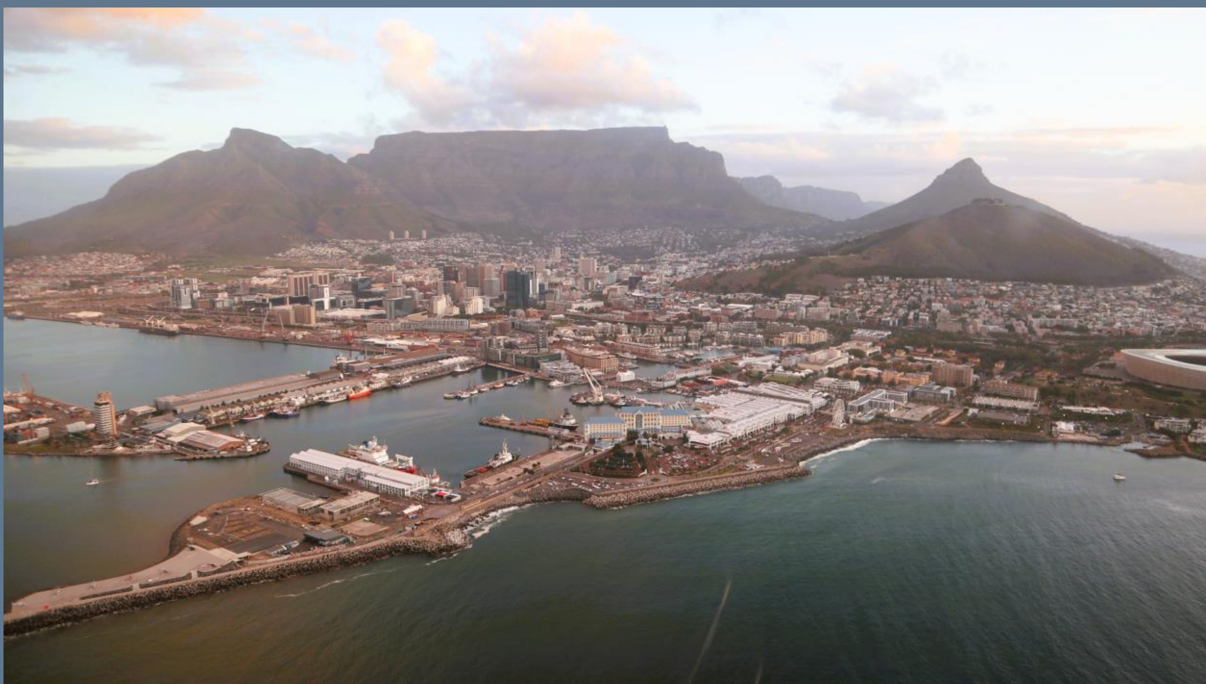
Infinity Environmental

MARINE SPECIALIST STUDY AND IMPACT ASSESSMENT FOR THE EXPANSION OF GRANGER BAY PRECINCT AT THE V&A WATERFRONT



2026

ANCHOR environmental

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MARINE SPECIALIST STUDY AND IMPACT ASSESSMENT FOR THE EXPANSION OF GRANGER BAY PRECINCT AT THE V&A WATERFRONT

2026

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EXECUTIVE SUMMARY

Introduction

Anchor Environmental Consultants (Pty) Ltd was appointed by Infinity Environmental (Pty) Ltd on behalf of the V&A Waterfront to undertake an updated Marine Specialist Impact Assessment for proposed amendments to the Granger Bay precinct development at the Port of Cape Town. The original development, approved in 2018, included land reclamation and a dolos revetment to support a mixed-use precinct. The updated assessment considers substantial new scientific and regulatory information since the original 2014 marine study and focuses on the ecological implications of changes to the revetment design and additional marine infrastructure. The proposed scheme assessed here includes reshaping the revetment, increasing its straight-line length from 470 m to 540 m, and introducing two breakwaters measuring approximately 90 m and 140 m. The plan also extends public access infrastructure, adding 100 m of walkway on each breakwater and connecting this to the Mouille Point promenade. While the reclaimed land area remains at 2.4 hectares, the breakwaters will increase the marine footprint by an additional 0.8 hectares. The marine infrastructure will be constructed in phases, with anticipated completion by 2029.

This reassessment was prompted by new data and regulations, including revised International Union for Conservation of Nature (IUCN) Red List assessments, updated Marine Protected Area designations, and emerging science on underwater noise impacts. A significant body of local and international literature on marine biodiversity and cumulative pressures in Table Bay has emerged, which is now incorporated into this updated baseline and assessment.

This Marine Specialist Study therefore presents up-to-date marine baseline conditions, and identifies potential impacts due to the proposed scheme, as well as mitigation and monitoring strategies required to manage these potential impacts. It integrates a separate, updated Marine Mammal Impact Assessment prepared by Sea Search Research and Conservation (Elwen 2025). Both studies are desktop-based and use available data and published literature. The assessment was conducted within the framework of key environmental legislation, including the National Environmental Management Act (NEMA), the Integrated Coastal Management Act (ICMA), the Marine Living Resources Act, the National Biodiversity Act (including regulations related to threatened and protected species and invasive species), and the Marine Spatial Planning Act. These statutes provide a comprehensive foundation for evaluating and managing environmental impacts associated with coastal infrastructure development.

Affected Environment

Granger Bay, situated within Table Bay, Western Cape, South Africa, is a shallow embayment influenced by the nutrient-rich Benguela Current upwelling system. The area is fairly ecologically diverse, supporting kelp forests, mixed rocky and sandy shores, and artificial harbour habitats. Marine communities are shaped by seasonal wind-driven upwelling, nutrient dynamics, and circulation patterns. While Table Bay's open waters generally exhibit good water quality, the Port of Cape Town is more degraded due to stormwater outflows, faecal contamination, heavy metal accumulation, and high concentrations of microplastics. Ecological surveys in 2024 documented high biodiversity in reef habitats across Granger Bay, with filter-feeding invertebrates and native macroalgae dominating, although several invasive species were also recorded.

Granger Bay supports diverse marine life, including fish, marine mammals, and seabirds. Resident Heaviside's dolphins, seasonal whale visitors, and semi-resident Cape fur seals are frequently observed. The proposed development area overlaps with key ecological zones and therefore requires careful assessment and mitigation to preserve biodiversity and ecosystem functioning.

Impact Assessment

Impacts associated with the proposed project activities include construction phase impacts (related to the installation of infrastructure, the direct loss of habitat by placement of infrastructure) and operational phase impacts, associated with the ongoing operation of the development, associated infrastructure and vehicle traffic. over the longer term. These potential impacts (both positive and negative), before and after mitigation, are summarised in Table 1.

Table 1. Summary of the impacts assed during construction and operation of the Granger Bay revetment development, including cumulative impacts.

Phase	Impact identified	Consequence	Probability	Significance	Status	Confidence
Construction phase	Impact 1 (a & b): Disturbance of intertidal and subtidal artificial habitat on rocky and soft sediment habitats	Very Low	Definite	**VERY LOW**	-ve	High
	With mitigation	Very Low	Definite	**VERY LOW**	-ve	High
	Impact 2: Impacts of construction on West Coast Rock Lobster.	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Probable	**LOW**	-ve	Medium
	Impact 3: Disturbance to pelagic open water habitats.	Very Low	Probable	**VERY LOW**	-ve	High
	With mitigation	Very Low	Probable	**VERY LOW**	-ve	High
	Impact 4: Waste generation and disposal during construction.	Medium	Probable	**MEDIUM**	-ve	High
	With mitigation	Low	Improbable	**VERY LOW**	-ve	High
	Impact 5: Effects of pollution.	Medium	Possible	**LOW**	-ve	High
	With mitigation	Low	Improbable	**VERY LOW**	-ve	High
	Impact 6: The effect of increased noise and vibration from construction on marine organisms (invertebrates, fish, birds).	Very Low	Definite	**VERY LOW**	-ve	Medium
	With mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	Medium
	Impact 7a: Impacts on marine mammals – increased vessel presence	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium
	Impact 7b: Impacts on marine mammals – underwater noise.	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium

Phase	Impact identified	Consequence	Probability	Significance	Status	Confidence
Operational phase	Impact 8: Change in habitat and system function.	Low	Probable	LOW	-ve	Medium
	With mitigation	Low	Possible	VERY LOW	-ve	Medium
	Impact 9: Loss of rocky shore habitat, introduction of artificial habitat.	Low	Definite	LOW	-ve	Medium
	No mitigation identified.					
	Impact 10: Impacts on West Coast Rock Lobster over the long term.	Low	Probable	LOW	+ve	Medium
	No mitigation identified.					
	Impact 11: Increased vessel traffic.	Medium	Probable	MEDIUM	-ve	Medium
	With mitigation	Low	Possible	VERY LOW	-ve	Medium
	Impact 12: Impacts on marine mammals – loss of habitat:					
	Complete abandonment	High	Possible	MEDIUM	-ve	Low
	No mitigation identified.					
	Partial abandonment and return	Low	Possible	LOW	-ve	Medium
	No mitigation identified.					
	Cumulative impacts	Medium	Probable	MEDIUM	-ve	Medium
	With mitigation	Medium	Possible	LOW	-ve	Medium

In general, the impacts are reversible, with low irreplaceability of resource loss caused by impacts. Impacts of particular note include:

- Construction will result in a short term, high intensity impact on the West Coast rock lobster *Jasus lalandi* populations within Granger Bay through the removal and alteration of existing dolosse to accommodate new infrastructure. The dolosse of Table Bay breakwater are a highly heterogeneous habitat that are an important habitat for the species. Similar artificial rocky shore habitat will exist after construction, and recovery of these populations will occur primarily through immigration from adjacent areas. The relatively small footprint of direct disturbance (total area of 0.032 km^2) and 'short-term' nature of construction activities (two years) will result in the impact being felt over a limited spatial scale. While limited mitigation is available to reduce the significance of this impact, some recommended mitigation to reduce the probability of immediate impacts includes phased removal, and potential translocation of individuals from high-density zones.

  It is noted however that once construction is complete, the installation of new dolosse as part of the development is expected to provide an increased area such habitat for recolonisation, which may support ecological recovery of the species over time. This impact is therefore rated as of low, positive significance

- Litter and general poor housekeeping practises may be properly managed during construction — all domestic and general waste generated must be disposed of responsibly, and all reasonable measures must be implemented to ensure there is no littering and that construction waste is adequately managed. Staff must be regularly reminded about the detrimental impacts of pollution on aquatic species and suitable handling and disposal protocols must be clearly explained and sign boarded. The 'reduce, reuse, recycle' policy must be implemented.

- While the area of development is relatively small, especially in the context of the broader Granger Bay and Table Bay areas, it falls within one of the highest density areas for Heaviside's dolphins known along the Cape Coast. The high-density area used by these dolphins on a daily basis extends from approximately the middle of the mainly port breakwater to adjacent to the Three Anchor Bay lighthouse. It is likely that the resident dolphins will move away from the site during construction, especially during noisier periods (rock dumping etc), which may result in a temporary emigration from the site. While there is evidence of this type of emigration, but then subsequent return, in a number of other species of dolphin and porpoise during construction projects (Benhemma-Le Gall et al. 2021, Piwetz et al. 2021, Weaver 2021, Huang et al. 2024), there is a chance that this emigration could be permanent. Permanent abandonment of the site will result in an impact of medium significance (note that no mitigation is possible, and that confidence in this assessment is rated as low). However, the creation of the land reclamation area will replace the current sheltered marine environment of Granger Bay with a type of habitat – while the direct area of habitat loss will be permanent, the same type of area will be present after construction, which may facilitate the dolphin's return. Partial abandonment of and return to the site over time will result in an impact of low significance. While no mitigation is possible, confidence in this assessment is rated as medium, given the prior evidence of return for similar construction projects.

The No-Go alternative represents the baseline against which the project related impacts are assessed. The no-go option would entail maintaining the current status quo, i.e. no land reclamation development within Granger Bay. The Construction Phase impacts are all assessed as of negative significance, with generally short- to medium- term durations and significances ranging from Insignificant to Vey Low after mitigation. Therefore, the no-go option would mean that none of these negative Construction phase impacts occur. In particular, the no-go alternative will mean that there would be no negative impacts to the resident Heaviside's dolphin populations, including the potential permanent abandonment of the site. However, the no-go option also means that the positive impacts assessed for the Operational Phase that may occur will not be realised — the development is considered to result in increased dolosse habitat for West Coast rock lobster, which may support ecological recovery over time.

Cumulative impacts arising from this development, when considered alongside other coastal and marine activities in Table Bay, are rated as medium in significance. These include ongoing urban development, vessel movements, and pollution pressures. While no high or irreversible impacts were identified, the cumulative pressures highlight the importance of coordinated coastal zone management and routine environmental monitoring to safeguard long-term ecosystem health.

DECLARATION OF INDEPENDENCE

Anchor Environmental Consultants (Pty) Ltd is an independent consultancy and has no business, financial, personal or other interest in the activity, application or appeal in respect of which the company was appointed other than fair renumeration for work performed in connection with the activity, application or appeal. No circumstances arose during the course of the project that compromised the objectivity of the specialists that performed the work.

BACKGROUND AND QUALIFICATIONS OF SPECIALIST CONSULTANTS

The study was undertaken by Ms Amy Wright, Dr Adam Rees, Ms Lily Bovim and Ms Megan Jackson.

Amy Wright has an MSc degree in Biological Sciences and BSc. Hons. degrees in Marine Biology and Applied Biology from the University of Cape Town. She is a Senior Associate for Marine Ecosystems & Resources at Anchor Environmental and a professionally registered Natural Scientist (SACNASP 131256). She is a marine ecologist with environmental research, impact assessment, permitting, dispersion modelling and environmental auditing experience in systems across South Africa, Namibia, Mozambique, Mauritius, Kenya and Tanzania. Her areas of expertise include maritime and estuarine engineering; reverse osmosis/desalination operations; industrial and small-scale intake, discharge and cooling systems (including gas to power, green hydrogen and fisheries processing); offshore oil and gas operations; land- and sea-based mariculture, dredging and offshore mining operations, and shipping (ballast, antifoulants). She has direct experience in the undertaking and application of two- and three-dimensional hydrodynamic modelling of marine and estuarine systems to inform impact assessments and regulatory compliance, as well as monitoring program design and implementation. She is the author of four scientific publications in Class A scientific journals and over 100 technical reports.

Dr Adam Rees has experience in temperate marine ecology, benthic ecosystems research, marine protected areas, marine spatial planning and management, marine impact assessment, commercial and recreational fisheries in a range of countries include the UK, Maldives, central and southern Africa. He is well experienced in quantifying and assessing changes to benthic systems, affected by marine protected areas (MPAs), fisheries/offshore aquaculture, marine renewable energy installations and anthropogenic developments/modifications. He has published in class A scientific journals as lead author. He is proficient in ecological survey design and planning, underwater video sampling and analyses, multivariate analysis of large quantitative datasets (PERMANOVA, R), spatial data analyses (ArcGIS, QGIS), boat and lab fieldwork and data collection, technical reporting, project and budget management, stakeholder engagement, grant writing and public speaking. He has previously worked as a postdoctoral researcher with the University of Plymouth and the Blue Marine Foundation (international marine NGO) and is currently a Visiting Researcher with the University of Plymouth. He has practical experience in several commercial fishery sectors and has good understanding of commercial fishery assessments and management. Adam is a SACNASP registered Professional Natural Scientist in Aquatic Science and Environmental Science (Registration Number: 141530).

Lily Bovim is a marine ecologist and a registered Professional Natural Scientist in Aquatic Science (SACNASP 172158), with a strong academic foundation and diverse field experience across Southern Africa and beyond. She holds an MSc in Marine Biological Resources (magna cum laude), awarded jointly by Ghent University, the University of the Algarve, and the Galway-Mayo Institute of Technology, with a thesis focused on telemetry-based research of *Argyrosomus regius*. She also holds a BSc Honours degree in Biological Sciences and a BSc in Marine Biology and Ocean & Atmosphere Sciences (Oceanography) from the University of Cape Town. Lily joined Anchor's Marine Ecosystems & Resources team in October 2022 as a Consultant and contributes to a range of marine and estuarine projects through data analysis, reporting, and fieldwork. She is a medically fit Class V Scientific Commercial Diver, a certified Marine Mammal Observer, and recently gained offshore experience. Her technical skills include R (programming), GIS, PRIMER, and graphic design.

Megan Jackson is an evolutionary ecologist with a BSc. (Genetics and Ecology & Evolution) and a BSc. Hons. (Biological Sciences) from the University of Cape Town, and an MSc. (Botany) from Stellenbosch University. Her BSc. Hons. thesis was focused on using a population genetics approach to assess whether cities act as barriers to movement and gene flow in caracals, thereby isolating populations and resulting in elevated levels of inbreeding. Megan's MSc. used a Next-Gen sequencing approach and bioinformatic processing to look at the population genomics of Cape Dwarf eelgrass in estuaries around the South African coastline to inform conservation planning and preserve the genomic diversity of the species. Following the completion of her studies, she spent a year working on Bird Island in the Algoa Bay MPA, as a Seabird Monitor, to aid with the conservation of the endangered African Penguins and Cape Gannets. Megan is a Junior Consultant at Anchor Environmental Consulting, where she is involved in carrying out water quality monitoring surveys, ecotoxicity testing, microplastic surveys, benthic species taxonomic IDs and Environmental Impact Assessments. She has broad research interests, and the combination of molecular and general biology has given her a unique perspective on conservation, as well as experience in both field and laboratory work across a diverse range of species in both marine and terrestrial environments.

SIGNATURE OF LEAD SPECIALIST

I, Amy Wright, declare that:

- I act as the independent specialist in this application;
- I have performed the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature

Date: June 2025

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GLOSSARY

Alien species: Species that become established in areas outside their natural, native range.

Amphipods: Crustaceans with no carapace and a laterally compressed body.

Anthropogenic: Environmental pollution originating from human activity

Ascidian: Primitive chordates resembling sac-like marine filter feeders, also known as sea squirts.

Benthic: Pertaining to the environment inhabited by organisms living on or in the ocean bottom

Biodiversity: The variety of plant and animal life in a particular habitat.

Bioregion: A region defined by characteristics of the natural environment rather than by man-made divisions.

Biota: Living organisms within a habitat or region

Bivalves: A class of marine and freshwater molluscs that have laterally compressed bodies enclosed by a shell consisting of two hinged parts. Includes oysters, mussels, and scallops.

Construction phase: The stage of project development comprising site preparation as well as all construction activities associated with the development.

Copepod: A group of small crustaceans found in the sea and nearly every freshwater habitat. Some species are planktonic (drifting in the water column), while some are benthic (living on the ocean floor).

Crustacea/n: Generally, differ from other arthropods in having two pairs of appendages (antennules and antennae) in front of the mouth and paired appendages near the mouth that function as jaws.

Cumulative impacts: Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors.

Diatom : A major group of algae that makes up the most common type of phytoplankton. Most are unicellular but they can group together to form colonies.

Dinoflagellate: A large and diverse group of unicellular protists, most of which are marine, and that can either be free-living in the plankton, or benthic.

Environment: The external circumstances, conditions and objects that affect the existence of an individual, organism, or group. These circumstances include biophysical, social, economic, historical, and cultural aspects.

Environmental Authorisation: Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014.

Environmental Impact Assessment: A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.

Ichthyoplankton: The eggs and larvae of fish, which are usually found in the sunlit zone of the water column (epipelagic/photic zone).

Impact: A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

Infauna: The assemblage of organisms inhabiting the seafloor.

Invasive species: Alien species capable of spreading beyond the initial introduction area and have the potential to cause significant harm to the environment, economy or society.

Invertebrate: An animal without a backbone (e.g. a starfish, crab, or worm)

Marine Protected Area: An area of sea and coastline that is dedicated to the protection of biodiversity and natural and cultural resources and is managed in a structured and legal manner. Different levels of MPAs exist, ranging from complete no-take zones (where nothing may be disturbed, caught or removed) to partial-take MPAs which have a suite of regulations that determine what activities may take place in which zone.

Mitigation measures: Design or management measures that are intended to minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.

Mollusc/a: Invertebrate with a soft unsegmented body and often a shell, secreted by the mantle.

Operational phase: The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.

Pelagic: Within the water column.

Phytoplankton: Ocean dwelling microalgae that contain chlorophyll and require sunlight in order to live and **grow.**

Polychaete/a: Segmented worms with many bristles (i.e. bristle worms).

PSU: Ocean salinity is generally defined as the salt concentration in sea water. It is measured in unit of PSU (Practical Salinity Unit), which is a unit based on the properties of sea water conductivity. It is equivalent to per thousand or (o/00) or to g/kg.

Synchrolift: A system for lifting boats and ships out of the water for maintenance work or repair. The vessel is manoeuvred over a submerged cradle, which is then lifted by a set of synchronized hoists or winches.

Turbidity: A measure of light conditions in the water column.

Upwelling: An oceanographic phenomenon that involves wind-driven motion of dense, cooler, and usually nutrient-rich water from deep water towards the ocean surface, replacing the warmer, usually nutrient-depleted surface water.

ABBREVIATIONS AND ACRONYMS

Anchor	Anchor Environmental Consultants (Pty) Ltd
BFRP	Basalt Fibre Reinforced Polymer
CBA	Critical Biodiversity Area
CoCT	City of Cape Town
CSIR	Council for Scientific and Industrial Research
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
IUCN	International Union for Conservation of Nature
ERL	Effect Range Low
ESA	Ecological Support Area
ICMA	Integrated Coastal Management Act (No. 24 of 2008)
IUCN	International Union for Conservation of Nature
MLRA	Marine Living Resources Act 18 of 1998 (as amended)
MPA	Marine Protected Area
MSL	Mean Sea Level
MSP	Marine Spatial Planning
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act (No. 107 of 1998, as amended)
NEM: BA	National Environmental Management: Biodiversity Act 10 of 2004
PAH	Polycyclic Aromatic Hydrocarbons
PSU	Practical Salinity Unit
SST	Sea Surface Temperature
TOC	Total Organic Content
TSS	Total Suspended Solids
V&A	Victoria and Alfred

1 INTRODUCTION

1.1 BACKGROUND

Anchor Environmental Consultants (Pty) Ltd (Anchor) was appointed by Infinity Environmental (Pty) Ltd on Behalf of the V&A Waterfront to undertake a Marine Impact Assessment for the proposed amendment to the development of the Granger Bay precinct of the V&A Waterfront. The application is for the development design of the revetment across Granger Bay and changes to the mix and extent of residential and retail uses within the Granger Bay precinct.

An existing authorised development scheme was approved in April 2018 (DEA&DP Reference Number: 16/3/1/2/A7/4/3058/12) and comprised of new dolos revetment and associated land reclamation and mixed-use development within the Granger Bay precinct. This application was supported by a Marine Specialist Report compiled by Anchor (Laird et al. 2014), and a Marine Mammal Specialist Report compiled by Sea Search Africa (Elwen & Gridley 2014).

The original studies were undertaken almost ten years ago, and there have been a number of new studies (both published literature and grey literature) that have been undertaken on the marine environment of Table Bay, and Granger Bay in particular. Additionally, updated International Union for Conservation of Nature (IUCN) Red List assessments, the development of new Marine Protected Areas, and substantial new information on the impacts of noise on wildlife, and guidelines on how to mitigate this impact have been published since the original application. This is of particular relevance to the marine mammal component — a substantial amount of new research, and local and global conservation work of relevance has been undertaken in the intervening years. These include further work on the key species encountered in the area (Heaviside's dolphins and dusky dolphins), and changes in the abundance and health of large whale species seen just offshore of the impact area. These new data are incorporated into this updated assessment as part of the baseline description of the affected environment.

There have also been a number of new developments and development applications conducted in the Granger Bay area and surrounds and these new potential cumulative impacts will need to be assessed as part of the assessment process.

This Marine Specialist Study therefore presents up-to-date marine baseline conditions, and identifies potential impacts due to the proposed scheme, as well as mitigation and monitoring strategies required to manage these potential impacts. It integrates a separate, updated Marine Mammal Impact Assessment prepared by Sea Search Research and Conservation (Elwen 2025)..

1.2 PROJECT DESCRIPTION

The proposed scheme for the Granger Bay precinct as assessed here is shown in Figure 1.1. Components of relevance to the marine environment include the replacement of coastal defence structures (associated revetment, breakwaters, and land reclamation) and revised mixed use development packages. The proposed revetment and breakwater will be constructed in phases over approximately six years. The current programme indicates the revetment, infrastructure, coastal walkway, and public amenities will be constructed by 2029.

The key differences to the approved EA proposed as part of this amendment scheme include the following:

- The reshaping of the proposed revetment, with an associated increase in total straight-line revetment length from 470 m to 540 m.
- The inclusion of two ('east' and 'west') breakwaters, approximately 90 m and 140 m long respectively.
- The inclusion of public amenities within shoreline protection infrastructure, including an extension of existing 540 m coastal public walkway within the application site by 100 m along each breakwater, and the connection to the Mouille Point promenade via Beach Road.
- While the total area newly reclaimed land will not increase (2.4 Ha), the two breakwaters will comprise a further 0.8 Ha (total area of 0.032 km^2).

Construction is planned over two years, commencing in summer 1, with Peak construction rates (both concrete and rubble) in summer 2 and final work completed in winter 2 (Figure 1.2).

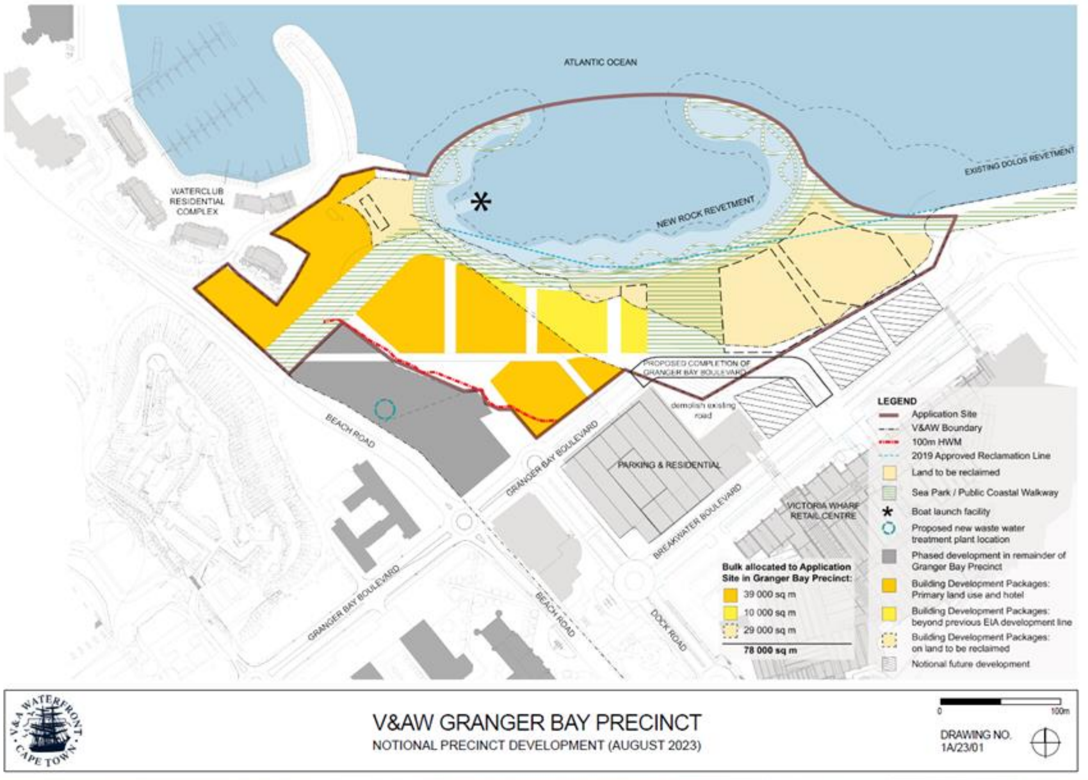


Figure 1.1. Site plan for the proposed scheme.

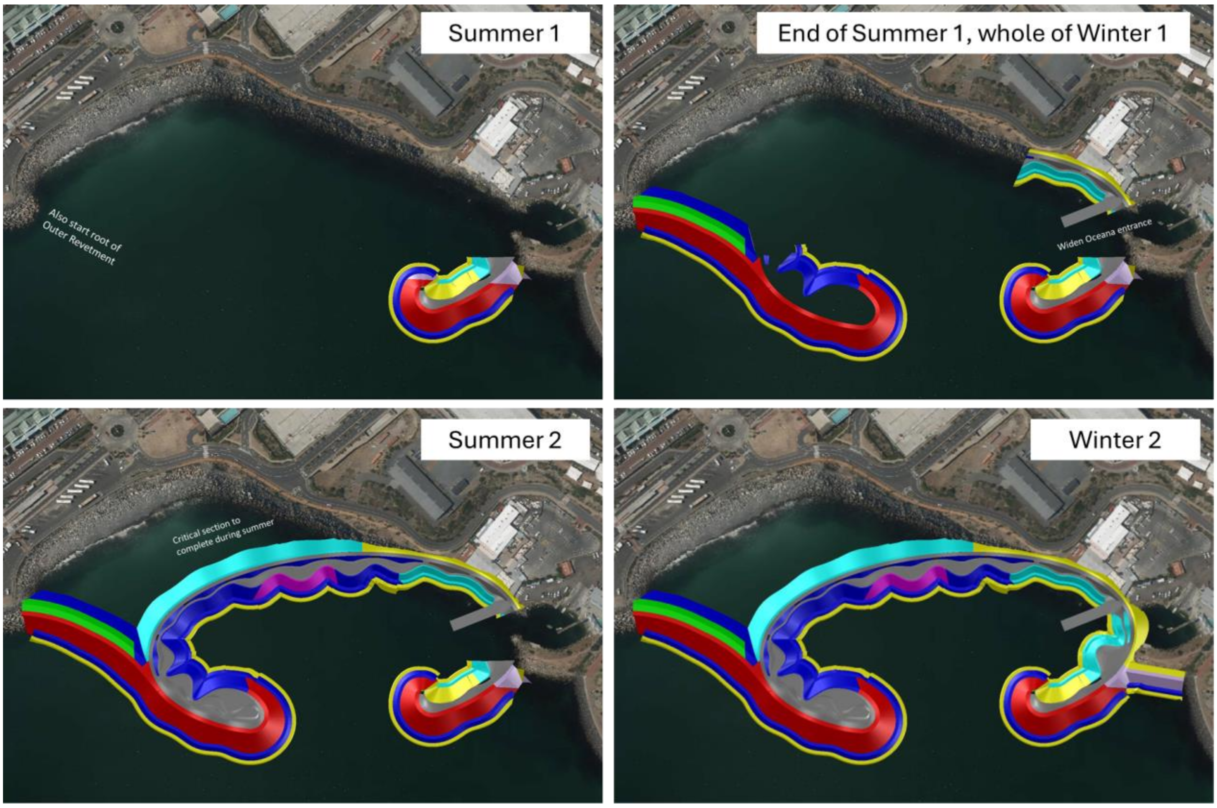


Figure 1.2. Conceptual project schedule. The project will be completed in phases, over two years (PRDW 2025).

1.3 Terms of Reference

The marine impact assessment will be led by Anchor, and the marine mammal component of the study will be subcontracted to Sea Search Research and Conservation NPC (Sea Search). This specialist study forms part of a full Scoping and EIA Process. The Terms of Refence (Tor) for the marine specialist study as follows:

- Describe the existing characteristics (baseline description) of the marine environment as described in the original specialist report as submitted as part of the original EIA process and indicate if any aspects of the baseline have changed since the original report was prepared.
- Identify and assess potential added or changed marine impacts resulting from the proposed scheme when compared to the scheme as originally assessed using the pre-determined impact rating methodology.
- Recommend mitigation measures to minimize potential added or changed impacts associated with the proposed development.
- Identify monitoring measures to ensure the correct implementation and adequacy of recommended mitigation measures, if applicable.
- Indicate whether the development alternatives (approved versus proposed scheme) are environmentally suitable or unsuitable and identify an environmentally preferred alternative.
- Address any additional issues raised through the public participation process applicable to the specialist field.

As a part of the baseline study the following information will be provided by the Marine Specialist in support of the ICMA Land Reclamation Process:

- Impact of reclamation processes on marine environment including biodiversity, and habitat fragmentation and destruction.
- Impact of reclamation processes on fisheries.
- Impacts on water quality including oxygen.
- If relevant, how the protected area will be impacted and describe the mitigation measures.
- Material to be used for reclamations.
- Risks of pollution due to material used.

1.4 Assumptions and limitations

A number of assumptions and limitations are applicable to this assessment:

- The study is based on details provided by the client as they pertain to planned infrastructure design.
- The accuracy and confidence of this study is dependent on the data available for the marine and coastal environments of the Table Bay and the Port of Cape Town.
- This assessment is entirely desktop based, and no new in situ data were collected as part of this assessment.
- It is assumed that there will be no dredging, piling or blasting undertaken. Should these activities be required, this report will need to be amended to assess impacts thereof.
- The marine environment in general and marine mammal presence has shown significant changes over the last two decades, with changes are likely to continue into the future. Information and impacts are therefore assessed with the dynamic nature of the environment in mind (Elwen 2025).
- There are no direct measures construction and operational phase noise levels, and therefore any values assessed are based on best estimates from the literature and other relevant reports. All data on the hearing thresholds of animals (and relevant impacts and responses) is based on literature and general assumptions of likely behaviour in relatively broad categories of animal group by ‘hearing frequency range’ (Elwen 2025).

2 LEGISLATIVE CONTEXT

2.1 Introduction

The key pieces of South African legislation that are applicable to the environmental impacts of the proposed development with specific reference to the marine environment are presented below.

2.2 National legislation

In terms of Section 24 of the Constitution of South Africa, 1996 (No. 108 of 1996) "everyone has the right:

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that;

i. Prevent pollution and ecological degradation;

ii. Promote conservation; and

iii. Secure ecologically sustainable development and use of natural; resources while promoting justifiable economic and social development".

2.2.1 National Environmental Management Act (No. 107 of 1998)

The National Environmental Management Act (No. 107 of 1998) (NEMA) as amended, provides for the incorporation of environmental considerations in decision-making. Section 2 of NEMA sets out the National Environmental Management principles. Section 2(3) states that "*development must be socially, environmentally and economically sustainable*". Section 2(4) states that:

c) "Sustainable development requires the consideration of all relevant factors including the following:

i. That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
iii. That the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
iv. That waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;

v. That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
vi. That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;
vii. That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
viii. That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied".

and "The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment."

Chapter 5 of NEMA sets out a suite of environmental management tools designed to ensure the integrated environmental management of activities. In accordance with this chapter, activities that have the potential to impact on— (a) the environment; (b) socio-economic conditions: and (c) the cultural heritage, need to be identified and must be considered. investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing. permitting, or otherwise allowing the implementation of such an activity. Activities that require authorisation are Listed in Listing Notices 1, 2 and 3 published in terms of the Environmental Impact regulations of 2014. As per Section 63, the competent authority must take into account various specified factors over and above the standard considerations for coastal activities, including consistency with the purpose of coastal public property and coastal access, socioeconomic impacts, impacts of coastal processes on the activity and vice versa, whether the activity is by its nature required to be located in the coastal environment, and whether public services will be provided by the activity.

2.2.2 National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008)

The National Environmental Management: Integrated Coastal Management Act 24 of 2008 (ICMA) is the primary environmental legislation responsible for the integration and coordination of various coastal and marine management efforts. This integrated coastal management addresses the governance of human activities affecting the sustainable use of goods and services generated by coastal and marine ecosystems. ICMA is applicable here in terms of Coastal Management Policy.

Section 7C of the ICMA notes that reclamation of land from the sea will be considered only in exceptional circumstances and when it is not contrary to the purpose of coastal public property (i.e. to improve public access to the seashore, to protect sensitive coastal ecosystems, to secure the natural functioning of coastal processes, and to provide protection from dynamic coastal processes including sea level rise.

2.2.3 The Marine Living Resources Act 18 of 1998 (as amended)

The objectives and principles of the Marine Living Resources Act (MLRA) deal with the management of marine living resources, the need to protect whole ecosystems, preserve marine biodiversity and minimize marine pollution, as well as to comply with international law and agreements. The Act was amended in 2014 (Marine Living Resources Amendment Act 5 of 2014, commencement date 8 March 2016). The West Coast Rock Lobster sanctuary ("Closed Area") WAS declared under Section 77 of the MLRA.

2.2.4 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act 10 of 2004 (NEM: BA) provides for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant protection; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.

The NEM: BA Alien and Invasive Species Regulations (2014) restricts the spread of listed invasive species through: transfer, release, discharging or disposing in waterways or oceans, catch and release, introduction to offshore islands, release into a discrete catchment system. It requires that a risk assessment should be carried out for listed species to ascertain likelihood of naturalisation and vector pathways.

NEM: BA Threatened or Protected Species Regulations (2007) provide a national approach to sustainable use of species that were threatened with extinction, or in need of national protection, while ensuring the survival of the species in the wild, thus ensuring the conservation of the species. NEM: BA enables the Minister to prohibit activities that may impact on the survival of species in the wild, and to regulate activities to ensure sustainable use of indigenous biological resources.

2.2.5 Biodiversity Management Plan for the African Penguin (2013)

The Biodiversity Management Plan for the African Penguin was developed and gazetted in terms of section 43 of NEM: BA, as the African penguin is listed as "Protected" in terms of Section 56 of NEM: BA. One of this plan's objectives is to *"[m]inimise and/or mitigate the impact of catastrophic events and other key pressures and risks on African penguins*". Another objective is to "minimise the impact of pollution (oil, hazardous and noxious substances) on African penguins through preventing spills, ensuring adequate preparedness, appropriate response and monitoring success." The plan provides for actions which should take place to achieve these objectives.

Currently, the Draft African Penguin Biodiversity Management Plan has been gazetted for comment (in 2022).

2.2.6 Marine Spatial Planning Act (Act 16 of 2018)

The Act is built on the National Framework for Marine Spatial Planning (MSP) in South Africa (2017), which provides guidance on MSP on a national level. It specifies the objectives of MSP and outlines the process. The objectives of the Marine Spatial Planning

Act (Act 16 of 2018) include the development and implementation of a shared marine spatial planning system to manage a changing environment that can be accessed by all sectors and users of the ocean, the conservation of the ocean for present and future generation and the facilitation of responsible use of the ocean. Where there is a conflict between existing uses, developing uses or activities, maximum coexistence of uses or activities should be preferred wherever possible but where such coexistence is not possible, the principles in Section 5(1) must be applied to resolve such conflict i.e., a precautionary approach must be applied. This approach must account for, inter alia, the sustainable use, growth and management of the ocean and its resources (5.1.a), the identification of economic opportunities which contribute to the develop-ment of the ocean economy (5.1.b), the promotion of collaboration and responsible use of the ocean through consultation and cooperation (5.1.c), the advancement of an ecosystem and earth system approach to ocean management which focuses on maintaining ecosystem structure and functioning within a marine area (5.1.c), adaptive management (5.1.e) and the reliance on the best available scientific information (5.1.h).

Section 5 describes the principles and criteria for Marine Spatial Planning. The precautionary approach is advised when following the principles, which include the sustainable use, growth and management of the ocean and its resources, the advancement of an ecosystem and earth system approach to ocean management which focuses on maintaining ecosystem structure and functioning within a marine area, the promotion of equity between and transformation of sectors, and the principle of good administration coherent and holistic planning and management.

Building on the Marine Spatial Planning Act (Act No. 16 of 2018) and the National Framework for Marine Spatial Planning in South Africa, the Department of Forestry, Fisheries and the Environment (DFFE) published the Proposed Approach to Spatial Development and Management for South Africa’s Marine Planning Areas in 2019. The document translates the overarching vision and high-level directions for developing South Africa’s ocean space into a spatial management system that applies to all Marine Planning Areas[1]. This document specifically provides for a “zoning scheme” system, which defines categories of sea use that inform the Draft marine sector plans (currently out for public comment).

[1] A ‘‘marine area plan’’ is defined by the Marine Spatial Planning Act (Act 16 of 2018) as “a plan developed within a marine area by analysing and allocating the spatial and temporal distribution of human activities in the South African waters to achieve ecological, economic and social objectives, taking into account all relevant principles and factors set out in this Act”.

3 RECEIVING ENVIRONMENT

3.1 SPATIAL CONTEXT

The Port of Cape Town is the southernmost commercial port in Africa, located at the apex of a major international shipping route on the northern edge of the Cape Peninsula. The Port is situated on the south-western coastline of South Africa in Table Bay, an open embayment in the southern Benguela Current ecosystem that covers approximately 100 km^2 (Carter 2006). The Bay encompasses Robben Island, with the rocky headlands of Mouille Point to the south and Blouberg to the north and is surrounded by metropolitan Cape Town (Figure 3.1). Table Bay is relatively shallow, with a maximum depth of 35 m. The depth increases to approximately 70-80 m outside the line between Mouille Point and the western shores of Robben Island (Figure 3.2). Granger Bay itself slopes off to 20 m depth within 300 m of the shore (Figure 3.3).

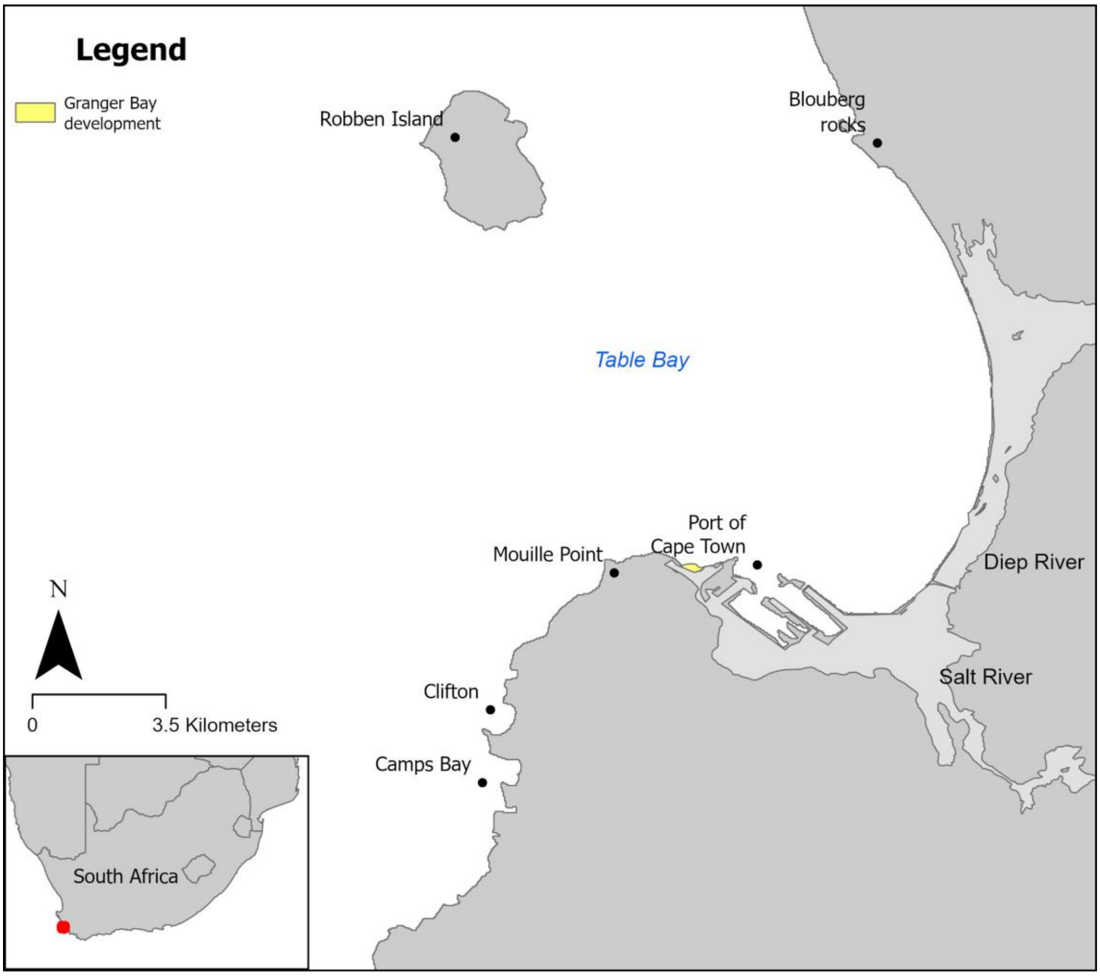


Figure 3.1. Table Bay with associated landmarks discussed in the text (adapted from Carter 2006).

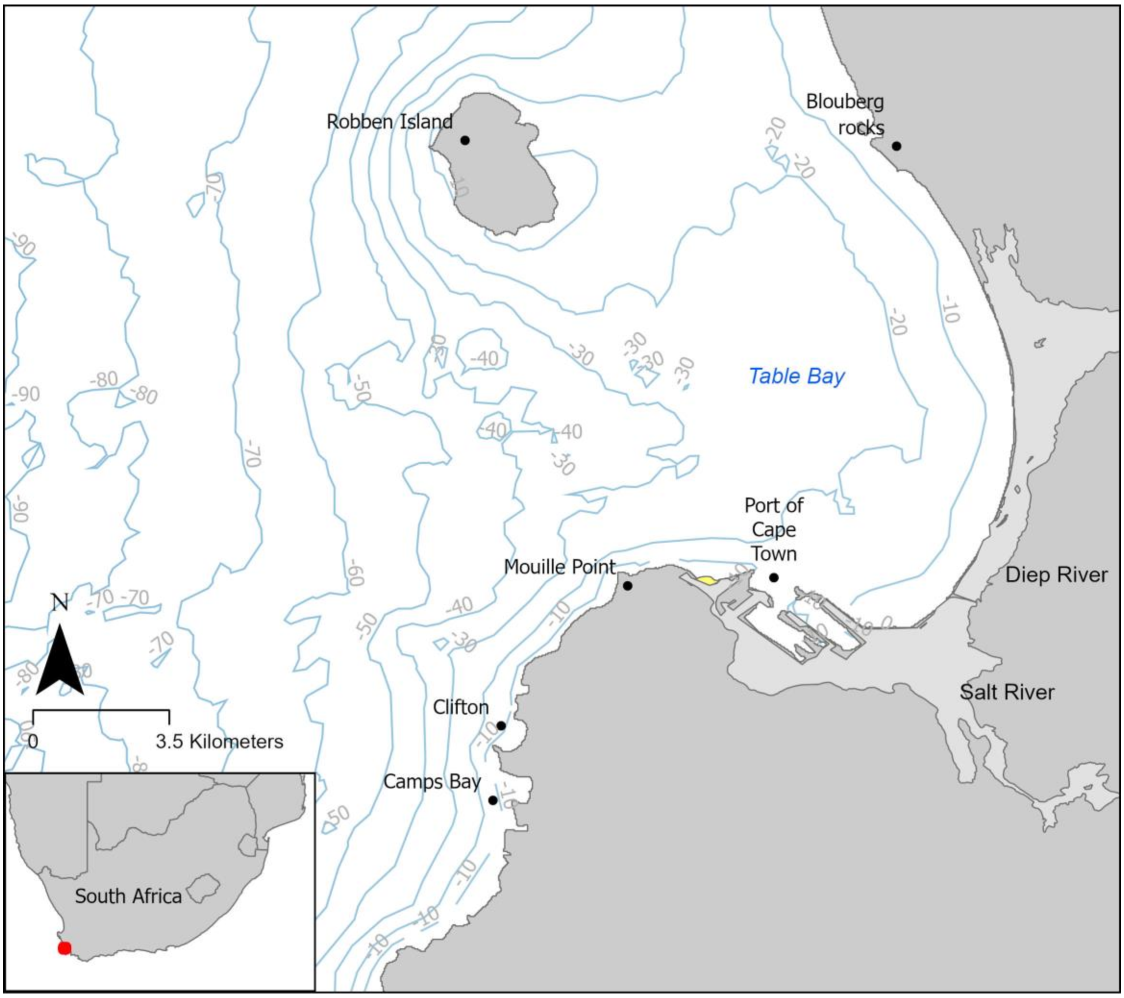


Figure 3.2. Bathymetry of the greater Table Bay area.

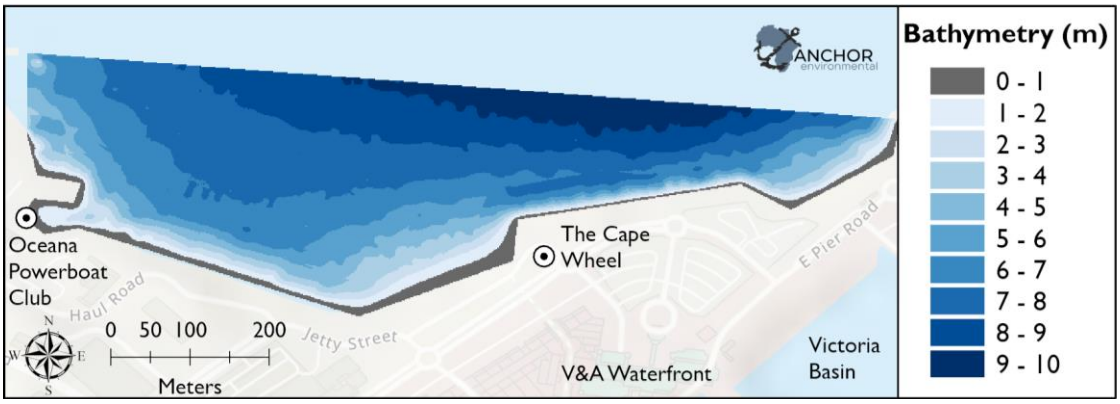


Figure 3.3. Nearshore bathymetry of Granger Bay area (Source: Anchor 2024).

The Port of Cape Town consists of the Victoria and Alfred Basins, the Duncan Dock and the Ben Schoeman Dock (Figure 3.4). The older Victoria and Alfred Basins are situated at the southern end of Table Bay, while the Alfred Basin is situated landward of the Victoria Basin and is connected to the Victoria Basin via a 30 m wide channel adjacent to the Clocktower precinct (Figure 3.4) (Anchor Environmental Consultants 2013). These basins have been developed into the Victoria and Alfred (V&A) Waterfront, a retailing, leisure and entertainment complex, and while they fall outside of Port limits, complement the commercial port by providing berthing for smaller recreational and fishing vessels (Transnet 2023). Tugs and admin craft are also berthed in the V&A Waterfront (Transnet 2023). The Duncan Dock lies to the southeast of the Victoria and Alfred Basins, with general cargo berths and liquid bulk berths, while the Ben Schoeman Dock lies seaward to the northeast, and has container berths which have recently been deepened to -15.5 m (Transnet 2013) (Figure 3.4). Ship repair jetty berths and the Sturrock Dry Dock are located on the eastern side of Duncan Dock (Figure 3.4). Local and foreign fishing vessels are berthed in various locations around the port. Recreational craft are moored in the Royal Yacht Club in the Small Craft Basin and in Elliot Basin (Figure 3.4) (Transnet 2023). Granger Bay, the focus area for this development, is located to the northeastern edge of the bay, outside of the existing breakwater (Figure 3.4).

Figure 3.4. Aerial view of the Port of Cape Town, showing the positions of the Victoria and Alfred (V&A) Basins, the Duncan Dock and Ben Schoeman Dock, as well as Table Bay and Granger Bay (Google Earth 2023).

3.2 Oceanography

Water temperature, nutrient and oxygen levels, and wave exposure are the principle oceanographic forces that drive the shape of marine communities. The broader physical, chemical and biological oceanography of the southern Benguela system of the West Coast of South Africa influences the marine ecology and oceanography of Port of Cape Town.

The Benguela system is influenced predominantly by the wind-driven upwelling of deep nutrient rich water close to the coast (Figure 3.5). Wind is the primary driver of life in the system, strongly influencing both water temperature and inorganic nutrient levels, and in turn, primary production. The prevailing south-easterly winds displace surface water offshore during the summer, and cause cold, nutrient rich water to rise from deeper water masses to replace this surface water. These upwelling events cause low water temperatures and high nutrient levels near the coast (Branch & Branch 2018). The oceanic primary producers, phytoplankton, bloom when upwelled nutrients become available for photosynthesis in the presence of sunlight. These are consumed by zooplankton, which are in turn consumed by small pelagic fish species such as anchovy and sardine. The Benguela upwelling region is one of the world's most productive systems, supporting rich fishing grounds and attracting large colonies of sea birds and seals (Branch & Griffiths 1988, Branch & Branch 2018). Upwelling cells (i.e., areas of intense upwelling) in the southern Benguela are located off Cape Columbine and the Cape Peninsula (Figure 3.5).

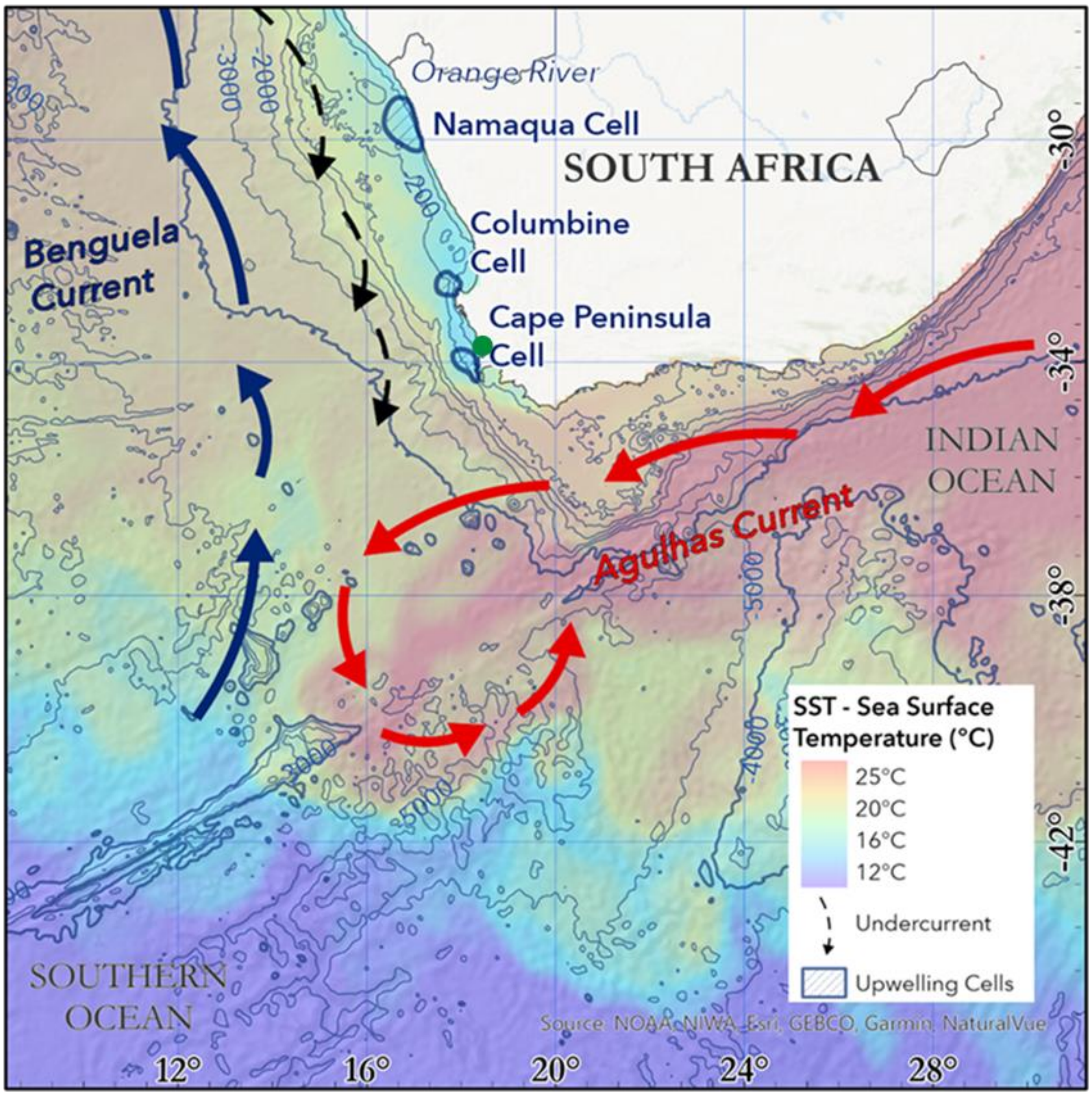


Figure 3.5. Major current streams around South Africa. The warm Agulhas Current (RED) flows down the east coast, and cold upwelling plumes (blue) can be observed along the west coast. Site location = green dot.

3.2.1 CURRENTS AND WIND

The water properties and circulation of Table Bay are characteristic of the southern Benguela upwelling system (Figure 3.5). Currents in the Bay are primarily wind-driven and relatively weak, with some, albeit minor, influence by tidal forcing. Offshore, water movement is also influenced by shelf currents, while waves and swell influence nearshore currents. Swell predominantly approaches the Bay from the southwest, generating a generally northerly longshore current (Quick & Roberts 1993, Carter et al. 2003). The currents in the Port itself (specifically in the Victoria and Alfred Basins) are driven by tidal fluctuations, with a minor influence of wind-driven forces (Diedericks & Smit 2013). The north facing Granger Bay faces the incoming southwest swell (i.e., Granger Bay itself is not considered a retentive environment) (Diedericks & Smit 2013) .

Summer and autumn winds in the Port of Cape Town are predominantly from the south-southeast, frequently in the range of 6-9 m/s, while winter winds are predominantly north-northwest, reaching higher speeds less frequently (Figure 3.6). In the summer, the strong south-easterly winds drive a northward, anti-clockwise circulation in Table Bay with a surface flow of 0.2-0.3 m/s (Quick & Roberts 1993). These winds induce coastal upwelling along the western seaboard, drawing cold, nutrient-rich water to the surface. This upwelling fuels high primary productivity, supporting rich pelagic and demersal fisheries. Sea surface temperatures in Table Bay can vary markedly due to the strength and location of upwelling cells (See Section 3.2.3).

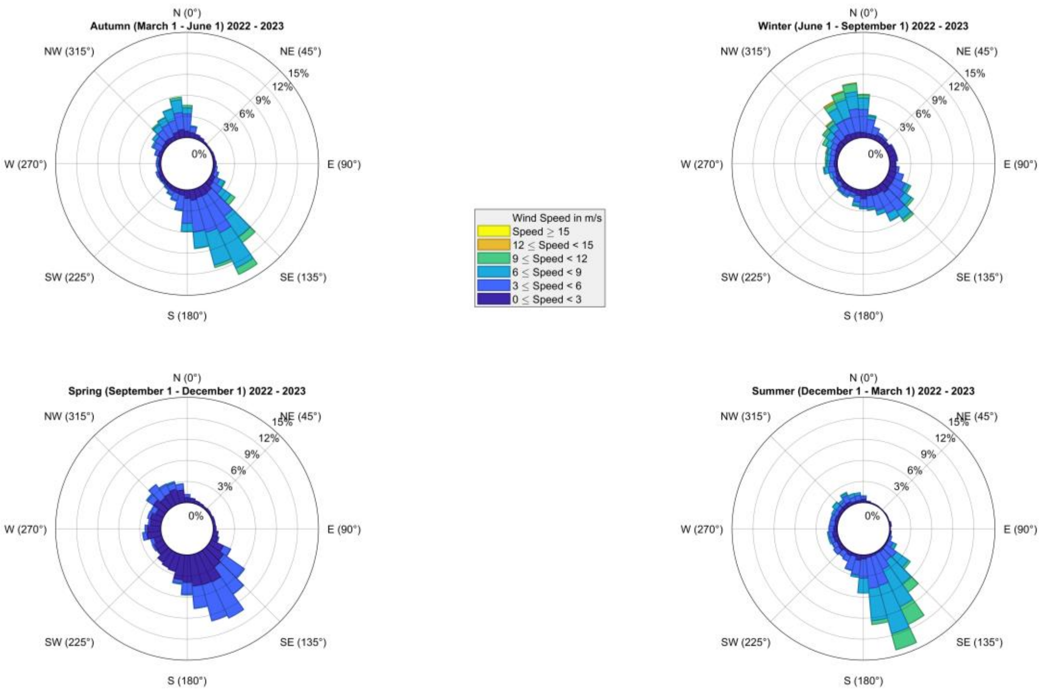


Figure 3.6. Seasonal wind roses for the Port of Cape Town for 2022 and 2023 (Hersbach et al. 2023).

In the winter, the predominately north/north-westerly winds produce clockwise circulation (Daniels et al. 2022a), bringing large swells and storm events from the Southern Ocean. This seasonal shift reduces upwelling intensity and increases wave action, which can affect sediment transport and port operations. Despite this, within the

Port, current velocities range from 0-0.21 m/s with little wave action, due to the protection afforded by the main breakwater of the Port of Cape Town (Diedericks & Smit 2013).

Residence time (i.e., the time in which 80% of the water is replaced) within Table Bay is relatively long, at approximately four days, while residence times in the Port ranges from seven days in the Victoria Basin to about one day in the Alfred Basin (Quick & Roberts 1993). Water residency time within the Duncan and Ben Schoeman docks is approximately 10 days, and the waters from the Ben Schoeman Dock and Duncan Dock do not mix with the water from the Victoria and Alfred Basins (Van Ballegooyen et al. 2006).

Local current data in the vicinity of the proposed development footprint was obtained through the deployment of a SonTek Argonaut XR Acoustic Doppler Current Profiler (ADCP) in Granger Bay (33°53.921'S; 18°25.584'E) from 6 March 2020 to 26 March 2020 (Wright et al. 2022). The instrument was programmed to record current direction (using its internal compass) and strength at 60-minute sampling intervals. The ADCP recorded average current direction and strength readings over 600 seconds (10-minute averaging interval) in ten bins throughout the water column, from 80 cm above the instrument sensor to the surface using the “Dynamic Boundary Adjustment” mode to take account of tidal changes in water depth. The instrument also measured bottom water temperature. The data were downloaded from the instrument, trimmed to exclude any cells close to or above the water surface using the dynamic cell end (as measured by the pressure sensor), corrected for magnetic declination (25.36°W), and analysed to produce current roses depicting direction, strength, and frequency of currents at different depths throughout the water column over the sampling period.

Time series plots of the current speed and direction for the dynamic cell (upper 3.5-4 m of the water columns) for the March 2020 deployment period show a prevailing current moving alongshore in an easterly direction, with a mean current speed of 5.3 cm/s, a maximum of 17.8 cm/s, and a minimum of 0.1 cm/s (Figure 3.7).

Current roses depicting strength, frequency and the direction of currents were constructed from this data to further enable the quantification of typical current velocities and directions under the prevailing wind conditions. By convention, wind roses depict the direction that a wind is blowing from, whilst current roses show the direction to which a current is flowing. The data that recorded currents from the surface to 3.5-4 m depth are summarised in a current rose that shows the prevailing current moving alongshore in a north-easterly direction, while, less frequently, currents flow in a south westerly direction (Figure 3.7). Current velocities recorded at the deployment site over the sampling period indicated that 45.5% of the measured current velocities were 1-5 cm/s, while a current speed of 5-10 cm/s was recorded 32% of the time. No currents above 20 cm/s were recorded (Figure 3.7).

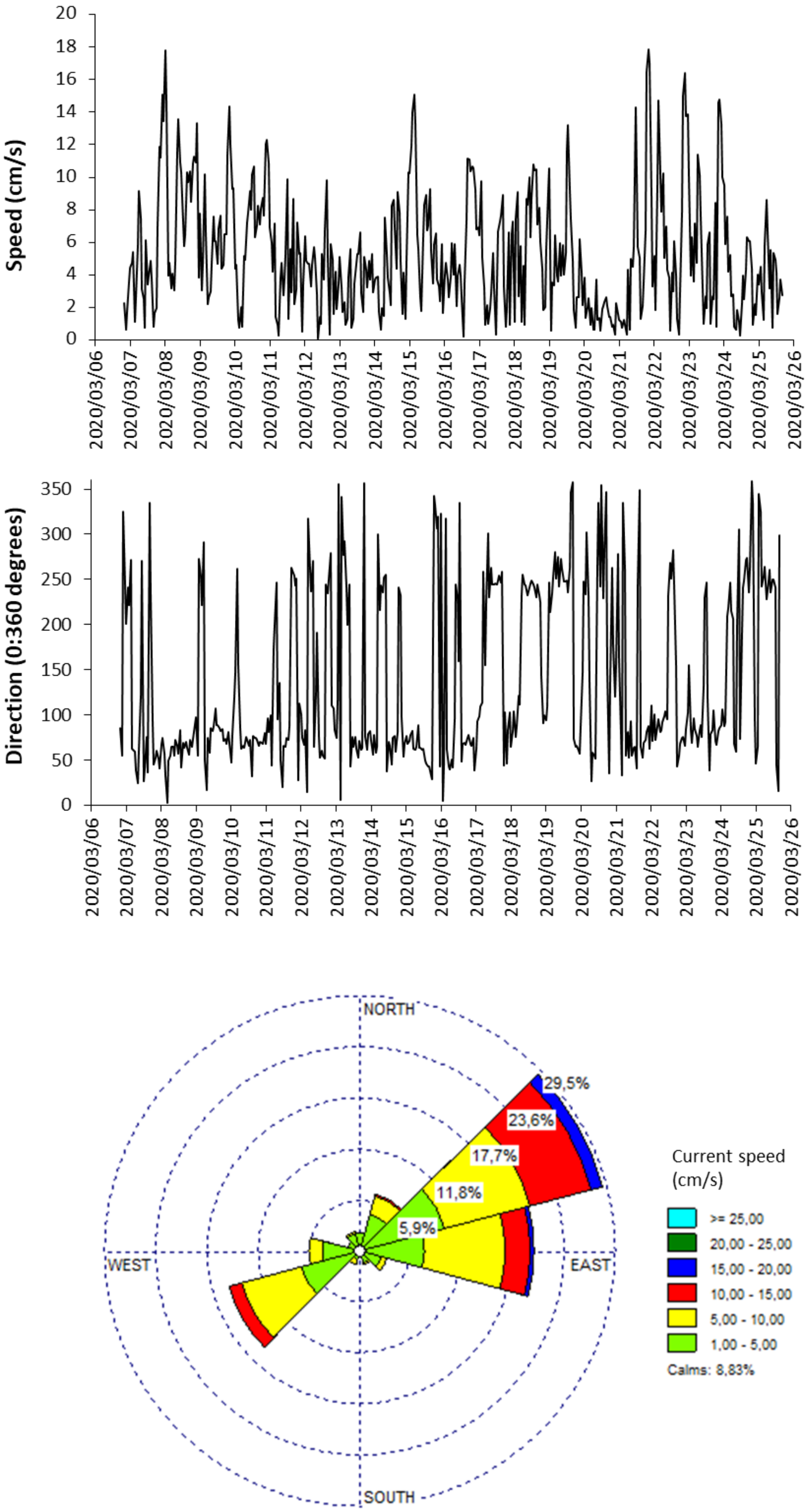


Figure 3.7. (Top) Current speed (cm/s) and (middle) current direction (0:360) for the March 2020 ACDP deployment period. (Bottom) Current rose showing current direction and strength data (cm/s) in the upper 3.5-4 m of the water column (Wright et al. 2022).

3.2.2 TEMPERATURE AND SALINITY

Summer wind forcing, and subsequent upwelling, drives cold water (9-13°C) into the south of Table Bay. This upwelling leads to a generally shoreward bottom flow and a highly stratified water column during the summer: during upwelling relaxation, the cold upwelled water collects at the bottom of the water column, while the surface water is warmed by solar radiation. Indeed, periods of upwelling relaxation and subsequent flow of water from the north and north-west can result in rapid increases in water temperature to >20°C (Monteiro 1997) . Winter storms (and the cessation of upwelling in winter) lead to strong mixing of the water column in the Bay, with a more uniform water temperature within a narrow band of 14-16°C (CSIR 2016). Twelve years of sea surface temperature (SST) measurements for two sites within Table Bay show a seasonal variation in surface water temperatures within the Bay (higher in summer, due to increased solar radiation, and lower in winter) (Figure 3.8). Indeed, over twelve years, the daily SST exceeded 18°C some 13% of the time, with a maximum SST of 20.5°C (Figure 3.8).

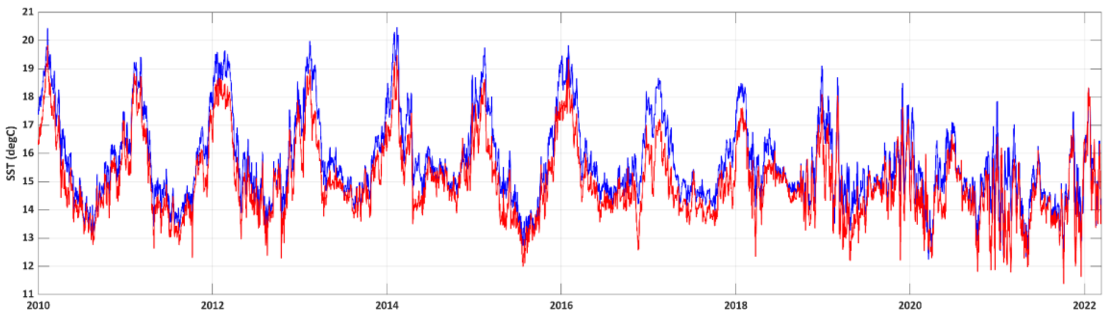


Figure 3.8. Daily Sea Surface Temperature (SST) for two Copernicus ERA5 remote sensing points in Table Bay from 2010-2022 (Hersbach et al. 2018).

Within the Port of Cape Town, seasonal temperatures are similar to those described for Table Bay. In general, winter water temperature readings indicate a well-mixed water column, while summer showed the stratification at stations in the V&A Marina, Victoria and Alfred Basins, and in Duncan Dock (CSIR 2016). Daily Victoria Basin intake water temperature for the Two Oceans Aquarium over almost ten years shows a strong seasonal pattern. Summer (December to February) and winter (June to August) temperature maximums are 20.2°C and 16.1°C respectively, while summer and winter minimums are 7.5°C and 7.6°C respectively. The mean summer temperature is 14.9°C (±1.4 stdev), slightly higher than the winter average of 13.9°C (±1.0 stdev).

Seasonal surface and bottom water temperatures over four years of measurement at a station within Granger Bay are shown in Figure 3.9. Summer temperatures ranged from 10.9-14.4°C at the surface, and between 10.1-13.2°C at the bottom (CSIR 2011, 2014, 2016, 2017b) (Figure 3.9). Summer bottom temperatures were generally cooler than those in winter, indicative of upwelling (see Section 3.2.1). A thermocline is frequently present at approximately 10 m depth during the summer (mean surface temperature of 13.4°C, mean bottom temperature of 10.5°C) (CSIR 2011, 2014, 2016, 2017b)

Temperature data collected during the March 2020 (autumn) ADCP deployment showed a variation of 5 °C (range from 9.7-14.7 °C) and a mean temperature of 10.6 °C (Figure 3.10) (Wright et al. 2022).

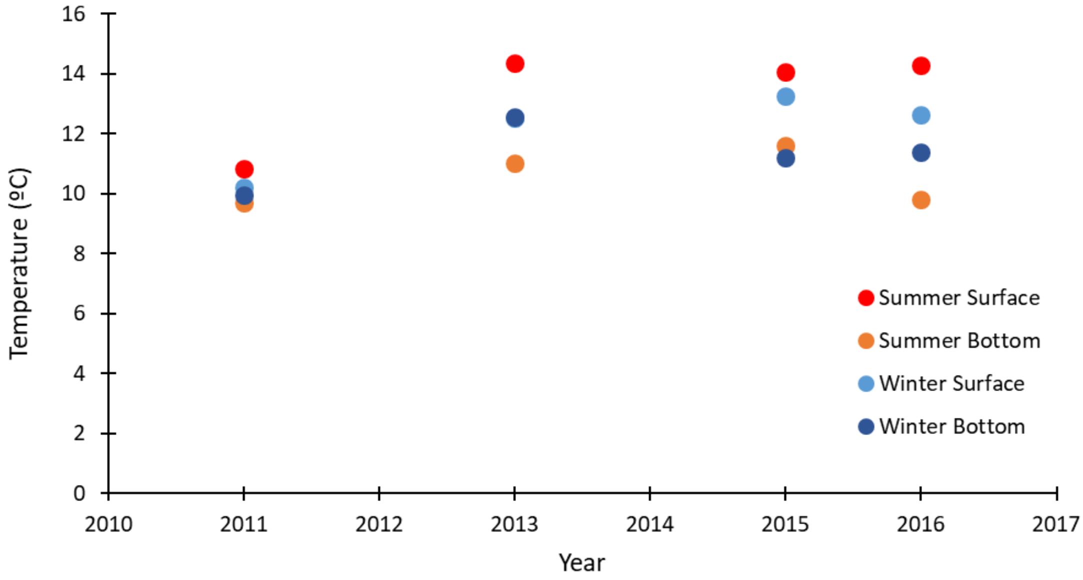


Figure 3.9. Seasonal temperature (°C) measurements at the surface and bottom waters in Granger Bay across four years (CSIR 2011, 2014, 2016, 2017b).

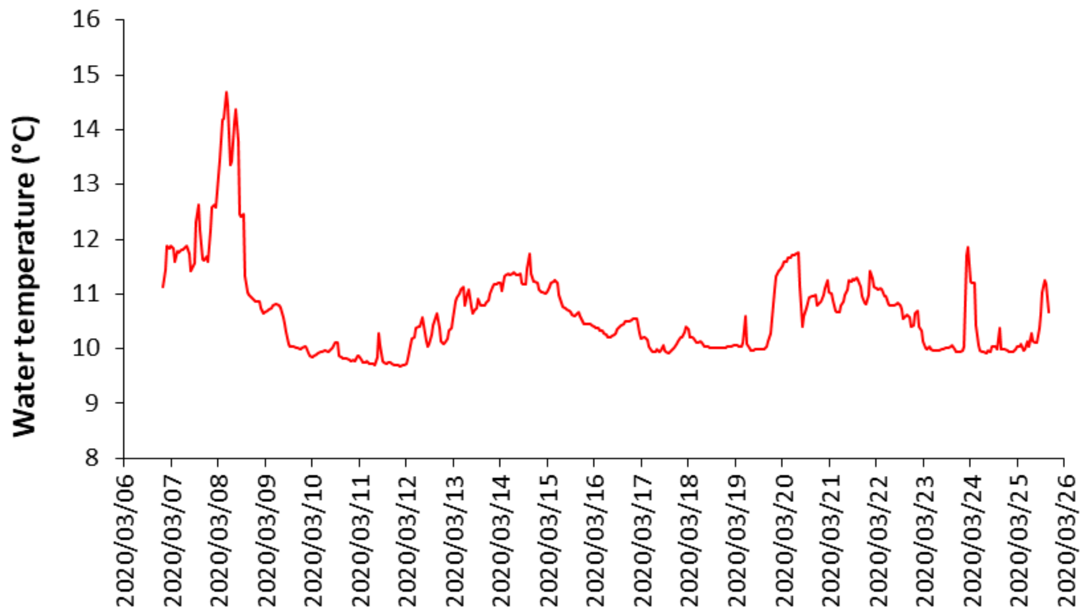


Figure 3.10. Hourly temperature data at the ADCP deployment site in Granger Bay from 2020/03/06 to 2020/03/25 at 10 m depth.

Table Bay salinity ranges between 34.7 and 35.3 with very little difference in values between stations across the bay or within the port itself (CSIR 2016, 2017a, Daniels et al. 2022b). However, there is a lowered salinity in proximity to freshwater outflow of the Diep and Salt Rivers into Table Bay, especially during the winter rainfall months (CSIR 2016, 2017a). In addition, stormwater runoff into Duncan Dock is evidenced by the salinity of surface water across the basin being generally lower than elsewhere in the Port (CSIR 2016, 2017a). Average surface salinities in Granger Bay ranged between 34.6-35.5, with bottom salinities of 34.8-35.2 (Figure 3.11). There is minimal variation in salinity through the water column with depth, especially in summer.

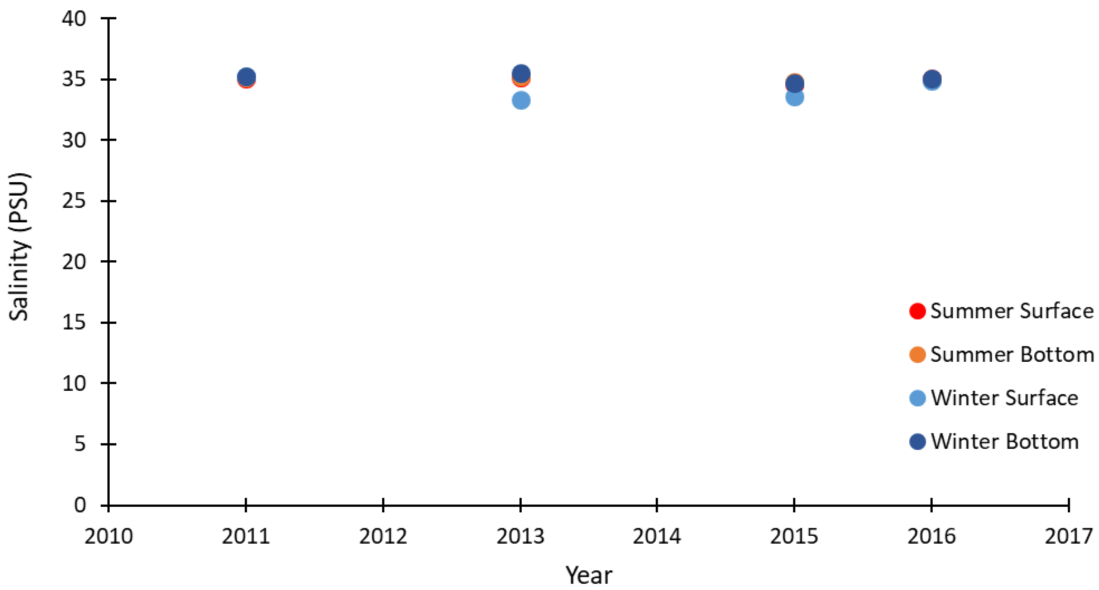


Figure 3.11. Seasonal salinity measurements at the surface and bottom waters in Granger Bay across four years (CSIR 2011, 2014, 2016, 2017b).

3.2.3 TIDES

The Port of Cape Town is characterised by a generally weak semi-diurnal tide, with maximum and typical tidal variations of approximately 2 m and 1 m, respectively (Diedericks & Smit 2013, Transnet 2023). However, meteorological conditions can result in in situ variations of up to 0.5 m from the tidal predictions (Diedericks & Smit 2013). The Hydrographic Office mean tidal levels for Cape Town are given in Table 3.1 below. However, localized wind-driven currents and eddies can influence navigation and sediment deposition within the Port of Cape Town. The Bay is partly sheltered by Robben Island and the Cape Peninsula, which helps mitigate some oceanic swell.

Table 3.1. South African Hydrographic Office Cape Town tidal levels. The values of Lowest Astronomical Tide (LAT) and Highest Astronomical Tide (HAT) are computed from 19 years' predictions. The Mean Levels are computed from the predictions of a recent year when the moon's average maximum declination was 23½°.

Description	Acronym	Level in m
Lowest Astronomical Tide	LAT	0
Mean Low Water Springs	MLWS	0.25
Mean Low Water Neaps	MLWN	0.70
Mean Level	ML	0.98
Mean High Water Neaps	MHWN	1.26
Mean High Water Springs	MHWS	1.74
Highest Astronomical Tide	HAT	2.02

3.3 WATER AND SEDIMENT QUALITY

The water quality in Table Bay is generally considered good, with limited sources of direct contaminants and pollution (e.g. the Green Point and Chevron/Caltex outfalls) (Monteiro 1997, CSIR 2006, Van Ballegooyen 2007). The water and sediment quality within the Port of Cape Town is of some concern however, because the Port is a working harbour, with various operations including the synchro-lift, fish factories, historical oil storage sites, and urban run-off from the City of Cape Town (including stormwater flow into Duncan Dock, the repository of all City Bowl stormwater) (CSIR 2016). The stormwater outfall into Duncan Dock appears to be a major source of contaminants to the port and surface water samples collected near the outfall in 2016 indicate the possibility that, “raw sewage is seeping into the stormwater reticulation system”, and ultimately flowing into the port (CSIR 2017a).

Within the Port, dissolved oxygen concentration and saturation varies minimally through the water column during the winter, as the water is well mixed (CSIR 2016). In contrast, dissolved oxygen concentration and saturation levels can vary considerably between stations in the Port in the summer, with high readings in the Victoria Basin, the entrance basin and in the outside marine environment, as a result of phytoplankton photosynthesis (surface water dissolved oxygen and chlorophyll-*a* concentration were reported to be very strongly, positively correlated, CSIR 2016). In the summers between 2011 and 2017, surface dissolved oxygen levels ranged between 7.16-13.31 mg/l in the Port and between 7.06-12.68 mg/l in the Bay (Figure 3.12). The CSIR Coastal Systems research group found that levels of dissolved oxygen in the surface and bottom waters were moderate and classified water quality as “good” or “fair” in both summer and winter (CSIR 2016).

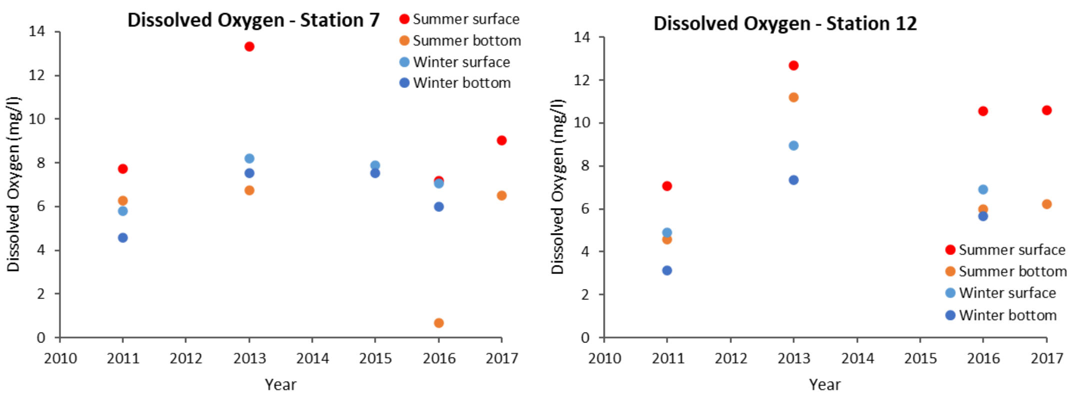


Figure 3.12. Seasonal surface and bottom water dissolved oxygen recorded at sites in (station 7) and near (station 12) the Port of Cape Town (CSIR 2011, 2014, 2016, 2017b).

There appears to be no significant trace metal pollution in the water column and the inorganic nutrient concentrations within the water column are not significantly different to those in Table Bay (Carter et al. 2003, Anchor Environmental Consultants 2013, Wright & Clark 2017). Suspended sediment concentrations in the Port of up to 50 mg/l have been reported, which are comparable to areas of significant anthropogenic nutrient flows and subsequent eutrophication, while suspended sediment concentrations in Table Bay range between 1 and 44 mg/l (Carter et al. 2003). More recent surveys indicate that in general, turbidity was low in the Port and generally varied minimally through the water column, and that total suspended solids (TSS) concentrations in surface water at most stations was relatively low, generally below 15 mg/l (CSIR 2016).The maximum observed TSS at Station 7 within the Ben Schoeman Dock across eight seasonal samples was 12 mg/l in the winter of 2016 (Figure 3.13). It must be noted, however, that the high levels of productivity in upwelling system such as the Benguela, may cause natural increases in

TSS and turbidity values (Froidefond et al. 1996). For example, an unusually high (classified "poor") TSS reading of 25 mg/l occurred in winter 2016 at the station within Duncan Dock.

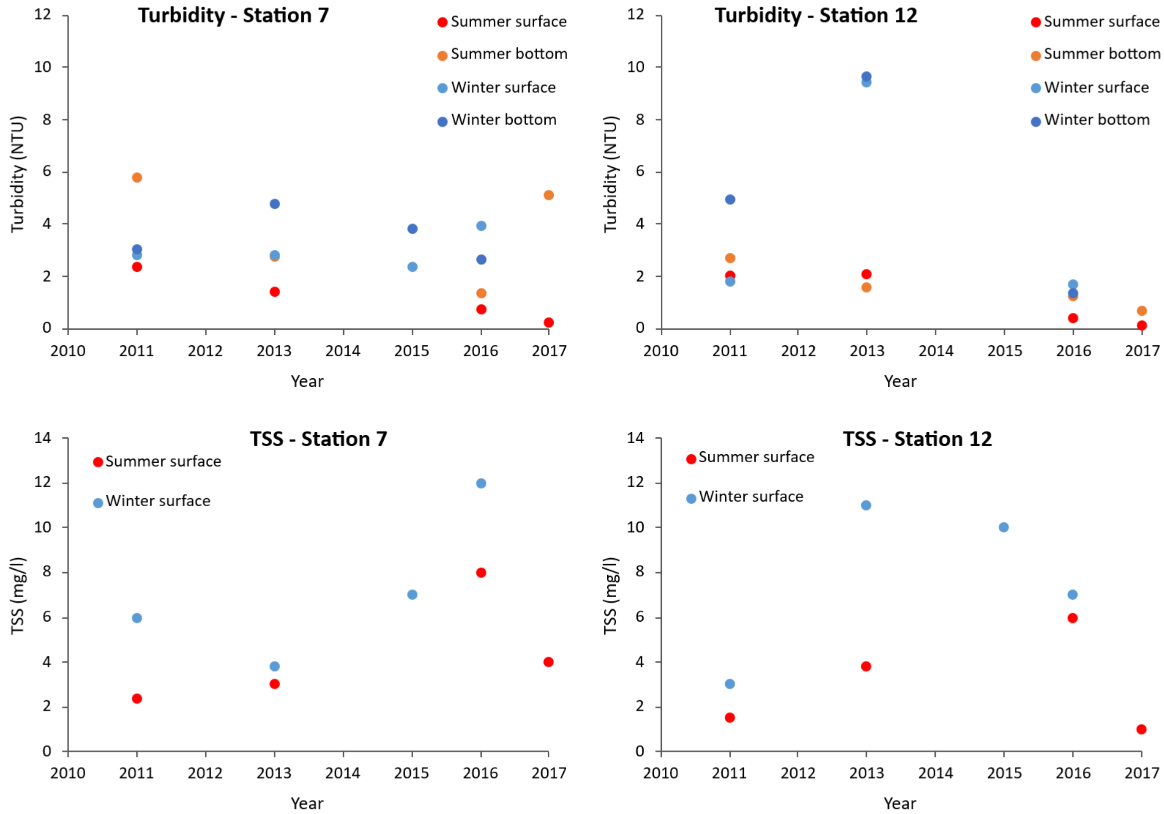


Figure 3.13. Seasonal surface and bottom water turbidity and surface total suspended solids (TSS) recorded at sites in (station 7) and near (station 12) the Port of Cape Town (CSIR 2011, 2014, 2016, 2017b).

Between 2011 and 2017, summer bottom waters generally more turbid than surface waters (Figure 3.13). The site in the port (station 7) reached a maximum turbidity of 5.76 NTU in the bottom waters in summer 2011 (Figure 3.13). Although stations outside of the Port (site 12) generally had lower turbidity overall, this site reached a higher maximum turbidity of 9.63 NTU in the bottom waters in winter 2013 (Figure 3.13). As this high turbidity coincided with particularly low salinity, it may be due to freshwater input (Figure 3.9).

In general, however, the water quality in the Port of Cape Town in general has been classified as "good" or "fair" in terms of the criteria for surface water quality for dissolved inorganic nitrogen, turbidity and suspended solids (CSIR 2016). The CSIR (2016) survey detected faecal coliform, *E. coli* and faecal streptococci bacteria in surface waters at all stations with the exception of the station in Table Bay, immediately west of the main breakwater, where faecal streptococci bacteria were not detected. The highest counts occurred within Duncan Dock (CSIR 2016). The survey defined water quality classification criteria for *E. coli* and faecal streptococci bacteria as 'good' at all but one station within Duncan Dock, where it was classified 'poor' (CSIR 2016).

Sediment quality in the Port of Cape Town was classified as "poor" at all stations in the V&A Marina and Alfred Basin (CSIR 2016). The rating reflects significant to severe contamination of Port sediments with pollutants such as metals, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, polychlorinated biphenyls and/or tributyltin present at such concentrations as to be acutely toxic to sediment-dwelling macrofauna, based on comparisons with sediment quality guidelines (CSIR 2016, 2017). It is considered highly probable that the metal contamination has an anthropogenic source, given that the most severely metal contaminated sediment occurs alongside or near vessel and oil rig repair facilities (CSIR 2016, 2017b). The sediments of the Ben Schoeman dock are considered mildly anoxic, while the sediments of the Victoria Basin are described as black, anoxic and contaminated by hydrocarbons (CSIR 2016). The highest PAH sediment concentrations ever recorded in in a South African port occurred at a station alongside the Synchrolift in Alfred Basin (CSIR 2016). Other sources for PAH pollution include oil leaked from vessels, the illegal discharge of contaminated bilge water from vessels, and the entrainment of oil leaked onto hard surfaces into the port by surface (stormwater) runoff (CSIR 2016).

Microplastics have recently been identified as a marine contaminant and potential pollutant that poses an ecological threat to both marine organisms and to the humans who subsequently consume these marine species. Microplastics are microscopic pieces of plastic which result from the breakdown of plastic debris (secondary microplastics) or small plastic particles, i.e. nurdles, which are specifically manufactured to be used in plastic production (primary microplastics). They can enter the ocean from either land-based sources, such as stormwater run-off, sewer overflows, construction and outflow pipes, or marine-based activities such as harbour dredging, the fishing industry or drilling from oil. Stormwater outfall pipes have been identified as a significant source of microplastic within South Africa with high levels of dangerous polymers found at Mouille Point in Cape Town by Granger Bay (234.67±31.42 particles/kg of sediment vs 149.71±21.17 particles/kg in False Bay: Julius, Awe & Sparks 2023).

Microplastics have been found in several marine species, including sardines (Bakir et al. 2020) and hake off the coast of South Africa (Sparks & Immelman 2020). Molluscs, such as mussels, are also often used as bioindicator species to monitor levels of pollution within marine systems, and a study within the Cape Town harbour indicates that there are high levels of harmful microplastics in the seawater which are likely to negatively impact the marine species living in the area (Sparks et al. 2023). Microplastic levels in the Cape Town Harbour were recorded as 12.08 Microplastic/L (±1.3 standard error of the mean) (Sparks et al. 2023) compared to studies in Durban Harbour which recorded levels of between 0.007-1.20 Microplastics/L of seawater (as summarised in Sparks et al. 2023). Ingestion of microplastics by marine organisms can cause mechanical impacts, such as the clogging of the digestive tract or smothering of breathing apparatus, or ecological effects, such as hepatic stress and slowed growth rates (Gall & Thompson 2015).

3.4 Biogeography

Numerous attempts have been made to understand and map marine biogeographic patterns around the coast of South Africa with the most recent being Sink et al. (2012). Most of the studies recognised three coastal regions; a cool temperate west coast, a warm temperate south coast and a subtropical east coast region; however, Sink et al. (2012) defined several new ecoregions that are now in use. According to these divisions,

Table Bay falls into the cool temperate west coast region, central within the Southwestern Cape inshore ecoregion (Figure 3.14).

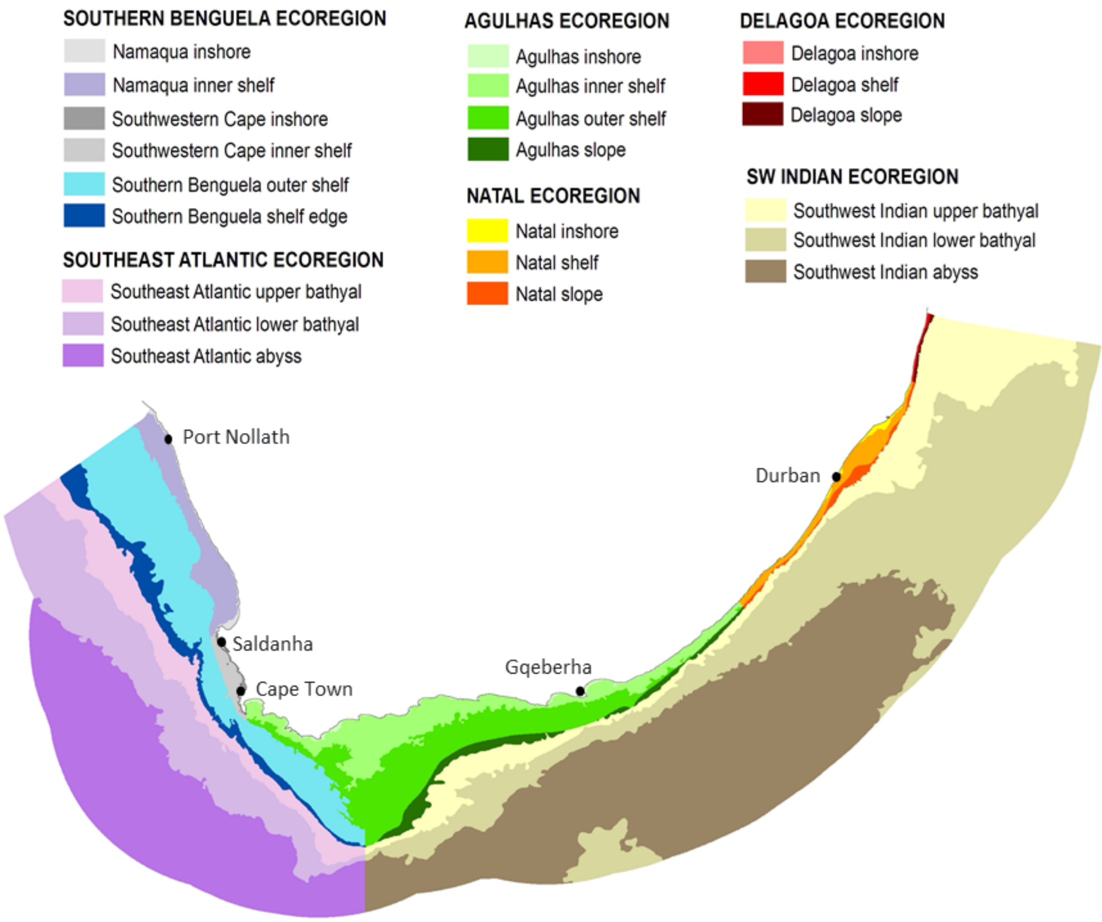


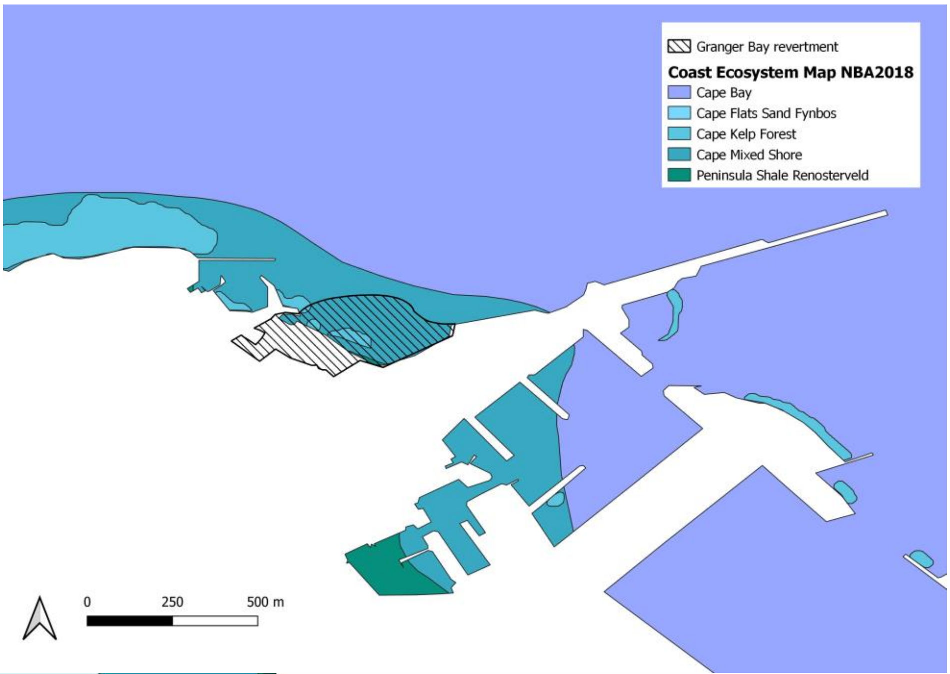
Figure 3.14. Inshore and offshore ecoregions in South Africa as defined by Driver et al. (2012), Sink et al. (2012).

3.5 Ecology and habitats

The Southern Benguela Ecoregion is the most productive of South Africa's ecoregions (Harris et al. 2019). Wind-driven coastal upwelling is the predominant physical forcing that shapes the high levels of biological productivity here, providing nutrients for primary producers, and food for diverse fauna, such as pelagic (pilchards, anchovy) and demersal fish stocks (hake, kingklip); near shore fisheries (linefish, rock lobster, abalone); mammals (seals, whales); and seabirds (penguins, gannets, cormorants, etc.).

Bays, such as Table Bay, are of high ecological importance in temperate (cold water) ecosystems as they provide sheltered areas of relative warmth and thermal stratification, thereby increasing the growth of phytoplankton and primary production. This increased primary production supports complex food webs and attracts a diversity of species, such as fish, birds and mammals, which congregate here to feed and reproduce (Harris et al. 2019). Bays also tend to have longer retention times of seawater due to circulation leading to longer retention times of larvae and, also, pollution.

The proposed site of construction is located off the sea-ward edge of Granger Bay (Port of Cape Town) which is located within Table Bay. There are also several Coastal Ecosystems which are found within the broader Table Bay area (Figure 3.15) and may be indirectly affected by any construction within the Bay. Marine Ecosystem Types within or surrounding the construction footprint are Cape Bay, Cape Kelp Forest, Cape Mixed Shore and Artificial Surfaces of the Harbour. The local ecosystems that directly overlap with the proposed development include the Cape Kelp Forest and Cape Mixed Shore Ecosystems (Figure 3.15).



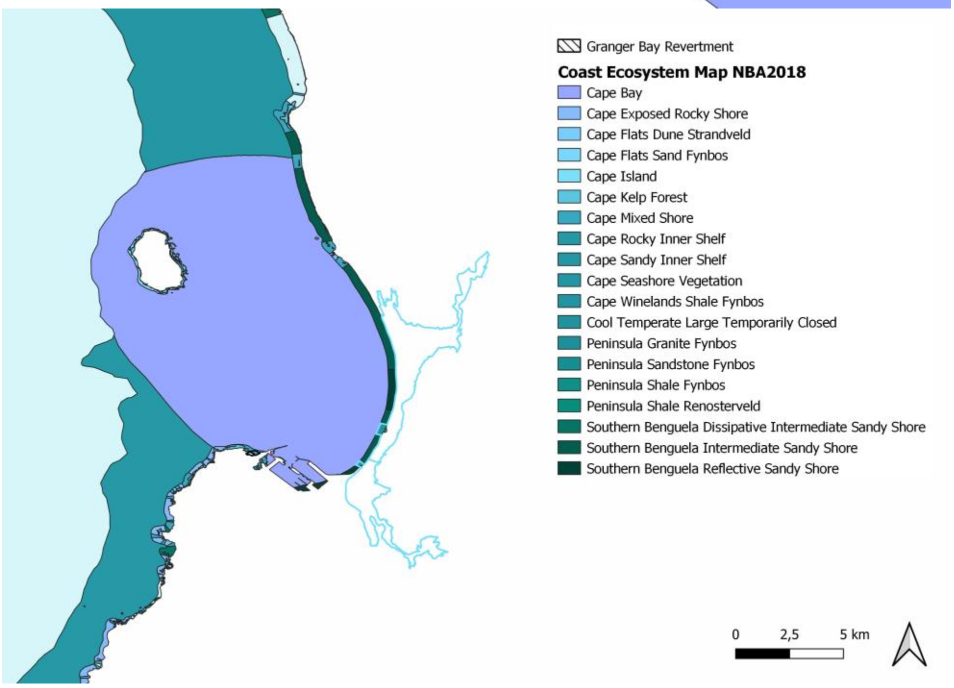


Figure 3.15. (Top) Overview of the Coastal Ecosystem types in relation to the proposed Granger Bay development. (Bottom) Broadscale overview of Coastal Ecosystem types of Table Bay (Harris et al. 2019). The Diep/Rietvlei and Sout Estuaries are outlined in light blue.

Both the marine and terrestrial environments within and around Granger Bay have been subjected to high levels of development in the past and are heavily impacted by urbanisation. On the terrestrial side, most natural vegetation has been lost and replaced by the urban development of the City of Cape Town. For example, prior to development of Granger Bay, an embryo dune ran along the coastline, but it is now fragmented (City of Cape Town 2023).

Within the marine and coastal realms, much of the adjacent land on the eastern boundary of Granger Bay has been reclaimed and is protected by a dolos revetment. Dolosse are concrete blocks of complex geometric shape weighing up to 20 tons and are used together to protect harbour walls from the erosive force of ocean waves. Although much of the natural habitat has been lost, the dolos revetment provides substrate for a well-developed rocky shore community (See Section 3.5.5).

The coastline in the middle reaches of Granger Bay comprises of a temporary rock revetment, which is subjected to abrasion by waves and has led to the formation of a steep gravel beach with a very coarse and pebbly adjacent subtidal area. The area landward of the temporary rock revetment is used for parking by the V&A Waterfront and is dependent on the upkeep of the revetment for protection. The western extent of the Bay comprises a rubble embankment, a sheltered boat launch site managed by the Oceana Power Boat Club, and the Granger Bay Marina (Wright et al. 2018).

3.5.1 Cape Bay (Open Pelagic system)

Table Bay pelagic communities are typical of those found throughout the southern Benguela system, as there are few barriers to water exchange within the Bay (Carter et al. 2003). Phytoplankton communities are dominated by large single-celled diatoms and dinoflagellates (Table 3.2) (Shannon & Pillar 1986).

Table 3.2. Table Bay pelagic community composition (Carter 2006) .

Group		Genera / species
Phytoplankton	Diatoms	*Chaetoceros, Nitschia, Thalassiosira, Skeletonema, Rhizoselenia, Coscinodiscus,* and *Asterionella*
	Dinoflagellates	*Prorocentrum, Tripos* and *Peridinium*
	Harmful Algal Bloom species	*Tripos furca, T. lineatus, Prorocentrum micans, Dinophysis sp., Noctiluca scintillans, Alexandrium tamarense, G. polygramma, Alexandrium catanella* and *Mesodinium rubrum*
Zooplankton	Copepods	*Centropages, Calanoides, Metridia, Nannocalanus, Paracalanus, Ctenocalanus* and *Oithona*
	Euphausiids	-
Ichthyoplankton	Fish eggs/larvae	*Engraulis capensis, Sardinops sagax, Merluccius* sp. and *Trachurus* sp.
Fish	Nearshore	*Chelon richardsonii, Atherina breviceps, Rhabdosargus globiceps, Clinus latipennis, Psammogobius knysnaensis and Caffrogobius nudiceps*
	Offshore	*Thyrsites atun, Pachymetopon blochil, Thunnus alalunga,* and *Scomber japonicas*

Harmful Algal Bloom (HAB) species occur episodically (Table 3.2) (Pitcher & Calder 2000). Table Bay pelagic zooplankton communities predominantly consist of crustacean copepods, while Euphausiid species are common in the nearshore (Shannon 1985, Hutchings et al. 1991) (Table 3.2). Ichthyoplankton in the southern Benguela are composed mainly of small pelagic anchovy and sardine fish eggs and larvae, with some hake and mackerel larvae (Table 3.2) (Shannon & Pillar 1986). Nearshore fish species includes harder/mullet *Chelon richardsonii*, silverside *Atherina breviceps*, and white stumpnose *Rhabdosargus globiceps* (Clark 1997) while offshore catches within Table Bay are dominated by snoek *Thyrsites atun*, with hottentot seabream *Pachymetopon blochii*, long fin/albacore tuna *Thunnus alalunga* and yellowtail *Seriola lalandii* also landed regularly (Table 3.2) (Carter 2006).

Three species of whale and three species of dolphin are known to occur in Table Bay at various times of the year, all of which may come in close proximity to, or utilise Granger Bay itself (Elwen 2025) (Table 3.3).

Table 3.3. Table Bay cetacean present and encounter frequency (after Elwen 2025).

Common name	**Species**	**IUCN listing** (IUCN 2025)	**Encounter frequency**
Baleen whales			
Humpback whale	*Megaptera novaeangliae australis*	Least Concern (*M. novaeangliae*)	Year-round at some level, with feeding peaks and likely daily presence during Nov-Feb
Southern right whale	*Eubalaena australis*	Least Concern	Year-round with peaks in Jul-Sep (breeding) and Feb-April (feeding)
Bryde's whale	*Balaenoptera edeni brydei*	Least Concern	Monthly, peak in winter-spring, mainly Aug-Oct
Toothed whales			
Killer whale	*Orcinus orca*	Data deficient (global)	< 5 times per year
Common dolphin	*Delphinus delphis*	Least Concern	Monthly, summer peak
African dusky dolphins	*Lagenorhynchus obscurus obscurus*	Data deficient	Daily
Heaviside's dolphin	*Cephalorhynchus heavisidii*	**Near Threatened**	Daily

Large baleen whales are typically more prevalent in Table Bay (and the West Coast in general) during the spring and summer months, in contrast to the 'winter peaks' of the South Coast, in areas like Hermanus and De Hoop). The Table Bay areas lies close to a major biogeographic boundary and significant changes in the presence, abundance and seasonality of several marine mammal species have been observed over the last two decades, associated with both anthropogenic impacts and broader environmental changes (Moloney et al. 2013, Blamey et al. 2015, Watermeyer et al. 2016). Details are presented in an updated Marine Mammal assessment report, which includes a full description of marine mammal use of Table Bay is available, and intended to be read in tandem with this report (Elwen 2025). This report specifically highlights the resident population of the Near Threatened Heaviside's dolphin in Granger Bay (Elwen 2025, IUCN 2025). The species is endemic to the Benguela Ecosystem and aggregates close to shore along open sandy coastlines and on the exposed end of most bays along the west coast of South Africa (Elwen 2025).. The area between Granger Bay to the Three Anchor Bay lighthouse (~2.8 km coastwise) represents the southernmost known aggregation site, and it is used on a daily basis by these dolphins for resting and socialising, mainly in the mornings (Elwen 2025).. The dolphins (and marine wildlife in general here) are a major attraction to commercial and private water users in Granger Bay.

Cape fur seals *Arctocephalus pusillus pusillus* are often sighted in Table Bay, although there is no breeding colony within the Bay itself (Huisamen et al. 2011). Individual vagrants of the subantarctic fur seal *Arctocephalus tropicalisa*, the leopard seal *Hydrurga leptonyx* and the southern elephant seal *Mirounga leonia* may occasionally occur in Table Bay. Cape clawless otters *Aonyx capensis* have also been spotted in the area.

There is almost no published information on communities inhabiting the water column in the Port of Cape Town, with information being primarily anecdotal. Euphausiids do occasionally occur in the Port reaching densities sufficiently high to clog the Two Oceans Aquarium seawater intakes, and small shoals of mullet have been seen in the outer Port area, particularly along the seawalls between the entrance to Duncan Dock and the western breakwater (Carter 2006). Vagrant dolphins do occasionally move into the Port, and box jellyfish are occasionally seen in the surface waters (Pers. obs.). There is a non-breeding semi-resident population of Cape fur seals (*Arctocephalus pusillus pusillus*) in the Port, which appear to forage mainly in the Victoria Basin (Anchor Environmental Consultants 2013)

3.5.2 Robben Island

Robben Island hosts numerous seabird species, including IUCN listed species such as the Critically Endangered African penguin (*Spheniscus demersus*; 931 breeding pairs as of 2023, (DFFE unpublished data, 2024 as presented in Brühl & Turpie 2025), the Endangered bank cormorant (*Phalacrocorax neglectus*; 93 breeding pairs) and the Endangered Cape cormorant (*P. capensis;* 2 166 breeding pairs). Other seabird species include crowned cormorant (*P. coronatus;* 74 breeding pairs), and the African black oystercatcher (*Haematopus moquini;* 133 breeding pairs as of 2020) (Quintana et al. 2021, Punt et al. 2023).

Indeed, Robben Island is considered to be a critically important breeding site for African penguins. In 2023, the island hosted approximately 11% of the total African penguin breeding population in South Africa (Brühl & Turpie 2025). The penguins forage within 20 km of Robben Island and the health of the greater Table Bay area is of critical importance in the maintenance of this population (Carter 2006, Van Ballegooyen 2007). Robben Island also hosts the largest breeding colony of Endangered bank cormorant *Phalacrocorax neglectus* in South Africa, as well as significant populations of Endangered Cape cormorant *P. capensis* (Punt et al. 2023).

3.5.3 Cape Kelp Forest

Upwelled nutrients brought to the euphotic zone support both microscopic primary producers (phytoplankton) and macroscopic algae (kelps), which occur in dense forests around the West Coast. Two kelp species, *Ecklonia maxima* and *Laminaria pallida,* dominate the subtidal rocky reefs in the Bay, while more sheltered areas allow the growth of the algae *Macrocystis pyrifera* (Branch & Griffiths 1988). The faunal community within these kelp forests includes carnivores, such as sea stars, anemones, whelks, polychaetes (worms), crabs and rock lobster, the latter of which feeds almost exclusively upon the abundant mussels (Carter et al. 2003). Less common are the grazers and debris feeders, including sea urchins, some patellid limpets, giant periwinkles, abalone, as well as isopods and amphipods (Carter et al. 2003). The kelp forests thin out further offshore, and are replaced with faunal communities of sea urchins, filter-feeding mussels, sponges and sea cucumbers (Velimirov et al. 1977, Field et al. 1980, Branch & Griffiths 1988). The fish fauna includes the endemic hottentot seabream *Pachymetopon blochii*, two tone fingerfin *Chirodactylus brachydactylus*, redfinger *Cheilodactylus fasciatus*, blacktail *Diplodus sargus capensis*, galjoen *Dichistius capensis*, maned blennies *Scartella emarginata*, and various klipfish (*Clinus* spp.) (Carter et al. 2003).

In April 2024, ecological reef surveys were conducted at ten sites within Granger Bay using photo-quadrats and video transects to provide an description of the reef community present within the Bay (Figure 3.16) (Dawson et al. 2024). Results from the substratum (reef) survey included 98 taxa, which could be ascribed to three kingdoms, 11 phyla, 18 classes, 41 orders, 61 families, 73 genera and 80 species. Diversity within the bay was fairly consistent ranging from a minimum of 42 taxa to a maximum of 53 taxa with nine species recorded from every site (Figure 3.17), including seven algae (*Botryocarpa prolifera*, *Ecklonia maxima*, *Laminaria pallida*, *Phymatolithon foveatum*, *Rhodymenia obtusa*, *Schizymenia apoda*, *Ulva rigida*), one ascidian (*Botrylloides magnicoecus*), and one bryozoan (*Jellyella tuberculata*). Three alien invasive species were recorded from this habitat, comprising the ascidians *Clavelina lepadiformis*, *Diplosoma listerianum* and *Botryllus schlosseri*.

Figure 3.16. Example of a photo-quadrat identifying reef communities (left) and incidental species detection recorded during video transects (Right).

The Granger Bay hard substratum (reef) community comprised marine animals (64%) and plants (36%) (Figure 3.18A), with the latter consisting of predominantly red algae (66%, phylum Rhodophyta), brown algae (20%, class Phaeophyceae), and green algae (14%, phylum Chlorophyta) (Figure 3.18D). The abundance of kelp (*Ecklonia maxima*, *Laminaria pallida*) at this location is consistent with previous studies (Field et al. 1980, Quick & Roberts 1993). The fauna was dominated by the phyla Mollusca (gastropods and bivalves), Porifera (sponges) and Chordata (ascidians) (Figure 3.18B). Consequently, the benthic community largely comprised filter feeders (60%) (Figure 3.18C), that feed on particles within the water column such as algal debris, plankton and/or sewage-derived detritus (Field et al. 1980).

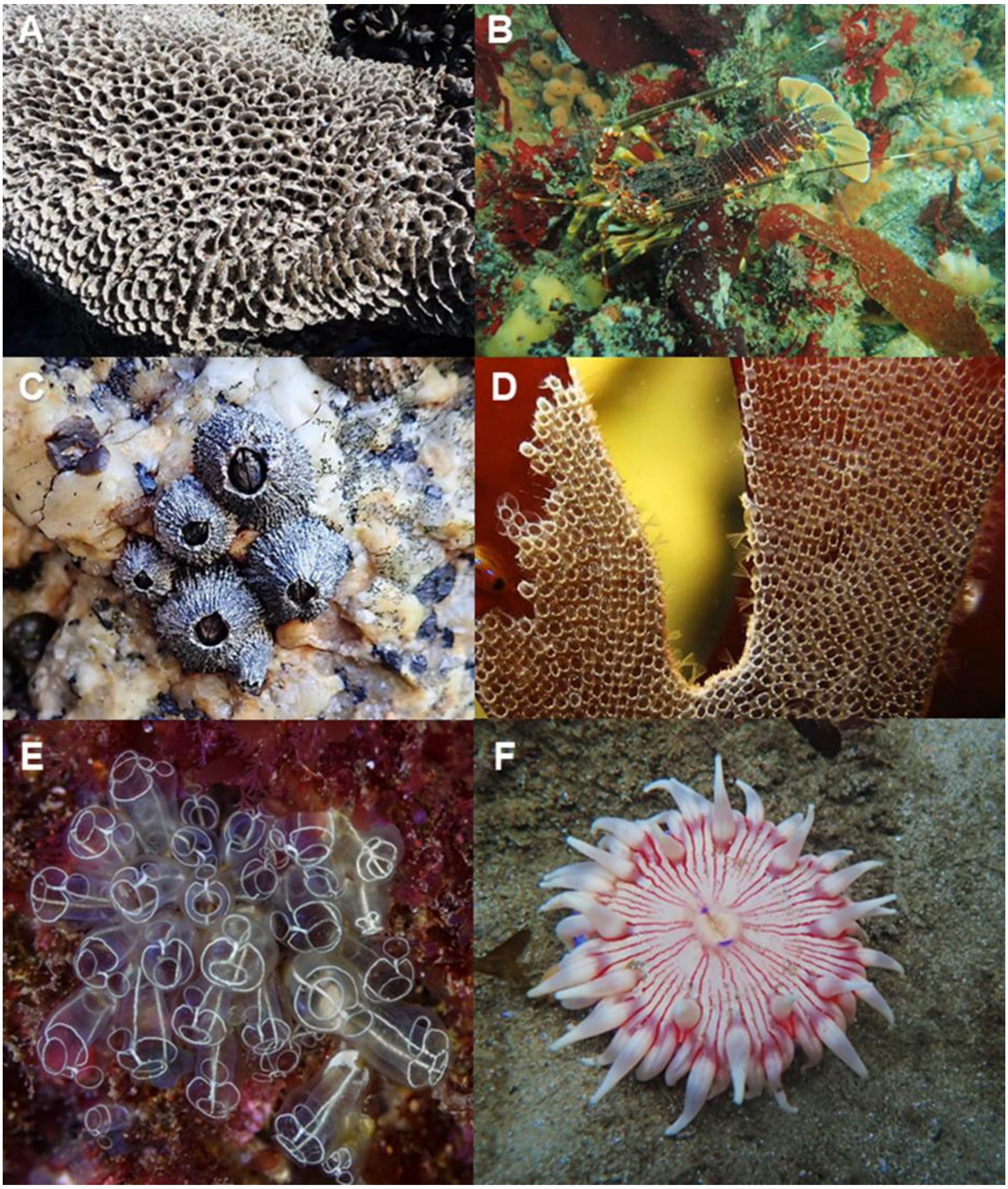


Figure 3.17. Selection of marine taxa recorded from hard substratum (reef) habitats within Granger Bay during the 2024 baseline study. A) Cape reef worm *Gunnarea gaimardi* (Anchor), B) West coast rock lobster *Jasus lalandii* (Anchor), C) grey volcano barnacle *Tetraclita serrata* (Anchor), D) hairy lace animal *Electra pilosa* (David Borg), E) bell ascidian *Clavelina lepadiformis* (Diego Delso), F) violet-spotted anemone *Anthostella stephensoni* (Anchor).

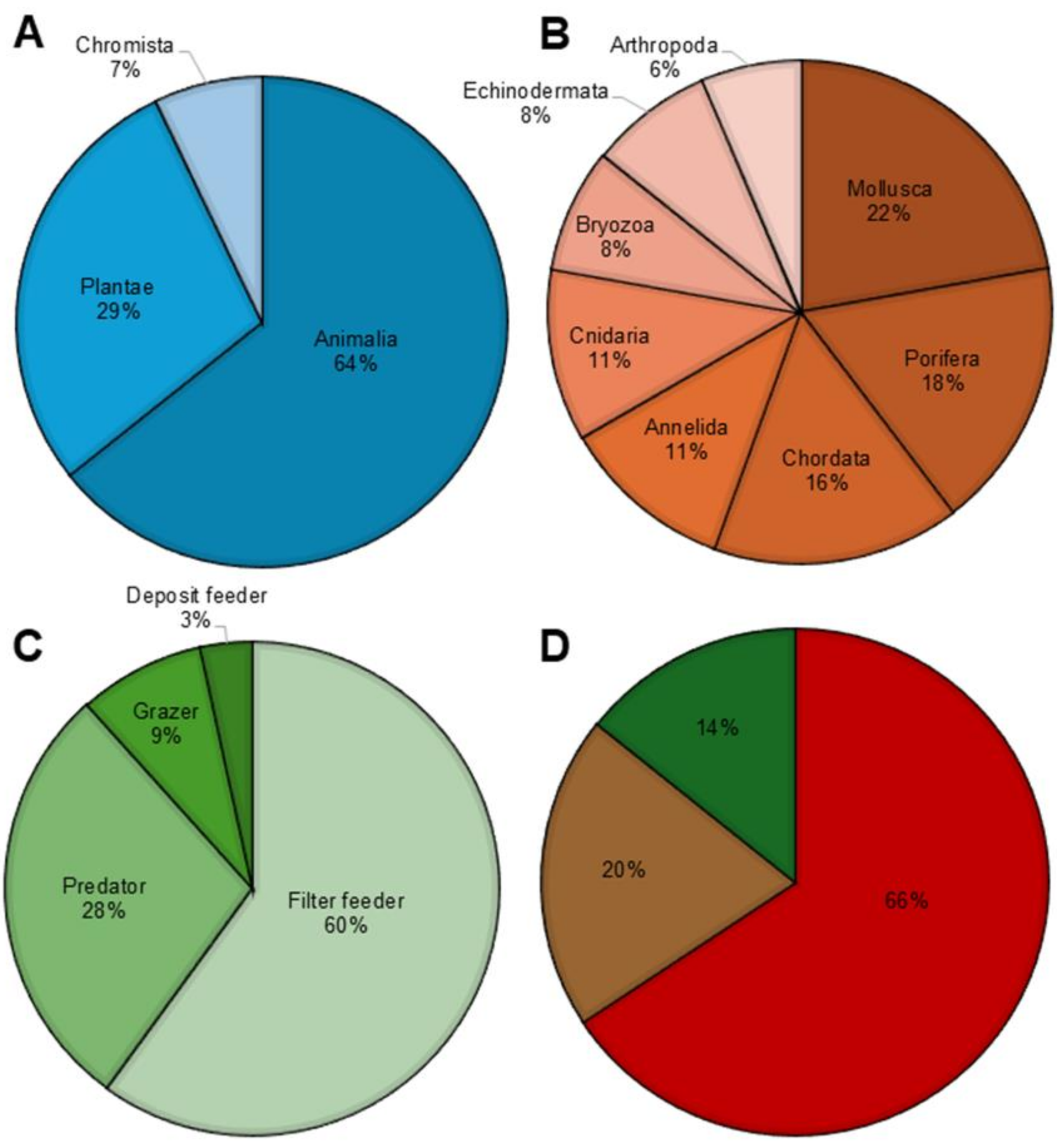


Figure 3.18. Hard substratum (reef) habitat marine community composition within Granger Bay as recorded during the 2024 baseline study. This includes: A) kingdoms, B) marine animals, C) marine animal feeding groups, D) marine plants comprising red (phylum Rhodophyta), brown (class Phaeophyceae), and green (phylum Chlorophyta) algae (Dawson et al. 2024).

Numerical variation in community indices between the 10 reef locations surveyed was fairly homogenous within the Bay (Dawson et al. 2024). Total number of species ranged from 42 to 53, while species richness had a much smaller range between 10.97 and 13.10, and similarly the Shannon Diversity index had a small spread from 3.78 to 3.97. This suggests that the reef communities are not substantially different within Granger Bay (Figure 3.19) (Dawson et al. 2024). Small variations in reef community indices within the Bay are present (see Figure 3.20), indicating that the most exposed sites, located on the outskirts of the Bay, have the lowest values for all community indices. Sites at the mouth of the Oceana Power Boat Club and the western edge of the break wall have the highest values for community indices (Figure 3.20) (Dawson et al. 2024). It is likely that the variation in reef community indices is a result of natural, slight environmental changes within Granger Bay, with all community results fairly homogenous across the Bay (Dawson et al. 2024).

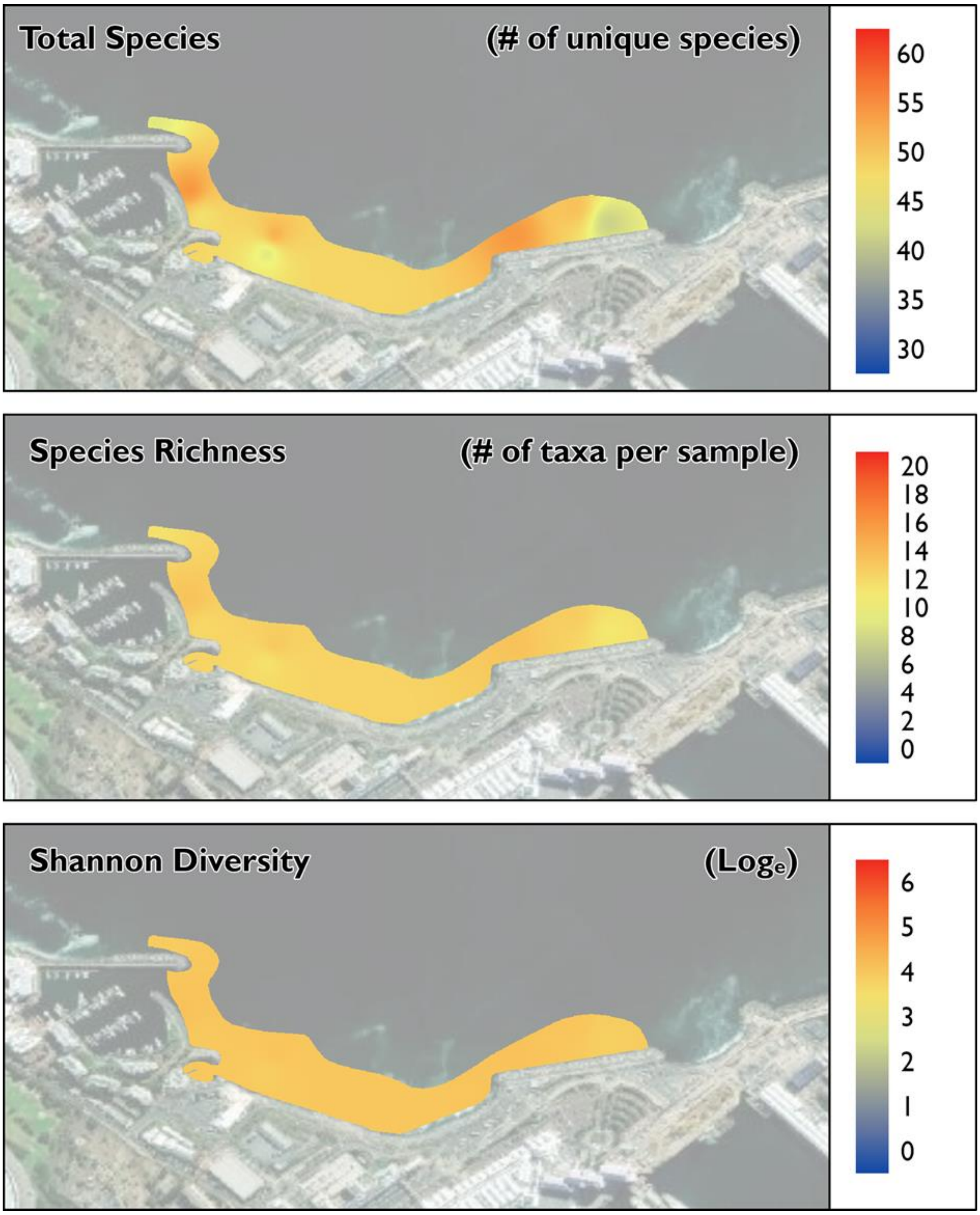


Figure 3.19. Interpolations of hard substate/reef total species, species richness and Shannon diversity at the sites sampled within Granger Bay (Dawson et al. 2024).

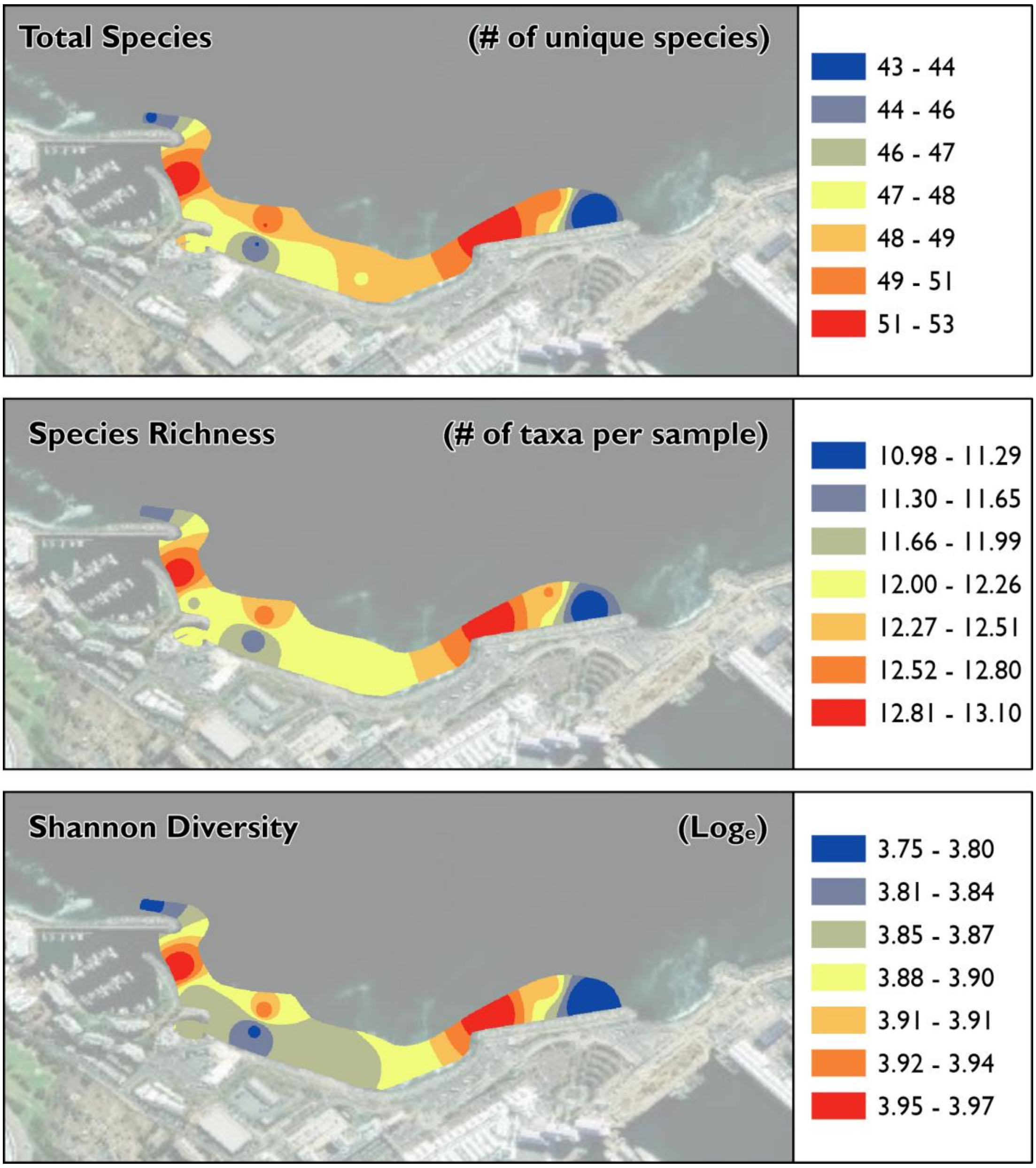


Figure 3.20. Interpolations of hard substate/reef total species, species richness and Shannon diversity at the sites sampled within Granger Bay using a restricted scale to emphasise variation (Dawson et al. 2024).

3.5.4 Cape Mixed Shore

The Cape Mixed Shore ecotype is characterized by both sandy and rocky habitat. The ecology and faunal communities comprising each zone within Table Bay are representative of the greater West Coast region (McQuaid et al. 1985, Branch & Griffiths 1988, Lane & Carter 1999). The rocky shores of Table Bay are heavily invaded by the alien Mediterranean mussel *Mytilus galloprovincialis*, the most invasive marine invertebrate species in South Africa. This alien has displaced indigenous species, including the ribbed mussel *Aulacomya atra* and the black mussel *Choromytilus meridionalis*, and has substantially increased the mussel biomass along the coastline (Hockey & Van Erkom Schurink 1992, Robinson 2005). The higher mussel biomass and subsequent abundance of food has resulted in the recovery of the African oystercatcher *Haematopus moquini* populations, as well as substantially increased the diversity and biomass of infauna within the mussel beds.

The benthic macrofauna of the Port of Cape Town is typical of sheltered benthic communities along the West Coast (CSIR 2016). Communities are dominated by segmented annelid polychaete worms, nematodes and amphipods (CSIR 2016, Wright et al. 2019). High numbers of polychaetes are typical of polluted or disturbed marine environments as other taxonomic classes, in particular amphipods, have been found to be more sensitive to pollution than polychaetes (Gesteira & Dauvin 2000, Gomez Gesteira et al. 2003). Macrofaunal abundance also tends to be higher in areas of lower sediment disturbance (i.e., in the yacht basin) compared to more frequently dredged basins, and lower in severely contaminated sediment (i.e. the Alfred Basin) (CSIR 2017b). Long-term monitoring has shown that there is a higher abundance of pollution-tolerant taxa than disturbance-tolerant taxa in the Port of Cape Town (CSIR 2017b).

These communities are substantially affected not only the anthropogenic activities, but also by variability within their habitat including, changes in sediment granulometry, particulate organic matter (POM) content and salinity (CSIR 2017b). Therefore, macrofaunal community changes must be interpreted with caution, particularly if the study lacks adequate control sites. All macrofaunal communities in the Port of Cape Town were classified as either ‘fair’ or ‘poor’ (CSIR 2016). Benthic communities in the V&A Basins were affected by ‘poor’ or ‘very poor’ sediment quality, while those in the Ben Schoeman Dock and Duncan Dock Basins were subject to ‘fair’ sediment quality (CSIR 2016).

Sandy (unconsolidated sediment) habitats were assessed doing the baseline survey (Dawson et al. 2024) conducted in April 2024 and provide data for benthic community structure both within Granger Bay as well as an area in Table Bay east of the Port of Cape Town Harbour Mouth for comparison. Results support the findings of previous studies which suggest significant variability in habitats based on physico-chemical parameters such as changes in sediment granulometry, metal content and total organic content (TOC) (CSIR 2017b). The sediment granulometry within Granger Bay consists of predominantly sand with a small portion of mud, while the area east of the port is influenced by discharge from the black river and has a significantly higher proportion of mud and in one case gravel (Figure 3.21) (Dawson et al. 2024).

Similarly, the percentage of total organic content (TOC) is higher in the Table Bay sites than in Granger Bay, with values ranging from 1.6-2.4%, while organic content in Table Bay sites ranged from 2.5 to a maximum of 5.3% (Figure 3.22). The higher TOC content in sites on the south-eastern side of Table Bay is likely the result of slightly higher mud content at these sites (Figure 3.21). This correspondence between TOC and mud content is expected given that organic matter and contaminants like metals and organic toxic pollutants are mainly found in depositional zones and are therefore linked with fine sediment particles, such as mud and silt. Given this, it is also expected that trace metal concentrations would be lower in Granger Bay than in Table Bay sites. All sediment samples collected at Granger Bay and Table Bay sites fell below the acceptable Effect Range Low (ERL) limit for all measured trace metals (Figure 3.23). Although iron and aluminium appeared elevated on the heatmap, these elements naturally occur in high concentrations in sediments and are unlikely to be due to anthropogenic sources (Dawson et al. 2024).

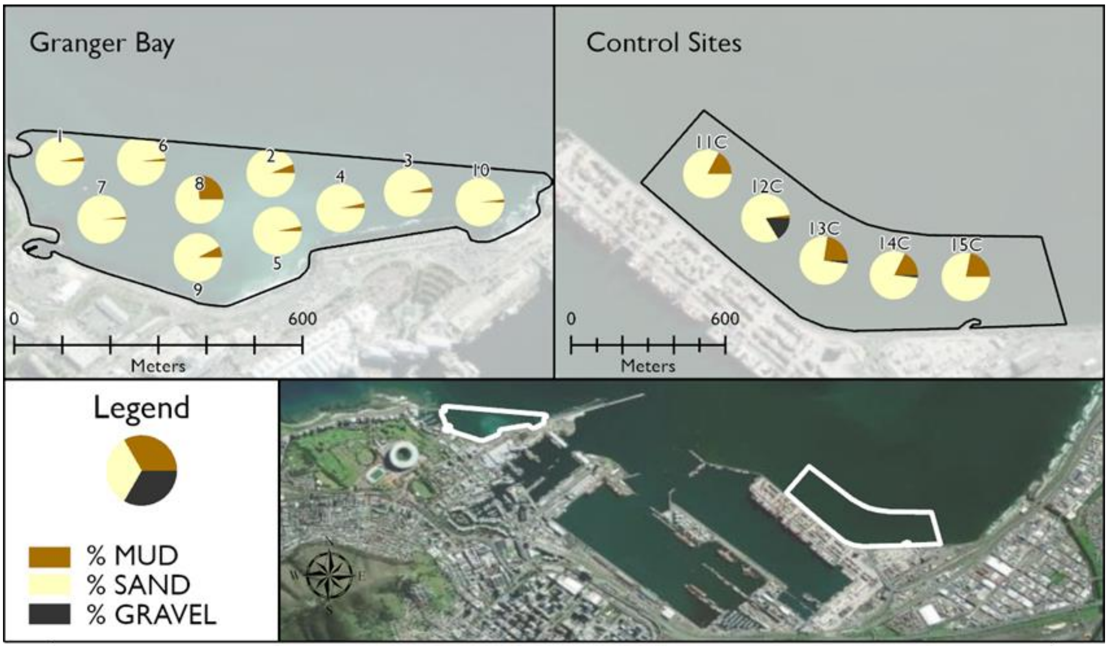


Figure 3.21. Percentage composition of mud, sand and gravel in sediments sampled at proposed impact sites in Granger Bay and control sites in Table Bay (Dawson et al. 2024).

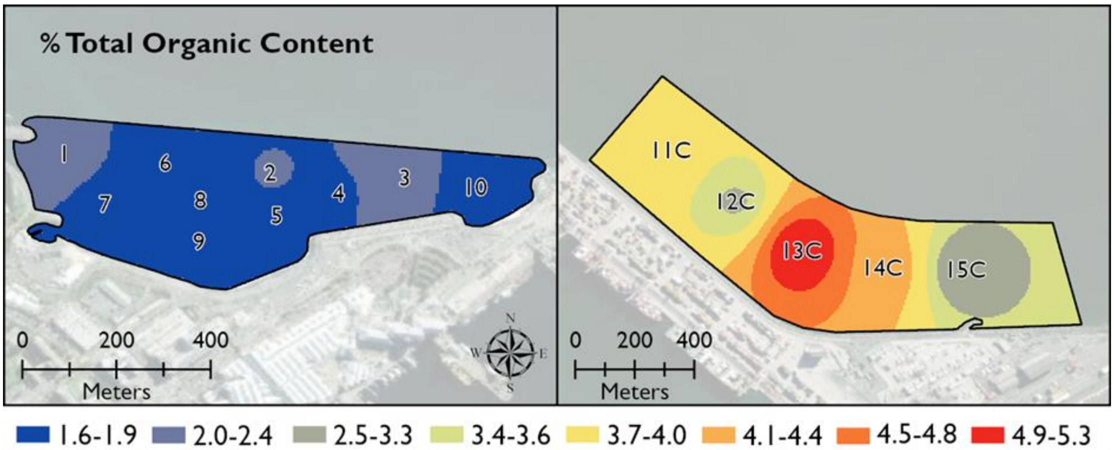


Figure 3.22. Percentage composition of total organic content (TOC) in sediments sampled at impact sites in Granger Bay and control sites in Table Bay (Dawson et al. 2024).

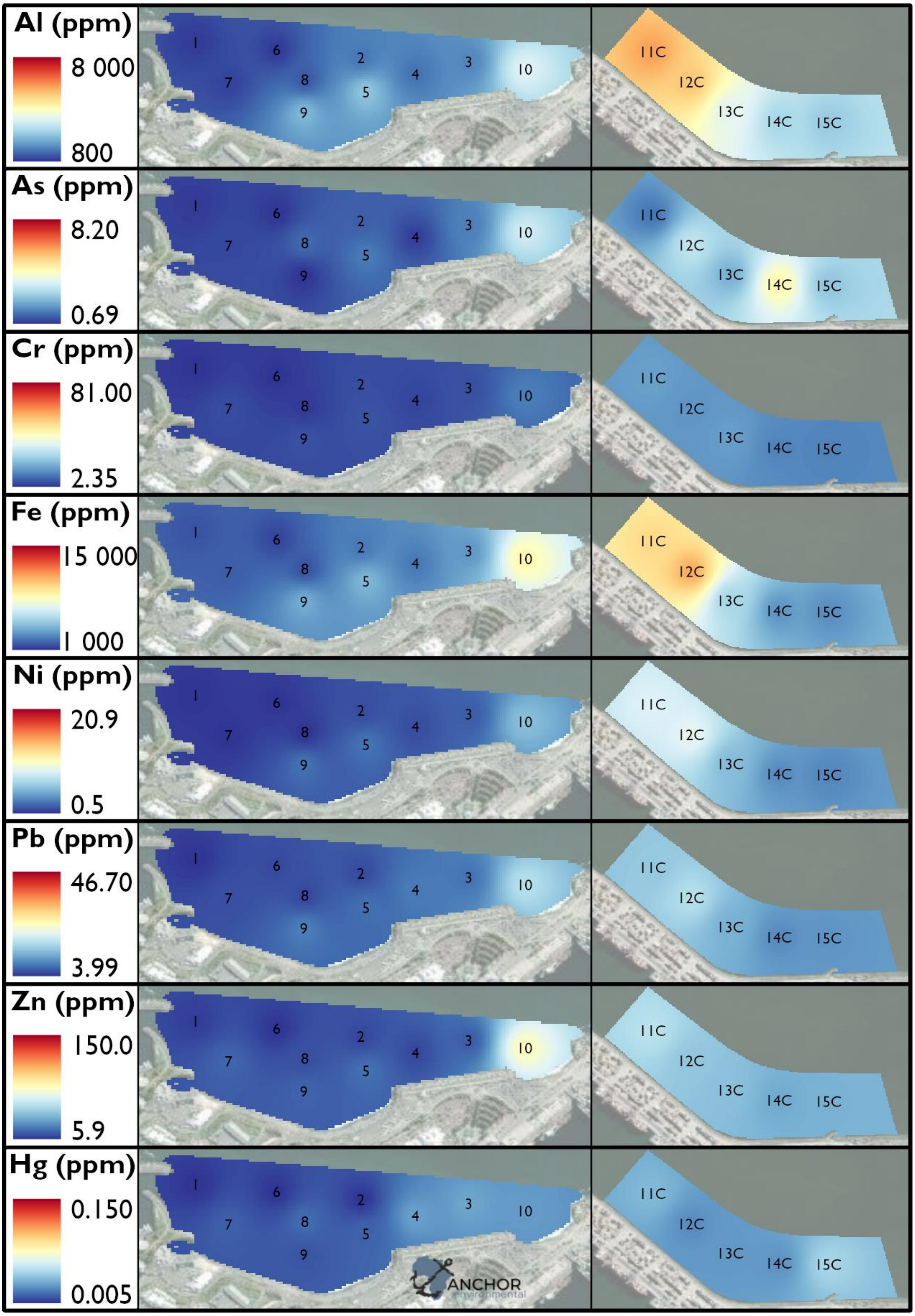


Figure 3.23. Spatial interpolation of trace metals. Cd is left out due to the fact that all sites reflected values lower than detection limits. The maximum values on the colour reference keys (red) reflect the ERL values. Al and Fe do not have ERL values (Dawson et al. 2024).

A total of 72 benthic infaunal macrofauna species from five phyla were collectively identified from the samples in Granger Bay and Table Bay sites (Dawson et al. 2024). The phyla included Nemertea (ribbon worms), Mollusca (gastropods and bivalves), Cnidaria (sea anemones), Arthropoda (amphipods, isopods, and true crabs), and Annelida (segmented worms and peanut worms). A selection of the species collected during the survey is shown in Figure 3.24.

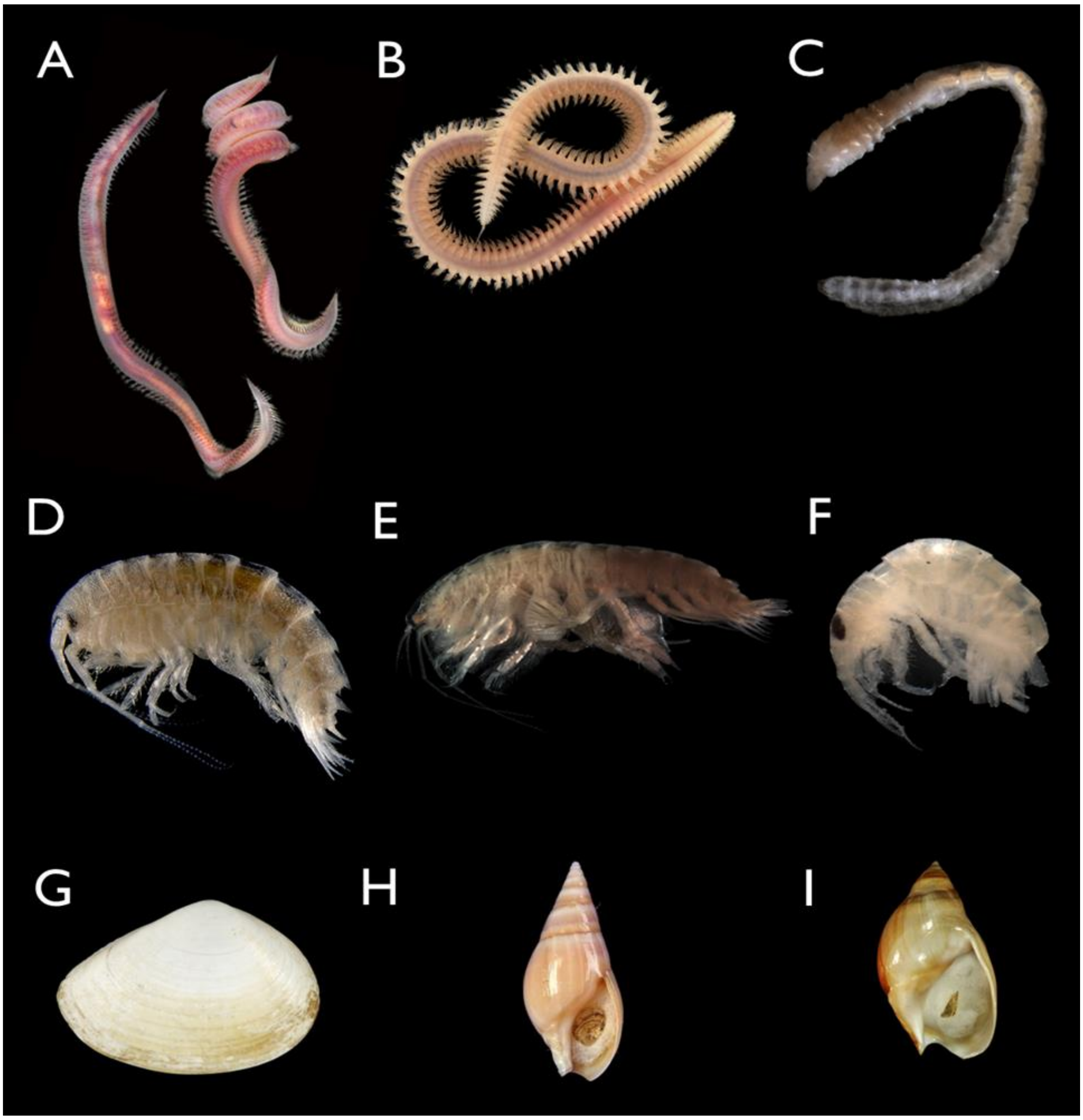


Figure 3.24. Selection of benthic macrofauna species obtained during the 2024 baseline survey at Granger Bay. A) glycerine worm *Glycera tridactyla* (Paul Sterry, Nature Photographers), B) catworm *Nephtys hombergii* (Fredrik Pleijel), C) polychaete worm *Capitella capitata* (wikidata.org), D) amphipod *Nototropis guttatus* (Hans Hillewaert), amphipod *Ampelisca brevicornis* (Hans Hillewaert), G) bivalve *Moerella tulipa* (G & Ph Poppe), H) smooth plough shell *Bullia rhodastome* (LA Reeve), I) fat plough shell *Bullia laevissima* (Joop Trausel & Frans Slieker).

Like the surrounding Port area, the benthic macrofauna community in Granger Bay is mainly dominated by annelids, contributing 36.1-96.2% to the abundance (per m^2), followed by Arthropods (1.9-57.8%) (Dawson et al. 2024). The most dominant annelid species at impact sites included two polychaete worms, namely *Prionospio sexoculata* and *Caulleriella acicula,* accounting for 15.9% and 47.7% of the total per square meter abundance, respectively. In terms of arthropods, two amphipod species dominated, including *Lysianassa ceratina* (6.1%) and *Socarnes septimus* (7.7%). Benthic macrofauna abundance was slightly higher at Table Bay sites (total of 101.6 to 348.8 ind./m^2 on average), compared to Granger Bay sites (total of 56.6 to 159.7 ind./m^2). The higher macrofaunal abundances recorded at Table Bay sites are likely attributed to the higher mud and TOC retention at the eastern corner of Table Bay. In contrast, the Granger Bay sites are more exposed to wave action, resulting in higher rates of mud and TOC being flushed out and therefore, overall lower values of these community indices within Granger Bay(Dawson et al. 2024).

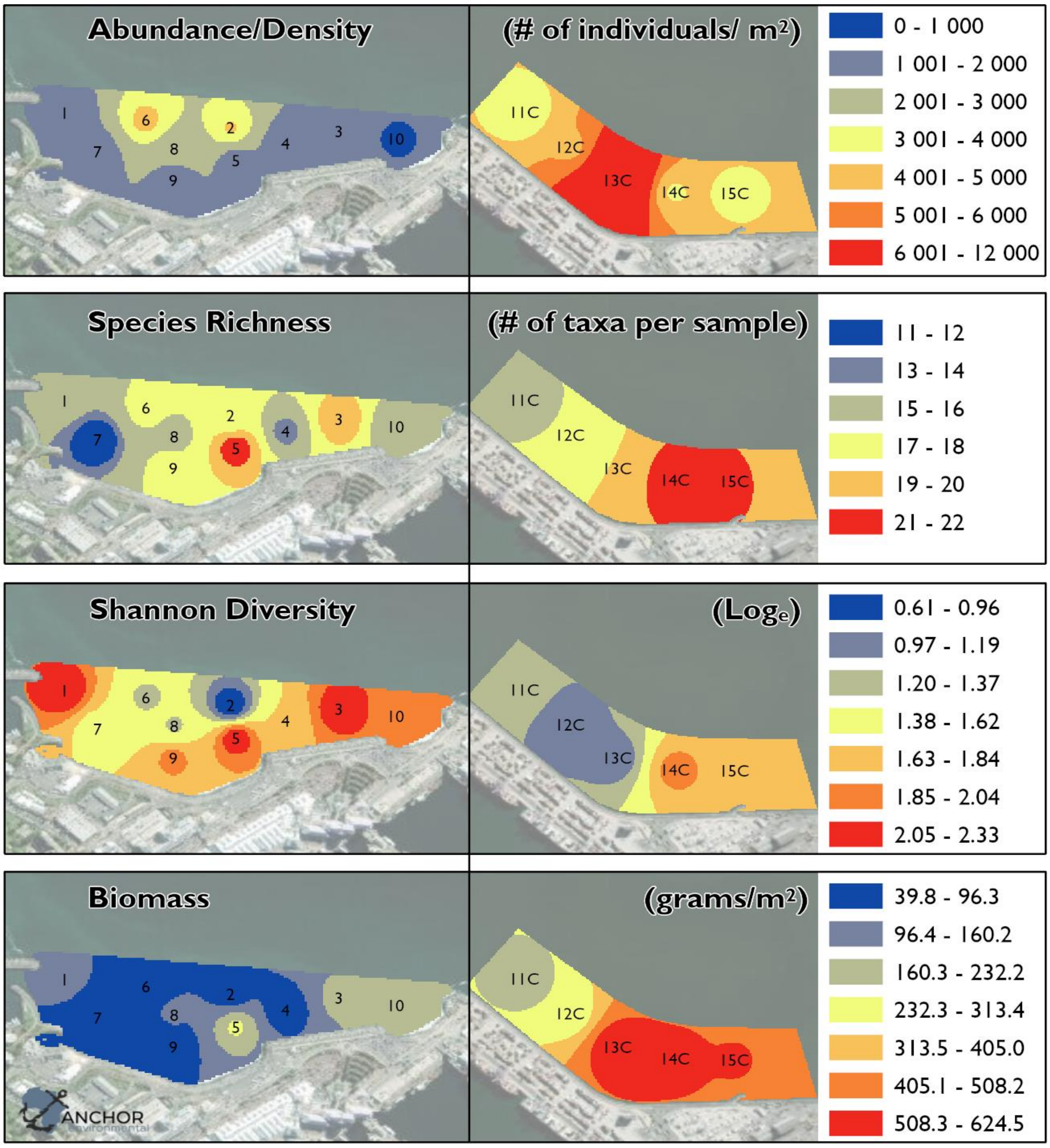


Figure 3.25. Interpolations of sandy substate infaunal abundance, species richness, Shannon diversity, and biomass at the sites (left) within Granger Bay and (right)control sites along the outside of the container terminal (Dawson et al. 2024).

Overall, species diversity was relatively similar between impact and control sites, but there was a notable difference in distribution pattern (Figure 3.25) (Dawson et al. 2024). .The Granger Bay impact sites showed a patchier distribution, likely due to the variability in nutrient availability within the area (as TOC levels were also patchy and highest at impact sites 1 and 3, where slightly elevated TOC levels were recorded). In contrast, species diversity at the control sites showed a more gradual pattern, starting low in the western section and increasing towards the east, likely influenced by nutrient availability and other environmental factors at these sites. It is noteworthy that all indices in the Granger Bay region appear to be slightly reduced in comparison to Table Bay.

3.5.5 Artificial surfaces of the harbour itself and the shore protection

The ecology of the hard surfaces of the Port of Cape Town is expected "to resemble an impoverished version of a sheltered rocky shore typical to the south-western Cape Bioregion" (Quick & Roberts 1993). However, Carter et al (2003) reported that there was a diverse and well-developed fouling community covering the hard structures of the harbour near the harbour entrance in the Victoria Basin, and on the inner Duncan Dock walls. This fouling community includes several species of barnacles, polychaetes, sponges, and algae as well as sea squirts, tunicates, spiral fanworms, bryozoans, feather stars, chitons, nudibranchs, amphipods, klipfish, crabs (*Plagusia chabrus*) and small lobsters (Anchor Environmental Consultants 2013). There is a marked decline in community diversity moving further into the harbour, and an increase in the abundance of alien species such as the anemone *Metridium senile* and the European shore crab *Carcinus maenas* (Carter et al. 2003, Steffani et al. 2003, Carter 2006). A high abundance of the knobbly anemone *Bunodosoma capensis* as well as barnacles, mussels, red-bait *Pyura stolonifera* and various species of algae was noted on the hard surfaces of the Collier Jetty in the Victoria Basin, albeit less extensive than the fouling community at the entrance to the Victoria Basin (Anchor Environmental Consultants 2013).

Outside the Port, the vertical harbour walls play host to large numbers of juvenile West Coast rock lobster *Jasus lalandi*, encrusting corallines, the barnacle *Notomegabalanus algicola*, the sea urchin *Parechinus angulosus*, the ribbed mussel *A. ater*, and sponges (Mayfield 1998, Hazell et al. 2002, Carter et al. 2003). In contrast to the rocky substrata of the broader Table Bay, there is a relatively low cover of mussels on these artificial surfaces, and an unusually high cover of encrusting corallines (Carter et al. 2003) .

Field surveys undertaken in February 2018 indicate that the dolosse of Table Bay breakwater are a highly heterogeneous habitat (Figure 3.26) (Wright et al. 2018). Environmental heterogeneity is an important factor in determining community structure, and there is the widespread evidence showing a positive relationship between richness and environmental heterogeneity (Yang et al. 2015) i.e., the more complex a habitat, the more diverse the community. The site visit revealed an abundance of West Coast rock lobster *J. lalandii*, crabs (*Plagusia chabrus*) and urchins *Parechinus angulosus* living among the mussels, kelp and red bait on the dolosse (Figure 3.26).

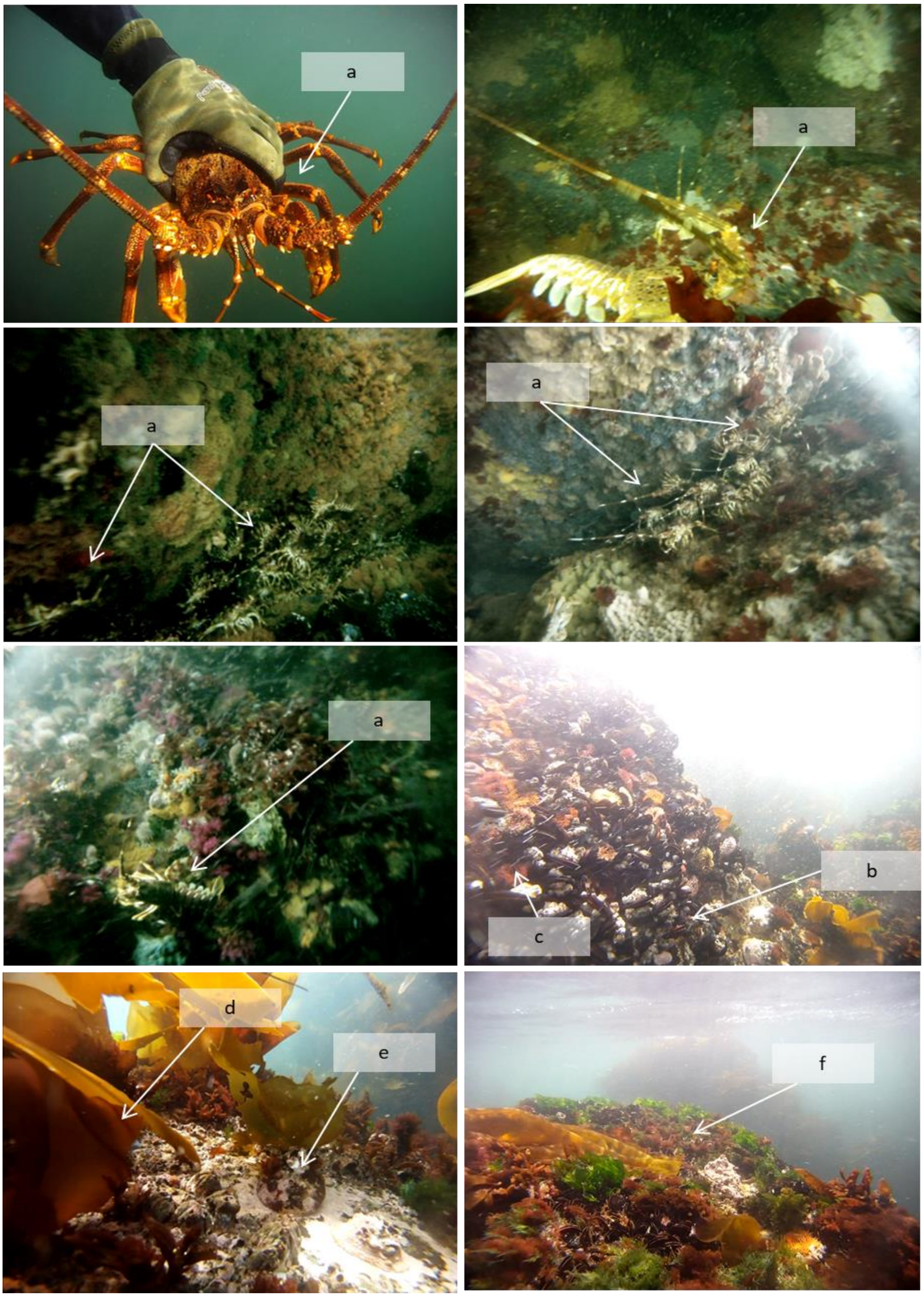


Figure 3.26. Screen grabs from GoPro footage taken during a short dive survey of the V&A dolosse: a) West Coast rock lobster *Jasus lalandii*, b) dense mussel beds of *Mytilus galloprovincialis*, c) anemones (*Bunodactis* sp.), d) kelp *Ecklonia maxima*, e) grazing patellid limpets surrounded by pink coralline algae, f) dense algal growth (Wright et al. 2018).

3.5.6 Alien and invasive species

Alien species are species that have been transported as a result of human activity into an area where they do not naturally occur. The survival of the alien species in the new environment is dependent on the suitability of the abiotic and biotic characteristics of the environment. If the species is able to establish a population, abundance can increase rapidly allowing them to 'take over the new environment' as they are generally not subjected to 'normal' controls, such as competition, disease and predation. Marine alien species are often transported in ship ballast water, by attaching to hulls, in the trade of live organisms for food, bait or aquaria, and as pathogens, carried by other organisms. Ports and harbours, like the Table Bay harbour, are vulnerable to the introduction of alien species due to the high volumes of trade and shipping as well as their high connectivity to ports and harbours internationally. Of the 103 identified alien and invasive species found in South Africa, 69 of them have been reported within the Southern Benguela region and are listed below in Table 3.4 (Robinson et al. 2020). These include ascidians (sea squirts), anemones, bryozoans, a sponge, segmented worms, crustaceans (amphipods, crabs and barnacles) and molluscs (mussels, nudibranch and a gastropod) (Picker & Griffiths 2017). Many of the reported species are limited to harbour habitats along South Africa's coast, possibly due to the sheltered nature of a harbour in comparison to the relatively exposed nature of the coastline. The main impact of concern caused by alien species within the Table Bay harbour is the fouling of vessels and infrastructure by the alien species. Another important impact is the modification of food webs as several of the alien species have become an abundant food source or have become established as important predators in the system. The risk of building new hard structure developments is that this disturbs local habitat and allows alien species to invade the new surfaces, as they are often more suited to colonizing new areas than local species which then end up displaced.

Table 3.4. List of Alien and Invasive Marine Species found in the Southern Benguela Region of South Africa (Sink et al. 2019a).

Phylum	Class	Taxon	Status	Common name	Natural Range
Annelid	Polychaeta	*Dodecaceria fewkesi*	Alien	Black Coral Worm	Pacific Northern America
		Janua pagenstecheri	Alien		Europe
		Polydora websteri	Alien	Oyster Mudworm	
		Boccardia proboscidea	Invasive	Shell Worm	Northern Pacific
		Ficopomatus enigmaticus	Invasive	Estuarine Tubeworm	Undetermined
		Neodexiospira brasiliensis	Invasive	Estuarine Tubeworm	West Indies, Brazil
		Polydora hoplura	Invasive	Mud Worm	Europe, Mediterranean
Arthropoda	Hexanauplia	*Perforatus*	Alien	Acorn Barnacle	
	Insecta	*Anisolabis maritima*	Alien	Maritime Earwig	Asia
		Cafius xantholoma	Invasive		Europe
	Malacostraca	*Homalaspis plana*	Alien	Chilean Stone Crab	Chile
		Caprella mutica	Invasive	Japanese Skeleton Shrimp	North-east Asia
		Porcellana africana	Invasive	Porcelain Crab	NW Africa between Western Sahara and Senegal
Brachiopoda	Lingulata	*Discinisca tenuis*	Invasive	Disc Lamp Shell	Namibian Coast
Bryozoa	Gymnolaemata	*Bugula neritina*	Invasive	Purple Dentate Moss Animal	
		Bugulina flabellata	Invasive		

Phylum	Class	Taxon	Status	Common name	Natural Range
		Conopeum seurati	Invasive	Europe	
		Cryptosula pallasiana	Invasive	Europe	
		Virididentula dentata	Invasive	Blue Dentate Moss Animal	Indo-Pacific
		Watersipora subtorquata	Invasive	Red-rust Bryozoan	Caribbean
Chlorophyta	Ulvophyceae	*Codium fragile*	Invasive	Green Sea Fingers	Korea
Chordata	Ascidiacea	*Ascidiella aspersa*	Invasive	Dirty Sea Squirt	North Sea
		Botryllus schlosseri	Invasive	Star Sea Squirt	Northeastern Atlantic
		Ciona robusta	Invasive	Solitary Tunicate	Undetermined
		Clavelina lepadiformis	Invasive	Light-bulb Sea Squirt	Europe
		Cnemidocarpa humilis	Invasive	Leathery Sea Squirt	
		Diplosoma listerianum	Invasive	Jelly Crust Tunicate	Europe
		Styela plicata	Invasive	Pleated Sea Squirt	West Pacific
Ciliophora	Heterotrichea	*Mirofolliculina limnoriae*	Alien		
Cnidaria	Anthozoa	*Metridium senile*	Alien	Plumose Anemone	North Atlantic
		Sagartia ornata	Alien	Brooding Anemone	Europe, Mediterranean
	Hydrozoa	*Ectopleura crocea*	Alien	Pink-mouthed Hydroid	North Atlantic coast of North America
		Gonothyraea loveni	Alien	North Atlantic	
		Laomedea calceolifera	Alien	North Atlantic	
		Obelia bidentata	Alien	Doubled-toothed Hydroid	
		Obelia dichotoma	Alien	Sea Plume	
		Obelia geniculata	Alien	Zigzag Hydroid	Europe, Mediterranean
		Pachycordyle navis	Alien	Brackish Hydroid	Europe, Mediterranean
		Coryne eximia	Invasive		North Atlantic, Pacific
		Odessia maeotica	Invasive		Black sea region
Crustacea	Amphipoda	*Ericthonius difformis*	Alien		
		Jassa marmorata	Alien		Northern Atlantic
		Monocorophium ascherusicum	Alien	Stout-antenna Amphipod	Northern Atlantic
		Cerapus tubularis	Invasive		
		Chelura terebrans	Invasive	Wood-boring Amphipod	Northern Atlantic
		Ericthonius brasiliensis	Invasive		Northern Atlantic
		Ischyrocerus anguipes	Invasive		Northern Atlantic
		Jassa morinoi	Invasive		
		Jassa slatteryi	Invasive		Pacific Northern America
		Orchestia gammarellus	Invasive	Beach Hopper	Europe, Mediterranean
	Cirripedia	*Balanus glandula*	Invasive	Pacific Barnacle	Northern American Pacific
	Decapoda	*Xantho incisus*	Alien	Black Fingered Crab	Europe, Mediterranean

Phylum	Class	Taxon	Status	Common name	Natural Range
		Carcinus maenas	Invasive	European Shore Crab	Europe, Mediterranean
		Pinnixa occidentalis	Invasive	Pea Crab	Pacific Northern America
	Isopoda	*Limnoria quadripunctata*	Alien	Quadripunctate Gribble	
		Limnoria tripunctata	Alien	Gribble	
Dinoflagellata	Dinophyceae	*Alexandrium minutum*	Alien		
		Alexandrium tamarense-complex	Alien		
		Dinophysis acuminata	Alien		
Echinodermata	Asteroidea	*Heliaster helianthus*	Alien	South American Multiradiate Sunstar	Chile
Mollusca	Bivalvia	*Lyrodus pedicellatus*	Alien	Blacktip Shipworm	
		Mytilus galloprovincialis	Invasive	Mediterranean Mussel	Mediterranean, Northeastern Atlantic
		Semimytilus algosus	Invasive	Bisexual Mussel	Pacific South America
		Teredo navalis	Invasive	Ship Worm	Europe, Mediterranean
	Gastropoda	*Catriona columbiana*	Alien	British Columbia Aeolid	North Pacific
		Littorina saxatilis	Invasive	Lagoon Snail	Europe, Mediterranean, Western Atlantic
Porifera	Demospongiae	*Suberites ficus*	Invasive	Sulphur Sponge	Northeastern Atlantic and Mediterranean
Rhodophyta	Florideophyceae	*Schimmelmannia elegans*	Alien	Atlantic island of Tristan da Cunha and Venezuela	
		Antithamnionella spirographidis	Invasive		
		Asparagopsis armata	Invasive	Red Harpoon	Southern Australia and New Zealand

3.6 Human Uses and Influences

3.6.1 Overview

Overall, Table Bay supports a multitude of industrial, ecological, and social uses, making it one of South Africa's most multifunctional marine environments. At the heart of this use is the Port of Cape Town, a major commercial hub strategically located at the southern tip of Africa. It handles container shipping, general cargo, and liquid bulk commodities, making it a key node in both regional and international maritime trade (Carter 2006). The port is also equipped with significant ship repair infrastructure, including the Sturrock Dry Dock and Synchrolift, which service local and foreign vessels. Various fishing fleets operate from the port, including trawlers and linefish boats, while fish processing and export activities occur in the adjacent industrial zones, particularly around Duncan Dock.

Urban development around the bay has transformed much of the original coastline through reclamation, coastal engineering, and infrastructure expansion. Projects such as the V&A Waterfront and the Granger Bay revetment involve substantial modification of the shoreline, including artificial breakwaters and shoreline hardening. A Sea Water Reverse

Osmosis desalination facility has also been proposed at the port, underlining the bay's growing importance in securing freshwater supplies for Cape Town. Port seawater is used for cooling of the Clocktower Precinct, and Victoria Basin seawater is used directly by the Two Oceans Aquarium for the marine fauna and flora exhibits (Anchor Environmental 2013). These users all require high quality intake water. These developments are accompanied by the need for careful environmental management and coastal permitting processes. The major human influences on Table Bay are currently land-based sources of pollution, coastal engineering structures, shipping activities and ship derived pollution.

Table 3.5. Human uses of Table Bay, adapted from Carter (2006), Van Ballegooyen (2007).

Use	Description
Shipping	The predominant use of the Bay, both container and cruise i.e. vessel navigation areas and anchorages
Commercial fishing	Boat based line fishery for snoek, hottentot and tunas in and adjacent to Table Bay. Prior to the closure of the fishery, abalone was dived for in the shallow rocky subtidal zone south of Mouille Point and around Robben Island
Collection of white mussels *Donax serra*	For consumption and bait on beaches from Milnerton to Blouberg
Recreation	Water sports such as yachting, kayaking, wind and kite surfing, surfing, diving, swimming and whale watching as well as general beach and coastal recreation
Industrial	Marine outfalls (the Green Point pipeline and the Chevron/Caltex pipeline); industrial cooling water use at the Koeberg power station; used and disused sea cables (Schoonees 2006) with landfalls at Milnerton and Melkbosstrand, and from Granger Bay and Murrays Harbour and the Port of Cape Town
Nature conservation	Table Mountain National Park (TMNP) managed 'multi-use' marine protected area (MPA) from Mouille Point, 14 km offshore, and south to Cape Point. Commercial and recreational fishing is allowed within the boundaries of the MPA, but there are 'no take' sanctuaries where fishing is prohibited. Table Bay is also a rock lobster sanctuary. Robben island and surrounding areas are also a zoned MPA.

3.6.2 FISHERIES

While Table Bay falls within the historical region of recruitment for commercially and ecologically important fish species such as sardine and anchovy, Table Bay is not of particular significance in this regard due to the relatively small area of the Bay compared to the total area of recruitment and foraging (Carter et al. 2003). Using the data sources available, a screening assessment was undertaken to review commercial fisheries which may operate within the proposed area of interest for the construction and operation of the desalination plant. The area of coast identified for the development is extremely modified by existing port infrastructure. The nearshore, disturbed nature of this site, plus the high level of vessel traffic within Table Bay means that almost all commercial fisheries do not operate in this region and so are therefore not considered to be part of the receiving environment. Commercial fisheries that do operate in this area are described below.

COMMERCIAL LINEFISHING

Linefishing (or "traditional linefishing" as it is known) in South Africa is defined as the capture of fish with hook and line but typically excludes the use of longlines. Together, the three sectors of the linefishery (commercial, recreational, and small-scale) target approximately 250 of South Africa's 2 200 marine fish species (Mann 2013). The commercial linefishing sector is exclusively boat-based.

Linefishing takes place year-round with a highly mobile fleet of powered boats targeting different species in area of aggregations at different times along most of South Africa's 2 800 km coast. The traditional linefishery in South Africa uses traditional handline or rod-and-reel methods to catch their target species, most of these species are reef-associated with a small number classed as pelagic. Some 455 boats are active in the sector, most of which are 7-10 m “skiboats” with planing hulls and twin outboard engines.

Various species of fish can be targeted through linefishing in Table Bay where fishing is allowed, including yellowtail, snoek, hake, and various types of reef fish. Catch and effort linefishing data from DFFE (2010-2020) show a relatively high level of linefishing effort in the reporting grid cell in the western portion of the proposed area of development, and a lower level of effort to the east (Figure 3.27).

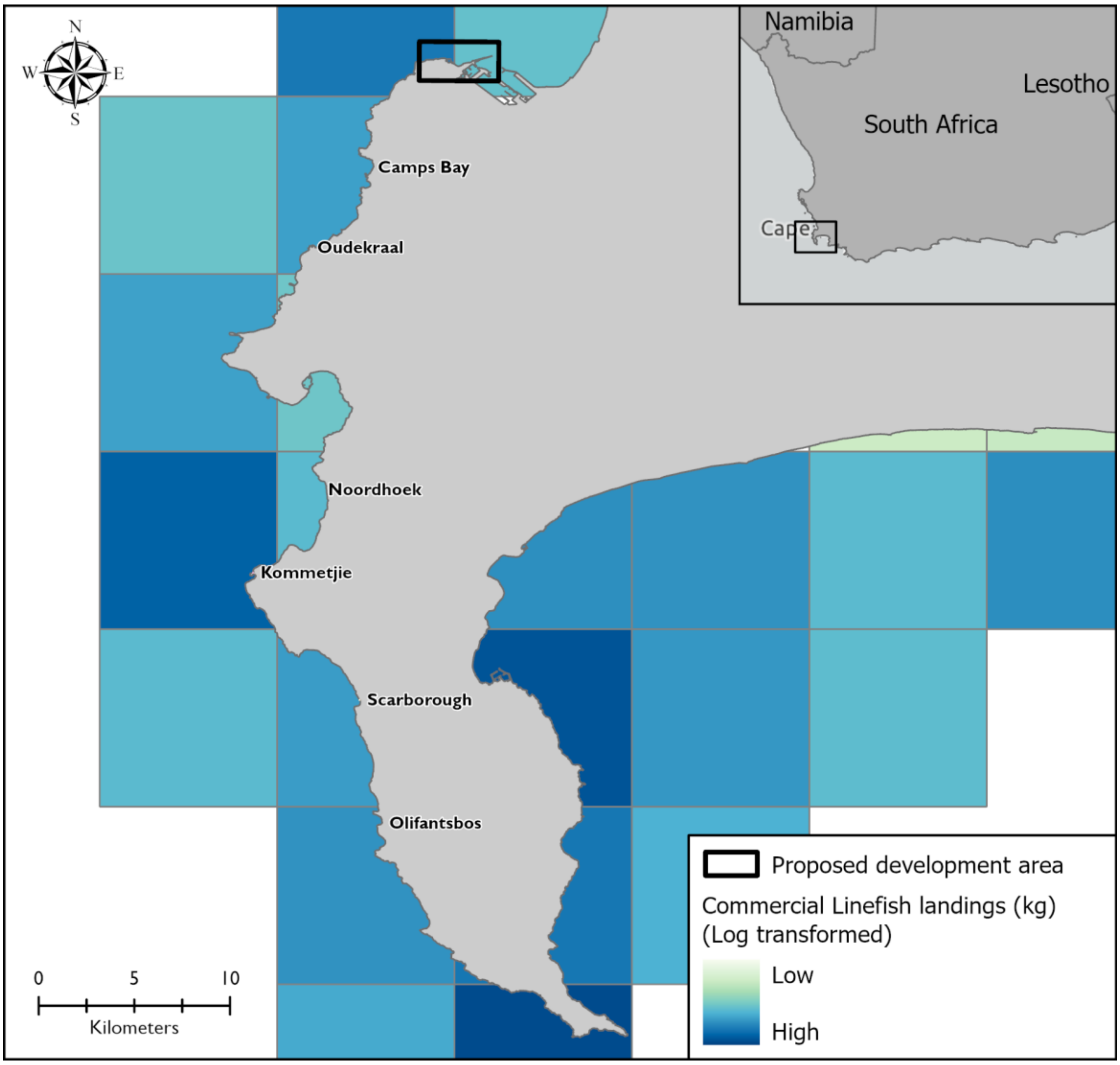


Figure 3.27. Commercial linefishing landings (Total Kg) around Cape Point peninsula. Western Cape, by 5' grid cell from 2010-2020. The Proposed development area is also displayed. Raw data were log transformed. Data acquired from DFFE from PAIA request in 2022.

In the past 10 years around 8 tons of linefish (from 34 fishing trips) have been landed from the coastal area near the proposed development, comprised of mostly hottentot (95%), with some snoek and white stumpnose (Table 3.6). These catches were reported by locality, with all catches coming from 'Milnerton'. This fishing activity is most likely to take place in the coastal nearshore of Milnerton beach or the mouth of the Milnerton estuary (see Figure 3.27). There are no records from elsewhere, suggesting the low level of commercial linefishing effort for this area (grid cell) is exclusively to the northeast of the proposed developed area.

Table 3.6 Summary of the commercial linefish trips undertaken and associated landings for the 5' grid cell overlapping the proposed development area and three adjacent grid cells (Figure 3 24). Data adapted from PAIA request data from DFFE (2010-2020).

Locality name as reported by fisher	Number of trips by locality	Species caught	Total landed weight (kg)
Blouberg Beach	5	Hottentot, Panga, Roman, Snoek	458
Granger Bay	2 487	Big-eye tuna, Bonito, Gurnard, Geelbek, Hottentot, Jacopever, Panga, sharks (undef.), Skipjack, Snoek, White stumpnose, Yellowtail	53 0184
Milnerton	34	Hottentot, Snoek, White stumpnose	8 319
Robben Island	2 013	Bonito, Carpenter, Cowshark, Geelbek, Houndshark, Hottentot, Jacopever, Panga, Roman, Soupfin shark, Slender tuna, Snoek, White stumpnose. Yellowtail	36 9342
Table Bay Harbour	92	Bonito, Hottentot, Jacopever, Shark (undef.), Skipjack tuna, Snoek, Whitestumpnose, Yellowtail	9 800
Three Anchor Bay	6	Hottentot	795

SMALL-SCALE/RECREATIONAL

Small scale fisheries, both in South Africa and abroad, are an important source of income and food security for many thousands of people and has been so for generations. Although small-scale fisheries contribute less than 1% to South Africa's GDP, they play an important role in the provision of protein and employment for an estimated 136 coastal communities distributed along South Africa's 3 000 km coastline (Clark et al. 2002, Sowman et al. 2014, Auld & Feris 2022). The extent and spread of small-scale fishers covers the four provinces with coastlines, especially the Western Cape, where fishing has been an important source of protein among the coastal communities since the 1700s (Isaacs 2013). Small-scale fishers are found both in urban and rural coastal areas.

Previously overlooked, the MLRA was amended in 2014 (commencement date 8 March 2016) to allow the DFFE to proceed with implementing a small-scale fisheries policy. As part of the amendments, a definition of 'small-scale fishers' and the communities involved meant 'a member of a small-scale fishing community engaged in fishing to meet food and basic livelihood needs, or directly involved in processing or marketing of fish, who—

a) traditionally operate in near-shore fishing grounds;
b) predominantly employ traditional low technology or passive fishing gear;
c) undertake single day fishing trips; and
d) is engaged in consumption, barter or sale of fish or otherwise involved in commercial activity, all within the small-scale fisheries sector".

The amended MLRA also replaces any refence to 'subsistence fisheries' with 'small-scale fisheries', essentially encasing the 'subsistence' definition within the larger understanding of 'small-scale fisheries'.

There is not a good amount of available data on small-scale fishing around South Africa. As a proxy, the fishing intensity layers from the National Biodiversity Assessment 2018 for beach seine, recreational and subsistence harvesting have been used when assessing small-scale fishing effort in Table Bay (Sink et al. 2019b). These data show that there are low levels of beach seine, recreational and subsistence fishing near to the proposed development area with only subsistence harvesting overlapping directly (Figure 3.28). This is likely an error in the dataset as subsistence harvesting near the development would take the form of bait harvesting and rod and line fishing from the beach to the east of the proposed development. There are no known subsistence harvesting activities that would take place around the concrete harbour/port in Table Bay.

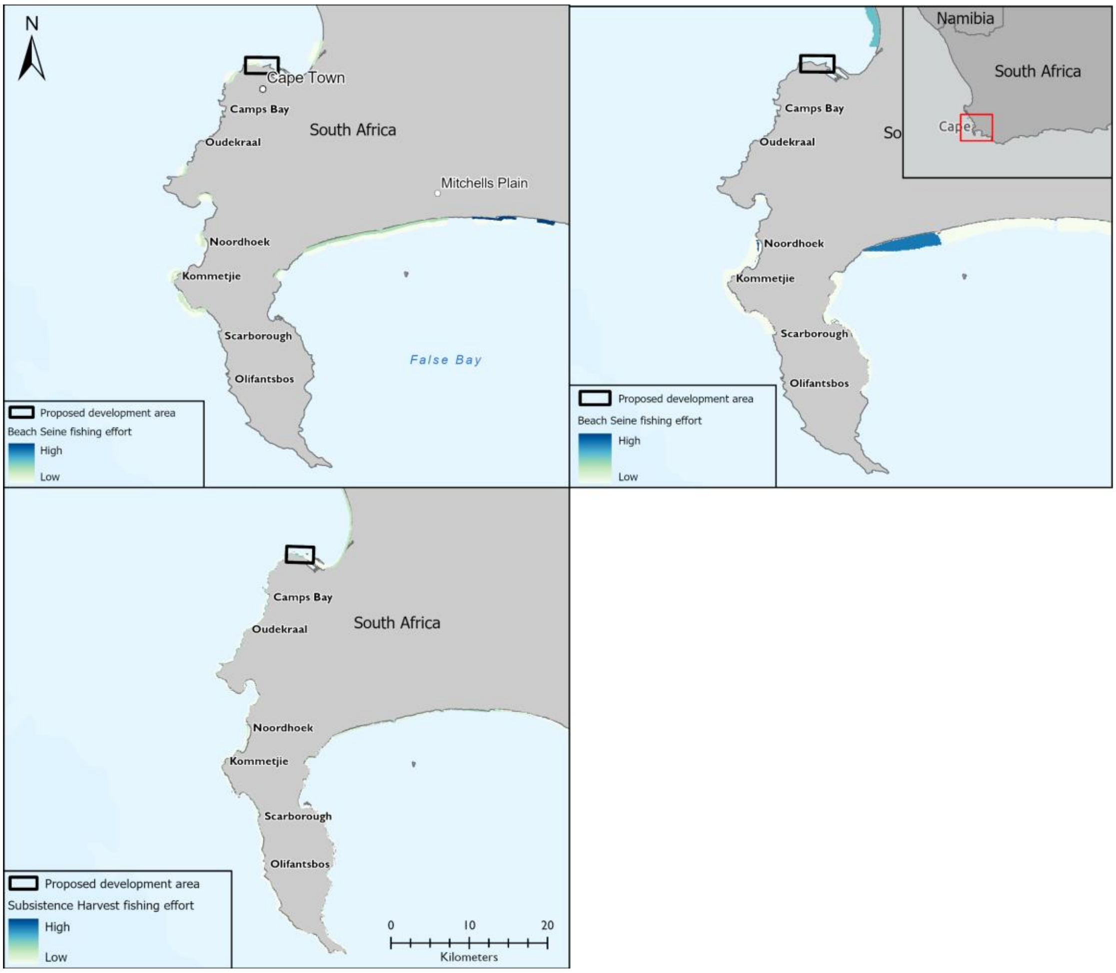


Figure 3.28. Beach seine, subsistence, and recreational fishing effort around Cape Point peninsula. Western Cape. Data taken from National Biodiversity Assessment 2018 pressure assessment (Sink et al. 2019b).

3.6.3 TOURISM AND RECREATION

Beyond extractive use, Table Bay also supports a thriving recreational boating community. The Oceana Power Boat Club is a well-established private boating club located on the western edge of Granger Bay, just outside the Port of Cape Town's breakwaters. It provides vital access to the sea for small craft operators, recreational fishers, and boating enthusiasts in Cape Town. The club is situated on reclaimed land and forms part of the broader V&A Waterfront marine precinct. This facility features a sheltered slipway and boat launch site, which is one of the few public-access marine launch points in the central Cape Town area. It serves a range of users, from powerboats and jet skis to small fishing vessels, and is particularly popular with recreational anglers. The launch area is backed by a gravel or rubble embankment, with the club itself comprising basic infrastructure, including boat parking, washing facilities, and a clubhouse (Figure 3.29). The club operates under a membership model (300+ members) but provides an important public service by maintaining access to Granger Bay's nearshore waters, which would otherwise be restricted due to urban development and coastal engineering. As such, it plays a key role in supporting small-scale and non-commercial marine activity in the area.

Figure 3.29. Oceana Power Boat Club, near Granger Bay (Western Cape Government 2023).

The Royal Cape Yacht Club, located in the Small Craft Basin, is home to many private yachts, with 412 moorings, and hosts regular regattas and sailing events. Charter vessels offering sunset cruises, wildlife tours, and fishing trips operate from the V&A Waterfront, which itself is a major urban tourism precinct. This area combines retail, hospitality, and entertainment with marinas and berthing space for small craft. The V&A Waterfront precinct also includes the Two Oceans Aquarium and sites of historical and cultural value, such as the Robben Island Museum.

Tourism and recreation are major contributors to the Bay's value. The Sea Point Promenade and surrounding beaches attract walkers, swimmers, and sunbathers, while the kelp forests and artificial structures provide popular SCUBA diving and snorkelling sites. The waters around Robben Island and Mouille Point are also prime areas for viewing seabirds, including penguins, cormorants, and oystercatchers. Furthermore, Table Bay is a focal point for marine science, conservation, and education. Institutions such as the University of Cape Town and the Two Oceans Aquarium conduct research on marine ecology, pollution, and species distribution. Regular environmental monitoring is undertaken in response to ongoing development.

4 SPATIAL CONSTRAINTS

4.1 MARINE PROTECTED AREAS AND SANCTUARY ZONES

A Marine Protected Area (MPA) is an area of ocean and/or coastline specifically protected for the benefit of people and the environment. It is stated in the Protected Areas Act (Act No. 57 of 2003) that "no person may conduct commercial prospecting or mining, exploration, production or related activities in a protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs". Therefore, these areas provide some refuge from human induced impacts for marine species and ecosystems. Prior to 2019, South Africa had 25 formally declared MPAs which covered a total ocean area of 0.43% of South Africa's mainland ocean territory (not including the Prince Edward Island in the Southern Ocean). In May 2019, the government formally gazetted the addition of 20 new or expanded MPAs (identified through Operation Phakisa), thereby increasing the total number of MPAs to 41 and the protected area of South Africa's Exclusive Economic Zone (EEZ) to 5% (Government Gazette 42478, Notice No. 757). These areas provide some protection to 87% of the different marine ecosystem types found in South African waters, ensuring that the MPA network is representative of the country's important diversity (South African National Biodiversity Institute 2019)

The presence of endangered seabird colonies (Section 3.5.2) was a large factor supporting the recent (2019) proclamation of the Robben Island MPA (Figure 4.1) that protects breeding and feeding areas for these endangered sea birds. Another aim of this MPA proclamation was to facilitate species management and support stock recovery of over-exploited species such as West Coast rock lobster *Jasus lalandi* and abalone *Haliotis midae* stocks. There is no overlap with any of the proposed infrastructure with any MPAs.

The entirety of Table Bay falls within a rock lobster sanctuary (Figure 4.2) and no West Coast rock lobster *J. lalandi* may be caught, either recreationally or commercially (see Section 2.2.3). The relevant regulations state *"(13) No person shall, in any manner or for any purpose, engage in fishing, collecting or disturbing west coast rock lobster within…The area within 12 nautical miles seaward of the high-water mark between, as northern limit, a line (270° true bearing) drawn through a beacon marked MB1 and situated at Melkbos Point, and as southern limit, a line (270° true bearing) drawn from a beacon marked HD1 at "Die Josie" situated near Chapman's Peak south of Hout Bay"*.

The West Coast rock lobster resource is considered heavily overexploited, with the most recent available work estimating that the current male commercially available biomass (i.e., above 75 mm carapace length, which is the commercial size limit) is ~1.4% of what would be considered pristine biomass (DFFE 2023). The outer harbour wall of the Port of Cape Town and the subtidal rocky reefs at Moullie Point have been identified as nursery reefs for *J. lalandi* (Hazell et al. 2002). Available data indicate, however, that the lobsters at the Port grow slower than those at Moullie Point, potentially due to differences in prey density (specifically, mussels, which are less common on the harbour wall). Dive surveys showed that abundances were almost 60% higher on the Atlantic Coast compared to False Bay (Gardner 2022). While the proposed development area does fall into this Closed Area, there are no extractive activities relevant to the proposed development.

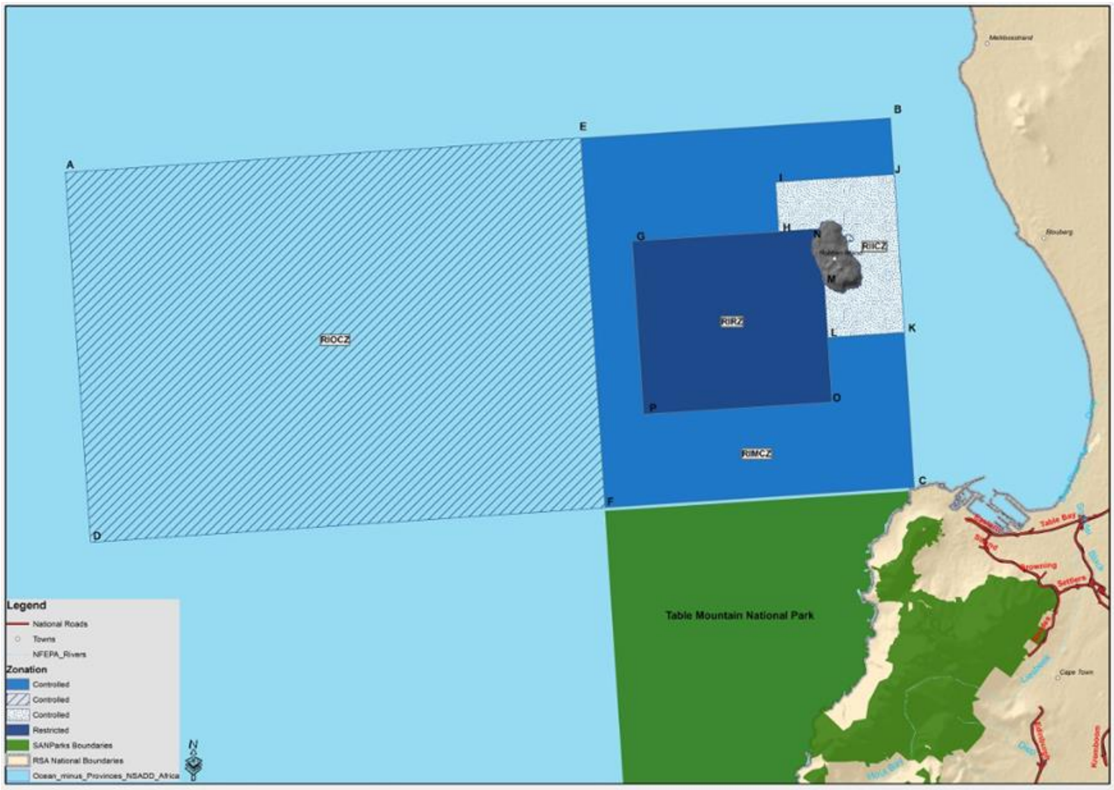


Figure 4.1. The Robben Island Marine Protected Area (MPA). The different use zones are designated (SANParks 2023; from https://www.sanparks.org/conservation/marine-protected-areas/robben-island-mpa, accessed 2024-01-12).

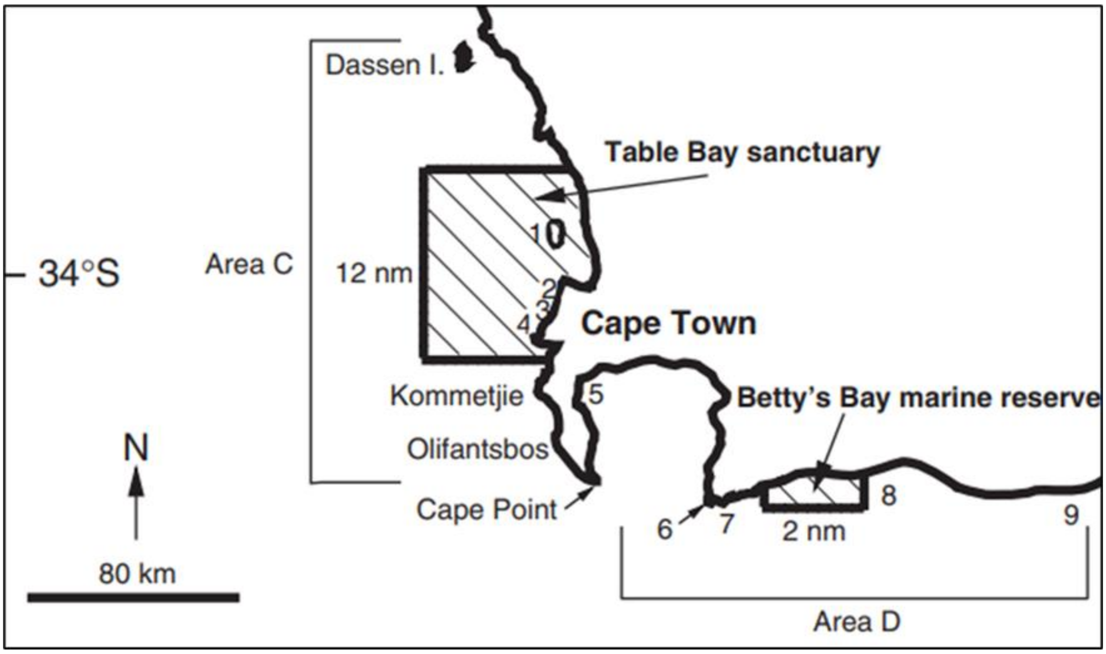


Figure 4.2. The extent of the Table Bay rock lobster sanctuary (Mayfield et al. 2005).

4.2 Ecosystem threat status

The Ecosystem Threat Status developed by SANBI (2018) is an indicator of how threatened ecosystems are, specifically the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, or composition (Harris *et al.* 2018). Ecosystem types are categorised as "Critically Endangered", "Endangered", "Vulnerable", "Near Threatened" or "Least Concern", based on the proportion of the original extent of each ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. The habitat threat status of the proposed area of development in Granger Bay is "Vulnerable" (Figure 4.3).

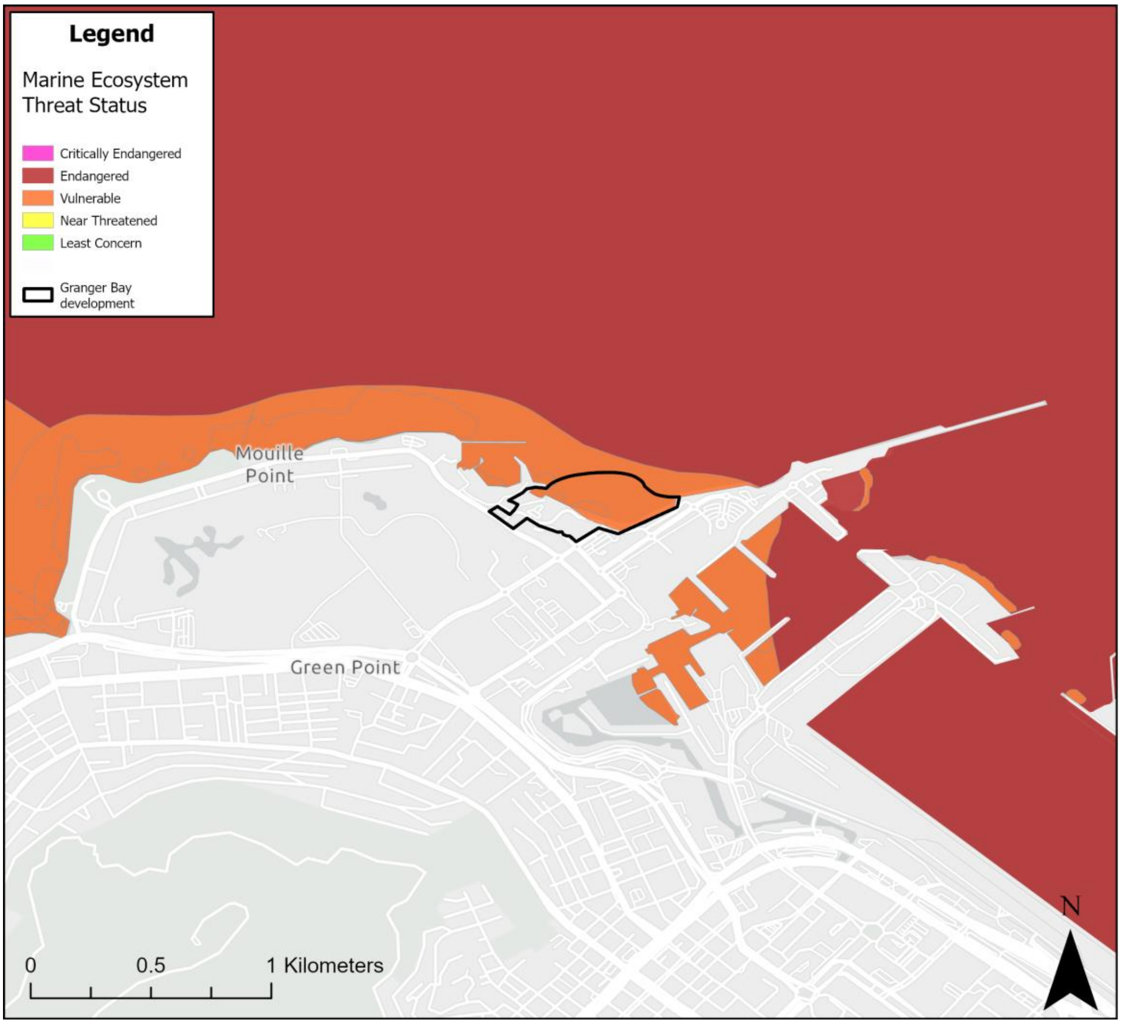


Figure 4.3. Ecosystem threat status as per the NBA (Sink *et al.* 2019) in proximity to the proposed Granger Bay development (indicated in black) and surrounds.

4.3 Critical Biodiversity and Ecological Support Areas

A Critical Biodiversity Area (CBA) assessment presents a spatial plan for the natural environment, designed to inform planning and decision-making in support of sustainable development, and CBA maps are developed using the principles of systematic biodiversity planning (SANBI 2017, Proposed Approach to Spatial Development and Management for South Africa's Marine Planning Areas 2019, and the Biodiversity Marine

Sector Plan 2024). These maps comprise three categories of biodiversity priority areas, namely Protected Areas, CBAs (called "Biodiversity Conservation/Restoration Areas" in the Marine sector plan for the Biodiversity Sector 2024) and Ecological Support Areas (ESAs) ("Biodiversity Impact Management Zones"), which are jointly important for the persistence of a viable representative sample of all ecosystem types and species, as well as the long-term ecological functioning and connectivity of the landscape or seascape as a whole.

CBA Natural sites have natural/near-natural ecological condition, with the management objective of maintaining the sites in that natural/near-natural state. CBA Restore sites are in a moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long term, restore these sites to a natural/near-natural state, or as close to that state as possible. As a minimum in CBA Restore sites, further deterioration in ecological condition must be avoided, and options for future restoration must be maintained. The ESAs include all portions of EBSAs that are not already within MPAs or CBAs, and a 5 km buffer area around all MPAs (where these areas are not already CBAs or ESAs). Within ESAs, negative impacts of human activities on key biodiversity features are managed and minimised to maintain the features in at least a functional, semi-natural state and/or to allow the area to improve in ecological condition. The proposed Granger Bay area overlaps with an ESA at the western edge (by the Oceana Power Boast Club) but otherwise falls entirely outside of any CBA delineated areas (Figure 4.4).

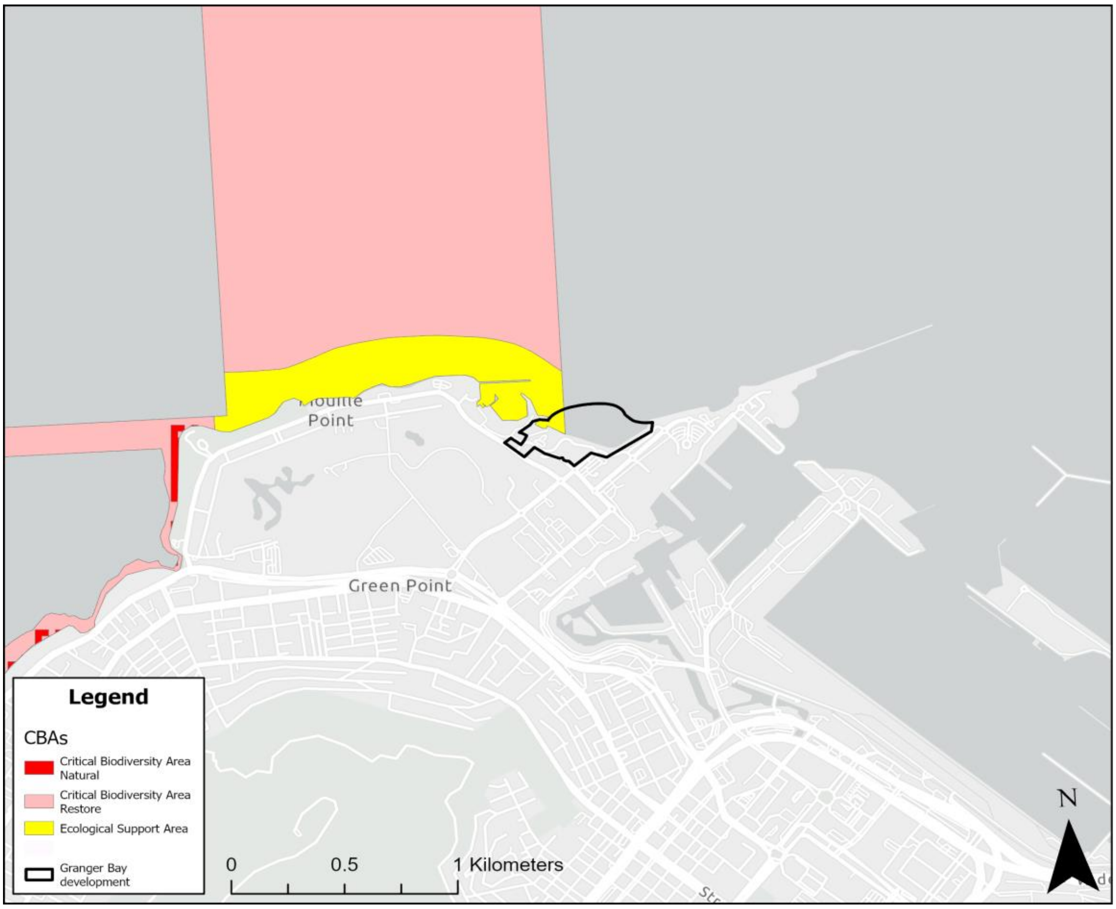


Figure 4.4. Critical Biodiversity Areas and Ecological Support Areas (ESA) in proximity to the proposed Granger Bay development (indicated in black) and surrounds.

4.4 IMPORTANT MARINE MAMMAL AREAS

Important Marine Mammal Areas (IMMA) are a marine spatial planning tool formulated by the joint IUCN Species Survival Commission/World Commission on Protected Areas, Marine Mammal Protected Areas Task Force. The areas considered as IMMAs include sites that host vulnerable species or a significant percentage of the members of a species, sites that are important for reproduction or feeding, and sites that are home to a wide variety of species. In South Africa, three IMMAs have been identified: the Cape Coastal Waters IMMA, Southern Coastal and Shelf Waters IMMA and the Southeast African Coastal Migration Corridor IMMA (Figure 4.5) (Purdon et al. 2020). Table Bay falls into the Southern Coastal and Shelf Waters IMMA (Figure 4.5).

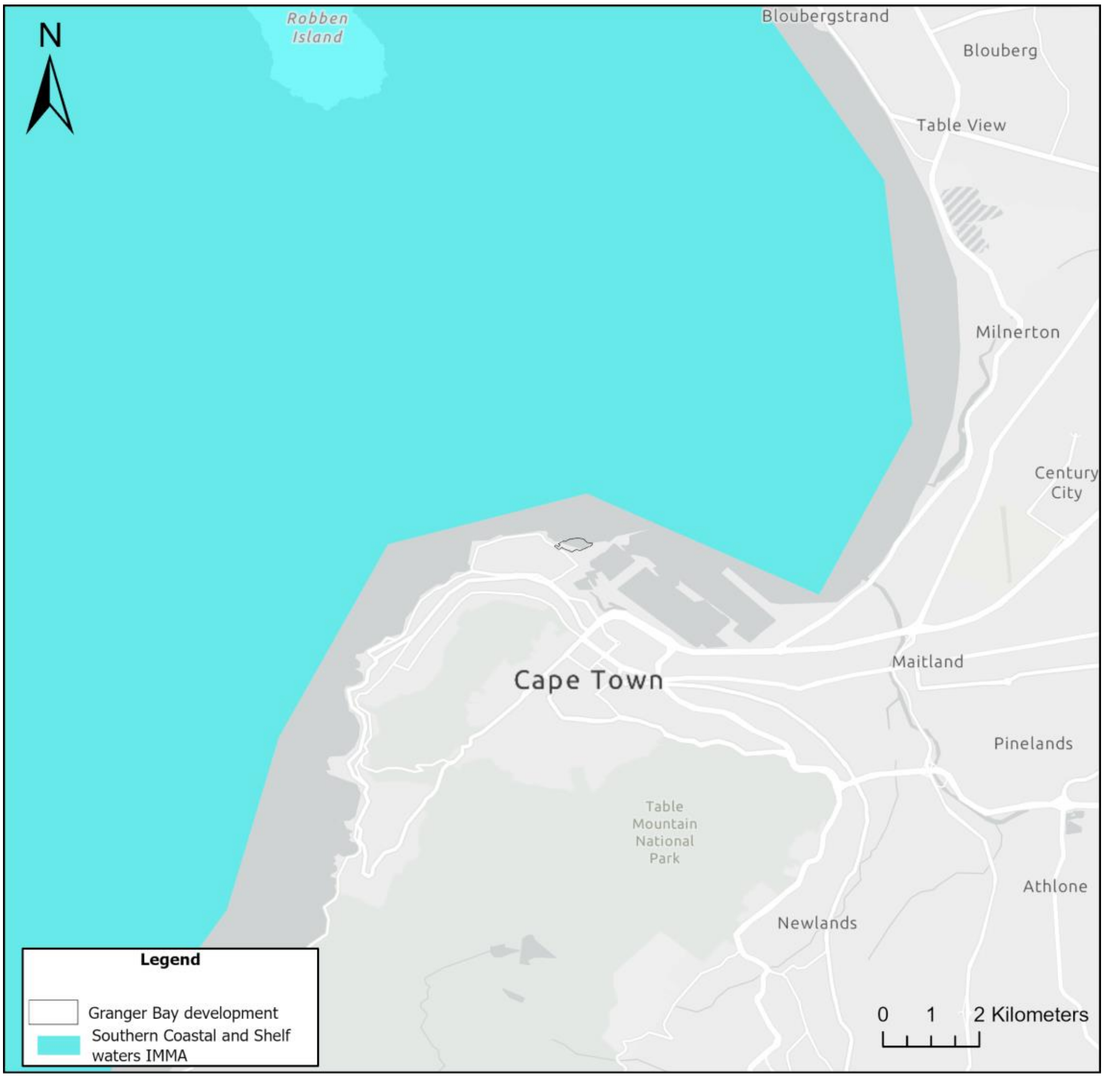


Figure 4.5. Important Marine Mammal Areas (IMMAs) relative to Table Bay and the Granger Bay development (indicated in black) (Marine Mammal Protected Area Task Force 2023, https://www.marinemammalhabitat.org/portfolio-item/southern-coastal-shelf-waters-south-africa/).

All whales and dolphins are given protection under the South African Law. The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or fished (in the Regulations for the management of boat-based whale watching and protection of turtles as part of the Marine Living Resources Act of 1998 the definition of "harassment" is given as "behaviour or conduct that threatens, disturbs or torments cetaceans"). The National Environmental Management: Biodiversity Act (NEM: BA, Act 10 of 2004) and regulations promulgated hereunder (Threatened or Protected Marine Species Regulations, Government Notice No. 40876 published 30 May 2017) provide for control of activities involving listed threatened or protected marine species, which includes the cetacean species that are may be present in Table Bay.

In term of these regulations, no person may carry out a restricted activity (which includes "harassment", defined as behaviour or conduct that "threatens, disturbs or torments a live specimen of a listed threatened or protected marine species, and includes— ... (b) in the case of a whale, approaching a whale with a vessel or aircraft closer than 300 meters…") unless the Minister has exempted him/her from carrying out of such restricted activity in terms of section 57(4) of the Act. As such, no vessel or aircraft may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.

5 POTENTIAL IMPACTS

5.1 INTRODUCTION

In the marine environment a disturbance can be relatively short-lived (e.g., accidental spill which is diluted in the water column below threshold limits within hours) but the effect of such a disturbance may have a much longer lifetime (e.g., attachment of pollutants to sediment which may be disturbed frequently). The assessment and rating procedure described in Appendix 1 addresses the effects and consequences (i.e., the impact) on the environment rather than the cause or initial disturbance alone. To reduce negative impacts, precautions referred to as 'mitigation measures' are set, and attainable mitigation actions are recommended.

'Worst case' impacts are assessed in this report. The assessment is presented as impacts under normal operations. Negative impacts associated with the proposed development as described in Section 1.2 fall into two phases:

- Construction phase impacts, related to the installation of infrastructure, the direct loss of habitat by placement of infrastructure, as well as other associated risks to the marine environment, and
- Operational phase impacts associated with the ongoing operation of the development, associated infrastructure and vehicle traffic.

Each of these phases are likely to affect the associated biota in different ways and at varying intensities depending on the nature of the affected habitat and the sensitivity of the biota.

The proposed mitigation measures are based on the mitigation hierarchy which allows for consideration of different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order (see methodology). When project impacts are considered, the first option should be to avoid or prevent an impact from occurring in the first place if at all possible. If such avoidance is not attainable, the impacts must be minimised as far as possible by the implementation of suitable mitigation measures. If the potential impact results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

Mitigation is separated out as Essential Mitigation (i.e., measures that will be implemented/undertaken as part of industry best practice or legislative requirements) and mitigation specific to the proposed activities in this specific marine environment with the specific identified marine receptors and sensitivities. Note that the unmitigated impact is assessed as prior to the implementation of any Essential or Recommended Mitigation and the mitigation measures proposed as part of the marine impact assessment.

5.2 CONSTRUCTION PHASE

Components of relevance to the marine environment and this impact assessment for the Granger Bay development include the construction/replacement of coastal defence structures (associated revetment, breakwaters) and land reclamation. The proposed revetment and breakwater will be constructed in phases over approximately six years (both in summer and winter). The current programme indicates the revetment, infrastructure, coastal walkway, and public amenities will be constructed over two years.

It is assumed that there will be no piling or blasting required.

5.2.1 DISTURBANCE OF INTERTIDAL AND SUBTIDAL ARTIFICIAL HABITAT

Construction will result in the direct loss of artificial rocky shore habitat, specifically that of the Granger Bay dolosse, and adjacent subtidal sandy and reef habitat (NBA 2018 Cape Mixed Shore ecosystem). This development will result in direct mortality of these communities within the project footprint during the construction phase.

The artificial dolosse habitat is colonised by a range of intertidal invertebrate fauna and flora (e.g. mussels, barnacles, crabs, algae), which characterise much of the intertidal habitat in Table Bay (Wright et al. 2018, Dawson et al. 2024). Field survey results indicate that subtidal reef community structure within Granger Bay is relatively homogenous, with no key areas of significant sensitivity (see Section 3.5.3) (Dawson et al. 2024). The soft sediment benthic macrofauna community in Granger Bay has lower abundances relative to more sheltered control sites to the east (see Section 3.5.4). The Granger Bay sites are more exposed to wave action, resulting in higher rates of mud and total organic content of the sediment being flushed out and therefore, overall lower values of these community indices within Granger Bay(Dawson et al. 2024).

While soft sediment habitats will be lost, similar artificial rocky shore habitat will exist after construction, and recovery of these rocky shore assemblages will occur primarily through immigration from adjacent areas. The relatively small footprint of direct disturbance (total area of 0.032 km^2) and 'short-term' nature of construction activities (two years) will result in the impact being felt over a limited spatial scale and is not anticipated to significantly influence the ecology of the area. Indeed, the development will result in an increased dolosse area post-construction, resulting in an increase in overall habitat of this type for these communities (Table 5.1).

As such, while the proposed development is considered to have site-specific impacts on subtidal habitats, the development is anticipated to result negligible alterations in natural system function. Since this disturbance will not result in an overall net loss of habitat, this impact is rated as very low significance (Table 5.1, Table 5.2). While mitigation measures do not reduce the overall significance of the impact, such measures should include rehabilitation of the disturbed area immediately following construction by removing all artificial materials not related to the permanent fixture of the development.

Table 5.1. Impact 1a: Disturbance of intertidal and subtidal artificial habitat on rocky habitats.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Very Low 3	Definite	**VERY LOW**	-ve	High
Essential mitigation measures: • Limit duration of construction activities in the coastal zone. • Constrain spatial extent of impacts to the minimum required.								

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
With mitigation	Local 1	Low 1	Short term 1	Very Low 3	Definite	**VERY LOW**	-ve	High
Reversibility of the impact: Hard subtidal habitat – high (impacts are fully reversible) **Irreplaceability of resource loss caused by impacts**: Low, natural recovery anticipated to occur relatively quickly (within two years).								

Table 5.2. Impact 1b: Disturbance of intertidal and subtidal artificial habitat on soft sediment habitats.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Very Low 3	Definite	**VERY LOW**	-ve	High
Essential mitigation measures: • Limit duration of construction activities in the coastal zone. • Constrain spatial extent of impacts to the minimum required.								
With mitigation	Local 1	Low 1	Short term 1	Very Low 3	Definite	**VERY LOW**	-ve	High
Reversibility of the impact: Soft subtidal habitat – permanent (impacts are non-reversible) **Irreplaceability of resource loss caused by impacts**: Low, natural recovery anticipated to occur relatively quickly (within two years).								

5.2.2 Impacts on West Coast Rock Lobster

The proposed harbour development at Granger Bay will involve the removal and alteration of existing dolosse to accommodate new infrastructure. This activity is expected to result in the displacement, injury, or mortality of numerous West Coast Rock Lobsters that currently inhabit the dolosse (Section 3.5.3 and Section 4.1). The impact will be intense, highly localised, and concentrated over the short-term construction period.

Although the construction will significantly disturb rock lobster habitat in the immediate area, population-level impacts on rock lobster are unlikely, given the species' broader distribution and mobility. Similar artificial rocky shore habitat will exist after construction, and recovery of these populations will occur primarily through immigration from adjacent areas. The relatively small footprint of direct disturbance (total area of 0.032 km^2) and 'short-term' nature of construction activities (two years) will result in the impact being felt over a limited spatial scale.

The impact of this construction phase impact on rock lobster populations is assessed to be of low significance prior to mitigation (Table 5.3). While limited mitigation is available to reduce the significance of this impact, some recommended mitigation to reduce the probability of immediate impacts includes phased removal, and potential translocation of individuals from high-density zones (Table 5.3).

Table 5.3. Impact 2: Impacts of construction on West Coast Rock Lobster.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Short term 1	Low 5	Definite	**LOW**	-ve	High

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Essential mitigation measures: • Constrain spatial extent of impacts to the minimum required. **Recommended mitigation measures:** • Implement phased removal, and potential translocation of individuals from high-density zones.								
With mitigation	Local 1	High 3	Short term 1	Low 5	Probable	**LOW**	-ve	Medium
Reversibility of the impact: High (impacts are fully reversible) **Irreplaceability of resource loss caused by impacts**: Moderate, but natural recovery anticipated within a number of years (unknow, but assumed to be within two to three years).								

5.2.3 DISTURBANCE OF PELAGIC OPEN WATER HABITAT

Construction will result in the temporary disturbance of pelagic habitat (NBA 2018 Cape Bay ecosystem) within the footprint of the Granger Bay development. Fish and other mobile pelagic species that utilise the habitat will be able to move to adjacent areas (impacts on marine mammals are assessed separately in Section 5.2.7). Considering that the area is generally already disturbed by constant vessel movement and that the pelagic habitat affected will be relatively small in comparison to adjacent areas of similar habitat in Table Bay.

The construction activities will likely result in the disturbance of benthic sediments, leading to their resuspension into the water column, which may result in elevated turbidity and associated impacts. Increased turbidity can reduce water clarity and light penetration and can disrupt the feeding and reproductive behaviours of various species that rely on clear water for survival. This may have negative implications for the primary productivity of microalgae (phytoplankton and microphytobenthos), and for invertebrates and fish. Fine particulate matter may result in the clogging of the feeding and breathing apparatus of certain organisms (e.g., filter feeding invertebrates and the gills of sensitive fish species) (Wenger et al. 2017). The response of larval fish to turbidity of the water column is generally species-specific (Harris et al. 1999). It is noted that sediment granulometry within Granger Bay consists of predominantly sand with a small portion of mud (Figure 3.21) (Dawson et al. 2024). The larger grain sizes mean that the spatial extent of any sediment disturbance to the water column is anticipated to be very small and will only persist for a short period after disturbance.

Released sediment can also introduce excess nutrients into the surrounding waters (Kahn & Mohammad 2014). Nutrient enrichment can lead to eutrophication, promoting algal blooms and reducing oxygen levels in the water. This can result in fish kills, habitat degradation, and the loss of biodiversity. However, field surveys show that the sediments of Granger Bay are course with a low proportion of mud, and low total organic content (16.-2.4% compared to 2.5-5.3% elsewhere in Table Bay) (Figure 3.22, see Section 3.5.4). It is unlikely therefore that there is a high risk of nutrient remobilisation as a result of the proposed development. Likewise, the low trace metal concentrations within the Granger By sediments (Figure 3.23) mean that there is a very low risk of harmful trace metal remobilisation into the system.

Given the local extent and low intensity, this impact is rated as of very low significance prior to mitigation (Table 5.4).

Table 5.4. Impact 3: Disturbance to pelagic open water habitats.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Very Low 3	Probable	**VERY LOW**	-ve	High
Essential mitigation measures: • Limit duration of construction activities in the coastal zone. • Constrain spatial extent of impacts to the minimum required.								
With mitigation	Local 1	Low 1	Short term 1	Very Low 3	Probable	**VERY LOW**	-ve	High
Reversibility of the impact: High (impacts are fully reversible) **Irreplaceability of resource loss caused by impacts**: Very low, natural recovery will occur very quickly (within one year).								

5.2.4 WASTE GENERATION AND DISPOSAL

During the construction of the revetments, walls and breakwaters, offcuts and fragments of construction materials used or brought to site during construction, may enter the water. The problem of litter entering the marine environment has escalated dramatically in recent decades, with an ever-increasing proportion of litter consisting of non-biodegradable plastic materials. South Africa has laws against littering, both on land and in the coastal zone, but these laws are seldom rigorously enforced. Objects which are particularly detrimental to aquatic fauna include plastic bags and bottles, pieces of rope and small plastic particles. Large numbers of aquatic organisms are killed or injured daily by becoming entangled in debris or as a result of the ingestion of small plastic particles (Gregory 2009, Wright et al. 2013). The impact on certain forms of marine life by floating or submerged solid materials can be substantial. Most at risk in this case include seabirds, mammals and fish, including possibly rare or even endangered species.

Poor housekeeping practises can also have impacts on water quality. For example, uncontrolled runoff of sewage and other organic wastes is harmful to biota due to high concentrations of nutrients which stimulate primary production that in turn leads to changes in species composition and changes to biodiversity, toxicity effects and impacts on water quality parameters like oxygen (Cloern 2001). The construction activities will also involve the presence of vehicles below the high-water mark, and spills or improper disposal of waste can lead to water contamination, posing risks to aquatic life and human health. Pollutants can bioaccumulate in the food chain and have long-lasting impacts on ecosystems.

In order to reduce this, all domestic and general waste generated must be disposed of responsibly. All reasonable measures must be implemented to ensure there is no littering and that construction waste is adequately managed. Staff must be regularly reminded about the detrimental impacts of pollution on aquatic species and suitable handling and disposal protocols must be clearly explained and sign boarded. The 'reduce, reuse, recycle' policy must be implemented. This impact is rated as of medium significance without mitigation and can be reduced to low significance by implementing the actions outlined in Table 5.5.

Table 5.5. Impact 4: Waste generation and disposal during construction.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Low 1	Long term 3	Medium 6	Probable	**MEDIUM**	-ve	High
Essential mitigation measures: • Inform and train all staff about sensitive marine species and the responsible disposal of construction waste. This training must be integrated into toolbox talks or onsite awareness sessions to ensure that waste management practices are understood and followed diligently. Additionally, contractors must prepare a method statement outlining specific waste management procedures, which must be approved by the resident engineer before construction activities commence. • Suitable handling and disposal protocols must be clearly explained, and sign boarded. • Reduce, reuse, recycle. • Waste disposal at licensed landfill sites by qualified contractors is mandatory, with proof of disposal submitted to the appointed Environmental Officer. Waste management certification must be obtained, and detailed records of all stored and disposed waste, including quantity, nature, and fate, must be maintained for auditing purposes. • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Enforcement of facility usage and cleanliness is crucial.								
With mitigation	Local 1	Low 1	Long term 2	Low 5	Improbable	**VERY LOW**	-ve	High
Reversibility of the impact: Moderate **Irreplaceability of resource loss caused by impacts**: Moderate								

5.2.5 EFFECTS OF CONSTRUCTION RELATED POLLUTION

Granger Bay revetment construction may involve some traffic on the breakwater by heavy vehicles and machinery, as well as potential manoeuvring of vessels. These activities will be localised and confined to within a few hundred metres of the construction footprint. The risk of spillage of a variety of hazardous substances may occur during the use of heavy machinery, construction vehicles and construction vessels. For example, spillage may occur as a result of fuel leaks, refuelling, or collision. Hydrocarbons are toxic to aquatic organisms and precautions must be taken to prevent them from contaminating the environment. This impact can be mitigated successfully if authorities implement a rigorous environmental management and control plan to limit ecological risks from accidents.

In terms of the material to be used for the construction of the revetment and land reclamation activities, quarried rock and concrete will be used which is largely considered as inert or to pose minimal pollution risk to the marine environment. In general, plain concrete will be used wherever possible. Reinforced concrete will be used for concrete elements that are subjected to high bending and tensile loads. The use of inert or protected reinforcement will also be considered wherever possible. To try and limit the impact the use of concrete on the environment consideration will be given to more sustainable ways of using concrete, such as using locally available aggregates, or recycled aggregates, wherever possible. Introducing specialised admixtures and element shapes to encourage growth of marine life and the formation of biodiverse marine habitats, will be considered wherever possible. All quarried rock will comply with PRDW's generic rock specification (PRDW 2019) which is based on the Rock Manual (CIRIA et al. 2007) and includes requirements to manage rock cleanliness (absence of soil or quarry dust), reducing the likelihood of the quarried rock introducing suspended sediments into the marine environment.

Construction of harbour infrastructure will likely generate localised increases in suspended sediments due to dredging, excavation, and placement of construction materials, resulting in temporary increases in turbidity and sediment deposition in adjacent marine areas. These elevated suspended solids may temporarily reduce water clarity and cause limited smothering or disturbance of nearby benthic habitats and marine organisms; however, such effects are typically confined to the construction footprint and immediate surroundings, and are short-term provided works are properly managed. Mitigation measures should therefore focus on minimising sediment release and spread through phased construction, use of turbidity or silt curtains where feasible, careful handling and placement of materials, and stabilisation of reclaimed or disturbed areas to ensure impacts remain localised and temporary.

All fuel and oil must be stored with adequate spill protection and no leaking vehicles should be permitted on site. Intentional disposal of any substance into the aquatic environment is strictly prohibited, while accidental spillage must be prevented, contained and reported immediately. After mitigation, the impact of construction related pollution is considered to be of very low significance (Table 5.6).

Table 5.6. Impact 5: Construction related pollution impacts on marine biota.

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>Without mitigation</td><td>Local
1</td><td>High
3</td><td>Medium term
2</td><td>Medium
6</td><td>Possible</td><td>LOW</td><td>-ve</td><td>High</td></tr>
<tr><td colspan="9">Essential mitigation measures:
• Intentional disposal of any substance into the environment is strictly prohibited, while accidental spillage must be prevented, contained and reported immediately.
• Implementation of a rigorous environmental management and control plan (including procedures for remediation).
• All fuel and oil is to be stored with adequate spill protection.
• No leaking vehicles are permitted on site.
• All hazardous substances must be accompanied by a permit, a hazard report sheet, and may only be handled by suitably trained operators.
• For concrete use, specialised admixtures and element shapes to encourage growth of marine life and the formation of biodiverse marine habitats, will be considered wherever possible.
• Using locally available aggregates, or recycled aggregates, to be considered wherever possible.
• Ensure quarried rock meets cleanliness specifications prior to transportation to construction site.
• Use turbidity or silt curtains where feasible to contain suspended sediments within the construction footprint.
• Ensure careful handling and controlled placement of construction materials to minimise unnecessary sediment disturbance and resuspension.
Recommended mitigation measures:
• Implement phased construction where feasible to limit the area of seabed disturbed at any one time and reduce sediment release
• Stabilise reclaimed or disturbed areas as soon as practicable to prevent continued erosion and sediment mobilisation following construction activities.</td></tr>
<tr><td>With mitigation</td><td>Local
1</td><td>Medium
2</td><td>Medium term
2</td><td>Low
5</td><td>Improbable</td><td>VERY LOW</td><td>-ve</td><td>High</td></tr>
<tr><td colspan="9">Reversibility of the impact: Moderate
Irreplaceability of resource loss caused by impacts: Moderate</td></tr>
</table>

5.2.6 NOISE AND VIBRATION IMPACTS ON FISH, INVERTEBRATES AND BIRDS

During construction operations, above water and below water noise may have an impact on marine organisms in the vicinity proposed development area. It is anticipated that the construction approach will be land-based through the use of excavators (or similar), with vessels likely used at some level for observation and survey work. Noise may therefore be generated by construction activities such as earth moving vehicles, service vehicles, vessels, cranes, heavy machinery, generators, excavating, installation of piles, drilling, grinding etc.

Noise pollution is characterised as either impulsive or non-impulsive. Impulsive noises are considered to have high peak sound pressure, short duration, fast rise-time and broad frequency content at source (Hastie et al. 2019, Southall et al. 2019). Non-impulsive sources are categorised as "steady state" noise (Southall et al. 2019). Explosives, impact piling and seismic airguns are considered impulsive noise sources while sonars, vibropiling, drilling, shipping and other relatively low-level continuous noises are considered non-impulsive (Hastie et al. 2019, Martin et al. 2020). A non-impulsive noise does not necessarily have to have a long duration. The extent and likelihood of noise causing adverse impacts on aquatic life is dependent on the qualities of the sound such as the sound level, source frequency, duration of exposure, and/or repetition rate (Hastings & Popper 2005).

Specific to this development, the excavation of existing rock and soil (especially when undertaken within the intertidal or subtidal zone using heavy machinery) can introduce moderate levels of underwater noise. Mechanical excavation and rock-breaking equipment produce low- to mid-frequency vibrations that can transmit through the substrate and water column. These sounds may cause temporary avoidance behaviour in fish and marine mammals (noise impacts to cetaceans are assessed separately in Section 5.2.7).

The dumping of rock into the sea, particularly when involving large rocks or dolosse, can produce short bursts of intense, low-frequency underwater sound as the material impacts the seabed. If conducted from height or involving heavy volumes, these impulsive sounds can travel substantial distances underwater. The subsequent shaping of dumped rock using excavators adds a layer of continuous mechanical noise, although generally of lower intensity. Together, these activities could lead to the temporary displacement of marine species and changes to local habitat use.

The placing of pre-cast concrete elements into the water also produces underwater sound, primarily as broad-spectrum impact noise when the elements contact the water or seabed. Though not as loud or harmful as impact piling, this noise can still cause localized disturbance.

Finally, casting of in-situ concrete for walkways, pools, or other structures usually generates low levels of underwater noise, unless vibrating equipment or pumps are used in close proximity to or directly within the water. Vibratory compactors, if used on in-water platforms or for submerged formwork, may transmit low-frequency vibration into the surrounding water column and sediment. While the associated risks are minor, they could still cause brief behavioural changes in sensitive marine species.

The noise levels generated by typical construction tools include pneumatic precision drills (~120 dB at source), hammer drills (114 dB), chain saws (110 dB), spray painters

(105 dB), hand drills (98 dB) and angle grinders (95-115 dB) (CDC 2005). Given the scale of this construction project, it is likely that noise levels will exceed 120 dB at times when industrial machinery, such as jackhammers, are used (130dB). Impact pile driving uses high energy impact hammers, and is the source of impulsive, intensive noise with demonstrated negative impacts on marine biota (Niu et al. 2023) In air, the dissipation of sound follows an inverse-square law, which means that for each doubling of distance from the noise source, the sounds pressure level will decrease by roughly 6 dB. Source volumes of 130 dB will dissipate below disturbance thresholds at approximately 675 metres from the source. However, such loud construction is likely to be intermittent and it is more likely that typically construction noise will top out at approximately 120 dB, meaning that noise levels for the proposed construction site are estimated to fall below disturbance levels of 70 dB at approximately 300 m from the source, with any fauna present inside of these areas likely experiencing noise disturbance (Dooling & Popper 2007, Ortega 2012).

Marine **invertebrates** have been shown to be relatively insensitive to low frequency sound, whilst **fish** appear to be able to tolerate moderate sound levels. While the hearing range of fishes is generally considered to be from approximately 30 Hz to 10 kHz, there are some species of fish that can detect higher frequencies. Fish are grouped into three categories depending on whether they have a swim bladder, and if it has a role in their ability to hear (Popper & Hawkins 2019). For fish, masking and behavioural effects are assessed qualitatively, in terms of relative risk (i.e., high, moderate, and low) at distances from a noise source (i.e., near, intermediate, and far) (Popper et al. 2014).

Noise pollution affects **birds** in a number of ways, including direct physical impacts (damage to hearing), stress, fright-flight and avoidance responses. There are also potential behavioural impacts, including changes in foraging, reproductive success, communication and potential decreased response to audible alerts (from, for example, predators) (Ortega 2012). Physical damage to birds ears occurs from either very loud sounds for a short duration (>140 dBA), from repeated loud noises (~125 dBA), or from continuous (72h) exposure to noise of greater than 110 dBA (Dooling & Popper 2007). A single sudden noise tends to have a larger impact than a continuous, more intense noise (Cutts et al. 2013). However, “noise facilitation” can also occur, wherein a disproportionately large impact can occur if multiple relatively low intensity sounds occur at the same time, i.e., construction occurring concurrently with nearby motorboat activity. Development construction typically falls within the second category (with repeated loud noise).

Both mobile fish and foraging seabirds are expected to avoid the sound source should it reach levels sufficient to cause discomfort. The area is already highly impacted by human activities due to the proximity to the Port of Cape Town, Oceana Power Boat Club slipway for small power vessels and the Waterclub/Granger Bay marina for medium sized private vessels (Elwen 2025) (see Section 3.6.3).

Given the duration of the impact (up to two years of total construction time, but intermittent noise sources), and the anticipated area of impact (localised, within 1 km, of the site) the impact of noise disturbance on invertebrates, fish and avifauna is assessed to be of very low significance before mitigation (Table 5.7). Noise emissions from mobile and fixed equipment should be subject to periodic checks as part of regular maintenance programmes to allow for detection of any unacceptable increases in noise. After mitigation is considered, the impact of noise and vibration on the marine environment is considered insignificant (Table 5.7).

Table 5.7. Impact 6: The effect of increased noise and vibration from construction on marine organisms (invertebrates, fish, birds).

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Very Low 3	Definite	**VERY LOW**	-ve	Medium
Essential mitigation measures: • Subject mobile equipment, vehicles and power generation equipment to noise tests at commencement and periodically throughout the construction phase.								
With mitigation	Local 1	Low 1	Short term 1	Very Low 3	Improbable	**INSIGNIFICANT**	-ve	Medium
Reversibility of the impact: High (impacts are fully reversible) **Irreplaceability of resource loss caused by impacts**: Low, natural recovery will occur relatively quickly (within two years).								

5.2.7 Impacts on marine mammals

Construction phase impacts of the proposed development of on marine mammals include an increase vessel presence in the area, the effects of construction noise, and an increase in turbidity and pollution.

The Granger Bay area is already subject to a significant level of boat traffic in the area (both recreational and commercial vessels), as it lies between three harbours/slipways (the Ocean Power Boast Club, the Por of Cape Town, and the Granger Bay marina). It is anticipated therefore that the presence of general small **construction support vessels** in the area is unlikely to represent a significant impact on the resident dolphins or other species of cetaceans. Impacts are anticipated to be larger should a large vessel or barge is installed (such as for a crane) (Elwen 2025). Impacts are rates as of very low significance with mitigation (Table 5.8).

Table 5.8. Impact 7a: Impacts on marine mammals – increased vessel presence.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Short term 1	Low 5	Definite	**LOW**	-ve	High
Essential mitigation measures: • Vessels used must be driven in a slow and responsible manner, keep gear changes and acceleration to a minimum to minimise rapid changes in noise levels, • A lookout must be kept for dolphins and whales at all times and groups should be avoided where possible. • If any impacts are observed (vessel strike, entanglement, strong avoidance responses) these should be report to the relevant environmental authority as soon as possible (e.g. DFFE).								
With mitigation	Local 1	High 3	Short term 1	Low 5	Possible	**VERY LOW**	-ve	Medium
Reversibility of the impact: Moderate (impacts are partially reversible) **Irreplaceability of resource loss caused by impacts**: Medium								

Cetaceans are highly acoustically orientated and reliant on sound channels for feeding, social communication and orientation within their environment, and are thus particularly vulnerable to the impacts of human generated sounds (Tyack et al. 2011, Southall et al. 2019). The impacts of noise disturbance on cetaceans include changes in vocalization, respiration rate, swim speed, migration routes, diving and foraging behaviour, physical and auditory damage (either temporary or permanent) and in extreme cases, death and/or strandings (Weilgart 2018). In the long term, exposure to low-frequency noise may be a chronic cause of stress (Rolland et al. 2012).

The hearing sensitivity of cetaceans varies considerably between taxonomic groups — large baleen whales are more sensitive to lower frequency sounds that overlap their vocalisation frequencies (mostly below 10 kHz), while dolphins are more sensitive to higher frequency sounds (especially above 1000 Hz) (Southall et al. 2008, 2019). Heaviside's dolphins have higher sensitivities at frequencies above 80 kHz (Southall et al. 2008, 2019). Indeed, impacts of the proposed development on the resident population of Heaviside's dolphins, which use the area on a daily basis for resting and socialising, has been flagged as of particular concern (the full assessment in Elwen 2025 is summarised below).

Underwater noise emissions for rock dumping activities are low compared to vessel propulsion noise and pile driving (Nedwell et al. 2012). The majority of these sounds will be low frequency (< 1000 Hz) which by their nature travel well through the water so may be detectable at longer distances. Given the general low frequency nature of these types of sounds, it is anticipated that impacts will be greater for baleen whales than on the dolphins in the area (Elwen 2025). Existing reports suggest that noise from rock dumping is lower than that typical from boat engines, so direct impacts on hearing thresholds are unlikely. The most likely response is a startle and or avoidance response from animals in the area (Elwen 2025).

It is anticipated that underwater noise will represent the impact of the largest spatial scale (hundreds of meters out to sea from the site during the construction phase) (Table 5.9). Impacts are rates as of very low significance with mitigation (Table 5.8).

Table 5.9. Impact 7b: Impacts on marine mammals – underwater noise.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Short term 1	Low 5	Definite	**LOW**	-ve	High

Essential mitigation measures:

- Before engaging in any rock dumping or similar actions where material is dumped directly into the ocean, ensure that no baleen whales are within ~500 m of the impact site (in the absence of direct measures of sound levels and hearing thresholds, 500 m is widely used as a typical distance for safe avoidance of noise impacts). As far as possible, ensure no dolphins are within 500 m of the impact site. A dedicated marine mammal observer should be used for these phases of work.
- Ensure all machinery is in good working order to reduce in in-air noise levels and transmission into the marine environment.
- Where rock placement/dumping/construction is planned - aim to work from the ocean space backwards towards shore to create a physical barrier to sound in the initial stages of work, then all other fill work will be effectively 'on land'.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
With mitigation	Local 1	High 3	Short term 1	Low 5	Possible	**VERY LOW**	-ve	Medium
Reversibility of the impact: Moderate (impacts are partially reversible) **Irreplaceability of resource loss caused by impacts**: Medium								

5.3 Operational Impacts

The primary operational phase impacts are permanent alteration to subtidal habitats and an increase vessel traffic as a result of the development. Assessment of these impacts was based on anticipated outcomes of the development based on current construction plans.

5.3.1 Change in habitats and system function

The loss of sandy benthic habitat during construction (Section 5.2.1) will remain in place (similar footprint area) during operations. The ecological effects of this habitat loss will persist and may become more pronounced over time. Sandy benthic areas support diverse communities of infaunal and epifaunal organisms, many of which form the basis of local food webs by providing foraging opportunities for demersal fish and mobile invertebrates. With the sandy substrate replaced by revetment material, these species will no longer find suitable habitat in the immediate area. The area is classified as Cape Mixed Shore so a shift in habitat from sandy benthic habitat to rocky reef habitat is complementary to existing habitat type, albeit artificial.

Additionally, changes to local hydrodynamics and sediment movement associated with the revetment may affect the quality and extent of surrounding sandy benthic areas, potentially leading to further habitat degradation nearby. In the adjacent open water environment, ongoing vessel activity and altered wave and current patterns may affect water quality and disrupt ecological processes such as planktonic productivity, larval dispersal, and the movement of pelagic species.

The revetment structure will modify local wave dynamics once established, by altering how wave energy is reflected and dissipated along the shoreline. The supporting modelling results (PRDW 2023) and Oceanographic specialist study (WML Coast 2025) identified that the wave height inside the development is generally reduced compared to current status, however, there is significant amplification in the centre of the development due to harbour resonance. The wave height inside the development is significantly larger than those inside the neighbouring Waterclub. The report also identified that shear stress is reduced in sheltered areas and therefore there is some risk of longer-term mud accumulation within the development. These changes in wave and sediment dynamics may have ecological consequences, particularly for intertidal and shallow subtidal habitats that are sensitive to sediment dynamics, including the rocky reef fauna and any adjacent kelp habitats. Furthermore, changes in wave climate may alter accessibility of intertidal zones to foraging species, thereby altering ecosystem function along the modified shoreline. Overall, the anticipated impacts associated with changes in hydrodynamics as a result of the development are considered to be relatively low.

The increased vessel activity/operations of the reclaimed area may also result in increased pollution sources, which need to be carefully managed limit further degradation of these habitats.

It is unlikely, however, that these changes will result in significance, long term changes to ecological processes of Table Bay or surrounds. This the impact is considered to be of very low significance with mitigation (Table 5.10).

Table 5.10. Impact 8: Change in habitat and system function.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long term 3	Low 5	Probable	**LOW**	-ve	Medium
Essential mitigation measures: • The project design must account for potential changes in hydrodynamic function and ensure that resultant local changes in hydrodynamics do not cause significant, ongoing scour of the seabed. • Ensure potential pollution sources (including bilge water and greywater etc.) associated with the development are managed to avoid pollution which may further degrade these habitats.								
With mitigation	Local 1	Low 1	Long term 3	Low 5	Possible	**VERY LOW**	-ve	Medium
Reversibility of the impact: Moderate (impacts are partially reversible) **Irreplaceability of resource loss caused by impacts**: Low								

5.3.2 LOSS OF ROCKY SHORE HABITAT AND INTRODUCTION OF ARTIFICIAL HABITAT

In cases where natural rocky shore (NBA 2018 Cape Mixed Shore) habitat has been removed or modified to accommodate the revetment, the operational phase will reflect a shift in habitat type from natural intertidal rock platforms to artificial, engineered hard surfaces. The revetment will however be colonised over time by marine organisms, as evidenced by the current rocky subtidal communities present on the dolosse of the Port (see Section 3.5.5). Indeed, the dolosse of Table Bay breakwater are a highly heterogeneous habitat, home to an abundance of West Coast rock lobster *J. lalandii*, crabs *Plagusia chabrus* and urchins *Parechinus angulosus* living among the mussels, kelp and red bait. Artificial habitats, however, may be susceptible to colonisation by non-native or invasive species, which can further alter the ecological balance and outcompete native biota. The shift from natural to artificial habitat may also impact species that rely on intertidal zones for specific life history functions, such as spawning, feeding, or sheltering during tidal fluctuations.

The total area of 'natural' rocky intertidal habitat lost to is extremely small — almost all of the rocky habitat within the development area is artificial, except for the scattered offshore reef structures (see Section 3.5.3). Therefore, this impact is rated as of low significance before mitigation, given the long-term nature of the impact, with no practical mitigation possible (Table 5.11).

Table 5.11. Impact 9: Loss of rocky shore habitat, introduction of artificial habitat.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long term	Low 5	Definite	**LOW**	-ve	Medium

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
			3					
Mitigation measures: • None identified.								
Reversibility of the impact: Low (impacts are reversible) **Irreplaceability of resource loss caused by impacts**: Low								

5.3.3 Impacts on West Coast Rock Lobster

While there is are anticipated negative impact on West Coast rock lobster populations in Granger during the construction phase impacts (of low negative significance, see Section 0), the evidence suggests that dolosse provide important habitat for the species. As such, the installation of new dolosse as part of the development is expected to provide an increased area such habitat for recolonisation, which may support ecological recovery of the species over time. This impact is therefore rated as of low, positive significance (Table 5.12).

Table 5.12. Impact 10: Impacts on West Coast Rock Lobster over the long term.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Low 1	Long term 3	Low 5	Probable	**LOW**	+ve	Medium
Recommended mitigation measures: • None identified.								
Reversibility of the impact: Moderate (impacts may be reversible) **Irreplaceability of resource loss caused by impacts**: Moderate								

5.3.4 Increased vessel traffic

Following completion of the infrastructure, vessel traffic in Granger Bay is expected to increase. This will include commercial, recreational, and potentially fishing and tourism vessels using the new facilities. Increased vessel activity poses a range of ecological risks, many of which are cumulative in nature. Underwater noise from engines and propellers can disrupt the behaviour, communication, and navigation of marine species. Additionally, routine discharges associated with vessel operations, such as bilge water, greywater, and deck runoff, can introduce pollutants, degrade water quality, and impact sensitive marine organisms. Ballast water and biofouling on hulls present a persistent threat of introducing invasive marine species, which can become established and outcompete native flora and fauna. Over time, these pressures may alter the species composition and functioning of local marine ecosystems, particularly within the semi-enclosed environment of Granger Bay where flushing is limited. These impacts can be mitigated successfully, resulting in an impact of very low significance with mitigation (Table 5.13).

Table 5.13. Impact 11: Increased vessel traffic.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Long term 3	Medium 6	Probable	**MEDIUM**	-ve	Medium

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Recommended mitigation: • Designate speed-restricted areas within Granger Bay to reduce underwater noise and minimise the risk of vessel strikes on marine fauna. • Follow local legislation and international best-practice guidelines for bilge and greywater discharge, with clear signage and training for all harbour users. • Awareness and reporting: Conduct regular environmental awareness campaigns for vessel operators, and implement a system for reporting marine mammal sightings and pollution events.								
With mitigation	Local 1	Low 1	Long term 3	Low 5	Possible	**VERY LOW**	-ve	Medium
Reversibility of the impact: Moderate **Irreplaceability of resource loss caused by impacts**: Moderate								

5.3.5 IMPACTS ON MARINE MAMMALS

The proposed development will result in land reclamation, leading to complete and irreversible habitat loss. Given the known distribution and habitat use of cetaceans in Table Bay, the habitat loss component of this project can be considered as limited to Heaviside's dolphins, as all other cetaceans tend to occur further from shore and visits are typically short lived (Elwen 2025).

While the area of development is relatively small, especially in the context of the broader Granger Bay and Table Bay areas, it falls within one of the highest density areas for Heaviside's dolphins known along the Cape Coast (Elwen 2025). The high density area used by these dolphins on a daily basis extends from approximately the middle of the mainly port breakwater to adjacent to the Three Anchor Bay lighthouse (Elwen 2025). The next known coastal aggregation sites for the species are Hout Bay (although there are far fewer dolphins) and to the north of Blouberg (Elwen et al. 2010, Elwen 2025).

It is likely that the resident dolphins will move away from the site during construction, especially during noisier periods (rock dumping etc), which may result in a temporary emigration from the site (Elwen 2025). While there is evidence of this type of emigration, but then subsequent return, in a number of other species of dolphin and porpoise during construction projects (Benhemma-Le Gall et al. 2021, Piwetz et al. 2021, Weaver 2021, Huang et al. 2024), there is a chance that this emigration could be permanent (Elwen 2025). Permanent abandonment of the site will result in an impact of medium significance — note that no mitigation is possible, and that confidence in this assessment is rated as low (Table 5.14).

However, the creation of the land reclamation area will replace the current sheltered marine environment of Granger Bay with a type of habitat — while the direct area of habitat loss will be permanent, the same type of area will be present after construction, which may facilitate the dolphin's return. Partial abandonment of and return to the site over time will result in an impact of low significance (Table 5.14) – note that no mitigation is possible, but that confidence in this assessment is rated as medium, given the prior evidence of return for similar construction projects (Table 5.14).

Under a no-go alternative, the proposed land reclamation and associated construction activities would not proceed. As a result, there would be no construction-related impacts. Resident dolphin groups would therefore not be exposed to additional disturbance or habitat alteration beyond current conditions. Temporary or permanent emigration from the site attributable to the project would not occur (see 5.6).

Table 5.14. Impact 12: Impacts on marine mammals – loss of habitat.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation - complete abandonment	Local 1	High 3	Long term 3	High 7	Possible	**MEDIUM**	-ve	Low
Without mitigation - partial abandonment and return	Local 1	Low 1	Long term 3	Low 5	Possible	**LOW**	-ve	Medium
Recommended mitigation measures: • None identified.								
Reversibility of the impact: Potentially non-reversible (impact is permanent), but also may be partially reversible **Irreplaceability of resource loss caused by impacts**: Moderate								

5.4 Decommissioning Phase

There are decommissioning procedures, or restoration plans for this development, as it is intended to be a permanent fixture.

5.5 Cumulative impacts

Anthropogenic activities can result in numerous and complex effects on the natural environment. While many of these are direct and immediate, the environmental effects of individual activities or projects can interact with each other in time and space to cause incremental or aggregate effects. Impacts from unrelated activities may accumulate or interact to cause additional effects that may not be apparent when assessing the activities individually. Cumulative effects are defined as the total impact that a series of developments, either present, past or future, will have on the environment within a specific region over a particular period of time (Department of Environmental Affairs and Tourism 2004).

The Port of Cape Town is a dynamic and multi-use coastal zone that supports a range of industrial, commercial, tourism, and conservation activities. Over time, incremental developments, such as port expansions, dredging, marine infrastructure upgrades, vessel traffic, pollution, and coastal urbanization, have contributed to environmental pressures. While individual projects may have limited impacts, their cumulative effects on marine ecosystems, water quality, noise levels, and local communities can be significant and long-lasting. Some of the recent and newly proposed developments are described below.

Granger Bay Development: A proposed R20 billion project plans to develop the Granger Bay precinct into a mixed-use area featuring residential apartments, retail spaces, hotels, and cultural facilities. The development includes creating a coastal promenade linking the city centre to Mouille Point and establishing a new public bay for swimming and water sports. The project is intended to roll out over 15 to 20 years, with construction potentially starting in 2025, pending approvals from the City of Cape Town.

Canal District expansion: Approved in 2021, this R3.9 billion expansion focuses on the 10.5-hectare Canal District, aiming to create a seamless link between the city and the V&A Waterfront. The project includes mixed-use developments.

Desalination plant: To ensure a sustainable freshwater supply, a 3.3 megalitre desalination plant is planned, with construction expected to begin in the first quarter of 2025 and completion by 2026. This initiative aims to reduce reliance on municipal water resources.

Seawater cooling plants: The V&A Waterfront has implemented a seawater cooling plant in the Silo District, saving approximately 15 million litres of water monthly. There are plans to construct a second plant to save an additional 25 million litres of water per month.

Renewable energy procurement: A power purchase agreement with Etana Energy has been signed to source 70% of the V&A Waterfront's electricity from wind and solar energy, contributing to the goal of achieving net-zero carbon emissions by 2035.

Furthermore, the Two Oceans Aquarium, in collaboration with the V&A Waterfront, has announced plans to establish a state-of-the-art Turtle Conservation Centre in Cape Town's Granger Bay precinct, scheduled to open in 2026. This new facility aims to expand the Aquarium's existing turtle rehabilitation efforts by integrating education, research, conservation, veterinary science, and tourism. It will feature a turtle rehabilitation centre, educational spaces, exhibition areas, a restaurant, and a shop, providing visitors with an interactive experience to learn about turtle conservation and marine ecosystems. The project is part of the V&A Waterfront's broader Granger Bay precinct improvement plan.

In combination, the cumulative impacts are considered to be to most impactful overall on the marine environment, considered the multiple pressures and threats the port already imposes as well as general disturbance and pollution sources that could further degreed the system. Increased vessel traffic may, in turn, introduced risks of collision to marine mammals (see Elwen 2025). Habitat loss combined with other impacts (noise, vessels etc) may result in a cumulative impact resulting in the potential partial or permanent abandonment of the Granger Bay area by the resident dolphin population (Elwen 2025)

Cumulative impacts here are rated as of low significance overall with mitigation (Table 5.15). Table 5.15. Cumulative impacts.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	Medium 2	Long term 3	Medium 6	Probable	**MEDIUM**	-ve	Medium

Essential mitigation measures:

- Constrain spatial extent of impacts to the minimum required.
- Subject mobile equipment, vehicles and power generation equipment to noise tests at commencement and periodically throughout the construction phase.
- Vessels used must be driven in a slow and responsible manner, keep gear changes and acceleration to a minimum to minimise rapid changes in noise levels,
- A lookout must be kept for dolphins and whales at all times and groups should be avoided where possible.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
• If any impacts are observed (vessel strike, entanglement, strong avoidance responses) these should be report to the relevant environmental authority as soon as possible (e.g. DFFE). • The project design must account for potential changes in hydrodynamic function and ensure that resultant local changes in hydrodynamics do not cause significant, ongoing scour of the seabed. • Ensure potential pollution sources (including bilge water and greywater etc.) associated with the development are managed to avoid pollution which may further degrade these habitats. • Designate speed-restricted areas within Granger Bay to reduce underwater noise and minimise the risk of vessel strikes on marine fauna. • Follow local legislation and international best-practice guidelines for bilge and greywater discharge, with clear signage and training for all harbour users. • Awareness and reporting: Conduct regular environmental awareness campaigns for vessel operators, and implement a system for reporting marine mammal sightings and pollution events								
With mitigation	Local 1	Medium 2	Long term 3	Medium 6	Possible	**LOW**	-ve	Medium
Reversibility of the impact: Moderate **Irreplaceability of resource loss caused by impacts**: Moderate								

5.6 No-go alternative

The No-Go alternative represents the baseline against which the project related impacts are assessed. The no-go option would entail maintaining the current status quo, i.e. no land reclamation development within Granger Bay.

The Construction Phase impacts assessed above (Section 5.2) are all assessed as of negative significance, with generally short- to medium- term durations and significances ranging from Insignificant to Vey Low after mitigation. Therefore, the no-go option would mean that none of these negative Construction phase impacts occur. In particular, the no-go alternative will mean that there would be no negative impacts to the resident Heaviside's dolphin populations, including the potential permanent abandonment of the site (Section 5.3.5).

However, the no-go option also means that the positive impacts assessed for the Operational Phase that may occur will not be realised — the development is considered to result in increased dolosse habitat for West Coast rock lobster, which may support ecological recovery over time (Section 5.3.3)

5.7 Summary of potential impacts

The impacts that may be experienced during construction and operation before and after mitigation are summarised in Table 5.16.

Table 5.16. Summary of potential impacts as a result of construction and operation of the proposed Granger Bay revetment.

Phase	Impact identified	Consequence	Probability	Significance	Status	Confidence
Construction phase	Impact 1 (a & b): Disturbance of intertidal and subtidal artificial habitat on rocky and soft sediment habitats	Very Low	Definite	**VERY LOW**	-ve	High
	With mitigation	Very Low	Definite	**VERY LOW**	-ve	High

Phase	Impact identified	Consequence	Probability	Significance	Status	Confidence
Construction phase (Cont.)	Impact 2: Impacts of construction on West Coast Rock Lobster.	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Probable	**LOW**	-ve	Medium
	Impact 3: Disturbance to pelagic open water habitats.	Very Low	Probable	**VERY LOW**	-ve	High
	With mitigation	Very Low	Probable	**VERY LOW**	-ve	High
	Impact 4: Waste generation and disposal during construction.	Medium	Probable	**MEDIUM**	-ve	High
	With mitigation	Low	Improbable	**VERY LOW**	-ve	High
	Impact 5: Effects of pollution	Medium	Possible	**LOW**	-ve	High
	With mitigation	Low	Improbable	**VERY LOW**	-ve	High
	Impact 6: The effect of increased noise and vibration from construction on marine organisms (invertebrates, fish, birds).	Very Low	Definite	**VERY LOW**	-ve	Medium
	With mitigation	Very Low	Improbable	**INSIGNIFICANT**	-ve	Medium
	Impact 7a: Impacts on marine mammals – increased vessel presence	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium
	Impact 7b: Impacts on marine mammals – underwater noise.	Low	Definite	**LOW**	-ve	High
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium
Operational phase	Impact 8: Change in habitat and system function.	Low	Probable	**LOW**	-ve	Medium
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium
	Impact 9: Loss of rocky shore habitat, introduction of artificial habitat.	Low	Definite	**LOW**	-ve	Medium
	No mitigation identified.					
	Impact 10: Impacts on West Coast Rock Lobster over the long term.	Low	Probable	**LOW**	+ve	Medium
	No mitigation identified.					
	Impact 11: Increased vessel traffic.	Medium	Probable	**MEDIUM**	-ve	Medium
	With mitigation	Low	Possible	**VERY LOW**	-ve	Medium
	Impact 12: Impacts on marine mammals – loss of habitat:					
	Complete abandonment	High	Possible	**MEDIUM**	-ve	Low

Phase	Impact identified	Consequence	Probability	Significance	Status	Confidence
	No mitigation identified. Partial abandonment and return No mitigation identified.	Low	Possible	**LOW**	-ve	Medium
	Cumulative impacts	Medium	Probable	**MEDIUM**	-ve	Medium
	With mitigation	Medium	Possible	**LOW**	-ve	Medium

6 ICMA LAND RECLAMATION PROCESS

6.1 Assessment

In terms of Section 7C of ICMA (see Section 2.2.2), certain information pertaining to impacts must be provided by the Marine Specialist in support of the ICMA Land Reclamation Process. An assessment of these requirements is detailed below.

6.1.1 Criteria 1: Impact of reclamation processes on marine environment including biodiversity, and habitat fragmentation and destruction

Construction will result in the direct loss of artificial rocky shore habitat, specifically that of the Granger Bay dolosse, and adjacent subtidal sandy and reef habitat (see details in Sections 5.2.1, 0, 5.2.3, 5.2.7, 5.3.1, 5.3.2 and 5.3.5). This development will result in disturbance to communities within the project footprint and area of influence during the construction phase, as well as changes to hydrodynamic function and habitat use:

- Impacts of benthic habitats assessed as of Very Low significance (with mitigation) (as per Table 5.1).
- Impacts on Rock lobster assessed as of Low significance (with mitigation) (as per Table 5.3). However, once completed, there is a Low, positive impact for Rock lobster populations (as per Table 5.12).
- Impacts on pelagic habitat (including disturbance of mobile fish) as of Very Low significance (with mitigation) (as per Table 5.4).
- Impacts related to changes to local hydrodynamics and sediment movement associated with the revetment assessed as of Very Low significance (with mitigation) (as per Table 5.10).
- Impacts related to conversion of 'natural' rocky intertidal habitat to artificial reclaimed habitat is rated as of Low significance (no mitigation possible) (as per Table 5.11).
- Impacts related to loss of habitat for marine mammals is rated as of Low or Medium significance (no mitigation is feasible) depending on if there is a partial or full abandonment of the site respectively (as per Table 5.14).

6.1.2 Criteria 2: Impact of reclamation processes on fisheries

Overlap of the proposed development with relevant fisheries is presented in Section 3.6.2 and summarised below:

- Catch and effort linefishing data from DFFE (2010-2020) show a relatively high level of linefishing effort in the reporting grid cell in the western portion of the proposed area of development, and a lower level of effort to the east. This effort is mostly linked to vessel-based line fishing effort. The reclamation may displace some fishers from this area (especially in the western portion of the proposed area of development), but the overall area of impact relative to the total available area is small. Impacts are likely to be very low to insignificant.
- There are no known subsistence harvesting activities that would take place around the concrete harbour/port in Table Bay. Impacts are likely to be insignificant.

6.1.3 Criteria 3: Impacts on water quality including oxygen

The construction activities will likely result in the disturbance of benthic sediments, leading to their resuspension into the water column, which may result in elevated turbidity and associated impacts (including oxygen impacts) (see Section 5.2.3). Likewise, trace metal concentrations within the Granger Bay sediments could be remobilised. Impacts on water quality assessed as of Very Low significance (with mitigation) (as per Table 5.4).

6.1.4 Criteria 4: Proximity to Protected Areas

This criterion requires comment about whether the proposed area for reclamation is in proximity to a protected area, and if so, how the protected area will be impacted (as well as description of the mitigation measures).

The area lies ~1.5 km from a Protected Area (the Robben Island MPA, see Section 4.1). The impacts are likely to extent a couple of kilometres from the source. There is anticipated to be a very small overlap of certain impacts with the MPA, specifically noise impacts. Noise impacts are associated with the excavation of existing rock and soil (especially when undertaken within the intertidal or subtidal zone using heavy machinery), as well as the dumping of rock into the sea (particularly when involving large rocks or dolosse), as well as the placing of pre-cast concrete elements into the water. Vibratory compactors, if used on in-water platforms or for submerged formwork, may transmit low-frequency vibration into the surrounding water column and sediment.

- Noise and vibration impacts on fish, invertebrates and birds within the MPA are assessed as Insignificant (with mitigation) (as per Table 5.7).
- Noise and vibration impacts on marina mammals within the MPA are assessed as of Very Low significance with mitigation (Table 5.8).

Mitigation requirements include the following:

- Subject mobile equipment, vehicles and power generation equipment to noise tests at commencement and periodically throughout the construction phase.
- Before engaging in any rock dumping or similar actions where material is dumped directly into the ocean, ensure that no baleen whales are within ~500 m of the impact site (in the absence of direct measures of sound levels and hearing thresholds, 500 m is widely used as a typical distance for safe avoidance of noise impacts). As far as possible, ensure no dolphins are within 500 m of the impact site. A dedicated marine mammal observer should be used for these phases of work.
- Ensure all machinery is in good working order to reduce in in-air noise levels and transmission into the marine environment.
- Where rock placement/dumping/construction is planned - aim to work from the ocean space backwards towards shore to create a physical barrier to sound in the initial stages of work, then all other fill work will be effectively ‘on land’.

6.1.5 Criteria 5: Material to be used for reclamations

The construction will involve the use of concrete and quarried rock (PRDW 2024). The project will make use of plain (unreinforced) concrete and reinforced concrete. In general, plain concrete will be used wherever possible. Reinforced concrete will be used for concrete elements that are subjected to high bending and tensile loads.

The use of inert or protected reinforcement, such as basalt fibre reinforced polymer (BFRP) reinforcement or galvanised steel, will also be considered wherever possible. To try and limit the impact the use of concrete on the environment consideration will be given to more sustainable ways of using concrete, such as:

- Using locally available aggregates, cement, and cement extenders wherever possible.
- Using low embodied carbon cement extenders, such as fly ash and calcined clay (metakaolin), wherever possible.
- Using recycled aggregates, wherever possible.
- Introducing specialised admixtures and element shapes to encourage growth of marine life and the formation of biodiverse marine habitats, wherever possible.

All quarried rock will comply with PRDW's generic rock specification (PRDW 2019) which is based on the Rock Manual (CIRIA et al. 2007) and includes requirements to manage rock cleanliness (absence of soil or quarry dust), reducing the likelihood of the quarried rock introducing suspended sediments into the marine environment.

6.1.6 CRITERIA 6: RISKS OF POLLUTION DUE TO MATERIAL UTILISED

Informed by Assessment Criteria 5 (Section 6.1.5), the impacts of pollution from the material to be used in the proposed reclamation is largely considered as inert or to have minimal polluting impact on the marine environment, and subsequently the environmental risk from the proposed material is assessed to be of Very Low significance (with mitigation) (as per Table 5.6).

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Impact Assessment

The updated Marine Specialist Impact Assessment for the Granger Bay Revetment Development evaluates the ecological implications of proposed amendments to the previously approved coastal infrastructure at the Port of Cape Town. Key changes include the extension of the revetment from 470 m to 540 m, the addition of two breakwaters measuring 90 m and 140 m respectively and expanded public access infrastructure including walkways and links to the Mouille Point promenade.

In general, the impacts are reversible, with low irreplaceability of resource loss caused by impacts. Fifteen impacts were assessed (including Cumulative impacts) — of these, four impacts were assessed as of medium significance before mitigation (where mitigation was possible, these were reduced to low or very low significance). Note that of these medium impacts, one (operational phase loss of habitat impacts resulting in permanent displacement by marine mammals) had no feasible mitigation, but was assessed with low confidence.

Construction will result in a short term, high intensity impact on the West Coast rock lobster *Jasus lalandi* populations within Granger Bay through the removal and alteration of existing dolosse to accommodate new infrastructure. The dolosse of Table Bay breakwater are a highly heterogeneous habitat that are an important habitat for the species. Similar artificial rocky shore habitat will exist after construction, and recovery of these populations will occur primarily through immigration from adjacent areas. The relatively small footprint of direct disturbance (total area of 0.032 km^2) and 'short-term' nature of construction activities (two years) will result in the impact being felt over a limited spatial scale. While limited mitigation is available to reduce the significance of this impact, some recommended mitigation to reduce the probability of immediate impacts includes phased removal, and potential translocation of individuals from high-density zones.

It is noted however that once construction is complete, the installation of new dolosse as part of the development is expected to provide an increased area such habitat for recolonisation, which may support ecological recovery of the species over time. This impact is therefore rated as of low, positive significance

Litter and general poor housekeeping practises may be properly managed during construction — all domestic and general waste generated must be disposed of responsibly, and all reasonable measures must be implemented to ensure there is no littering and that construction waste is adequately managed. Staff must be regularly reminded about the detrimental impacts of pollution on aquatic species and suitable handling and disposal protocols must be clearly explained and sign boarded. The 'reduce, reuse, recycle' policy must be implemented.

While the area of development is relatively small, especially in the context of the broader Granger Bay and Table Bay areas, it falls within one of the highest density areas for Heaviside's dolphins known along the Cape Coast. The high density area used by these dolphins on a daily basis extends from approximately the middle of the mainly port breakwater to adjacent to the Three Anchor Bay lighthouse. It is likely that the resident dolphins will move away from the site during construction, especially during noisier periods (rock dumping etc), which may result in a temporary emigration from the site (Elwen 2025). While there is evidence of this type of emigration, but then subsequent return, in a number of other species of dolphin and porpoise during construction projects (Benhemma-Le Gall et al. 2021, Piwetz et al. 2021, Weaver 2021, Huang et al. 2024), there is a chance that this emigration could be permanent (Elwen 2025). Permanent abandonment of the site will result in an impact of medium significance — note that no mitigation is possible, and that confidence in this assessment is rated as low. However, the creation of the land reclamation area will replace the current sheltered marine environment of Granger Bay with a type of habitat — while the direct area of habitat loss will be permanent, the same type of area will be present after construction, which may facilitate the dolphin's return. Partial abandonment of and return to the site over time will result in an impact of low significance. While no mitigation is possible, confidence in this assessment is rated as medium, given the prior evidence of return for similar construction projects.

The No-Go alternative represents the baseline against which the project related impacts are assessed. The no-go option would entail maintaining the current status quo, i.e. no land reclamation development within Granger Bay. The Construction Phase impacts are all assessed as of negative significance, with generally short- to medium- term durations and significances ranging from Insignificant to Vey Low after mitigation. Therefore, the no-go option would mean that none of these negative Construction phase impacts occur. In particular, the no-go alternative will mean that there would be no negative impacts to the resident Heaviside's dolphin populations, including the potential permanent abandonment of the site. However, the no-go option also means that the positive impacts assessed for the Operational Phase that may occur will not be realised — the development is considered to result in increased dolosse habitat for West Coast rock lobster, which may support ecological recovery over time.

Cumulative impacts arising from this development, when considered alongside other coastal and marine activities in Table Bay, are rated as medium in significance. These include ongoing urban development, vessel movements, and pollution pressures. While no high or irreversible impacts were identified, the cumulative pressures highlight the importance of coordinated coastal zone management and routine environmental monitoring to safeguard long-term ecosystem health.

7.2 Mitigation

Essential construction phase mitigation requirements include the following:

- Limit duration of construction activities in the coastal zone.
- Constrain spatial extent of impacts to the minimum required.
- Inform and train all staff about sensitive marine species and the responsible disposal of construction waste. This training must be integrated into toolbox talks or onsite awareness sessions to ensure that waste management practices are understood and followed diligently. Additionally, contractors must prepare a method statement outlining specific waste management procedures, which must be approved by the resident engineer before construction activities commence.
- Suitable handling and disposal protocols must be clearly explained, and sign boarded.
- Reduce, reuse, recycle.

- Waste disposal at licensed landfill sites by qualified contractors is mandatory, with proof of disposal submitted to the appointed Environmental Officer. Waste management certification must be obtained, and detailed records of all stored and disposed waste, including quantity, nature, and fate, must be maintained for auditing purposes.
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Enforcement of facility usage and cleanliness is crucial.
- Intentional disposal of any substance into the environment is strictly prohibited, while accidental spillage must be prevented, contained and reported immediately.
- Implementation of a rigorous environmental management and control plan (including procedures for remediation).
- All fuel and oil is to be stored with adequate spill protection.
- No leaking vehicles are permitted on site.
- All hazardous substances must be accompanied by a permit, a hazard report sheet, and may only be handled by suitably trained operators.
- Subject mobile equipment, vehicles and power generation equipment to noise tests at commencement and periodically throughout the construction phase.
- Vessels used must be driven in a slow and responsible manner, keep gear changes and acceleration to a minimum to minimise rapid changes in noise levels,
- A lookout must be kept for dolphins and whales at all times and groups should be avoided where possible.
- If any impacts are observed (vessel strike, entanglement, strong avoidance responses) these should be report to the relevant environmental authority as soon as possible (e.g. DFFE).
- Before engaging in any rock dumping or similar actions where material is dumped directly into the ocean, ensure that no baleen whales are within ~500 m of the impact site (in the absence of direct measures of sound levels and hearing thresholds, 500 m is widely used as a typical distance for safe avoidance of noise impacts). As far as possible, ensure no dolphins are within 500 m of the impact site. A dedicated marine mammal observer should be used for these phases of work.
- Ensure all machinery is in good working order to reduce in in-air noise levels and transmission into the marine environment.
- Where rock placement/dumping/construction is planned - aim to work from the ocean space backwards towards shore to create a physical barrier to sound in the initial stages of work, then all other fill work will be effectively ‘on land’.
- Use turbidity or silt curtains where feasible to contain suspended sediments within the construction footprint.
- Ensure careful handling and controlled placement of construction materials to minimise unnecessary sediment disturbance and resuspension.

Recommended construction phase mitigation requirements include the following:

- Implement phased removal, and potential translocation of rocky lobster individuals from high-density zones.
- Implement phased construction where feasible to limit the area of seabed disturbed at any one time and reduce sediment release

Stabilise reclaimed or disturbed areas as soon as practicable to prevent continued erosion and sediment mobilisation following construction activities. Essential operational phase mitigation requirements include the following:

- The project design must account for potential changes in hydrodynamic function and ensure that resultant local changes in hydrodynamics do not cause significant, ongoing scour of the seabed.
- Ensure potential pollution sources (including bilge water and greywater etc.) associated with the development are managed to avoid pollution which may further degrade these habitats
- Designate speed-restricted areas within Granger Bay to reduce underwater noise and minimise the risk of vessel strikes on marine fauna.
- Follow local legislation and international best-practice guidelines for bilge and greywater discharge, with clear signage and training for all harbour users.
- Awareness and reporting: Conduct regular environmental awareness campaigns for vessel operators and implement a system for reporting marine mammal sightings and pollution events.

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APPENDIX I

8.1 Impact Assessment Methodology

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The significance of each identified impact was thus rated according to the Anchor methodology set out below (modified for Infinity Environmental):

Step 1 – Determine the consequence rating for the impact by determining the score for each of the three criteria (A-C) listed below and then adding them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. **Extent** – the area over which the impact will be experienced.		
Site specific/local	Confined to project or study area or part thereof (< 2 km)	1
Regional	The region (within 30 km of the site)	2
(Inter) national	Significantly beyond Saldanha Bay and adjacent land areas	3
B. **Intensity** – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources.		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. **Duration** – the time frame for which the impact will be experienced and its reversibility.		
Temporary	> 1 year	1
Short-term	Up to 2 years	
Medium-term	2 to 15 years	2
Long-term	More than 15 years (state whether impact is irreversible)	3

The combined score of these three criteria corresponds to a Consequence Rating, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Example 1:

Extent	Intensity	Duration	Consequence
Regional 2	Medium 2	Long-term 3	High 7

Step 2 – Assess the probability of the impact occurring according to the following definitions:

Probability – the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Probable	40% - 70% chance of occurring
Highly Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Example 2:

Extent	Intensity	Duration	Consequence	Probability
Regional 2	Medium 2	Long-term 3	High 7	Probable

Step 3 – Determine the overall significance of the impact as a combination of the consequence and probability ratings, as set out below:

		PROBABILITY			
CONSEQUENCE		Improbable	Possible	Probable	Definite
	Very Low	INSIGNIFICANT	INSIGNIFICANT	VERY LOW	VERY LOW
	Low	VERY LOW	VERY LOW	LOW	LOW
	Medium	LOW	LOW	MEDIUM	MEDIUM
	High	MEDIUM	MEDIUM	HIGH	HIGH
	Very High	HIGH	HIGH	VERY HIGH	VERY HIGH

Example 3:

Extent	Intensity	Duration	Consequence	Probability	Significance
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH

Step 4 – Note the status of the impact (i.e. will the effect of the impact be negative or positive?)

Example 4:

Extent	Intensity	Duration	Consequence	Probability	Significance	Status
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	-‘ve

Step 5 – State the level of confidence in the assessment of the impact (high, medium or low).

Impacts are also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below. Depending on the data available, a higher level of confidence may be attached to the assessment of some impacts than others. For example, if the assessment is based on extrapolated data, this may reduce the confidence level to low, noting that further ground-truthing is required to improve this.

Confidence rating	
Status of impact	+ ve (beneficial) or – ve (cost)
Confidence of assessment	Low, Medium or High

Example 5:

Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	-‘ve	High

The significance rating of impacts is considered by decision-makers, as shown below. Note, this method does not apply to minor impacts which can be logically grouped into a single assessment.

- **INSIGNIFICANT**: the potential impact is negligible and will not have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact may not have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact should influence the decision regarding the proposed activity.
- **HIGH**: the potential impact will affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Step 6 – Identify and describe practical mitigation and optimisation measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

1. Essential: must be implemented and are non-negotiable; and

2. Best Practice: must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Example 6:

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	-'ve	High
Essential mitigation measures • Xxxx • Xxxxx								
With mitigation	Local 1	Low 1	Long-term 3	Low 5	Improbable	VERY LOW	– ve	High

Step 7 – Prepare a summary table of all impact significance ratings as follows:

Phase	Impact identified	Severity	Probability	Significance	Status	Confidence
xxxxxx	Impact 1: xxx	Medium	Improbable	LOW	–ve	High
	With mitigation	Low	Improbable	VERY LOW		High
	Impact 1: xxx	Very Low	Definite	VERY LOW	–ve	Medium
	With mitigation	Very Low	Improbable	INSIGNIFICANT	–ve	Medium

Indicate whether the proposed development alternatives are environmentally suitable or unsuitable in terms of the respective impacts assessed by the relevant specialist and the environmentally preferred alternative.