opportunities, and lack of alternative sources of income were identified as key issues within communities in the SBM, especially among small-scale fishers. As such the set of projects outlined in **Error! Reference source not found.** will provide positive socio-economic impacts which will help to diversify the economy of local communities. SMMEs are the backbone of the South African economy, employing 64% of the labour forces in 2021, and thus are more labour intensive in their employment than larger companies (SEDA, 2021), and which operate in a harsh economic environment which results in 75% of SMMEs failing within their first three years (Bruwer & Coetzee, 2016). Economic and skills support to SMMEs will significantly improve their chances of long-term survival, and if properly established, will result in long-term positive socio-economic impacts beyond the project's lifetime – especially considering the 20-year duration of the Enterprise Development component – which will have a strong multiplier effect through consumption and production spending. Direct support for small-scale fishers and aquaculture will provide alternate, and sustainable employment opportunities for small-scale fishers which allows them to stay within culturally relevant employment and provides more stable income outside of the seasonal earnings associated with fishing. Further, because Karpowership SA will be implementing these projects through engagement with local communities these projects are more likely to succeed given that they will be utilising local knowledge.

Further enterprise development support is provided through a Supplier Development Programme, which has been allocated R1 million for the construction period, and R910 000 per annum for the 20 years of operations (Karpowership SA, 2022). This will involve the provision of seed or development capital, loans and credit facilities organised through partner financing companies, and assistance with training and mentoring. The development of a local supplier value chain which is centred around the maritime sector will further increase the development of the SBIDZ, as it will increase the local skills base, and production capacity which is geared towards industry relevant services and products. This will increase the likelihood of other vessels and international maritime companies planning maintenance, and restocking for at the Saldanha Bay Port, rather than other locations, increasing local investment, and consumption spending. These impacts work in turn with the skills development programme, as it provides industry relevant employment opportunities for the youth whose skills have been developed under the skills development programme.

These proposed social and enterprise development programmes will meaningfully contribute towards the development of the SBM, and will bring significant socio-economic benefits, especially to small-scale fishing communities which are directly targeted by the Economic Development Plan. The development of the local economy in a meaningful way which extends beyond the core interests of the project will further integrate surrounding communities into the SBIDZ's supply chain, and the economy of the wider SBM. It is also important to note that situating these projects within local, and underprivileged communities will cause a wider positive socio-economic impact that is likely to stimulate economic development in these areas and improve households' standard of living. Due to these reasons, the positive socio-economic impacts of the Project are likely to extend beyond its operations lifetime.

6.4.2 Tourism

According to the IHS (2020) report, in Saldanha Bay Local Municipality, the *Leisure / Holiday* visitor segment recorded the highest average annual growth rate from 2009 (75 700) to 2019 (118 000) at 4.50%. The tourism segment that recorded the lowest growth was *Other (Medical, Religious, etc)* with an average annual growth rate of -6.04% from 2009 (9 840) to 2019 (5 280).

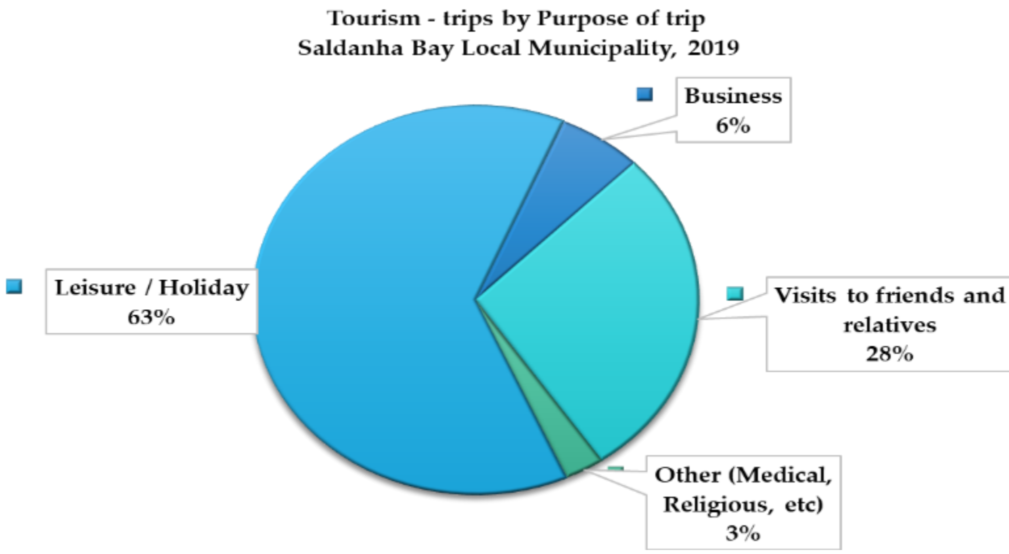


Figure 6-31: Saldanha Bay Local Municipality Tourism trips by purpose

6.4.2.1 Tourism spending as a share of GDP

- In Saldanha Bay Local Municipality the tourism spending as a percentage of GDP in 2019 was 24.6%.
- The Saldanha Local Municipality is part of the West Coast District Municipality. Tourism spending as a percentage of GDP for 2019 was 13.0% in West Coast District Municipality, 7.6% in Western Cape Province.
- Looking at South Africa as a whole, it can be seen that total tourism spending had a total percentage share of GDP of 5.6%.

6.5 TRAFFIC

6.5.1 Traffic

There are two routes that connect Saldanha Bay with the R27, the MR559/Langebaan Rd and the TR8501, the MR559/Langebaan Rd roads are both single carriageways. This route runs through and pass sensitive residential areas. The TR8501 route is also a single carriageway two lane road. However, its alignment is away from sensitive residential areas.

6.5.2 Marine Traffic

The existing and anticipated vessel traffic in the Port of Saldanha in 2020 is 568 vessels with approximately 63% of these vessels being export iron ore vessels. The current demand for iron ore export is 60.5 million tonnes per annum (Mtpa) and has the potential to grow to approximately 90 Mtpa by 2051. Subsequent to operationalisation of Berth 104, the liquid bulk terminal is forecast to increase handling of total liquid bulk products (including LPG at the MBM) from approximately 4.5 Mtpa in 2021 to approximately 8 Mtpa in 2051.

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 6 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 Draft EIA Report for I&AP comments, Triplo4 engaged with numerous specialists and detailed studies were conducted and considered. Refer to Table 1-4 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 Saldanha 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 7.7 and 7.8 respectively.

The findings of the assessment of the potential impacts and risks associated with the proposed project and alternatives, as well as identification of mitigation measures, are reported in detail in Section 7. The mitigation measures are also collated into the draft Environmental Management Programme (EMPr). Both the draft EIA Report and EMPr are made available for an extended 33-day period for I&APs to comment. Comments received will be 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 (1) (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; viii) the possible mitigation measures that could be applied and level of residual risk.

This section describes the 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.

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

Table 7-1: Scoring of impacts and determination of overall significance

Scoring of Impacts	
Consequence	
Severity	1 – Insignificant / Non-harmful 2 – Small / Potentially harmful 3 – Significant / Slightly harmful 4 – Great / Harmful 5 – Disastrous / Extremely harmful
Duration	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	1 – Immediate, fully contained area 2 – Surrounding area 3 – Within business unit area or responsibility 4 – Within mining boundary area / Beyond BU boundary 5 – Regional, National, International
Overall Consequence = (Severity + Duration + Extent) / 3	
Likelihood	
Frequency of the Activity	1 – Once a year or once / more during operation / LOM 2 – Once / more in 6 months 3 – Once / more a month 4 – Once / more a week 5 – Daily / hourly
Probability of the Incident / Impact	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

The cumulative impacts of the existing developments and new projects in the study area were also assessed by each specialist. The table below presents projects that were assessed for cumulative impacts.

Table 7-2: Projects assessed for cumulative impacts

Project name and description	**Applicant**	**Current status and documents sourced- Oct 2022**
The Vortum (CCGT) Thermal Power Plant situated on Portion 6 of the Farm Langeberg 188, Malmesbury Road. The plant consists of gas turbine units and/or gas engine units with a capacity up to 400 MWel each and an overall capacity of 800MWel; Heat Recovery Steam Generators (HRSG) to generate steam; steam turbine units with an overall capacity of up to 400 MWel; and electrical generators which convert the energy of the gas and steam turbine units to electricity	Vortum Energy (Pty) Ltd (Reg. No. 2013/088004/07)	Currently in PPP Phase. The project construction is expected to commence from 2023. Subsequent to that it will enter into commercial operation by 2024.
2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom “Aurora – Saldanha Steel” 2 X 132 kV Power Lines (Double Circuits), located in the Saldanha Bay Local Municipality.	Vortum Energy (Pty) Ltd	The Aurora Substation project’s construction is expected to begin in 2023. The works are expected to be commissioned in 2024.
Proposed Combined Cycle Gas Turbine (CCGT) Power Plant on a Portion (±59 Ha) of Portion 6 of the Farm Langeberg 188, Malmesbury Rd, Saldanha Bay Local Municipality. The energy generation facility will be a thermal power plant with a maximum generation capacity up to 1200 MWel (electrical rated power). The proposed thermal power plant will be a Combined Cycle Gas Turbine (CCGT) power plant and/or a Gas Engine power plant, to be fuelled with natural gas imported by means of one or more gas import facilities (e.g., LNG Import Terminal(s) and/or new gas pipeline(s)).		Permitting. The project construction is expected to commence from 2023.
Gas-To-Power (GTP) project on a 50 hectare development area located on a section of the Remainder	Sunrise Energy	Phase 1 completed in 2017. Currently in phase 2.

Project name and description	Applicant	Current status and documents sourced- Oct 2022
(a portion of Portion 1) of the Farm Uyekraal 189, approximately 15 km north-east of Saldanha, Western Cape Province. The proposed development will consist of the construction and operation of a 900 MW Open Cycle Gas Turbine Plant (OCGT), transmission lines to the Blouwater and/or Aurora Substations, electrical infrastructure required for the GTP project and other associated infrastructure. The project developer is Mulilo Thermal Project Developments (Pty) Ltdwithin Saldanha Bay Local Municipality. The project and associated infrastructure will comprise LPG pipeline (approx. 8.3km), LPG handling facility (approx-3ha) and modification on the existing jetty.		Phases 2 and 3 of the project will see modular expansion that will enable the terminal to meet regional LPG supply demands for the next 27 years.
Gas-To-Power (GTP) project on a 50 hectare development area located on a section of the Remainder (a portion of Portion 1) of the Farm Uyekraal 189, approximately 15 km north-east of Saldanha, Western Cape Province. The proposed development will consist of the construction and operation of a 900 MW Open Cycle Gas Turbine Plant (OCGT), transmission lines to the Blouwater and/or Aurora Substations, electrical infrastructure required for the GTP project and other associated infrastructure. The project developer is Mulilo Thermal Project Developments (Pty) Ltd	No Information available	No Information available

7.3 ASSUMPTIONS, UNCERTANITIES OR GAPS

The information in this report is based on findings of several specialists' studies and technical reports. During the compilation of this EIA Report, the assumptions and limitations relating to this assessment were identified by the EAP and specialists:

Table 7-3: Specialists' Studies Assumption and Limitations Indications

Specialist Studies	Page No.	Section
Appendix A1 - Hydrology Assessment	N/A	N/A
Appendix A2 - Aquatic Assessment	1	2.1
Appendix A3 - Hydropedology Assessment	12	1.4
Appendix A4 - Geohydrology Assessment	12	1.5
Appendix A5 - Water Balance Assessment	4	1.5
Appendix A6 - Wetland Delineation and Functional Assessment	18	6

Appendix A7 - Heritage Assessment	19	6.5
Appendix A8 - Terrestrial Biodiversity Assessment	3	1.4
Appendix A9 - Avifauna Assessment	15	5.2
Appendix B1 - Baseline Noise Assessment	N/A	N/A
Appendix B2 - Underwater Noise Assessment	18	6
Appendix B3 - Underwater Heritage Assessment	12	4b
Appendix B4 - Marine Ecology, Avifauna, Coastal and Fishers Assessment	50	4.1
Appendix B5 - Estuary Compliance Statement	N/A	N/A
Appendix C1 - Atmospheric Impact Report	9	2.9
Appendix C2.1 - SA Terrestrial Noise Assessment	11	1.5
Appendix C2.2 - Ghana Ambient Noise Assessment	N/A	N/A
Appendix C3 - Climate Change Impact Assessment	27	3.1.6
Appendix D1 - Socio-economic Impact Assessment	N/A	N/A
Appendix D1.1 - Small Scale Fishers Engagement	N/A	N/A
Appendix D1.2 - Tourism Assessment	17	5.1.2
Appendix D1.3 - Traffic Evaluation	7	2.2
Appendix D2 - Visual Impact Assessment	8	1.6
Appendix D3 - MHI Assessment	20	2.4.5

Additionally, the following was identified:

- The scope of this report is limited to assessing the environmental impacts of the proposed Karpowership gas-to-energy project and its associated infrastructure.
- The information provided by the applicant and specialists are accurate and unbiased.
- Information from secondary sources and I&APs is accurate.
- Assessments of impact significance for social impact often need to be made without quantification. These are based on a consideration of the likely severity of impacts and/or expert judgements, unless otherwise specified or quantified.
- The assessment only considers the impacts of the proposed project and the no-go and does not make comparisons with or assessments of other gas-to-energy projects as there are currently none in the area. Proposed *Risk Mitigation IPP Procurement Programme* projects have been considered under the cumulative impacts section.

7.4 SCOPING REPORT AND PLAN OF STUDY DEVIATIONS

All deviations from the Scoping Phase have been identified and included in this EIA Report.

The list of deviations include:

1. The transmission component of the project includes detailed description on the associated infrastructure such as switching station, various other transmission components.
2. Detailed descriptions and locations on contractor facilities were included for the stringing yard, back of quay loading area and site office complex.
3. A corridor servitude 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 60

metre corridor which includes the 31m working servitude. The gas line was determined in consideration with sensitivities on site. The subsea section of the pipeline will have a servitude of approximately 50m each side. The onshore buried section will require an anticipated servitude of 0.5 m each side.

4. Polygons 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 detail 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.
5. 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.
6. The Powership position in Small Bay was screened out from further assessment and a new Powership position within Big Bay was included based on TNPA's preference (**Error! Reference source not found.**);
7. The alignment of the gas pipeline to the Powership deviates from the plan of study due to the change in the Powership position. In addition, the alignment of the gas pipeline is not feasible due to land legal issues and specialist input.
8. A new gas pipeline route from the FSRU to the Powership which a shorter onshore pipeline.
9. A 132KV line connection to the Aurora – Saldanha Steel network via a new 132 KV switching station as requested by Eskom (**Error! Reference source not found.** and **Error! Reference source not found.**);
10. The footprint of the proposed transmission line is approximately 232 500m^2
11. Connections to the main transmission line to National Grid (route to Eskom Aurora Main transmission substation) based on Eskom's requirements;
12. The Climate Change Impact Assessment has been revised to include Scope 3 emissions for Powership operations.
13. The width of the working servitude for the transmission line was updated from 30m to 31m wide, in line with Eskom requirements.

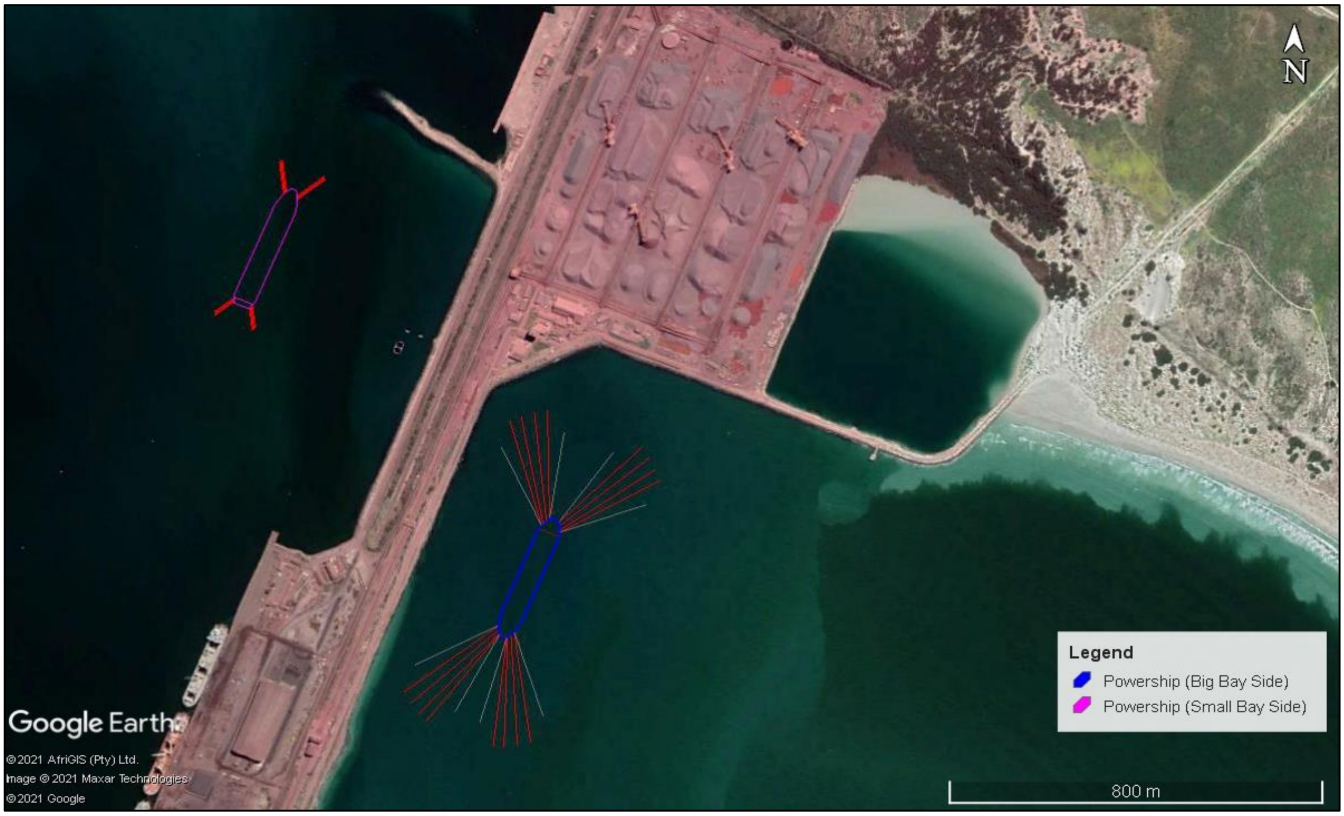


Figure 7-1: Powership Deviation – New position in Big Bay (Preferred).

Figure 7-2: Transmission Line Deviation – Connection to Aurora – Saldanha Steel Network

Figure 7-3: Deviation – New Switching Station

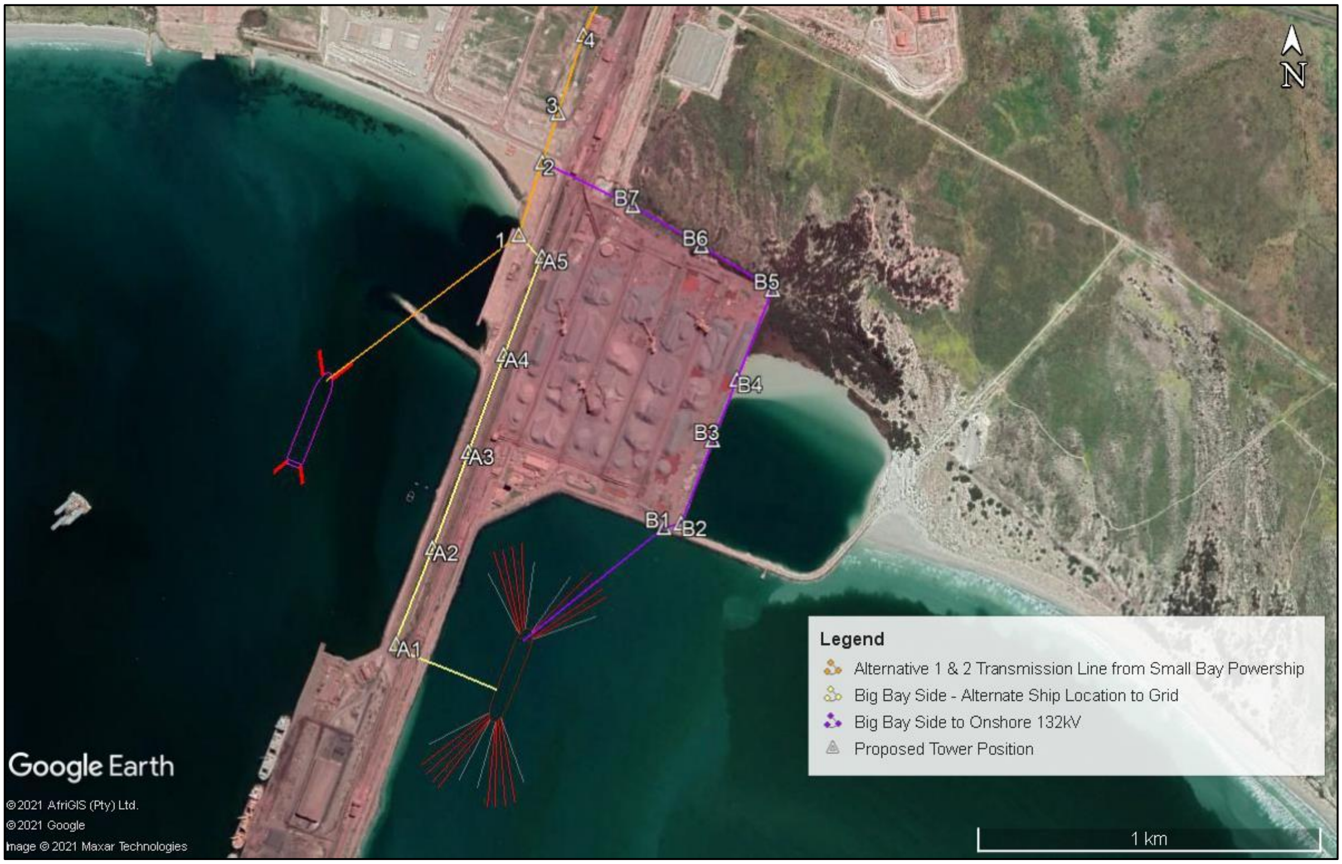


Figure 7-4: Transmission Line Deviations – Connection from New Big Bay Position to either Transmission Line Alternative 1 or 2

7.5 IMPACT ASSESSMENT FINDINGS, MITIGATION 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 this section (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 specialist 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

Literature indicated the presence of several depressions (west Strandveld bioregion) situated >250m away from the proposed transmission lines. The wetland type depression is classified as being poorly protected. No recognised surface water streams or rivers are associated with the project area. The absence of baseflow in the project area is due to the limited surface water bodies and wetland units that occur. With regards to the hydrological cycle for the sub-catchment, as there are no recognised rivers and streams in the project area, the ocean is the end-receiver of runoff in the project area.

Due to there being no significant surface water bodies in close proximity to the site, flood line modelling was not justifiable for this site.

7.5.1.1 Impact assessment with mitigation: ***<u>Construction and Operational Phases</u>***

Since there are no nearby surface water bodies at the proposed Saldanha Bay development site, it can be said that there is no risk posed to surface water in the area (i.e. no recognized water bodies exist). For a limited time during the year, during the rainy season, limited runoff from the site will occur that may transport sediment and contaminants to the soils, aquifers and regional areas. A stormwater management plan will be required for the main construction to mitigate the impact of this runoff (if required).

- Stormwater management should focus on the following, for each site, before the work takes place:
    - Assess the site constraints and any site-specific concerns, including:
        - 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.
  - Based on the above-mentioned, it is recommended that the transmission line be installed during dry months and don't leave excavations open or the area unrehabilitated before a rainfall month occurs. If work does commence in wet seasons, it is advised that the measures in this document be considered, as well as any means to prevent erosion and sediment runoff (i.e. temporary sandbags, reed beds, re-vegetation, temporary stilling basins, temporary berms etc.).

Due to there not being any surface water bodies or stream in the project area, and no surface water impacts, no monitoring will be required. No hydrological avoidance areas or exclusion zones were identified.

7.5.1.2 *Cumulative Impacts*

No cumulative impacts were identified by the specialist.

7.5.1.3 *Specialist Conclusion*

This assessment cannot find any grounds or identify high geohydrological risks to not proceed with the development of the proposed transmission lines. This is grounded on there not being any recognised surface water bodies in the project area that could potentially be at risk.

7.5.2 **Aquatic Impacts**

There are no identified watercourses or drainage lines along the route of the 132kV transmission line (refer to section 3.6 below). Therefore, there are no anticipated risks for the construction and operational phase for the proposed development and associated infrastructure. Although the Bok River is situated within 3 km of the proposed development no impacts to this system is likely due to its position within a different watershed area.

7.5.2.1 *Cumulative Impacts*

Based on available information for the other projects in the area (i.e. Vortum (CCGT) Thermal Power Plant, 2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom "Aurora – Saldanha Steel", Combined Cycle Gas Turbine (CCGT) Power Plant, and Gas-To-Power (GTP)), and in terms of the potential contributing impact on the aquatic environment after consideration of this project, it is concluded that there will be no contributing impacts to other similar projects in the area.

7.5.2.2 *Specialist Conclusion*

It is recommended that 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 information presented in this report be further supplemented by the generic EMPr document.

7.5.3 Hydropedology Impacts

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The hydrological processes associated with the soils in the project area are discussed concerning the numbered arrows. *The proposed activity will likely only impact hillslope 1, as no transmission line will be constructed in sub-catchment 2.*

1. Available data suggest that interflow (A/B) soils may occur in areas associated with manmade and infilled areas (near the industrial developments in the project area):
   a. In interflow (A/B) soils the flow path is predominantly downslope in a lateral direction. If interflow (A/B) soils occur downstream of interflow (soil/bedrock) and overland flow at the soil interface may occur.
   b. Deep secondary flow towards the saturated zone is expected.
2. Soils associated with the Mispah and Fernwood soil type (the dominant soil type across the study area) are predominantly controlled by interflow (A/Bedrock or Soil/Bedrock) processes.
   a. In areas where shallow refusal occurs, temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction will occur.
   b. Deep secondary flow towards the saturated zone and subsequent footslope areas are expected for interflow (A/B) and interflow (A/Bedrock) type soils in the study area.

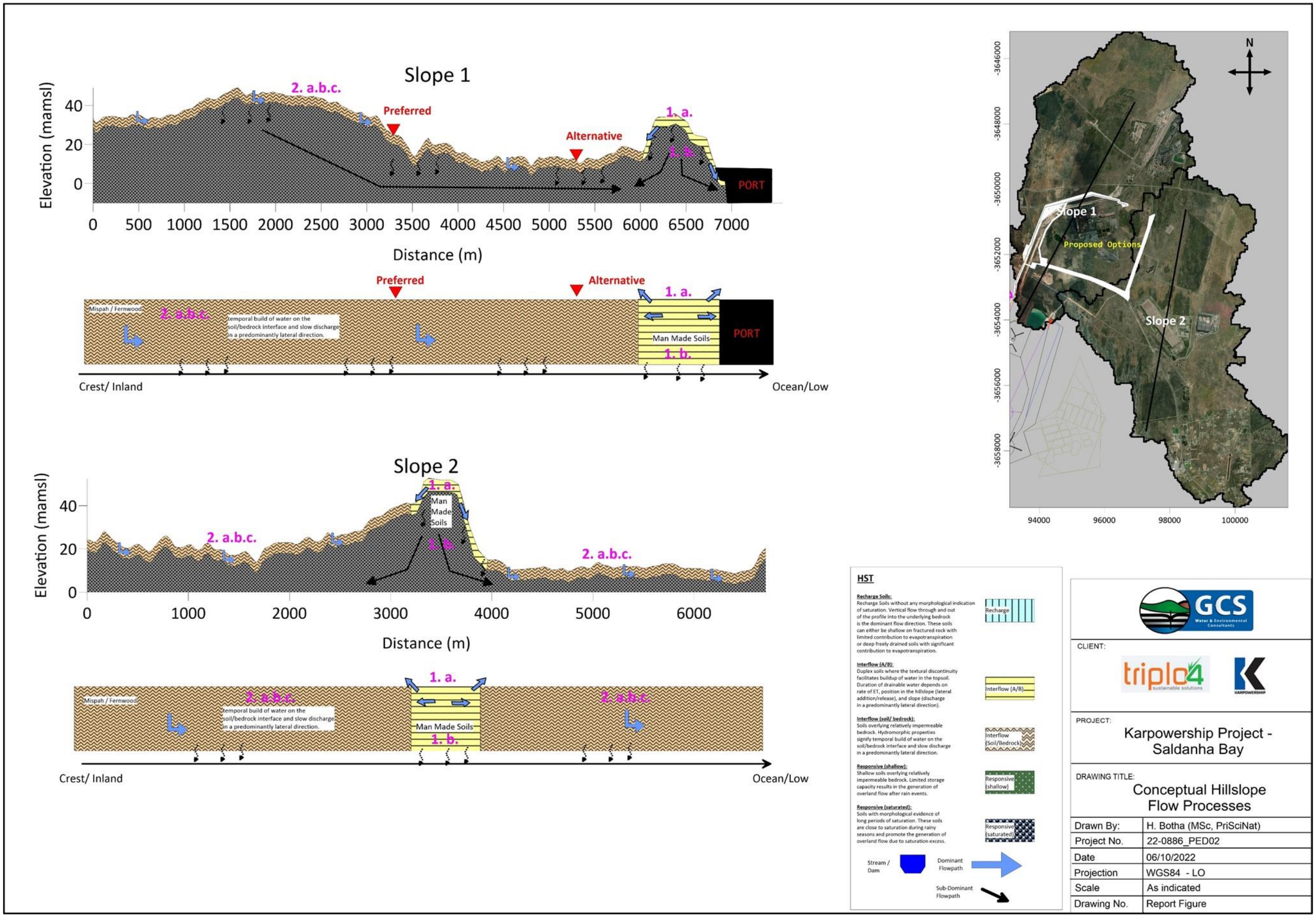


Figure 7-5: Hillslope hydropedological behaviours and flow zones.

No dedicated buffer areas were identified as part of this 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 identified by Triplo4 (2022) 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.

7.5.3.1 *Impact assessment:* ***<u>Construction Phase</u>***

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

- 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 contamination from leakages from vehicles and machines, and building materials
- Vegetation loss could decrease soil infiltration and increase runoff.

Table 7-4: 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. Soil quality: • Natural nutrient content decreases due to soil exposure. • Loss of natural bio-organisms essential to soil processes.	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. 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. 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)	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/run off 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)	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Surface water monitoring if visual signs of pollution are noted.	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

7.5.3.2 *Impact assessment:* ***<u>Operational Phase</u>***

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

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

Table 7-5: 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*

From a review of other draft EIA reports for the projects in the area (i.e. Vortum (CCGT) Thermal Power Plant, 2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom "Aurora – Saldanha Steel", Combined Cycle Gas Turbine (CCGT) Power Plant, and Gas-To-Power (GTP)), 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 *Specialist Conclusion*

This 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**

The site conceptual geohydrological model (SCM) for the site shows that 2 aquifers exist in the area, an unconfined aquifer associated with the unconsolidated sands; and a confined and fractured aquifer network associated with deeper TMG sediments. The aquifer underlying the site consists of undifferentiated coastal deposits and can be regarded as a low-yielding aquifer, with reported yields < 0.1 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 is likely to discharge towards the ocean and 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 Darcy seepage velocity suggests very slow-moving groundwater through the study area. For the scale of abstraction and aquifer stress for the combined groundwater sub-catchment it was determined that 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 = - 42.04 mm/yr). The proposed development involves several transmission lines (i.e. limited impermeable surface generation), and no groundwater abstraction activities are proposed. Hence, the impact of the proposed development on the groundwater reserve is considered zero.

7.5.4.1 *Impact assessment with mitigation:* ***<u>Construction Phase</u>***

Based on the risk assessment and project type, the impacts on the groundwater environment are low to neutral. Moreover, it is anticipated that the impact on groundwater is going to be uniform for all of the tower/pylon sites (i.e. there is no need for tower-specific mitigation). No decommissioning phase is anticipated for this project. However, similar risks as for the construction phase are anticipated if the facilities at the site are ever decommissioned; or if additional facilities are constructed. No surface water risks exist, as there are no recognised surface water bodies/streams /rivers/wetlands near or downstream of the proposed transmission lines.

Table 7-6: Potential geohydrological risks and mitigation measures (construction 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
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
Groundwater Users in the Area (Groundwater table and users of groundwater)	No groundwater boreholes were identified downstream of the proposed transmission. 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)	Neutral impact. No mitigation required								
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)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	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

*7.5.4.2 Impact assessment with mitigation: **Operational Phase***

Table 7-7: 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	
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)	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)	No groundwater boreholes were identified downstream of the proposed transmission. 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. The impact probability is neutral.								

7.5.4.3 *Cumulative Impacts*

Other proposed energy developments (i.e. Vortum (CCGT) Thermal Power Plant, 2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom "Aurora – Saldanha Steel", Combined Cycle Gas Turbine (CCGT) Power Plant, and Gas-To-Power (GTP)) 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 above-mentioned projects, and in terms of the potential contributing impact on the geohydrological 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 considered low to 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 Conclusion*

The geohydrological assessment could not 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 consists of a total of one (1) wetland which was classified as a depression wetland (Figure 7-6). The depression wetland will not be impacted by the proposed development, specifically by the Preferred Alternative Transmission Line Route due to this transmission line being approximately 266m away from the wetland and is buffered by dense vegetation. Thus, this wetland will not be at risk from the proposed project. Upon conducting the risk screening, the wetland specialists determined that no watercourses will be at risk from the proposed development, and due to no watercourses being at risk, no further assessments (in terms of integrity, functionality and buffer calculation) were required.

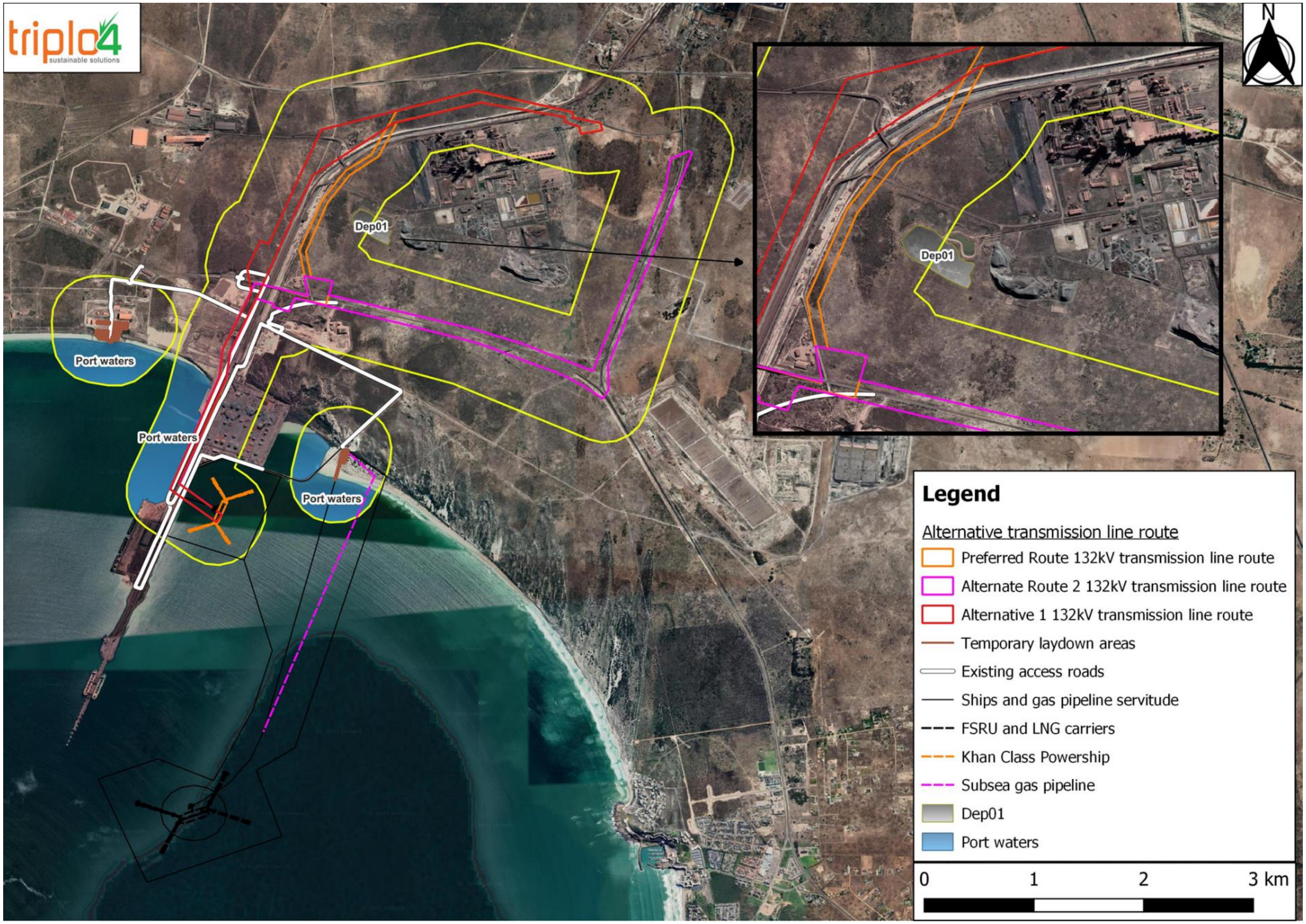


Figure 7-6: Map of the in-field delineations of the watercourses identified at the proposed development and 500m assessment radius

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. This quantitative impact assessment was conducted in line with the request from the minister of Environmental Affairs. It must be noted that it is the opinion of the wetland specialists that the scoring methodology provided is not a true reflection of the project situation and the findings of this assessment (e.g. impact duration). The overall specialist recommendation scoring has thus been added to provide the best assessment possible as indicated in the table below.

*7.5.5.1 Impact assessment with mitigation: **Construction Phase***

From the impact assessment, it can be seen that the overall impact significance scores can be mitigated to very low impact rating as per DFFE preferred scoring method. However, the specialist overall impact significant scores are noted to be very low pre-and-post mitigation. All impacts are regarded as reversible, and no features are regarded as irreplaceable loss. However, it must be noted that in order to achieve reversibility of impacts and no loss of irreplaceable features, the mitigation measures outlined in the wetland report must be implemented. In terms of all aspects assessed by the wetland specialist, the project is not regarded as a fatal flaw.

Table 7-8: Impact categories and significance rating relating to the proposed project.

Aspect:	Risk/ Aspect Description	Overall Significance - Pre as per DFFE	Overall Significance-Pre as per Specialist Recommendation	Mitigation Of Impacts	Overall Significance - Post as per DFFE	Overall Significance-Post as per Specialist Recommendation	Reversibility	Irreplaceable Loss of Resources	Fatal Flaw
				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*	Low (Negative)	Very 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 in line with the construction plan. • 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 monitoring requirements of this report (Section 10).	Very Low (Negative)	Very Low (Negative)	Reversible	No	No
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 environment.* - *General waste being deposited into the environment by construction personnel* - *Excess sediment input as a result of the construction activities and associated soil displacement* - *Raw cement entering the environment through incorrect batching procedure and/or direct disposal.*	Low (Negative)	Very 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, and should only 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.	Very Low (Negative)	Very Low (Negative)	Reversible	No	No

7.5.5.2 Cumulative Impacts

The following represents the assumed cumulative impacts which takes into consideration proposed similar projects within the Port of Saldanha Bay:

In taking into consideration the four (4) projects (i.e. Vortum (CCGT) Thermal Power Plant, 2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom "Aurora – Saldanha Steel", Combined Cycle Gas Turbine (CCGT) Power Plant, and Gas-To-Power (GTP)), the potential cumulative loss of wetlands could be considered. Assessment of the projects did not identify any wetlands that would be at risk of being directly or indirectly impacted upon. Thus, the overall cumulative impacts can be measured as a (Very Low to No) loss of wetlands, and thus it is the specialist's opinion that the proposed development in terms of all alternatives and associated infrastructure being assessed in this report can proceed.

7.5.5.3 Mitigation Measures

The proposed development takes into consideration the 'avoid or prevent' principle by providing alternatives to the transmission line routes (specifically Preferred Alternative and Alternative 2), that is considered to have negligible to no risk to the surrounding watercourses.

The tier chosen for the proposed development is 'minimise' by utilising preferred technology such as monopole infrastructure for the evacuation of power. This reduces the individual footprints within the catchment. Various mitigations are provided for inclusion into the EMPr to minimise potential impacts on the receiving environment.

The general mitigation measures presented below, specific to the impacts associated with the construction and operational activities are intended to augment standard/generic mitigation measures included in the project-specific EMPr.

Table 7-9: Pre-construction phase mitigation measure

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 natural environment. - 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 Control 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 covered within the site-specific EMPr and should not require input from a wetland assessment (above what is detailed within this report). - No-go 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 (Dep01) in the vicinity of the development activities. Unnecessary intrusion into this system is prohibited. This area must be clearly

	demarcated onsite and indicated to all construction workers onsite before any construction activities (including site establishment) takes place.
Site/Project Specific	- Existing access/haulage routes must be utilised during construction as far as possible.

Table 7-10: 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 construction method statement 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. - 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 environment. - 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. - Establish cut off drains and berms to reduce stormwater flow through the construction site. - 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 system 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 wetland system. 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 environmental competent authority; • 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 100m away from the wetland, 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 delineated wetland, 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 these activities. - 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.
Site/Project Specific	- Silt traps must be erected around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. - Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. - Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. - All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion. Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. - All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.

Table 7-11: Post Construction/Rehabilitation phase measures

Mitigative Measures	Phase of Proposed Development - Post-Construction/Rehabilitation
Generic/Broad	- 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 natural environment is likely to respond to the rehabilitation interventions. - All post-construction building material and waste must be cleared in accordance with the EMPr, before any re-vegetation may take place. - 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, 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 horticulturist. - 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. - 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 the natural environment.
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 list can be sourced from Ecological Impact Assessment)

Table 7-12: Operation 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 monitoring requirements of this report. 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 natural environment.
Site/Project Specific	- Additional monitoring is required as per the monitoring requirements (Section 10) below.

The monitoring of the proposed development is essential to maintain and/or improve the biodiversity of an area. 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 potential 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 document 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 development 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:

- 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 and bird species.
- 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 potential impacts on the watercourses are adequately managed and mitigated against and that rehabilitation of any disturbed areas within the natural environment is successful.

7.5.5.4 Specialist Conclusion

It is the specialist's opinion that all of the transmission line routes (Preferred, Alternative 1 and 2) and associated infrastructure (switching stations and temporary laydown areas) are supported. Furthermore, the mitigation measures outlined in this report are to be included in the EMPr, and must be followed.

7.5.6 **Archaeology and Palaeontology Impacts**

Archaeology

No pre-colonial Stone Age archaeological heritage resources were encountered during the 2020 field assessment (Kaplan 2020), which comprised a walk down survey of the Proposed Route Options.

A scatter of fragmented white sand mussel shell (Perna Perna) was noted in a large, patch of sand in the Port Area, but no stone tools, pottery, or any other organic remains (i. e. ostrich eggshell or bone), were found.

Note: The Proposed Alternative 2 transmission route has not been physically assessed, as it follows the alignment of the MR559 and the OP538 Road and is not considered to be a sensitive archaeological landscape.

Palaeontology

According to Pether (2022), the proposed route options for the transmission line, from the Port to the Eskom Blouwater Substation are all situated on the calcreted Langebaan Formation, beneath a thin cover of Springfontyn Formation sands.

Close to the coast the Witsand Formation dunes are underlain by the older aeolianite of the Langebaan Formation and the interbedded shelly beach deposits of the Velddrif Formation.

The Langebaan Formation is classified to be of high sensitivity, due to previous fossil finds of significant scientific value. Most of the pylon foundations will be embedded in the compact upper Langebaan Formation, calcrete and aeolianite. This shallow depth of the excavations will reduce the impact, as fossil bones are overall sparse in the upper calcreted Langebaan Formation. Test pits along the powerline traverse could also unearth fossil bones.

Close to the coast, the surface has been much disturbed and no impact on the loose Witsand Formation is expected.

Along the initial ~1.5kms of the route, it is possible that shelly beds of the Velddrif Formation may be intersected, although this is considered to be unlikely in the shallow excavations envisaged (Pether 2020, 2022).

7.5.6.1 *Impact assessment:* ***Construction Phase***

Archaeology

Buried archaeological remains such as stone tools, bone and shell may be uncovered during excavations for powerline foundations, but overall, the archaeological risk sources are rated as being low.

Palaeontology

The primary impact on palaeontological resources takes place during the construction phases of the proposed development.

Extents

The physical extent of impacts on potential palaeontological resources relates directly to the extents of subsurface disturbance involved in the installation of infrastructure and buildings during the Construction Phase, i.e. limited to the sites of construction activity.

However, unlike an impact that has a defined spatial extent (e.g. loss of a portion of a habitat), the cultural, heritage and scientific impacts are of regional to national extent, as is implicit in the National Heritage Resources Act No. 25 (1999) and, if scientifically important specimens or assemblages are uncovered, are of international interest. This is evident in the amount of foreign-funded palaeontological research that takes place in South Africa by scientists of other nationalities.

Duration

The initial duration of the impact is short term (<5 years) and primarily related to the Construction Phase when excavations for infrastructure are made. This is the “time window” for mitigation.

The impact of both the finding or the loss of fossils is permanent. The found fossils must be preserved “for posterity”; the lost, overlooked or destroyed fossils are lost to posterity. The duration of impact is therefore permanent with or without mitigation.

Intensity/Magnitude

The intensity or magnitude of impact relates to the palaeontological sensitivities of the affected formations and the degree or volume of disturbance.

The construction activity mainly entails shallow excavations of small footprint made into the calcreted upper part of the Langebaan Fm. Although the Langebaan Formation aeolianite is rated as being of very high palaeontological sensitivity, the relatively limited depths of disturbance and sparse distribution of fossil bones serve to ameliorate the associated intensity of impact to a medium level.

There is some possibility that the fossil shell beds of the Velddrif Fm. could be intersected close to the coast. As exposures of the Velddrif Fm. occur in the wider region and the fossil shell content is mainly of extant species the intensity of impact is rated as low.

Consequence of impact or risk

Permanent loss of material palaeontological heritage (fossil specimens) and the scientific discovery and knowledge implicit in their origin and context.

Probability of occurrence

Notwithstanding that fossil bones are sparse in the upper Langebaan Fm. there will be a considerable number of pylon foundation excavations analogous to “test pits” along the powerline traverse and thus it is distinctly possible (40-70% chance) that fossil bones could be discovered.

Fossil shell beds of the Velddrif Fm. may be intersected near the coast, but this is considered to be improbable (<40% chance) due to the limited depth of excavations.

Irreplaceable loss of resources

Without mitigation and rescue of unearthed fossils there will be a complete loss of resources within the footprints of the development.

Reversibility

Palaeontological resources are unique and their loss is Irreversible.

Indirect impacts

The material fossil evidence of “deep time” is embedded in the creation of the sacred landscape and contributes to the “sense of place” cultural aesthetic of the region. The loss of fossils and concomitant interpreted knowledge impoverishes the tangible testimony of the prehistoric landscape and ecological context of ancient humans.

Degree to which impact can be avoided

There is a risk of valuable fossils being lost despite management actions to mitigate such loss. The avoidance of impact is low to moderate.

Degree to which impact can be managed

Experience of coastal developments has shown that the impact is difficult to manage and will require significant mitigation co-operation and effort on the part of excavation contractors and supervisors, i.e. moderate. Seldom are fossil bone finds reported from contexts where they are expected to occur. The conclusion is that the monitoring of digging is generally inadequate for the capture of small-scale fossil bone occurrences as the fossils are only briefly exposed, while large bones or bone clusters are seen. In contrast, fossil shell beds are easily seen, the fossils are usually abundant and mitigation by sampling and recording is readily accomplished.

Degree to which an impact can be mitigated

Given unavoidable loss of fossils the impact can only be partly mitigated, i.e. moderate.

Residual impacts

Negative residual impact arises from the unavoidable loss of fossils of unknown significance in spite of mitigation efforts. Positive residual impact arises from the successful rescue of fossil material for posterity, resulting in material for future research, employment opportunities for budding, young researchers and enhanced insights into the prehistory of the SW Cape.

Significance

Without mitigation the significance of the impact of the earthworks on the fossil bone content of the Langebaan Fm. is Low Negative. Notwithstanding a similar low but positive significance with mitigation, depending on the scientific significance of the actual finds, the significance of the impact may range from Medium Positive to High Positive. Without mitigation the significance of the impact of the earthworks on the fossil shell content of the Velddrif Fm. is Very Low Negative and with mitigation is Very Low Positive.

The following impact rating table refers to pylon foundation excavations with respect to fossil bones.

Loss of fossil bones during excavation of pylon foundations								
	Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	Medium 2	Long 3	Medium 6	Possible (40-70% chance)	LOW	-ve	Medium
Essential mitigation measures • Identify and appoint stand-by palaeontologist should paleontological finds be uncovered by earthworks. • Construction personnel to be alert for rare fossil bones and follow "Fossil Finds Procedure". • Cease construction on (chance) discovery of fossil bones and protect fossils from further damage. • Contact appointed palaeontologist providing information and images. • Palaeontologist will assess information and establish suitable response, such as the importance of the find and recommendations for preservation, collection and record keeping. • Exposed fossiliferous sections in earthworks recorded and sampled by appointed palaeontologist.								
With mitigation	Local 1	Medium 2	Long 3	Medium 6	Possible (40-70% chance)	LOW	-ve	Medium

The following impact rating table refers to the fossil shells of the Velddrif Formation.

Loss of fossil shells during excavation of pylon foundations								
	Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	Low 1	Long term 3	Low 5	Improbable	VERY LOW	-ve	High
Essential mitigation measures • Identify and appoint stand-by palaeontologist should paleontological finds be uncovered by earthworks. • Construction personnel and ECO to be aware that a substantial temporary exposure of marine shelly beds may require sampling and recording. • In the event of a large exposure of shell beds, the appointed palaeontologist must be notified and provided with information and images. Palaeontologist will assess information and establish suitable response, such as the importance of the find and recommendations for sample collection and record keeping. • Selected exposed fossiliferous sections in earthworks recorded and sampled by appointed palaeontologist								
With mitigation	Local 1	Low 1	Long term 3	Low 5	Improbable	VERY LOW	-ve	High

The Langebaan Formation is classified to be of high sensitivity, due to previous fossil finds of significant scientific value.

The palaeontological sensitivity of the Springfontyn Formation sands is classified as low. Buried archaeological material, such as artefacts, shell, and bone scatters, could be uncovered in the loose coversands of the Springfontyn Formation, but the overall palaeontological sensitivity of the coversand deposits in the area is classified as low (Pether 2020, 2022).

Without mitigation and rescue of unearthed fossils there will be a complete loss of resources within the footprints of the development (Pether 2022:17). Palaeontological resources are unique, and their loss is irreversible (Pether 2022:17).

7.5.6.2 *Cumulative Impacts*

Regarding Cumulative Impacts associated with the Karpower Gas to Power Powership Project, the following comparable projects have been assessed:

- Archaeological Impact Assessment, for the Proposed Combined Cycle Gas Turbine (CCGT) Power Plant on a Portion of the Remainder of the Farm Langeberg 188 and associated infrastructure across a number of Farm Portions in the Saldanha Bay Local Municipality, West Coast District Municipality, Western Cape Province (Kruger 2016).

The Cumulative Impact is rated as being Low.

According to Pether (2022:17), (The) `Cumulative Impact is the inevitable and permanent loss of fossils and the associated scientific implications. Diligent and successful mitigation contributes to a positive cumulative impact as the rescued fossils are preserved and accumulated for scientific study. Even though just a very minor portion of the bone fossils exposed in coastal excavations has been seen and saved, the rescued fossils have proved to be of fundamental scientific value'.

7.5.6.3 *Recommendations*

Archaeology

1. No archaeological mitigation is required prior to construction operations commencing.
2. An archaeologist must monitor excavations for the Stringing Yard Construction Area and gas pipeline.
3. If any human burials/remains or ostrich eggshell water containers, for example are uncovered during excavations, work must immediately stop, and the finds reported to Heritage Western Cape (Stephanie Barnardt 021 483 9695). Human remains must not be disturbed until inspected by a professional archaeologist.

Palaeontology

1. The Environmental Control Officer (ECO) and contractor must inform staff of the need to watch for potential fossil occurrences. A Fossil Finds Procedure is included in the PIA report and provides guidelines to be followed in the event of fossil finds in the excavations. Contractors and workers involved in excavating

footings for example, must be informed of the need to watch for fossils and archaeological material, and the procedure to follow in the event of any fossils being found.

2. If a significant occurrence of fossil bones or shells is discovered a professional palaeontologist must be appointed to collect them and to record their contexts.
3. The above recommendation must be included in the Environmental Management Plan (EMP) for the proposed development.

7.5.6.4 Specialist Conclusion

Archaeology

The results of the study indicate that the proposed Gas to Power Powership Project in the Port of Saldanha Bay does not pose a significant threat to local archaeological heritage resources. Excavations for powerline foundations could possibly uncover buried archaeological resources such as stone artefacts, bone, and shell.

Shipwreck remains and shell middens may be uncovered during excavations for the Stringing Yard Construction Area, and undersea gas pipeline (Maitland 2022).

From an archaeological perspective however, there are no fatal flaws and provided that the recommendations made are implemented, there are no objections to the authorisation of the proposed activities

Palaeontology

According to Pether (2022), the proposed route options are not distinguished by differing palaeontological sensitivities and do not differ in their impacts.

7.5.7 **Terrestrial Biodiversity Impacts**

Eight different habitat types were delineated within the assessment area (Table 7-13, Figure 7-7). All habitats within the project area of the proposed development were allocated a sensitivity category or SEI.

Table 7-13: 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	

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Cape Seashore Vegetation	Low	Low	Low	High	Very Low
	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species.	Several minor and major current negative ecological impacts.		Habitat that can recover relatively quickly (~ 5–10 years) to restore	
Degraded Dune Strandveld	Low	Low	Low	Medium	Low
	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species.	Several minor and major current negative ecological impacts.		Will recover slowly (~ more than 10 years) to restore	
Flats Strandveld	High	Low	Medium	Low	High
	Confirmed or highly likely occurrence of CR, EN, VU species. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat		Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore	
Degraded Flats Strandveld	Medium	Low	Low	Low	Medium
	> 50% of receptor contains natural	Several minor and major current		Habitat that is unlikely to be able to	

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
	habitat with potential to support SCC.	negative ecological impacts.		recover fully after a relatively long period: > 15 years required to restore	
Highly degraded strandveld	Low	Low	Low	High	Very Low
	< 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	
Limestone Strandveld	Very High	High	Very High	Very Low	Very High
	Any area of natural habitat of a CR ecosystem type	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type		Habitat that is unable to recover from major impacts,	
Degraded Limestone Strandveld	Very High	Low	Medium	Medium	Medium
	Any area of natural habitat of a CR ecosystem type	Several minor and major current negative ecological impacts.		Will recover slowly (~ more than 10 years) to restore	

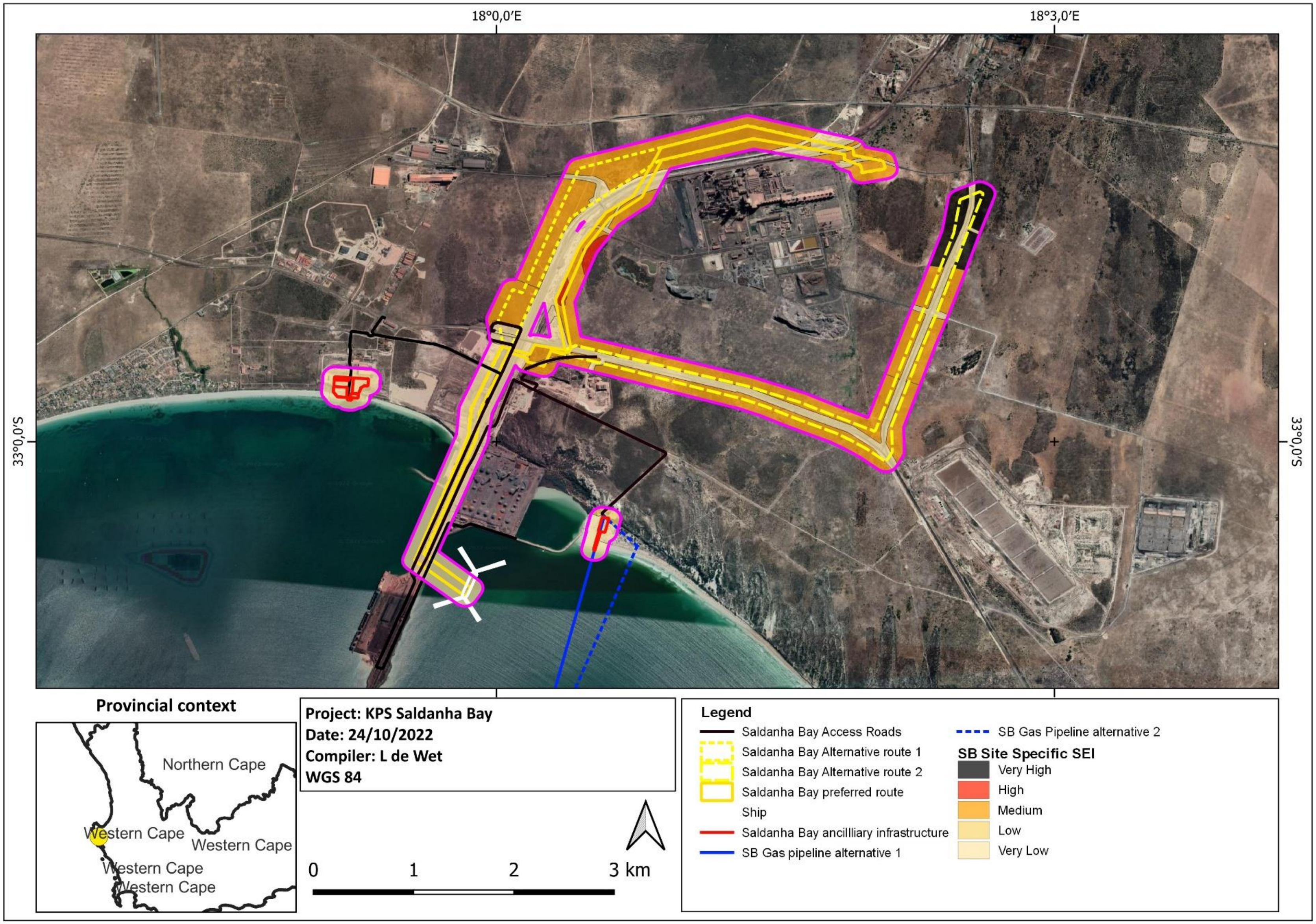


Figure 7-7: SEI of the project site

Impacts associated with transmission line route Alternative 2 were not assessed as this line route is considered a no-go as a result of the avifauna assessment due to the presence and activity of a black harrier. Moreover, this route option traverses an area of critically endangered limestone strandveld which should be avoided. This area of strandveld is also located within an area for which offsets are not possible so avoidance is the only option. Thus, Alternative route 2 is not supported from an ecological standpoint.

The gas pipeline options include Alternative 1 which will affect a transformed area of the beach and dunes (previously utilized as a laydown area) and Alternative 2 which traverses some dunes. Dune systems are highly sensitive and should not be disturbed so Alternative 2 is not supported from an ecological standpoint.

Impacts of the transmission line preferred and alternative route 1 are comparable and either are acceptable.

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 intact indigenous vegetation. Impacts are on average medium-high to medium-low and can be reduced to medium-low to low with the recommended mitigation measures.

The following impacts were identified and assessed as per the subsequent sections:

Construction phase

Issue 1: Loss of vegetation communities

- 1: Loss of Dune Strandveld
- 2: Loss of Flats Strandveld – Alternative route 1
- 2: Loss of Flats Strandveld – Preferred Alternative
- 3: Loss of Limestone Strandveld – alternative route 1

Issue 2: Loss of Species of Special Concern and Biodiversity

- 4: Loss of Flora SCC
- 5: Loss of Fauna SCC
- 6: Loss of biodiversity in general

Issue 3: Ecosystem function and process

- 7: Fragmentation
- 8: Invasion of alien species

Operational phase

Issue 1: Loss of vegetation communities

- 1: Loss of Dune Strandveld
- 2: Loss of Flats Strandveld – alternative route 1
- 2: Loss of Flats Strandveld - preferred alternative
- 3: Loss of Limestone Strandveld – Alternative route 1

Issue 2: Loss of Species of Special Concern and Biodiversity

- 4: Loss of Flora SCC
- 5: Loss of Fauna SCC
- 5: Loss of biodiversity in general

Issue 3: Ecosystem function and process

- 6: Fragmentation
- 7: Invasion of alien species

7.5.7.1 *Impact assessment:* ***Construction and Operational Phases***

7.4.7.1.1 Issue 1: Loss of vegetation communities

Loss of vegetation communities will definitely occur as a result of the proposed transmission line route, vegetation lost will comprise mostly transformed, modified and degraded vegetation but does traverse some areas of Saldanha Flats Strandveld. The location of the land-based gas pipelines and temporary lay-down area is in Saldanha Dune Strandveld a sensitive dune area. No construction within the dunes should be allowed unless in an already disturbed area. Hence, only gas pipeline option 1 is acceptable from an ecological standpoint. Gas pipeline option 2 is considered a No-Go and is not. As the project is located within an IDZ, and limited damage to indigenous habitat will occur, it is considered that this loss is acceptable for the transmission line route and is within the limits of acceptable change. Impacts to vegetation are assessed for each of the indigenous vegetation types affected by the proposed transmission line route and associated infrastructure.

Transmission line route option 2 is not assessed here. In accordance with the polycentric approach adopted by the project, this route option is considered not supported by the avifauna assessment as a result of the presence and activity of a Black Harrier. It is therefore not assessed here.

7.4.7.1.1.1 Impact 1: Loss of Dune Strandveld

The impact in the construction phase will be small over the short term and restricted to the surrounding area. It will possibly occur once a year resulting in a medium-low overall significance that can be reduced to very low with mitigation measures.

The impact in the operational phase will be small over the short term and restricted to the surrounding area. It will possibly occur once a year resulting in a medium-low overall significance that can be reduced to very low with mitigation measures.

This impact is reversible. As the current area is transformed as a result of previous land use, and will be rehabilitated post construction, this will result in a small biodiversity gain. The impact causes a loss of resources that can be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 1: Loss of Saldanha Dune Strandveld														
Construction Phase														
Without mitigation	Small	2	Short term	2	Surrounding area	2	2	Once a year	1	Possible	4	2.5	5	Medium-Low

With mitigation	Insignificant	1	Brief	1	Immediate	1	1	Once a year	1	Seldom	3	2	2	Very Low
Operational phase														
Without mitigation	Small	2	Short term	2	Surrounding area	2	2	Once a year	1	Possible	4	2.5	5	Medium-Low
With mitigation	Insignificant	1	Brief	1	Immediate	1	1	Once a year	1	Seldom	3	2	2	Very Low

Mitigation and Management:

- Any and all excavations must be rehabilitated immediately after construction with the help of a qualified dune rehabilitation specialist. The rehabilitation must then be monitored and any impacts adaptively managed.
- No additional infrastructure or use of the surrounding vegetation will be allowed and includes placement of portable toilets, use of the beach for recreational purposes, fishing, hunting or removal of indigenous plant species.

7.4.7.1.1.2 Impact 2: Loss of Flats Strandveld

For Alternative 1 - The impact in the construction phase will be significant over the long term and restricted to the surrounding area. It will defiantly occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation. In the operational phase, the impact will be significant over the long term and restricted to the surrounding area. It will definitely occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation.

For the Preferred Alternative - The impact in the construction phase will be great over the long term and restricted to the surrounding area. It will defiantly occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation. In the operational phase, the impact will be significant over the long term and restricted to the surrounding area. It will definitely occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation.

This impact is considered partially reversible as the area is already degraded, and rehabilitation is able to replace the current ecosystem function and services as well as return the area to a state equal to, or better than prior to the impact. The impact causes a loss of resources that can't be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		

Impact 2: Loss of Flats Strandveld														
Alternative route 1														
Construction Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	3	Once a year	1	Definite	5	3	9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low
Operational Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	3	Once a year	1	Definite	5	3	9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low
Preferred Alternative														
Construction Phase														
Without mitigation	Great	4	Long term	4	Surrounding area	2	3.3	Once a year	1	Definite	5	3	9..9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low
Operational Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	3	Once a year	1	Definite	5	3	9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low

Mitigation and Management:

- 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 will be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- Construction of the proposed monopole structures should be executed using the least impactful methods. This must be the avoidance of clearing of linear footprints, but rather the erection of each individual pole, reducing the footprint as far as possible.

7.4.7.1.1.3 Impact 3: Loss of Limestone Strandveld – for Alternative 1 only

The impact in the construction phase will be significant over the long term and restricted to the surrounding area. It will defiantly occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation. In the operational phase, the impact will be significant over the long term and restricted to the surrounding area. It will definitely occur once a year resulting in an overall impact of medium-high which can be reduced to medium-low with mitigation.

This impact is considered partially reversible as the area is already degraded, and rehabilitation is able to replace the current ecosystem function and services as well as return the area to a state equal to, or better than prior to the impact. The impact causes a loss of resources that can't be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 3: Loss of Limestone Strandveld														
Alternative route 1														
Construction Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	3	Once a year	1	Definite	5	3	9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low
Operational Phase														
Without mitigation	Significant	3	Long term	4	Surrounding area	2	3	Once a year	1	Definite	5	3	9	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low

Mitigation and Management:

- 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 will be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- Construction of the proposed monopole structures should be executed using the least impactful methods. This must be the avoidance of clearing of linear footprints, but rather the erection of each individual pole, reducing the footprint as far as possible.

7.4.7.1.2 Issue 2: Loss of Species of Special Concern and Biodiversity

7.4.7.1.2.1 Impact 4: Loss of Flora SCC

The impact in the construction phase will be great over the long term and regional. It will possible once a year resulting in an overall impact rating of medium-high which can be reduced to low with mitigation. In the operational phase, the impact will be small over the long term and regional. It will be highly unlikely once a year resulting in an overall impact of medium-low that can be reduced to very low with mitigation measures.

This impact is partially reversible, as transfer of conservation important species to a nursery will allow for continued propagation of these species. However, artificial populations do not offer the same biodiversity value as undisturbed in-situ populations. The impact causes a loss of resources that can't be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 4: Loss of Flora SCC														
Construction Phase														
Without mitigation	Great	4	Long term	4	Regional	5	4.3	Once a year	1	Possible	4	2.5	10.75	Medium-High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Highly unlikely	2	1.5	3.45	Low
Operational Phase														

Without mitigation	Small	2	Long term	4	Regional	5	3.6	Once a year	1	Highly unlikely	2	1.5	5.4	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Almost impossible	1	1	2	Very Low

Mitigation and Management:

- Construction measures must consist of the least impactful individual erection of monopole structures and all SCC avoided where possible.
- Micro siting of the monopole structures and construction footprint should be done to ensure no SCC are affected wherever practicable.
- 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 must be conducted in the summer prior to any construction activities to list all SSC and associated permits should be obtained for their removal or transplantation.

7.4.7.1.2.2 Impact 5: Loss of Fauna Species of Conservation Concern

The impact in the construction phase will be small over the short term and regional. It will possibly occur once a year resulting in an overall impact of medium which can be reduced to very low with mitigation. In the operational phase, the impact will be small over the long term and regional. It will occur once a year and be highly unlikely resulting in an overall impact of medium-low which can be reduced to very low with mitigation.

This impact is reversible, as faunal SCC can be relocated to alternative habitat in the area. The impact causes a loss of resources that can be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 5: Loss of Fauna SCC														
Construction Phase														
Without mitigation	Small	2	Short term	2	Regional	5	3	Once a year	1	Possible	4	2.5	7.5	Medium
With mitigation	Insignificant	1	Brief	1	Surrounding area	2	1.3	Once a year	1	Unlikely	3	2	2.6	Very Low
Operational Phase														

Without mitigation	Small	2	Long term	4	Regional	5	3.6	Once a year	1	Highly unlikely	2	1.5	5.4	Medium-Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Almost impossible	1	1	2	Very 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 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 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.

7.4.7.1.2.3 Impact 6: Loss of biodiversity in general

The impact in the construction phase will be great over the long term and restricted to the surrounding area. It will definitely occur once a year with an overall significance of medium-high which can be reduced to medium-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 to occur once a year resulting in an overall impact of medium-low which can be reduced to low wit mitigation.

This impact is partially reversible, as rehabilitation with indigenous plants would result in the reduction of erosion risk and maintenance and restoration of ecosystem services. However, it is unlikely that restoration of the area to the point that it approximates 90% of the naturally occurring undisturbed vegetation can be achieved. The impact causes a loss of resources that can be replaced.

	Consequence							**Likelihood**					**Total Score**	**Significance**
	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL		
Impact 6: Loss of biodiversity in general														
Construction Phase														
Without mitigation	Great	4	Long term	4	Surrounding area	2	3.3	Once a year	1	Definite	5	3	9.9	Medium-High

With mitigation	Significant	3	Long term	4	Immediate	1	2.6	Once a year	1	Possible	4	2.5	6.5	Medium-Low
Operational Phase														
Without mitigation	Small	2	Long term	4	Surrounding area	2	2.6	Once a year	1	Unlikely	3	2	5.2	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 should be strictly maintained, and impacts retained within the boundary of the site.
- Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site.
- Restoration of areas utilized during construction, but not operation, must be done.

7.4.7.1.3 Issue 3: Ecosystem function and process

7.4.7.1.3.1 Impact 7: Fragmentation

The impact in the construction phase will be significant and permanent and restricted to the surrounding area. It will possibly occur once a year resulting in an overall impact of medium which can be reduced to medium-low with mitigation. In the operational phase, the impact will be small, permanent and restricted to the surrounding area. It will highly unlikely once a year resulting in an overall impact of low which can be reduced to very low with mitigation.

This impact is partially reversible, as rehabilitation with indigenous plants would result in the reduction of erosion risk and maintenance and restoration of ecosystem services. However, it is unlikely that restoration of the area to the point that it approximates 90% of the naturally occurring undisturbed vegetation can be achieved. The impact causes a loss of resources that can be replaced.

	Consequence				**Likelihood**			**Total Score**	**Significance**
	Severity	Duration	Spatial scale	TOTAL	Frequency	Probability	TOTAL		
Impact 7: Fragmentation									
Construction Phase									

Without mitigation	Significant	3	Permanent	5	Surrounding area	2	3.3	Once a year	1	Possible	4	2.5	8.25	Medium
With mitigation	Small	2	Permanent	5	Immediate	1	2.6	Once a year	1	Unlikely	3	2	5.2	Medium-Low
Operational Phase														
Without mitigation	Small	2	Permanent	5	Surrounding area	2	3	Once a year	1	Highly unlikely	2	1.5	4.5	Low
With mitigation	Insignificant	1	Long term	4	Immediate	1	2	Once a year	1	Almost impossible	1	1	2	Very Low

Mitigation and Management:

- The majority of the indigenous vegetation must be maintained as a part of the open space and managed for conservation wherever possible.
- Boundaries of the site must be adhered to, and no additional loss of vegetation should occur.
- Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site.

The 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.

7.4.7.1.3.2 Impact 8: Invasion of alien species

The impact in the construction phase will be great over the long term and restricted to the surrounding area. It will definitely occur once or more over 6 months resulting in an overall significance of high which can be reduced to medium-low with mitigation. In the operational phase, the impact will be great over the long term and restricted to the surrounding area. It will definitely occur once or more over 6 months resulting in an overall significance of high which can be reduced to medium-low with mitigation.

This impact is reversible, if the site is continually managed for the removal of existing and new alien invasive species. The impact causes a loss of resources that can be replaced.

	Consequence	Likelihood		Significance

	Severity		Duration		Spatial scale		TOTAL	Frequency		Probability		TOTAL	**Total Score**	
Impact 7: Fragmentation														
Construction Phase														
Without mitigation	Great	4	Long term	4	Surrounding area	2	3.3	Once or more in 6 months	2	Definite	5	3.5	11.55	High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-Low
Operational Phase														
Without mitigation	Great	4	Long term	4	Surrounding area	2	3.3	Once or more in 6 months	2	Definite	5	3.5	11.55	High
With mitigation	Small	2	Long term	4	Immediate	1	2.3	Once a year	1	Possible	4	2.5	5.75	Medium-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*

The construction and operation of developments within the Saldanha port area will result in cumulative impacts, of which the Karpowership project forms a part. As the project site is located within the existing and operational Port of Saldanha, existing and operational facilities in proximity that were considered (i.e. Vortum (CCGT) Thermal Power Plant, 2 X 132 kV Power Lines (Double Circuits) for the connection of the Vortum Thermal Power Plant to the Eskom "Aurora – Saldanha Steel", Combined Cycle Gas Turbine (CCGT) Power Plant, and Gas-To-Power (GTP)).

The presence of these pipelines and associated powerlines and plant facilities will increase habitat disturbance as well as contribute to loss of Species of Conservation Concern. As a result, fragmentation of the port area will be increased, as well as the numbers and level of invasive of alien invasive plant species. Cumulative impacts are expected to be high.

It is recommended that all activities within the area coordinate the mitigation measures to ensure that an Open Space Management Plan, Rehabilitation Plan and Alien Invasive Plant Management Plan are developed and implemented for the area as a whole as these kinds of management measures should not be attempted in isolation.

7.5.7.3 *Specialist 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 Species of Conservation Concern.
- Amendment of application for permits for removal of any SCC where required.
- The development and application of a rehabilitation plan post Environmental Authorisation.
- The development and implementation of an alien invasive plant management plan post Environmental Authorisation.

7.5.8 **Avifauna Impacts**

Five species of Priority birds were recorded along the existing power lines and from two Vantage Points either side of the port docking area. These included some of the most collision-prone species known in South Africa. Of special note was the presence of two *Endangered* species: Black Harriers *Circus maurus* and Cape Cormorants *Phalacrocorax capensis*) and the *Vulnerable* Caspian Terns (*Sterna caspia*). Other species were Least concern and mainly raptors.

A major finding was the presence of a pair of Black Harriers starting to breed in September on the shoreline in *Juncus* vegetation. This vegetation type is a favoured nesting substrate but the presence of the birds so close to a busy port (500 m from the iron ore storage facility) was unexpected. The male Black Harrier captured and GPS-tagged on 19 October in the harbour areas. The first 48-hours of his track is shown in Figure 7-8.

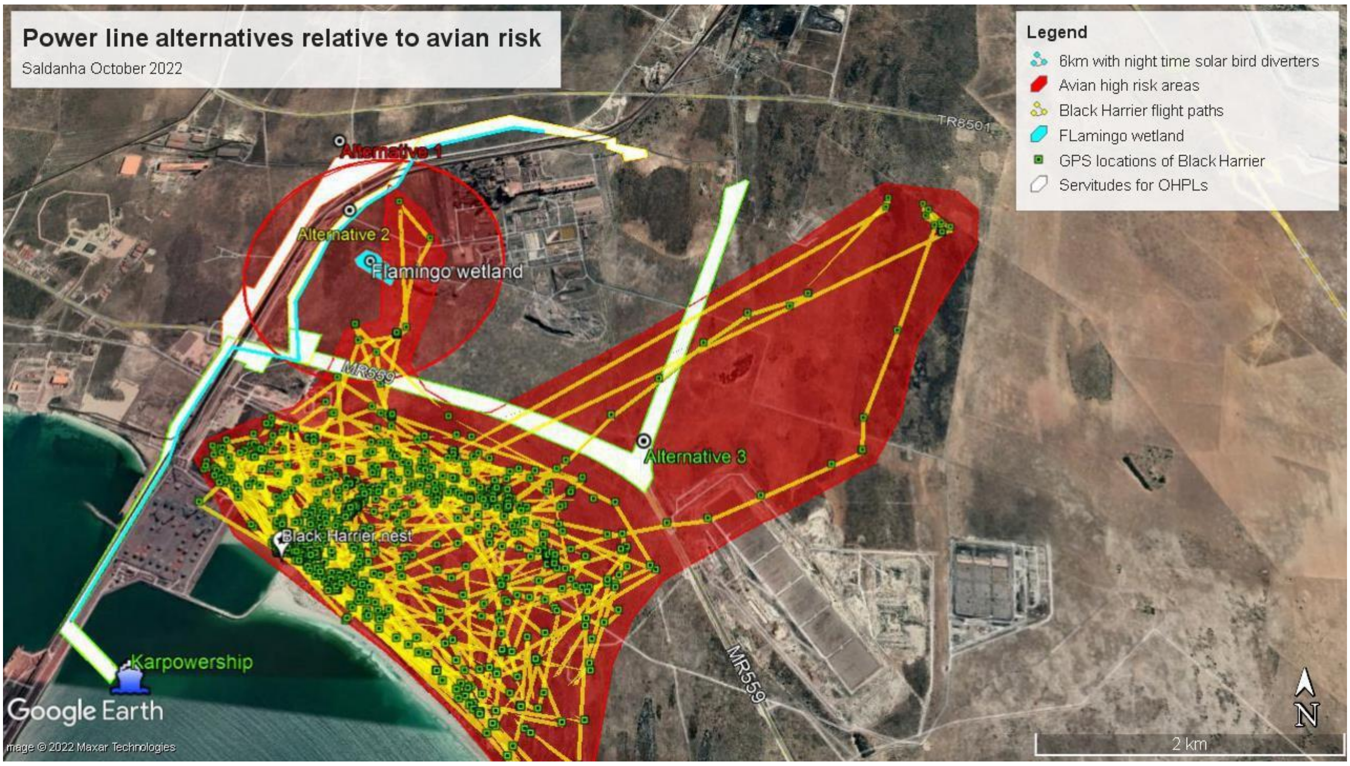


Figure 7-8: Avian High-risk areas (= red polygons) associated with the OHPL alternatives in Saldanha Harbour area. Two red data species of conservation concern, the Black Harrier nesting (= BH nest) and 140+ flamingos occur in the wetland (= flamingo wetland) buffered by the circular polygon (= 1 km radius). As night-flying and highly collision-prone species the Alternative 2 OHPL is now only 280m from flamingos (rather than >500 m). As such it is risky from an avian perspective. GPS-tracking data of the Black Harrier from 20-26 October 2022 (yellow lines) identified the main foraging areas of the male (= largest polygon) nesting in the harbour area. The Alternative 3 OHPL is a no-go option for birds because it intersects the Black Harrier flight path and the Flamingo buffer. The OHPL alternative 1 (= red) remains the least risky for all birds but is not technically and legally feasible and the Alternative 2 option with diurnal-nocturnal bird diverters (= blue line) along 6km is the best of the two options.

To provide more exact estimate of the risk to birds in the Saldanha Bay area, the number of birds that may cross the lines were determined by recording the number of priority species per hour of observation from the two Vantage Points overlooking the beach and the iron ore facility where the lines will come on shore. At this stage, time was limited by a lack of access to the Transnet port facility and 6.5 hours was undertaken recording flying birds in February 2021. In June 2022, the emphasis was targeting possible breeding areas of the Black Harriers, requiring different techniques, and covering 3h of focussed work. A follow up visit in October 2022 covered 48 hours of observation and trapping. The passage rate was relatively high at 9.85 birds per hour for all 9 species and included two red data species – Caspian Terns and Cape Cormorants – both in low numbers. A total 5 priority birds were recorded. Flight heights were often at power line height of 0 to 50m (31 of 38) for all species combined (Table 3). Thus, while Passage Rates were high, the number of priority species was low.

The risk to priority collision-prone birds was measured by walking and driving 9.1 km of the existing lines (from 2 to 5 lines abreast) in February 2021 and September 2022. Only 3 fatalities and three species were found in the 9km surveyed to give a fatality rate of 0.33 birds per km. No dead birds were found in 2022. No migratory species, found in abundance in the surrounding bays, lagoons and IBAs were found as power line fatalities. This suggested these birds won't be at risk from future power lines here.

On the positive side, power lines are sometimes used for breeding by raptors or crows and one prominent and unusual breeding species was a Yellow-billed Kite (*Milvus parasitus*) found just outside the main entrance of the Saldanha steel works.

In 2022, several significant finds came to light:

- 3000 Cape Cormorants were recorded on the beach adjacent to the iron-ore depot.
- An *Endangered* Black Harrier nest was discovered on the shore nearby.
- A wetland, dry in 2021, but inundated in 2022 was found holding 140+ Greater and Lesser Flamingos, and that lay 600-m from the proposed lined. As a highly collision-prone species the adjacent power line requires mitigation to avoid collisions.

The planned entry point of the Gas pipeline on shore (Figure 7-9) is a challenge for the following reasons:

- The roost site of up to 3000 Cape Cormorants (pipe bisects the roost)
- The newly discovered breeding site of the Black Harrier (stringing yard is only 200m from the nest)

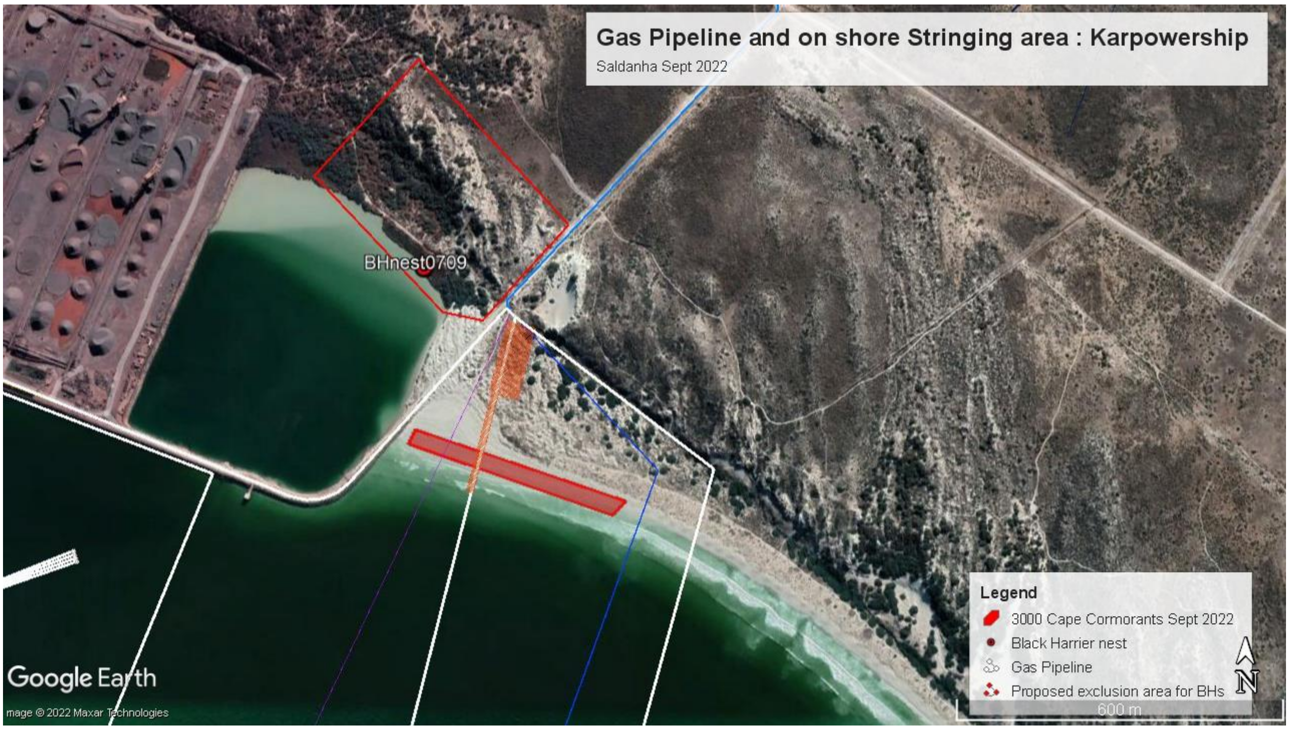


Figure 7-9: The on-shore entry point of the undersea liquid gas pipeline (=central white line) indicating the Construction ("Stringing") area (= orange polygon) and its proximity to the Black Harrier nest, 220 m west, and the roosting Cormorants (= red polygon).

The proximity of the stringing area (Figure 7-9) to the active Black Harrier nest, 220m west, will cause (noise and human) disturbance. The mitigations for reducing disturbance are outlined below.

The presence of the Red Data species in the form of the Black Harrier nest, the 3000 cormorants and the ~140 flamingos each requires careful planning to avoid disturbance or collision fatality. In summary**,** Passage Rates for birds along the shoreline were relatively high at almost 10 birds per hour and included three Red Data species (Black Harrier, Cape Cormorant and Caspian Tern). Six Priority species were recorded in total. Few bird fatalities occurred on the existing lines (0.33 birds/km of 132kV line), possibly because multiple lines are more visible. None were Priority species. This suggests that few fatalities will occur if another line, parallel to the existing lines, is built to export energy from the power ship to the grid. However, the presence of the Red Data species including (i) the Black Harrier nest, (ii) the 3000 cormorants and (iii) the ~140 flamingos represent high risk areas each requiring careful planning of power lines and pipelines to avoid disturbance or collision fatality. These mitigation measures have been discussed and explained to Karpowership SA, and it has been confirmed the recommendations and mitigation measures will be implemented.

Given the presence of the above species, the following high risk areas were identified (Figure 7-8):

- **A high-risk** area around the flamingo wetland (a 1 km buffer is shown)
- A **high risk area:** where the stringing yard and preferred liquid gas pipeline route is planned to reach the shorelines from the FSRU.
- A **high risk** area around the Black Harrier nest site, extending northeast around the first 48 hours of GPS-tracking of the male Black Harrier.

No hotspots of avian fatalities along the existing lines were located based on the low frequency of live birds in flight and the low number of bird carcasses found under 9km of surveyed power line.

For the high-risk areas identified along the onshore power lines, we recommend the following mitigations along the proposed routing, for the ship-to-shore section across open water and for the harrier nest area.

Power line alternatives, mitigations and constraints

(a) **Alternative 1** (red in Figure 7-8) is the safest option as it is furthest from the flamingo wetland (> 500m) and it allows the line to be aligned parallel with the existing 132kV lines and the pylons to be staggered such that the new pylons align with the mid-span of the existing line. This will create a **staggered pylon effect** increasing visibility of each line (Pallett et al. 2022). This is the shortest option.

(b) **Alternative 2** (yellow in Figure 7-8) is less optimal because it will occur only 280m from ~150 flamingos, and it does not allow staggering as a mitigation option. **If this line is chosen, then nocturnal-diurnal bird diverters will be required along the entire (7 km) length in the flamingo buffer.** These are lit at night such that night-flying species such as flamingos are alerted to the lines.

(c) **Alternative 3** (green in Figure 7-8) is high-risk given the presence of the Black Harrier foraging path highlighted by the GPS-tracking data. In 48 hours the male traversed this option 6 times in 24 hours.

(d) For the **Ship to shore power line** connection, we recommend that the shorter route is constructed, and provided with bird diverters (birds may still perch on, and foul, the line).

(e) All pylons must be bird-friendly (conductors slung below the towers) to avoid electrocution

(f) As one of the few vessels to be permanently moored in the Big Bay section of Saldanha harbour, the Karpowership itself is likely to **attract many marine birds** seeking predator-free and warm areas to roost. Cormorants are particularly known to be attracted to stationary vessels for roosting. With 3000 – 5000 cormorants recorded in the bay they have the potential to foul the ship with copious guano deposits. Thus, bird deterrents must be investigated should this occur. The avifaunal specialist suggests human and automated bird scarers to keep cormorants away.

Constraints: implementing the Alternative 1 (as the preferred option to reduce risks to flamingos and harriers) is not an option given both legal issues and land-ownership issues preventing the new OHPL being constructed adjacent to the exiting line (Triplo4 pers comm 25 October 2022). Thus, while building the line further (> 500m) from the flamingo wetland and staggering the pylons would be the optimal mitigation to reduce risk, this is not feasible. Alternative 2 ("Preferred"), is the second-best alternative, but it must be constructed with the nocturnal-diurnal bird diverters for the entire length of the line (~7 km).

Pipeline alternative, Black Harrier nest disturbance, mitigations and constraints

The avifaunal specialist originally recommended that the Liquid Gas Pipeline is routed directly to the stone causeway of the Oyster farm avoiding the beach and the roosting cormorants altogether. However, discussions (9 October 2022) with C Meintjies of Karpowership, Dr K Pitamber of Siring Engineering and H Plomp and S Singh of Triplo4, revealed this was not technically feasible. The gas pipeline will be laid subsurface of the beach and will surface closer to the vegetated dunes ~300m above the low tide. The technically preferred option is that shown as the white line in Figure 7-10.

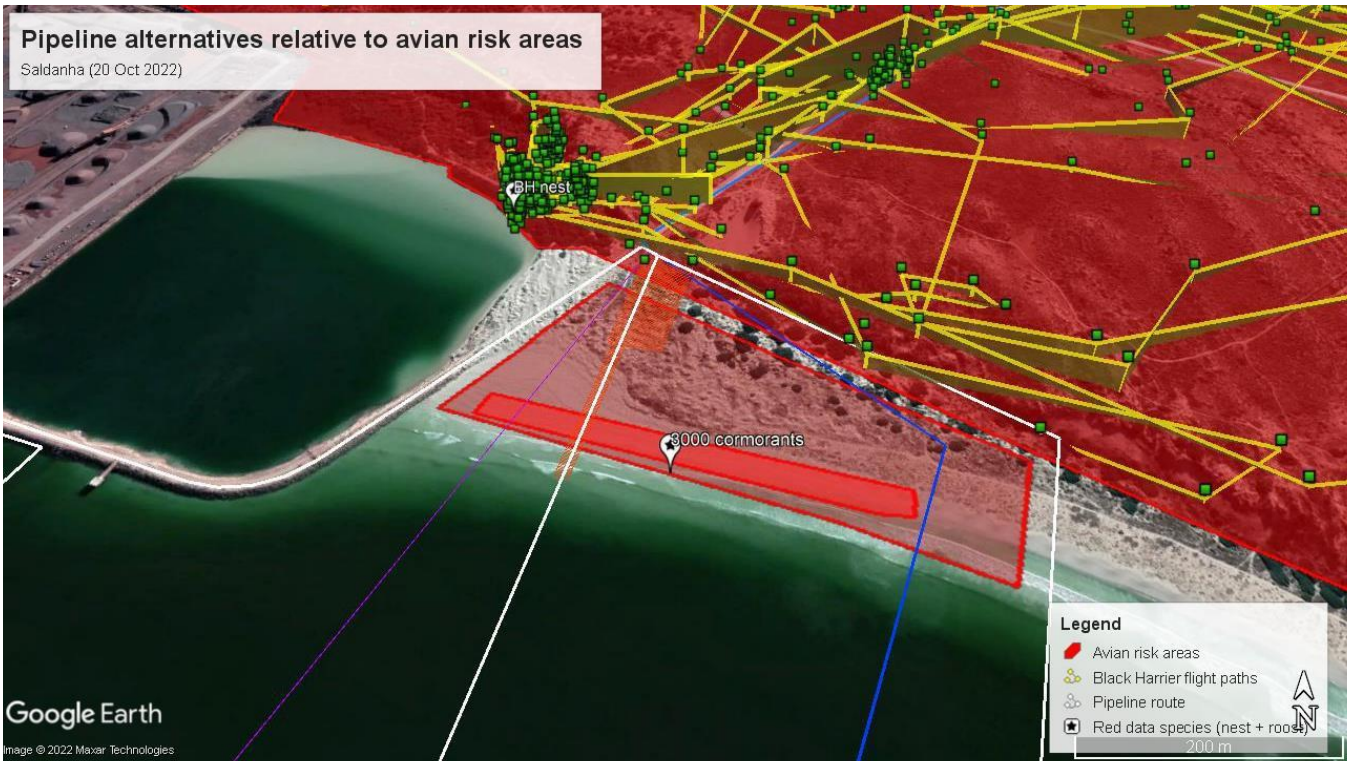


Figure 7-10: The on-shore entry point of the undersea liquid gas pipeline (= central white line) indicating the Construction ("Stringing yard") area (= orange polygon) and its proximity to the Black Harrier nest, 220 m west, and the roosting Cormorants (= red polygon). The alternative routing (= blue line) is preferred is least risky but in discussion with the EAP creates disturbance to fragile dune environment. Thus the white line routing is the best routing with construction mitigations for the Black Harrier nest in place.

The avifaunal specialist recommended that:

- The pipeline comes ashore 200m east of the white centre line (blue line in Figure 7-10) to reduce disturbance to roosting cormorants but more importantly to the Black Harrier nest (only 220m away). Disturbance to the breeding harriers is the main issue at stake here. Moving the stringing yard >500m from this nest would have been the best option avifaunally.

Constraints: In discussions (25 October 2022) with Triplo4, the feasibility of moving the stringing yard (an area where the pipes are fitted together and slowly pushed out to sea) was discussed and it was pointed out that the fragile dune habitat (through which the pipeline would need to run), could not be disturbed, and it was also outside the property boundaries of the Steel works. Both reasons make this option unviable.

The avifaunal specialist thus recommends instead that:

- The construction at the Stringing Yard is ideally undertaken outside the harrier breeding season of July/Aug (eggs vulnerable) to October/December (nestlings vulnerable). This may not be necessary if the following is complied with.
- Discussions with the EAP, engineer and Karpowership (4 November 2022) indicated that stringing yards are relatively quiet construction areas comprising some welding of pre-formed sections of pipes (inside a sheltered area) that are then winched out to sea by a barge 3km offshore.
- Several containers are required for storage, and they should be placed on the north-east side of the lay down area. No workers stay over night in the area.
- Disturbance at the time of initial clearing of the site can be gauged by the avifaunal specialist and feedback given to the ECO and the contractors on site
- **The avifaunal specialist strongly recommends that the harrier nest is fenced off**. That is, it is both fenced off (preventing human access and disturbance) and screened off (preventing visual disturbance). The fencing should be on the west side of access "Sunrise" road and be a minimum of 2m high (Figure 7-11). Visibility should be reduced with dense shade cloth, able to withstand the strong south easterly winds that are a feature of this area. Green chain-link fencing and notices to keep out of the area will be required. The avifaunal specialist suggests that the fencing is removed at the end of operations (thus it is a temporary structure). Any alien trees that have grown in the 12 months around the fence should be removed at the same time.
- The avifaunal specialist further recommends that the fence limits access to the nest area but does not surround the Black Harrier nest area as originally suggested. This will allow access to the wood cutters (from the north) to continue to remove the alien trees that threaten to engulf the two vleis here. This too should be limited to outside the harrier breeding season
- Given that the construction of the fencing is not constrained by the winter storms, the avifaunal specialist suggests that this is built outside the harrier breeding season, well before the Stringing operations begin (i.e. constructed between 1 January and 30 June if possible)
- The fencing should disallow predators such as crows, gulls and Jackal Buzzards from perching on it (hence each support pole should have a sharp end, disallowing perching).

The Soundscape bubbles presented for the Karpowership noise pollution study are relevant here since the sound bubbles extend around the Black Harrier nest. The noise level is however, 30-40 dBA and is unlikely to disturb the birds. No additional mitigations are required, therefore.

Figure 7-11: The proposed double fence around the Black Harrier nest to prevent disturbance and human intrusion from the Stringing Yard operations. The red line represents a screening fence (robust shade cloth) to reduce visual impacts over and above the chain-link fence to reduce human intrusions. The north-west side of the fence no longer joins with the Iron ore depot to allow access to wood cutters to remove alien trees smothering the two vleis here.

Given compliance with all the avian mitigations itemised above, the avifaunal specialist recommends that the power line Alternative 2, and the preferred pipeline routings be authorised. Given the constraints on the Stringing operations, the avifaunal specialist recommends that the operations at the Stringing Yard be allowed to commence as winter storms subside and that all efforts to reduce noise and visual disturbance are enacted as detailed above. The double fence, unconstrained by winter storms can be built earlier – outside the harrier breeding season.

7.5.8.1 Impact assessment with mitigation: __Construction and Operational Phases__

1. 132kV power line and collector substation to export generated power from the power ship to the national grid. **Operational Phase. Note this is for the "Preferred" alternative (yellow in Figure 5)** **Nature**: Negative impact due to direct impact mortality (or avoidance of area) around any new power line for the Red-listed bird groups identified as at risk above. Flamingos, and other shorebirds or terns are the most likely to be impacted by overhead power lines; Resident birds are more likely to face disturbance during the construction phase of the grid infrastructure.		
	Without mitigation	**With mitigation**
Extent (E)	**1**	**1**
Duration (D)	**4**	**4**
Severity (S)	**5**	**3**
Frequency (F)	**3**	**3**

Probability (P)	**5**	**3**
Significance (F+P)/2*[(E+D+S)/3]	**13.3 (High)**	**9.3 (Medium-high)**
Status (+ve or –ve)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of species?	No	No
Fatal Flaw?	Yes, it is unnecessary to construct the new Preferred line this close to a wetland with known highly collision-prone red data species	This can be mitigated by moving the proposed "Preferred" line away from the flamingo wetland
Can impacts be mitigated?	Yes, by staggering the pylons of the proposed **Alternative 1** line adjacent to the existing Eskom 132 kV Only by adding diurnal-nocturnal bird diverters along all sections of the "Preferred" line would any form of reduction in flamingo fatalities be possible.	Yes, by marking all future lines as they are constructed, and staggering adjacent power line towers
Mitigation for power lines: (i) Move the "Preferred" line to the Alternative 1 option (away from the flamingo wetland) (ii) Micro-adjust the 132 kV line route alongside the existing Iscor-Blouwater line and **stagger** the pylons to increase visibility for all birds on site; (iii) add bird diverters or spirals (diurnal and nocturnal) to all new lines, to reduce fatality rate (iv) ensure all electrical infrastructure is bird-friendly to avoid electrocutions by slinging all conductors below the support structures		
Residual impacts: After mitigation, direct mortality may still occur through collision or area avoidance by the species identified above, and additional mitigation (more nocturnal diverters) for the high-risk sections of the power line will be needed.		

132 kV power line and switching station to export generated power from the Karpowership to the national grid, **Construction phase.** **Nature**: Negative impact due to avoidance of the area (due to human activity, noise, predation threat, iron ore dust) due to construction of the new power line for the Red-listed bird groups identified as at risk above. The shorebirds, ibises, kites and other collision-prone species may be disturbed due to anthropogenic activity caused on the ground during the construction phase of the grid infrastructure.		
	Without mitigation	**With mitigation**
Extent	**1**	**1**
Duration	**4**	**4**
Severity	2	1
Frequency	**1**	**1**
Probability	**2**	**2**

Significance (E+D+M)P	**3.5 (Low)**	**3.0 (Low)**
Status (+ve or –ve)	Negative	Negative
Reversibility	Medium	Medium for all bird
Irreplaceable loss of species?	No	No
Can impacts be mitigated?	Low impacts, but reduce human disturbance around the line especially near the flamingos	

Mitigation for disturbance during construction:
There are several classes of mitigation for birds in terms of the construction disturbance for the proposed grid connection through and from the 132 kV Karpowership:

(i) reduce the extent of human disturbance to around the line itself (i.e. within the 300-m corridor allocated);
(ii) avoid any active nests (some ground-nesters may be found on the beach);
(iii) avoid polluting the area with plastics or human waste – all material to be disposed of in suitable sites.

Residual impacts:
After mitigation, direct mortality may still occur through collision or area avoidance by the species identified above, and further research and mitigation for the high-risk sections of the power line will be needed.

2. **Liquid gas pipeline routing and Stringing Yard**

Nature: Negative impact due to major disturbance to (i) harrier breeding habitat and (ii) roosting habitat of the Cape Cormorants by the presence of the Stringing yard.
The prime Black Harrier nesting habitat (220 m west) in particular will be disturbed by the construction and presence of the "Stringing yard" where the pipeline comes ashore at the beach and emerges 300m inland.

	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Severity	4	3
Frequency	4	4
Probability	4	3
Significance (E+D+M)P	**12.0 (High)**	9.3 (medium)
Status (+ve or –ve)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of species?	No	No
Can impacts be mitigated?	Yes, by avoiding this area by re-routing the pipeline to come ashore 360 m east (Fig 5) If this is not possible, the stringing operations should rather take place outside the July to December window (the harrier breeding season) to reduce disturbance at critical times.	

	The Black Harrier breeding area should be fenced off, preferably with palisade fencing, shade cloth and signage, disallowing human entry and also from other predators from perching See Figure 5
Mitigation for pipelines: (iv) Re-route the liquid gas pipeline to come ashore 360m further east away from the harrier nest area. (v) If this is not feasible then construction should not occur from July to December (the harrier breeding season) (vi) Fence off the area around the Black Harrier nest (see figure 6) to reduce any human or vehicle disturbance (fence construction also outside the breeding season – mid-December to end of June)	
Residual impacts After mitigation, disturbance or destruction of habitat may still occur and BBU suggests that the area around the Black Harrier nest is fenced off to disallow human or vehicle traffic. Monitoring of this high-risk area is essential to determine impacts.	
Fatal Flaws Human disturbance at the Black Harrier nest can cause failure and this must be avoided wherever possible	

1. **Karpowership mooring and soundscape**

Nature: Negative impact due to noise from power generation on (i) harriers breeding ~1.1 km and (ii) roosting habitat of the Cape Cormorants. The harrier nest and Cormorant roost lie within the sound bubble of 30-40 decibel and this relatively low frequency and low volume hum is unlikely to have adverse effects on the birds. Birds are known to move away from noise levels of 110 dB. (Williams 2021) but the Karpowership will not produce noise of this magnitude at these distances (Figure 8).

Nature: Positive, if Cape Cormorants (and other birds) seek a secure (and warm) roosting site on the Powership

Negative, if the ships' sound bubble drives fish and marine species away

	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Severity	2	1
Frequency	5	5
Probability	3	2
Significance (E+D+M)P	**9.3 (Medium-high)**	**7.0 (medium)**
Status (+ve or –ve)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of species?	No	No
Fatal Flaw?	No	No
Can impacts be mitigated?	Yes, presumably by sound baffling around the ship	

Mitigation for noise levels: Sound baffling around the ship and generators could reduce the noise levels Mitigation for birds roosting on the ship: Various methods exist for dissuading birds from roosting on ships, of which the simplest is to manually scare birds away. For more inaccessible areas, loud noises, flapping flags and slowly turning horizontal fans with long arms are useful. Turning mirrors are not generally successful due to habituation.
Residual impacts After mitigation, noise disturbance may still occur and BBU suggests that the additional noise abatement strategies are pursued with experts and constantly monitored.

7.5.8.2 Cumulative Impacts

Cumulative impacts are those that will impact the general avian communities in and around the 132 kV Gas to power development and the associated grid infrastructure, mainly by other wind and solar farms and their associated infrastructure in the Nama Karoo. This will happen via the same factors identified here viz: collision, avoidance and displacement. As a starting point, the number of renewable energy developments (proposed and approved and developed) around the region within a 30-km radius of the site needs to be determined, and secondly, to know their impact on avifauna.

Given the general assumption that power line length and bird impacts are linearly related, a starting point in determining cumulative impacts is to determine:

- the number of birds killed by collision with the new power lines surrounding the site; and
- the length and size of the existing power lines within 30-km.

Given that:

- transmission lines (> 220kV) kill ~1.05 birds/km/yr (Shaw 2013); and
- distribution lines of 66kV kill ~0.37 birds /km/yr (Shaw 2013);
- the Aurora-Blouwater 132kV line kills an estimated 0.33 birds /km.

a cumulative total of 57 priority birds per year are expected to be killed by these 66 kV, 132kV power and 400 kV lines per year.

Table 7-14: All power lines within 50-km of the 132 kV Gas to power Solar PV Farm and associated (adjusted) bird fatalities from similar size power lines (Shaw 2015). Estimated fatalities for the entire 78-km is 57 birds per year.

	Power line	Voltage	Length within the 30-km radius (km)	Rate of bird deaths from same-size power lines	Estimated number of bird deaths/ year
1	Aurora/Blouwater	132 kV	25.0 km	0.33 b/km/yr	8.25
2	Aurora/Paleisheuwel	132 kV	10.0 km	0.33 b /km/yr	3.3
3	Amcor/Blouwater	66 kV	28 km	0.33 b/km/yr	9.24
4	Blouwater/Tee 1/Velddrift	66 kV	32km	0.33 b/km/yr	10.6
5	Blouwater/Fisheries Linking	66 kV	32 km	0.33 b/km/yr	10.6
6	Aurora/Moreesburg	400kV	14.5 km	1.05 b/km/yr	15.2
7	Aurora/Juno	400 kV	19.0 km	1.05 b/km/yr	20.9

Totals: 7 lines (2 of 132kV, 3 of 66 kV and 2 of 400 kV) of 78-km are estimated to kill 57 birds per year	**57 birds**

Table 7-15: Cumulative impacts of the 132 kV Gas to power project relative to other power lines within 30-km of the proposed power line.

Nature: The impact of the grid infrastructure power line and switching station, in the Saldanha habitat is expected to be generally negative and arise from disturbance, and collision for birds around the power lines. The associated infrastructure (power ship) may also affect species in the form of impacts with noise pollution. However, it will simultaneously provide nesting sites and perch sites for some avian species (gulls, cormorants, kestrels and kites), and the warmth may attract these species to roost on the lines and or Powership.

The direct cumulative impact of the 6.5-km of new proposed lines (Table 7-14) was gauged using empirical data from the existing Iscor -Blouwater132kV lines themselves and from Shaw (2015) on bustard mortalities on South African power lines of different sizes. An estimated 57 birds are expected to be killed annually on the lines (mainly ibises, gulls, crows and other non-priority species). What is unknown is how the flamingos as nocturnal flyers will add to these totals.

Careful mitigation through marked lines, nocturnal-diurnal bird diverters and staggered pylons (on shore) along adjacent lines can reduce this low mortality to lower levels.

	Contribution of the proposed grid infrastructure for the proposed 132 kV Gas to power project *	**Cumulative Impact of all power lines within 50 km**
Extent	Local (1)	Regional (3)
Duration	Long-term (4)	Long-term (4)
Severity	Significant (3)	Significant (3)
Probability	Likely (3)	Likely (3)
Frequency	Once or more per month (3)	Once or more per month (3)
Significance	**Medium-High (9.3)**	**High-Medium (9.3)**
Status (positive/negative)	Negative/positive	Negative/positive
Reversibility	High	Medium
Loss of resources/species?	Yes	Yes
Can impacts be mitigated?	Yes	Yes

*with mitigation

Confidence in findings: Medium-high: the mortality data derived from the powerlines are on site and will influence exactly the same species as the proposer 132 kV line. The data on bustards and other birds (Shaw 2015) is also based on a large data set across different lines in South Africa. The mitigation measures suggested (staggered pylons and nocturnal bird diverters on the lines) have not been tested, but diverters alone have in a large-scale experiment in the Karoo (Shaw et al. 2020). They reduced large bird fatalities by >50% relative to unmarked controls. For Blue Cranes the line markers reduced fatalities by 92%. What is unknown is if flamingos will be susceptible to the power lines marked with diurnal-nocturnal markers.

Mitigation: Reducing avian impacts at power lines can be achieved several ways. The recommended measures include:

- Staggering the pylons, with the existing Iscor-Blouwater 132kV line, to increase visibility and reduce the risk of flamingos/bustards/harriers colliding with them.
- Marking, with diurnal-nocturnal bird diverters, all OHPL within the high-risk areas in Figure 5.

7.5.8.3 Specialist Conclusion

By implementing these measures to mitigate possible impacts for these collision-prone species, risks and mortality can be reduced to acceptable level and the avifaunal specialist recommends authorisation be permitted.

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 Saldanha, which identified noise levels to which the water at the Iron Ore Jetty and surrounding area is already exposed. A survey was also carried out at the location of a large Khan class Powership in Ghana, of a similar class specification (sister ship) to that of the Powership planned at the Port of Saldanha, 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.

No significant construction activities to aid mooring of the vessels, for example rock breaking, dredging or impact piling, will be required for the installation of the Powership or FSRU. Therefore, any noise will be commensurate with the port working under normal conditions.

The results of the assessment showed that after installing the Powership and an FSRU, even with the Powership operating in excess of the maximum output proposed for the port, the background noise would increase by approximately 9 dB in close proximity to the Powership (approximately 400 m from the ship). This is equivalent to a noise level of 127.6 dB SPL_{RMS} re 1 µPa. This is an above worst-case scenario, since the Powership's maximum contracted capacity is set to 320 MW in Saldanha, whereas this prediction is based on a directly measured 420 MW operation. For context, large cargo vessels were frequently loading or unloading in the Port of Saldanha during the baseline survey and, for example, a bulk carrier typical of the type accessed in the harbour produced noise levels of 134.6 dB SPL_{RMS} re 1 µPa at 100 m from its side in port, a similar noise level to the Powership at the same distance.

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 in Small Bay and most of Big Bay will be less than 1 dB above baseline with the Powership operating at maximum power. Outside the Port of Saldanha Bay, no detectable noise contribution is expected.

7.5.9.1 *Impact assessment:* ***<u>Operational Phase</u>***

7.4.9.1.1 Impact of underwater noise on marine mammals

In order to correctly assess the impact on various species, the underwater noise must be appropriately weighted to account for the differing hearing sensitivities of each species.

To present a worst-case scenario, it has been assumed that the Powership will operate at maximum capacity for 24 hours a day; it is understood however that Powership operation in Port of Saldanha is limited to 16.5 hours a day and will not be operating at maximum installed capacity.

Table 7-16: TTS thresholds for marine mammals exposed to the Powership continuously for 24 hr/day, based on TTS thresholds defined in Southall et al. (2019)

	TTS threshold	Range to meet TTS onset
Low-frequency cetaceans (LF)	179 dB SELcum	290 m
High-frequency cetaceans (HF)	178 dB SELcum	<50 m
Very high-frequency cetaceans (VHF)	153 dB SELcum	700 m
Phocid carnivores in water (PCW)	181 dB SELcum	55 m
Other carnivores in water (OCW)	199 dB SELcum	<50 m

Only LF cetaceans (baleen whales) and VHF cetaceans (porpoises) have calculated impact ranges in excess of 200 m. The largest range, for VHF cetaceans, would require an individual to remain in 'line of sight' of the Powership within the above range for a full 24-hour period to be exposed to noise sufficient to produce the onset of TTS symptoms, even under the worst-case scenario conditions described above. To produce PTS onset, the most sensitive species (VHF cetaceans) would need to remain within approximately 25 m of the Powership for an entire day under maximum load (much closer for the other species categories), and as such there is no reasonable expectation of this.

Based on the above, particularly 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 Port of Saldanha.

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 outside of the normal operational port is anticipated, except if potentially directly adjacent to the ships.

7.4.9.1.2 Impact of underwater noise on fish

The assessment of underwater noise on fish is simpler than for marine mammals; based on the Guidelines in Popper *et al.* (2014) (see section 5.2) no weighting is applied or required to calculate the impact thresholds. The exposure criterion for TTS to the most sensitive species of fish is 158 dB SPL_{RMS}, to which a fish must be exposed for 12 hours.

The calculated noise levels in the Port of Saldanha 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 Saldanha is expected as a result of the Powership installation. More information is provided in the marine ecology report Ref. B4, Marine Ecology, Oct 2022.

7.5.9.2 Cumulative Impacts

Based on measurements taken during the baseline monitoring exercise at Port of Saldanha, it is demonstrable that the noise levels shown (that represent the effect of Powership operations) 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. The cumulative effect of these passing vessels will be negligible due to their distance from the operational Powership and auxiliary vessels.

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 (VHF cetaceans, i.e. porpoises) remained within 700 m of the Powership operating at maximum capacity for a full 24 hours. 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.

7.5.9.3 Specialist Conclusion

Based on this assessment, no significant impacts on fish or marine mammals are predicted as a result of the operation of the Powership in Port of Saldanha 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**

Two anomalies, MA 04 and MA 08 are near the shoreline, east of the LNG pipeline. MA 06 is on the edge of the survey zone. It may be a bigger anomaly; however, it is unlikely to be impacted by the development. It is also near the aquaculture zone and may be debris from its construction. Another anomaly, MA16, on the western edge of the survey area is 288m from the jetty and may be jetsam – the underwater archaeology specialist indicated that if this area is going to be impacted, it should be investigated.

The anomaly to look out for during construction is to the north of the aforementioned anomaly. MA15, is a fairly large anomaly, not near to the jetty and far away from where ships dock. It is also close to the shoreline where one usually finds wrecks, and although it is not large enough to be a shipwreck, it may be part of a wreck debris field. The magnetometer survey cannot get close to the shoreline. It is directly under the proposed pipeline and must be investigated after EIA authorisation is received and prior to construction commencing. The appointed archaeologist must verify this anomaly during construction of the gas pipeline (see management measures below).

The only study that was considered under a polycentric approach was the ACRM (2022) report on potential pre-colonial terrestrial sites and our conclusions and recommendations are aligned. While there is a low probability that shipwrecks will be found underwater, there exists a chance that shipwreck material and/or pre-colonial sites (shell middens and stone tools) may be found in the dunes and on the beach during construction and if that is the case, the management measures below must be followed.

7.5.10.1 Management Measures

The following management measures apply to the project:

- An archaeologist must be appointed for the duration of the construction phase of the project, specifically for the beach/dune area.

- The appointed archaeologist must have the requisite experience and knowledge to recognise maritime cultural heritage that may be found in the beach/dune area.
- The appointed archaeologist must do a short induction to familiarise the contractors and workers, including divers, to the potential heritage material artefacts that may be exposed during work. This includes Stone Age, Early Farming communities, colonial and shipwreck artefacts and human burials.
- Should any heritage artefacts be exposed during marine/terrestrial excavations, work in the immediate area where the artefacts are discovered, shall cease immediately and the appointed archaeologist shall be notified as soon as possible.
- All discoveries shall be reported immediately to the appointed archaeologist so that an investigation and evaluation of the finds can be made. The archaeologist will advise the necessary actions to be taken, including notifying SAHRA and if the artefacts are below the high-water mark, SAHRA's MUCH Unit must be contacted.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the NHRA (Act No. 25 of 1999), Section 51.

7.5.10.2 *Specialist Conclusion*

There is a low possibility that impacts to underwater heritage could occur through the proposed development. With mitigation there is the possibility of a benefit to the heritage knowledge base through the discovery and recording of previously unknown underwater heritage. **The underwater archaeology report finds that the project is feasible, so long as the stipulated management (mitigation) measures are applied.**

7.5.11 **Marine Ecology and Marine Avifauna Impacts**

Impact 1: The effects of gas pipeline construction and installation and vessel mooring on the littoral and benthic community

A Powership and an FSRU will be berthed during the proposed project lifespan of 20 years. Berthing and mooring will be conducted as per the Port of Saldanha Bay's approved procedures and requirements, and ships will be located where adequate depths exist so that no additional dredging will be required. The moorings will comprise a spread-mooring system, comprising sixteen anchor legs running from chain stoppers on the vessel's deck to either 15-t embedment anchors or gravity-based mass concrete anchors. A gas pipeline to supply fuel to the Powership from the FSRU will be installed between the vessels.

Accordingly, the assigned overall environmental significance rating of the effects of construction on marine receptors is Medium-Low without mitigation and Low with mitigation.

Impact 2: The effects of the intake of cooling water on marine organisms in the surrounding water body

The operation of the Powership involves the continuous abstraction of seawater for cooling of the reciprocating engines, condensers and other auxiliaries. The cooling water is then discharged into the sea at a depth of 8 m, as recommended in the modelling report (PRDW 2022).

Seawater abstracted by the Powerships will entrain small marine organisms such as holoplankton, meroplankton and ichthyoplankton from the surrounding water body condenser cooling systems. This will be coupled with the impingement or trapping of larger organisms against the screens used to prevent debris from being drawn into the cooling water intake.

The impact's spatial scale will be site-specific but with potentially harmful impacts to marine ecology due to the volume and speed of intake. However, natural functions are not anticipated to be altered. The impacts are expected to last for the duration of the FPP operation, for the lifetime of the project. The ecological effect will be temporary as plankton biomass recovers quickly due to short generation times. Furthermore, the impact will be reversed once the project infrastructure is removed. Although some deleterious effects are expected, there will be little impact on natural processes in the context of site-specific scale and no irreplaceable loss of marine fauna and flora is expected. The assigned overall environmental significance rating is Medium pre-mitigation and Medium-Low post mitigation.

Impact 3: The effects of the discharge of cooling water on the marine ecology in the receiving water body

The operation of the Powership will involve the continuous discharge of cooling water into the sea at a depth of 8 m, as recommended in the modelling reports (PRDW 2021, 2022). The seawater is discharged through multiple outlets on the vessel hull. Total intake/outlet flow rates range from 2.4 to 11.4 m^3/s, and the increase in temperature of the seawater (ΔT) between intake and discharge ranges from 4 to 15°C.

The modelling results show that 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. No effects on benthos are expected. The thermal plume exceeds the 1°C ΔT guideline by 0.1°C. Nevertheless, the plume's absolute temperature did not exceed any of the biological thresholds. Some impacts within the Zone of Initial Dilution (ZID) can be expected, but these should be limited to non-acute levels. Therefore, the probability of damage to marine ecology if guidelines are met is "extremely low" outside of the ZID but could be "low" within the ZID in that community structure may be changed, but ecological function should continue. Where exceedance of the water quality guideline was observed (beyond 100 m of the discharge point), no ecologically sensitive habitats are present, i.e., natural functions should remain unaltered. No irreplaceable loss of marine fauna or flora is expected. The assigned overall environmental significance rating is Medium-High pre-mitigation and is reduced to Medium post mitigation.

Impact 4: The effects of increased noise and vibration levels on the marine ecology

Underwater noise will be generated primarily by the FPP operations. The noise generated by the FPP 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 FPP operations in Saldanha Bay.

The results of the underwater noise assessment of the Saldanha Port show that after the installation of a Powership and an FSRU, with the Powership operating at a maximum output in excess of that proposed for the port, an increase in background noise of approximately 9 dB in close proximity to the Powership (approximately 400 m from the ship) would be observed. This is equivalent to a noise level of 127.6 dB SPL_{RMS} re 1 µPa.

The noise produced by the FPP operations is not anticipated to contribute meaningfully to the existing noise levels in the Port of Saldanha. Furthermore, when considering an "above worst-case" scenario, the Powership does 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 Powership will be continuous. It is possible that marine organisms within hundreds of metres of the Powership 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 tens of metres of the Powership for 24 hours in order to experience the onset of Temporary Threshold Shift (where a temporary reduction in hearing sensitivity may occur). Considering these factors, the severity of the noise produced by the FPP is considered to be “small or potentially harmful” to marine receptors. The duration of the effect will be beyond 10 years as noise will be produced by the vessel for the duration of its operation. Noise produced by the FPP 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. No irreplaceable loss of marine fauna or flora is expected. Accordingly, the assigned overall environmental significance rating is Medium-High without mitigation and with mitigation is reduced to Medium.

Impact 5: The effects of impacts on ecosystem services

This report covers the impacts of the FPP on the provisioning services provided by Saldanha Bay, i.e., fisheries and mariculture. The impacts of increased noise levels due to the FPP are not certain due to the sparse literature on the effect of continuous low-level noise on marine organisms. However, there is evidence that noise of this type has the potential to be harmful or interfere with the ecological functioning of marine biota. As the Underwater Noise Assessment (Mason & Midforth 2022) determined, the Powership operations are not anticipated to significantly increase the underwater noise levels in Saldanha Bay. Within 400 m of the Powership there will be an increase in noise of approximately 9 dB but noise levels will not be high enough to cause direct harm to marine fauna, unless they experience prolonged exposure, which is deemed unlikely. Marine fauna may experience masking and behavioural changes within hundreds of metres of the Powership, which could have negative consequences over time.

Saldanha Bay, and especially the nearshore shallow waters, is an essential nursery habitat for the juveniles of many fish species and 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 FPP. Given the current population and low levels of white stumpnose recruitment within Saldanha Bay, efforts should be made to reduce impacts on juvenile white stumpnose. The extent to which juvenile white stumpnose inhabit the area of the proposed Powership needs to be established. 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 heavily fished areas of Saldanha Bay, increasing the risk of over-exploitation by commercial and recreational fisheries.

Marine invertebrates may also be impacted by underwater noise or the intake and/or discharge of cooling water. If the prey of fish are impacted, this could have knock-on effects to the fisheries. As the impacts of noise and the cooling water system are expected to be localised, it is unlikely that any impacts on invertebrates will have consequences felt at the fisheries-level.

The Aquaculture Development Zones (ADZs) in Saldanha are outside the noise impact zone of 400 m from the FPP vessels (which is predicted to experience and increase in noise of 9 dB). Given that the areas in the Bay outside of this noise impact zone are not predicted to experience any meaningful increase in noise due to the FPP, the ADZs will also not experience any significant elevation in noise levels. The nearest ADZ to the FPP is reserved for finfish, but it is not close enough for there to be any impact of noise on the fish, based on the results of Impact 4. The ADZs are also outside of the range of influence from the discharged cooling water.

The impact of the construction phase on ecosystem services has an Overall Environmental Significance of Low, which is reduced to Very Low if the calcrete reef is avoided, as this is a sensitive habitat that supports the marine ecosystem services.

Although noise from the operational phase is unlikely to cause direct harm to fish, there is still uncertainty around the extent to which the noise from the FPP will affect fish behaviour and distribution, partly due to gaps in research. As a result, the extent to which fisheries will be affected by the FPP operations is uncertain and the impacts are considered as possible. The scoring results in a Medium Overall Environmental Significance, which remains Medium 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.

Impact 6: Impact on dynamic coastal processes

The coastal location of the proposed activity within a Port and linking via transmission line to Saldanha Bay Steel means that these activities will be inherently exposed to risks associated with natural and dynamic coastal processes that continually reshape the coastal zone, such as wind, waves and sediment movement. As such, the anticipated key issues identified in the scoping report (Moore and Breetzke, 2020) related to the movement of sediment and wind erosion are collectively included within this assessment of impact and detailed collectively as Dynamic Coastal Processes. This includes climate change vulnerability, which is addressed fully in a separate specialist report.

With the proposed location of the Karpowership west of the ore jetty, within the existing inner Port of Saldanha, its proposed operation will not add to the existing and historic impact on sediment movement caused by the construction of the Port and its piers.

Potential impact on the dune systems that lie along the beach to the southeast of the Sichen pier during the transmission line installation is deemed to be negligible with impacts limited to the construction area. Any increase in wind-blown sand, as a result of construction, can be mitigated through best practice methods. Due to their largely vegetated and immobile state, any impact of blown sand on the gas to power process is also deemed largely non-existent.

The proposed operation could be susceptible to impacts relating to sea level rise (SLR), which is projected globally to be between 60 and 90 cm by 2100 according to the Intergovernmental Panel on Climate Change (IPCC). The proposed location of the Karpowership west of the ore jetty within the existing and protected inner Port of Saldanha with its lack of wave action and currents, implies that any impact will be addressed as part of the Environmental Management / Climate Change mitigation planning undertaken by the Transnet Ports Authority, in respect to all shipping activities associated with the Port.

Accordingly, the Overall Environmental Significance for the impact on dynamic coastal processes is Medium-Low, which is reduced to Low with mitigation.

Impact 7: Impacts of coastal pollution

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 process is considered to be high and specific controls are included in the EMPr.

As the proposed operation of the gas to power process takes place within a Port environment, the necessary Transnet National Ports Authorities environmental management programme and systems, specifically policies and processes relating to waste, dockside maintenance and repairs and comprehensive emergency response plans dealing with all foreseeable environmental emergencies, must be applied. It should be noted that the ‘Polluter Pays’ principle whereby those responsible for the spill are held liable for the clean-up costs, will apply in any pollution incident.

Solid waste is also anticipated to be generated by the construction of the transmission lines. If not properly managed and contained, these items will find their way onto the beach and into the surf zone. Any waste materials must be transported to appropriate disposal facilities.

Accordingly, the Overall Environmental Significance for the impact of coastal pollution is High, which is reduced to Low with mitigation.

Assessment of Potential Coastal Impacts

The majority of the infrastructure will be installed within the access-controlled Sishen pier and immediate operational area, so no change in coastal access is expected, as access is already restricted. The proposed location of the transmission lines does not restrict access to the coast and access routes to the coastline will still continue under the overhead lines. The only potential access restriction would be in the vicinity of the portion of the proposed gas pipeline that lies on the beach west of the Sishen pier. Although the pipeline itself will not physically restrict access, it is assumed that this portion of the beach would be closed to the public both during construction and operation due to safety as well as security concerns.

From a mitigation perspective, while access to public property along the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users.

Impacts of catastrophic accidents on marine ecology and ecosystem services

The introduction of the Powership and FSRU vessels increase the risk of the likelihood of catastrophic accidents occurring. Here, the following were considered to be a catastrophic accident:

- Large hydrocarbon spills above Tier 3 as outlined in the “Port of Saldanha oil spill contingency plan” (Transnet National Ports Authority 2007) - i.e., a spill greater than 300 tonnes.
- Explosion/flash fires.
- Major vessel collision/sinking.
- Unintentional removal of vessel from moorings.
- Introduction of toxins, biocides or alien species considered extremely harmful to marine ecology.

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.

7.5.11.1 *Impact assessment:* ***<u>Construction Phase</u>***

Impact 1: The effects of gas pipeline construction and installation and vessel mooring on the littoral and benthic community

Table 7-17. Impact 1 scoring table (without mitigation): Pipeline construction and installation.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	4 – Site-specific and wider natural processes and/or functions are altered to a large degree/temporarily cease
Duration a measure of the lifetime that the impact will be present	1 – up to 1 year
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint
Overall Consequence = 6 / 3 = 2	
Likelihood	
Frequency how often the impact will occur	1 – Once a year, or once or more during operation, or once off
Probability the likelihood or the chances that the impact will occur	5 – >75% chance of occurring (definite)
Overall Likelihood = 6 / 2 = 3	
Overall Environmental Significance = 2 x 3 = 6	
Overall Environmental Significance:	
5 - 6.9	Medium - Low
Reversibility	
Reversibility degree to which the impact can be reversed	Irreversible – the impact is not reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Mitigation measures

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. It is recommended that high resolution bathymetry and side scan surveys should be conducted before the gas pipeline is installed to confirm that there are no important, potentially sensitive habitats along the pipeline route. This should expand on and address gaps the recently completed reef survey undertaken by Anchor in 2022.

The mooring's concrete blocks and the crushed rock used to protect the pipeline will provide hard structures for the colonisation of benthic communities, which tends to increase biological diversity in the project area.

If the calcrete reef habitats are avoided as far as possible, lasting damage to the benthic community is predicted to be extremely low due to the very limited spatial scale of disturbance along with low macrofaunal density in the intertidal and likely fairly rapid recovery. Irreplaceable loss of benthic fauna is unlikely to occur. The duration of the effects will be between up to 1 year. Impacts will, however, only reversed once the infrastructure is completely removed, and resettlement has occurred. Accordingly, the assigned overall environmental significance rating is Low with mitigation (Table 7-18).

Table 7-18: Impact 1 scoring table (with mitigation): Pipeline construction and installation.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	3 - Site-specific and wider natural processes and/or functions continue albeit in a modified way (general integrity maintained)
Duration a measure of the lifetime that the impact will be present	1 – up to 1 year
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint
Overall Consequence = 5 / 3 = 1.67	
Likelihood	
Frequency how often the impact will occur	1 – Once a year, or once or more during operation, or once off
Probability the likelihood or the chances that the impact will occur	4 – 50% - 75% (highly probable)
Overall Likelihood = 5/ 2 = 2.5	
Overall Environmental Significance = 1.67 x 2.5 = 4.18	
Overall Environmental Significance:	
3 - 4.9	Low
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Impact 5: The effects of impacts on ecosystem services

Table 7-19: Impact 5 scoring table (without mitigation): Impacts of the construction phase on ecosystem services

Scoring of Impacts	
Consequence	

Severity the degree to which the project affects or changes the environment	3 - Site-specific and wider natural processes and/or functions continue albeit in a modified way (general integrity maintained)
Duration a measure of the lifetime that the impact will be present	1 – up to 1 year
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint
Overall Consequence = 5 / 3 =1.67	
Likelihood	
Frequency how often the impact will occur	1 – Once a year, or once or more during operation, or once off
Probability the likelihood or the chances that the impact will occur	3 – >25% - 50% chance of occurring (probable)
Overall Likelihood = 4 / 2 = 2	
Overall Environmental Significance = 1.67 x 2 = 3.34	
Overall Environmental Significance:	
3 - 4.9	Low
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Mitigation measures: construction phase

The mitigation measures proposed for the construction phase are provided under Impact 1. These are mitigation measures for the marine ecology that underpin the ecosystem services.

Table 7-20: Impact 5 scoring table (with mitigation): Impacts of the construction phase on ecosystem services

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	1 – up to 1 year
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint

Overall Consequence = 5 / 3 = 1.67	
Likelihood	
Frequency how often the impact will occur	1 – Once a year, or once or more during operation, or once off
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 3 / 2 = 1.5	
Overall Environmental Significance = 1.67 x 1.5 = 2.5	
Overall Environmental Significance:	
0 - 2.9	Very Low
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Impact 6: Impact on dynamic coastal processes

Table 7-21: Ratings for the impact on dynamic coastal processes

	Severity	**Duration**	**Spatial scale**	**Overall Consequence**	**Frequency**	**Probability**	**Overall Likelihood**	**Overall Environmental Significance**
Preferred locations	1	3	2	**2**	3	2	**2.5**	**5** **Medium-Low**
<u>*Mitigation measures:*</u> • During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed, controlled and the area rehabilitated. • Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions. • The Gas to Power operation must be aware of Transnet National Ports Authority Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events.								
Preferred locations	1	3	1	**1.6**	3	2	**2.5**	**4** **Low**

*7.5.11.2 Impact assessment: **Operational Phase***

Impact 2: The effects of the intake of cooling water on marine organisms in the surrounding water body

Table 7-22: Impact 2 scoring table (without mitigation): Cooling water intake.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint
Overall Consequence = 6 / 3 = 2	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	3 – >25% - 50% chance of occurring (probable)
Overall Likelihood = 8 / 2 = 4	
Overall Environmental Significance = 2 x 4 = 8	
Overall Environmental Significance:	
7 - 8.9	Medium
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

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 values — these increase the area of intake, resulting in a decrease in intake velocity to safe levels. The following mitigation measures are proposed:

- Intake velocities should 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 values.
- Intake structures should not draw in water from the upper meter of the water column.
- Intake structures should ensure the horizontal intake of water.

A detailed assessment of the impact post-mitigation is provided in Table 7-23: Mitigation reduces the severity and probability of impact, resulting in a Medium-Low Overall Environmental Significance.

Table 7-23: Impact 2 scoring table (with mitigation): Cooling water intake.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	1 - Site-specific and wider natural functions and processes are not altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	1 – Project footprint
Overall Consequence = 5 / 3 = 1.67	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 7 / 2 = 3.5	
Overall Environmental Significance = 1.67 x 3.5 = 5.85	
Overall Environmental Significance:	
5 - 6.9	Medium - Low
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Impact 3: The effects of the discharge of cooling water on the marine ecology in the receiving water body

Table 7-24: Impact 3 scoring table (without mitigation): Cooling water discharge.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered

Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	2 – Within the broader Port
Overall Consequence = 7 / 3 = 2.33	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	3 – >25% - 50% chance of occurring (probable)
Overall Likelihood = 8 / 2 = 4	
Overall Environmental Significance = 2.33 x 4 = 9.32	
Overall Environmental Significance:	
9 - 10.9	Medium - High
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

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).
- 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. A detailed assessment of the impact post- mitigation is provided. Mitigation reduces the probability of the impact, which lowers the Overall Environmental Significance to Medium.

Table 7-25: Impact 3 scoring table (with mitigation): Cooling water discharge.

• Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	2 – Within the broader Port
Overall Consequence = 7 / 3 = 2.33	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 10 / 2 = 5	
Overall Environmental Significance = 3 x 5 = 11.65	
Overall Environmental Significance:	
7 - 8.9	Medium
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

Impact 4: The effects of increased noise and vibration levels on the marine ecology

Table 7-26: Impact 4 scoring table: Impacts of increased noise on the marine ecology

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	3 - Site-specific and wider natural processes and/or functions continue albeit in a modified way (general integrity maintained)
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale	2 – Within the broader Port

the extent / size of the area that may be affected	
Overall Consequence = 8 / 3 = 2.66	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 7 / 2 = 3.5	
Overall Environmental Significance = 2.66 x 3.5 = 9.31	
Overall Environmental Significance:	
9 - 10.9	Medium - High
Reversibility	
Reversibility degree to which the impact t can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	Medium

Mitigation measures

Mitigation measures should ensure that the worst-case scenario assumptions made in this assessment are not met, so that noise levels created by the FPP are lower than what is predicted. This will help to avoid disturbances and potential harm to marine organisms. For example:

- The Powership should not be operational for 24 hours a day, to reduce chronic exposure of noise to marine organisms. It is expected that the Powership will operate for 16.5 hours a day.
- Maximum power output from the Powership should be avoided. Noise levels produced by the Powership 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 290 m of the FPP, the Powership should not operate at maximum power output, to reduce the noise level produced and thus the chances of disturbing the animal.
- When moving in and out of the port, the LNGC should not move at maximum speed, so as to reduce the amount of noise produced by its engines.

A baseline study of the ecology in the immediate vicinity of the FPP should be undertaken following a before-after-control-impact (BACI) approach. This should include an assessment of the local macrofauna and video surveys and fish sampling to understand the fish community in the nearshore region associated with the Powership. An assessment of the distribution and behaviour of diving seabirds in the context of the Powership 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 Powership 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.

A detailed assessment of the impact post-mitigation is provided in **Error! Reference source not found.**. Mitigation reduces the severity of the impact, resulting in an Overall Environmental Significance of Medium.

Table 7-27: Impact 4 scoring table (with mitigation): Impacts of increased noise on the marine ecology

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	2 – Within the broader Port
Overall Consequence = 7 / 3 = 2.33	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 7 / 2 = 3.5	
Overall Environmental Significance = 2.33 x 3.5 = 8.16	
Overall Environmental Significance:	
7 - 8.9	Medium
Reversibility	
Reversibility degree to which the impact t can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	Medium

Impact 5: The effects of impacts on ecosystem services

Table 7-28: Impact 5 scoring table (pre-mitigation): Impacts of the operational phase on ecosystem services

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	2 – Within the broader Port
Overall Consequence = 7 / 3 = 2.66	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 7 / 2 = 3.5	
Overall Environmental Significance = 2.66 x 3.5 = 8.15	
Overall Environmental Significance:	
7 - 8.9	Medium
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	Medium

Mitigation measures: operational phase

The mitigation measures for the intake and discharge of cooling water and mitigation measures for the additional noise produced by the FPP are provided. These are mitigation measures for the marine ecology that underpin the ecosystem services. The scoring of Impact 5 with mitigation is provided. Mitigation will reduce the probability of impacts but not sufficiently to change the score.

Table 7-29: Impact 5 scoring table (with mitigation): Impacts of the operational phase on ecosystem services

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 - Site-specific and wider natural processes and functions are slightly altered
Duration a measure of the lifetime that the impact will be present	3 – 2 to 20 years
Spatial Scale the extent / size of the area that may be affected	2 – Within the broader Port
Overall Consequence = 7 / 3 = 2.66	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	2 – >5 - 25% chance of occurring (possible)
Overall Likelihood = 7 / 2 = 3.5	
Overall Environmental Significance = 2.66 x 3.5 = 8.15	
Overall Environmental Significance:	
7 - 8.9	Medium
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	Medium

Impact 7: Impacts of coastal pollution

Table 7-30: Ratings for the impact of coastal pollution

	Severity	Duration	Spatial scale	Overall Consequence	Frequency	Probability	Overall Likelihood	Overall Environmental Significance
Preferred locations	4	4	3	**3.7**	3	3	**3.0**	**11.0 High**
Mitigation measures: • Shipping:								

- Provide an inventory of waste produced and the nature of waste being produced and cooperate with the Transnet National Ports Authority in every way. - A requirement to report environmental accidents and emergencies immediately they occur, to the port captain. - A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future. - Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications. • Construction must be undertaken according to a site-specific approved Environmental Management Programme (EMPr) and must be monitored by an on-site environmental officer. • All solid waste must be removed to an appropriate disposal facility. - In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the MPA and the Langebaan lagoon. The polluter pay principle where Karpowership will be held liable for any clean-up costs associated with an incident.							
Preferred locations	3	3	1	**2.3**	**2**	2	**2**	**4.6 Low**

7.5.11.3 Cumulative Impacts

By definition, cumulative marine environmental impacts emanating from the proposed FPP 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 FPP 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 400 m 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).

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	2 – Small / Potentially harmful
Duration a measure of the lifetime that the impact will be present	5 – Beyond 10 years
Spatial Scale the extent / size of the area that may be affected	2 – Surrounding area (< 2km)
Overall Consequence = 9 / 3 = 2.66	
Likelihood	
Frequency how often the impact will occur	5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	5 – Daily / highly likely / definitely
Overall Likelihood = 10 / 2 = 5	
Overall Environmental Significance = 2.66 x 5 = 13.33	

Overall Environmental Significance:	
11 and above	High
Reversibility	
Reversibility degree to which the impact can be reversed	Reversible – the impact is reversible
Irreplaceable Loss of Resources	
Irreplaceable Loss of Resources degree to which the loss of resources can be replaced	No – the impact does not cause a loss of resources that cannot be replaced
Fatal Flaw	
Fatal Flaw degree to which the impact is a fatal flaw	No – the impact does not result in a fatal flaw
Confidence (from Anchor methodology)	
Status of impact	– ve (cost)
Confidence of assessment	High

There are several other power generation projects proposed within and close to Saldanha Bay. These include the Vortum Energy (Pty) Ltd Thermal Energy Plant and associated infrastructure, operational by 2024, and the gas to power project proposed by Mulilo Thermal Developments (Pty) Ltd. This project and associated infrastructure will comprise LPG pipeline (approx. 8.3km), LPG handling facility (approx-3ha) and modification on the existing jetty. All of these projects have proposed onshore infrastructure and do not require seawater for cooling i.e., have no associated marine infrastructure. Furthermore, The Strategic Fuel Fund proposes to develop an LPG import facility, pipeline and handling facility within the Port of Saldanha Bay. No construction or development will occur in the marine environment. These projects, thus, presumably will have no marine ecological impacts and their cumulative impacts on the marine environment and associated ecosystem services are not considered further.

7.5.11.4 Specialist Conclusion

It is acknowledged that the surrounding coastal environment is dynamic and sensitive. Despite its critically modified state, the remaining habitat of the Saldanha Bay estuarine system provides important habitat for numerous sensitive marine species, which are unlikely to be affected by the proposed Gas to Power project to a significant degree.

Notwithstanding the above, the environmental impacts related to the broader construction of the port must have been considered under the EIA for these areas. This activity is therefore deemed reasonable as it is proposed within a transformed port, which is earmarked for future development.

Impacts associated with the construction and operational phases of the project were evaluated in this study as ranging from Medium – Low, post mitigation. Clearly, given the extremely high conservation importance of the area, and the not insubstantial risks and threats posed by existing development in the Bay, many of which will likely be further exacerbated by impacts associated with this project, the decision as to whether to permit this project to go ahead requires very careful consideration.

None of the direct or indirect impacts associated with the project were identified as anything other than highly localised in nature.

The cumulative impacts of superimposing the Karpowership project in this environment were rated as high. **None of these impacts were identified as being fatal flaw, and thus should not prevent the project from going ahead.**

7.5.12 Coastal and Estuary Impacts

Langebaan Lagoon comprises a unique and extensive sheltered water environment characterised by predominantly marine features and processes. The shoreline comprises a mixture of coves and shallow embayments, stretches of sandy white beaches, truncated with rocky headlands. In the northern half of the system, where marine exchange is strong and the system is deepest, the western shoreline is dominated by volcanic rocky outcrops of the Postberg region and the beaches, where present, are narrow. Along the eastern shore is the town of Langebaan, with roads, parking areas and numerous developments fronting immediately onto the lagoon. The shallow water area at Alabama, linking to the Langebaan Main Beach, together provide favourable swimming and boat launching conditions.

In the southern section, where the system is shallow and tidal currents are reduced, sand flats with deep water channels are extensive from Shark Bay southwards. Large saltmarsh areas are prevalent in the southern most section of the system, including either side of the point near Churchhaven on the western shore. Saltmarsh habitat is easily observed at Geelbek at the head of the lagoon. Also observed in this section of the lagoon are freshwater seep areas arising from groundwater inputs, identifiable by stands of *Phragmites* and *Typha*. The habitats at the head of the lagoon support numerous water bird species, such as pelicans (*Pelecanus* sp.), flamingos (*Phoenicopterus* sp.), spoonbills (*Platalea alba*), and herons (*Ardea* sp.). Apart from the saltmarsh and freshwater reed habitat at the head, the dominant vegetation surrounding the lagoon is typical strandveld vegetation, specifically Langebaan Dune Strandveld.

Based on the desktop assessment and findings of the site investigation, the specialist confirms that the Langebaan Lagoon is a very highly sensitive aquatic (estuarine) ecosystem. As per the project description and location of the project components, the site investigation further confirms that the proposed project will not be located within the sensitive Langebaan Lagoon or its associated MPA, but rather within the Port of Saldanha, beyond the estuarine functional zone (EFZ) of Langebaan Lagoon, approximately 6.3 km from delineated lagoon boundary and 3.2 km from the MPA boundary.

In following the polycentric or holistic approach, and for determining the likelihood of impacts on the Langebaan Lagoon, and the following specialist reports were consulted:

- the updated Terrestrial Noise assessment (Safetech, 2022) : Measurable terrestrial/airborne noise impacts dissipate with increasing distance from the Powerships and reach low levels (30-40 dBA) at a distance of approximately 2.5 km from the FRSU/LNG carrier. Noise impacts do not reach sensitive receptors at the boundary of the Langebaan Lagoon MPA, and therefore do not pose a threat to the lagoon ecosystem.
- the updated Underwater Noise Assessment (Subacoustech Environmental, 2022): Marine fauna will need to remain within close proximity of the Powerships for several hours to experience detrimental noise effects, marine organisms within hundreds of metres of the Powership will experience noise levels that interfere with ecologically relevant sounds, but these sound levels will not reach the lagoon which is almost 7 000m metres away.
- the updated Marine Ecology Specialist Assessment (Lwandle and Anchor Environmental Consultants, 2022) : none of the critical impacts assessed are determined to extend beyond a maximum of 2 km

from the Powership and FSRU (noise, thermal impacts, impacts of fisheries), and will therefore not affect the lagoon.

- the updated Avifauna assessment: The status of the Langebaan Lagoon as an IBA is acknowledged. Large waterbirds, *e.g.* flamingos, utilising wetland in close proximity to the transmission lines will likely be most affected. While the lagoon ecosystem will not be directly affected, priority species visiting the system as well as resident species flying between wetland areas may be affected by the cumulative impact of transmission lines in the area. The overall impact was rated as Low-medium, medium reversibility, with the loss of species unlikely. Mitigation measures and a management plan are provided to reduce the number of fatalities

Given the substantial distance between the proposed activity and the Langebaan Lagoon and MPA, the proposed activity is unlikely to have any significant measurable impacts on the sensitive biodiversity features of this system. This is due to the dynamic processes of the marine environment that would ameliorate such effects before reaching the lagoon or MPA.

Based on the information gathered during the Scoping Phase, the table below presents the general environmental impacts of the Gas to Power project accompanied by a brief comment on the nature of the impact. Effectively all impacts will be highly localised and it is highly unlikely that there will any impacts on the lagoon ecosystem.

7.5.12.1 *Impact assessment:* ***<u>Construction and Operational Phases</u>***

Table 7-31: Potential impacts of the Port of Saldanha Gas to Power project

POTENTIAL IMPACT	COMMENTS
1. Water quality impacts	
Construction / instalment phase: • **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons** **(Note: no dredging is required, no marine structures are planned)**	• Disturbance of bottom sediments may result in localised increased turbidity/suspended solids and the release of sediment-bound contaminants, with knock on effects for benthic and pelagic organisms. • **Impacts on marine water quality have been assessed under the Marine Ecology Assessment.**
Operation of the Karpowership: • **Abstraction of seawater for cooling and subsequent discharge of heated water**	• These processes are likely to result in localised disturbance of the water column and the marine soft-sediment environment, with knock on effects for benthic and pelagic organisms. • Impacts to sensitive communities could be reduced by discharging within the deep water and/or where water circulation by tidal flushing would be maximised. • Discharges would need to be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DEA, 2018; DWAF, 1995). • **Impacts on marine water quality and marine biota have been assessed under the Marine Ecology Assessment.** • **Site-specific temperature thresholds have been determined under the Marine Ecology Assessment and Thermal Plume Modelling.**

2. Air quality	
Construction / instalment phase: • **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons**	• General construction activities, including the operation of plant and vessels, will result in air emissions. • **Impact of emissions have been assessed under the Air Quality Assessment.**
Operation of the Karpowership: • **Production of air emissions, namely sulphur dioxide, nitrous oxide, carbon monoxide, carbon dioxide and particulate matter**	• As a cleaner fossil fuel option, air emissions generated from natural gas are expected to be negligible. • **Impact of emissions have been assessed under the Air Quality Assessment.**
3. Habitat disturbance	
Construction / instalment phase: • **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons** **(Note: no dredging is required, no marine structures are planned)**	• Laying of the mooring facilities (heavy chain, anchor system) and the subsea pipeline is likely to result in localised disturbance of the water column and the marine soft-sediment environment, with knock on effects for benthic and pelagic organisms (as indicated in the 2021 State of the Bay report). • Construction of the pylons will result removal/destruction of coastal vegetation. • General construction activities, increased human and vessel presence and movement will result in disturbance to marine fauna. • **Impacts on marine habitats and fauna have been assessed under Marine Ecology Assessment.** • **Impacts on the vegetation have been assessed under Terrestrial Ecological Assessment.**
Operation of the Karpowership: • **Noise pollution, vibrations, gas flaring, night time lighting, and danger of transmission powerlines**	• These aspects have the potential to cause disturbance to the sensitive marine fauna utilising the bay, and birds flying over the area. • The impact of vibrations on soft-sediment environment stability, benthic and pelagic organisms is unknown and needs to be investigated. • The mooring facilities, and other undersea infrastructure will result in additional hard surfaces for the colonisation of sedentary marine organisms. This is likely to have a positive impact for indigenous marine species of the bay, but a negative impact if colonised by invasive species. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment**. • **Impact of powerlines have been assessed under the Terrestrial Ecological Assessment.** • **Impact of noise have been assessed under the Noise Assessment.** • **Impact of emissions have been assessed under the Air Quality Assessment.**
4. Injury/mortality of marine organisms	
Construction / instalment phase:	• Laying of the mooring facilities (heavy chain, anchor system) and the subsea pipeline is likely to result in localised disturbance of the water

• **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons** **(Note: no dredging is required, no marine structures are planned)**	column and the marine soft-sediment environment, with knock on effects for benthic and pelagic organisms, which may result in localised smothering and/or injury of marine organisms. • Construction of the pylons may result in the injury/mortality of terrestrial fauna. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.** • **Impacts of pylons have been assessed under the Terrestrial Ecological Assessment.**
Operation of the Karpowership: • **Abstraction of seawater for cooling and subsequent discharge of heated water** • **Overhead transmission lines**	• Certain marine fauna will be particularly vulnerable to injury/mortality during the cooling process. • **Site-specific temperature thresholds have been determined under the Marine Ecology Assessment and the Thermal Plume Modelling.** • Bird collisions are likely to result from new overhead powerlines, this may include species that utilise the lagoon. • This can be somewhat mitigated by ensuring that the overhead lines follow existing transmission line routes. • **Impacts of pylons on birds have been assessed under the Avifauna Assessment.** • **Impacts of pylons have been assessed under the Terrestrial Ecological Assessment.** • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.**
5. Invasive species	
Operation of the Karpowership: • **Arrival of Karpowership** • **Frequent mooring of LNG carrier**	• Vessels discharging ballast water within the bay are likely to introduce foreign and invasive species that would impact negatively on the indigenous marine and potentially the lagoon / estuarine biodiversity. • However, this is issue is not considered to be of greater significance than current vessel movements and will be addressed by Transnet Ports Authority's ballast management protocols. • **This has been verified by Marine Ecology Assessment.**
6. Spills and leaks	
Construction / instalment phase: • **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons**	• Temporary site facilities onshore will be required for the assembly and launching of the pipeline. • Any spills and leaks emanating from the site camp or instalment activities will have a negative effect on the immediate marine water quality, and thus the ecology of the Bay. • Under extreme circumstances, pollution from the Port may reach the sensitive environments of the MPA and the lagoon (as indicated in the State of the Bay report). • However, this issue is not considered to be of greater significance than current port activities (ore handling, oil births, gas mooring). • Such incidents can be mitigated through an on-site Environmental Management Programme and through Transnet Ports Authority's pollution/emergency protocols. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.**

Operation and maintenance of the Karpowership and infrastructure: • **Receiving LNG** • **Transfer/pumping of natural gas** • **Oil/fuel leaks** • **Maintenance**	• LNG spills on seawater vaporise rapidly, leaving no residue or film. • Due to the shallow depth (<100m), any subsea leaks are not likely to result in dissolved oxygen depletion. • Any spills and leaks of oil, fuel and other hydrocarbons from the vessels will have a negative effect on the immediate marine water quality, and thus the ecology of the bay. • However, this issue is not considered to be of greater significance than current port activities (ore handling, oil births, gas mooring). • Such incidents can be mitigated through Transnet Ports Authority's pollution/emergency protocols, MARPOL etc. • **Impacts on marine habitats and fauna have been assessed under Marine Ecology Assessment.**
7. Explosions	
Operation of the Karpowership: • **Receiving LNG** • **Transfer/pumping of natural gas**	• Although unlikely and also unpredictable, a gas explosion will result in significant habitat disturbance/ modification with the potential for numerous mortalities. • However, this is an issue that is not considered to be of greater significance than current port activities (LPG pipeline already in place) and be mitigated by Transnet Ports Authority's pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.**
8. Waste Production (domestic effluent, solid waste, chemicals used for maintenance and repairs)	
Construction / instalment phase: • **Mooring infrastructure** • **Laying of pipeline** • **Construction of pylons**	• Temporary site facilities onshore will be required for the assembly and launching of the pipeline. • Inappropriate waste management will result in pollution of the marine environment, and potentially the lagoon environment. • However, this issue is not considered to be of greater significance than current port activities and can be mitigated through an on-site Environmental Management Programme and through Transnet Ports Authority's pollution and waste management protocols. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.**
Operation and maintenance of the Karpowership, and infrastructure	• Inappropriate waste management will result in pollution of the marine environment, and potentially the lagoon environment. • However, this issue is not considered to be of greater significance than current port activities and can be mitigated through an on-site Environmental Management Programme and through Transnet Ports Authority's pollution and waste management protocols. • **Impacts on marine habitats and fauna have been assessed under the Marine Ecology Assessment.**

7.5.12.2 Recommendations

It is imperative that annual ecological monitoring of the Saldanha Bay and Langebaan Lagoon (State of the Bay) continues throughout the operation of the Powerships contract as this would assist in recording any notable changes attributed to the project. If the long-term monitoring programme ceases, Karpowership must initiate and undertake similar monitoring, relative to the project infrastructure, activities, and impacts, for the duration of operation/power supply.

7.5.12.3 Specialist Conclusion

Based on the review of applicable specialist reports, it is the opinion of the estuarine specialist that, the proposed development will have no measurable impact on the Langebaan Lagoon and Langebaan Lagoon MPA.

7.5.13 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). Carbon dioxide (CO_2) is the main Greenhouse Gas resulting from LNG combustion. SO_2 is produced from the combustion of sulphur in the LNG. NO_X is produced from thermal fixation of atmospheric nitrogen in the combustion flame and from oxidation of nitrogen bound in the LNG. The quantity of NO_X produced is directly proportional to the temperature of the flame. The non-combustible portion of the fuel remains as solid waste and emitted as particulates.

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 7-32: Annual emissions from the Khan Powership and the FSRU (tonnes/annum)

Source	SO_2	NO_X	PM_{10}
Powership (Khan)	36.7	917.1	183.4
FSRU	7.0	174.7	34.9

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. Ship manoeuvring assumes main engines while auxiliary engines are assumed during LNG transfer.

Table 7-33: LNG supply ship emissions (tonnes/annum)

Source number	SO_2	NO_X	PM_{10}
Ship manoeuvring	2.06	18.44	0.41
At berth	0.58	3.68	0.11
Total	2.64	22.12	0.52

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.

*7.5.13.1 Impact assessment: **<u>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 Saldanha Bay is assessed. Impact scores are presented in the tables 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 Saldanha 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.

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 north of the Port of Saldanha Bay over parts of the industrial area and open land, and to the south towards to Port entrance. The spatial scale of the impact is limited to the Port of Saldanha 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 Saldanha

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 and occur over the Port of Saldanha Bay. The addition to existing ambient concentrations is unlikely to result in exceedances of the NAAQS, i.e. the frequency of exceedances of the NAAQS as a result of the project is low. 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 Saldanha 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 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 for NO_2 is low. 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 SO_2, NO_2 and PM_{10}.

Table 7-34: 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

7.5.13.2 Cumulative Impacts

The Department of Mineral Resources and Energy launched the Risk Mitigation Independent Power producers Programme (RMI4P) in August 2020 to procure 2000MW 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 projects may be procured in Saldanha Bay as part of the RMI4P. It is therefore relevant to assess the potential cumulative effects of these project on ambient air quality in Saldanha Bay. Three potential gas-to-power projects are reviewed to assess the potential cumulative impacts of the suite of gas-to-power project (Table 7-35).

Table 7-35: Potential gas-to-power generation project in Saldanha Bay

Project name and description	Project description	Applicant
Auriga Power Plant	Situated on Portion 6 of the Farm Langeberg 188, Malmesbury Road. The proposed thermal power plant will be a Combined Cycle Gas Turbine (CCGT. In Phase 1 the plant will operate as Open Cycle Gas Turbine (OCGT) power plant (up to 800 MW), and convert to combine cycle Gas Turbine in Phase 2 with the addition of a steam turbine, increasing up to 1200 MW. The plant will ultimately use Natural Gas, but initially may need to use liquid fuel such as diesel.	Vortum Energy (Pty) Ltd
315 MW LPG Power Plant	Proposed 315 MW Liquified Petroleum Gas (LPG) power plant at Saldanha Bay situated between Aurora Saldanha Steel and the Port of Saldanha Bay. Electricity will be evacuated via a new powerline that to Eskom's Blouwater Substation	Frontier Power (Pty) Ltd
Uyekraal Gas-to-Power Development	Development on Portion 1 of the Farm Uyekraal 189, approximately 15 km north-east of Saldanha Bay. The proposed development will consist of a 900 MW Open Cycle Gas Turbine Plant (OCGT), transmission lines to the Blouwater and/or Aurora Substations.	Mulilo Thermal Project Developments (Pty) Ltd

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 7-36. The highest rating for an individual project is used to assess the potential cumulative impact of the four gas-to-power projects (Table 7-36).

Table 7-36: Significance of project and cumulative impacts

Project	SO_2	NO_2	PM_{10}	Reference
Karpowership	Very low	Very low	Very low	This report
Auriga Power Plant	Medium	Low-medium	Low-medium	AGES (2016)
Frontier Power	Very low	Very low	Very low	uMoya-NILU (2020)
Uyekraal Gas-to-Power	Low	Low	Low	No reference
Cumulative impact	Medium	Low-medium	Low-medium	Highest rating

For NO_2 and SO_2 the significance of the cumulative impact of Karpowership with other gas- to-power projects is rated as low. For PM_{10} the significance of the impact is rated as very low.

No mitigation is required, and therefore no mitigation measures are proposed.

7.5.13.3 Specialist 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.

7.5.14 **Terrestrial Noise Impacts**

In order to determine the noise impacts of a Powership at the Port of Saldanha, a study on the noise levels of a similar vessel had to be determined. Airborne noise levels were sampled during the operation of the Osman

Khan Powership at Sekondi-Takoradi, Ghana, in September 2022. The noise from the Powership came from two clear source types. On the water in the harbour, low elevation air intakes produced noise from the ducts linked to operating engines. At high level, heat exhaust outlets behind a louvre are a significant source of noise. A sample noise measurement was taken on the ship at 3 m from this position (1 engine operating). There was no obvious noise audible from the chimney stacks, suggesting that the primary noise sources were the air intake and exhaust duct openings, although the hull itself is likely to radiate to some extent. Built-in noise attenuation such as silencers in the stacks and machinery vibration isolation will help to reduce the escape of noise.

Measurements were taken on a mobile survey vessel that transited on transects around the ship. A total of eight datasets were sampled, at three power outputs, i.e. at low output with 1 engine running at approximately 16 MW, at medium output with 14 engines at approximately 250 MW, and at maximum available power with 23 engines at approximately 420 MW (1 engine was offline for maintenance), each under downwind and upwind conditions. Conditions during the surveys were ideal for environmental noise measurement, clear and dry, with temperatures around 24-27°C and relative humidity above 80% remaining fairly consistent day to day. Wind direction was south westerly and typically remained between 1 and 3 m/s. The wave height was less than 0.5 m at all times.

Noise levels were sampled on the survey vessel at various distances from the ship, between 50 m at the closest point and 800 m at the furthest. Noise from the Powership was audible at all distances. The noise level was 70.0 dB LAeq at the closest measured position on the water, 50 m, at 420 MW. On the adjacent quayside, 35 m away from the hull, a higher noise level was recorded at 71.3 dB LAeq (and 74.3 dB under significant venting from the ship a condition which was not noted at any other time).

At the furthest location, 800 m downwind from the ship and at full power, the measured noise was 55.0 dB LAeq. Due to the lack of other noise sources in the vicinity, no noise other than the Powership contributed significantly to the survey environment.

The effect on the noise at lower electrical power outputs was as would be expected, where a reduction in power output led to a commensurately lower noise level, and noise attenuated more quickly with distance upwind, compared to downwind.

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 however will be the most significant during calm meteorological conditions when little wind noise masking will occur, therefore this worst-case was considered and wind speed and direction was not considered during the impact assessment process.

*7.5.14.1 Impact assessment with mitigation): **Construction Phase***

The field study results showed that the residual noise levels in the area of the proposed development were 54.9 dB(A). NSA 2 is approximately 1280m away from the nearest pipeline location. It was inferred that NSA 2 (industrial area) will experience noise levels of approximately 49 dB(A). NSA 1 (Blue Bay Lodge) is the closest residential area. The predicted noise during construction will be approximately 40dB(A). This does not take into account any of the masking effects of wind noise, wave noise on the shore, etc.

Mitigation actions for the Construction phase:
As a precautionary measure vibro-piling (if required) should not occur at night. In summary, it is unlikely that the construction noise will severely impact on the noise sensitive areas over the short term. With the effective

implementation of the above recommended mitigation measure, the residual noise impact associated with construction activities are predicted to be of low significance. It is recommended that the ambient noise around the project and at the closest receptors be monitored during the construction phase to ensure compliance to the Western Cape Noise Control Regulations.

	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	-	-	-

*7.5.14.2 Impact assessment with mitigation): **Operational Phase***

The operational noise levels of the proposed Project will not exceed the SANS 10103:2008 rating limits for the identified Noise Sensitive Areas.

The noise impact associated with the operational activities of the proposed Project is predicted to be of **Low** significance after mitigation at the Port of Saldanha. The terrestrial environmental noise impact assessment for the operational phase is presented in the table below.

	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													
Measures related to the construction phase:													

	Severity	Duration	Spatial Scale	Consequence	Frequency	Probability	Likelihood	Significance	Status	Confidence	Reversibility	Irreplaceability	Fatal Flaw
• 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.													
After Management	1	4	2	2.3	1	2	1.5	3.45	Low	High	Yes	No	No
No-go Option	-	-	-	-	-	-	-	-	-	High	-	-	-

**The impact rating methodology is contained in the appendices.*

Figure 7-12 below shows the noise level contours in relation to the layout and the identified NSAs.

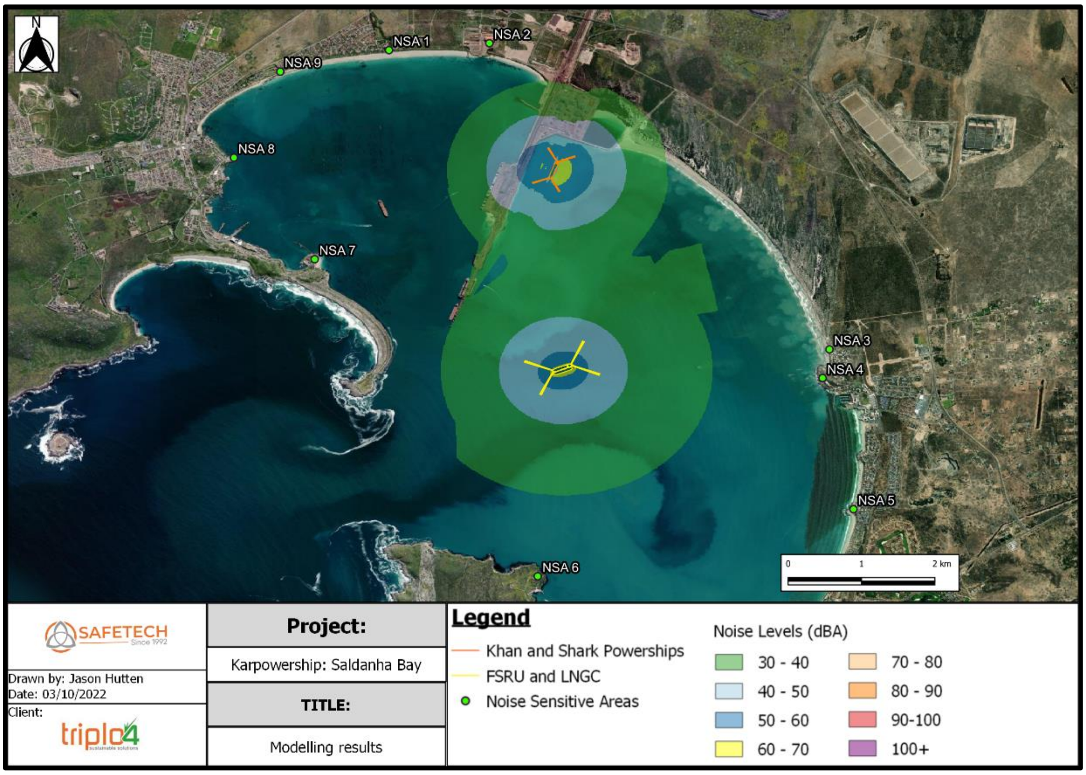


Figure 7-12: Predicted noise levels during the operational phase of the project.

The results of the noise impact assessment of the proposed Gas to Power - Powership Project within the Port of Saldanha shows that at none of the terrestrial receptors, will exceed the SANS 10103:2008 rating limits. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation measures are implemented. The construction related noise impacts will be of Low significance after mitigation measures are implemented.

7.5.14.3 Cumulative Impacts

The cumulative impact from the other noise sources in the Port of Saldanha 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 possible developments in the vicinity of the Port of Saldanha were identified as having the potential to contribute to the cumulative noise impacts. These projects are:

- The Vortum (CCGT) Thermal Power Plant situated on Portion 6 of the Farm Langeberg 188, Malmesbury Road.
- Proposed Combined Cycle Gas Turbine (CCGT) Power Plant on a Portion (±59 Ha) of Portion 6 of the Farm Langeberg 188, Malmesbury Rd, Saldanha Bay Local Municipality
- Liquid Petroleum Gas (LPG) Import Facility, Pipeline and Handling Facility in the Port of Saldanha within Saldanha Bay Local Municipality.
- Gas-To-Power (GTP) project on a 50 hectare development area located on a section of the Remainder (a portion of Portion 1) of the Farm Uyekraal 189, approximately 15 km north-east of Saldanha, Western Cape Province.

The noise information on the individual projects was not available at the time of completing this report. However, the closest of these developments is situated approximately 4 500m from the Karpowership Project and is therefore unlikely to contribute to the cumulative noise due to the attenuation of noise as distance increases.

7.5.14.4 Recommendations

The following is highly recommended by the terrestrial noise specialist:

a) Ensure that all acoustic enclosures or attenuators that are fitted to the vessel are in place during operations.
b) Periodic noise measurements are taken during the construction and operational phases in order to ensure that the Western Cape Noise Control By-law is complied with.
c) As a precautionary measure vibro-piling (if required) should not occur at night.
d) If possible, position the ship so that the port side that contains the air inlets is positioned away from highly sensitive noise receptors.

7.5.14.5 Specialist Conclusion

If the above mitigation measures are implemented, it is recommended that the project receive environmental authorisation.

7.5.15 **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 7-37 below. The scenarios indicate that the impact intensity of the project falls into the medium threshold when the Project is not operated at 100% of the contracted capacity.

Table 7-37: Emissions by generation scenario

Scenario	Operating hours/day	Annual emissions	Lifetime emissions	Impact Intensity
100%	16.5 hrs/day	1 099 581 tCO_2e	21 991 625 tCO_2e	Medium
50%	8.25 hrs/day	549 791 tCO_2e	10 995 813 tCO_2e	Medium
25%	4.125 hrs/day	274 895 tCO_2e	5 497 906 tCO_2e	Medium

Table 7-38: Operation emissions (100% scenario)

Emission category	Emission source	Operation phase	Total over life of project (20 years)
Category 1: Direct GHG emissions and removals	Natural gas combustion	993 821 tCO_2e	19 876 429 tCO_2e
Total Direct emissions		**1.0 million tCO_2e**	**19.9 million tCO_2e**
Category 3: Indirect GHG emissions from transportation	Natural gas transport	35 013 tCO_2e	700 263 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	70 747 tCO_2e	1 414 933 tCO_2e
	Total Category 4 emissions	**70 747 tCO_2e**	**1 414 933 tCO_2e**
Total indirect emissions		**106 $ktCO_2e$**	**2.1 million tCO_2e**
Total emissions		**1.1 million tCO_2e**	**22 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 7-39 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 7-39: 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
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 Saldanha Bay are shown in Table 7-40 below. The total avoided emissions between 2023 and 2030 is approximately 12 million tCO_2e.

Table 7-40: 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	1.6	1.6	1.6	1.6	1.5	1.5	1.4	1.3

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 powerplant 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

Carboc 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).

7.5.15.1 Impact assessment findings: ***Operational Phase***

The proposed Karpowership Project would result in approximately 1.1 million tCO_2e/annum and 22 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, 22 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 5.5 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.

7.5.15.2 *Cumulative Impacts*

The principle that the emission of GHGs has no local impact and can therefore not be managed on a local level, is fundamental to the formation of the UNFCCC, the Kyoto Protocol, and the Paris Agreement. It is in this context that the climate change specialist study did not consider the cumulative impacts of any of the additional power plants underway or planned within proximity of Saldanha Bay.

7.5.15.3 *Mitigation Measures*

The climate change specialist noted that 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 powerplant 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.

7.5.15.4 *Specialist Conclusion*

In accordance with the findings of this Climate Change Impact Assessment, the climate change specialists advise that the proposed Karpowership Project at Saldanha Bay should not be refused environmental authorisation based on climate change related issues.

7.5.16 **Socio-Economic Impacts**

7.5.16.1 *Impact assessment (with mitigation):* ***<u>Construction Phase</u>***

Economic development information for Port of Saldanha Powership

The below provides an overview of the key socio-economic impacts which the Port of Saldanha Bay Powership and associated land-based infrastructure will have on the impact areas.

Table 7-41: Economic Development Information for Port of Saldanha Powership

Indicator	Value
Total investment value of Karpowership during construction phase (12 months)	R543.475 million
Amount of total investment value spent in South African economy during construction phase (12 months)	R305.781 million
Operations and maintenance costs per annum (20 years)	R262.773 million

Temporary Stimulation of the national and local economy during the construction phase

The table below details the national and local economies would be positively impacted in the following ways during the construction period:

Indicator		Production	GDP	Page number
Direct		R306.55 million	R87.554 million	41
Indirect		R535.226 million	R153 million	41
Induced		R406.204 million	R116.043 million	41
Total		R1.247 billion	R356.597 million	41

It is estimated that the largest stimulation effects to production and GDP will be through the multiplier effect through a combination of the production and consumption induced effects, with the majority of direct spending spent within local economies. Production effects result from construction companies increasing the demand for goods and services from local businesses. Consumption effects are the result of construction workers spending on local goods and services. Urban-Econ (2021b) noted that mitigation/enhancement would be to encourage the engineering, construction, and procurement contractor to increase local procurement and employment as far as possible. Cumulative impacts are noted, with regards to a number of similar proposed developments in the area that would drive demand for goods and services for construction of similar facilities, which could provide sufficient economies of scale for new industries.

Table 7-42: Temporary increase in the GDP and production of the national and local economies during construction

	Without mitigation	With mitigation
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Highly likely (5)	Highly likely (5)
Significance	**12 (High)**	**12 (High)**
Reversibility	Benefit is terminated with the end of construction	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. • The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.		
Cumulative impacts: • None foreseen at this stage		
Residual Impacts: • None foreseen at this stage		

Temporary increases in employment in the national and local economies during construction phase

The project will create Full Time Equivalent (FTE) positions within the impact area during the construction phase. The breakdown of the direct, indirect, and induced jobs are presented in Table 7-43: Breakdown of estimated Full Time Equivalent employment positions during the construction phase below.

Table 7-43: Breakdown of estimated Full Time Equivalent employment positions during the construction phase

Effect	Employment (FTE)
Direct	334
Indirect	677
Induced	514
Total	**1 525**

It was estimated that the construction industry in the WCDM is large enough to provide the 334 construction workers required, where it is recommended that the contractor fill as many positions as possible from the WCDM. Urban-Econ’s (2021b) review of the WCDM education and skill levels indicate that levels are still low and most un- and semi-skilled labour required during the project will be drawn from WCDM, skilled personnel from outside the area would initially need to be brought in.

The direct employment opportunities are expected to have a positive spin-off effect on employment in other sectors through the procurement of goods and services, which will indirectly support an additional 677 FTE employment positions. The investment and infrastructure development by Karpowership is expected to induce a further 514 FTE employment positions. While these jobs are temporary in nature, there are already several gas-to-power projects planned for the area, and there are likely to be more as the gas industry developments in the area in the future, increasing the supply of gas and reducing its cost of access. These projects will create new construction job opportunities within the area, and will be seeking low-, semi-, and skilled construction workers from the area who have experience in similar projects.

Table 7-44: Temporary increase in employment in local and national economies

	Without mitigation	**With mitigation**
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Highly likely (5)	Highly likely (5)
Significance	**12 (High)**	**12 (High)**
Reversibility	Benefit is terminated with the end of construction	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • Organise local community meetings to advise the local labour force about the project that is planned to be established and the jobs that can potentially be applied for. • Establish a local skills desk (in WCDM) to determine the potential skills that could be sourced in the area. • Recruit local labour as far as feasible. • Employment of labour-intensive methods in construction where feasible. • Sub-contract to local construction companies particularly SMME's and BBBEE compliant and women-owned enterprises where possible. • Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering and other services to the construction crews.		
Cumulative impacts: • There might be limited cumulative construction jobs with skilled employees given the focus on oil and gas related projects planned for the area.		
Residual Impacts: • None foreseen at this stage		

Contributions to skills development in the national and local economy during construction phase

There is likely to be a positive impact on skills development in both the national and local economies from construction phase and associated infrastructure development. This is due to the fact that foreign technical experts will work with local labour during the establishment phase, which will lead to skills and knowledge transfer. Construction crews are likely to gain knowledge of development of gas industry electrical infrastructure, which is likely to be useful given that the IRP 2019 targets generating 2000-3000 MW of electricity from gas by 2030 (DMRE, 2019). These skills will reduce the cost of future gas-related developments in the municipality and could contribute to the development of local gas industry R&D and manufacturing. These skills will be of particular use, given the emphasis on gas and oil industries in the SBIDZ (Saldanha Bay Industrial Development Zone, 2022).

Table 7-45: Contribution to skills development in the country and in the local economy

	Without mitigation	With mitigation
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)
Significance	**9.2 (Medium-Low)**	**9.2 (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)	
Mitigation/Enhancement: • Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases. • Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.		
Cumulative impacts: • Improved labour productivity and employability of construction workers for similar projects. • Possible development of local skills and expertise in industries related to the gas industry.		
Residual Impacts: • South Africa's human capital development		

Temporary increase in household and government earnings during construction phase

The FTE employment listed under Table 7-43 are estimated to result in the following increases in household incomes:

Table 7-46: Estimated Household Revenue Created during Construction

Indicator	Value
Direct	R41.797 million
Indirect	R72.925 million
Induced	R55.326 million
Total	R170.049 million

It is recommended that as far as feasible local labour is recruited to benefit local households, and is recommended that labour intensive methods during construction are used where feasible, and lastly that services such as transport, catering, and other services are provided to construction crews by SMME's and BBBEE enterprises. The increases in household earnings, while temporary, will improve the standard of living of benefitting households.

Table 7-47: Temporary improvement of the standard of living of the positively affected households

	Without mitigation	With mitigation
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Significant (3)	Great (4)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)

Significance	**9.2 (Medium)**	**10 (Medium)**
Reversibility	Benefit is terminated with the end of construction	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • Recruit local labour as far as feasible to increase the benefits to the local households. • Employ labour intensive methods in construction where feasible. • Sub-contract to local construction companies where possible. • Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews.		
Cumulative impacts: • Improved standard of living of the affected households		
Residual Impacts: • Possible increase of households' saving accounts		

The construction phase is expected to further generate revenue for government through companies' taxes, company income taxes, personal income tax, and VAT. These earnings will contribute both to local government earnings through municipal taxes – improving surrounding communities – and contribute to the national fiscus through national government levied taxes.

Table 7-48: Temporary increase in government revenue

	Without mitigation	**With mitigation**
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)
Significance	**9.2 (Medium)**	**9.2 (Medium)**
Reversibility	Benefit is terminated with the end of construction	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • None suggested		
Cumulative impacts: • Lower government debt and servicing costs		
Residual Impacts: • None envisioned		

Temporary increase in social disruptions associated with the influx of people during construction

It is likely that some of the construction workers will be drawn from areas outside of the local community, which could cause social disruptions between the local population and existing construction workers in the area with the new workers due to the local population view the migrant workers as 'stealing' their jobs. The influx of people may lead to a temporary increase in petty crime, illicit activity, litter, and the spread of communicable diseases. Semi- and unskilled construction workers may choose to remain in the area after construction is complete, and if they have no alternative sources of income these individuals are at risk of increasing local poverty levels. It should be noted that the 61% of local jobs are for skilled workers, which would increase the skills base in the area. To mitigate these negative impacts, it is recommended that potential social impacts are discussed with and addressed with local stakeholders.

Table 7-49: Temporary increase in social conflicts associated with the influx of construction workers and job seekers to the area

	Without mitigation	**With mitigation**
Spatial Scale	Surrounding area (2)	Surrounding area (2)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Insignificant (1)	Insignificant (1)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Unlikely (2)
Significance	**6 (Medium-Low)**	**4 (Low)**
Reversibility	Reversibility within a short period	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment. • Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence. • Employ locals as far as feasible through the creation of a local skills database. • Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area. • Ensure that any damages or losses to nearby buildings that can be linked to the conduct of construction workers are adequately reimbursed. • Assign a dedicated person to deal with complaints and concerns of affected parties		
Cumulative impacts: • None foreseen		
Residual Impacts: • Contribution towards social conflicts in the area by construction workers and job seekers who decide to stay in the area after construction is complete and who are unable to find a sustainable income		

Negative impacts on economic and social infrastructure during construction

The construction phase of the project will directly create 334 FTE, which will result in a large number of people on the construction site – a notable portion of which will come from outside of the WCDM, and other parts of Western Cape, and South Africa. This will result in an increase in demand for rental accommodation, social services, and access to water and electricity. More specifically:

- Healthcare facilities are likely to see an increase in demand from the influx in workers and job seekers. The WCDM's IDP (2020) notes a number of healthcare facilities situated in the areas surrounding the project site which will likely be under increased demand given their proximity to the construction site, and due to the influx of workers and job seekers, however these healthcare facilities are expected to be able to deal with the increased demand, and first aid facilities will be provided at the construction site.

- Construction workers and other professionals from outside the area are expected to have little difficulty in securing accommodation through B&Bs, hotels, or self-catering accommodation.
- Water will be utilised from local access points, and thus will not adversely affect existing municipal infrastructure. Electricity will be accessed through the closest Eskom take-off point with a back-up generator, and a generator only where no take-off points are close at hand.
- There are expected to be increase in usage of local road infrastructure due to an increase in traffic during the construction phase which could lead to deterioration of local road conditions, particularly where roads are already in a poor state. This impact has been minimised through the development of a traffic management plan, which sees truck trips mainly localised to the construction site, and thus expected to have a limited impact on road congestion and deterioration.

Table 7-50: Added pressure on economic and social infrastructure during construction as a result of increase in local traffic and in migration of construction workers

	Without mitigation	**With mitigation**
Spatial Scale	Surrounding area (2)	Surrounding area (2)
Duration	3 months to 1 year (3)	3 months to 1 year (3)
Severity	Small (2)	Insignificant (1)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Unlikely (3)
Significance	**5.8 (Medium-Low)**	**4 (Low)**
Reversibility	Reversible within a short period	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site. • Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers. • Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.		
Cumulative impacts: • None foreseen due to the temporal nature of the construction phase		
Residual Impacts: • None foreseen at this stage		

Changes to the sense of place during the construction

Changes to surrounding communities' sense of place are expected, given that there will be a change to the visual landscape of the Port, and increased noise during construction, however these changes are expected to be limited given that the Powership and FSRU are being moored in an already active port, which is situated in an industrial area. Most properties that have high visual exposure to the existing port and industrial structures will have a high visual exposure to the Powership, however it is moored comparatively far from major residential areas. The FSRU is moored in the Bay of Saldanha, and as such while more visible due to the lack of obstruction from port infrastructure, is several kilometres from any settlements, and in an area which other ships and boats normally traverse. As such the FSRU is expected to not change the visual landscape significantly, however it will increase its industrial nature due to the fact that it will be permanently moored in its position. It is acknowledged that any rapid changes to an area that significantly alter its characteristics can have a potential negative impact on a community's sense of place. That being said, the existing port, maritime traffic, and industrial nature of the area mean that the Powership and FSRU are unlikely to significantly alter its appearance, and as such have a significant impact on local communities' sense of place.

Table 7-51: Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the construction phase

	Without mitigation	**With mitigation**
Spatial Scale	Immediate (1)	Immediate (1)
Duration	3months to 1 year (3)	3 Months to 1 year (3)
Severity	Small (2)	Insignificant (1)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Unlikely (2)
Significance	**5 (Medium)**	**3 (Low)**
Reversibility	Possible to reverse but only with decommissioning	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation/Enhancement: • The mitigation measures proposed by the visual and noise specialists should be adhered to • Efforts should also be made to avoid disturbing such sites during construction. • During Construction the small fisherman should be engaged to reduce negative impacts on their operations		
Cumulative impacts: • Change in perception of the area due to the construction of the infrastructure linked to similar developments albeit temporarily		
Residual Impacts: • Altered characteristics of the environment		

*7.5.16.2 Impact assessment (with mitigation): **<u>Operational Phase</u>***

Sustainable increase in production and GDP nationally and locally during operations phase

The annual impact on total production is expected to be R461.75 million a year and will primarily be generated within the WCDM through the multiplier effect due to the high annual spend on labour and procurement of local goods and services needed to operate the Powership and related infrastructure. The majority of spending will be on utilities, however the electrical machinery and apparatus, insurance, and transport service will also experience a significant portion of the stimulus.

A smaller portion will be accounted for in the rest of the Western Cape and country because of this, and under the assumption that revenue generated is accounted for in the WCDM rather than in the province where the developers' headquarters are located (Gauteng). A lower, but still significant impact will be experienced through value added to GDP, which will equate to R280.482 million per annum in the national economy. The full break down of Production and GDP impacts in 2022 prices are listed in Table 7-52, and the related impact assessment in Table 7-53.

Table 7-52: Estimated Annual Impact on the National and Local Economies - OPEX

Indicator	Direct	Indirect	Induced	Total

Production	R170.929 million	R137.821 million	R153 million	R461.75 million
GDP	R103.833 million	R83.705 million	R92.944 million	R280.482 million

Table 7-53: Temporary increase in the GDP and production of the national and local economies during construction

	Without mitigation	With mitigation
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Great (4)	Great (4)
Frequency	Once a year (1)	Once a year (1)
Probability	Highly likely (5)	Highly likely (5)
Significance	**14 (High)**	**14 (High)**
Reversibility	Benefits are sustained only over project's lifespan	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • The operator of the Powership and related infrastructure should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy		
Cumulative impacts: • Improved energy supply in the country • Reduced carbon emissions in generation of electricity • Sufficient economies of scale could be created to establish new businesses in the local economies. These businesses could then supply the goods and services required for the operation and maintenance of the facility than cannot currently be procured in the area. This would contribute to the local economies' growth and development. • Increased economic activity will require a stable power supply, of which the proposes Powership will be providing and will also benefit businesses in the long term.		
Residual Impacts: • None foreseen at this stage		

Creation of sustainable employment positions nationally and locally during the operations phase

The operations phase is expected to conservatively generate 142 FTE positions which will be retained for the lifespan of the development, and will be related to the operation, maintenance, and monitoring of the Powership and their related infrastructure. The annual spending outlined in Table 7-52 will result in 46 indirect jobs, and 51 induced jobs through production and consumption induced effects. These jobs will also mostly be created in the local area due to the nature of the spending, with the trade, utilities, and community and personal services sectors benefiting the most from these new employment positions.

Table 7-54: Estimated Full Time Equivalent positions to be created during operations

Effect	Employment (FTE)
Direct	142

Indirect	46
Induced	51
Total	**240**

Table 7-55: Creation of sustainable employment positions nationally and locally

	Without mitigation	With mitigation
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Great (4)	Great (4)
Frequency	Once a year (1)	Once a year (1)
Probability	Highly likely (4)	Highly likely (5)
Significance	**11.7 (High)**	**14 (High)**
Reversibility	Benefits are sustained only over project's lifespan	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • Where possible, local labour should be considered for employment to increase the positive impact on the local economy. • As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powership and related infrastructure.		
Cumulative impacts: • Improved living standards of the directly and indirectly affected households		
Residual Impacts: • Experience in operating and maintaining Powership and their related infrastructure		

Skills development of permanently employed workers during operations phase

The gas industry in South Africa is currently in its infancy and there are currently no FSRU facilities present in the country, consequently there are a lack of skills to operate and maintain future facilities. Thus, it is likely that skilled personal – such as mechatronics engineers (dual specialised electrical and mechanical engineers) – will need to be recruited from outside of the WCDM and trained by Karpowership, as will less skilled workers doing safety, security, and mechatronic assistance work. However, the gas industry is one of the sectors being targeted by the SBIDZ, and there are likely to be alternate opportunities for workers, should the desire arise. In addition to this, the developer has allocated R29.69 million to skills development over the course of the project, which will be utilised to ensure that local citizens are upskilled, and could be used towards training additional gas workers for the future development of the local industry.

Table 7-56: Skills development of permanently employed workers during operations phase

	Without mitigation	With mitigation
Spatial Scale	Surrounding area (2)	Surrounding area (2)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Small (2)	Small (2)

Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Highly likely (5)
Significance	**6.7 (Medium-Low)**	**9 (Medium-High)**
Reversibility	Yes, skills can be lost in not practiced	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the Powership and their related infrastructure and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.		
Cumulative impacts: • Development of new skills and expertise in the country to support the development of the gas industry as well as the industry which has been prioritised in the municipality		
Residual Impacts: • Human capital development of the affected workers		

Improved standards of living for benefiting households during operations phase

The increases in FTE detailed in Table 7-54 will have a positive impact on household revenues during the operations phase and are estimated to result directly in a total of R28.708 million in household revenue, with the total increase to households with the addition of production, and consumption effects estimated to be R77.435 million. These incomes will be sustained for the duration of the project, and will contribute positively to the standard of living of benefitting households.

Table 7-57: Estimated Household Revenue Created during Operations

Indicator	Value
Direct	R28.708 million
Indirect	R23.099 million
Induced	R25.628 million
Total	R77.435 million

Table 7-58: Improved standard of living for benefitting households

	Without mitigation	**With mitigation**
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Small (2)	Small (2)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)
Significance	**10 (Medium-High)**	**10 (Medium-High)**
Reversibility	Benefits are sustainable only over project's lifespan	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy. • As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powership and their related infrastructure.		
Cumulative impacts: • Improved productivity of workers • Improved health and living conditions of the affected households		
Residual Impacts: • None foreseen at this stage		

Sustainable increase in national and local government revenue during operations phase

The project will contribute to both national and local revenues during its operations. At a local level water utilities payments to operate the Powership and associated infrastructure will be earned by local government. National government will benefit from tax revenues collected from the payment of salaries and wages, as well as corporate income taxes. It is impossible to know how exactly these revenues will be allocated, but any increase to national and local revenue will result in an increase in development spending.

Table 7-59: Sustainable increase in national and local government revenue

	Without mitigation	**With mitigation**
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)
Significance	**10.8 (Medium-High)**	**10.8 (Medium-High)**
Reversibility	Benefits are sustained only over project's lifespan	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation/Enhancement: • None suggested.		
Cumulative impacts: • Possible improvement in service delivery		
Residual Impacts: • None foreseen at this stage		

Provision of electricity for future development during operations phase

South Africa is currently in the grips of an energy crisis which is likely to last for several years, and requires immediate and substantial action to address it. The RMI4P plays a critical role in this, as it is the nearest term procurement programme to provide short-term energy relief which is critical for reducing the risk to the energy supply and resulting loadshedding when demand outstrips supply. The Powership will allow Eskom to reduce their use of diesel-fired OCGT, which will reduce the cost of electricity, as it is around half the price which Eskom pays per kWh to run diesel-fired OCGT. Thus, the project will allow for cost savings in the short-term, support business development, and improve households' standards of living by providing a reliable source of electricity.

Table 7-60: Sustainable increase in national and local government revenue

	Without mitigation	**With mitigation**
Spatial Scale	Regional, National, International (5)	Regional, National, International (5)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Likely (4)
Significance	**10.8 (Medium-High)**	**10.8 (Medium-High)**
Reversibility	Benefits are sustained only over project's lifespan	
Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation/Enhancement: • None suggested.		
Cumulative impacts: • Possible improvement in service delivery		
Residual Impacts: • None foreseen at this stage		

Local economic and social development benefits derived from the project's operations during operation

Karpowership has committed to a corporate social responsibility plan which includes both social and enterprise development, a full list of which is detailed under Annexure C. Current regulations require that a minimum of 1% of project revenue (R30.468 million) is allocated towards social- and economic development, with a further 0.4% allocated to enterprise development (R12.099 million). The DMRE will verify these contributions through quarterly audits. Approximately 80% of these two contributions will accrue directly to the local community, with communities living in close proximity to the development benefiting the most (typically 50km radius), and the remaining 20% assigned to other communities in the province. Government requirements mean that these funds will be directed towards addressing the local communities' social and economic needs.

Table 7-61: Local community and social development benefits derived from the project's operations

	Without mitigation	**With mitigation**
Spatial Scale	Surrounding area (2)	Surrounding area (2)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Significant (3)	Significant (3)
Frequency	Once a year (1)	Once a year (1)
Probability	Likely (4)	Highly likely (5)
Significance	**8.3 (Medium)**	**10 (Medium-High)**
Reversibility	Benefits could stretch beyond project's lifespan	

Status (positive or negative)	Positive	Positive
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes (enhanced)	
Mitigation/Enhancement: • A three-year social development and economic development programmes should be devised by the developer throughout the project's lifespan. • The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. • These plans should be reviewed on an annual basis and, where necessary, updated. • When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises. • In devising the programmes to be implemented, the developer should take into account the priorities set out in the local IDP.		
Cumulative impacts: • Declining levels of poverty in WCDM, and Western Cape. • Improved standards of living of the members of the community and households that benefit from the various programmes. • Possible improvements in access to services and status of local infrastructure		
Residual Impacts: • None foreseen at this stage		

Negative changes to sense of place during operation

The negative impact to the community's sense of place will be similar to that during the construction phase, although somewhat less significant as there will not be the increase in traffic due to construction vehicles. Additionally, no significant visual impact anticipated as the Powership will be in an active port and industrial zone and will be well screened with other port infrastructure, and undulating beach. Therefore, it is anticipated that the impact on one's sense of place will be limited.

Table 7-62: Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase

	Without mitigation	**With mitigation**
Spatial Scale	Immediate (1)	Immediate (1)
Duration	Beyond 10 years (5)	Beyond 10 years (5)
Severity	Small (2)	Insignificant (1)
Frequency	Once a year (1)	Once a year ()
Probability	Highly unlikely (2)	Highly unlikely (2)
Significance	**4 (Low)**	**3.5 (Low)**
Reversibility	Possible to reverse but only with decommissioning	
Status (positive or negative)	Negative	Negative
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation/Enhancement: • The mitigation measures proposed by the visual and noise specialists should be adhered to • Efforts should also be made to avoid disturbing such sites during construction.
Cumulative impacts: • Change in perception of the area due to the construction of the infrastructure linked to similar developments albeit temporarily
Residual Impacts: • Altered characteristics of the environment

7.5.16.3 *Polycentric Impacts*

Fisherman and Mariculture

The potential socio-economic impacts of the proposed project on the fisheries and mariculture sector are of importance given that the fisheries sector supports a large number of small-scale fishers in the area whose livelihood depends on continuing availability of near shore fish stocks. Further, the mariculture industry provides additional employment opportunities in the area, and provides important export income to the country as the sector supplies both the domestic and international market. This industry also provides indigenous peoples access to employment, which is supportive of their cultural and spiritual needs, as access to the sea has been outlined by local traditional leaders as being of cultural and spiritual importance

It is crucial to understand that no fishing is permitted within the port area. As an active port and industrial zone, Transnet National Port Authority (TNPA) does not grant access for fishing. DFFE have also confirmed that there are no registered small scale fishing cooperative associated within the port.

Marine Ecology and fisheries

The white stumpnose (commercial and recreational line fishers) and harders (gill net and recreational shore-anglers) are the most important fish species to fisheries industry in Saldanha and Langebaan (Lwandle & Anchor Environmental Consultants, 2022). The estimated value of the commercial sectors landed cash is approximately R630 000, at R40/kg and 39 tonnes, although the recreational catch value is not known, it is estimated to exceed that of the commercial fishers (Lwandle & Anchor Environmental Consultants, 2022). The local fish stocks of harder and white stumpnose have both declined, and while there was limited recovery during the height of the Covid-19 pandemic, these recoveries are expected to be short-lived (Lwandle & Anchor Environmental Consultants, 2022). Evidence of overfishing is beginning to show, with the average size of harders caught declining, and while the juveniles being caught are healthy, this is evidence of an overexploited fish stock (Lwandle & Anchor Environmental Consultants, 2022).

Saldanha Bay is an important site for mariculture as it is the only naturally sheltered embayment in the country, and as such in 2018 was granted Environmental Authorisation to establish an Aquaculture Development Zone (ADZ) in Saldanha Bay over an area of 464 ha which was later expanded to 884 ha (Lwandle & Anchor Environmental Consultants, 2022). The ADZ has four precincts, namely: Small Bay, Big Bay, Outer Bay North, and Outer Bay South (which are shown in Figure 3 2 below), in which 30 entities have been granted marine aquaculture rights, with 25 of which are currently operational (Lwandle & Anchor Environmental Consultants, 2022). Studies on the ecological carrying capacity of Saldanha Bay for bivalve farming suggests the industry could increase 10 to 28 times, creating an additional 940 to 2 500 jobs (Lwandle & Anchor Environmental Consultants, 2022) indicating that the mariculture industry has significant potential for job creation in the area.

Considering the importance of both the fishing and mariculture industry, the following impacts - and related mitigation measures - were found:

- Impact 1: Effects of the gas pipeline construction and installation, and vessel mooring on littoral (nearshore) and benthic (ocean floor) communities
- Impact 2: the effects of the intake of cooling water on marine organisms in the surrounding water body
- Impact 3: The effects of the discharge of cooling water on the marine ecology in the receiving water body
- Impact 4: The effects of increased noise and vibration levels on the marine ecology
- Impact 5: The effect of impacts on ecosystem services
- Impact 6: Impact on dynamic coastal processes
- Impact 7: Impacts of coastal pollution
- Cumulative impacts

Small-Scale Fishers

Saldanha Bay supports a strong small-scale fishers' industry that spans several communities in surrounding areas, which provides income, food, and cultural significance to these communities. Any negative impacts to the sector due to the proposed project could have significant socio-economic impacts. To understand how the proposed project may result in socio-economic impacts the Fisheries and Mariculture report by Lwandle and Anchor Environmental Consultants is referenced to unpack the marine impacts, while to understand the positions and concerns of small-scales fishers the engagements undertaken by Steenkamp and Rezaei from Afro Development Planning's resulting Stakeholder Engagement Report are referenced.

It is noted that the specialists from Afro Development Planning conducting the Socio-Economic Assessment for Saldanha Bay did not undertake a dedicated stakeholder engagement with the small-scale fishers. It was concluded that the scope of engagements undertaken by Steenkamp and Rezaei sufficiently covered the questions which the socio-economic team from Afro Development Planning had, and would reduce the engagement fatigue experienced by local stakeholders. As such it was decided that holding separate engagements on socio-economic impacts when an engagement had been held by the stakeholder engagement team would not be fruitful, especially considering that the same questions and topics would be raised with the stakeholders.

During the stakeholder engagements the following negative impacts of the Powership were raised:

- Changes to the water temperature could impact marine species, and mariculture
- Increased water temperatures could lead to oxygen level changes, and algae blooms which could negatively impact muscle growth.

The impact on water temperatures from the discharge of cooling water from the Powership will be isolated to the project site, with the ZID not extending more than 100m. This is more than a kilometre away from the closest edge of the ADZ, and as such there will be no impact on the bivalve mariculture. Thus, there are not expected to be any negative socio-economic impacts related to mariculture industry from the Powership.

It is also important to note that the previous socio-economic impact assessment received comments from small-scale fishers, as to the possible impacts which the project could have, and specifically noted the following:

- Small-scale fishers utilise small boats which cannot go fishing more than 5 miles (8km) from launch sites.
- White stumpnose are an important species for small-scale fishers, and the port is used as a breeding ground.
- Negative impacts which reduce small-scale fishers' incomes will leave families and communities stranded without an alternate income source.

As noted, small-scale fishers have a much smaller range than commercial fishing operations, and Saldanha Bay provides an important, and safe, fishing area for these fishers. Hence there are obvious concerns about the exclusion zones around the Powership and FSRU which might reduce small-scale fishers range and thus livelihood opportunities. It is firstly important to note that all fishing activities raised during the stakeholder engagement were located outside of the Port, none were identified in the project area, and small-scale fishing cooperatives are not registered to fish in the Port as it is an industrial zone, with the majority of fishing identified as taking place in the lagoon and along the coastline (Steenkamp & Rezaei, 2022). Thus, the designated project site will not directly interfere with small-scale fishers by taking up the area where they can fish.

Secondly, the Powership will not indirectly reduce the small-scale fishers range as it is moored adjacent to the iron ore terminal, and thus not in the path of fishing from any of the harbours or boat launch sites in Saldanha Bay. The FSRU has an 800m exclusion zone surrounding it for safety reasons, which will result in small-scale fishers needing to take alternate routes which may have previously transversed the zone. The placement of the FSRU has been situated in such a manner not to interfere with the passage of vessels entering the Saldanha Port, and as such the alternate routes which small-scale fishers would need to take will require relatively small adjustments to course, and thus not meaningfully impact their range. Therefore the Powership and FSRU are not expected to reduce the effective range of small-scale fishers in a manner which will reduce their catch rates, and thus there are no negative socio-economic impacts which will arise from this.

Finally, regarding the breeding of white stumpnose, it is noted that the only area where these fish may be impacted is within the 300m of the Powership, where the increased noise may cause juveniles which utilise the area as a nursery to move further away from it. It is important to note that the white stumpnose stock is overexploited in the area and already under pressure, and that juveniles displaced from the Powership site could enter more heavily fished areas (Lwandle & Anchor Environmental Consultants, 2022). This is not expected to have a significant impact on the wider white stumpnose stock, however it was noted that more investigation into the Powership site is needed to establish if the project site is a nursery area. If it is identified to be one, then adequate mitigation measures will be put in place (Lwandle & Anchor Environmental Consultants, 2022). Thus, due to the localised nature of the impact, and the findings of Fisheries and Mariculture specialist there will not be a wider negative impact on the white stumpnose stock beyond a 300m zone around the Powership (Lwandle & Anchor Environmental Consultants, 2022), and therefore no negative socio-economic impacts are anticipated.

The negative socio-economic impact of the Powership and FSRU on small-scale fishers have been an area of contention since NERSA granted Karpowership SA its generating licence, however it is important to highlight the expected positive socio-economic impacts related to the small-scale fishers and the mariculture industry given the economic development projects outlined by Karpowership (in its Economic Development plan). One of the central issues raised during the stakeholder engagement undertaken by Steenkamp and Rezaei (2022) was the need for skills development, support for small and medium businesses, supporting local sports and recreation activities, and job creation opportunities, issues which were reflected in the comments received by Urban-Econ (2021b) in the initial Socio-economic Impact Assessment. Unemployment, limited educational attainment and skills development, and poverty are issues which the local communities experience, and are issues which Karpowership SA (2022) has identified as a part of their economic development plan for the area. The summary of the projects Karpowership SA will be implementing can be found in the sub-section.

There are a number of positive socio-economic impacts which will be derived from the project for under privileged communities in SBM. The projects categorised under Student Skills Development are of particular interest given that they will improve skills levels in areas which are relevant to the industries present or being further developed in Saldanha, and as such will both contribute to increasing the level of local employment for future projects and development of the SBIDZ, increasing the areas attractiveness for further investments. This is what Levy (2014) describes as developing islands of efficiency, areas where collaboration between local stakeholders and industry, improved infrastructure, and workforce skilled towards particular industries increases both the productivity of an area, but also its attractiveness to investors.

Secondly, providing youth with skills training which are in demand in their community reduces the need for them to leave their communities to find employment. From a social perspective, this reduces youth migration from rural, and peri-urban areas to cities in search of work, reducing the breakup of communities, and providing youth with a support structure while they are trying to establish themselves in the workplace. Economically this provides significant advantages as it reduces transport, accommodation, and food costs for the youth, as well as the cost of transferring remittance to their families. Local employment will further increase the local multiplier effect of employment, as consumption spending will be undertaken within the local community, ultimately leading to increased local employment.

Finally, the Environmental Sustainability project will increase the amount of unskilled and low skilled labour in the area, increasing household incomes in local communities, and improve the ability for the SBM to adapt to the impacts of climate change. Coastal regions are expected to be significantly impacted by climate change due to rising sea levels, and increased storm intensity, which in turn increases coastal soil erosion which can be combated through nature-based solutions such as the planting of indigenous plants. This project will also further enhance the interests of indigenous peoples in the area, as comments from the traditional leaders of the Gorachouqua Kai Bi'a Council indicated that their main interests lie in the rehabilitation of the environment (Steenkamp & Rezaei, 2022). It is recommended that the programme be expanded to investigate the planting of mangroves and seagrass in areas where it is ecologically appropriate. These measures will further protect local coastal areas from storm surges driven by rising sea levels due to climate change, protecting coastal infrastructure, and reducing coastal erosion.

In addition to the Socio-economic Development Programme's contribution to local skills development, a dedicated Skills Development Programme will be implemented during the operations phase of the project. This will be allocated a budget of R27.7 million over the 20 years, at approximately R1.4 million per annum (Karpowership SA, 2022). The intention of this programme is for positions which are initially filled by foreign personal to be filled by South Africans who are trained through the skills development programme. School leavers and graduates will be supported through bursaries, and internships. Powership internal staff, and community members will be provided with learnership or apprenticeship opportunities, and informal and work-integrated learning. This will provide the same benefits outlined above regarding to locally relevant skills, and continue to develop the skills base in a manner which is relevant to the local industrial development plans, and increase the level of localisation of the project.

Limited employment opportunities, and lack of alternative sources of income were identified as key issues within communities in the SBM, especially among small-scale fishers. As such the set of projects outlined in Table

7-65 will provide positive socio-economic impacts which will help to diversify the economy of local communities. SMMEs are the backbone of the South African economy, employing 64% of the labour forces in 2021, and thus are more labour intensive in their employment than larger companies (SEDA, 2021), and which operate in a harsh economic environment which results in 75% of SMMEs failing within their first three years (Bruwer & Coetzee, 2016). Economic and skills support to SMMEs will significantly improve their chances of long-term survival, and if properly established, will result in long-term positive socio-economic impacts beyond the project's lifetime – especially considering the 20-year duration of the Enterprise Development component – which will have a strong multiplier effect through consumption and production spending. Direct support for small-scale fishers and aquaculture will provide alternate, and sustainable employment opportunities for small-scale fishers which allows them to stay within culturally relevant employment and provides more stable income outside of the seasonal earnings associated with fishing. Further, because Karpowership SA will be implementing these projects through engagement with local communities these projects are more likely to succeed given that they will be utilising local knowledge.

Further enterprise development support is provided through a Supplier Development Programme, which has been allocated R1 million for the construction period, and R910 000 per annum for the 20 years of operations (Karpowership SA, 2022). This will involve the provision of seed or development capital, loans and credit facilities organised through partner financing companies, and assistance with training and mentoring. The development of a local supplier value chain which is centred around the maritime sector will further increase the development of the SBIDZ, as it will increase the local skills base, and production capacity which is geared towards industry relevant services and products. This will increase the likelihood of other vessels and international maritime companies planning maintenance, and restocking for at the Saldanha Bay Port, rather than other locations, increasing local investment, and consumption spending. These impacts work in turn with the skills development programme, as it provides industry relevant employment opportunities for the youth whose skills have been developed under the skills development programme.

These proposed social and enterprise development programmes will meaningfully contribute towards the development of the SBM, and will bring significant socio-economic benefits, especially to small-scale fishing communities which are directly targeted by the Economic Development Plan. The development of the local economy in a meaningful way which extends beyond the core interests of the project will further integrate surrounding communities into the SBIDZ's supply chain, and the economy of the wider SBM. It is also important to note that situating these projects within local, and underprivileged communities will cause a wider positive socio-economic impact that is likely to stimulate economic development in these areas and improve households' standard of living. Due to these reasons, the positive socio-economic impacts of the Project are likely to extend beyond its operations lifetime.

Environmental

The environmental impacts of the Powership are considered in this chapter, which will look at both the marine and terrestrial impacts on flora and fauna, with consideration given to the socio-economic impacts which the related impacts are likely to have. Reference will be made to the specialist reports which inform these findings, and can be viewed for more detail. Overall, it is noted that the specialists find that there will be limited to low impacts from the Powership, FSRU, and associated infrastructure. Given these findings, it is unlikely that the project will have negative socio-economic impacts, and instead the balance of socio-economic impacts are likely to be positive when considering the CSR projects, and increased job opportunities created by many of the mitigation measures.

Avian impacts

Estimates for the impact of the Powership, FSRU, and powerlines proposed sites were assessed through desktop studies, and site visits, with the Simmons (2022) observing and walking the existing 132 kV lines which cover a similar area to the proposed power lines, beach area where the LNG pipelines are proposed for, and observing the proposed area for the Powership and FSRU moorings. This assessment was critical due to the fact that the proposed project location lies between two globally Important Bird Areas (Langebaan Lagoon and the Berg River Estuary), which are internationally recognised (Simmons, 2022).

Simmons (2022) found that if the mitigation measures are put in place, then the impact on local bird life will be minimal, and the project should proceed, and should include a minimum of a two-year observation period post-construction to monitor any cumulative impacts which might occur and provide enhanced mitigation measures. Given these findings it is estimated that negative socio-economic impacts are unlikely, given the limited significance of the avian impacts, and will therefore have minimal impact on tourist and birdwatchers visiting the area which could reduce local income.

Wetlands and estuaries

Estimates for the impact of the powerlines proposed sites were assessed through desktop studies, and site visits by Hoosen (2022). Scoping of the area revealed that none of the proposed powerline routes traverse any watercourses, and will interact with one watercourse only namely the Port (Hoosen, 2022). The report does however note mitigation and rehabilitation measures which will need to be undertaken in accordance with the post-construction and decommissioning rehabilitation requirements – the specifics of which can be reviewed in Hoosen’s (2022) report. These rehabilitation measures will mainly require low- and semi-skilled labour to be undertaken, under the supervision of experts, and as such will create a positive socio-economic impact in the area through additional job creation.

Marine organisms and fisheries

Impacts to the marine environment were as per the previous sections.

Climate Change

The GHG emissions from this project contribute to the global stock of GHG emissions. Whereas it is important for each project to mitigate as far as possible, the contribution of this project to global GHG emissions is very low. 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.

South African electricity generation is dominated by coal, accounting for 83% of electricity generation in 2020 (Calitz & Wright, 2020), and as coal is the predominant source of baseload electricity in South Africa, and is planned to be until 2030, it is the best source of comparison out of the generation sources (Promethium Carbon, 2022b). LNGC produces around half the GHG emissions than that of coal, and does not produce any particulate, or nitrates (NOx) and sulphates (SOx) which coal produces significant amounts of, and as such is significantly better for human health (Promethium Carbon, 2022b). A comparison of GHG emissions between Eskom’s main fuel sources, including diesel, given the current heavy reliance on diesel generation (Pram et al., 2022), is shown in Table 7-63. This stark difference in emissions is highlighted by the fact that operational emissions of the Powership for 5 years will result in less emissions than running a coal fired plant for a year (Promethium Carbon, 2022b). This highlights the role of LNG as a transition fuel that will enable the move from heavily polluting coal plants to a full renewable future.

Table 7-63: Alternative generation sources

Power source	Emission Factor
Coal	96.1 tCO2/TJ
Diesel	74.1 tCO2/TJ
Natural Gas	56.1 tCO2/TJ
Renewables	0 tCO2/TJ

The project's role in assisting the transition to a low carbon future is not limited to the reduction of GHG and particular emissions when compared to coal, but also its ability to support renewable energy plants coming online by making up for their intermittent energy generation. In the future, renewable energy plants paired with battery storage will preclude the need for fossil fuel-based generation, however this will only become a reality in the future when battery storage technology and manufacturing capacity has improved (Promethium Carbon, 2022b). By providing load following and dispatchable electricity which renewable energy cannot provide, the project will enable more renewable energy projects to come online than otherwise would have been be possible, providing the energy stabilisation needed until sufficient battery technology can be deployed (Promethium Carbon, 2022b). This will result in additional emissions saving, as it will allow a further reduction in demand for coal fired electricity as more renewable energy comes online (Promethium Carbon, 2022b). It is important to note that coal cannot fill the same role as LNG in supporting renewable energy because coal fired plants do not provide dispatchable energy. Coal fired plants have to run for extended periods of time with limited shutdown periods to remain efficient and operational, usually only implemented when maintenance is required. Gas-to-power plants by comparison are able to turn on and off at will, providing electricity as dispatch demands fluctuate, and only experiencing efficiency losses between cold and hot starts.

These avoidances in GHG emissions enabled by the project due to a direct avoidance of coal emissions, and an indirect reduction through the support of renewable energy means that the project will ultimately provide more GHG emissions avoidance than the total amount of GHG emissions it will produce over its lifetime, even when accounting for the worst-case scenario (Promethium Carbon, 2022b). Coupled with the positive economic impacts at a national level from providing dispatchable electricity which is critical for economic development, and reducing the negative impacts of loadshedding on the economy, means that Promethium Carbon (2022b) estimates that the project will have a low positive impact. Thus, on a climate change basis, Promethium Carbon finds that the project is desirable (2022b).

When considering the project's impact on climate change in conjunction with the climate change impacts of surrounding gas-to-power plants planned for the area, a similar conclusion is drawn. Increased intensification of gas-to-power projects in the area will increase the expertise and infrastructure available, improving the efficiency of construction which will reduce construction emissions. Secondly, other plants utilising natural gas are expected to result in similar avoidance of emissions from coal, and enabling greater renewable energy deployment. Thus, while an increase in gas-to-power plants will increase the emissions being produced in SBM, it will reduce the emissions being produced nationally if it leads to reduced use of coal, and greater renewable energy development. Climate change impacts are not driven by local contributions to emissions, due to the distributed nature of GHG, but rather than the global level of GHG, and as such the local emissions cannot be directly tied to the climate change impacts which will be felt in the SBM (Promethium Carbon, 2022b).

Considering the assessment by Promethium Carbon (2022b), which contextualises the project's GHG emissions in comparison to the direct avoidance of GHG and particulate emissions from coal and diesel fired plants, and the indirect avoidance of emissions by enabling a greater development of renewable energy sources, the socio-economic impacts are expected to be positive.

Tourism

Travel to Saldanha Bay specifically is dominated by leisure/holiday (63%) – as seen in Figure 3 1 – and has seen the highest annual growth rate between 2009 and 2019 was 4.5% (3T Business Fusion, 2022). Tourism is vital part of the economy in Saldanha Bay, contributing 24.6% to the GDP of the Saldanha Bay Local Municipality, while it played a less important role for the WCDM it is still an important component providing 13% of GDP (3T Business Fusion, 2022).

Impacts of loadshedding on the tourism industry

The loadshedding has had a significant impact on the South African tourism industry for a number of years now but has been most keenly felt post-Covid-19 Lockdowns as the industry attempts to recover from the impacts of the period. These impacts are experienced most significantly by small, medium, and micro enterprises (SMMEs) which incur a higher cost from adapting to loadshedding, and are more likely to go out of business compared to larger businesses due to coping costs and the impacts to revenue generation due to interrupted operations (Mbomvu et al., 2021). This creates significant issues for economic recovery, as SMMEs are drivers of economic growth in South Africa (Bruwer et al., 2018), employing 64% of the labour forces in 2021 (SEDA, 2021), and which already operate in a harsh economic environment with 75% of SMMEs failing within in their first three years (Bruwer & Coetzee, 2016). This experience is mirrored in the tourism industry, where SMMEs are impacted heavily by loadshedding (3T Business Fusion, 2022). The tourism industry in South Africa has seen consistent growth, even as the national economy has seen slow growth, however this is being significantly threatened by loadshedding, and has been identified as a key issue reducing recovery of the industry in the Western Cape (3T Business Fusion, 2022).

Impact of the Powership and FSRU on the local tourism industry

The area which the Powership and FSRU will be stationed is an existing industrial area and has been granted a license to establish an IDZ, which the municipality has been driving as a source of development in the area, with the envisaged investment bringing significant benefits to Saldanha and the larger region (Saldanha Bay Industrial Development Zone, 2022). Due to this existing level of industrialisation in the area it is not anticipated that the Karpowership will have a negative visual impact on the tourism industry, and in fact could have positive impacts from industrial tourists who visit the port specifically to view large ships (3T Business Fusion, 2022). Thus, while there may be a small negative impact to some tourists who are abjectly opposed to industrial development in the area, these individuals are likely to be in the minority given the fact that Saldanha is clearly advertised as having a working port which is the deepest natural harbour in the Southern Hemisphere.

From an environmental perspective, the Powership and FSRU are expected to have a limited impact on both the marine and terrestrial environment (Hoosen, 2022; Lwandle & Anchor Environmental Consultants, 2022; Simmons, 2022), and as such are not expected to have a negative impact on environmental tourism (3T Business Fusion, 2022). This was raised as a significant concern by I&APs, given that the majority of tourists come to Saldanha and its surrounding areas for its natural beauty.

A further impact which the Powership could have on the tourism industry is through terrestrial noise disturbing tourists staying in accommodation, visiting restaurants, or tourist attractions in the vicinity of the Powership. Acoustic modelling of the Sekondi Powership in Ghana, found that the operations phase of the project will have a low sound impact with mitigation measures, and will not exceed the noise limits for any residential areas within the zone of noise (Safetech, 2022). Noise above 40 decibels will only be experienced within the Iron Ore and Oil Jetty, which are still within industrial noise levels (Safetech, 2022). Thus, there are not expected to be any negative socio-economic impacts on the tourism industry due to reduced tourist revenues for tourists reducing the length of their stay or activities due to noise levels.

It is important to note that the Saldanha tourism industry has been harmed by loadshedding, with tourists spending less time in the area, and less time at restaurants as a consequence. This has hampered the wholesale and retail, and catering and should the investigated if they fall within the construction impact zone, after the receipt of environmental approval, and prior to commencement of construction accommodation sectors in particular (3T Business Fusion, 2022). As such, 3T Business Fusion (2022) anticipates that the inclusion of the Powership in the port will bring relief to the industry by reducing the cost of loadshedding on the area, reducing coping costs such as generators, fuel, non-electrical lighting, alternate refrigeration for perishable goods, and increased security (Bruwer et al., 2018). This is further expected to increase revenue as businesses are able to operate for longer with less interruptions, and tourists are likely to stay in the area for longer (3T Business Fusion, 2022).

Saldanha Bay has a rich underwater archaeological history, with 45 wrecked ships in the Saldanha Bay area, with 12 wrecks possibly within the area of construction (although all have a medium to low probability of presence in the impact zone) (Maitland, 2022). If elements of these wrecks are uncovered they could contribute to museum displays, adding to the cultural heritage of Saldanha and an additional tourist attraction. After conducting boat-based surveys for magnetic anomalies, and diver investigations of identified sites within the construction zone, it was found that there was no direct evidence of all of the 12 wrecks, although five magnetic anomalies were identified as points of interest (Maitland, 2022). These magnetic anomalies could not be attributed to harbour, jetty, aquaculture zone, or LPG mooring debris, and as such could be underwater heritage artefacts, and should be investigated if they fall within the construction impact zone, after the receipt of environmental approval, and prior to commencement of construction (Maitland, 2022). These considerations accounted for, the Underwater Archaeological Impact Assessment still finds the project to be feasible (Maitland, 2022).

Visual

The visual impact of the Powership, FSRU, and powerlines have been raised as areas of concern, given the visual beauty of the area, and prosperous tourist industry. The visual impact assessment considered the visual impact of the project from the perspective of Saldanha, Mykonos, Saldanha Beach, and roads in the surrounding areas (Environmental Planning and Design, 2022).

Beginning with the proposed 132kV overhead powerlines, it was found that because the powerlines will be located within existing infrastructure, and will start and end in industrial areas, the project will not introduce elements which are outside existing development (Environmental Planning and Design, 2022). As such the visual impact of the powerlines is expected to be low.

The Powership's location on the Eastern side of the Iron Ore and Oil Jetty will largely screen it from being viewed from Saldanha, and it will likely blend in with the existing industrial infrastructure (Environmental Planning and Design, 2022). Further, as it is moored in an active port, the Powership is unlikely to be viewed as any different from other vessels (Environmental Planning and Design, 2022). Placement of the Powership on the western side of the Iron Ore and Oil Jetty will have a more significant visual impact than it's placement on the eastern side of the Jetty (Environmental Planning and Design, 2022). From the perspective of Mykonos, the Powership will be approximately 6km away, and as such is viewed as reasonable visual buffer that would ensure that the landscape/seascape will not be significantly changed due to the project, and will not be visually obvious (Environmental Planning and Design, 2022). When considered in conjunction with the existing industrial infrastructure which will be in the background, and thus will have a low visual impact (Environmental Planning and Design, 2022). There is a slightly higher visual impact expected when viewed from Saldanha Beach, given its closer proximity to the Powership, however the impact is still expected to be low (Environmental Planning and Design, 2022).

Considering the impact of the FSRU, it is likely to bring the industrial nature of the port closer to Mykonos from a visual perspective, however the FSRU will still be 4.1km away from the settlement (Environmental Planning and Design, 2022). As such the FSRU will have a higher visual impact on Mykonos than the Powership which will not be visually obvious, however the distance is still considered a significant enough visual buffer (Environmental Planning and Design, 2022). The FSRU is expected to have a low significance, and the majority of people are not likely to differentiate the FSRU from the other ships in the bay, and port (Environmental Planning and Design, 2022). From the perspective of Saldanha, the FSRU is located around 6.2km away from the reference viewing point, and will be on the opposite side of the Iron Ore and Oil Jetty (Environmental Planning and Design, 2022). Thus, the partial screening and significant distance means that there will be a low visual impact (Environmental Planning and Design, 2022). A similar visual impact to that experienced by Mykonos is expected for Saldanha Beach, although the visual impact will be larger given that it is closer to the FSRU. The distances are however still considered to be large enough to be considered a reasonable visual buffer (Environmental Planning and Design, 2022).

Considering these visual impacts, which see the project infrastructure as either obscured or adjacent to existing industrial infrastructure, being situated in an active port, and in the case of the Powership and FSRU, are at a considerable distance from surrounding settlements, the socio-economic impacts from a visual perspective are likely to be low. While some residents and tourists may be diametrically opposed to the project, and thus will find issue with the project regardless of its location in Saldanha Bay, it is likely that the majority of people will not view the Powership and FSRU differently from the existing vessels using the port. This difference is likely to decrease with time, as the Port becomes busier, and even more vessel traffic further reduces the significance of the Powership and FSRU. As such there are unlikely to be negative impacts on the tourist industry – as noted in section 3.6 – and given that the area is already industrialised, and an active port, is unlikely to negatively impact housing prices.

Economic Development Plan

The following section provides a summary of the Economic Development Plan which Karpowership SA has developed for the SBM and surrounding areas.

Table 7-64: Socio-Economic Development Projects

	Project Name and number	**Project description**	**Duration**	**Support value**
Student skills Development	1.Primary and secondary school focus on building educator and learner capacity in STEM	Establish robotics programmes at all 5 no-fee schools in SBM to target science, technology, engineering, and mathematics skills for learners in Grade 5-12. Teachers will be upskilled, and local unemployed graduates will be trained to assist in after-school programmes. Aim to address scares skills in South Africa such as engineering, maritime sciences, and medicine.	8 years	R3m first year, additional budget allocated year on year
	2.Scholarships/Bursary Programme	Providing Scholarships or Bursaries to 20 talented Learners from disadvantaged	Academic year	R3m over first year

		backgrounds from SBM who qualify for higher education, or students who have had to drop out of higher education due to economic circumstances.		
Community Support Programmes	3.Installation of Energy Efficient systems	Providing energy efficient solutions to the approximate 3000 indigent and low-income households.	3 years	R8 million over the first year.
	4.Support to Vulnerable Communities	Provision of poverty relief programmes to address the needs of the most vulnerable within SBM by supporting NGOs and community-based programmes working with victims of abuse, drug and alcohol addiction, childcare facilities and care for the physically challenged and elderly	3 years	R3 million over the first year.
	5.Sports and Recreation	Provision and/improvement of recreational and sports infrastructure (including outdoor gyms) for underprivileged communities and the sponsorship of sporting codes and events in the SBM.	3 years	R2.5 million over the first year.
Environmental support	6.Environmental sustainability	Contributing to efforts to understand the environmental challenges facing the Saldanha Bay coastline. Employment of unskilled and low skilled labour for alien invasive plant removal, planting of indigenous trees and plants to manage soil erosion, and fire management.	3 years	R2.4 million over the first year.

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 R27.7 million over the 20 years, or approximately R1.4 million per annum (Karpowership SA, 2022). The intention is for positions which are initially filled by foreign personal to be filled by South Africans who are trained through the skills development programme. School leavers and graduates will be supported through bursaries, and internships. Karpowership internal staff, and community members will be provided with learnership or apprenticeship opportunities, and informal and work-integrated learning. This will provide the similar benefits outlined in the section on small scale fishers, regarding to the development of locally relevant skills and continue to develop the skills base in a manner which is relevant to the local industrial development plans, and increase the level of localisation of the project.

Table 7-65: Enterprise Development Programmes

Project Name and number	Project description	Duration	Support value
1.Vendor Kiosks for SMME's	Providing lockable vendor kiosks in high traffic location where SMME's are currently trading in SBM.	2 year, with possible extension.	R 2 million over the first year.
2.Supporting Fishing Communities, Aquaculture and Fish Farming	Support to small scale fishing communities, existing (or erecting) small-scale aquaculture and fish farming facilities in multiple wards.	3 years	R 3.5 million over the first year.

3.Youth Enterprise Development	Identify 10 youth with business ideas and support their establishment of SMMEs, providing start-up capital, and business mentoring for 1 year.	Pilot project will be for 1 year and if successful will become an annual project	R2 million over the first year.
4.Enterprise Development	Support existing SMMEs with short-term cash flow support, and longer-term loans, and business knowledge development. Supporting SMMEs both within and outside of the Karpowership value chain.	20 years (project life time)	R4.5 million over the first year.

A dedicated Supplier Development Programme is also planned, with R1 million allocated for the construction period, and R910 000 per annum for the 20 years of operations (Karpowership SA, 2022). This will involve the provision of seed or development capital, loans and credit facilities organised through partner financing companies, and assistance with training and mentoring (Karpowership SA, 2022). The development of a local supplier value chain which is centred around the maritime sector, and provision of Chandler Services will further increase the development of the SBIDZ, as it will increase local skills base, and production capacity which is geared towards industry relevant services and products. This will increase the likelihood of other vessels and international maritime companies planning maintenance, and restocking at the Saldanha Bay Port, rather than other locations, increasing local investment, and consumption spending.

These proposed social- and enterprise development programmes will meaningfully contribute towards the development of the SBM, and bring significant socio-economic benefits

7.5.16.4 *Cumulative Impacts*

The Karpowership project is one of many projects planned, for the Port of Saldanha and the SBIDZ. Including it being one of a number of gas projects. Karpowership is well poised to contribute to- and help build the gas industry locally. Moreover, Karpowership will invest in the local community and industry through the implementation of a social and economic development plan. The cumulative socio-economic impacts through this mechanism, along with the multiplier effects further creates positive impact on the local economy.

The cumulative impacts of the Karpowership project on the biophysical environment and climate change have been presented above (with more detail available in each specialist impact report). Mitigation measures should be implemented to reduce the (low) negative impact on the small-scale fishers and tourism where necessary. Longer term positive impacts continuing beyond the 20-year contract duration of the project, particularly in relation to the gas industry, should be implemented together with the local municipality and other key stakeholders.

7.5.16.5 *Specialist Conclusion*

No fatal flaws have been identified as part of the supplementary socio-economic impact assessment.

Based on the findings of the socio-economic impact assessment done by Urban-econ (2021a) and supplemented by the Afro Development Planning assessment, the Karpowership project should be implemented.

7.5.17 **Tourism Impacts**

According to the IHS (2020) report, in Saldanha Bay Local Municipality, the Leisure / Holiday visitor segment recorded the highest average annual growth rate from 2009 (75 700) to 2019 (118 000) at 4.50%. The tourism segment that recorded the lowest growth was Other (Medical, Religious, etc) with an average annual growth rate of -6.04% from 2009 (9 840) to 2019 (5 280).

In Saldanha Bay Local Municipality the tourism spending as a percentage of GDP in 2019 was 24.6%. The Saldanha Local Municipality is part of the West Coast District Municipality. Tourism spending as a percentage of GDP for 2019 was 13.0% in West Coast District Municipality, 7.6% in Western Cape Province. Looking at South Africa as a whole, it can be seen that total tourism spending had a total percentage share of GDP of 5.6%.

Impact of Power outages (load-shedding) on Tourism in SA

Businesses in South Africa are already feeling the impact of the power outages (load shedding), especially on an operational level. Load shedding directly affects operators, clients and agents in the tourism industry (Du Toit, 2019, Goldberg, 2016). The power outages affect mobile network coverage and access to online booking systems which further hampers the ability to handle incoming online requests and queries for businesses (Du Toit, 2019, Goldberg, 2016).

According to South African Tourism (2022) report, it had been estimated in 2016 that SA's tourism industry contributed around 3% of GDP employing more than 720,000 people, representing at least 4,5% of the South African workforce.

When it comes to creating employment, the tourism sector has remained resilient despite tough economic conditions. Tourism generated almost 32,000 new net new jobs in 2017 (Stats SA, 2017). With the number of international tourists visiting South African shores increasing from 12,5 million in 2017 to 12,6 million in 2019 (Figure 1), the tourism sector looked set to remain an important driver of job growth.

However, this positive trajectory was tainted by the Covid-19 pandemic. According to the statistics presented in Figure 1 above on international arrivals, foreign arrivals dropped from 12.3 million in 2019 to less than 3 million in 2021.

The size of the economy is now at pre-pandemic levels, with GDP slightly higher than what it was before the Covid-19 pandemic. South Africa's gross domestic product (GDP) expanded by 1.9% in the first quarter of 2022, representing a second consecutive quarter of upward growth (Stats SA, Tourism 2022). However, after two consecutive quarters of positive growth, real GDP decreased by 0.7% in the second quarter of 2022. 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 increase in population in recent years has put a lot of pressure on Eskom as the principal supplier to provide electricity to the majority of South Africans. (Makgopa & Mpetsheni, 2022). The drivers contributing to the energy deficit may be due to factors such as significant loss of vital skills, poorly maintained infrastructure, corruption, vandalism and theft of Eskom equipment and deficient labour, resulting in load shedding that has been going on for years (Du Toit 2019, Botha, 2019; Lenferna, 2021). 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 South African economy could be 10% larger if Eskom worked properly according to Dawie Roodt (businesstech.co.za).

The impacts of load shedding on business in South Africa can already be felt, with a lot of businesses closing down, resulting in job losses (Mthimkhulu (2021, Baigrie et al. 2020). 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). As recently as 9 March 2022, the Mayor of Cape Town listed load shedding as one of the challenges hampering the recovery of the tourism industry from the debilitating impacts of the COVID-19 pandemic (Githahu, 2022).

Survey

A self-administered survey was conducted to determine the potential impact of the Karpowership SA initiative on Tourism Product Owners. 50% of the respondents indicated that they had heard of the Karpowership SA initiative and its objective. 41% of the respondents indicated a neutral view when asked if they thought the initiative would have negative consequences on tourism, which could be indicative of the lack of understanding of the objectives of the initiative.

With regard to the impact of load shedding on tourism, 38.9% of respondents indicated that there was a very huge impact of load shedding on tourism. 61% of the respondents indicated that they solely depend on Eskom power provision while the rest indicated the use of hybrid power supply which includes the use of solar-generated power, gas and generators. It can be assumed that the negative impact of load shedding is offsetting the growth of the tourism sector. More than 60% of the respondents indicated that growth was on a positive trajectory.

7.5.17.1 *Impact assessment (with mitigation):* ***<u>Construction and Operational Phases</u>***

Noise Impacts on Marine Wildlife and Tourism Activities

Saldanha Bay's location makes it an attractive destination for watersport enthusiasts. The port's local economy is strongly dependent on fishing, mussels, seafood processing, the steel industry and the harbour. Furthermore, its sheltered harbour plays an important part in the Sishen-Saldanha iron-ore project (connected by the Sishen-Saldanha Railway at which Saldanha Steel is of economic importance.

The offshore islands provide important nesting areas for several red-listed seabird species. The lagoon has a rich diversity of marine invertebrates and seaweeds and supports approximately 10% of the coastal wader population in South Africa. The Lagoon is registered as an important non-breeding site for hundreds of thousands of Palaearctic migrant waders during the austral summer (Summers *et al*. 1977). The SAS Saldanha Nature Reserve offers a display of wildflowers during late winter and spring while Southern Right Whales also visit the waters in and around the nature reserve.

Cape fur seal colonies historically occurred on the nearshore islands in Saldanha Bay, but no longer occupy this habitat. However, seals still forage in the area, often preying on the seabirds of the islands (Yssel, 2000). Seals were not frequent in the lagoon previously, and it is probably aided by the recent addition of the breeding colony on Vondeling Island. A variety of whale and dolphin species are found off the South African coast.

Several charters/boat trips are found in Saldanha Bay and offer extended adventures and deep-sea fishing trips. Other activities include mussel farming, watching seals, gannets, penguin, cormorants, and in-season whale and dolphin watching. Cruises include visits to amongst others, Dassen Island, Kraalbaai and Paternoster. However, there are no tourism activities of note inside the port itself by virtue of strict access control within a national key point area.

As described in the underwater noise assessment by Mason & Midforth (2022), the proposed Karpowership has noise mitigation built into the design of the ship, reducing any potential noise emission from the machinery on board. The High-frequency (HF) cetaceans (dolphins) are most likely to be present in the Port of Saldanha Bay, which are considerably less sensitive to the adverse effects of noise. However, for the noise to have a significant impact, the dolphins would need to remain extremely close to any of the sources to obtain a noise exposure sufficient to lead to Temporary Threshold Shift (TTS). Therefore, the application of any noise mitigation is not deemed to be appropriate according to the underwater noise assessment (Mason & Midforth, 2022).

Table 7-66: Potential negative noise impact in the Saldanha Bay Port on the marine tourism activities

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	

The significant impact on marine tourism is low to significant (Table 7-66). The noise levels produced by the ships associated with this Karpowership project are not substantially different to the noise levels produced by ships typically using the harbour and will not affect the wider bay or the species of marine mammals and fish in it (Mason & Midforth, 2022). No mitigation measures are required.

Visual and Noise Impact on Hospitality and Tourism Industry

A few protected areas such as the West Coast NP including the Marine Protected Area (MPA), the SAS Saldanha Nature reserve, the Elandsfontein Private Nature Reserve, and the Hopefield Private Reserve are found in the Saldanha Bay area. The key conservation areas of West Coast National Park are the Langebaan Lagoon and the offshore islands in Saldanha Bay, which together form the Langebaan Ramsar site, a wetland of international importance. The Lagoon is also registered as a wetland of international importance (Ramsar 1990) with about 32% of South Africa's saltmarshes. The West Coast National Park forms the core conservation area of the Cape West Coast Biosphere. West Coast National Park, with the islands in Saldanha Bay, has been identified by BirdLife International as an Important Bird Area (Source: Birdlife International).

Several lodges, beachside cottages and a few restaurants are also found in Saldanha Bay, built only metres from the water's edge offering a wide range of services and activities. In general, the visual impact will be insignificant as the Powerships are placed in an existing operational port and views of the harbour and ships are part of the port landscape. The public cannot see the vessels in the Saldanha Bay Port and therefore the sense of place will not be impacted. Tourists still visit the cities of Durban and Cape Town, for example, despite the visibility of heavy ship traffic destined for the harbours. Overall, the impacts will be insignificant.

Both the Osman Khan and the proposed Powerships to be installed at Saldanha Bay Port have built-in noise attenuation devices which limit the escape of both airborne and underwater noise from the ship.

Table 7-67: Potential negative visual and noise impacts on tourism at Saldanha Bay Port

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	

The visual and noise significance impact is low to insignificant (Table 7-67). According to the findings by Manson & Midforth (2022), no ship noise was audible on the far side of the breakwater, despite it being a busy harbour. Therefore, no significant noise is expected to pass through the breakwater. Other hospitality and tourism establishments such as national parks (i.e., West Coast NP) and hotels are located far from the port and there will be no negative visual and noise impacts. The consequence and significance of the visual impacts are therefore too small to have adverse impacts on the tourism and hospitality industry.

Electricity Provision on Hospitality and Tourism Industries

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 focused mainly on the possible impact of electricity provision by Karpowership at the Saldanha Bay Port on the hospitality and tourism sectors. The table below summarises the consequence and significant impacts.

Table 7-68: Potential positive impacts of Karpowerships electricity provision on the hospitality and tourism industry in the Saldanha Bay

Ranking	Without Mitigation	With Mitigation
Magnitude	Low (2)	Moderate (3)
Reversibility	Completely reversible (1)	Moderate (3) – Reversible with human intervention
Extent	Local (2)	Moderate (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** **= 13**
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	

The provision of power supply from the Karpowership will positively benefit the hospitality and restaurant establishments in the area (i.e. savings on fuel for generators) and a general increase in 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.

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. With the remarkable increase in tourism development 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. This type of tourism includes visits to the energy facilities and locations such as factories, mines, renewable energy sites and power stations such as in the Saldanha Bay port.

The majority of South Africans across the cultural divide have never seen a Powership and do not know how 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).

The table below reflects the positive effects that can be brought about by marketing the highly developed industrial (i.e., Port of Saldanha 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.

Table 7-69: Potential Positive Impacts on Energy and Industrial Tourism in the Saldanha 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**

The significant impact of Karpowerships on energy and industrial tourism is low to insignificant (Table 7-69) 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, though insignificant.

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 Western Cape Province.

Different charters providing marine activities mostly from Saldanha Bay will most probably include the Powerships as part of their discovery and exploratory sites. However, it is acknowledged that Transnet National Ports Authority (TNPA) will not change its existing policy of strict access into the port by allowing visitors to view the Powerships because of the breakwater and vessel traffic entering and leaving the port, although the limited view from the ocean side may still have positive spinoffs.

7.5.17.2 Cumulative Impacts

Cumulative impacts were not assessed.

7.5.17.3 Specialist Conclusion

For the Port of Saldanha Bay, the assessment results indicate the following conclusions against the elements that were assessed.

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 the 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 this 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.

7.5.18 **Traffic Impacts**

The construction stage of the project is expected to generate 103 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 30 trips onto the broader road network during the commuter peak hour. 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.

7.5.18.1 *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 so as not to impede the general flow of traffic at the port.
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
3. Trucks that need to access the R27 should utilise the TR8501 route as this route does not pass through sensitive residential areas and will therefore not have any traffic or social impact on neighbouring communities.

7.5.19 **Visual Impacts**

In order to indicate the visual scale of the moored boats, the following key viewpoints were selected:

- **Viewpoint 1 (VP1) - The beach at Saldanha Bay**. This area is important for local recreation, it is also backed by residential land use.
- **Viewpoint 2 (VP2) – The beach next to Mykonos**. The Mykonos development includes a marina, holiday accommodation, hotel, conference facilities and residential units. It is therefore an important tourism area. The view was taken from the public beach immediately adjacent to Mykonos. The view is therefore representative of views public and private areas.

- **Viewpoint 3 (VP3) – The beach at Langebaan**. This area is important for tourism, water sports and is a sought after settlement area. The Langebaan Lagoon and surrounding hillsides are also part of the West Coast National Park.

The alternative ship locations will have the following effects:

- **Alternative 1 ship locations** will result in the FSRU being located significantly closer (within approximately 4.2km of Mykonos) to the eastern side of the Bay.
- **Alternative 2 ship locations** will maintain the ships close to the existing jetty. The FSRU will be the ship closest to the eastern side of the Bay and will be approximately 4.3km from Mykonos.

The following list of possible impacts have been identified;

a) The proposed development could change the character and sense of place of the landscape setting;
b) The proposed development could change the character of the landscape as seen from Saldanha;
c) The proposed development could change the character of the landscape as seen from Mykonos;
d) The proposed development could change the character of the landscape as seen from Langebaan, Langebaan lagoon and the West Coast National Park; and
e) Lighting impacts.

It should be noted that the impacts identified will all gradually increase from the current situation to the impact level indicated during the construction phase, be consistent at the impact levels indicated during the operational phase and decrease again from the levels indicated to close to the current situation during the decommissioning phase.

7.5.19.1 *Impact assessment with mitigation:* ***Construction and Operational Phases***

7.4.20.1.1 The proposed development could change the character and sense of place of the landscape setting (Landscape Change)

Nature of impact: The proposed Powership and FSRU are large industrial ships that will be located within the Port. Whilst they will include industrial superstructure that is not typical of most shipping that visits the port. However, they are essentially ships within a busy Port. It was also noted that Port infrastructure includes large cranes and gantries that are taller than the stacks on the Powership and that with distance the taller superstructure is likely to become less obvious particularly as it merges with existing cranes and structures on the Iron Ore and Oil Jetty close to which it will be located. The proposed project is very much in keeping with this character. All proposed power line alternatives will run through an existing heavy industrial area and beside existing power line servitudes. They will not change the character of existing natural landscape or urban areas.		
	Without mitigation	**With mitigation**
Extent	**Power Ship & FSRU** Site and immediate surroundings, **(2)** **All Power lines** Site and immediate surroundings, **(2)**	**All Power lines** Site and immediate surroundings, **(2)**
Duration	Long term, **(4)**	Long term, **(4)**

Magnitude	**Power Ship & FSRU** Small, **(0)** **Preferred and Alternative 1 Power lines** Small, **(0)** **Alternative 2 Power Line** Minor, **(2)**	**Preferred and Alternative 1 Power lines** Small, **(0)** **Alternative 2 Power Line** Minor to small, **(1)**
Probability	**Power Ship & FSRU** Improbable, **(2)** **Preferred and Alternative 1 Power lines** Very Improbable, **(1)** **Alternative 2 Power Line** Probable, **(3)**	**Preferred and Alternative 1 Power lines** Very Improbable, **(1)** **Alternative 2 Power Line** Probable, **(3)**
Significance	**Power Ship & FSRU** Low, **(12)** **Preferred and Alternative 1 Power lines** Low, **(6)** **Alternative 2 Power Line** Low, **(24)**	**Preferred and Alternative 1 Power lines** Low, **(6)** **Alternative 2 Power Line** Low, **(21)**
Status	Probably the majority of people would expect to see ships in the port and wouldn't necessarily differentiate between types of ship. However some are likely to see the Powership in a negative light. Proposed power lines will be also be viewed in the context of other major industry. **Neutral - Negative**	**Neutral - Negative**
Reversibility	High	High
Irreplaceable loss	The proposed project will be removed from site on completion of contract period There will therefore be **no irreplaceable loss**.	**No irreplaceable loss**.
Can impacts be mitigated?	**Yes** but only power lines	**NA**
Mitigation / Management: Proposed Power Lines 1. Minimising disturbance during construction 2. Undertaking landscape rehabilitation of disturbed areas following construction; and		

3. Removing all infrastructure on decommissioning.
Cumulative Impacts: The proposed project will be located within a port that has major industry. The proposed project will not extend the industrialisation of the area. The cumulative contribution to the overall impact of industry within the area is therefore anticipated to be low.
Residual Impacts: No residual risk has been identified.

7.4.20.1.2 The proposed development could change the character of the landscape as seen from the Saldanha urban area and beach.

Nature of impact:

Ship location alternative 1

The proposed Powership will be located on the eastern side of the Iron Ore and Oil Jetty and so will be visible from Saldanha and from the beach. It will be located approximately 3.5km from Viewpoint 1 and approximately 1.26km from the northern end of the beach to the north of the built up area of Saldanha. The ship will be visible and is likely to be obvious particularly from the northern end of the beach to which it will be closest.

The FSRU will be located approximately 6.2km from Viewpoint 1 and on the eastern and opposite side of the Iron Ore and Oil Jetty from Saldanha. At this distance and with partial screening provided by the jetty, the ship is unlikely to be highly obvious.

Ship location alternative 2

The proposed Powership will be located on the western side of the Iron Ore and Oil Jetty and so will be largely screened from Saldanha and from the beach. It will be located approximately 4.3km from Viewpoint 1 and approximately 1.9km from the northern end of the beach to the north of the built up area of Saldanha. The ship will be visible is likely to be largely screened by the jetty.

The FSRU will be located approximately 6.2km from Viewpoint 1 and on the eastern and opposite side of the Iron Ore and Oil Jetty from Saldanha. At this distance and with screening provided by the jetty, the ship is unlikely to be highly obvious.

All power line alternatives are unlikely to be visible.

	Without mitigation	**With mitigation**
Extent	**Ships - Alternative 1 & 2** Site and immediate surroundings, **(2)** **All Power lines** Site and immediate surroundings, **(2)**	NA
Duration	Long term, **(4)**	NA
Magnitude	**Ships - Alternative 1** Low, **(4)** **Ships - Alternative 2** Minor, **(2)** **All Power lines**	NA

	Small, **(0)**	
Probability	**Ships - Alternative 1** Highly probable, **(4)** **Ships - Alternative 2** Improbable, **(2)** **All Power lines** Very improbable, **(1)**	NA
Significance	**Ships - Alternative 1** Medium, **(40)** **Ships - Alternative 2** Small, **(16)** **All Power lines** Low, **(6)**	NA
Status	Probably the majority of people would expect to see ships in the port and wouldn't necessarily differentiate between types of ship. **Ships - Alternative 1** However the proximity to be beach of the Powership associated with **Alternative 1 is likely to be seen as a negative impact by beach goers**. **Ships - Alternative 2** Screening provided by the jetty, the impact of the jetty itself and the additional distance are all likely to result the Powership associated with alternative 2 **not bring considered as a negative impact by the majority of beach goers.** **All Power lines** Power line alternatives are highly unlikely to be considered as having a negative impact	NA
Reversibility	High	NA
Irreplaceable loss	The proposed project will be removed from site on completion of contract period	NA

	There will therefore be **no irreplaceable loss**.	
Can impacts be mitigated?	**No**	NA
Mitigation / Management: NA		
Cumulative Impacts: **Ships - Alternative 1** Whilst it won't change the highly industrialised backdrop which includes the Iron Ore and Oil Jetty and any bulk carriers moored alongside, the Powership location associated with this alternative will move another relatively large industrial influence slightly closer to Saldanha and particularly the beach. **This is assessed as likely to add a cumulative influence of medium significance to a currently high cumulative industrial impact.** **Ships - Alternative 2** **This alternative with the Powership located to the east of the** Iron Ore and Oil Jetty takes the additional industrial influence away from Saldanha. The jetty and any ships alongside provide a level of screening meaning that only superstructure is likely to be visible to much of the beach area. This will be seen in the context of other tall infrastructure on the jetty. **This is assessed as likely to add a cumulative influence of low significance to a currently high cumulative industrial impact.** **Power Lines** Because they are unlikely to be visually obvious, the proposed power line alternatives are unlikely to have a significant cumulative influence.		
Residual Impacts: No residual risk has been identified.		

7.4.20.1.3 The proposed development could change the character of the landscape as seen from Mykonos.

Nature of impact: The proposed alternative 1 Powership will be located approximately 6.9 km to the north-west and will be partly screened by the Iron Ore and Oil Jetty. The proposed alternative 2 Powership will be located approximately 6km to the north-west and will be in front of the Iron Ore and Oil Jetty so will be in full view. The proposed FSRU will be located approximately 4.1km to the north-west. At the distances involved, detail on the Powership is unlikely to be highly obvious and visually Alternative 2 is likely to blend with the jetty. Alternative 1 is unlikely to be discernible to the human eye. Superstructure is likely to blend with the landform which provides a backdrop and so will not be as obvious as if it were viewed against a clear sky. The FSRU is likely to be relatively obvious. Its impact could be exacerbated if either the Vortum or the Auriga CCGT plant is operational at the same time in which case the more frequent sight of gas ships at this location in the port may occur.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings, **(2)**	NA

Duration	Long term, **(4)**	NA
Magnitude	**Power Ships Alternatives 1 & 2** Minor, **(2)** **FSRU** Minor, **(2)** **All Power lines** Small, **(0)**	NA
Probability	**Power Ships Alternative 1** Very Improbable, **(1)** **Power Ships Alternative 2** Improbable, **(2)** **FSRU** Probable, **(3)** **All Power lines** Very Improbable, **(1)**	NA
Significance	**Power Ship Alternative 1** Low, **(8)** **Power Ship Alternative 2** Low, **(16)** **FSRU** Low, **(24)** **All Power lines** Low, **(6)**	NA
Status	Probably the majority of people would expect to see ships in the port and wouldn't necessarily differentiate between types of ship. **Neutral - Negative**	NA
Reversibility	High	NA
Irreplaceable loss	The proposed project will be removed from site on completion of contract period There will therefore be **no irreplaceable loss**.	NA

Can impacts be mitigated?	**No**	NA
Mitigation / Management: NA		
Cumulative Impacts: The proposed project will be located within a busy industrial port. The proposed project will not extend the industrialisation of the area. The cumulative contribution to the overall impact of industry within the area is therefore anticipated to be low with or without the proposed Vortum or the Auriga CCGT projects that will see additional gas delivery ships moored in the port.		
Residual Impacts: No Residual Impacts.		

7.4.20.1.4 The proposed development could change the character of the landscape as seen from Langebaan, Langebaan lagoon and the West Coast National Park.

Nature of impact: The FSRU storage ship will be located significantly closer to Langebaan (5.3km) than both of the Powership alternatives. Currently shipping on the Iron Ore and Oil Jetty is approximately 5.5km from Mykonos. The proposed location for the FSRU is approximately 4.3 km from Mykonos. This distance is considered a reasonable visual buffer that should ensure that the landscape / seascape as viewed from these areas will not be significantly influenced by the industrial nature of the ship. Alternative 2 will see the Powership approximately 8.2km from the viewpoint. Alternative 1 will see the ship at a distance of approximately 9.2km. The likely visual impact experienced from this viewpoint is therefore expected to have an impact similar to the current situation. From this viewpoint Alternative 1 is preferred as the Powership will be screened by the Iron Ore and Oil Jetty as well as bulk carriers at the jetty. However even though Alternative 2 will see the Powership in Big Bay without any screening elements, because of the distance, the busy industrial background as well as the landform behind the ship, whilst the FSRU will be visible the Powership is unlikely to be visually obvious and is unlikely to be discernible from the background under most weather conditions. There will be no irreplaceable loss and the impact will be reversible on removal of the ships.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings, **(2)**	NA
Duration	Long term, **(4)**	NA
Magnitude	**Alternatives 1 & 2** Small to Minor, **(1)** **Power lines** Small, **(0)**	NA
Probability	**Alternatives 1 & 2** Improbable, **(2)** **Power lines** Very improbable, **(1)**	NA

Significance	**Alternatives 1 & 2** Low, **(14)** **Power lines** Low, **(6)**	NA
Status	Probably the majority of people would expect to see ships in the port and wouldn't necessarily differentiate between types of ship. However some are likely to see the Powership in a negative light. **Neutral - Negative**	NA
Reversibility	High	NA
Irreplaceable loss	The proposed project will be removed from site on completion of contract period There will therefore be **no irreplaceable loss**.	NA
Can impacts be mitigated?	**No**	NA
Mitigation / Management: N/A		
Cumulative Impacts: The proposed project will be located within a busy industrial port. The proposed project will not extend the industrialisation of the area. The cumulative contribution to the overall impact of industry within the area is therefore anticipated to be low.		
Residual Impacts: No residual impacts.		

7.4.20.1.5 The potential visual impact of operational, safety and security lighting of the facility at night on observers.

Nature of impact: The ships will be operational at night and so will be lit at deck level to enable this. The lighting of shipping at deck level is normal practice while in port. The port area is also brightly lit at night to enable ongoing operations and port security. There will be no lighting associated with the alternative power lines.		
	Without mitigation	**With mitigation**
Extent	Region **(3)**	Region **(3)**
Duration	Long term, **(4)**	Medium term, **(3)**
Magnitude	Minor **(2)**	Minor **(2)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Low **(27)**	Low **(24)**

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Status</td><td>Probably the majority of people would expect to see ships in the port and wouldn’t necessarily differentiate between types of ship. However some are likely to see the Powership in a negative light.
Proposed power lines will be also be viewed in the context of other industry.
Neutral - Negative</td><td>Neutral - Negative</td></tr>
<tr><td>Irreplaceable loss</td><td>The proposed project will be removed from site on completion of contract period
There will therefore be no irreplaceable loss.</td><td>No irreplaceable loss</td></tr>
<tr><td>Reversibility</td><td>High</td><td>High</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Yes</td><td>Unlikely</td></tr>
<tr><td colspan="3">Mitigation / Management:
N/A</td></tr>
<tr><td colspan="3">Cumulative Impacts:
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 is therefore anticipated to be low.</td></tr>
<tr><td colspan="3">Residual Impacts:
No residual risk has been identified.</td></tr>
</table>

For the landscape change / sense of place, the proposed ships and power line alternatives were assessed as likely to have a landscape impact of low significance.

With regard to the change in character of the landscape as seen from the Saldanha urban area and beach, the impact of Ship Locations Alternative 1 was assessed as likely to have an impact of medium significance, while the impact of Ship Locations Alternative 2 was assessed as likely to have an impact of low significance. This is therefore the preferred alternative from this location. The impact of power line alternatives were assessed as likely to have an impact of low significance. However, because Alternative 2 will impact a new landscape area, this impact was assessed as being slightly higher than the Preferred and Alternative 1 alignments. For this reason Alternative 2 is not favoured.

With regard to the change the character of the landscape as seen from Mykonos, the impact of Powership Locations Alternatives 1 and 2 were assessed as likely to have an impacts of low significance. Alternative 1 is therefore preferred from this viewpoint. The impact of the FSRU location was assessed as likely to have an impact of low significance. The impact of power line alternatives was assessed as likely to have an impact of low significance.

For the change in character of the landscape as seen from Langebaan, the impact of Powership Locations Alternatives 1 and 2 were assessed as likely to have an impacts of low significance. The impact of the FSRU location was also assessed as likely to have an impact of low significance. The impact of power line alternatives was assessed as likely to have an impact of low significance.

For lighting Impacts, potential security and operational lighting was assessed as likely to have an impact of low significance.

7.5.19.2 *Cumulative Impacts*

The proposed project will be located within a busy industrial port. For most people, the proposed ships from most viewpoints will appear as part of normal port operations. The proposed power line alternatives will also have minimal impact. Therefore, from the majority of the area the proposed project is unlikely to extend the visual influence of industry significantly. The project will therefore generally have a small contribution to an existing high levels of industrialisation. The exception to this is the impact from Saldanha and Saldanha Beach. Because the proposed Powership is closer to these receptors than the existing Iron Ore and Oil Jetty it will move a major industrial element closer. This cumulative contribution was assessed as likely to have a medium significance.

7.5.19.3 *Mitigation Measures*

No mitigation measures are deemed required for the Powership as the low impact is congruent with the proposed and anticipated character of the area. Mitigation of the landscape impact of the proposed power line alignments is possible through:

1. Minimising disturbance during construction
2. Undertaking landscape rehabilitation of disturbed areas following construction; and
3. Removing all infrastructure on decommissioning

7.5.19.4 *Specialist Conclusion*

From a landscape and visual impact perspective:

- Due to it resulting in a slightly lower visual impact on Saldanha, Ship location Alternative 2 is favoured;

- Due to the resulting lower landscape impact, the Preferred and Alternative 1 Power Line Alignments are favoured over Power Line Alignment 2.

However, should there be other valid environmental reasons, the likely difference in levels of landscape and visual impact is not sufficient to prevent the unfavoured alternatives being authorised.

Therefore, from a landscape and visual impact perspective the proposed project should be authorised.

7.5.20 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 166m around the hose connections;
- The 1.0e-5 (one in a hundred thousand) orange contour, is confined to the two ships and 237m around the hose connections;
- The 1.0e-6 (one-in-a-million) yellow contour, stretches for a maximum distance of 305m 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 330m from the generator barge hose connection.

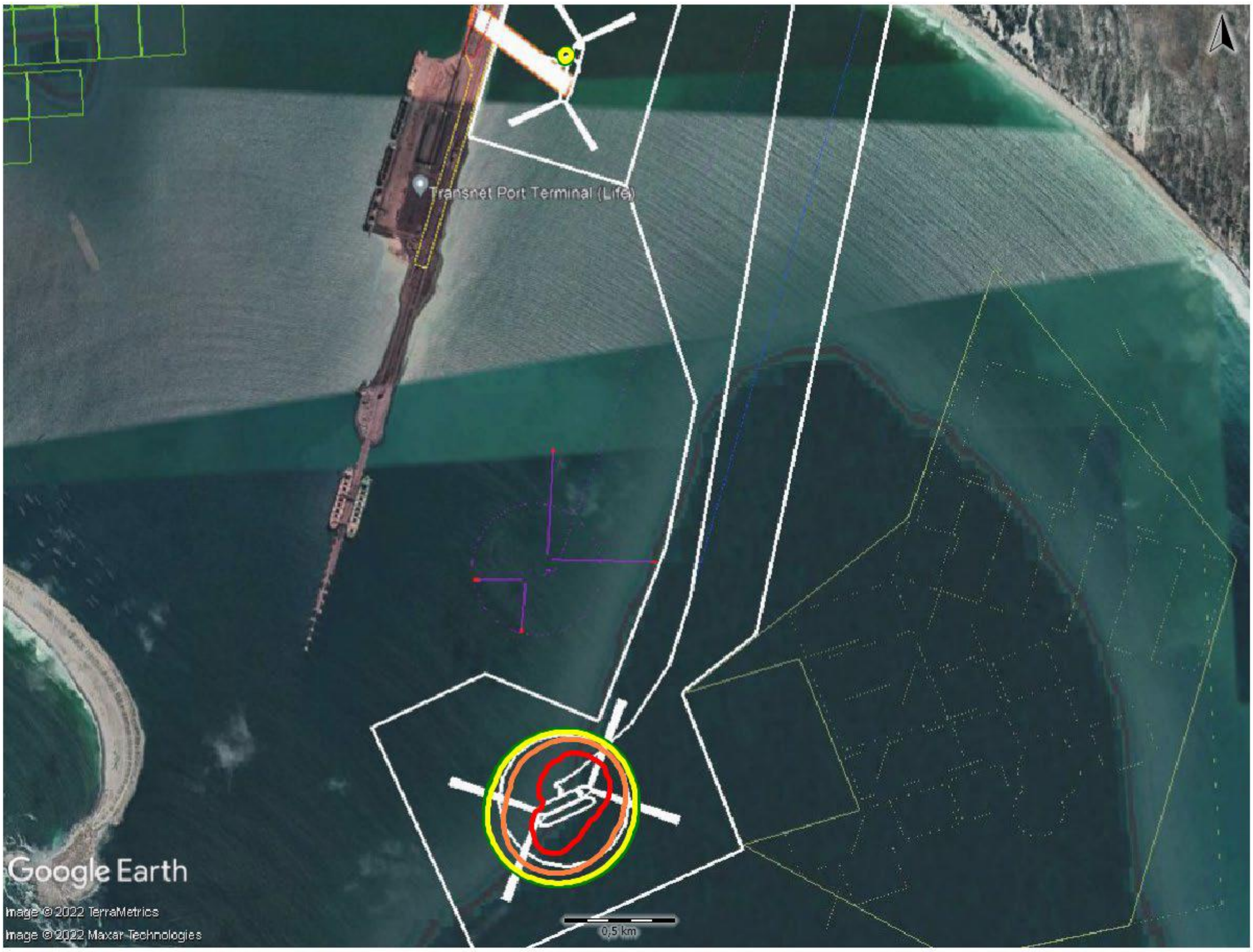


Figure 7-13: Individual Risk

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 General Maintenance Quay	No risks
Risks at Multi-Purpose Quay	No risks
Risks at Liquid Bulk Berth	No risks
Risks at the MBM	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'.

7.5.20.1 *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.

7.5.20.2 *Specialist Conclusion*

This Assessment established that an incident involving the Gas to Power Project at the Port of Saldanha 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.

7.5.20.3 *Minor Safety Incident – Indonesia 2018*

Karpowership has carried out numerous risk studies on their Powerships, including QRA, FERA and Gas Dispersion assessments, HAZID/HAZOP Review, Collision Risk Assessment, amongst others. Due to the company's stringent risk management philosophy, comprised of a number of mitigation procedures and policies, all risks are also covered under their comprehensive insurance policies. They 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 <u>pressurized steam</u> 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 <u>release of pressurised steam</u> and damage to the boiler drum. There were <u>no casualties or injuries</u> 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, <u>the incident was not a gas, fuel, oil or otherwise flammable material explosion</u>, but a pressurized steam release from a boiler drum.

7.5.21 **Marine Traffic Impacts**

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 Saldanha Bay. In the identification of the preferred site in the Port of Saldanha Bay, the sites of existing cargo facilities and the future short term developments were avoided.

The existing and anticipated vessel traffic in the Port of Saldanha in 2020 is 568 vessels with approximately 63% of these vessels being export iron ore vessels. The current demand for iron ore export is 60.5 million tonnes per annum (Mtpa) and has the potential to grow to approximately 90 Mtpa by 2051. Subsequent to operationalisation of Berth 104, the liquid bulk terminal is forecast to increase handling of total liquid bulk products (including LPG at the MBM) from approximately 4.5 Mtpa in 2021 to approximately 8 Mtpa in 2051.

The number of additional vessels contributable to the Powership operations is 10 vessels per annum, 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 Saldanha Bay.

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 congestion within the port. The Port of Saldanha is forecasted to have approximately 82% and 69% spare slot capacity in 2021 and 2051 respectively.

7.6 DECOMMISSIONING PHASE IMPACTS

Karpowership has prepared this decommissioning report to outline the methods and means to decommission the Saldanha 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.

<u>Legal Context</u>

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:

<u>Switching station</u>

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

<u>Transmission lines</u>

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 ASSESSMENT OF THE NO-GO ALTERNATIVE

The key positive impacts of not implementing the project relate to the environmental elements.

For avifauna, more especially the pair of Black Harriers, cormorants and flamingos that were identified as being impacted by the implementation of this project (Simmons, 2022). The currently proposed routing for the LNG pipeline from the FSRU to the Powership runs through a beach where 3000+ endangered Cape Cormorants were recorded roosting, as well as the nest site of endangered Black Harriers further west. The Flamingo wetland identified approximately 266m east of the Preferred transmission line route. The proposed powerlines could cause collision fatalities for birds, with 0.33 fatalities observed every 1 km along the existing lines. As such there are three alternative powerlines proposed, which could result in 2.4 fatalities along the Preferred route, 2.3 fatalities along Alternative 1 and 2.8 fatalities along Alternative 2 (Simmons, 2022). Not implementing the project will reduce the disturbance and collision risks to these avifaunal species. However, one must also bear in mind that Saldanha Bay is an active port with existing disturbances and infrastructure such as transmission lines.

Marine ecology will not be directly impacted on from the operation of the Powership. The operation of the Powership involves the continuous abstraction of seawater for cooling of the reciprocating engines, condensers and other auxiliaries. The cooling water is then discharged into the sea at a depth of 8 m, as recommended in the modelling report (PRDW 2022). Seawater abstracted by the Powerships will entrain small marine organisms such as holoplankton, meroplankton and ichthyoplankton from the surrounding water body condenser cooling systems. This will be coupled with the impingement or trapping of larger organisms against the screens used to prevent debris from being drawn into the cooling water intake. The impact's spatial scale will be site-specific but with potentially harmful impacts to marine ecology due to the volume and speed of intake. However, natural functions are not anticipated to be altered. The impacts are expected to last for the duration of the FPP operation, for the lifetime of the project. Also important to note is that the ecological effect will be temporary as plankton biomass recovers quickly due to short generation times. Furthermore, the impact will be reversed once the project infrastructure is removed. Although some deleterious effects are expected, there will be little impact on natural processes in the context of site-specific scale and no irreplaceable loss of marine fauna and flora is expected. The assigned overall environmental significance rating is Medium pre-mitigation and Medium-Low post mitigation.

Marine ecology will also not be impacted on by underwater noise. Underwater noise will be generated primarily by the Powership operations. The noise generated by the Powership operations is expected to be semi-continuous, up to 16.5 hours a day. With the Powership operating at a maximum output in excess of that proposed for the port, an increase in background noise of approximately 9 dB in close proximity to the Powership (approximately 400 m from the ship) would be observed. This is equivalent to a noise level of 127.6 dB SPL_{RMS} re 1 µPa. The noise produced by the Powership operations is not anticipated to contribute meaningfully to the existing noise levels in the Port of Saldanha. Furthermore, when considering an “above worst-case” scenario, the Powership does 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 Powership will be continuous. It is possible that marine organisms within hundreds of metres of the Powership 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 tens of metres of the Powership for 24 hours in order to experience the onset of Temporary Threshold Shift (where a temporary reduction in hearing sensitivity may occur). Considering these factors, the severity of the noise produced by the FPP is considered to be “small or potentially harmful” to marine receptors. The duration of the effect will be beyond 10 years as noise will be produced by the vessel for the duration of its operation. Noise produced by the FPP 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. No irreplaceable loss of marine fauna or flora is expected. Accordingly, the assigned overall environmental significance rating is Medium-High without mitigation and with mitigation is reduced to Medium.

In contrast, the negative impacts are related to the socio-economic landsape, from local to national level.

The Powership will be moored in Big Bay in the Port of Saldanha, adjacent to the Iron Ore jetty. The Port of Saldanha Bay is an important industrial zone and economic hub for the country. It is the largest and deepest natural anchorage port in the Southern Hemisphere. It provides crucial economic activities, and although it mainly handles iron ore exports, it is also home to the South African Naval Station of SAS Saldanha, the NSRI rescue station and fishing harbour. It is a unique port offering a rail link connected to a jetty bulk loading facility for the shipment of iron ore from mines in Sishen in the Northern Cape, and steel manufactured at the Saldanha Steel Mill. There are also plans to develop the port further, including the development of ship and oil rig repair facilities to service the local industry.

Climate change over the next 30 years will have several significant and far-reaching consequences. Based on the climate change modelling done by Promethium Carbon (2022), heat and water security related stresses will cause numerous direct and indirect effects in ecosystem services, food scarcity, illnesses, diseases, increased social tensions, and increased reliance on cooling systems, furthering greenhouse gas emissions (Steenkamp, 2022). The emissions over the 20-year lifetime of the Karpowership SA project are comparable to 2 years of running a new coal fired power station which reiterated the reasoning that natural gas can be used as a transitional technology to move away from reliance on coal. Avoided emissions are those that are emitted if the project is not implemented. The total avoided emissions from the Karpowership SA project between 2023 and 2030 is approximately 12 million tCO_2e.

It is also important to note that the Karpowership SA project's role in assisting the transition to a low carbon future is not limited to the reduction of GHG and particular emissions when compared to coal, but also its ability to support renewable energy plants coming online by making up for their intermittent energy generation. In the future, renewable energy plants paired with battery storage will preclude the need for fossil fuel-based generation, however this will only become a reality in the future when battery storage technology and manufacturing capacity has improved (Promethium Carbon, 2022b). By providing load following and dispatchable electricity which renewable energy cannot provide, the project will enable more renewable energy projects to come online than otherwise would have been be possible, providing the energy stabilisation needed until sufficient battery technology can be deployed (Promethium Carbon, 2022b). This will result in additional emissions saving, as it will allow a further reduction in demand for coal fired electricity as more renewable energy comes online (Promethium Carbon, 2022b). It is important to note that coal cannot fill the same role as LNG in supporting renewable energy because coal fired plants do not provide dispatchable energy. Coal fired plants have to run for extended periods of time with limited shutdown periods to remain efficient and operational, usually only implemented when maintenance is required. Gas-to-power plants by comparison are able to turn on and off at will, providing electricity as dispatch demands fluctuate, and only experiencing efficiency losses between cold and hot starts.

These avoidances in GHG emissions enabled by the project due to a direct avoidance of coal emissions, and an indirect reduction through the support of renewable energy means that the project will ultimately provide more GHG emissions avoidance than the total amount of GHG emissions it will produce over its lifetime, even when accounting for the worst-case scenario (Promethium Carbon, 2022b).

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.

Karpowership SA had developed and intends to implement an Economic Development Plan which is aimed at contributing to the local development in various ways. Local skills development will be further enhanced through a Skills Development Programme which will be implemented during the operational phase of the project, with an allocated budget of R27.7 million over the 20 years, or approximately R1.4 million per annum (Karpowership SA, 2022). The intention is for positions which are initially filled by foreign personal to be filled by South Africans who are trained through the skills development programme. School leavers and graduates will be supported through bursaries, and internships. Karpowership internal staff, and community members will be provided with learnership or apprenticeship opportunities, and informal and work-integrated learning. This will provide benefits outlined in the development of locally relevant skills and continue to develop the skills base in a manner which is relevant to the local industrial development plans, and increase the level of localisation of the project.

A dedicated Supplier Development Programme is also planned by Karpowership SA, with R1 million allocated for the construction period, and R910 000 million per annum for the 20 years of operations (Karpowership SA, 2022). This will involve the provision of seed or development capital, loans and credit facilities organised through partner financing companies, and assistance with training and mentoring (Karpowership SA, 2022). The development of a local supplier value chain which is centred around the maritime sector, and provision of Chandler Services will further increase the development of the SBIDZ, as it will increase local skills base, and production capacity which is geared towards industry relevant services and products. This will increase the likelihood of other vessels and international maritime companies planning maintenance, and restocking at the Saldanha Bay Port, rather than other locations, increasing local investment, and consumption spending.

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

Table 7-70: Local and National considerations for the no-go option

Considerations For the No-Go:	Considerations Against the No-Go
• Medium-Low impacts to loss of Strandveld, fauna, flora and biodiversity in general. • Medium-High impact of mortality around any new power line for the Red-listed bird groups. • Medium impact of major disturbance to the harrier breeding habitat and the roosting habitat of the Cape Cormorants by the presence of the Stringing yard. • Medium impacts of the effects of the discharge of cooling water and the effects of noise on the marine ecology. • Low risks from ship-to ship transfer of LNG and NG will be avoided. • Low visual impacts (due to shipping being aligned with the Port operations) will not occur. • Climate change impacts originating from the generation of gas to power as per the proposed project will not occur. • High socio-economic impacts from influx of people looking for work opportunities may not occur.	• The Karpowership fleet can be deployed immediately, and 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 baseload, mid-merit and peaking power and because Karpowership provides dispatchable power, it can respond in minutes when the energy supply is under strain. • Because Karpowership is a floating power, 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 the Karpowership will also contribute to skills and capacity development which will benefit local individuals 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).

Considerations For the No-Go:	Considerations Against the No-Go
	• The 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. • 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 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.

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 320MW Gas to Power Powership Project, should be authorised subject to the conditions proposed in Section 9, which include compliance with the EMPr. 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 <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.

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 7-71 is relevant to understanding the site.

Table 7-71: 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.

Organising principles of Complex Adaptive Systems (CAS)		Conceptual implications for social-ecological systems (SES)
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. • 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.	• 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.
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.	• SES are context sensitive.

Organising principles of Complex Adaptive Systems (CAS)		**Conceptual implications for social-ecological systems (SES)**
	• 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 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 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.	• Cause-and-effect cannot be traced in linear causal trajectories • Emergent phenomena arise from multiple recursive patterns and unintended outcomes.

Given the CAS organising principles as described in Table 7-71, 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 synthesise 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 Karpowership Project. 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 (**Error! Reference source not found.**). 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.

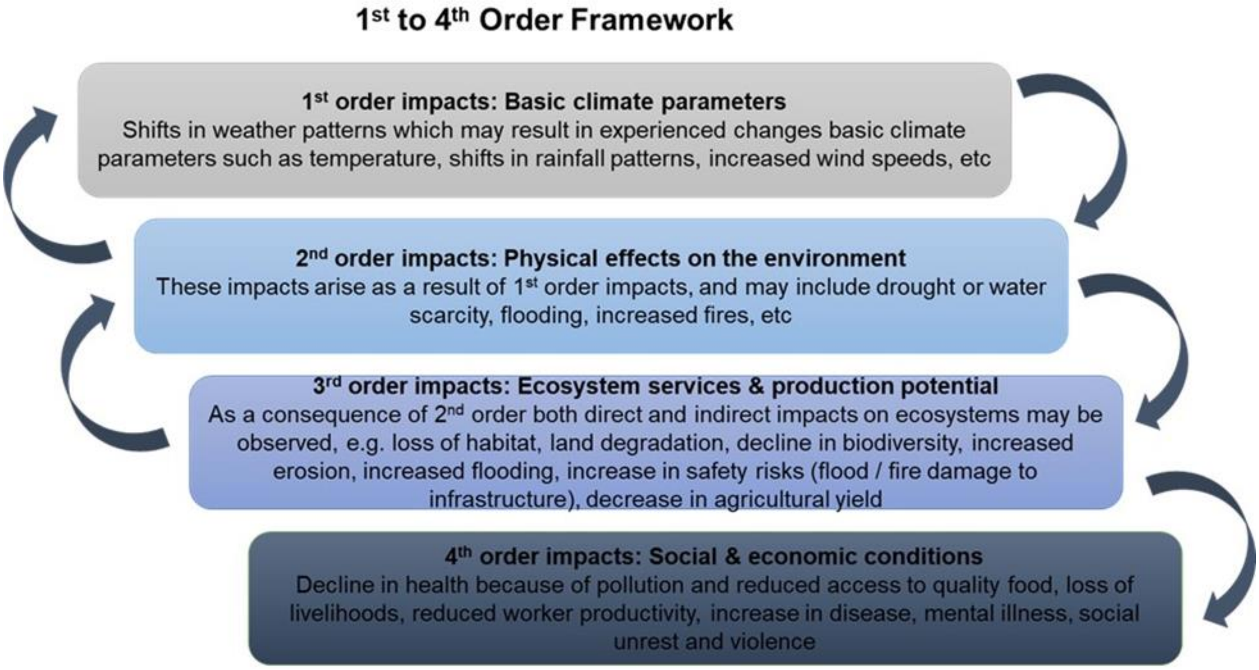


Figure 7-14: Description of the 1st to 4th order framework

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.

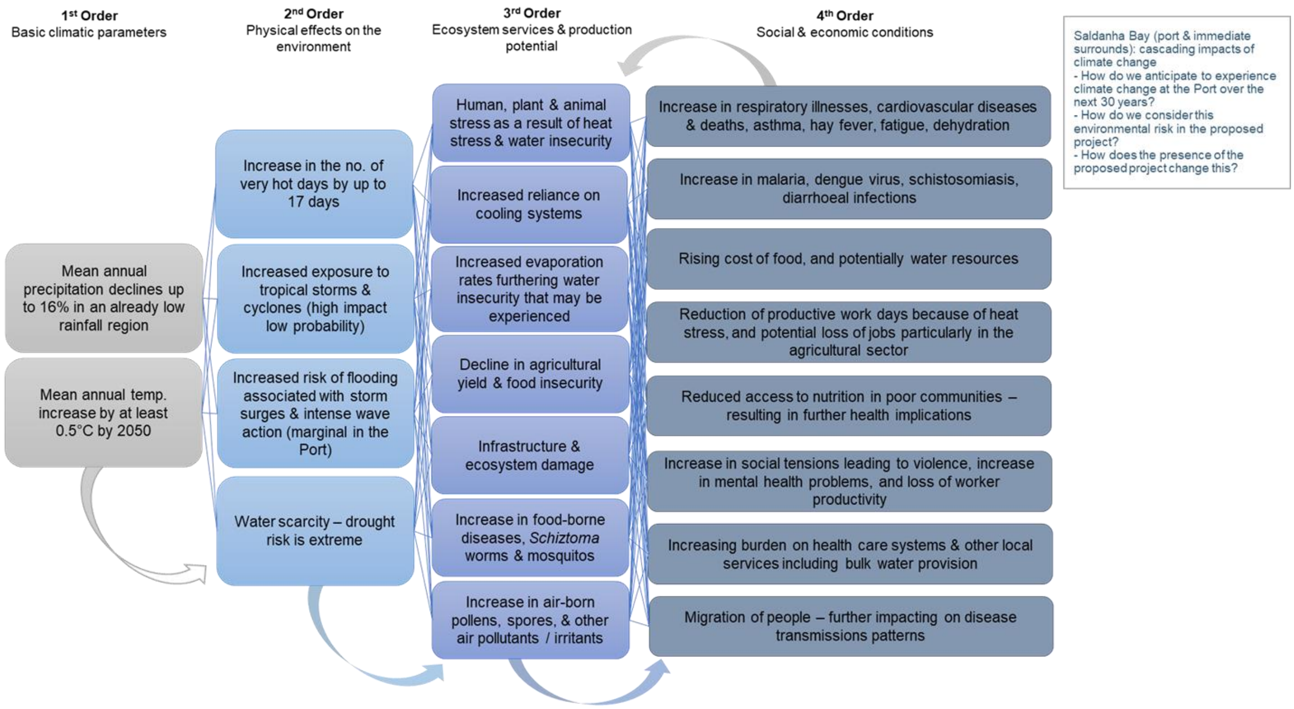


Figure 7-15: Anticipated cascading direct and indirect impacts of climate change

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 Saldanha 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 Saldanha over the next 30 years, based on climate change modelling (Promethium Carbon, 2022):

- Mean annual temperature is expected to increase by up to 0.5° C over the next 30 years whilst very hot days is likely to increase by up to 17 days per year.
- Mean annual precipitation is likely to continue a declining trend with up to a 16% decrease in an already relatively low rainfall area. The expected change in extreme rainfall days is negligible.
- By 2050, drought risk is classified as extreme relative to the baseline, whilst coastal flooding and fire risks are classified as medium.
- With regards to storm surges and wave height, there is evidence to suggest a change in wave height due to strengthening of the Benguela current. However, detailed information is lacking. Given the low-lying topography of the bay surrounds and proliferation of development nearshore, there is a high risk of coastal flooding if storm activity increases in combination with higher sea level.

- 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. It is also not clear how this will be experienced in the Port, considering that the Port is a sheltered environment.
- Sea level has increased by ±6.4 cm since the late 1970s and is likely to rise by 9-43 cm by the middle of the 21st century. 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 ±0.79°C since 1900 and is currently around 17.4°C. This could increase to up to 18.4°C by 2030 and 25.3°C by 2050. This should not impact the project materially but could have impacts on marine biota which should be assessed by the relevant specialist/s. The further warming of temperatures in the Bay may pose a risk to important sectors in the region such as aquaculture and fisheries.

Based on the above-mentioned points, a 1st to 4th Order Framework was prepared for Saldanha 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, as shown in Figure 7-15.

Water scarcity and drought are anticipated to be an extreme risk as a consequence of reduced rainfall, and the increased number of very hot days by as much as 17 days. This is in a region which already receives low rainfall. This is a risk to the municipality, local industry and local residents that will need to be managed with foresight and careful planning.

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 – again, 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 considered to be 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 (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;
- Black Harrier double fence for preventing human access and disturbance and for screening off stringing yard operations – to be built outside of the harrier breeding season;
- Black Harrier nest monitoring for activity and breeding success in all years in which construction takes place (July – December)
- Reduce or eliminate collisions of avifauna with the transmission lines
- Water for construction is compliant with the requirements of the National Water Act (Act No. 36 of 1998);
- Impacts related to storm and waste water are avoided, prevented and managed;
- Impact to watercourses and estuaries are managed in adherence to legislation and specialist recommendations;
- Impacts to marine environment are managed in adherence to legislation and specialist recommendations;
- Reduce catchment modifications;
- Prevent deterioration of water quality;
- Vegetation clearance and associated impacts are minimised and managed;
- All precautions are taken to minimise the risk of injury, harm or complaints;
- No pollution or disease arises in terms of poorly maintained ablution / sanitation facilities or lack thereof;
- All necessary precautions linked to the spread of disease are taken;
- Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies;
- Safe storage, handling, use and disposal of hazardous substances;
- Spillages and contamination of soil, surface water and groundwater are avoided, minimised and managed;
- Dust prevention measures are applied to minimise the generation of dust;

- Noise management is undertaken in accordance with SANS 10103 and the Occupational Health and Safety Act (Act No. 85 of 1993).
- Noise abatement measures to minimise noise disturbance;
- Fire prevention measures are carried out in accordance with the relevant legislation.
- Erosion and sedimentation as a result of stockpiling are reduced.
- Minimise the risk of environmental impact during periods of site closure;
- Post-construction and rehabilitation activities are undertaken in accordance with EMPR requirements as well as Rehabilitation Plans;
- Socio-economic development is enhanced and job creation and economics in the area are improved;
- Effective awareness and training for all construction staff to minimise environmental impacts;
- Ensuring social and ecological well-being of the site and community;
- Impact on No-Go areas are avoided through effective demarcation and management of these areas;
- Impacts resulting from earthworks are managed and guided by specifications;
- Construction materials are sourced from authorised sites;
- Potential impacts to the environment caused by waste (general and hazardous) are avoided or managed;
- All onsite staff are aware and understands the individual responsibilities in terms of this EMPr.
- Stormwater related impacts are avoided, minimised and managed;
- Dust, emissions and odour impacts are minimised and managed;
- Impact to heritage and palaeontological resources are managed in terms of the National Heritage Act.
- Compliance with all environmental legislative requirements during the operational phase of the project is implemented and managed; and
- Environmental impacts during the Operation and Maintenance Phase are managed in terms of Operational Maintenance Management Plan requirements.

8 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 Saldanha), 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 Saldanha 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.

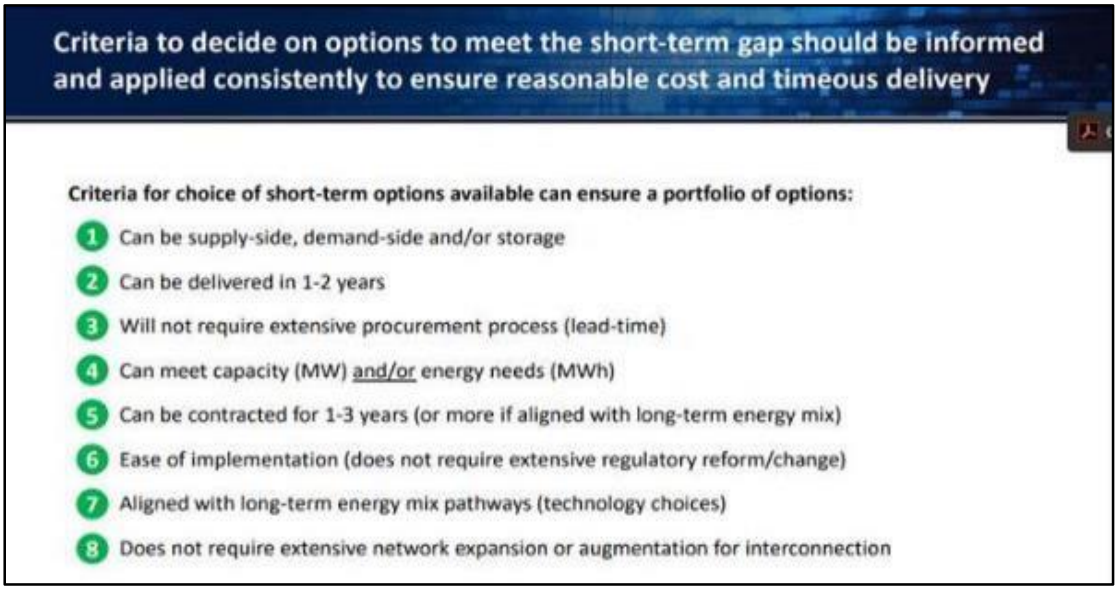


Figure 8-2: Extract from the CSIR Report (Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020).

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 IPP Procurement Programme

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

The 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).

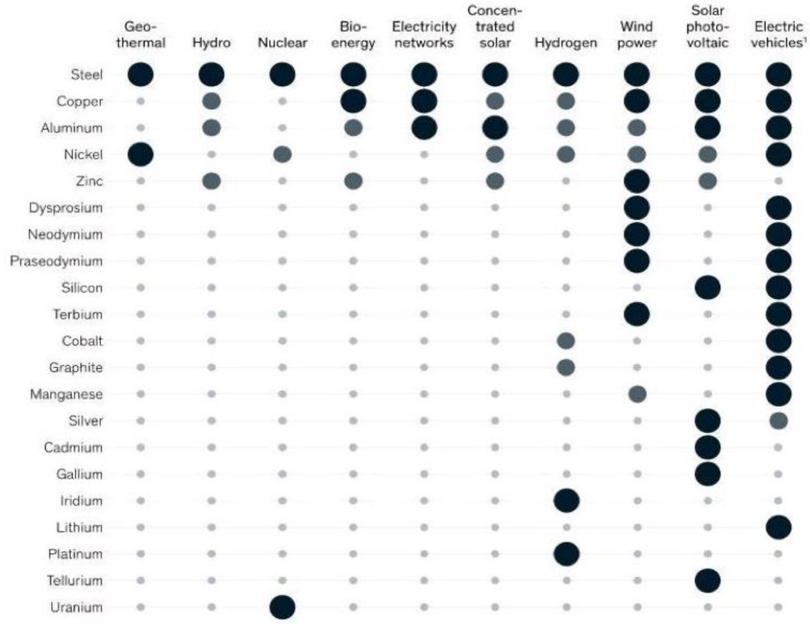
Global geopolitics and global geopolitical risks need to be considered in energy making security decisions making. During times of conflict, global energy prices has been shown to rise due to global energy interdependencies and nations looking to safeguard their own energy security. History has also 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.



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 8-4 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 8-5 shows how 2 years later there is an ever-growing need for gas and it makes up a significant part of the energy mix.

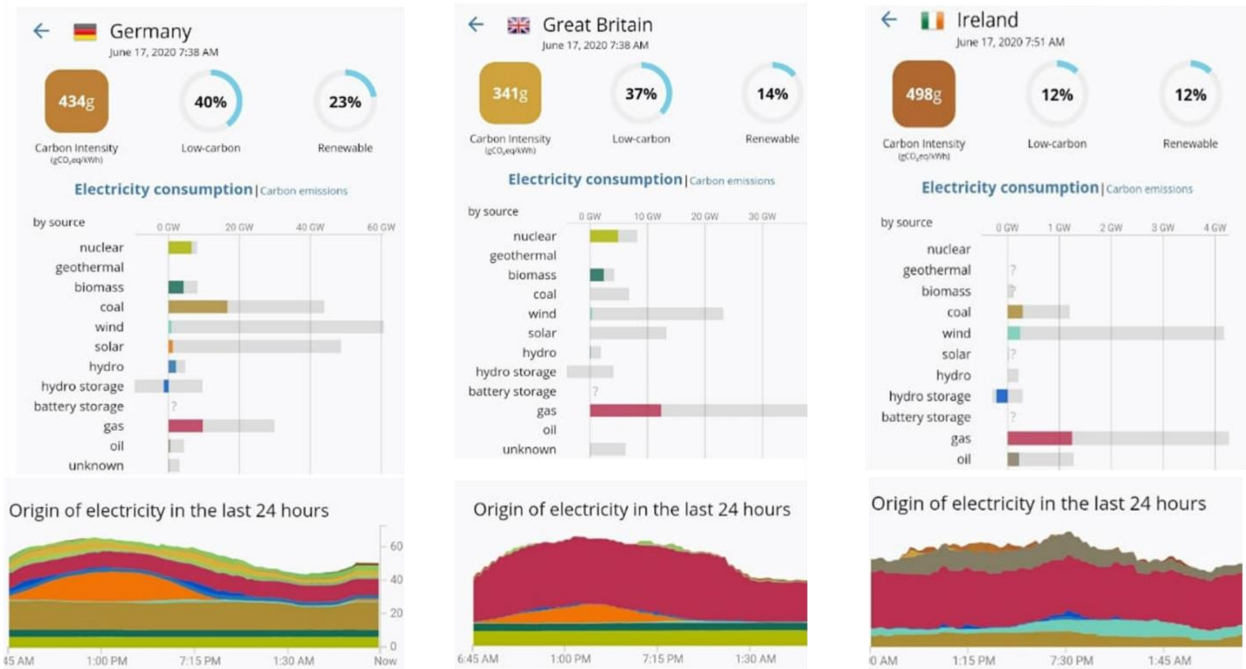


Figure 8-4: Electricity Map (June 17 2020)

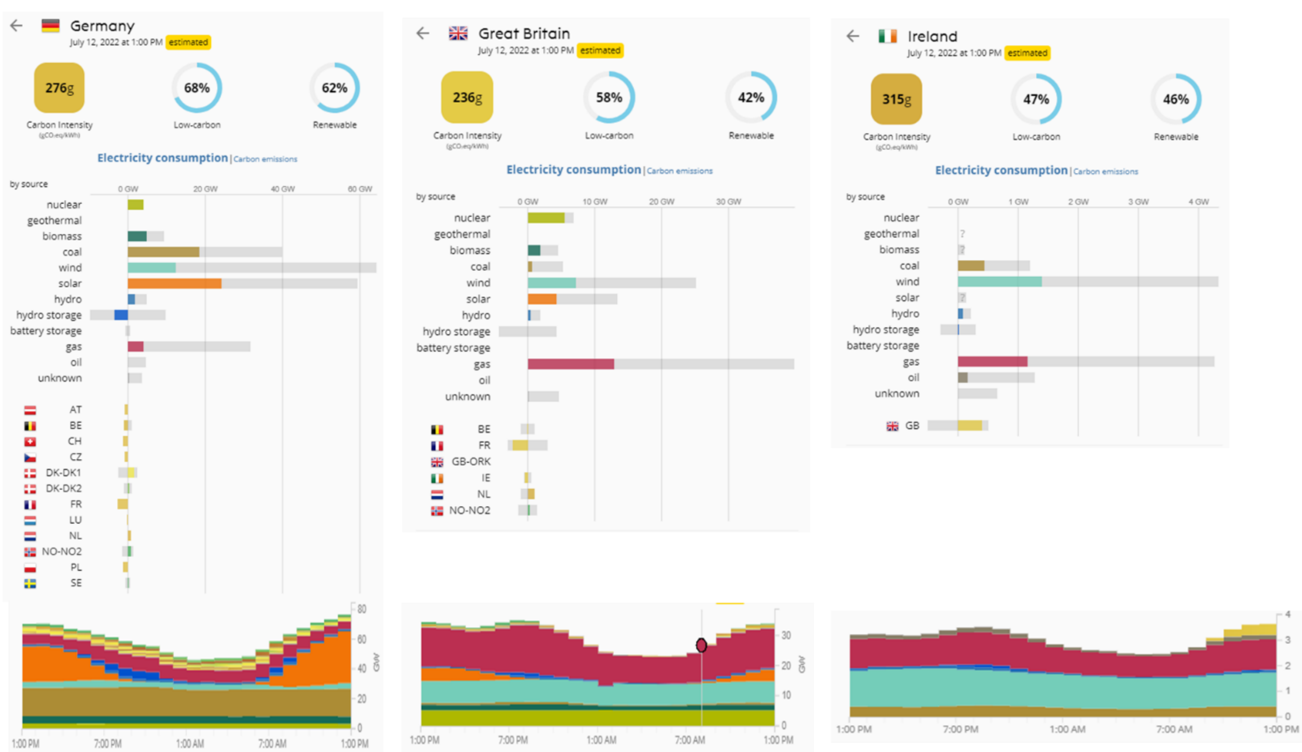


Figure 8-5: Electricity Map (July 12 2022)

The greyed-out bars on both Figure 8-4 and Figure 8-5 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.

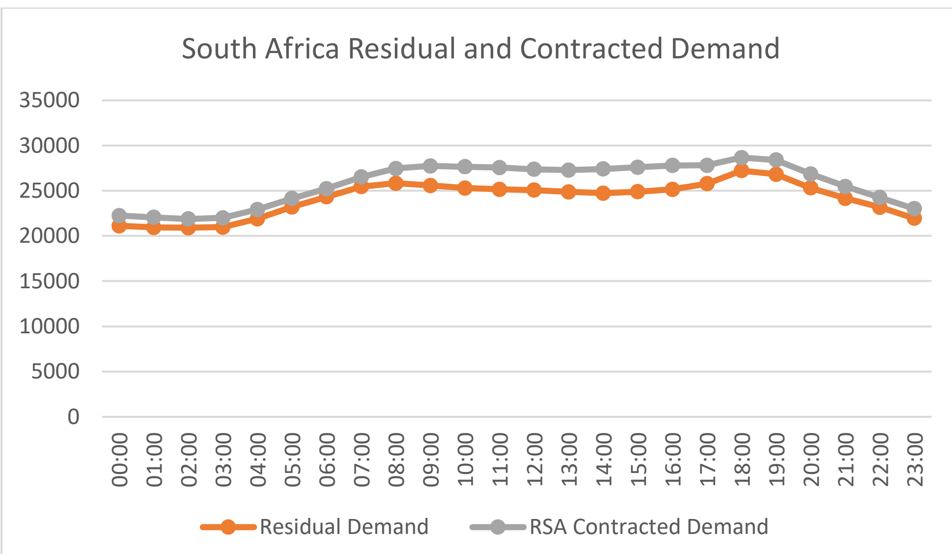


Figure 8-6*:* Typical Daily Load Profile (01/04/2022)

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.

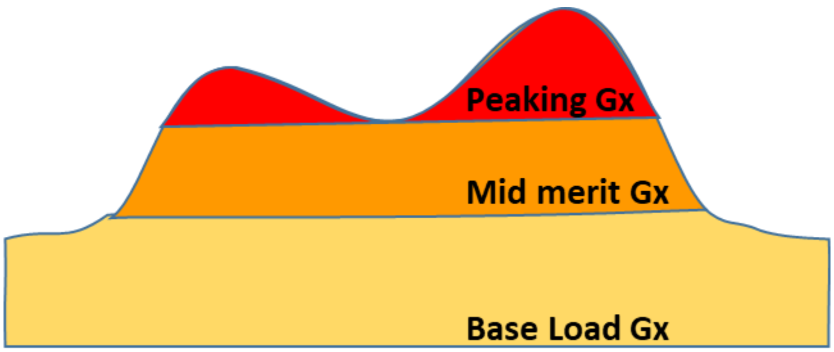


Figure 8-7: Optimal Energy Mix

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 8-6 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 8-8 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.

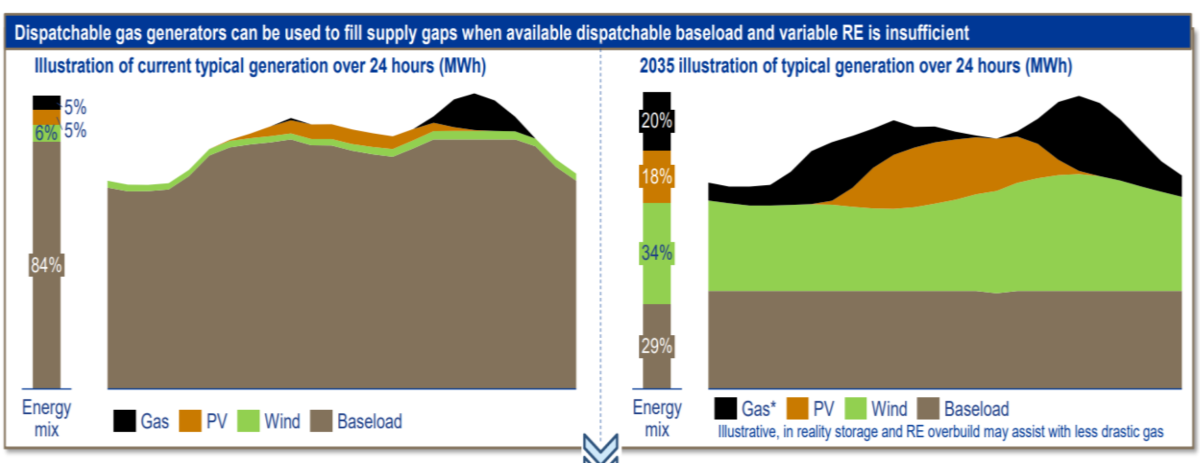


Figure 8-8: Stacked Product Offering (Eskom)

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 especially when the entire value chain is considered.	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 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.
	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	Maintains livelihoods of affected individuals.	Established framework in the form of the REIPPPP.

	existing/decommissioned plants.		

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 14th 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.

The short (2019-2028), medium (2029-2048) and long-term (beyond 2048) Port Development Framework Plans (PDFPs) for the Port of Saldanha Bay in terms of the National Ports Plan 2019 was considered. A summary of relevant foreseen changes are listed below:

- **Short-term:**
  New liquid Bulk storage areas. These areas are located within the port limits and within the new proposed ports limits. The total area of the proposed liquid bulk is 197 ha;
  LNG gas to power FSRU infrastructure connected to the new LNG facilities; and
  Expansion of the commercial logistics area (Port Logistics Park) to 17 ha;
- **Medium- term:**
  Land reclamation next to the current iron ore stockyard for the construction of new LNG facilities (long term) / increase of iron ore stockpile area; and
  LNG gas to power FSRU infrastructure connected to the new LNG facilities
- **Long-term:**
  New proposed land-based LNG storage area inside the port limits.

Extensive discussions took place with Karpowership to address challenges and ensure Sunrise facility as well as aquaculture facility were not impacted. The proposed project could work from an operational-infrastructure fit perspective. There were no critical concerns with the lay-out as it was the preferred location and orientation within the Port as per TNPA engagement.

8.2.11.2 SEZ Planning

The Saldanha Bay Industrial Development Zone (SBIDZ) is bringing in investment worth US$18.3m (Mtezuka, 2020). These investment projects are anticipated to increase job creation and bolster the local economy. The SBIDZ has implemented a “Project Leasing Facility” to facilitate government energy projects which can be completed in less than 24 months. The proposed Powership project requires no construction, however the transmission line connecting the Powership to the national grid would require construction that would be completed well within 24 months. The “Project Leasing Facility” would assist the Transnet National Ports Authority (TNPA) with storage space aiding in provision of renewable energy independent power producer programme (REIPPP). As outlined in the SBIDZ Corporate Plan 2019/ 2020 the area of gas to energy is to be focused on, especially in the development of skills and job creation within this sector. The gas to power Powership project enables for the creation of jobs and development of skills in this sector. Karpowership engaged with TNPA to ensure alignment with Port planning.

8.2.11.3 Provincial Planning

Western Cape Provincial Spatial Development Framework

The Provincial Spatial Development Framework of Western Cape supports the National Development Plan’s spatial agenda and supports the Provincial Strategic Objectives. The National Development Plan **1.4.1.2 Improving Infrastructure**, speaks of diversifying the energy mix, incorporating liquid natural gas and renewables. The proposed Powership project for Saldanha feeds into this strategy. One of the significant target areas within the Western Cape Economic sector is Gas - new LNG terminal facilities in Mossel Bay and between Saldanha Bay and Cape Town, associated gas power stations, and conversion of nearby industrial areas. The proposed Powership will be powered by Liquid Natural Gas (LNG), based in Saldanha Bay and feeding power to the surrounding industrialised areas.

The 2013 Western Cape Infrastructure Framework (WCIF) promotes innovative methods for infrastructure to meet the growing demand. In particular for the energy systems, “Aligning energy generation infrastructure with point of gas import (i.e. Saldanha Bay and Mossel Bay)” and “Procure land for a gas-based energy system, including liquid natural gas (LNG) port facilities, gas plants (3 envisaged), and gas pipelines”.

8.2.11.4 Municipal Planning

Saldanha Bay Municipal Spatial Development Framework

According to the Saldanha Bay Municipal Spatial Development Framework – Spatial Analysis, there is additional demand for electricity projected for Saldanha Bay and the IDC area. With new industry coming in to the area, it is projected that this demand will continue to grow. The Municipal Spatial Development Strategy underlines that "Critical to any growth management strategy will be the timeous provision of bulk infrastructure capacity (water, sewerage, electricity) in the identified growth areas, to address both existing capacity backlogs and the supply of additional capacity to provide for growth". From this 6 key strategies were developed. (iv) Bulk Service Infrastructure Provision Strategy: Compile a co-ordinated bulk infrastructure supply provision policy which prioritises the implementation of bulk infrastructure based on the municipal spatial development concept / Growth Management Framework. The Powership project is in direct support of Strategy 4.

Saldanha Bay Municipality 4th Generation Integrated Development Plan

The Integrated Development Plan (IDP) 2017 – 2022 forms the strategic framework guiding planning within the municipality. An analysis of the energy grid within the municipality has identified that a concern of note is the Eskom owned Duferco substation (based within the Saldanha Port) which has an availability of supply capacity that has not been utilised which may be a limiting factor if not capitalized on. During the 2016 Risk Assessment disruptions in electricity supply was noted as an area of risk and major concern.

Strategic Objective 4 of the Saldanha Bay IDP is "to maintain and expand basic infrastructure as a catalyst for economic development". This is proposed to be achieved through provision of a quality electricity supply, managing demand and maintaining existing infrastructure. The proposed Powership project allows for the reliable supply of power facilitating economic growth and allowing for job creation in a struggling economy.

Saldanha Local Area Plan

The vision for the Local Area Plan (LAP) is for Saldanha Bay Municipality to be a modern, integrated, clean and model town with satisfied and happy citizens. As outlined in the LAP and in the Port Development Framework Plans port expansion is planned. The proposed Powership project would directly support this by facilitating the expansion through provision of power and reduce the impacts of loadshedding.

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 (see **Error! Reference source not found.**). 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 Saldanha 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

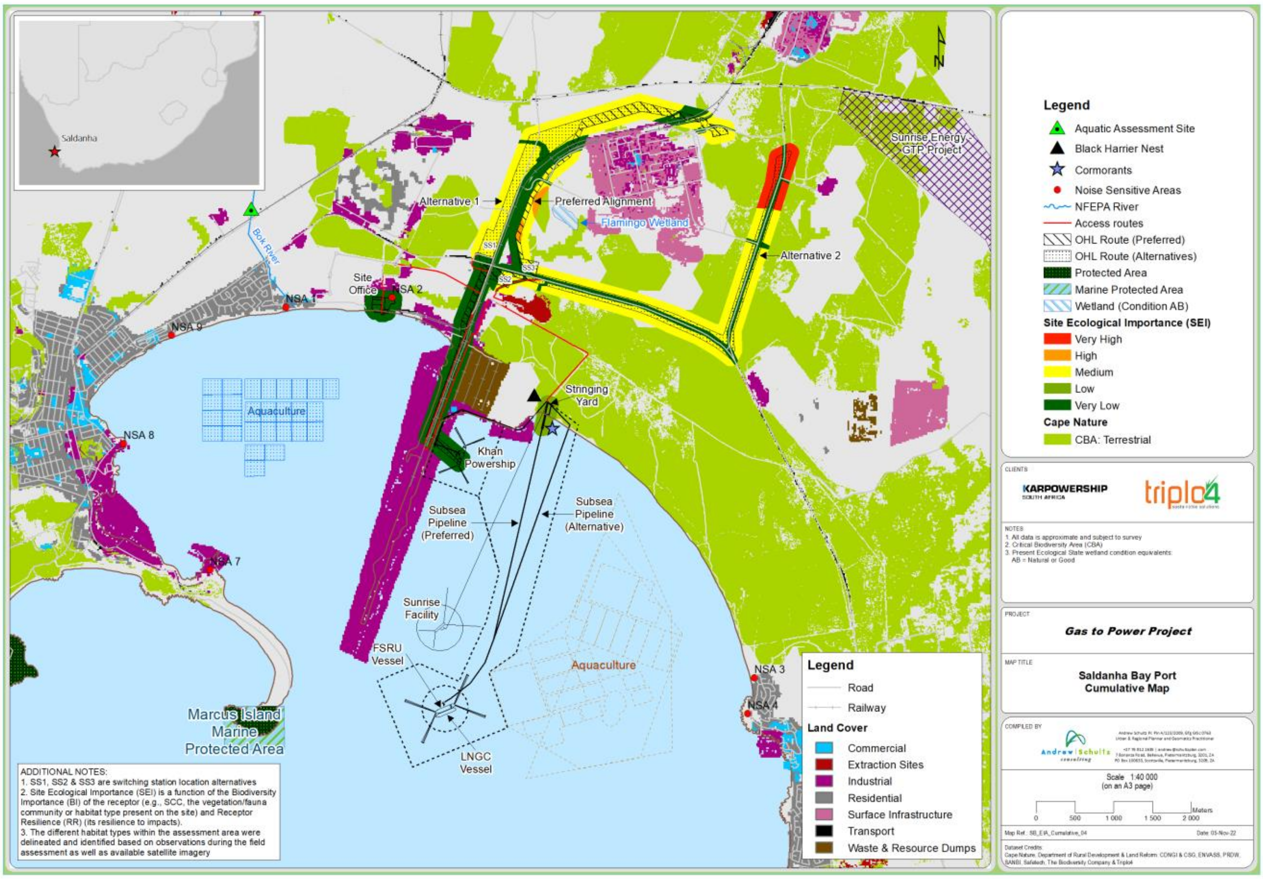


Figure 8-9: Cumulative impacts of the Karpowership project

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:

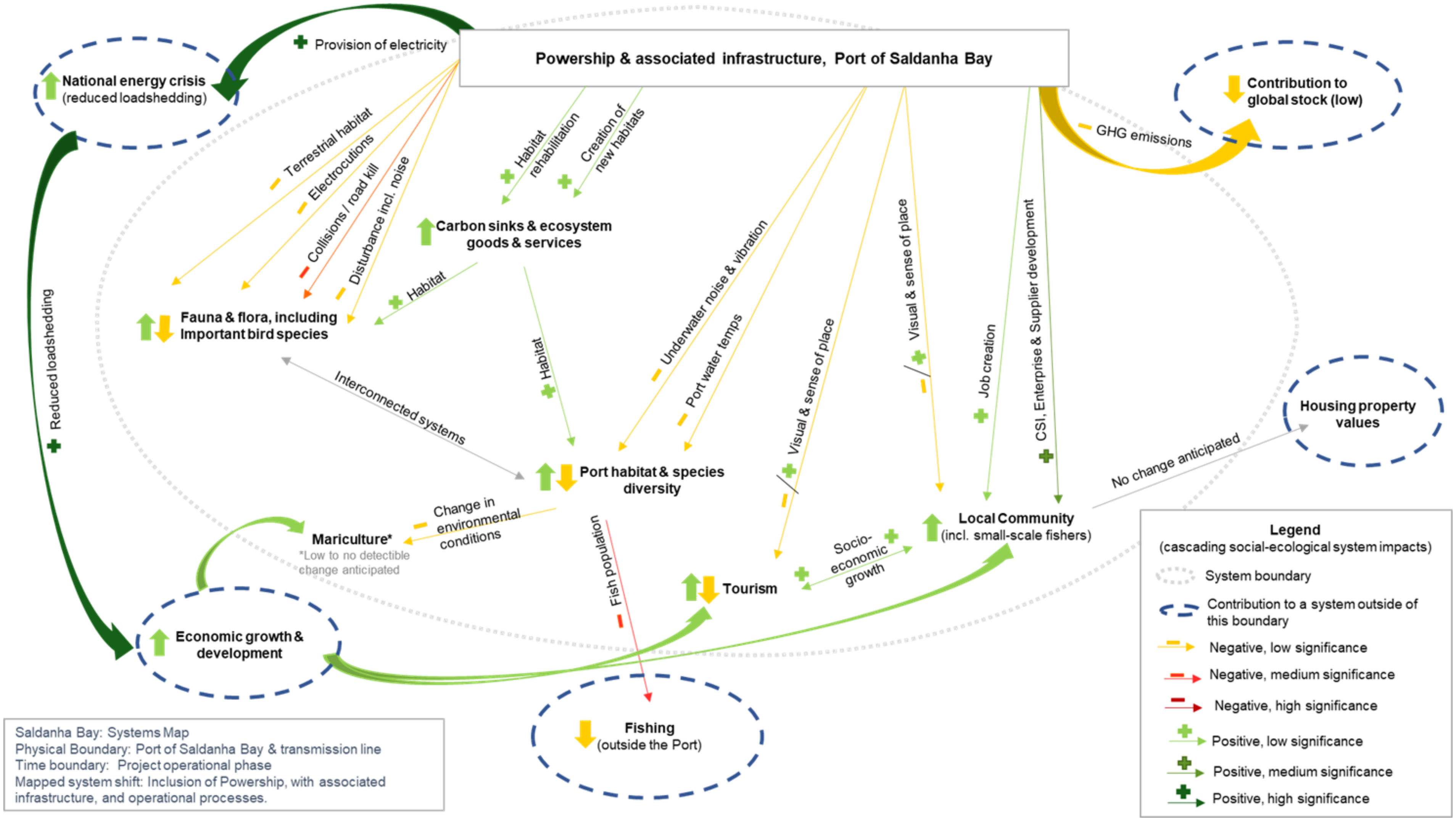


Figure 8-10: System map illustrating the anticipated shifts to the socio-ecology system following the inclusion of the Powership and associated infrastructure in Saldanha Bay (Big Bay)

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 are opportunities for the small-scale fishers and the rest of the community to benefit from corporate social investments, job creation & skills development, and supplier and enterprise development as a result of Karpowership SA’s local content commitments. 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.
- Underwater noise and the thermal plume associated with the operations of the Powership, may affect marine life in the port. While low impacts are anticipated associated with the mariculture, it is anticipated that marine mammals may be negatively impacted as a consequence of the long duration of the project (anticipated medium overall environmental significance impact rating). A key concern is the impact on juvenile fish who make use of the port as a nursery. Consequently, this may negatively affect fish populations, which are under strain as a result of longstanding overfishing.
- The terrestrial noise caused by the Powership during electricity generation, on assessment will not extend into residential areas and therefore is not anticipated to affect local communities.
- Noise from power generation could disturb the Black Harriers’ nest and Cape Cormorants roost, which lie within the sound bubble of 60-70 decibel, which may have an adverse effect on the birds, although the usual noise level which birds are disturbed and move away from is 100 decibels upwards.
- The proposed powerlines could cause increased collision fatalities for birds as a cumulative impact with the transmission lines that are already in place. There are 0.33 fatalities observed every 1 km along the existing lines. As such there are three alternative powerlines proposed, which could result in the following annual avian fatalities: Preferred route: 2.4 fatalities; Alternative route 1: 2.3 fatalities; Alternative route 2: 2.8 fatalities. It is important to note that the alternative route 2 for the transmission line is not supported because of the presence of the Black Harrier.
- Construction and maintenance of the gas pipeline, transmission line and switching stations is anticipated to result in some loss of some important fauna and flora. Both mitigation recommendations and rehabilitation have been proposed to limit the impacts.
- 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, and industrial processes. The tourism sector may further benefit from peaked interest in the Powerships, yielding ‘energy tourism’. This may further stimulate maritime recreational economic opportunities.
- Tropical cyclones are typically high impact low probability hazards and are generally quite difficult to manage because of their unpredictable nature. This has been considered in the design and operational considerations, and therefore the impact is anticipated to be low and will not impact core operations.

- 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 the local scale, 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 rehabilitation of a range of habitats in the vicinity of the Karpowership SA project; 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.

Key findings 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 growth and development, and transition to the energy mix as proposed in the IRP 2019 (a high positive impact is expected). Please see '*The economic impact of rolling blackouts in South Africa: Shaping the context*' 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.
- Underwater noise and the thermal plume associated with the operations of the Powership, will affect marine life in the port. While low impacts are anticipated associated with the mariculture, it is anticipated that marine mammals may be negatively impacted as a consequence of the long duration of the project (anticipated medium overall environmental significance impact rating). A key concern is the impact on juvenile fish who make use of the port as a nursery. Consequently, this may negatively affect fish populations, which are already under strain because of overfishing.
- 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.

- Noise from power generation could disturb the Black Harriers' nest and Cape Cormorants roost, which lie within the sound bubble of 60-70 decibel, and may have an adverse effect on the birds, although the usual noise level which birds move away from is 100 decibels.
- The proposed powerlines could cause increased collision fatalities for birds as a cumulative impact with the transmission lines that are already in place. There are 0.33 fatalities observed every 1 km along the existing lines. As such there are three alternative powerlines proposed, which could result in the following annual avian fatalities: Preferred route: 2.4 fatalities; Alternative route 1: 2.3 fatalities; Alternative route 2: 2.8 fatalities. It is important to note that the alternative route 2 for the transmission line is not supported because of the presence of the Black Harrier.
- Construction and maintenance of the gas pipeline, transmission line and switching stations is anticipated to result in a loss of important fauna and flora. Both mitigation recommendations and rehabilitation have been proposed to limit the impacts.
- 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, and industrial processes. The tourism sector may further benefit from peaked interest in the Powerships, yielding 'energy tourism'. This may further stimulate maritime recreational economic opportunities.
- Tropical cyclones are typically high impact low probability hazards and are generally quite difficult to manage because of their unpredictable nature. This has been considered in the design and operational considerations, and therefore the impact is anticipated to be low and will not impact core operations.
- 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 the local scale, 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 rehabilitation of a range of habitats in the vicinity of the Karpowership SA project; 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, 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 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,	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 Impact ▪ Thermal Plume

Ref No:	Question	Response
	Ecological drivers of the ecosystem, Environmental Management, Framework, Spatial Development Framework (SDF) and Global and international responsibilities	No fatal flaws were identified from the specialists and provided supportive conclusions. The specialists considered the status (sensitivity, vulnerability and threatened) of the ecosystems. The study area is located outside of any Threatened Ecosystems. Avifauna and Terrestrial: Transmission Line Alternative 2 traverses the flight path of a black harrier and is also an area of critically endangered limestone strandveld which should be avoided. This area of strandveld is also located within an area for which offsets are not possible so avoidance is the only option. Thus, Alternative 2 is not supported from an avifaunal and ecological standpoint. Marine: The project site is situated outside West Coast National Park, Malgas and Jutten Island MPAs do not occur within the proposed powerplant development's immediate area and are 9, 9.3 and 10.5 km away from the Powership and FSRU locations, respectively. The project is confined to Big Bay in the Port of Saldanha, adjacent to the Iron Ore jetty and forms part of the activities of the Port under TNPA jurisdiction. 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 project was sustainable from an ecological perspective. The proposed development will reduce the pressure on other alternative to other fossil fuels and produces roughly half of the amount of CO_2 per unit energy as coal. This scenario makes natural gas attractive as a potential 'bridge' or

Ref No:	Question	Response
		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 stringing yard for the gas pipeline, although on a previously disturbed area, is in proximity to the cormorant area on the beach and the black harrier nesting site. The location of the stringing yard could not be moved as the operation has to be on the beach area. Additionally, locating the stringing yard on a pristine area of the dune would not be environmentally sound. Following consultations between the engineers and the avifaunal specialist, mitigation measures such as a screening fence for the harrier site was proposed. It was also concluded that all construction works will be programmed to occur outside of the harrier breeding season. The full list of mitigation measures was included in the EMPr (Appendix 6). The applicant further committed to undertake monitoring of the black harriers from site establishment through to the operational phase.
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 utilising 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	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

Ref No:	Question	Response
	explored to safely treat and/or dispose of unavoidable waste?	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 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 the surrounding IDZ area. The proposed ships and the power line alternatives were assessed to have landscape impacts commensurate with existing land uses and landscape character. The preferred alternatives have the least visual impact as per the Visual Impact Assessment Specialist conclusion.
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 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.

Ref No:	Question	Response
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 measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impact?	Karpowership SA through its Economic Development contributions and Economic Development Plan (EDP) will support the development of renewable energy projects and Blue Oceans Economy.
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 (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.
1.	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.	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 assembly area for the gas pipeline.
1.8.	How were a risk-averse and cautious approach applied in terms of ecological impacts?	

Ref No:	Question	Response
1.8	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Numerous independent specialist 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	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low.
1.8	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	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 medium to 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 positive 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	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;

Ref No:	Question	Response
		▪ 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-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	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 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 Powership in the Port and the associated transmission route industrial area 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 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 ecosytems.
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 substation. Please refer Section 3 – Alternatives and 6.2 – Preferred Development Footprint and Site.

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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 largely Low/moderate and the same as the direct impacts due to the locality of the project and the impacts being confined to the area. This Project has been located in the Port and IDZ which has been earmarked for energy and gas development.
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.	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area	Saldanha Bay Municipality 4th Generation Integrated Development Plan The Integrated Development Plan (IDP) 2017 – 2022 forms the strategic framework guiding planning within the municipality. An analysis of the energy grid within the municipality has identified that a concern of note is the Eskom owned Duferco substation (based within the Saldanha Port) which has an availability of supply capacity that has not been utilised which may be a limiting factor if not capitalized on. During the 2016 Risk Assessment disruptions in electricity supply was noted as an area of risk and major concern. Strategic Objective 4 of the Saldanha Bay IDP is "to maintain and expand basic infrastructure as a catalyst for economic development". This is proposed to be achieved through provision of a quality electricity supply, managing demand and maintaining existing infrastructure. The proposed Powership project allows for the reliable supply of power facilitating economic growth and allowing for job creation in a struggling economy. The proposed project is proposed in the Port adjacent to the Saldanha Industrial Development Zone. Furthermore, engagements between Karpowership SA and TNPA has resulted in the approved location of the Powership and FSRU

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		to be in line with current marine traffic predictions and future port expansion plans as per the National Ports Plan 2019.
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 415MW of dispatchable power reliably and consistently, has a footprint of circa 15,000m^2. 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.	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	<u>Saldanha Bay Municipal Spatial Development Framework</u> According to the Saldanha Bay Municipal Spatial Development Framework – Spatial Analysis, there is additional demand for electricity projected for Saldanha Bay and the IDC area. With new industry coming in to the area, it is projected that this demand will continue to grow. The Municipal Spatial Development Strategy underlines that "Critical to any growth management strategy will be the timeous provision of bulk infrastructure capacity (water, sewerage, electricity) in the identified growth areas, to address both existing capacity backlogs and the supply of additional capacity to provide for growth". From this 6 key strategies were developed. **(iv) Bulk Service Infrastructure Provision Strategy: Compile a co-ordinated bulk infrastructure supply provision policy which prioritises the implementation of bulk infrastructure based**

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		on the municipal spatial development concept / Growth Management Framework. The Powership project is in direct support of Strategy 4. The proposed development of infrastructure for the provision of electricity is in line with the permitted uses within the Harbour land use. The ports of South Africa are hubs of the economy, maintaining crucial connection between sea and land transport as well as imports and exports. Ports are closely associated with the IDZs/ Special Economic Zones (SEZ) in terms of the Special Economic Zones Act 16 of 2014, so called as they are specifically designed to allow for related industries to be based in an Industrial Zone. 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.
2.1	Municipal Economic Development Strategy ("LED Strategy").	According to the Saldanha Bay Municipality Economic Development Strategy (2017) For economic development (ED) to stimulate faster economic (GDPR) growth, SBM stakeholders needs to: • Promote growth in enterprises that earn revenue (GDPR) from external markets. • Increase local enterprise's earnings from local markets. As a consequence of more money in the local economy, retail and services sectors will also grow. As a consequence tax revenues will also grow - from increasing number of rate paying (employed) citizens and growth of enterprises. There by contributing to more sustained public service delivery.
2.2.	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate	Karpowership is committed to supporting Local Economic Transformation processes and as such, once the project has achieved Financial

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	elements/aspects), and specifically also on the socio-economic objectives of the area?	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 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.
2.	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	
2.3.	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	
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?	

Ref No:	Question	Response
		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. 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 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	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

Ref No:	Question	Response
		operational phase, and will provide employment opportunities to the local communities.
2.	reduce the need for transport of people and goods	During the operational phase will reside on the ship and will not require the transportation of people. 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.	result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport)	
2.	compliment other uses in the area,	Compliment port activities and provision of electricity into the national grid, support socio-economic activities
2.	be in line with the planning for the area	The proposed development is in line with the Municipality's Spatial Development Framework and Port's Plans
2.	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 IDZ and urban edge is retained for development and future port planning can be supported in terms of the technology employed.
2.	optimise the use of existing resources and infrastructure,	Existing infrastructure from the Port and ESKOM is utilised together with existing services servitude for the evacuation of power such as the breakwater and disturbed areas have been selected for use as far as possible
2.	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.	discourage "urban sprawl" and contribute to compaction/densification,	The location within the Port ensures optimum development with the SEZ.
2.	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.	encourage environmentally sustainable land development practices and processes,	
2.	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 existing Aurora- Saldanha Steel network.
2.	the investment in the settlement or area in question will generate the highest socio-	Positive socio-economic impacts in the form of employment creation and the indirect benefits of

Ref No:	Question	Response
	economic returns (i.e. an area with high economic potential),	economic growth are anticipated in the construction and operational phases. 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 R27.7 million over the 20 years, or approximately R1.4 million per annum. A dedicated Supplier Development Programme is also planned, with R1 million allocated for the construction period, and R910 000 per annum for the 20 years of operations.
2.5	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 significantly on any heritage resources and the visual assessment has deemed the impacts of low significance.
2.5	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 transition fuel on our path to de-carbonisation 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	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated	Numerous independent specialist studies were commissioned in terms of ecological as well socio-economic environments. These include local (micro) aspects as per IDP, TNPA and SDF 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	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic	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

Ref No:	Question	Response
	vulnerability and sustainability) associated with the limits of current knowledge?	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.(	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, municipal and local forums and programmes 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.]	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.]	Positive impacts. What measures were taken to enhance positive impacts?	Providing dispatchable power at scale into the South African grid. 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.

Ref No:	Question	Response
		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 too 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 R27.7 million over the 20 years, or approximately R1.4 million per annum. A dedicated Supplier Development Programme is also planned, with R1 million allocated for the construction period, and R910 000 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 impacts (e.g. over utilisation of natural resources, etc.)?	Given the technology and location within the Port, is it not anticipated, socio economic aspects will result in ecological impacts The ED plan may look at capacitating the small scale fishers which may encourage fishing in excess of available quotas and increased small craft in the area may impact on local fauna. 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 SEZ.

Ref No:	Question	Response
		Similarly the preferred transmission line route was selected based on engagements with the avifaunal and terrestrial specialists.
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 adjacent communities as per the ED plan benefits will also accrue to these 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 equitably 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 been addressed throughout the development's life cycle	Specialist studies considered health and safety. This included the Air Emissions Impact Report as well as Major Hazardous Installation. These reports show the impacts to be of low significance. In addition, being situated within the Port, the relevant TNPA and SAMSA requirements will be adhered to.
2.13.	What measures were taken to:	
2.:	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.:	provide all people with an opportunity to develop the understanding, skills and capacity	Refer to Section 5 of this report, describing the public participation process undertaken for the

Ref No:	Question	Response
	necessary for achieving equitable and effective participation,	proposed project. The BID, advertisements, knock and drop flyers, radio announcements, notification letter and site notices have been made available in English, Afrikaans, isiXhosa and Sesotho 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.	ensure participation by vulnerable and disadvantaged persons,	
2.	promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means	
2.	ensure openness and transparency, and access to information in terms of the process	
2.	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.	ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted	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. 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.	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 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 RMI4P. 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 development in the country, increase
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.	the distance from where labourers will have to travel	
2.	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
2.	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
		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.
2.17.	What measures were taken to ensure:	
2.:	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. Pre-consultation meetings were undertaken with various key stakeholders prior to the commencement of the public participation process. The purpose of these meetings were to familiarize the stakeholders with the project, determine their concerns or issues upfront, and assist with the clarification of their queries.
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	The applicant will be responsible for the rehabilitation of laydown areas and implementation as well as compliance with any authorisations which would take into account the appropriate mitigation measures included in

Ref No:	Question	Response
	damage or adverse health effects will be paid for by those responsible for harming the environment?	the EMPr as assessed and recommended by the specialists and EAP.
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	Transmission Line Alternative 2 traverses the flight path of a black harrier and is also an area of critically endangered limestone strandveld which should be avoided. This area of strandveld is also located within an area for which offsets are not possible so avoidance is the only option. Thus, Alternative 2 is not supported from an avifaunal and ecological standpoint. 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 6.
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. visual, noise) as well macro components (e.g. climate change, socio-economic). As per Section 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 CONCLUSION AND RECOMMENDATION

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 49% owned by a 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 Saldanha Project making up 320MW 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 the fully integrated floating Powership, fuelled by natural gas whilst being moored in the Port of Saldanha Bay in the Western Cape.

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 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 a Khan Class Powership with gas fuelled reciprocating engines and a Floating Storage & Regasification Unit (FSRU) which will store LNG, regassify and deliver NG to the Powership. These vessels will, as per TNPA requirements, be moored in Big Bay at the Port of Saldanha during the project's 20-year lifespan with the following associated infrastructure:

- A 132 kV transmission lines comprising overhead monopole transmission towers, from the Powership to the proposed switching station
- A proposed gas pipeline subsea pipeline with a subsea and overland component from the FSRU to the Powership; and
- Temporary laydown areas.

The Project has a total electrical output capacity of 415 MW, and a contracted capacity of 320 MW which cannot be exceeded. The Powership uses 24 reciprocating engines (GEN-SET) that run on gas. These can run in a simple cycle configuration or a combined cycle with 2 steam turbine generators (STG) that utilise exhaust heat from the engine to create the steam to drive turbine generators. 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 Aurora-Saldanha Steel network, approximately 7.5 km away. The Powership also has freshwater generators (FW GEN) to produce freshwater from the same seawater intake used for cooling, for operational purposes.

The operation of the Powership involves the abstraction of seawater for cooling of the power generation units and the subsequent discharge of the same water back into the receiving environment, with no chemical or other additives but with a slight rise in temperature. Total intake/outlet flow rates at 100% load are 6.61 $m^3.s^{-1,}$ and the increase in temperature across that process (Δt) varies from 12 to 14°C, depending on the cycle configuration in use. The output flows will be discharged at depth (8 m) through multiple ducted outlets on the vessel hulls. Discharges will operate continuously while the ships generate power as per dispatchable instructions, 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 Saldanha, whereas the gas and powerlines 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 were implemented or formed part of the technology to avoid specific impacts:

- Screening out of Alternative 2:
  - The avifauna assessment indicated the presence and activity of a black harrier with flight paths that would constantly cross the proposed powerline.
  - Critically endangered limestone strandveld located within an area for which offsets are not possible. Avoidance was the only option;

- The gas pipeline alternative selected the shortest route within the coastal dune area, avoiding pristine areas.
- The transmission line was proposed adjacent existing infrastructure associated with disturbance and transformation.
- The use of cooling water systems that exclude the use of biocides and chlorine and thus prevent 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 provide for built-in noise mitigation e.g. double hull and anti-vibration mounting systems.
- Management of water intake velocities, physical block cages around intakes and placement of intake outside the benthic environment to reduce impacts within the marine ecosystem from ingress into the system.
- Navigational simulations (full bridge simulations with Harbour Masters and tug operators) and TNPA agreements on FSRU and Powership positions ensured the optimal position of the vessels to avoid marine traffic safety issues 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. The EMPr 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.

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: Project alternatives

Alternative	Description	Status	Key reasoning	Report Section
Site Alternatives within Western Cape Province	Port of Cape Town,	Screened out	This not a feasible alternative.	Section 3.1.1
	Port of Saldanha	Assessed in EIA	This is a feasible and preferred alternative. Aligned with Port	Section 3.1.2

Alternative	Description	Status	Key reasoning	Report Section
			activities, sufficient depth and available grid infrastructure via existing services servitude with connection to Aurora -Saldanha Steel transmission network via 132kV switching station.	
Layout Alternative Powership	Alternative 1: Powership and FSRU Position within Big Bay	Assessed in EIA	No alternative mooring sites were initially considered as per the Scoping Report as the preferred location is within the TNPA port limits and is aligned with the proposed Port plans (NPP, 2019). TNPA's preference for the Powership position within Big Bay instead of Small Bay (Figure 3-1) was an outcome of prior public participation and engagements between Karpowership and TNPA.	Section 3.2.1
Layout Alternative Gas Pipeline	Alternative 1: onshore pipeline follows a shorter route to the overland gas pipeline connection	Assessed in EIA	This is a feasible and preferred alternative. Together with more detailed bathymetry, it was possible to reorient the pipeline, position the shore crossing adjacent to the Sunrise LPG pipeline shore crossing and reuse the same area of the beach for the stringing yard as was used for the Sunrise installation. This relocation of the shore crossing results in 400m less of the pipeline route traversing the dune field.	Section 3.2.2
	Alternative 2: onshore pipeline follows a longer route further east to the overland gas pipeline connection	Assessed in EIA	This route traverses 400m more the beach before connecting to the overland gas pipeline. Although feasible, this route is therefore not supported.	Section 3.2.2
Layout Alternative: Transmission Lines	Alternative 1: 7.2km Transmission line	Assessed in EIA	This is a feasible alternative. This alternative has been indicated as the preferred as the Applicant's land legal team have been in liaison with the associated landowners and	Section 3.2.3

Alternative	Description	Status	Key reasoning	Report Section
			have indicated that this route is most preferred. In addition, the length of the line is slightly shorter than Alternative 1 and 2.	
	Alternative 2: 7.5km Transmission line	Assessed in EIA	This is a feasible but not practical alternative. This route is primarily based between Transnet and the Saldanha Steel property and crosses properties owned by Afrisam and Duferco. Should the land legal issues be resolved, this alternative is feasible and supported by the specialists.	Section 3.2.3
	Alternative 3: 8.6km Transmission line	Assessed in EIA	This not a feasible alternative. ▪ According to the avifaunal specialist, it was determined that this alternative is a no-go option as it cuts across the fight paths of three priority species including GPS-tracked Black Harriers. ▪ Furthermore, the terrestrial ecologist indicated that this route traverses an area of critically endangered limestone strandveld which should be avoided	Section 3.2.3
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 RMIPPPP submission and awarded SIP.	Section 3.2.5

Alternative	Description	Status	Key reasoning	Report Section
	Hydrogen	Not assessed in EIA	This is not a current feasible option; however, it is not an excluded option over the 20 yrs 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 provide 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 developed is thus preferred.	Section 3.2.6, Chapter 7 and Appendix 9

9.4 ENVIRONMENTAL IMPACT STATEMENT

In accordance with 3(1)(l) in Appendix 3 of GN982, this section contains:

(i) *A summary of the key findings of the environmental impact assessment (refer Section 9.4.2 and 9.4.4).*

(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

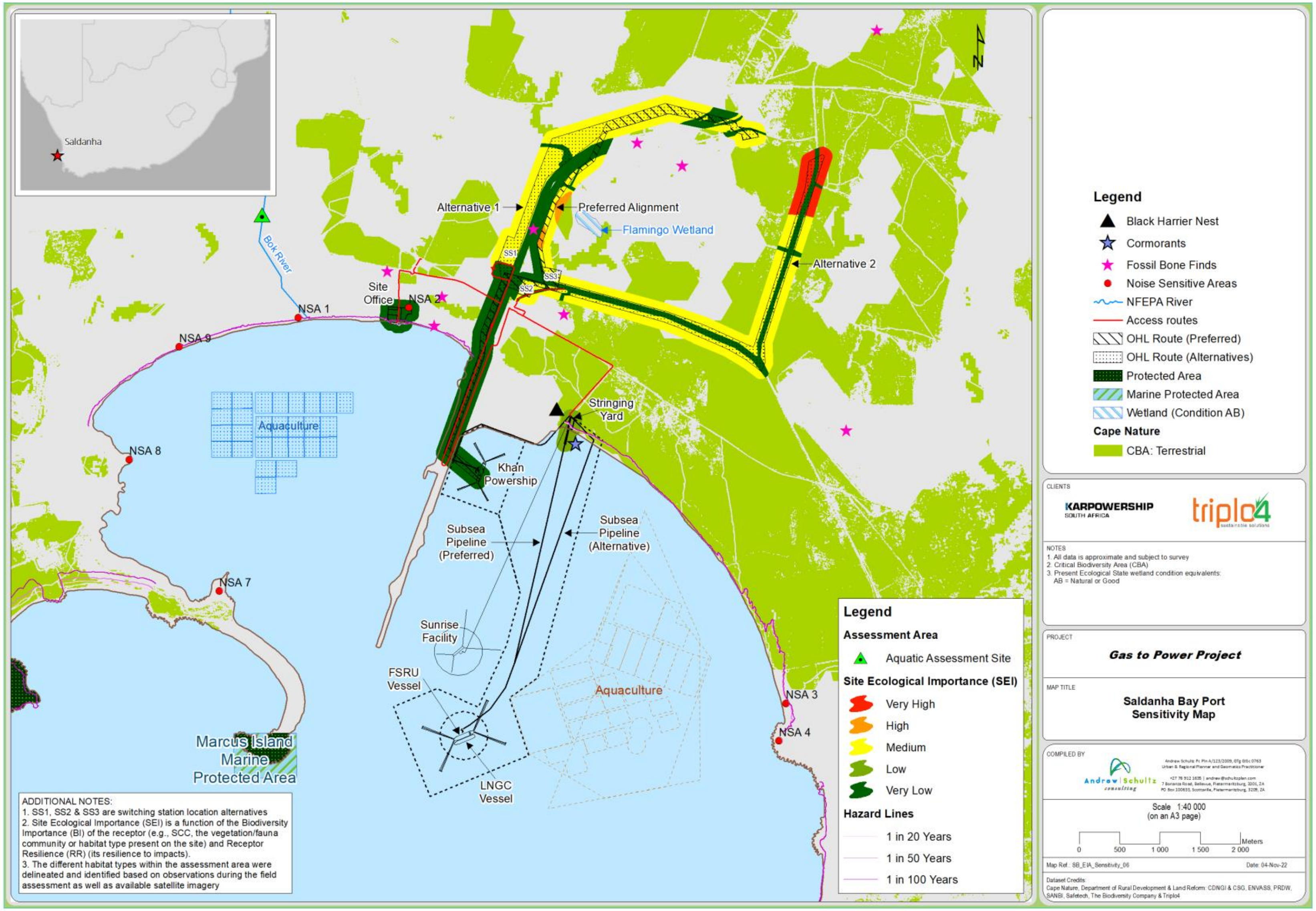

Figure 9-1: Sensitivity Map depicting sensitive environmental features in relation to the proposed activity in the Port of Saldanha

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 7.4.1)		
No impacts		
Aquatic Impacts (Section 7.4.2)		
No impacts		
Hydropedology Impacts (Section 7.4.3)		
Site preparation impacting on soil interflow processes, soil quality, soil structure and land capability	Neutral/ Negligible	Neutral/ Negligible
Disturbing vadose zone, the in-situ placement of new soils, vegetation clearing & soil stockpiling impacting on soil interflow processes, soil quality, soil structure and land capability	Low	Neutral/ Negligible
Surface water (wetland) quality as well as possible oil & fuel spills impacting on soil quality	Low	Neutral/ Negligible
Geohydrology Impacts (Section 7.4.4)		
Disturbing vadose zone during soil excavations and possible hydrocarbon contamination (construction activities)	Low	Neutral/ Negligible
Impacts to downstream groundwater users (construction and operational phase); Perched water table dewatering	Neutral/ Negligible	Neutral/ Negligible
Hydrocarbon contamination of the vadose zone (operational phase)	Neutral/ Negligible	Neutral/ Negligible
Wetland Impacts (Section 7.4.5)		
Catchment modifications	Low	Very Low
Water Quality	Low	Very Low
Archaeology and Palaeontology Impacts (Section 7.4.6)		
Loss of fossil bones and shells during excavation of pylon foundations	Low	Very Low
Terrestrial Biodiversity Impacts (Section 7.4.7)		
Loss of Dune Strandveld	Medium-Low	Very Low
Loss of Flats Strandveld – Alternative route 1 or Preferred Alternative (Construction)	Medium-High	Medium-Low
Loss of Limestone Strandveld – Alternative route 1	Medium-High	Medium-Low
Loss of Flora SCC (Construction)	Medium-High	Low
Loss of Flora SCC (Operation)	Medium-Low	Very Low

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Loss of Fauna SCC	Medium	Very Low
Loss of biodiversity in general (Construction)	Medium-High	Medium-Low
Los of biodiversity in general (Operation)	Medium-Low	Low
Fragmentation (Construction)	Medium	Medium-Low
Fragmentation (Operation)	Low	Very Low
Invasion of alien species	High	Medium-Low
Avifauna Impacts (Section 7.4.8)		
Negative impact of transmission line due to direct impact mortality (or avoidance of area) around any new power line for the Red-listed bird groups (operational phase)	High	Medium-high
Negative impact due to avoidance of the construction area for the transmission line (construction phase)	Low	Low
Major disturbance to (i) harrier breeding habitat and (ii) roosting habitat of the Cape Cormorants by the presence of the Stringing yard	High	Medium
Noise from power generation	Medium-High	Medium
Underwater Noise Impacts (Section 7.4.9)		
No impact		
Underwater Archaeology Impacts (Section 7.4.10)		
Impacts to underwater heritage resources	Low	Low
Marine Ecology and Marine Avifauna Impacts (Section 7.4.11)		
Effects of gas pipeline construction and installation and vessel mooring on the benthic community	Medium-Low	Low
Effects of the intake of cooling water on marine organisms in the surrounding water body	Medium	Medium-Low
The effects on the marine ecology in the receiving water body due to discharge of cooling water or increased noise and vibration levels	Medium-High	Medium
The effects of impacts on ecosystem services (operational phase)	Medium	Medium
Impact on dynamic coastal processes	Medium-Low	Low
Impact of coastal pollution	High	Low
Coastal and Estuary Impacts (Section 7.4.12)		
No impacts		
Atmospheric Impacts and Risks (Section 7.4.13)		
SO_2 ; NO_2 and PM_{10}	Low	Low
Terrestrial Noise Impacts and Risks (Section 7.4.14)		
Noise impacts from construction and operational activities	Medium-Low	Low
Climate Change Impacts and Risks (Section 7.4.15)		
Contribution to climate change	Low (Positive)	Low (Positive)
Socio-Economic Impacts and Risks (Section 7.4.16)		
Temporary increase in the GDP and production of the national and local economies during construction	High (Positive)	High (Positive)
Temporary increase in employment in local and national economies	High (Positive)	High (Positive)

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Contribution to skills development in the country and in the local economy	Medium (Positive)	Medium (Positive)
Temporary improvement of the standard of living of the positively affected households or temporary increase in government revenue	Medium (Positive)	Medium (Positive)
Temporary increase in social conflicts associated with the influx of construction workers and job seekers to the area	Medium-Low	Low
Added pressure on economic and social infrastructure during construction as a result of increase in local traffic and in migration of construction workers	Medium-Low	Low
Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the construction phase	Medium	Low
Temporary increase in the GDP and production of the national and local economies during construction	High (Positive)	High (Positive)
Creation of sustainable employment positions nationally and locally	High (Positive)	High (Positive)
Skills development of permanently employed workers during operations phase	Medium-Low (Positive)	Medium-High (Positive)
Improved standard of living for benefitting households and provision of electricity for future development	Medium-High (Positive)	Medium-High (Positive)
Sustainable increase in national and local government revenue	Medium-High (Positive)	Medium-High (Positive)
Local community and social development benefits derived from the project's operations	Medium (Positive)	Medium-High (Positive)
Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase	Low	Low
Tourism Impacts and Risks (Section 7.4.17)		
Potential negative noise impact in the Saldanha Bay Port on the marine tourism activities.	Low	N/A
Potential negative visual and noise impacts on tourism at Saldanha Bay Port	Low	N/A
Potential positive impacts of Karpowerships electricity provision on the hospitality and tourism industry in the Saldanha Bay	Very High (Positive)	Very High (Positive)
Potential Positive Impacts on Energy and Industrial Tourism in the Saldanha Bay	Low (Positive)	Low (Positive)
Traffic Impacts (Section 7.4.18)		
No impacts.		
Visual Impacts (Section 7.4.19)		
Change the character and sense of place of the landscape setting (Landscape Change) - Powership & FSRU	Low	N/A
Change the character and sense of place of the landscape setting (Landscape Change) - Preferred and Alternative 1 & 2 Power lines	Low	Low

Potential Impact and Risk	Significance	
	Pre-Mitigation	Post Mitigation
Change the character of the landscape as seen from the Saldanha urban area and beach - Powership Alternative 1	Medium	N/A
Change the character of the landscape as seen from • Saldanha urban area and beach - Powership Alternative 2 & Transmission Line • Mykonos - Power Ships Alternatives 1 & 2, FSRU and Transmission Line • Langebaan, Langebaan lagoon and the West Coast National Park - Powership Alternative 1, 2 and Transmission Lines	Low	N/A
Visual impact of operational, safety and security lighting of the facility at night on observers	Low	Low
Major Hazard Installation Risk (Section 7.4.20)		
Impacts are acceptable		
Marine Traffic Impacts and Risk (Section 7.4.21)		
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 traffic, marine traffic, major hazard installation, hydrology, geohydrology, hydropedology, aquatic, underwater noise, coastal and estuary, tourism and visual aspects.

Impacts and risks of very low and low significance were identified for wetlands, archaeology, underwater archaeology, atmospheric emissions, terrestrial noise, tourism and visual impacts and socio-economic. Terrestrial biodiversity impacts ranged from very low to medium low.

Medium high impact was identified for direct impact mortality of red-listed bird groups (or avoidance of area) due to the new power line, which is based on existing data associated with the establishing powerlines (This is not unique to this project). Disturbance to the harrier nesting was identified as medium following the extensive mitigation measures specified which include construction exclusion periods and avifaunal specialist monitoring.

Medium impacts were specified regarding the effects on the marine ecology in the receiving water body due to discharge of cooling water or increased noise and vibration levels of the Powership and the effects of impacts on ecosystem services during the operational phase.

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 medium, medium-high 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 Saldanha 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.

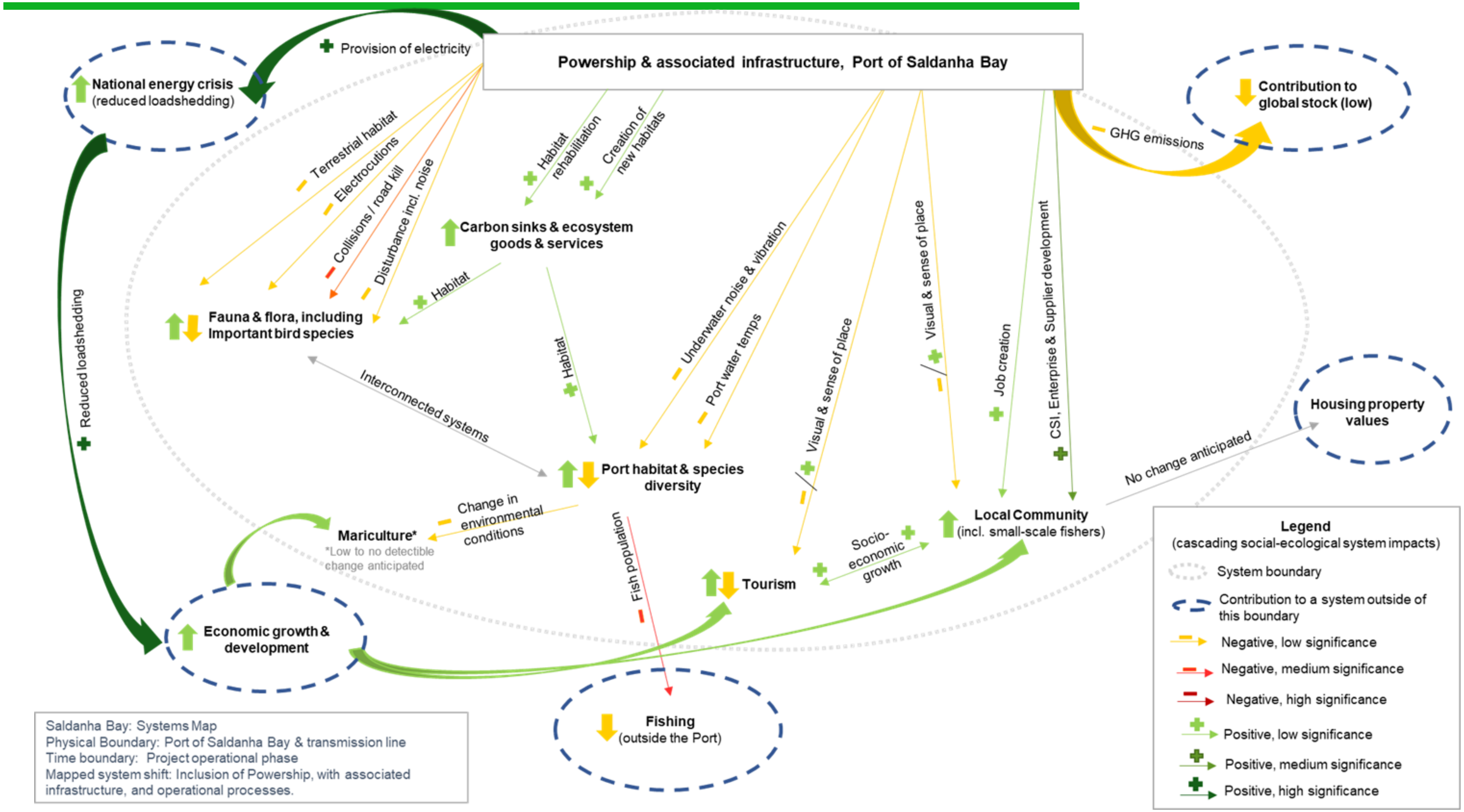

Figure 9-2: System map illustrating the anticipated shifts to the socio-ecology system following the inclusion of the Powership and associated infrastructure in Saldanha Bay (Big Bay)

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 are opportunities for the small-scale fishers and the rest of the community to benefit from corporate social investments, job creation & skills development, and supplier and enterprise development as a result of Karpowership SA's local content commitments. 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.
- Underwater noise and the thermal plume associated with the operations of the Powership, may affect marine life in the port. While low impacts are anticipated associated with the mariculture, it is anticipated that marine mammals may be negatively impacted as a consequence of the long duration of the project (anticipated medium overall environmental significance impact rating). A key concern is the impact on juvenile fish who make use of the port as a nursery. Consequently, this may negatively affect fish populations, which are under strain as a result of longstanding overfishing.
- The terrestrial noise caused by the Powership during electricity generation, on assessment will not extend into residential areas and therefore is not anticipated to affect local communities.
- Noise from power generation could disturb the Black Harriers' nest and Cape Cormorants roost, which lie within the sound bubble of 60-70 decibel, which may have an adverse effect on the birds, although the usual noise level which birds are disturbed and move away from is 100 decibels upwards.
- The proposed powerlines could cause increased collision fatalities for birds as a cumulative impact with the transmission lines that are already in place. There are 0.33 fatalities observed every 1 km along the existing lines. As such there are three alternative powerlines proposed, which could result in the following annual avian fatalities: Preferred route: 2.4 fatalities; Alternative route 1: 2.3 fatalities; Alternative route 2: 2.8 fatalities. It is important to note that the alternative route 2 for the transmission line is not supported because of the presence of the Black Harrier.
- Construction and maintenance of the gas pipeline, transmission line and switching stations is anticipated to result in some loss of some important fauna and flora. Both mitigation recommendations and rehabilitation have been proposed to limit the impacts.
- 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, and industrial processes. The tourism sector may further benefit from peaked interest in the Powerships, yielding 'energy tourism'. This may further stimulate maritime recreational economic opportunities.

- Tropical cyclones are typically high impact low probability hazards and are generally quite difficult to manage because of their unpredictable nature. This has been considered in the design and operational considerations, and therefore the impact is anticipated to be low and will not impact core operations.
- 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 the local scale, 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 rehabilitation of a range of habitats in the vicinity of the Karpowership SA project; 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.

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 Saldanha 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.
- Construction on the project must commence within 18 months of the date of the granting of the authorisation, the date of any related appeal to the Minister or the date of the final judgment of a competent Court, if the granting of the authorisation is taken on review, whichever date is the latest.
- 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.

Signature of EAP

Signature of EAP

07 November 2022
Date

Kindly refer to the Declaration of Interests and Undertaking under Oath attached in Appendix 4.

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