KAOKO GREEN ENERGY SOLUTIONS (PTY) LTD

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

The Proposed "/Hao" Waveroller Pilot Project for the Generation of Electricity by Utilizing Namibia's Ocean Waves Using Waveroller Technology by AW-Energy on Ocean Water

Wlotzkasbaken Settlement, Erongo Region, Namibia

January 2024

Prepared by:

I.N.K Enviro Consultants

Prepared for:

Kaoko GREEN ENERGY SOLUTIONS

DOCUMENT CONTROL	
REPORT TITLE	THE PROPOSED "/HAO" WAVEROLLER PILOT PROJECT FOR THE GENERATION OF ELECTRICITY BY UTILISING NAMIBIA'S OCEAN WAVES USING WAVEROLLER TECHNOLOGY BY AW-ENERGY ON OCEAN WATER LOCATED IN WLOTZKASBAKEN SETTLEMENT, ERONGO REGION, NAMIBIA
I.N.K PROJECT NO	YP2401
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DATE OF REPORT COMPILATION	JANUARY 2024
CURRENT REVISION	DRAFT

CONSULTANT'S EXPERTISE

I.N.K Enviro Consultants cc is the independent firm of environmental consultants that has been appointed by Kaoko Green Energy Solutions (Pty) Ltd to conduct the ESIA process.

Immanuel N. Katali, the Environmental Assessment Practitioner holds a B. Arts (Honours) Geography, Environmental Studies and Sociology and has over seven years of relevant experience in conducting/managing Environmental and Social Impact Assessments (ESIAs), and Environmental Compliance/Monitoring Audits in Namibia. Immanuel is certified as an Environmental Assessment Practitioner under the Environmental Assessment Professionals Association of Namibia (EAPAN).

DECLARATION OF INDEPENDENCE AND DISCLAIMER

I.N.K Enviro Consultants cc herewith declare that this report represents an independent assessment of the proposed "/Hao" Waveroller Pilot Project, on the request of Kaoko Green Energy Solutions (Pty) Ltd.

The Environmental Consultant has prepared this report based on an agreed scope of work and acts in all professional manner as an Independent Environmental Consultant to Kaoko Green Energy Solutions (Pty) Ltd and exercises all reasonable skill and care in the provision of its environmental professional services in a manner consistent with the level of expertise exercised by members of the environmental profession.

The information, statements and commentary contained in this report have been prepared by I.N.K Enviro Consultants cc from information provided by Kaoko Green Energy Solutions (Pty) Ltd and the Public Participation Process. I.N.K Enviro Consultants cc does not express an opinion as to the accuracy or completeness of the information provided, the assumptions made by the party that provided the information or any conclusions reached. I.N.K Enviro Consultants cc has based this report on information received or obtained, on the basis that such information is accurate and, where it is represented to I.N.K Enviro Consultants cc as such, complete.

I.N.K Enviro Consultants cc is not responsible and will not be held liable to any other person or organization for any loss or damage suffered by any other person or organization arising from matters dealt with or conclusions expressed in this report.

This report is the sole property of Kaoko Green Energy Solutions (Pty) Ltd and must not be altered or added to without the prior written consent of Kaoko Green Energy Solutions (Pty) Ltd.

EXECUTIVE SUMMARY

Project Background

Kaoko intends to apply for an Environmental Clearance Certificate (ECC) for its proposed "/Hao" WaveRoller pilot project for the generation of electricity by utilizing Namibia's ocean waves using WaveRoller technology on ocean water. The pilot project proposes to install five (5) WaveRoller devices using its technology to convert wave energy to electricity that will be transmitted via subsea and onshore underground power transmission cables from the offshore site to a Containerized Officeand NamPower substation located onshore (A separate ESIA report assessing the underground power cable is compiled).

The proposed development will be an offshore integrated green power and transmission system powered by clean energy, located approximately 1 km from the coastline and 5 km north-west of Wlotzkasbaken settlement, Erongo Region, Namibia. In terms of the bathymetry, the proposed study site lies between 0 - 200 meters (m) below sea level.

Project Need and Desirability

Currently the transition towards more sustainable energy production is mainly being implemented by wind and solar power installations. The major issue with the approach comes with the times of no sunshine and calm winds. Wave energy flows both during the night and day from the constant ocean waves that roll into Namibia's coastline. These waves have their origins far away in the ocean and by the time they reach Namibia their energy is, over the year, on average 25 to 35 kW per metre and the total theoretical potential of near-shore wave energy in Namibia is more than 10 GW. Complementary technologies that have the capacity to generate renewable electricity at all times is essential to achieve both deeper decarbonization and affordable electricity.

Namibia is blessed with substantial wave energy resource, that constitutes a comparative national advantage that the country can use to its long-term socio-economic benefit. But despite the abundance of this natural blessing, the productive use remains unknown in Africa in general and Namibia in particular. There is no compelling reason why the use of wave energy to generate electricity through energy efficient technologies cannot be dramatically accelerated to contribute to Namibia's development, considering the countries' high renewable energy capacity.

In addition, Namibia's vision 2030, launched in 2004 and aiming to provide long-term policy scenarios on the future course of development in the country at different points in time until

2030, sets out the objective to achieve security of energy supply through an appropriate diversity of economically competitive and reliable resources, to ensure that households and communities have access to affordable and appropriate energy supplies and to establish and efficient energy sector that makes contributions to Namibia's economic competitiveness. Vision 2030 defines as one of its strategies - the promotion of renewable energy sources and the implementation of projects for production from these sources to meet industry demand (Namibia Planning Commission, 2004).

The Harambee Prosperity Plan II (HPPII) (covering the period 2021 - 2025) builds on the solid foundation of the inaugural HPP 2016 - 2020. It continues to prioritize the implementation of targeted policy programme in order to enhance service delivery, contribute to economic recovery and engender inclusive growth. HPPII aims to increase local electricity generation capacity from 624 MW (2020) to 879 MW by 2025 (Government of Namibia, 2021).

The Government of Nambia is encouraging energy projects in the country to reduce the overall NamPower tariff to the customer. It is against this background, that the specific site has been identified as an area earmarked for the deployment of the WaveRoller technology. Therefore, the proposed project will form the basis of electricity from ocean waves and contribute to Namibia's Renewable Energy Policy Framework to ensure the above-mentioned renewable energy plans are effectively and successfully carried out.

Public Participation Process

The public participation process for the proposed project is conducted to ensure that all persons and/or organisations that may be affected by, or interested in the proposed project, were informed of the project and could register their views and concerns. By consulting with relevant authorities and I&APs, the range of environmental issues to be considered in this Report has been given specific context and focus.

General Assumptions and Limitations

The key assumptions and limitations of this ESIA Report are detailed below.

- It is assumed that the information provided by Kaoko, relating to the project activities is accurate and that the project will be implemented and operated as described.
- The predictions of the impacts of the WaveRoller devices on the marine environment need to be validated by regular field observations and subsequent monitoring.

- The extent of the impacts and assessment ratings are not quantified over the larger project area. The potential impact rating and extent is determined only as per the direct impact surrounding the specific devices.
- The results of specialist study formed the basis for the assessment of impact significance. The specialist investigations are conducted by an independent specialist considered to be experts in their fields. It was assumed that the information from these sources is relevant and accurate.
- Considering the dynamic nature of the marine environment and its susceptibility to the influence of climate change e.g. sea level rise, increases in frequency of wave storms, are not evidently considered in this study.
- Area is frequented by the Orano Desalination Plant activities, recreational fishers and off-road driving, as such the beach area is not pristine.

Applicable Laws, Policies and Regulations

As the main source of legislation, the Constitution of the Republic of Namibia (1990) makes provision for the creation and enforcement of applicable legislation. In this context and in accordance with its constitution, Namibia has passed numerous laws intended to protect the natural environment and mitigate against adverse environmental impacts.

The management and regulation of the activities in the Namibian ocean fall within the jurisdiction of the Ministry of Fisheries and Marine resources. The environmental regulations are guided and implemented by the DEA within the MEFT.

In the context of the proposed project activities, there are several laws and policies currently applicable.

The Marine resources Act 27 of 2000 provides for the conservation of the marine ecosystem; the responsible utilization, conservation, protection, promotion of marine resources in a sustainable manner and for the control of marine resources for these purposes. The Minister of Fisheries is empowered to make regulations under section 61 on a broad number of topics including "regulating or prohibiting the discharge in the sea or discarding on the seashore and land of specified substances or materials, or substances or materials not complying with specified requirements or having specified properties"

The EIA Policy (1995) is enforced through the Environmental Management Act, 7 of 2007 and the EIA Regulations of 6 January 2012 (EIA Regulations). In terms of this legal framework

certain identified activities may not commence without an environmental clearance issued by MEFT.

Identification of Potential Environmental Aspects and Potential Impacts

The scoping phase which included a consultation process with key stakeholders that included government authorities and I&APs allowed the opportunity to raise the issues associated with the project development. It was identified that; the Marine Ecological Impacts will need to be further assessed.

Assessment Approach and Methodology

The assessment largely adopted a desktop approach, where qualitative information on the intertidal environment was collected during a site visit and a beach survey conducted on 01 December 2023. The extent of the impacts and assessment ratings are not quantified over the larger project area. The potential impact rating and extent is determined only as per the direct impact surrounding the specific devices.

The beach survey collected sediment for grain size analysis, wave data entailing the height and frequency, as well as sediment samples for invertebrates. Counts of avifauna and marine flora were also taken into consideration. No exploratory dives and sediment grab sampling were carried out in deeper water of the proposed location. This approach is deemed adequate for placing into context the potential impacts associated with the establishment of wave rollers as proposed for this pilot project.

An assessment of the potential positive and negative impacts associated with the installation and operations phase of the proposed pilot project is provided below. As an outcome of the Scoping Phase, specialist input was requested for some of the environmental issues and has been included in this assessment.

Other potential environmental impacts resulting from the proposed project activities and facilities (also identified during the Scoping Phase of the ESIA) were assessed by I.N.K and are also presented below.

Impacts are considered in a cumulative manner where possible such that the impacts of the proposed Project are seen in the context of the baseline conditions described in Section 6. Information that has been included in Section 6 will not be repeated in this Section.

- Both the criteria used to assess the impacts and the Method of determining the frequency/severity of the impacts is outlined in Impacts on the Marine Ecology.

Conclusions and Recommendations

The proposed area overlaps with other coastal activities and proposed activities may lead to exclusion of other users; hence the need for planned and well-coordinated efforts to ensure optimal use of this space of the ocean. Furthermore, the area could also be important ecological niche for various marine flora and fauna including zooplanktons, benthic fauna, fish species, and cetaceans. Proposed installation of WaveRoller devices will be temporary and localized, however, the assessment had identified measures to mitigate anticipated impacts on VECs (valued ecosystem components). VECs are essential components of the ecosystem which include ambient air, seawater and sediment quality and marine flora and fauna.

Project activities will potentially affect the benthic environment, water and sediment quality as well as phytoplankton and zooplankton communities. The potential impacts on fish, marine mammals and avifauna are not expected to be significant compared to potential impacts on benthic species, phytoplankton and zooplankton communities. The potential disturbance of benthic biodiversity will be due to the direct contact of the WaveRoller device, on the seafloor where the benthnic community is found. However, with mitigation measures in place, these potential impacts can be minimized and reduced.

The mitigation measures that have been identified and recommended by I.N.K will promote the positive impacts of the project, as well as reduce the negative impacts to acceptable levels. An ESMP was further developed which identifies potential impacts of the project during the installation and operation phases. The ESMP is a legally binding document to which Kaoko must adhere to.

Despite these impacts, I.N.K concludes that the Proponent should be allowed to undertake the proposed activities, provided the potential impacts in the ESMP are mitigated.

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LIST OF ACRONYMS, ABBREVIATIONS AND UNITS

Acronyms / Abbreviations / Units	Definition
BCLME	Benguela Current Large Marine Ecosystem
BID	Background Information Document
CO_2	Carbon Dioxide
DAE	Department of Agricultural Engineering
DEA	Directorate of Environmental Affairs
DO	Dissolved Oxygen
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate

Acronyms / Abbreviations / Units	Definition
EEZ	Exclusivee Economic Zone
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMA	Environmental Management Act
ESF	Environmental and Social Framework
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Safeguard
GW	GigaWatt
ha	Hectares
HAB	Harmful Algae Blooms
IPF	Investment Project Financing
IRR	Issues and Response Report
IMO	International Maritime Organization
I&APs	Interested and Affected Party
Km	Kilometer
kW	kiloWatt
M	Meter
MAWLR	Ministry of Agriculture, Water and Land Reform
MD	Ministry of Defense
MEFT	Ministry of Environment, Forestry and Tourism
mm	Millimeter
MME	Ministry of Mines and Energy
MWh	MegaWatt
MWT	Ministry of Works and Transport
NACOMA	Namibian Coast Conservation and Management
NAMPOWER	Namibia Power Corporation
NDP	National Development Plan
PAN	Pesticides Action Network
PPAH	Pollution Prevemtion and Abatement Handbook
PPP	Public Participation Process
PTO	Power Take-Off
SEA	Strategic Environmental Assessment
SOLAS	Safety of Life at SEA
SST	Sea Surface Temperature

1 INTRODUCTION

1.1 Purpose of the Report

Kaoko Green Energy Solutions (Pty) Ltd (hereinafter referred to as "Kaoko") plans to implement the proposed "/Hao" WaveRoller Pilot Project.

Three (3) separate Environmental Clearance Certificate (ECC) Applications have been submitted to the Ministry of Environment, Forestry and Tourism (MEFT) for: a) the deployment of the WaveRoller technology, by AW-Energy (Finland) in the Atlantic Ocean, b) the installation of power transmission cables and b) subdivision of the industrial land.

This report focuses only on the proposed deployment of the WaveRoller technology in the Atlantic Ocean.

Interested and/or Affected Parties (I&APs) relating to the proposed pilot project are invited to comment on this Report. The final report, including comments received from I&APs, will be submitted to the Ministry of Fisheries and Marine Resources (MFMR), Ministry of Mines and Energy (MME) and Ministry of Works and Transport, as the Competent Authorities, for their review and consideration. In terms of Section 32 of the Environmental Management Act, 2007 (No. 7 of 2007), MFMR and MME are required to make recommendations on the acceptance or rejection of the report to the Ministry Environment ,Forestry and Tourism (MEFT): Department of Environmental Affairs (DEA), who will make the final decision on the application for an environmental clearance.

Prior to the commencement of the project, an environmental clearance is required based on an approved Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP). This report describes the Environmental and Social Impact Assessment (ESIA) process being followed and provides an overview of the affected environment. It includes an assessment of the environmental impacts that the proposed activities are likely to have and sets out the consultants' recommendations. The proposed management and mitigation measures related to the proposed activities are documented in an Environmental and Social Management Plan (ESMP).

1.2 Project Background

Kaoko intends to apply for an Environmental Clearance Certificate (ECC) for its proposed "/Hao" WaveRoller pilot project for the generation of electricity by utilizing Namibia's ocean waves using WaveRoller technology on ocean water. The pilot project proposes to install five (5) WaveRoller devices using its technology to convert wave energy to electricity that will be transmitted via subsea and onshore underground power transmission cables from the offshore site to a Containerized Officeand NamPower substation located onshore (A separate ESIA report assessing the underground power cable is compiled).

The proposed development will be an offshore integrated green power and transmission system powered by clean energy, located approximately 1 km from the coastline and 5 km north-west of Wlotzkasbaken settlement, Erongo Region, Namibia (Figure 1). In terms of the bathymetry, the proposed study site lies between 0 - 200 meters (m) below sea level.

Kaoko, is a Namibian private energy-generation assets development company, with its mission anchored in the potent forces of sustainability - wave, solar and wind. The company has identified the power of Namibia's coastal waves and through a pilot project, WaveRoller devices will be deployed in the Namibia water to generate clean and affordable electricity from ocean waves and then deliver that 200 MWh per year of electricity to communities close to the coast of the Erongo Region in Namibia and tap into Southern Africa Power Pool (SAAP). This development and generation of electricity from WaveRoller devices promises to breathe new life into the Wlotzkasbasken settlement area.

The project will be located in the Atlantic Ocean where the flow of energy through waves is abundantly available both during the day and night. Wave energy changes at a much lower rate and is more predictable than wind and solar. These characteristics prompt the development of the technology and provide security of energy supply.

I.N.K Enviro Consultants cc (hereinafter referred to as I.N.K), an independent firm of environmental consultants, has been appointed to undertake the Environmental and Social Impact Assessment process for this project. For more details on the ESIA process that was followed, please refer to Section 1.4.

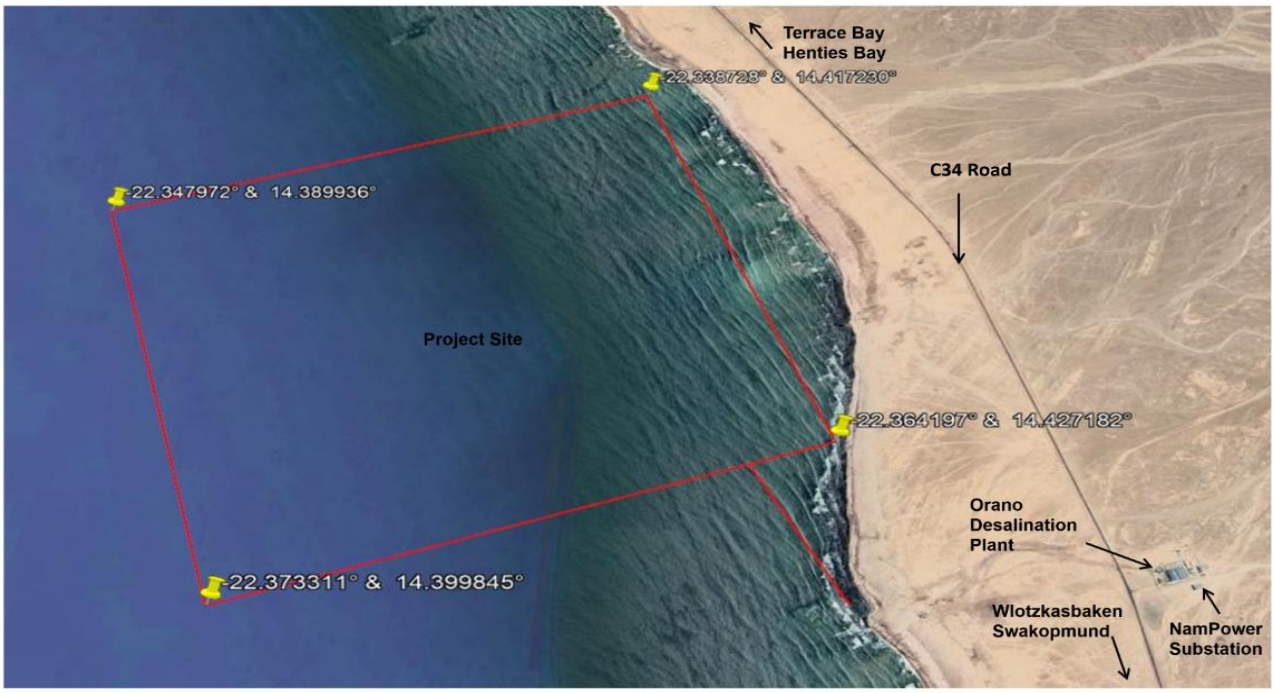

Figure 1: Project Site Layout

1.3 Project Need and Desirability

Currently the transition towards more sustainable energy production is mainly being implemented by wind and solar power installations. The major issue with the approach comes with the times of no sunshine and calm winds. Wave energy flows both during the night and day from the constant ocean waves that roll into Namibia's coastline. These waves have their origins far away in the ocean and by the time they reach Namibia their energy is, over the year, on average 25 to 35 kW per metre and the total theoretical potential of near-shore wave energy in Namibia is more than 10 GW. Complementary technologies that have the capacity to generate renewable electricity at all times is essential to achieve both deeper decarbonization and affordable electricity.

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despite the abundance of this natural blessing, the productive use remains unknown in Africa in general and Namibia in particular. There is no compelling reason why the use of wave energy to generate electricity through energy efficient technologies cannot be dramatically accelerated to contribute to Namibia's development, considering the countries' high renewable energy capacity.

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1.4 Introduction to the Environmental and Social Impact Assessment Process

Environmental and Social Impact Assessments are regulated by the Ministry of Environment, Forestry and Tourism (MEFT) in terms of the Environmental Management Act, 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and enacted on 6 January 2012. The Environmental and Social Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) were promulgated on 6 January 2012.

ESIA Process

The ESIA process that has been followed is summarized in the table below:

Table 1: ESIA Process

ESIA OBJECTIVES	CORRESPONDING ACTIVITIES
Project initiation, Screening Phase	
◆ Understanding of the environmental and social baseline relating to the proposed Project. ◆ Notify the decision-making authority of the proposed Project. ◆ Initiate the Environmental and Social Impact Assessment process. ◆ Site visits and identify environmental issues. ◆ Identify key stakeholders and early identification of other I&APs.	◆ Project Inception and initiation meetings to discuss the Project and ESIA process requirements. ◆ Liaise with the Marine Ecology Specialist. ◆ Draft ESIA Schedule. ◆ Initiate baseline studies. ◆ Submit Application for authorisations and a Background Information Document (BID) to the authorities. ◆ Register the Project and Applications for environmental clearances with MEFT (DEA) on its online portal. ◆ Early identification of environmental aspects and potential impacts associated with the proposed Project.
Scoping Phase	
◆ Notify other regulatory authorities and I&APs of the proposed Project (via newspaper advertisements, BID, emails, site notices and telephone calls). ◆ Conduct Key Stakeholder and Public meetings. ◆ Carry out specialist investigations and establish baseline environmental conditions. ◆ Determine the terms of reference for additional assessment work. ◆ Compile Scoping Report and Issues and Response Report (IRR) ◆ Distribute the Scoping Report for review and comment by relevant authorities and I&APs. ◆ Assessment of potential issues, consider comments received and compile the ESIA final report.	◆ Develop Public Participatory Process (PPP) Programme. ◆ Develop I&AP database. ◆ Prepare BID and distribute to I&APs. ◆ Notify government authorities and IAPs of the Project and ESIA process (telephone calls, e-mails, BID newspaper advertisements and site notices). ◆ IAP registration and comments. ◆ Meetings with authorities and IAPs. ◆ Investigations by appointed specialists. ◆ Compilation of Scoping Report and ESMPs. ◆ Distribute Scoping Report and ESMP to all I&APs for review and comments. ◆ Assess potential issues, obtain comments and update the Scoping Report and ESMP.

Within this framework, the required components of the ESIA report are discussed in more detail as part of the ESIA Methodology in Section 8.

ESIAs are influenced by national legislation and a range of guidelines. The legislation applicable to this project and the ESIA process is discussed further in Section 3 below.

1.4.1 ESIA Team

I.N.K Enviro Consultants cc is the independent firm of consultants that has been appointed by Kaoko to undertake the Environmental and Social Impact Assessment and related processes. The full ESIA team comprises of a Marine Ecologist as per the following table below.

Table 2: ESIA Team

Specialist	Designation	Tasks and Roles	Company
Mr. Immanuel N. Katali	Project Manager Social Expert	Management of the process, team members and other stakeholders. Report compilation and process review.	I.N.K Enviro Consultants cc
Ms. Mayday Haulofu	Marine Ecology Specialist	Marine Ecology Assessment	Envirodu Consulting and Training Solutions

2 SCOPING METHODOLOGY

2.1 Information Collection

An assessment focusing on the potential aquatic and marine disturbance and displacement and looking at the potential marine fauna and flora impacts as a result of the project was conducted.

From desktop study methodology and literature review, the description will be based on, inter alia, a review of existing information and data from local and international scientific literature and information sourced from the internet sources and complemented by a beach survey in the proposed area.

Therefore, I.N.K used various information sources to identify and assess the issues associated with the proposed project as per the following:

- Site visit by I.N.K.
- Consultation with Kaoko Project Technical Team.
- Consultation with MEFT via online application system.
- Similar ESIA report in the vicinity of Wlotzkasbaken - Desalination Plant and Water Carriage System to Secure Water Supply to the Central Coast, Windhoek And En-Route Users (SLR, 2021).
- Other WaveRoller ESIAs conducted in Europe.
- Consultation with I&APs.
- Atlas of Namibia.
- Google Earth.
- Internet sources.

2.2 Scoping

The main purpose of scoping is to indicate which environmental aspects relating to the proposed project might have an impact on the environment, to assess them and provide management and mitigation measures to avoid or minimise these impacts.

Table 3 outlines the Scoping requirements as set out in Section 8 of the Environmental and Social Impact Assessment Regulations that were promulgated in January 2012 in terms of the Environmental Management Act, 7 of 2007.

Table 3: Scoping requirements stipulated in the ESIA regulations.

Requirements for a Scoping Report in terms of the February 2012 regulations	Reference in report
(a) the curriculum vitae of the EAP who prepared the report;	Appendix A
(b) a description of the proposed activity;	Section 4
(c) a description of the site on which the activity is to be undertaken and the location of the activity on the site;	Section 4
(d) a description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed listed activity;	Sections 6
(e) an identification of laws and guidelines that have been considered in the preparation of the Scoping Report;	Section 3
(f) details of the public consultation process conducted in terms of regulation 7(1) in connection with the application, including - (i) the steps that were taken to notify potentially interested and affected parties of the proposed application; (ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given; (iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 22 as interested and affected parties in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	Sections 2.3, 2.4, 2.5 and Appendix B
(g) a description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives have on the environment and on the community that may be affected by the activity;	Sections 1.2
(h) a description and assessment of the significance of any significant effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the proposed listed activity;	Sections 7 and 8
(i) terms of reference for the detailed assessment; and	Section 7 & 8
(j) a management plan, which includes -	Section 9

(i) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure; (ii) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and (iii) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process that causes pollution or environmental degradation and remedy the cause of pollution or degradation and migration of pollutants.	

2.3 Public Participation Process

The public participation process for the proposed project is conducted to ensure that all persons and/or organisations that may be affected by, or interested in the proposed project, were informed of the project and could register their views and concerns. By consulting with relevant authorities and I&APs, the range of environmental issues to be considered in this Report has been given specific context and focus.

Included below is a summary of the I&APs consulted, the process that was followed and the issues that were identified.

2.4 The Proposed ("Hao") WaveRoller Pilot Project I&APs

The table below provides a broad list of persons, group of persons or organisations that were informed about the project and were requested to register as I&APs should they be interested and/or affected.

Table 4: Kaoko's Project Stakeholders

IAP Grouping	Organisation
Government Ministries	◆ Ministry of Environment, Forestry and Tourism (MEFT) ◆ Ministry of Fisheries and Marine Resources (MFMR) ◆ Ministry of Mines and Energy ◆ Ministry of Works and Transport (MWT) ◆ Ministry of Defense (MD)
Local Authorities	◆ Erongo Regional Council

IAP Grouping	Organisation
	◆ Arandis Constituency Office ◆ Wlotzkasbaken Settlement Office
Parastatal	◆ Nampower ◆ Electricity Control Board. ◆ ErongoRed ◆ Namport ◆ Namwater ◆ University of Namibia - Sam Nujoma Campus
Nearest Communities	◆ Orano Desalination Plant ◆ Residents in Wlotzkasbaken
Media	Newspaper adverts placed on Friday, 10 and Friday, 17 November 2023, in the following newspapers: ◆ Die Republikein ◆ The Allgemeine ◆ The Namibian Sun. ◆ The Namib Times.
Other interested and affected parties	Any other people with an interest in the proposed project or who may be affected by the proposed project.

2.5 Steps in the Consultation Process

Table 5 sets out the steps that were followed as part of the consultation process:

Table 5: Consultation Process with I&APs and Authorities

TASK	DESCRIPTION
Notification - regulatory authorities and IAPs	
Notification to MEFT	I.N.K submitted the Application Form (online system) as a form of project registration and notification to MEFT.
I&AP identification	A stakeholder database was developed for the proposed project and ESIA process. Additional I&APs will be updated during the ESIA process as required.
Distribution of background information	BIDs were made available to all I&APs on the project's stakeholder database. Copies of the BID were available on request to I.N.K.

TASK	DESCRIPTION
Notification - regulatory authorities and IAPs	
document (BID), flyers and stakeholders meeting invitation letters	Stakeholder meeting invitation were given out to the residents of Wlotzkasbaken. The purpose of the BID was to inform I&APs and authorities about the proposed project, the ESIA process, possible environmental impacts and means of providing input into the ESIA process. Attached to the BID was a registration and response form, which provided I&APs with an opportunity to submit their names, contact details and comments on the project.
Newspaper Advertisements	Block advertisements were placed as follows: ◆ Die Republikein (10 and 17 March 2023) ◆ The Namibian Sun (10 and 17 March 2023) ◆ Allgemeine (10 and 17 March 2023) ◆ The Namib Times (10 and 17 March 2023)
Scoping Meetings	Several consultations were made with I&APs. This included meetings and telephonic discussions. Meetings were held with key stakeholders as follows: ◆ Date - Tuesday, 28 November 2023 ◆ Venue - The Orano Desalination Plant Conference Room ◆ Date - Friday, 01 December 2023 ◆ Venue - The New Erongo Regional Council Offices in Wlotzkasbaken The due date to register as an I&AP and submit comments was from 10 November 2023 to 07 December 2023.
Comments and Responses	Minutes and Issues and Response of the meetings were recorded.
MEFT review of ESIA Report and ESMP	A copy of the final Scoping Report, including authority and I&AP review comments, will be submitted to MEFT on completion of the public review process via the online application system.

2.6 General Assumptions and Limitations

The key assumptions and limitations of this ESIA Report are detailed below.

- It is assumed that the information provided by Kaoko, relating to the project activities is accurate and that the project will be implemented and operated as described.

- The predictions of the impacts of the WaveRoller devices on the marine environment need to be validated by regular field observations and subsequent monitoring.
- The extent of the impacts and assessment ratings are not quantified over the larger project area. The potential impact rating and extent is determined only as per the direct impact surrounding the specific devices.
- The results of specialist study formed the basis for the assessment of impact significance. The specialist investigations are conducted by an independent specialist considered to be experts in their fields. It was assumed that the information from these sources is relevant and accurate.
- Considering the dynamic nature of the marine environment and its susceptibility to the influence of climate change e.g. sea level rise, increases in frequency of wave storms, are not evidently considered in this study.
- Area is frequented by the Orano Desalination Plant activities, recreational fishers and off-road driving, as such the beach area is not pristine.

3 IDENTIFICATION OF APPLICABLE ENVIRONMENTAL AND SOCIAL GUIDELINES

3.1 Introduction

The Republic of Namibia has five tiers of law and several policies relevant to environmental assessment and protection, which include:

- The Constitution.
- Statutory law.
- Common law.
- Customary law.
- International law.

As the main source of legislation, the Constitution of the Republic of Namibia (1990) makes provision for the creation and enforcement of applicable legislation. In this context and in accordance with its constitution, Namibia has passed numerous laws intended to protect the natural environment and mitigate against adverse environmental impacts.

The management and regulation of the activities in the Namibian ocean fall within the jurisdiction of the Ministry of Fisheries and Marine resources. The environmental regulations are guided and implemented by the DEA within the MEFT.

In the context of the proposed project activities, there are several laws and policies currently applicable.

The Marine resources Act 27 of 2000 provides for the conservation of the marine ecosystem; the responsible utilization, conservation, protection, promotion of marine resources in a sustainable manner and for the control of marine resources for these purposes. The Minister of Fisheries is empowered to make regulations under section 61 on a broad number of topics including "regulating or prohibiting the discharge in the sea or discarding on the seashore and land of specified substances or materials, or substances or materials not complying with specified requirements or having specified properties"

The EIA Policy (1995) is enforced through the Environmental Management Act, 7 of 2007 and the EIA Regulations of 6 January 2012 (EIA Regulations). In terms of this legal framework

certain identified activities may not commence without an environmental clearance issued by MEFT.

3.2 Applicable Authorities

3.2.1 Ministry of Environment, Forestry and Tourism

The mission of the Ministry of Environment, Forestry and Tourism is to promote biodiversity conservation in the Namibian environment through the sustainable utilization of natural resources and tourism development for the maximum social and economic benefit of its citizens. MEFT develops, administers and enforces environmental legislation and policy.

The MEFT's Department of Environmental Affairs ("DEA") is mandated to give effect to Article 95L of the Constitution by promoting environmental sustainability. The Environmental Commissioner serves as head of the DEA. The DEA is responsible for, inter alia, the administration of the EIA process undertaken in terms of the Environmental Management Act, 2007 and the EIA Regulations 2012. The DEA will be responsible for issuing a decision on the application for an ECC, based on the recommendations from MFMR and MME. If approved, the DEA will issue an Environmental Clearance Certificate.

3.2.2 Ministry of Fisheries and Marine Resources (MFMR)

The Ministry of Fisheries and Marine Resources is responsible for the management and development of fisheries and aquaculture in Namibia. The Ministry is comprised of four directorates; two of which include the Directorate of Resource Management and Directorate of Operations and Surveillance.The Directorate of Resource Management is responsible for scientific research and providing advice on the state of commercially important marine fish stocks and recommending catch quotas. It is also responsible for managing and regulating species fish size limits, dates of closed fishing seasons, declaring areas closed to fishing and determining fishing gear use.

The Directorate of Operations and Surveillance is responsible for monitoring, controlling and surveillance of fishing-related activities both at sea and onshore.

The MFMR is a key stakeholder in the project and the ESIA process due to the proposed deployment of the WaveRoller technology (refer to Section 4). The WaveRoller technology has

the potential to have both negative and positive impact on the marine ecology and the fishing industry.

3.2.3 Ministry of Mines and Energy (MME)

The MME comprises six directorates; one of which is the Directorate of Energy. The Directorate of Energy consists of 2 divisions:

- Electricity Division
- Renewable Energy Division

The Directorate of Energy enforces the compliance of legal requirements of energy legislation (Electricity Act, 2007) and regulations and researches new and renewable sources of energy. The National Integrated Resource Plan is a 20-year development plan for Namibia's Electricity Supply Industry, spanning the period between 2016 and 2035.The Directorate conducts functions such as:

- Implementation of Rural Electrification
- Implementation of Off-Grid Energisation Master Plan

The mandate of the Energy directorate is to ensure the adequate and affordable energy supply in a sustainable manner taking advantage of Namibia's natural resources in support of the nation's socioeconomic development. The MME is a key stakeholder in the project and the ESIA process due to the proposal for the deployment of the Wave Roller technology to generate electricity and feeding energy into the grid.

The Namibia Power Corporation (Pty) Ltd ("NamPower") is Namibia's national power utility, whose core business is the generation, transmission and energy trading and its mission is to provide for the energy needs of its customers. NamPower supplies bulk electricity to regional electricity distributors, mines, farms and local authorities throughout Namibia.

3.3 The Integrated Coastal Management Bill

Once enacted, the Integrated Coastal Management Bill (2014) aims to establish a system of integrated coastal management in Namibia in order to promote the conservation of the coastal environment, maintaining the natural attributes of the coastal landscapes and seascapes, and ensuring the sustainable development and use of the natural resources within the coastal zone that is also socially, economically and ecologically justifiable.

3.4 Coastal Strategic Environmental Assessments

Two Namibian coastal Strategic Environmental Assessments (SEAs) were undertaken between 2006 and 2008, i.e. one for the northern regions of Kunene and Erongo and another for the southern regions of Karas and Hardap. These draw on international experience and were undertaken at a time of mounting production sector pressures within Namibia. Being an initiative of the Namibian Government through MEFT, the two SEAs seek to inform political and technical decision makers at local, regional and national levels.

The 2008 "SEA for the coastal areas of the Erongo and Kunene Regions" compiled by the Namibian Coast Conservation & Management Project (NACOMA) is aimed at ensuring informed decisions on issues related to biodiversity conservation, land use planning and socio-economic development planning in the Kunene and Erongo coastal regions.

3.5 Relevant Namibian Policies

Namibia's policies provide the framework to the applicable legislation. Whilst policies do not often carry the same legal recognition as official statutes, policies are used in providing support to legal interpretation or guidance for civil servants and other stakeholders in the implementation of government objectives.

3.5.1 The Namibia Vision 2030

The principles that underpin Vision 2030 , a policy framework for Namibia's long-term national development, comprise the following:

- Good governance;
- Partnership;
- Capacity enhancement;
- Comparative advantage;
- Sustainable development;
- Economic growth;
- National sovereignty and human integrity;
- Environment; and
- Peace and security.

Vision 2030 states that natural environments are disappearing quickly. Consequently, the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets. Vision 2030 emphasises the importance of promoting healthy living which includes that the majority of Namibians are provided with safe drinking water. The importance of developing wealth, livelihood, and the economy is also emphasized by Vision 2030. This includes infrastructure provision like transport, communication, water, and electricity.

3.5.2 The Harambee Prosperity Plan II

The Harambee Prosperity Plan II (HPPII) (covering the period 2021 - 2025) builds on the solid foundation of the inaugural HPP 2016 - 2020. It continues to prioritize the implementation of targeted policy programme in order to enhance service delivery, contribute to economic recovery and engender inclusive growth. HPPII aims to increase local electricity generation capacity from 624 MW (2020) to 879 MW by 2025.

3.6 Other Relevant Local Policies and Legislation

Below (Table 6) is a list of other applicable local policies and legislation for the proposed project.

Table 6: List of local policies and legislation

Legislation	Summary	Environmental principles
Marine Resources Amendment Act no. 9 of 2015, Marine Resources Act 27 of 2000	This act provides for the sovereign exercise of ownership by the State over marine resources; to amend the provisions relating to the total allowable catch and allocation of quotas	Principles of this act is to manage, protect, harvest and utilize marine resources in Namibia.
Marine Traffic Act (no. 2 of 1981) as Amended Namibian Ports Authority Act of 1991	Ships may not be repaired within territorial sea or internal waters outside a harbor or fishing. No person shall sink a ship or dump ship wreck within territorial sea or internal waters outside a harbor or fishing.	Prevention of waste from ship repairs and ship wrecks.
Pollution Control and Waste Management Bill	This Act promote sustainable development; to provide for the establishment of a body corporate to be known as the Pollution Control and Waste Management Agency; to prevent and regulate the discharge of pollutants to the air, water and land; to make provision for the establishment of an appropriate	The environmental principle specific to this Bill is pollution control.

	framework for integrated pollution prevention and control; to regulate noise, dust and odor pollution; to establish a 'system of waste planning and management; and to enable Namibia to comply with its obligations under international law in this regard.	
Territorial sea and exclusive economic zone of Namibia Act 3 of 1990	This Act determines and defines the territorial sea, internal waters, contiguous zone, exclusive economic zone and continental shelf of Namibia and to provide matters incidental thereto.	Minimize the exploitation of natural resources of the sea.
Walvis Bay and Offshore Islands Act 1 of 1994	An Act to make provision for the smooth transfer of control over Walvis Bay and the offshore islands from the Republic of South Africa to the Republic of Namibia effective as of 1 March 1994.	Provide provision for governance; fishing authorization, fishery management and conservation.
Namibia Ports Authority Act 2 of 1994	To provide for the establishment of the Namibia Ports Authority to undertake the management control of ports and lighthouse in Namibia and the provision of facilities and services related thereto.	To manage and exercise control over the operation of ports and lighthouse and other navigational aids in Namibia and its territorial waters.
Aquaculture Act 18 of 2002	This Act regulate and control aquaculture activities; to provide for the sustainable development of aquaculture resources; and to provide for related matters.	Environmental principles of this act are to promote sustainable aquaculture; management, protection and conservation of marine and onshore aquatic ecosystems.
Animal Health Act 1 of 2011	This Act predominantly deals with *prevention, monitoring* and *control* of animal diseases in order to protect public health but it also has other provisions (such as trade) that not relevant to the environment.	To prevent and control animal diseases in public and environment
Urban and Regional Planning Act no. 5 of 2018	This Act consolidate the laws relating to urban and regional planning; to provide for a legal framework for spatial planning in Namibia; to provide for principles and standards of spatial planning.	Environmental principles specific to this act are: harmonization and streamlining of spatial planning in order to avoid land use conflicts, delays in decision making and to minimize negative environmental impacts.
Atmospheric Pollution Prevention Ordinance 11 of 1976	To provide for the prevention of the pollution of the atmosphere	To prevent atmospheric pollution and minimize environmental impacts associated with it.
Water Resources Management Act 11 of 2013	To provide for the management, protection, development, use and conservation of water resources; to provide for the regulation and monitoring of water services and to provide for	Manage water resources, prevent water pollution and control water storage and provision.

	incidental matters.	
Public and Environmental Health Act 1 of 2015	To provide a framework for a structured uniform public and environmental health system in Namibia.	Principles of this act includes protecting individuals and communities from public health risks, encourage community participation in order to create a healthy environment; and provide for early detection of diseases and public health risks.
National Climate Change Policy	This policy identifies technology development and transfer to be a key issue for which strategies and action plans should be developed.	Promote and encourage new and clean technologies to be developed in order to reduce greenhouse gas emissions.

3.7 Relevant International Standards

3.7.1 The EIB's Statement of Environmental and Social Principles and Standards (EIB, 2009)

The European Investment Bank (EIB) adopted an Environmental Statement in 1996 to underline its commitment to protecting and improving the natural and built environment according to EU policy (EIB, 209). The statement focuses on, a) the principles on which the EIB approach to environmental and social issues are based and b) the environmental and social performance standards that ensure compliance with Bank requirements. The principles and standards are derived from EU policy and law and supplemented by other examples of international good practice. The EIB requires that all the projects it is financing are acceptable in environmental and social terms by applying appropriate safeguards to all its operations.

3.7.2 The EIB's Environmental and Social Handbook (EIB, 2013)

The EIB Environmental and Social Handbook provides an operational translation of the policies and principles contained in the 2009 EIB Statement of Environmental and Social Principles and Standards (see above). Principles include the Environmental and Social Impact Assessment process of identifying predicting, evaluating a project's positive and negative environmental and social impact on the biophysical and human environment as well as identifying ways of avoiding, minimizing, mitigating and compensating, including offsetting in the case of the environment and

remedying in the case of social impacts, by applying the mitigation hierarchy. This process includes consultation with direct and indirect stakeholders and the elaboration of an environmental and social management plan detailing the implementation of the mitigation measures.

3.7.3 World Bank Environmental and Social Framework

The W orld Bank's Environmental and Social Framework (ESF) enables the World Bank and Borrowers to better manage environmental and social risks of projects and to improve development outcomes. The ESF offers broad and systematic coverage of environmental and social risks. It makes important advances in areas such as transparency, non-discrimination, public participation, and accountability - including expanded roles for grievance mechanisms. It brings the World Bank's environmental and social protections into closer harmony with those of other development institutions.

The ESF consists of:

- The World Bank's Vision for Sustainable Development.
- The World Bank's Environmental and Social Policy for Investment Project Financing (IPF) which sets out the requirements that apply to the Bank.
- The 10 Environmental and Social Standards (ESS), which set out the requirements that apply to Borrowers.
- Bank Directive: Environmental and Social Directive for Investment Project Financing
- Bank Directive on Addressing Risks and Impacts on Disadvantaged or Vulnerable Individuals or Groups.

3.7.4 World Bank's Pollution Prevention and Abatement Handbook (PPAH)

The Pollution Prevention and Abatement Handbook (PPAH) promotes the concepts of sustainable development by focusing attention on the benefits, both environmental and economic, of pollution prevention, including cleaner production and good management techniques. In many cases, the guidelines provide numerical targets for reducing pollution, as well as maximum emissions levels that are normally achievable through a combination of cleaner production and end-of-pipe treatment. The guidelines are designed to protect human health, reduce mass loading to the environment, draw on commercially proven technologies, be

cost effective, follow current regulatory trends and promote good industrial practices, which offer greater productivity and increased energy efficiency.

3.7.5 Applicable International Finance Corporation (IFC) Performance Standards

IFC's Environmental and Social Performance Standards define IFC clients' responsibilities for managing their environmental and social risks. The Performance Standards provide guidance on how to identify sustainability risks and impacts and are designed to help avoid, mitigate, and manage them as a way of doing business in a more sustainable way.

The following are the performance standards that are applicable to the construction and operation of the project and are used as the basis of investigation for the ESMP:

Table 7: Applicable Performance Standards

IFC Performance Standard	Description	Applicable	Not Applicable
1. Environmental and Social Management System	An environmental and social management system (ESMS) helps companies integrate plans and standards into their core operations—so they can anticipate environmental and social risks posed by their business activities and avoid, minimize, and compensate for such impacts as necessary. A good management system provides for consultation with stakeholders and a means for complaints from workers and local communities to be addressed.	☑	☐
2. Labour and Working Conditions	It asks that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child or forced labor, and identify risks in their primary supply chain.	☑	☐
3. Pollution Prevention and Control	It guides companies to integrate practices and technologies that promote energy efficiency, use resources—including energy and water—sustainably, and reduce greenhouse gas emissions.	☑	☐

4. Occupational Health and Safety, Public Health and Security	It helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures.	☑	☐
5. Land Acquisition and Involuntary Resettlement	It advises companies to avoid involuntary resettlement wherever possible and to minimize its impact on those displaced through mitigation measures such as fair compensation and improvements to and living conditions. Active community engagement throughout the process is essential.	☐	☑
6. Biodiversity and Ecosystems	It recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development.	☑	☐
7. Rights and Interests of Indigenous People	It seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. Informed consultation and participation with IPs throughout the project process is a core requirement and may include Free, Prior and Informed Consent under certain circumstances.	☑	☐
8. Cultural Heritage	Cultural heritage encompasses properties and sites of archaeological, historical, cultural, artistic, and religious significance. It also refers to unique environmental features and cultural knowledge, as well as intangible forms of culture embodying traditional lifestyles that should be preserved for current and future generations. PS8 aims to guide companies in protecting cultural heritage from adverse impacts of project activities and supporting its preservation. It also promotes the equitable sharing of benefits from the use of cultural heritage.	☐	☑

3.7.6 International Conventions and Agreements

Below (Table 8) is a list of applicable international conventions and agreements for the proposed project.

Table 8: International conventions and agreements

Legislation	Summary	Environmental principles
2011 Guidelines for the Control and Management of Ship's Biofouling to minimize the Transfer of invasive Aquatic Species.	These guidelines are intended to provide a globally consistent approach to the management of biofouling organisms, which could present a bio-risk in local ports.	Prevent the transfer of invasive species and coordinating a timely and effective response to invasions which requires cooperation and collaboration among governments.
Stockholm Convention on Persistent Organic Pollution (2001)	Is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for longer periods.	To protect human health and the environment from persistent organic pollutants; especially those used in marine paints.
Vienna Convention for the protection of ozone layer (1985)	This Convention is aimed to promote cooperation among nations by exchanging information on the effects of human activities on the ozone layer.	To take control actions to protect the ozone layer.
Montreal protocol (1997)	Is a global agreement to protect the earth's ozone layer by phasing out the chemicals that depletes it.	Control substances and chemicals production that are depleting the ozone layer.
UN Framework on climate change (1992)	This framework was introduced to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference	Countries should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.

	with the climate system.	
Kyoto protocol (1997)	It is also designed to assist countries in adapting to the adverse of climate change. It facilitates the development and deployment of technologies that can help increase resilience to the impacts of climate change.	Reduce GHG emission at least by 18%.
Basel Convention (1992)	To protect human health and the environment against the adverse effects of hazardous wastes.	Reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes
Conventions on Wetland of International Importance (1971)	Conserving wetlands (swamps, marshes, lakes, mudflats, peat bogs and other bodies of water whether natural or artificial, permanent or temporary).	This convention establishes a management framework aimed at conserving the wetland and ensuring its wise use. The Walvis Bay is recognized under this convention.
Paris Agreement (2015)	Is a legally binding international treaty on climate change.	To limit global warming to preferably 1.5 degrees Celsius, compared to pre-industrial levels.
United Nations Convention on Law of the Sea of 1982.	It's a legal framework for marine and maritime activities. It 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.	It provides that coastal States have sovereign rights in a 200-nautical mile Exclusive Economic Zone (EEZ) with respect to natural resources and certain economic activities, and exercise jurisdiction over marine science research and environmental protection.

International Convention for the Control of and Management of Ships' Ballast Water and Sediments of 2004.	This Convention seeks to prevent the spread of harmful aquatic organisms from one region to another, by the establishment of standards and procedures for the management and control of ships' ballast water and sediments.	Protect the oceans from invasive aquatic species
International Convention for the Prevention of Pollution from Ships (MARPOL) and the protocol of 1978.	This convention is aimed at the prevention of pollution from ships caused by operational or accidental causes.	Prevention of pollution by sewage, oil and garbage from ships in the sea; Prevention of air pollution from ships; prevent pollution by Harmful Substances carried at sea in packaged form.
International Convention of the Safety of life at Sea of 1974 (SOLAS).	SOLAS is an international maritime treaty which sets minimum safety standards in the construction, equipment and operation of merchant ships.	Convention allows for flag states to compel ships under their flags to comply with safety requirements including fire-fighting equipment and nuclear containment facilities in order to prevent impacts associated with risks of transportation of dangerous goods.
Convention on the Prevention of Marine Pollution by dumping of wastes and other matters, 1972 (as amended by the protocol of 1996).	This convention protects the marine environment from human activities such as pollution.	Take practicable steps to prevent pollution of the sea, promote the effective control of all sources of marine environment caused by dumping at sea; (black and grey list).
International Convention on Oil Pollution Preparedness, Response and Co-operation of 1990 (OPRC Convention) with its Protocol of 2000 (OPRC-HNS Protocol).	Convention was developed by the International Maritime Organization (IMO) to further prevent pollution from ships and it requires coastal states to prepare and response to oil spills risks.	Convention compels states to carry onboard oil pollution emergency plan in order to effectively respond to oil pollution incidents.

Nairobi International Convention on removal of wrecks (18 May 2007).	The Convention provides a set of uniform international rules aimed at ensuring the prompt and effective removal of wrecks located beyond the territorial sea. The Convention also includes an optional clause enabling States Parties to apply certain provisions to their territory, including their territorial sea.	It provides a sound legal basis for coastal states to remove wrecks which pose a hazard to the safety of navigation as well as the marine and coastal environments.
Internal Convention on Biological Diversity	Among others, this Convention aims at conservation of biological diversity and promote sustainable development of biological components.	Conservation of biological diversity, sustainable use and equitable sharing of utilization of biodiversity, ecosystem assessment and monitoring and mitigation of adverse environmental impacts.
International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001)	The convention prohibits the use of harmful organotin in anti-fouling paints used and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.	It is preferable to minimize the accumulation of biofouling on vessels and movable structures.

3.7.7 Applicable Listed Activities

The EIA Regulations promulgated in terms of the Environmental Management Act, identify certain activities which could have a substantially detrimental effect on the environment. These listed activities require environmental clearance from MEFT prior to commencing. The following listed activities (Table 9) identified in the regulations apply to the proposed project:

Table 9: Listed activities triggered by the proposed Project.

Listed activity
1. Energy generation, transmission and storage activities
1.1 The construction of facilities for - (a) the generation of electricity; (b) the transmission and supply of electricity.

4 PROJECT DESCRIPTION

4.1 Introduction

As mentioned in Section 1.2, Kaoko intends to apply for an Environmental Clearance Certificate (ECC) for its proposed "/Hao" WaveRoller Pilot Project for the generation of electricity by utilizing Namibia's ocean waves using WaveRoller technology on ocean water. The pilot project proposes to install five (5) WaveRoller devices using its technology to convert wave energy to electricity that will be transmitted via underground power cables from the offshore site to a substation located onshore (A separate ESIA report assessing the underground power cable is compiled).

The proposed project is located offshore, approximately 1 km from the coastline and 5 km north-west of Wlotzkasbaken settlement, Erongo Region, Namibia.

4.2 WaveRoller Technology

WaveRoller devices convert ocean wave energy to electricity. It converts movement to electricity using an onboard power storage and hydraulic system. Depending on tidal conditions, the units can be partly or fully submerged and anchored to the seabed. The capacity factor of the devices is 25-50% depending on wave conditions at the project site. The device is designed for deployment in littoral zones from 25 m from the shoreline.

The purpose of the study is to demonstrate wave energy power production in Namibia and learn about any positive or negative impacts that this new technology could cause in Namibia. The pilot study aims to deploy five units of the technology, in a horizontal stretch with a distance of approximately 100-200 m between each unit.

4.3 Wave Energy

Wave energy is optimally utilised at 10 - 15 m depth when the seabed compresses and concentrates the wave energy. Extremely large waves break and dissipate in deeper water. This is illustrated in Figure 3 below.

Therefore, the five WaveRoller devices will be deployed at various depths ranging between 10 - 15 m from the seabed where there are optimal conditions and at different locations between 200 m - 500 m from the shoreline. Nearshore (0.5 - 2 km) is the optimal spot to extract energy. The

device is inherently resistant to shoaling and breaking waves, which allows long deployment periods in harsh nearshore locations.

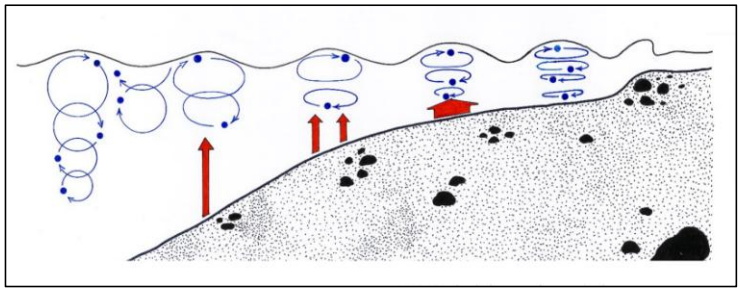


Figure 2: Wave energy at different depths

4.4 Design of the WaveRoller Device

The WaveRoller device (Figure 3) is designed not to contain significant amount of hazardous material or substances and is an environmentally friendly solution. For example, the unit is protected with non-poisonous silicone paint and zinc or aluminium anodes. Marine growth is not prevented in the basement structure that increases compatibility with the surrounding environments and the seabed. The amount of hydraulic oil and lubricants in the Power-Take-Off (PTO) is kept as low as possible and oil and seawater are always separated with two barriers. According to EU-legislation, only non-poisonous hydraulic oil is used.

In addition, the device is a fully concealed subsea unit. This reduces the risk of third parties tampering or sabotaging equipment, providing a full-proof operating energy device.

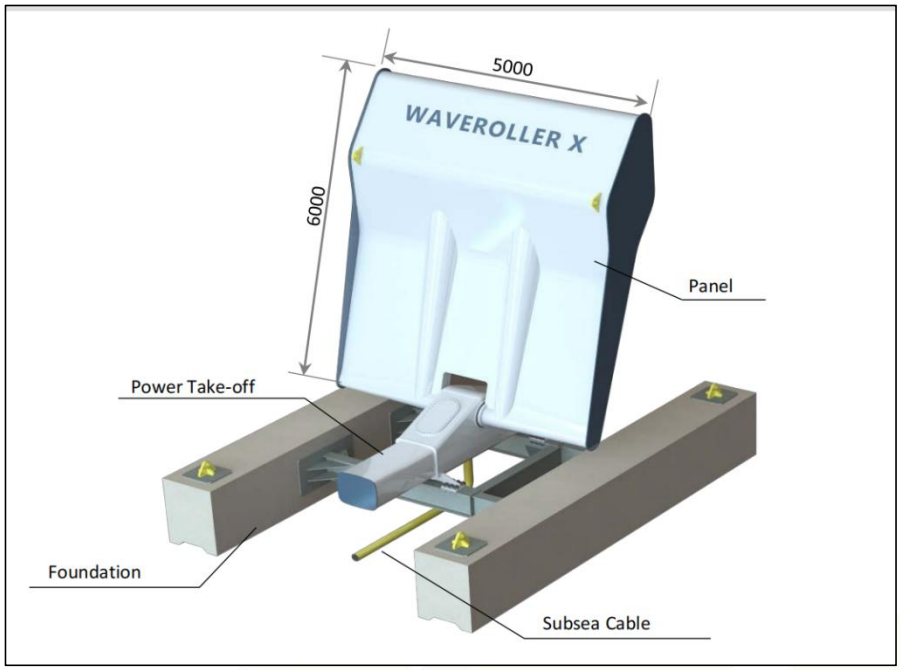


Figure 3: WaveRoller Device

The components of the WaveRoller Device are described in Table 10 below.

Table 10: Components and Description of the WaveRoller Device

Component	Description
Panel	Steel panel 5 m wide and 6 m all for deployment in 8-10 m depth.
Power take-off	Converts panel oscillation to electrical power. Accumulators smooth output power over 20-30s.
Subsea Cable	Standard off-the-shelf type subsea cable. Wet-mate connection to simplify operations.
Foundation	Provides a stable platform. Ensures station keeping in extreme weather conditions.
Supply	Modules supplied ex-works from Fonshore for assembly at site. Total unit weight about 20 t enabling shipment in ISO containers.
Assembly and Deployment	Components are assembled at site with standard mobile cranes. Deployment and recovery using typical small work boats. Training and instructions included.

4.5 WaveRoller Device Specification

The specification of the WaveRoller Device are indicated in tableTable 11 below.

Table 11: WaveRoller Device Specification

Specification	
Electric System	AC 3P
Nominal Voltage	400V/50 Hz
Maximum Current	25A
Maximum PTO Shaft Torque	10 ton-metres
Isolation transformer	400V / 1000V
Power Cable Type	Rubber cable with excellent chemical, thermal and mechanical resistance (4 x 10 mm^2)
Data Cable Type	Polyurethane Ethernet cable with water blocking filling compound. Two connections.
Cable Protection	The cables are protected with a rubber hose.
Subsea Connectors	High power and Ethernet circular
Maximum Voltage	100 V AC mms (max)
Maximum Current in Water	50 A
Number of Devices per Chain	WaveRoller units

4.6 Hydraulic Power Transmission

Power from the panel axle is transmitted to the electric generator axle using a hydraulic power transmission system. The system utilizes hydraulic accumulators for power balancing and therefore power in the panel axle can fluctuate whereas power in the generator axle is stable. The system is constructed using standard-off-the-shelf components available globally. The system can be maintained by a regular mechanic.

4.7 Power Capture

The device captures power with a bottom fixed panel (oscillating wave surge converter): captures highly efficient power, operating in low -, mid - and high-sea states, and with no cut-off and with only one moving part, reduces unexpected downtime and maintenance costs.

4.8 Employment

The project will employ approximately 10 workers for the installation phase on a permanent basis and approximately 5 people will be employed for this pilot project with an aim to employ more people when it developed into a full operation and commercial.

4.9 Installation Phase

4.9.1 Transportation Routes/Access

Upon identifying the exact locations for the deployment of the devices, the components will be transported from to Namibia via shipping. The components will then be assembled at the Namibian Port and transported to the identified sites on a vessel or towed, for installation.

4.9.2 Installation Timeline

The devices will take approximately one day per device to be installed.

4.9.3 Installation Workforce

The installation will require approximately 10 number of people, which include:

- 3 Engineers
- 2-3 Divers
- 4 Boat crew

4.9.4 Health and Safety

All workers will be exposed to health and safety risks in the course of their work, during both the installation and operation phases of the pilot project, i.e., handling and transportation of the device components, diving into the ocean during installation and during maintenance routines. The presence of marine-life in certain areas where the devices will be deployed could as well pose a health and safety concern. This increases the possibility of injury, and the contractor must ensure that all employees and contractors are made aware of the potential risks of injury on site.

In order to limit the possibility of injury to persons or damage to property all reasonable practicable measures will be taken to fully train its workforce to identify and mitigate health risks and hazards associated with the project's activities.

AW-Energy is ISO9001 certified and has a Health and Safety policy and manual. AW-Energy require that contractors meet or exceed the requirements set out in this manual. The outcome of this implementation is to ensure the prevention of injury and adverse health effects.

4.10 Decommissioning

At the end of the WaveRoller operations, the site including all linear infrastructure will be decommissioned and suitably rehabilitated. Where possible, rehabilitation will be undertaken progressively during operation as areas become available. This approach will allow the operational team to determine the best and most effective method of rehabilitation for the various areas disturbed by Project activities.

5 PROJECT ALTERNATIVES

5.1 Alternative Site Location

The project location for the deployment of the WaveRoller device is considered optimal in terms of its ability to extract high energy from the waves. The selected and proposed site is optimally located along Namibia's coastline in an area that has both access to infrastructure and highwave energy, therefore making it suitable for the deployment of the devices in order to yield maximum wave energy and deliver it to the consumer.

Not implementing the project at these specific location with favourable conditions will, therefore, limit the access to this renewable and local electricity supply.

5.2 The "no project" option

With reference to section 1.3, currently the transition towards more sustainable energy production is mainly being implemented by wind and solar power installations. The major issue with the approach comes with the times of no sunshine and calm winds. Wave energy flows both during the night and day from the constant ocean waves that roll into Namibia's coastline. These waves have their origins far away in the ocean and by the time they reach Namibia their energy is, over the year, on average 25 to 35 kW per metre and the total theoretical potential of near-shore wave energy in Namibia is more than 10 GW. Complementary technologies that have the capacity to generate electricity at all times times is essential to achieve both deeper decarbonization and affordable electricity.

Larger versions of WaveRoller technology have been deployed in Europe. The purpose of the /Hao WaveRoller Pilot Project is to deploy a small scale project using the small scale version of the WaveRoller technology and to investigate the environmental performance of the technology within Namibian waters. This small project will thus influence and inform subsequent wave energy projects in Namibia.

Therefore, the challenge facing the project proponent is its contribution towards achieving these goals while at the same time preventing and/or mitigating potential negative social and environmental impacts. The proponent will have to ensure that the identified mitigation measures and commitments to address the potential impacts, will appropriately be implemented and adhered to.

6 DESCRIPTION OF THE CURRENT ENVIRONMENT

This section was compiled utilising the following sources of information:

- Information shared by Kaoko Green Energy Solutions (Pty) Ltd.
- Visual observations during a site visit by I.N.K.
- Specialist investigation (Marine Ecology).
- Google Earth.
- Atlas of Namibia.
- Internet sources.

6.1 Benguela Upwelling

Namibia's ocean space is part of a unique natural marine environment, the Benguela Current Large Marine Ecosystem (BCLME), which is considered as one of the most productive marine regions of the world's oceans. It boasts high biological productivity with abundant zooplankton, phytoplankton, important fisheries, and healthy top predator populations such as the Cape fur seals. Namibia's marine environment is controlled by the seasonal changes in the south Atlantic high-pressure system, bringing southerly winds throughout the year, albeit stronger in winter and spring.

The project site is located in NWCRA and BCLME (Benguela Current Large Marine Ecosystem); mainly influenced by the cold Benguela Current Upwelling System. The BCLME is driven by southerly winds, which induces transportation of deep cold and nutrient-rich waters near the coast. Among others, several physical factors that play a critical role during the upwelling process are Carbon Dioxide (CO2), SSTs (Sea Surface Temperatures), DO (Dissolved Oxygen), sun radiation and nutrients. When describing the central BCLME based on SSTs and DO; generally, the ecosystem appears to display low mean annual SSTs and low DO throughout the year, with upwelling at its maximum during winter.

Although the project is located in this ecosystem, the current predominantly flows in deeper water. The Lüderitz Upwelling Cell is far to the south and the project site is far from the most important and sensitive areas in the south; i.e. Mercury Island, Ichaboe Island, Halifax Island and Possession Island.

6.2 Activities in the Area

The Orano Desalination Plant and its associated linear infrastructure (pipelines) is one of the key activities and it is located approximately 1 km south of the proposed pilot study area.

Other activities include, recreational angling, which is an activity in the central coast primarily from Swakopmund to Henties Bay, targeting species such as Silver Kob, Blacktail, Galjoen and West Coast Steenbras Figure 5. Life forms such as dense stands of foliose and fruticose lichens occur in this area. Wlotzkasbasken, a small settlement between North of Swakopmund and south of Henties Bay is not exempt from the aforementioned activities. Silver Kob is the main recreational fish species of importance on the vicinity of the proposed pilot area. The Wlotzkasbasken area is an important spawning site for Silver Kob (Figure 6). Anglers can cast their fishing lines at a distance of approximately 100 m from the shoreline, while the devices are proposed to be located at a distance of between 200 m - 500 m from the shoreline. This distance between the two activities will prevent the interference of the the WaveRoller activities on fishing activities.

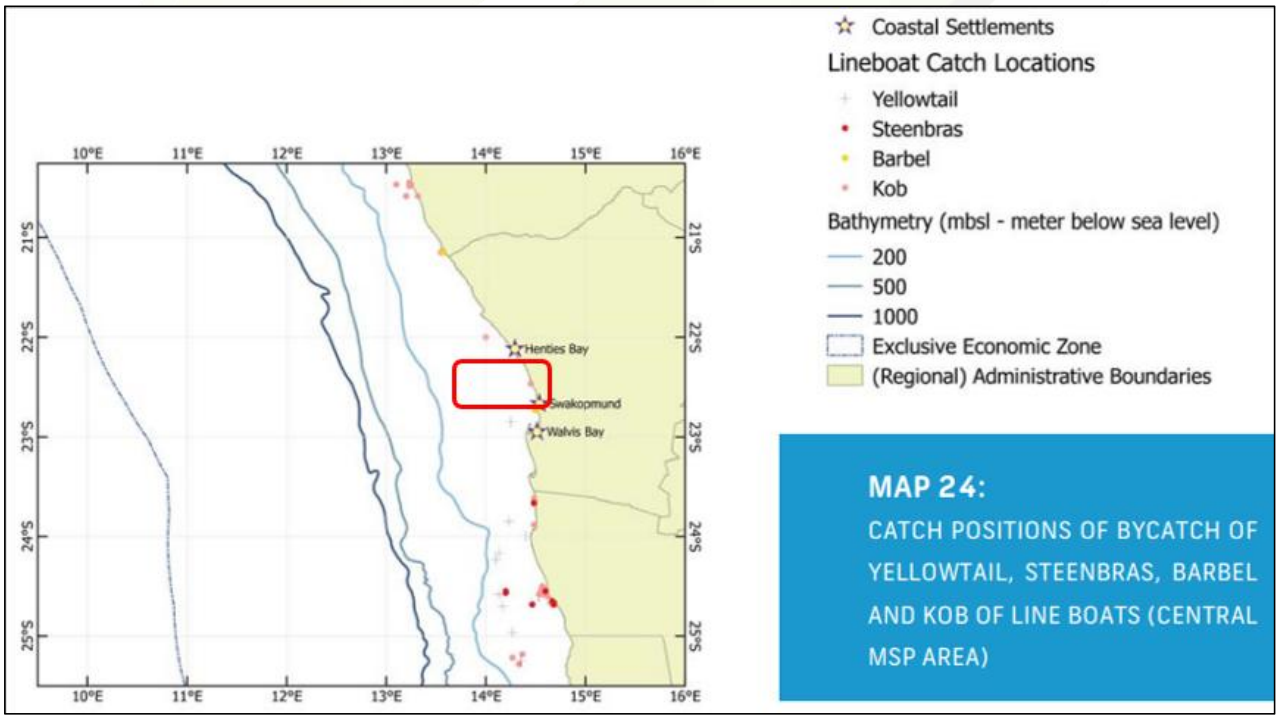


Figure 4: Map showing catch positions for recreational fish species in vicinity of pilot area

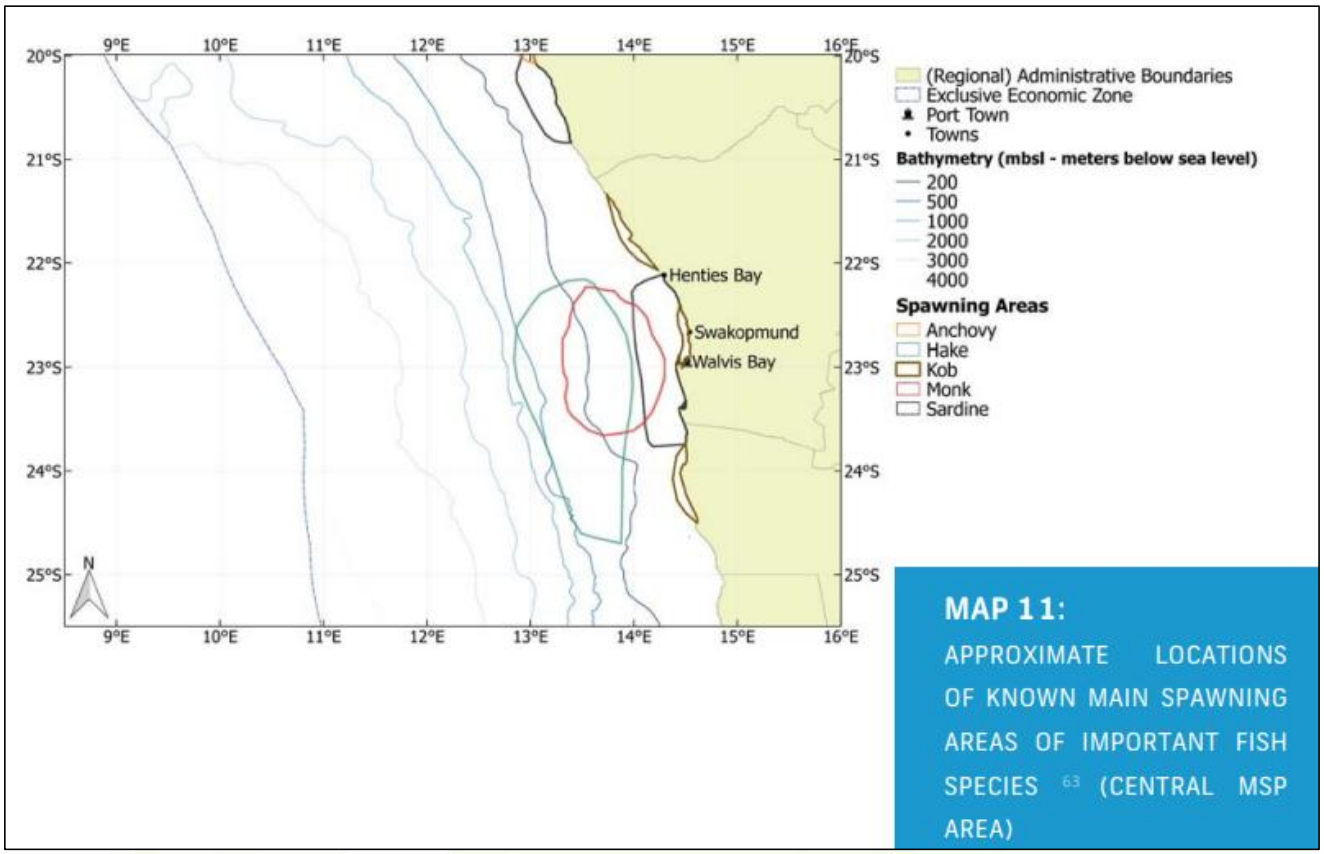
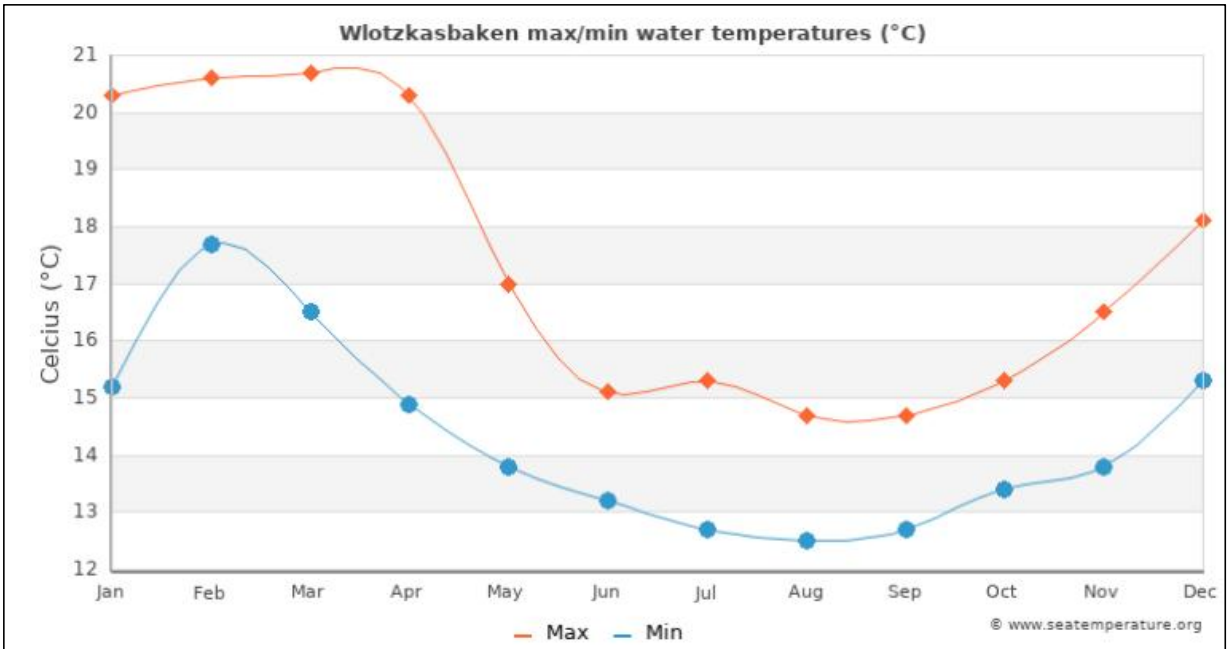


Figure 5: Known spawning locations for fish species in the central coast of Namibia

6.3 Sea Surface Temperatures and salinity

Based on historical data, **Figure 7** shows the average seawater temperatures for the general Wlotzkasbasken area. The measurements for the water temperature are provided by the daily satellite readings provided by the NOAA. The temperatures given are the sea surface temperature (SST) which is most relevant. The average warm and cold sea surface temperatures in the area are 19.1°C in February, and 13.6°C in August respectively. A high seasonality is displayed by these temperature variations. Salinities range between 34.5‰ and 35.5‰ are observed for the area.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min °C	15.2	17.7	16.5	14.9	13.8	13.2	12.7	12.5	12.7	13.4	13.8	15.3
Max °C	20.3	20.6	20.7	20.3	17	15.1	15.3	14.7	14.7	15.3	16.5	18.1
Min °F	61.4	65	63.4	61	58.1	56.5	55.9	55.4	55.7	56.8	57.9	60.7
Max °F	66.5	67.9	67.6	66.4	61.3	58.4	58.5	57.6	57.7	58.7	60.6	63.5

Figure 6: Min/Max water SST at Wlotzkasbasken, source: SeaTemperature.org

6.4 Dissolved Oxygen (DO) concentration and nutrients

After upwelling, dissolved inorganic nutrients are converted into organic nutrients and through photosynthesis, oxygen is released. Literally, waters associated with upwelling are supposed to be rich in DO. However, this is not the case for the Namibian shelf. Anoxicity is a common feature in the northern BCLME and has a peak in summer between January and March annually. It accounts for huge losses of crustaceans and pelagic fish species. Water with concentrations below 2 ml/l is considered oxygen deficient while water below 5 ml/l are oxygen depleted. Concentrations <0.5 ml/l are recorded in the BCLME near 15°S. The continental shelf waters of the Benguela system are characterized by low oxygen concentrations, especially on the bottom. Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, which indicate typical nutrient enrichment.

6.5 Turbidity and Total Suspended Solids (TSS)

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Typically, Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ, depending on suspended sediments in the area of interest. Turbidity is caused by presence of solids in water due to physical (e.g. rock weathering), chemical or biological (e.g. decay of phytoplankton biomass) activities and anthropogenic activities such as dredging, benthic sampling and disposal of tailings overboard, disturbance of seafloor etc. The major source of turbidity in the swell-influenced nearshore areas off Namibia is the redistribution of fine inner shelf sediments by long-period Southern Ocean swells. The reported current velocities typical of Benguela are 10-30 cm/s, which can be responsible for resuspending quantities of sediments. However, these currents do not extend to shallow water where the devices are proposed for deployment.

6.6 Phytoplankton fauna

Phytoplankton fauna are well found in the specific pilot study area. Phytoplankton is important because it forms a basis of the productivity of the marine environment. Additionally, they play a key role as sinks of excess atmospheric carbon dioxide released from all anthropogenic CO^2 sources. Phytoplankton has a higher potential for reduction of atmospheric carbon and mitigation of air pollution. Moreover, through the photosynthesis process, phytoplankton release oxygen which is essential for respiration by marine organisms. There are phytoplankton species that are toxic to humans when ingested through consumption of shellfish. Harmful phytoplankton species are associated with HABs (harmful algae blooms). The season for HABs is from July to October with a peak in August. Eutrophication is a main contributing factor to HABs and is caused by several natural factors such as intense upwelling activity, but anthropogenic factors such as river run-off, sewage discharge and others may also contribute. Higher upwelling in the BCLME mainly accounts for HABs when nutrient-rich waters are transported near the coast and in the euphotic zone. It is postulated that HABs could also be induced by anthropogenic activities; however, this has not been scientifically proven.

Additionally, effects of wave energy generation activities on phytoplankton may have a positive impact as the movement of the WaveRoller panels may increase seawater absorption of oxygen and carbon dioxide.

6.7 Benthic Fauna

Marine sediments form one of the largest habitats on earth by covering more than 80% of the ocean floor. In spite of high size variations of the benthos, the benthic biomass is dominated by the macrofaunal invertebrates (>0.5 mm), including many species of polychaetas, crustaceans, mollusks and echinoderms. Amongst the benthic communities, the macrofauna is the community that includes invertebrates that are retained on a 0.5 mm sieve. The main taxa that comprise the macrofauna are the phyla: Arthropoda (mainly crustaceans of the malacostraca group), Mollusca (mainly bivalves and gastropods) and Annelida (mainly polychaetas). Macrofauna has been widely used as indicators of pollution in marine environments.

In addition to importance as indicator of anthropogenic impacts, macrofauna plays a major role in ecosystem functions such as organic matter mineralization and nutrient recycling. Primarily, the bacteria inhabiting the seabed carry out these tasks, but macrofauna enhances them through active biological transport, i.e. bioturbation (active mixing of sediment) and bio-irrigation (active flushing of solutes). These processes produce an increase in the supply of oxygen and other electron acceptors of the seabed surface with the porewater. This increases the metabolic capacity of bacteria and, in turn, of the sediment, to mineralize organic matter and recycle nutrients. Benthic fauna have reduced mobility compared with other groups of species such as fish, marine mammals, and marine birds and so, they tend to remain on the site after the impact has occurred.

6.8 Waves

The central coast of Namibia is characterized by sea waves generated locally by the persistent south-westerly winds. Historical wave data for Wlotzkasbasken is scarce, however literature indicates average wave heights in the range of 1.5 m to 2.5 m, occurring frequently over the area. For most of its length, the Namibian coast is exposed and open to buffering from heavy wave action. Tables 11 - 15 below, indicate the baseline information collected during the beach survey on 01 December 2023, at Wlotzkasbasken is indicated.

Table 12: Physical wave data at three sampled sites at Wlotzkasbasken

Date	Lat	Long	Station	Beach width (m)	Station interval (m)
01 Dec 23	22°21'22" S	14°25'41" E	station 1_WLTZ	22	11
01 Dec 23	22°20'56" S	14°25'31" E	station 2_WLTZ	23	11.5

01 Dec 23	22°20'32" S	14°25'19" E	station 3_WLTZ	30	15

Table 13: Wave data recorded at sampling station 1, Wlotzkasbasken.

Wave height(m)	Wave frequency/min
1	3
1.2	7
1.2	6
1	6
1.3	7

Table 14: Wave data recorded at sampling station 2, Wlotzkasbasken.

Wave height(m)	Wave frequency/min
0.5	7
0.5	6
0.8	7
1	6
1	5

Table 15: Wave data recorded at sampling station 3, Wlotzkasbasken.

Wave height(m)	Wave frequency/min	Effluent crossing/ min
0.5	4	0
0.7	5	1
0.5	3	0
0.5	4	0
0.5	3	0

6.9 Topography and sediments

Figure 8 shows the typical seafloor geomorphic features of the Namibian coastal seafloor. This depicts that of the proposed pilot area.

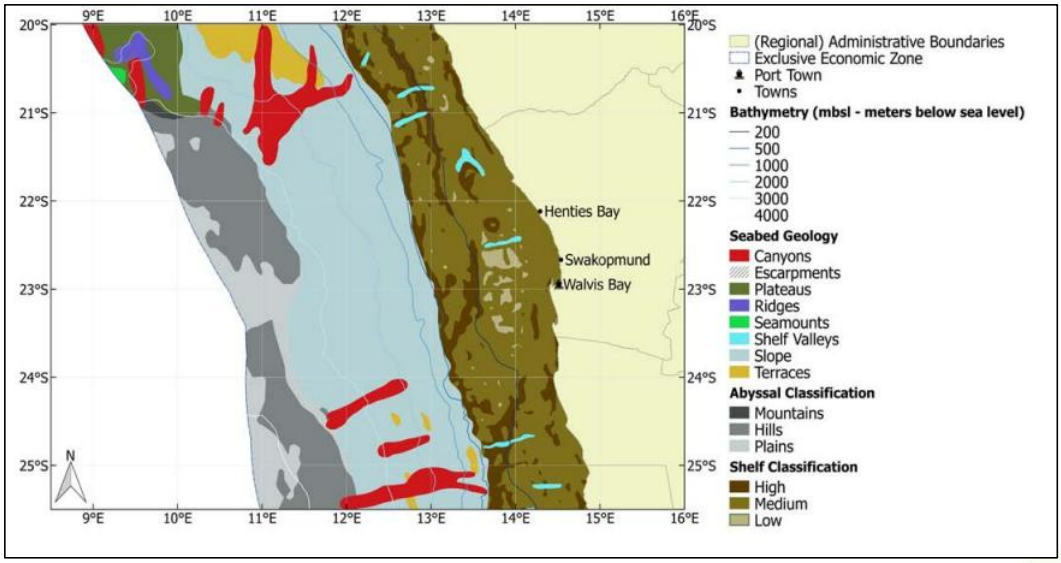
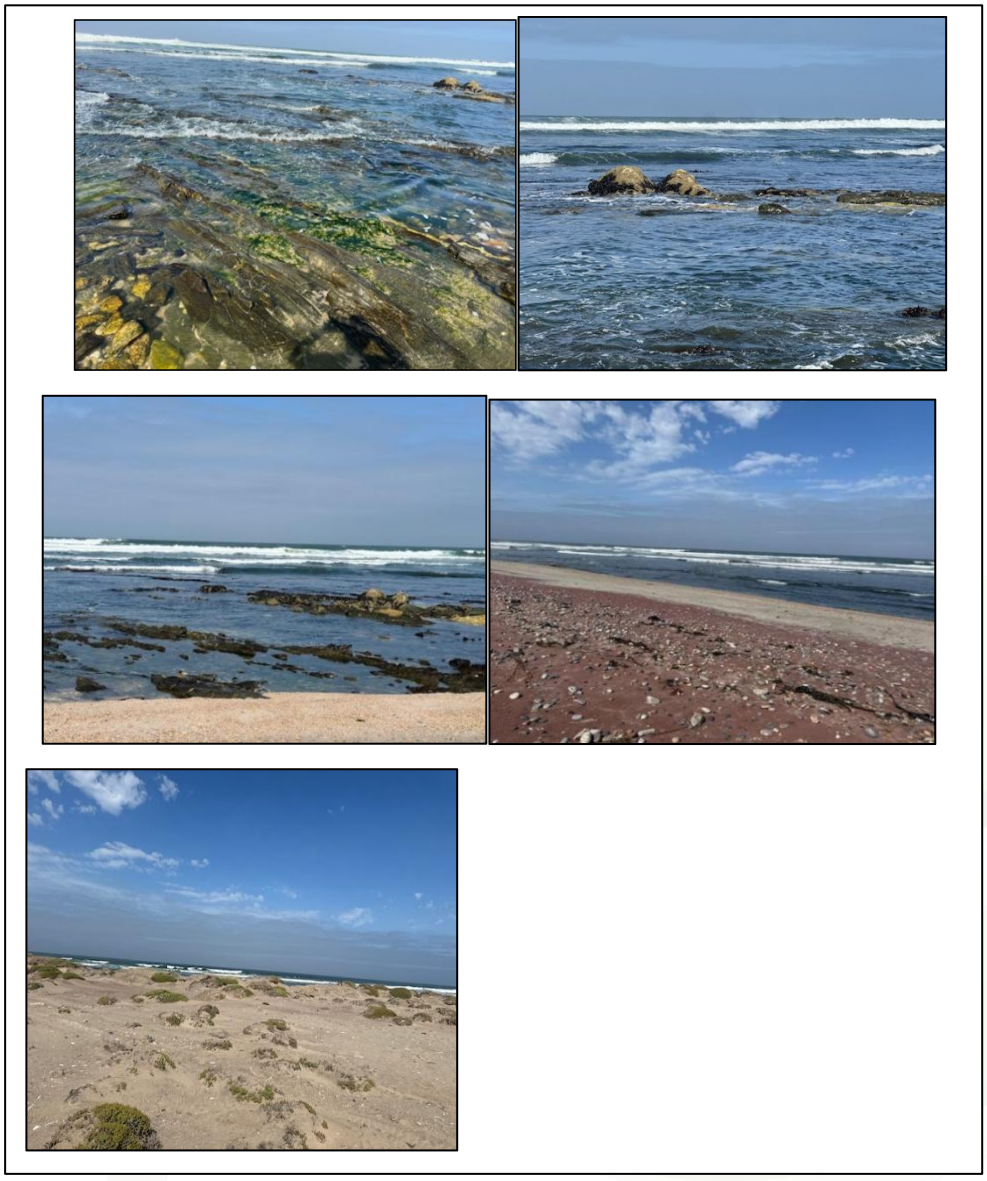


Figure 7: Seafloor geomorphic features. Source: MFMR 2018

The images taken during the beach survey, show the topography of the selected pilot area. Generally, the peripherical sediments in the intertidal and low-shore areas are generally dominated by moderately to well-sorted fine to medium sand with median particle sizes of 200-400 µm. Northwards, in the vicinity of the proposed pilot area, the sediments become coarser and contain proportions of gravel and pebbles, with extensive pebble beds in the mid- and low-shore, especially station 3. Beyond the low water mark inshore, the pilot area has rock outcrops, running along the seafloor appearing as the dominant topography in the pilot area. Existing information suggests a rock plate sloping very gently into the intertidal area.

The rock surface appears rough in some areas and smooth on others with a micro relief of approximately 0.5–1.0 m. Literature indicate that that offshore, about 200m, the seabed comprises smooth, flat bedrock with sparse patches of sand. Additionally, the area is characterized by small, shallow gullies of 0.5 – 1 m wide and 0.3 m deep orientated perpendicular to the coast. The general characterization of the topography along the Namibian coast, comprises of few rocky outcrops (16%) and intertidal reefs that characterize the coast, covered in seaweed, and marine invertebrate epi-fauna such as but not limited to barnacles, limpets, black mussels and sea anemones, whilst the sandy escarpments (which makes up 58% of the coastal shore environment) are home to infauna e.g. amphipods, polychaetas etc. The bottom sediments of up to 2km offshore, constitute clean coarse-grained sand and shells, with water depths increasing at a distance of 10 -15 km from the shore.



Photos 1-5: Topography of pilot area (Station 1)

Photos 6-9: Topography of pilot area (Station 2)Photo 10: Topography of pilot area (Station 3)

Photos 10-14: Topography of pilot area (Station 2)Photo 10: Topography of pilot area (Station 4)

7 IDENTIFICATION OF ENVIRONMENTAL ASPECTS AND POTENTIAL IMPACTS

The scoping phase which included a consultation process with key stakeholders that included government authorities and I&APs allowed the opportunity to raise the issues associated with the project development. It was identified that; the following aspect will need to be further assessed:

- Marine Ecological Impacts.

The relevance of the potential impacts ("screening") are also presented in the tables below to determine aspects to be assessed in further detail (Section 8 of this report).

Table 16: Environmental Aspects and Potential Impacts

ASPECT	APPLICABLE PHASE	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT
Accidental oil spills from vessel operations and from the hydraulic power transmission.	Installation, Operational and Decommissioning Phases	Potential impact on water resources and water quality	With reference to section 4.9.1, the assembled WaveRoller units will be transported from the Namibian Port to the identified sites on a vessel or towed. The installation of the devices will take place on site. These vessels have the potential to affect the water quality as a result of oil spillages. However, this is deemed to be minimal. The maintenance crew to undertake monitoring, servicing and replacement of the WaveRoller parts, will be transported to site via vessels. These vessels have the potential to affect the water quality as a result of oil spillages. However, this is deemed to be minimal. With reference to section 4.4, the WaveRoller device is designed to contain no significant amount of hazardous material or substances and is an environmentally friendly solution. For example, the unit is protected with non-poisonous silicone panel and zinc or aluminium a nodes. Marine growth is not prevented in the basement structure that increases compatibility with the surrounding environments and the seabed. The amount of hydraulic oil and lubricants in the Power-Take-Off (PTO) is kept as low as possible and oil and seawater are always separated with two barriers Therefore, no further assessment was required. The hydrocarbons management and mitigation measures are stipulated in the ESMP.
Archaeology	Installation and Operational	Impact on archaeology sites	There's no evidence of archaeological remains in the area. Therefore, no impacts are expected for this issue. No further assessment is required. However, should there be any archaeological findings on site, the related management and mitigation measures stipulated in the ESMP should be followed.
Noise and deployment of the device on seabed	Installation, Operational and Decommissioning Phase	Impact on marine ecology	The study area is commonly known to consist of various fish species that include, Silver Kob, Blacktail, Galjoen and West Coast Steenbra. In addition, phytoplankton such as algae blooms and benthic fauna are well found in the pilot study area. The installation, operational and decommissioning phases are likely to affect the above mentioned species due to the

			human movements and noise generated from the device. However, noise and electromagnetic emissions (EMF) from the monitoring of a similar device in Portugal, suggest that the noise levels from the device during operations are lower than the natural marine sounds caused mainly by the waves. During the installation activities, benthic communities will be most affected than any other marine fauna, due to physical damage to the seabed, alteration of sediment structure. The potential reduction in benthic biodiversity will be due to installation/deployment.However, the percentage area of the device basement compared to the overall project area size is approximately <0.001%. This indicates that the extent of the potential impact is minimal. The potential marine ecology impacts, have been assessed further in section 8.
Visual	Operational	Changes in visual conditions.	Visual impacts on 3rd parties i.e., fishermen, travelers on C34 main road, people at the Orano Desalination Plant and on vessels and boats in the area. However, the five WaveRoller devices will be deployed at various depths ranging between 10 - 15 m where there is optimal wave energy. Considering that the device are 6 m high, it indicates that the device will be submerged and could only slightly be exposed to the surface during extremely low tides. Therefore, no further assessment was required. The visual management and mitigation measures are stipulated in the ESMP.
Maritime Traffic - Interference and possible collision with vessels and boats.	Operational	Impacts relating to the interference and possible collision with vessels and boats.	Vessels and boats linked to the Orano Desalination Plant operations and local fishing boats can be found in the area. Though the devices will be deployed at depths between 10 - 15 m, the low tides could slightly expose the device to the surface and posing a collision risk with vessels and boat. However, due to the location of the project in the breaking water zone, vessel's navigation in this area is unlikely. Therefore, no further assessment was required. The visual management and mitigation measures are stipulated in the ESMP.

8 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

8.1 Assessment Approach and Methodology

The assessment largely adopted a desktop approach, where qualitative information on the intertidal environment was collected during a site visit and a beach survey conducted on 01 December 2023. The extent of the impacts and assessment ratings are not quantified over the larger project area. The potential impact rating and extent is determined only as per the direct impact surrounding the specific devices.

The beach survey collected sediment for grain size analysis, wave data entailing the height and frequency, as well as sediment samples for invertebrates. Counts of avifauna and marine flora were also taken into consideration. No exploratory dives and sediment grab sampling were carried out in deeper water of the proposed location. This approach is deemed adequate for placing into context the potential impacts associated with the establishment of wave rollers as proposed for this pilot project.

An assessment of the potential positive and negative impacts associated with the installation and operations phase of the proposed pilot project is provided below. As an outcome of the Scoping Phase, specialist input was requested for some of the environmental issues and has been included in this assessment.

Other potential environmental impacts resulting from the proposed project activities and facilities (also identified during the Scoping Phase of the ESIA) were assessed by I.N.K and are also presented below.

Impacts are considered in a cumulative manner where possible such that the impacts of the proposed Project are seen in the context of the baseline conditions described in Section 6. Information that has been included in Section 6 will not be repeated in this Section.

- Both the criteria used to assess the impacts and the Method of determining the frequency/severity of the impacts is outlined in Impacts on the Marine Ecology.

Table 16. This Method complies with the EIA Regulations: EMA, 2007 (Government Gazette No. 4878) EIA regulations. Both mitigated and unmitigated scenarios are considered for each impact in the ESIA results.

The potential impacts that required further assessment include the following:

- Impacts on the Marine Ecology.

Table 17: Frequency/Severity Rating

Likelihood / Frequency	Definition	Probability	Rating	Consequence/ Severity				
				Insignificant	**Minor**	**Moderate**	**Major**	**Critical**
				Very minor or no impact.	Minor impact that can be contained	Impact may have moderate effects	Serious impact/effect	Permanent Impact/effect
				1	**2**	**3**	**4**	**5**
Very high	Almost certain Extremely likely	>90%	**5**	Low	**Medium**	High	Extreme	Extreme
				5	10	15	20	25
High	Very likely Will probably occur	60-90%	**4**	Low	**Medium**	**Medium**	High	Extreme
				4	**8**	12	16	20
Medium	Likely to happen	40-59%	**3**	**Low**	**Low**	**Medium**	**Medium**	High
				3	**6**	**9**	12	15
Low	Possible but unlikely	10-39%	**2**	**Low**	**Low**	**Low**	Medium	**Medium**
				2	**4**	**6**	8	**10**
Very low	Conceivable but extremely unlikely	<10%	**1**	**Low**	**Low**	**Low**	**Low**	**Low**
				1	**2**	**3**	**2**	**2**

8.2 Impact: Introduction of artificial hard substratum due to installation of WaveRoller Devices

The presence and laying of WaveRoller devices is unavoidable. However, artificial hard substratum may act as habitat for opportunistic organisms such as mussels, barnacles and other attaching marine organisms. These structures function as fish aggregating devices or artificial reefs, attracting fish and other mobile organisms to the biofouling organisms as a source of food and to the structures as sources of protection, refuge, and shade. However, this could potentially alter species distributions and abundance, habitat connectivity, and biodiversity.

Table 19: Introduction of artificial hard substratum due to installation of WaveRoller devices

				Severity	
Likelihood	**Definition**	**Probability**	**Rating**	**Unmitigated**	**Mitigated**
Medium	Likely to happen	40-59%	5	Medium (10)	Low (5)

8.3 Impact: Physical disturbance to the seabed and potential impact on benthnic fauna

Physical disturbance to the seafloor will cause an alteration in benthic fauna community composition and there could be a potential reduction in benthic biodiversity due to installation/deployment of wave energy technologies and energy generation activities. Mobile organisms such as fish, shore birds and marine mammals, may avoid this area for some time. Natural recovery of 2-3 year is likely to recreate some boundary conditions of this area. This impact is unavoidable for this pilot project.

Table 20: Physical disturbance to the seabed and potential impact on benthnic fauna

				Severity	
Likelihood	**Definition**	**Probability**	**Rating**	**Unmitigated**	**Mitigated**
High	Very likely, will probably occur	80%	4	Medium(9)	Low (6)

8.4 Impact: Disturbance of spawning and migratory route for Silver kob

During summer months, adult Silver Kob migrate southwards along the central Namibian coast, from Skeleton Coast National to Sandwich harbour, passing the Wlotzkasbasken area. The spawning period is protracted over 6 months (October-March), which coincides with warmer water temperatures (>15 °C) and the occurrence of large-sized spawning Silver Kob in the southern and central part of Namibia. It would be advisable to limit the duration of the device installation to the specified times each day, and minimise the device installation activities as low as practically possible.

Table 21: Disturbance of spawning and migratory route for Silver kob

				Severity	
Likelihood	**Definition**	**Probability**	**Rating**	**unmitigated**	**Mitigated**
High	Very likely, will probably occur	80%	4	High (16)	Medium (12)

8.5 Impact: Disturbance to cetacean movements due to underwater noise generation during installation of WaveRoller devices

Literature indicates that the frequency ranges at which the device operates overlap those used by some low and midfrequency cetaceans. Only behavioral responses would be expected if the organisms swim near the WaveRoller devices. Cetaceans may not be detected around the WaveRoller device because of the low depth where the devices will be installed. The noise is likely to subside once the initial phase of the installation is done. Marine organisms are likely to avoid the area during this period.

Table 18: Disturbance to cetacean movements due to underwater noise generation during installation of WaveRoller Devices

				Severity	
Likelihood	**Definition**	**Probability**	**Rating**	**Unmitigated**	**Mitigated**
Medium	Likely to happen	70%	3	Medium (9)	Low (6)

9 CONCLUSIONS AND RECOMMENDATIONS

The proposed area overlaps with other coastal activities and proposed activities may lead to exclusion of other users; hence the need for planned and well-coordinated efforts to ensure optimal use of this space of the ocean. Furthermore, the area could also be important ecological niche for various marine flora and fauna including zooplanktons, benthic fauna, fish species, and cetaceans. Proposed installation of WaveRoller devices will be temporary and localized, however, the assessment had identified measures to mitigate anticipated impacts on VECs (valued ecosystem components). VECs are essential components of the ecosystem which include ambient air, seawater and sediment quality and marine flora and fauna.

Project activities will potentially affect the benthic environment, water and sediment quality as well as phytoplankton and zooplankton communities. The potential impacts on fish, marine mammals and avifauna are not expected to be significant compared to potential impacts on benthic species, phytoplankton and zooplankton communities. The potential disturbance of benthic biodiversity will be due to the direct contact of the WaveRoller device, on the seafloor where the benthnic community is found. However, with mitigation measures in place, these potential impacts can be minimized and reduced.

The mitigation measures that have been identified and recommended by I.N.K will promote the positive impacts of the project, as well as reduce the negative impacts to acceptable levels. An ESMP was further developed which identifies potential impacts of the project during the installation and operation phases. The ESMP is a legally binding document to which Kaoko must adhere to.

Despite these impacts, I.N.K concludes that the Proponent should be allowed to undertake the proposed activities, provided the potential impacts in the ESMP are mitigated.

References

Abaunza P, Gordo L, Karlou-Riga C, Murta A, Eltink ATGW, GarcíaSantamaría MT, Zimmermann C, Hammer C, Lucio P, IversenSA, Molloy J, Gallo E. 2003. Growth and reproduction of horsemackerel, Trachurus trachurus (Carangidae). Reviews in Fish Biology and Fisheries 13: 27–61

Assorov, V. V., and Berenbeim, D. Y. 1983. Spawning grounds and cycles of Cape hakes in the southeast Atlantic. Collection of Scientific Papers of the International Commission for Southeast Atlantic Fisheries, 10 (i): 27–30.

Awad, A.A., Haag, F., Anil, A. C., & Abdulla, A. (2014). Guidance on Port Biological Baseline Surveys (PBBS).

Bakun A., 1995. "Climate variability and regime shift in the eastern boundary upwelling current," In O'Toole, M. J. (ed), 1995, The Benguela current and comparable eastern boundary upwelling systems. GTZ, Germany. p14.

Benedetti, F., Gasparini, S. and Ayata S. D. 2015. "Short term communication: identifying copepod functional groups from species functional traits". Journal of Plankton Research 38 (1): 159-166.

Bianchi, G., Carpenter, K. E., Roux, J.-P., Molloy, F. J., Boyer, D. and Boyer, H. J. (Eds) 1999. Food and Agricultural Organisation (FAO). FAO species identification guide for fishery purposes. A field guide to the living marine resources of Namibia. The living marine resources of the Western Central Pacific. Food and Agricultural Organisation of the United Nations. Rome, Italy.

Boyd, A. J., and R. A. Cruickshank (1983). An environmental basin model for West Coast pelagic fish distribution. S. Afr. J. Sci. 79(4): 150–151.

Boyer, D. C, Boyer, H. J, and Fossen I, Kreiner A. (2001) Changes in abundance of the northern Benguela sardine stock during the decade 1990–2000, with comments on the relative importance of fishing and the environment, South African Journal of Marine Science, 23:1, 67-84, DOI: 10.2989/025776101784528854

Boyer, D. C. and Hampton, I. 2001. An overview of the living marine resources of Namibia. In: Payne, A. I. L., Pillar, S., C. and Crawford, R. J. M. (eds), A decade of Namibian fisheries science. South African Journal of Marine Science. 23, 5–35.

Branch, G. M., Griffiths, C. L., Branch, M. L. & Beckley, M. L. (2016). Two oceans: a guide to the marine life of southern Africa (4th ed.). Cape Town: Struik Nature.

Britz PJ (2006). A Review of Aquaculture Policy and Institutional Capacity in the BCLME Region with Recommended Regional Policy Options. Report BCLME project LMR/MC/03/01. Development of Responsible Aquaculture Policy for the BCLME Region.

Bromley C, McGonigle C, Ashton EC, Roberts D (2016). Bad moves: Pros and cons of moving oysters – a case study of global translocations of Ostrea edulis Linnaeus, 1758 (Mollusca

Burmeister, L.-M. 2001. Depth-stratified density estimates and distribution of the Cape hake Merluccius capensis and M. paradoxus off Namibia, deduced from survey data, 1990–1999. South African Journal of Marine Science, 23: 347–356

Chiripanhura B, Teweldemedhin M (2016). An analysis of the fishing industry in Namibia: the structure, performance, challenges, and prospects for growth and diversification. www.agrodep.org/sites/default/files/AGRODEPWP0021

Collette, B. B., and C. E. Nauen. 1983. FAO species catalogue, vol. 2, Scombrids of the world. FAO. Fisheries synopsis 125 (2): 137 p.

Copping A. 2018. The state of knowledge for environmental effects: Driving consenting/permitting for the marine renewable energy industry. Report by Pacific Northwest National Laboratory (PNNL), 25.

Crawford, R. J. M., Dyer, B. M., Cordes, I., Williams, A. J. 1999. Seasonal pattern of breeding, population trend and conservation status of bank cormorants Phalacrocorax neglectus off South western Africa. Biol Conserv. 87, 49–58.

Critchley KW, Rotmann G and Molloy FJ (1991). The Namibian seaweed industry: Present and potential. Bioresource Technology. 38: 137-143.

Du Preez D. 1996. Conservation priorities and management recommendations for the Erongo Region Coastal Zone, Namibia (Master's thesis, University of Cape Town).

GRN, (2021). The Harambee Prosperity Plan II 2021 -2025. Government of the Republic of Namibia. Office of the President. Windhoek.

MFMR. 2018. MSP in Namibia. Current Status Report Knowledge Baseline for Namibia's Central Marine Plan.

O'Toole M. 1996. Namibia's Marine Environment.

Pfiz M, Loris K, Erb E, Wirth V, Küppers M. 2010. Changing patterns of lichen growth form distributions within the lichen fields of the Central Namib. Biodiversity in southern Africa, 2, 33-37.

Tjipute M, Thorarensen H, Jenson P. 2011. Feasibility study for mass production of the silver kob, Argyrosomus inodorus, in Namibia.

Gordoa A, Macpherson E. 1990. Food selection by a sit-and-wait predator, the monkfish, Lophius upsicephalus, off Namibia (South West Africa). Environmental Biology of Fishes. 27: 71–76.

Gordoa, A., and Duarte, C. M. 1991. Size-dependent spatial distribution of hake (Merluccius capensis and Merluccius paradoxus) in Namibian waters. Canadian Journal of Fisheries and Aquatic Sciences, 48: 2095–2099.

Gordoa, A., Masó, M., and Voges, E. 2000. Monthly variability in the catchability of Namibian hake and its relationship with environmental seasonality. Fisheries Research, 48: 185–195.

Hamukuaya, H., O'Toole, M. J. and Woodhead, P. M J. 1998 "Observations of severe hypoxia and offshore displacement of cape hakes over the Namibian shelf in 1994" S. Afr. J. Mari. Sci. 19. p.57-59.

Iitembu JA (2005). Analysis of Marine Aquaculture Developments in Namibia: Environmental, Economic and Legislative considerations. Master of Science in International Fisheries Management Norwegian College of Fishery Science, University of Tromsø, N-9037, Tromsø, Norway.

Kirchner, C. (1998). Population dynamics and stock assessment of the exploited silver kob (Argyrosomus inodorus) in Namibian waters. Ph.D. thesis, University of Port Elizabeth: 240 pp.

Mann, K. H. and Lazier, J. R .N. 1996. Dynamics of Marine Ecosystems: Biological-Physical Interaction in the Oceans. Blackwell Science, Inc.: Cambridge, UK. pp 150-175; 282-316.

Matthews, J. P. (1964). The pilchard of South West Africa (Sardinops ocellata). Sexual development, condition factor and reproduction 1957–1960. Investl Rep. mar. Res. Lab. S.W. Afr. 10: 96 pp.

Mecenero, S., Roux, J.-P., Underhill, L. G., and Bester, M. N. (2006). Diet of Cape fur seals Arctocephalus pusillus pusillus at three maonshore breeding colonies in Namibia. 1. Spatial variation. African Journal of Marine Science, 28 (1): 57–71.

Ministry of Fisheries & Marine Resources. (2019). Coastal Biodiversity Survey, Survey 1. Swakopmund, Namibia.

NPC, (2004). Vision 2030. National Planning Commission of Namibia. Government of the Republic of Namibia. Office of the President. Windhoek.

Potts, W. M., Sauer, W HH, Henriques, R., Sequesseque, S., Santos, C. V. and Shaw, P. W. (2010) 'The biology, life history and management needs of a large sciaenid fish, Argyrosomus coronus, in Angola', African Journal of Marine Science, 32: 2, 247 — 258To link to this Article: DOI: 10.2989/1814232X.2010.501567URL: http://dx.doi.org/10.2989/1814232X.2010.

Reiss, H.; Kroncke, I. Seasonal variability of benthic indices: An approach to test the applicability of different indices for ecosystem quality assessment. Mar. Pollut. Bull. 2005, 50, 1490–1499.

Reiss, M. R. 1996. Effect of depth, dissolved oxygen concentration and temperature on sex and size composition of catches of cape hake, Merluccius capensis, off Namibia. Master thesis. State University of New York. pp. 2-21; 30-41; 44-111

Renaud, P.E., Webb, T.J., Bjørgesæter, A., Karakassis, I., Kedra, M., Kendall, M.A., Labrune, C., Lampadariou, N., Somerfield, P.J., Wlodarska-Kowalczuk, M., Vanden Bergh, E., Claus, S., Aleffi, I.F., Amouroux, J.M., Bryne, K.H., Cochrane, S.J., Dahle, S., Degraer, S., Denisenko, S.G., Deprez, T., Dounas, C., Fleischer, D., Gil, J., Grémare, A., Janas, U., Mackie, A.S.Y., Palerud, R., Rumohr, H., Sardá, R., Speybroeck, J., Taboada, S., Van Hoey, G., Weslawski, J.M., Whomersley, P., Zettler, M.L. (2009) Continental-scale patterns in benthic invertebrate diversity: insights from the MacroBen database. Marine Ecology Progress Series (382) 239-252.

Rosenberg R. 2001. Marine benthic faunal successional stages and related sedimentary activity. Scientia Marina 65: 107–119.

Roux, J.-P., and Shannon, L. J. 2004. Ecosystem approach to fisheries management in the northern Benguela: the Namibian experience. African Journal of Marine Science, 26: 79–93.

Shannon, V. and O'Toole, M. J. 1999, (eds) "Integrated overview of the oceanography and environmental variability of the Benguela current region" BCLME report. Online: www.bclme.org/factfig/asp#chemistry accessed 24 April 2004

Tjipute M. Feasibility study for mass production of the silver kob, Argyrosomus inodorus, in Namibia. Reykjavík: United Nations University – Fisheries Training Programme; 2011

Van der Lingen, CD, Hutchings L, Pitcher GC, Lamont T (2016). Climate change, dinoflagellate blooms 1045 and sardine in the southern Benguela current large marine ecosystem. Environmental Development 17: 230–243. https://doi.org/10.1016/j.envdev.2015.09.004

Van der Westhuizen, A. 2001. A decade of exploitation and management of the Namibian hake stocks. South African Journal of Marine Science. 7615, 307–315.

Walmsley, S., Leslie, R. and Sauer, W. 2005. The biology and distribution of the monkfish Lophius vomerinus off South Africa. African Journal of Marine Science. 27, 157–168.