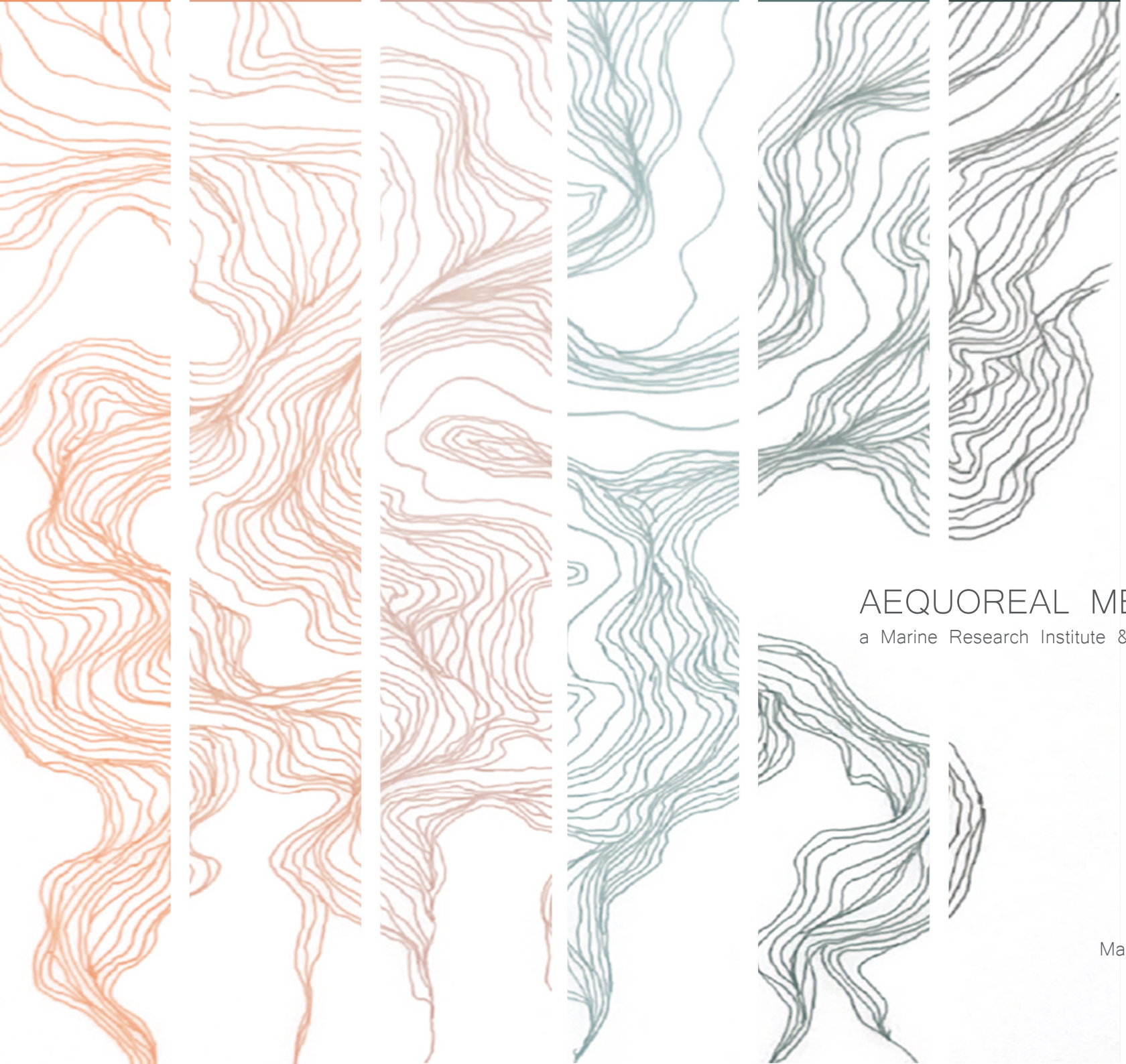


AEQUOREAL MEDIATION

a Marine Research Institute & Aquarium in Mossel Bay

Mané Breytenbach | 2017 029 683
MArchProf 2022

acknowledgements

For my parents, for your endless love, support and encouragement throughout my studies.

- -

My supervisors, Prof. Jan Smit, Petria Smit, Hein Raubenheimer, Prof. Jonathan Noble and Orepa Mosidi, for the guidance and advice throughout this complex process.

- -

My grandmother, Ouma Mana, for your help from Mossel Bay when I could not be there.

- -

And Hardy... for all your support, love and understanding throughout this year <3.

declaration

This dissertation is submitted in partial fulfilment of the requirements for the degree M.Arch.(Prof). All the work contained in this document is my own except where otherwise acknowledged.

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Date of submission: 11 October 2022

Declaration of original authorship:
The work contained in this dissertation has not been previously submitted to meet requirements for an award at this or any other institution of higher education. To the best of my knowledge, this dissertation contains no material previously published or written by another person except where due reference is made.

preamble

Humans have come into the habit of viewing nature as a dead entity – a thing we can manipulate, use and dominate to the fullest extent. Thus, we live in a world that is alienated from the world. We interact primarily with other humans in man-made environments with man-made technologies. It allowed us to become disconnected from our roots and origin in nature, in the ocean.

This dissertation will aim to investigate how a biophilic architectural intervention can mediate the relationship between land and sea, people and nature. The basis of this thesis is a personal interest in the ocean processes, marine life, and the importance thereof. The ocean is one of the primary sources of life and needs to be protected and preserved. People also need to be educated on the importance of the ocean and the marine life.

In order to attempt the mediation between land and sea, I propose a Marine Research Institute and Aquarium in Mossel Bay in the Western Cape, South Africa. The building will be divided into three hubs: an educational, an entertainment, and an interaction hub. Additional amenities will include a reading room, classrooms, an auditorium, and a tidal pool where people can experience the ocean first-hand in a safe, controlled environment.

This dissertation is divided into five integral parts: introducing the site (Part 01), conceptual explorations with reference to a touchstone, concept models and theoretical underpinnings (Part 02), design and structural investigations (Part 03), a proposed final design solution (Part 04), and the findings and complete evaluation thereof (Part 05).

glossary

The following words are defined for the purpose of this thesis.

Aequoreal
Archaic word meaning marine or oceanic.

Marine Life
The ocean's inhabitants, including fish, crustaceans, cephalopods, etc.

Mediation
The intervention of architecture to resolve the disconnection between land and sea.

Quay
A stone or metal platform that lays alongside water or project into the water to help load and unload boats.

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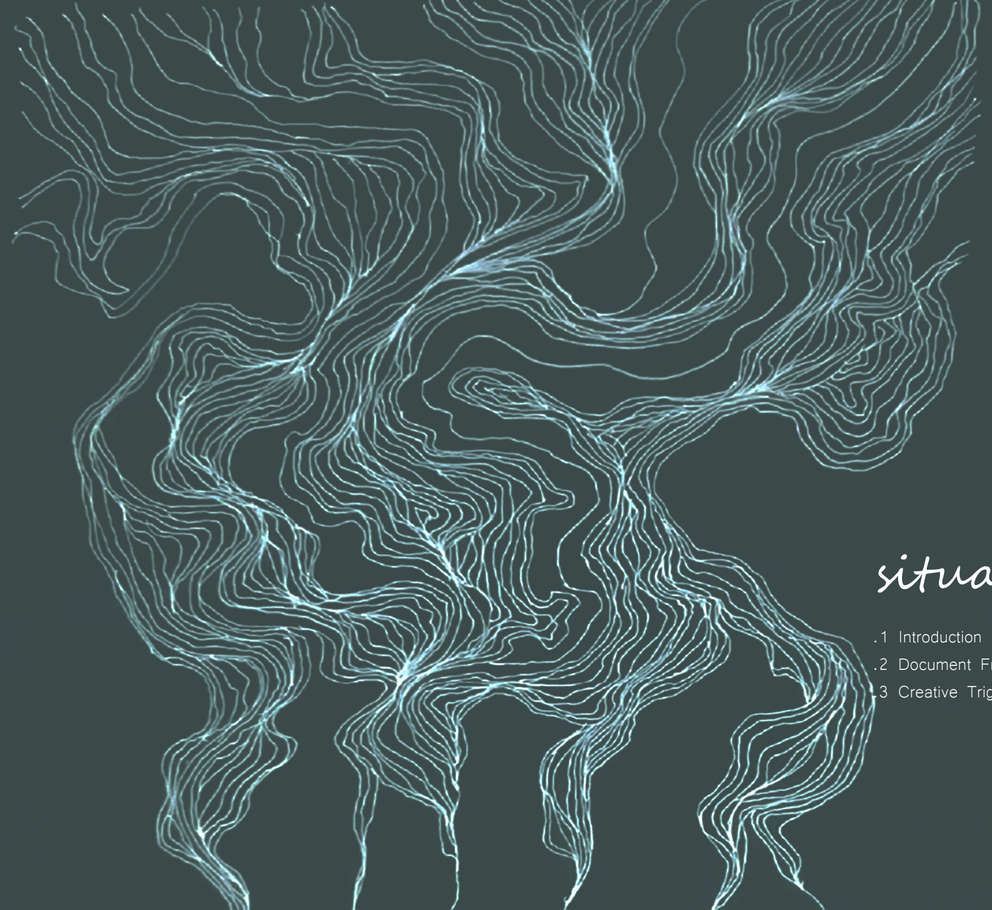
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00:



situating the investigation

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introduction

There is something beautiful about the ocean, the intense blueness of it... so tranquil, gliding, and calming. The serene brutality, the sense of awe at the sight of it, the feeling of unknownness. For some, the ocean sparks joy and excitement; for others, fear and unease. There is a certain beauty to the diverse experiences of the ocean.

Considering that more than 70% of the earth's surface is covered with the ocean, one would believe that humans would have explored it thoroughly. However, under 20% is mapped and explored. There is also a multitude of life within the ocean that is not widely discussed. Thus, the essence of this project lies in educating people about the ocean and the marine life and how architecture can promote it.

The title of the thesis – Aequoreal Mediation – can be broken into two core parts. Aequoreal is an archaic word that means marine or oceanic. In this thesis, mediation is architecture's intervention to resolve the disconnection between land and sea. The title frames the thesis and alludes early on to the mediation between man and nature.

This thesis aims to capture and frame the beauty of the ocean, allow people to experience it, and to bridge the gap between land and sea. Furthermore, it aims to educate people on what is happening within the ocean and the different marine life in the area. It also aims to encourage a positive experience of, and connotation to, the ocean.

Therefore, through this research, this project hopes to uncover a better understanding of the ocean and marine life and explore ways architecture can promote education specifically about the ocean. This research also hopes to assist in diffusing the boundaries set between land and sea.

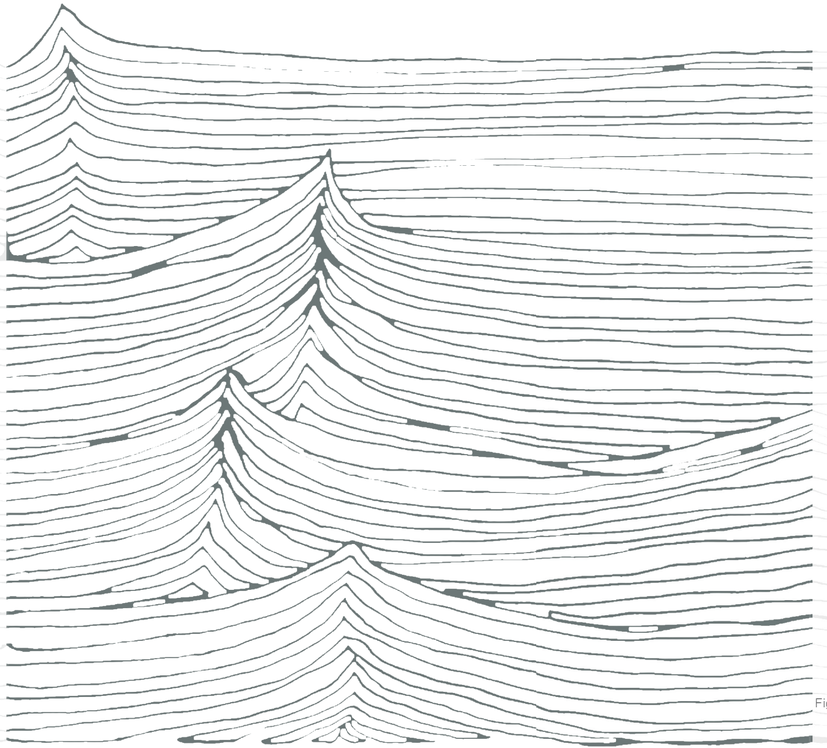


Fig. 1: Oceanic experience (Author, 2022).

Thus, a Marine Research Institute and Aquarium are proposed at Quay 4 in Mossel Bay. In this facility, research teams can explore the ocean and log their research. The general public can also go on an exploration trip and be educated on the ocean and the marine life.

Considering the objectives proposed for this thesis, theoretical concepts specifically related to it will be investigated. Theoretical concepts regarding the mediation between land and sea will include the interrelationship between the built and natural environment, diffusing boundaries, and defamiliarization. Concepts regarding experience will include phenomenology bridging over into eco-phenomenology and embodiment. Lastly, biophilic architecture will be researched to ensure nature plays an integral role in the design. These concepts will be investigated and discussed later on.

The proposed architectural project aims to capture the ocean in a way that is accessible for humans and promotes an interactive experience that enables education to be fun and exciting, creating a place for the community and tourists to engage in an oceanic experience. It also aims to bring people closer and promote a deeper connection to nature.

document framework



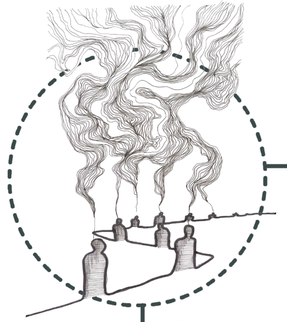
00 - Situating the investigation

This section of the document will introduce the readers to the project, client, site, and rationale behind the project.



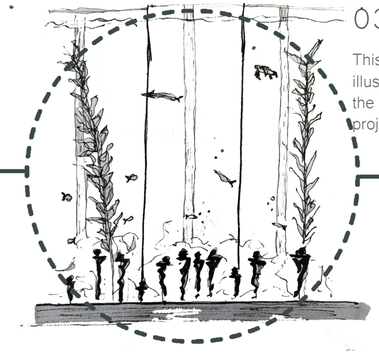
01 - Grounding

The section of the document will elaborate on the client, site through site analysis, and the project's objectives.



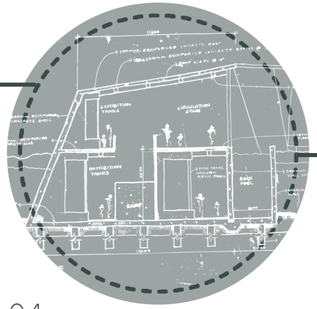
02 - Exploration

The section of the document will lead the reader through the theoretical aspects that influenced the design.



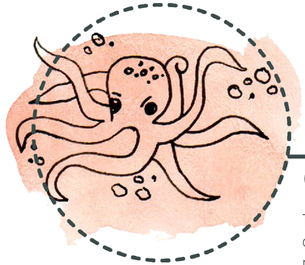
03 - Design Synthesis

This section of the document will illustrate the design process and the final design outcome of the project.



04 - Technical Synthesis

This section of the document will illustrate the construction and technical aspects of the final design.



05 - Conclusion & Findings

This section of the document will conclude the project, elaborate, and reflect on the findings and outcome of the project.

creative trigger

The original muse for the research project was sparked by the 2020 documentary *My Octopus Teacher*, directed by Pippa Ehrlich and James Reed. The story follows a filmmaker, Craig Foster, on a remarkable journey as he dives into the Camps Bay kelp forest and his relationship with a wild octopus.
After suffering a loss of purpose, Craig Foster started a daily diving regime in the freezing waters of Camps Bay. Through his diving adventures, he stumbles upon an unusually curious octopus. The two begin an unlikely friendship as the octopus lets him into her secret world in the vastness of the ocean. The encounters that these two shares are breathtaking, dangerous, dramatic, and emotional and invite the viewer into a world of colours and textures that they have never seen before.

The documentary starts with the octopus swimming away from Foster, trying to camouflage herself into her surroundings. But as she got used to Foster visiting every day, she realised that he was not a threat to her, and they slowly began to bond over the span of a year. It documents how she comes out of her hiding place to greet Foster, how she feeds, and how she disguises herself from potential threats. It documents the exhilaratingly terrifying moment a pyjama shark finds her and hunts her. The beautiful scene shows how she eludes the shark and even fights back. Unfortunately, at the end of this scene, the shark has bitten off one of her arms. Foster spends the following days checking up on her and witnessing her healing process by growing a brand-new arm.

Towards the end of the documentary, Foster captures a beautiful, emotional scene: the octopus hugging him and them spending a few quiet moments together. That was the last contact between the two. Foster spent the following time documenting as the octopus found a mate and brought new life into the world. Unfortunately, after reproducing, the octopus stops eating and wastes away, leading to her death. When her eggs hatched, she was gone... leaving many viewers in tears.

The documentary ends with Foster and his son going out to the kelp forest a few months after she died, and they stumble upon a tiny octopus. He comments about how rare it is to see an animal that small and how they imagined that it was one of her young because it is the right size and the right time. They shared a joyous moment and thought: “Well, there she is.”

Craig Foster finishes the documentary off with the following:
“She made me realise just how precious wild places are. You go into that water, and it is extremely liberating. All your worries and problems and life drama just dissolve. You slowly start to care about all the animals, even the tiniest little animals. You realise that everyone is very important. To sense how vulnerable these wild animals’ lives are, and actually then how vulnerable all our lives on this planet are. My relationship with the sea forest and its creatures deepen... week after month after year after year. You’re in touch with this wild place, and it is speaking to you. Its language is visible. I fell in love with her but also with that amazing wildness that she represented and how that changed me. What she taught me is to feel that you are part of this place. Not a visitor. And that’s a huge difference (Foster, 2020: online).”



Fig. 2: Baby octopus Foster found in the water (Foster, 2020: online).



Fig. 3: Pyjama shark that attacked the octopus (Foster, 2020: online).

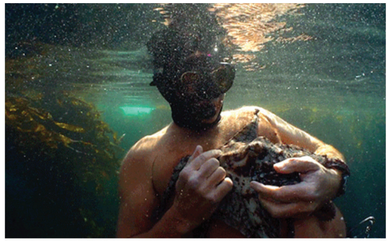


Fig. 4: The last physical contact Foster had with the octopus (the hug they shared) (Foster, 2020: online).



Fig. 5: Close-up of the octopus (Foster, 2020: online).



Fig. 6: The octopus cleverly camouflaging into her surroundings (Foster, 2020: online).

The documentary reminds the viewers that we are part of a living planet and nature is our life support. We are naturally interrelated to everything around us. It reminds us to connect to nature and let it into our hearts.

This documentary pulled on my heartstrings and opened a world of ideas for this research project. It opened the possibility of designing an aquarium that challenges the traditional norm and focuses on creating a bond between humans and nature. This documentary led to the initial spark of creating lasting memories and unbreakable bonds through connecting architecture and nature, especially focussing on the ocean. The idea of creating a place that challenges the view of how humans see themselves separated from the natural world and take them on a journey of realisation that the divide is a myth is what drove this project.

CHAPTER 01:



grounding

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1.1 introduction

This chapter is an introduction to the project. It strives to outline the context of the project and provide critical reasoning as to why this project was chosen.

The exploration consists of the problem statement, project aims, and an introduction to the theoretical framework, which will be discussed in Chapter 02. This chapter will also introduce the site and the proposed functions of the design that will be indicated on a preliminary map to situate the project. The historic overview highlights Mossel Bay's most notable historical moments and how important places came to be. The site analysis will indicate where improvements can be made to the site and assist in developing the building's morphology, typology, and topology.

1.2 problem statement

The ocean covers more than 70% of the earth and is still fairly underexplored, with less than 20% mapped. The ocean is a massive part of life on earth and influences two key factors: sun radiation and the water cycle. The ocean absorbs energy from the sun and distributes it all over the world, ensuring that hot places can cool down and that cool places can warm up. Without the ocean, the water cycle would also be disrupted, and rain would become very rare, causing the world to become a massive desert (Flinn, n.d.: online). The common public has limited knowledge of the ocean and all its inhabitants.

Apart from the above-mentioned fact, the ocean is also home to numerous marine life. Mossel Bay is blessed with an unusually large variety of marine life. The ocean in the bay is filled with different marine animals and organisms that include a variety of fish, dolphins, whales, sharks, seals, coral, and more (1.10 Marine Life). However, beach-goers, people who litter, fishing industries, gas and oil companies, this sea life is under constant threat. These aspects could cause the marine life to dwindle or to evacuate the area completely.

Despite Mossel Bay's established tourist attractions, the marine life is also a big magnet for tourists. Beach-goers are often left in awe when a school of dolphins plays in the waves, whales pass by, or a seal or two decide to swim with the humans. There are also frequent boat rides to "Robbe Eiland" and other activities such as shark cage diving or snorkelling. However, it does not give tourists an extensive overview of all the marine life in the area. Mossel Bay currently has a mini-aquarium called The Shark Lab. This mini-aquarium makes its best effort to promote the preservation and protection of the marine life and give tourists the opportunity to see it, but they have limited space.

1.3 project aims





Therefore, this project aims to investigate a possible solution for creating a safe environment for both humans and marine life, within the Mossel Bay area. The three main objectives are:

1. educating people on the marine life, focussing on the environment within and surrounding Mossel Bay.

2. understanding marine life better and providing a home for injured and rehabilitating marine animals.



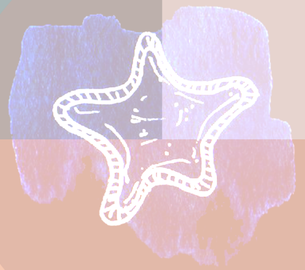


3. providing a safe space for tourists to interact with and learn more about the ocean and its inhabitants.





1.4 research question



How can a biophilic architectural intervention act as a mediator between the land and the sea within Mossel Bay, while diffusing the boundaries and changing the way in which the ocean is experienced?

This research question investigates how architectural interventions can create a connection between the ocean and the land, between the natural environment and humans.

The question aims to generate design concepts, lead the design theory and start the design process.

research question defined

The research question defined:

How can a:
- biophilic architectural: architecture focussed on incorporating nature into the design
- intervention: alter the surrounding environment
- act as a
- mediator between the land and sea: the intervention of architecture to resolve the disconnection between land and sea
- within Mossel Bay, while
- diffusing the boundaries: aim to break down previously known boundaries to change the way people experience the space
- and changing the way in which the ocean is experienced

Explicated Research Question:
How can an architecture focused on incorporating nature in the design alter the surrounding area and act as an intervention to resolve the disconnection between land and sea within Mossel Bay while breaking down previous boundaries to change the way people experience space and the ocean?

Important Subthemes

1. the mediation between land & sea
2. the way in which the ocean is experienced
3. biophilic architecture

1.5 client



This project is a proposal for The Shark Lab. The Shark Lab is a mini-aquarium and research facility located at the Point in Mossel Bay. This aquarium and research facility is presented by Oceans Aware and is dedicated to presenting the wonders of the ocean and marine life to children. They firmly believe that they have a responsibility to help facilitate the education of the marine environment to the younger generation that will be responsible for the ocean in a few years (The Shark Lab, 2016: online).

This aquarium offers tourists an opportunity to swim with two hound sharks, Bonnie and Bean (1.10 Marine Life). They try to promote that not all sharks will attack humans and to build knowledge of sharks in general. They also have exhibitions with tropical coral fish from around the world and an open water tank home to the “friendliest” octopus (The Shark Lab, 2016: online).

the shark lab



Fig. 7: Location of The Shark Lab (Google Earth, 2022: online, adapted by Author).



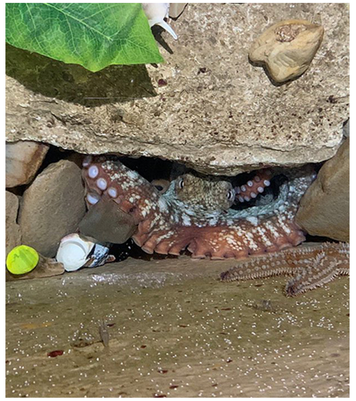
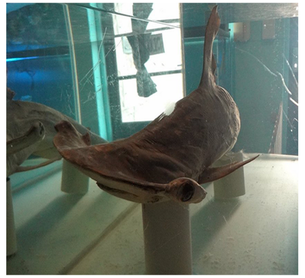
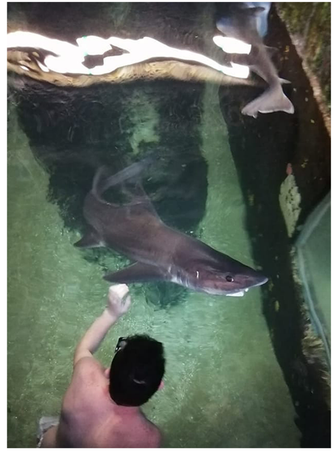


Fig. 8 & 9: The Shark Lab (The Shark Lab, 2016: online).

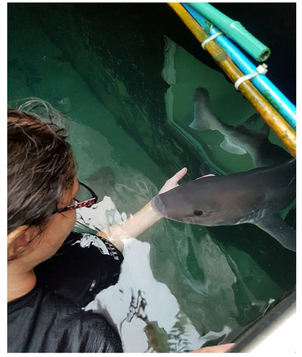














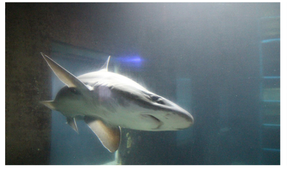




Fig. 10-18: The Shark Lab (The Shark Lab, 2016: online).

1.6 the site

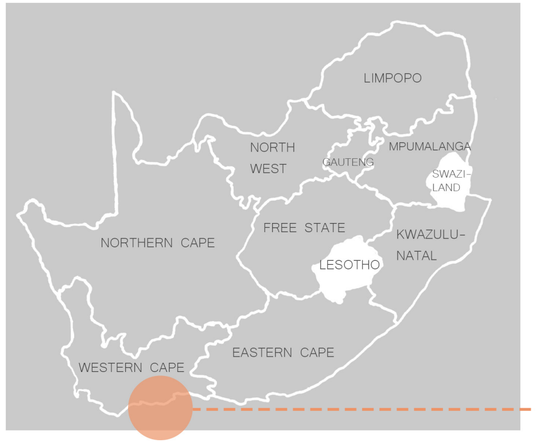


Mossel Bay forms a part of the Garden Route in the Western Cape that stretches along the coastline of South Africa. It borders the Indian Ocean and has the most breathtaking coastal scenery, important historical value, and an unusually large variety of marine life. A few companies in the area (page 43), such as The Shark Lab and Romonza Boating Adventures, encourage a connection to the ocean and the exploration thereof. However, there is more that can be done with regard to sea life. Mossel Bay has amazing marine life surrounding it that people don't necessarily know about.

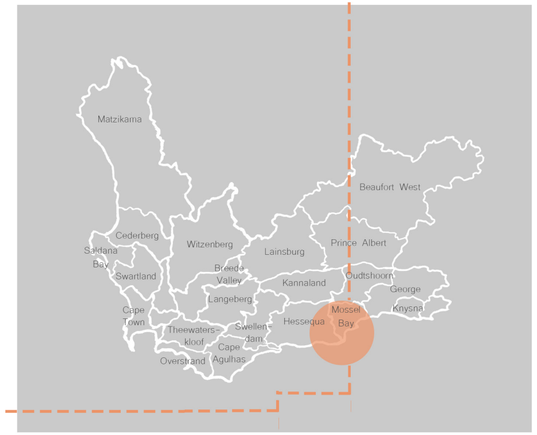
The proposed site is next to Quay 4, stretching out into the ocean. The site is located in an up-and-coming tourist hub in Mossel Bay, with places such as the Sea Gypsy Cafe and Kaai4Braai surrounding it. The site is easy to locate and will therefore be visited more frequently than The Shark Lab, which is hidden away at the Point. There are also numerous water activities, such as jet skiing, boat riding, and snorkelling, happening in the area.

The motivating factor for the site choice is due to its proximity to the open ocean and the surrounding attractions.

the site



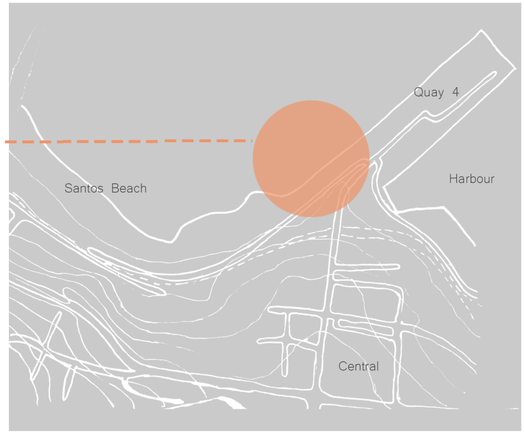
South Africa



Western Cape



Mossel Bay



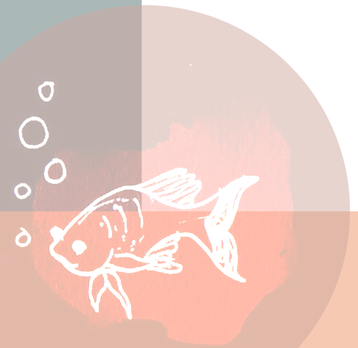
Quay 4 (Mossel Bay)

Fig. 19-22: Maps (Author, 2022).

Fig. 23: Mossel Bay's Pier, Quay 4, the location of the chosen site (CR, 2022: online).



1.7 proposed functions



The proposed functions for this project are divided into three hubs: education, entertainment, and interaction. The decision to split the design into three hubs came forth during the design development and will be discussed in Chapter 03. All the proposed functions will be an extension of Quay 4 in Mossel Bay.

1. Education

A Marine Research Institute is proposed. This institute will house all the necessary laboratories and functions that Marine Biologists may need to do proper research.
Other educational functions included are focused more on the public and visitors. This includes an auditorium, classrooms, and a reading room.

2. Entertainment

In order to qualify as a tourist attraction, encourage visitors and encourage learning about the ocean, an aquarium is proposed that houses marine life own to Mossel Bay.
A cafe is also proposed to give visitors the time to relax and enjoy the oceanic view.

3. Interaction

To promote education in a fun, playful manner, interactive experiences are proposed. These experiences include a tide pool that creates a safe space for people to swim in and experience the ocean.
For those visitors, who prefer not to enter the ocean, there are also interactive rockpools and touch pools, as well as the water edge where they can sit next to the ocean.

three hubs

3 HUBS

1 educational

RESEARCH FACILITY
- Lab
- Analytical Lab
- Coastal Biology & Greenhouse
- Equipment Room
- Tank Farm
- Tray Room
- Core Seawater Lab
- Mechanical Room
- Chemical- & Waste Storage
- Environmental Rooms
- Specimen Room
- Lab Assist
- Changing Rooms
- Diving Access
- Boating Dock
- Reception
- Staff Room & Kitchen
- Boardroom
- 2x Offices
- Ablution

EDUCATIONAL
- 2x Classrooms
- Auditorium
- Reading Room

2 entertainment

AQUARIUM
- Exhibitions
- Aquarium Technology
- Souvenir Shop
- Seating
- Look-out Platform
- Entrance / Exit
- Staff Room
- 2x Offices
- Ablution
- Cleaners (Breakroom & Storage)

CAFE
- Seating Area
- Kitchen
- Serving Counter
- Deliveries

3 interaction

TIDE POOL
- Pool
- Changing Rooms
- Access Platform

WATER EDGE
- Seating
- Walkway



Fig. 24: Site and proposed function locations (Author, 2022).

1.8 history



History of the area: a series of firsts for South Africa

Since the discovery of Mossel Bay in 1488, it has had numerous names. The first of which was Agra dos Vagueiros, or Bay of Herders, named by Bartholomeu Dias in 1488. Vasco da Gama named it Bahia or Aquada de Sao Bras, the Watering Place of Saint Blaze, in 1497. This was the first official name of Mossel Bay. However, the name Mossel Bay was given by Paulus van Caerden in 1601. He wrote the following description in his manifest (translated from the original Dutch): "We found it a lovely land, without many trees, but with deer and elephants. Apart from water, we got little refreshment except for mussels, and therefore gave it the name of Mossel Bay." (Gavin, 2020: 33).



Fig. 25: Bartholomeu Dias (ThinkStock, n.d.: online).

1488

3 February 1488
Bartholomeu Dias' fleet lands on shore. This marks the first European foreigners to set foot on the Southern Africa.

1497

25 November 1497
Vasco da Gama arrived and named the bay Aquada de Sao Bras. The first trading transaction of Southern Africa between foreigners and Khoi took place when da Gama traded a red cap and bracelets for an ox. The Khoi entertained the visitors with music. Da Gama set up a stone and wooden cross on the highest, most southern point, which was destroyed by the Khoi right after.

1400



Fig. 27: Vasco da Gama (Getty Images, 2017: online).

1500



Fig. 26: Jaco da Nova (Wikipedia, n.d.: online).

1500

Captain Pedro d'Ataide leaves a warning message in a boot, near the watering place in a tree to warn explorers about antagonism toward the Portuguese in Calcutta.

1501

Admiral Jaco da Nova finds the warning message and erects a small chapel (Ermina) as thanks.

1595

The first Dutch seafarer to sail to India via the Cape, Cornelius Houtman arrived and traded goods for sheep. He also drew the first map of the bay which mentions fresh water and a big tree.



Fig. 28: Cornelius Houtman (Muklas, 2012: online).

1600

1601

Admiral Paulus van Caerden named the bay Mosselbaai.



Fig. 29: Paulus van Caerden (L.M.C, 2018: online).



Fig. 30: Jan van Riebeeck (Coenman, 1677: online).

1652

Jan van Riebeek arrived in Table Bay (Cape of Good Hope) to establish a military post for the Vereenigde Oostindische Compagnie (VOC).

1700

1729

The first "Leenplaas" was awarded – a form of property granted to many early settlers in Southern Africa. This was the first of many more farming communities that settled in the district.

1785

A military post was established in Mossel Bay by the Dutch East India Company (VOC), and consisted of an officer, Hans Abue, and six soldiers with the task to prevent the French from claiming the land.

1786

The granary was built by Godfried Frederik Kock – a storage space for a record amount of wheat harvested.



Fig. 31: The Granary (Sleigh, 1993).

1800



Fig. 32: Anglican Church School Chapel (Promtheus, 2017: online).

1810s

1811
Mossel Bay, which formerly fell under the jurisdiction of Swellendam, now fell under George.

1818
The Boplaas farm was given to the town to be used by everyone.

1820
The land was surveyed and plots were set out. Stands 1, 2, 3 along Church Street was bought by Mr CW Pohl. He built a house on Plot 1 and a single-storey store on Plot 3. This store was expanded to a second-story in 1824.

1840s

1843
The first rubble quay was built by Harris.

1845
The first NG Kerk built, followed by the pastorie in 1846.

1848
Mossel Bay is established as a town and a magistrates' district known as Aliwal.

1850s

1851
A horse racing track was established on Boplaas farm and is believed to be one of the first, if not the first in South Africa.

1852
12 July 1852
Mossel Bay is declared as a municipality, known as Aliwal.

1855/6
The Anglican Church School Chapel was built.

1858
The first municipal building was built, known as Market house and housed a venue for municipal meetings, a library and a reading room.



Fig. 33: Dutch Reformed Church (Du Preez, 2017: online).

1860s

1861
The first police station was built.

1862
The 122m long Pilkingtons Jetty was erected and was funded by public subscription.

1864
March 1864
The St Blaize Lighthouse was completed when the fixed light was installed.

1867
When diamonds were discovered in Hopetown, a lot of the tools needed was shipped through Mossel Bay.

1869
The Robinson Pass opened.



Fig. 34: Robinson Pass (via Youtube).

1870s

1871
The first edition of the Mossel Bay Advertiser was published.

1872
The first public school opened. Originally called Non-denominational Public School, later renamed to Jongenskool.

1874
The Queens warehouse was built, giving a space for the Custom offices.

1880s

1880
September 1880
The Trojan of the Union Lines called, and offered people of Mossel Bay to see 'electric light' for the first time.
The first post office was in Powrie's chemist shop and the first Telegraph started.

1881
The Kleinbosch Water Scheme started. Up until this point, Mossel Bay relied on two boreholes and a stream for their water needs. This was fairly inadequate for the growing community.

1886
The Schermbrucker Reservoir was commissioned.

1887
The Victoria Park, later known as Harry Giddey Park, was laid out.



Fig. 35: Overlooking the Bay (Circa, 1890).

1890s

1892
12 November 1892
The first public clock was installed in the Klipkerk.

1894
The town library, designed by Herbert Baker, was built.

1895
The harbour wall was built

1897
The harbour was managed by Mossel Bay Boating Co (founded in the same year).



Fig. 36: Mossel Bay boating co. (Circa, 1901).

1900

1910s

1903
Mossel Bay received a telephone service that would only be activated in 1971. Mossel Bay had a telephone service before they had electricity.

1906
Cape Central extended the railway line from Worcester to Mossel Bay.

1910
In honour of the coronation of King George V, the town hall (Coronation Hall) and Rink Hall (markets) were built.

1912
Funded by public contribution and treatment charges, the hospital was built.

1916
The Santos Pavilion was built.



Fig. 38: Bland street (Circa, 1901).

1920s

1920
The municipality opened the first register of buildings.
The first prison was built.

1922
The power station was built above Santos Beach and electricity was finally available for the town of Mossel Bay.

1925
The Poort Tea Room and changing rooms were built.

1927
A new magistrate's court were introduced.

1928
A rail bridge over the Gouritz River was completed.



Fig. 37: Marsh St. from Church St. (Circa, 1930).



Fig. 39: Church St. (Circa, 1930).

1950s

1954
At the request of the Coloured community, Tarka and New Sunnyside was declared as coloured housing areas.

1959
A Provincial hospital in Linkside was opened, replacing the one built in 1910.

1960s

1960
1 May 1960
An oil discharge terminal in the ocean was commissioned, enabling tankers to discharge oil and gas.

1962
The Post Office Tree was declared as a National Monument.

1963
A "Shoe" post box was erected at the post office tree.

1969
Padrao (a replica of Vasco da Gama's stone and wooden crosses) was erected above Munro's Bay.

1980s

1988
The 500-year celebration of the arrival of Bartolomeu Dias was celebrated through a re-enactment of the voyage from Lisbon to Mossel Bay in a replica of the Caravel (ship).

1989
3 February 1989
The Dias Museum officially opened and housed the Caravel.



Fig. 40: Mossel Bay Harbour (Circa, n.d.)

1990s

1992
The Mossel Bay Gass to Liquid Refinery was commissioned. At the time, it was the largest GLT Refinery in the world, and is presently the third largest.

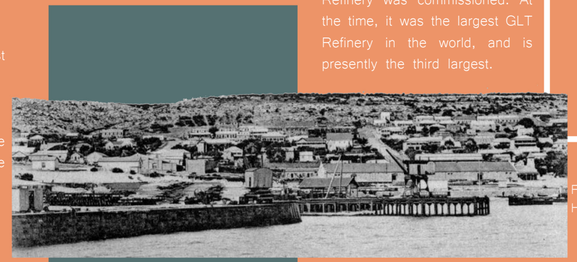


Fig. 41 Wooden jetty at Mossel Bay Harbour (Circa, 1906).

2000

2019

Major gas finds were announced by the Brull Padda off-shore field (owned by Total & partners).



Fig. 43: Mossel Bay Zipline (South Africa Touriism, 2021: online).



Fig. 42: Gas drill in South Dias (CMSAdmin, 2021: online)

2020

The Mossel Bay Zipline was opened, the world's longest over-ocean zipline at 1100 meters.

1.9 site analysis



Despite Mossel Bay's rich tourist attractions, the marine life is also quite extensive. The ocean in the bay is filled with different marine animals and organisms and is a rich environment for research, and an aquarium.

The current site is located between the Sea Gypsy Cafe and the Romanza Boat adventure company.

This section of the document will entail a site analysis of Mossel Bay and the area directly related to the site.
The site analysis will include the following:

- Mossel Bay tourism
- Mossel Bay Contours
- Regulations relating to building in the ocean
- Mossel Bay Climate
- The surroundings of the chosen site
- Important locations surrounding the site
- High & low tide
- Rock Pool Analysis

the site



Fig. 44: Aerial view of Mossel Bay (Daly, 2021: online).



Fig. 45: View of Mossel Bay Harbour (Mossel Bay Advertiser, 2017: online).



MAP OF MOSSELL BAY

Fig. 46: (Google Earth, 2022: online, adapted by Author).

MOSSEL BAY TOURISM

Mossel Bay has two distinct features which set it apart as a tourist destination. Firstly, Mossel Bay has a diverse natural environment consisting of mountains, marine, vegetative and coastal. Secondly, it has numerous attractions, adventures, activities, and entertainment for visitors.

Mossel Bay is generally an important sporting hub, with national and international events taking place there. The town is also hosting the annual Mossel Bay Sports and Recreation Festival during the September holiday. The beachfront accommodation in Mossel Bay also accommodates different budgets compared to other areas where beachfront accommodations are only for high spenders.

(Portfolio Committee of Tourism, 2017: online).

MAP OF MOSSEL BAY

This map of Mossel Bay indicates the important routes that go through Mossel Bay – the N2 and Louis Fourie Road. It indicates the position of the chosen site, nearby Mossel Bay harbour. It also shows the site in relation to nearby tourist attractions, such as waterfront restaurants, water activities, Mossel Bay zipline, and more.

The map indicates popular nearby beaches which are notorious for attracting tourists. Beaches such as Diaz Strand, which, amongst other things, are known for their “touchies” tournament and beachfront hotels, and Bayview, more commonly known as Hartenbos.

The map shows the site in relation to the harbour. The Mossel Bay harbour attracts Cruise Liners who visit in season, and the possible new aquarium can benefit from this influx of tourists.

MOSSEL BAY CONTOURS

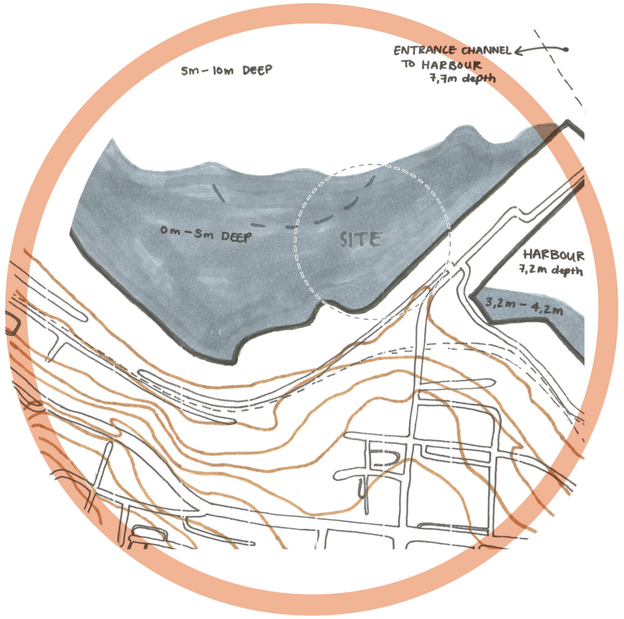
The contours on the map are at an interval of 5m. Due to the mountainous region, Mossel Bay quickly rises above sea level, which provides numerous opportunities for buildings and houses to have an ocean view.
(CapeFarmMappers, 2022: online).

The ocean depth is at an interval of 5m. The map indicates the increase of depth from the beach at 0m to 10m deep a kilometre in. This indicates that the chosen site is at a depth of 5m-7m. The nearby harbour has a level depth of 7,2m, and the entrance channel to the harbour has a depth of 7,7m.
(i-Boating, 2022: online).

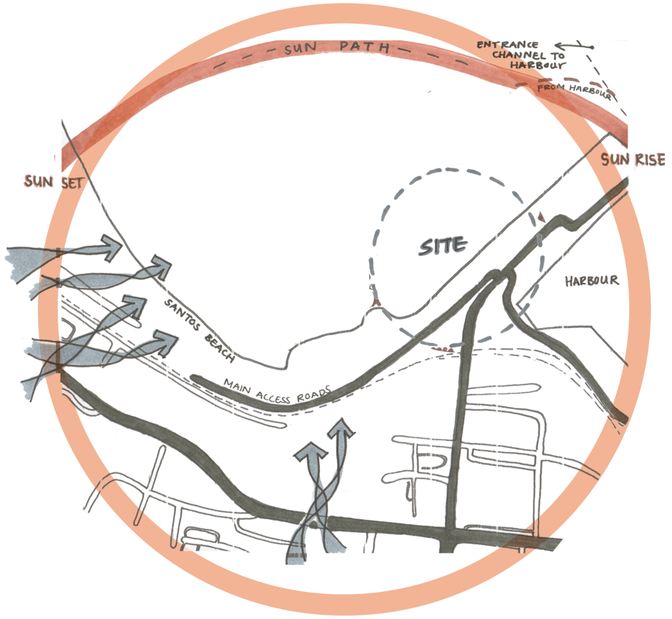
REGULATIONS

The Coastal By-laws of South Africa stipulates very little regarding regulations and restrictions about construction and building within the ocean. Most by-laws are only applicable to building on the beachfront.

The only restrictions stipulated were the construction of temporary structures within the ocean.
Other regulations applicable to building in the ocean are nature conservation and research. Any structure built should benefit or aid the natural environment and not be damaging and intruding. It could also assist in researching certain key aspects of the natural environment or any organisms within the environment.
(Coastal By-law, 2020: online).



SITE CONTOURS
Fig. 47: (Author, 2022).



SITE ANALYSIS
Fig. 48: (Author, 2022).

MOSSEL BAY CLIMATE

Mossel Bay's notorious summer season lasts from mid-December to mid-March. Consequently, these months, starting from late November, are the best time to visit Mossel Bay; thus, most tourist activities happen during those times. The cold winter months stretch from June to October, with the least tourist activity during these months.

Mossel Bay, as a seaside town, experiences wind most of the year, especially from May to March. The most wind-still month is April. Mossel Bay has three prevailing wind directions: east, south, and west. The most prevalent wind direction is from the west during the months of April to October. The next is south during the months of November to February. The eastern wind is only experienced during the months of February to April and October to November.
(Weather Spark, 2020: online).

SITE ANALYSIS

The site analysis diagram indicates essential aspects that affect the chosen site.
The sun path leads from the east to the west, with the western sun being the harshest. eastern and northern light is the preferred light to allow into the window.
It indicates the wind direction predominantly from the western side, followed by the southern side. It indicates from where the wind would affect the chosen site.
The main access roads that lead into the city and the parking areas are indicated in black.
Access to the site is indicated in brown. These will probably be the access routes to the site: 1. Route extending from waterfront parking, 2. Route extending from existing jeti at Kaai 4 Braai, and 3. Route extending from the harbour.

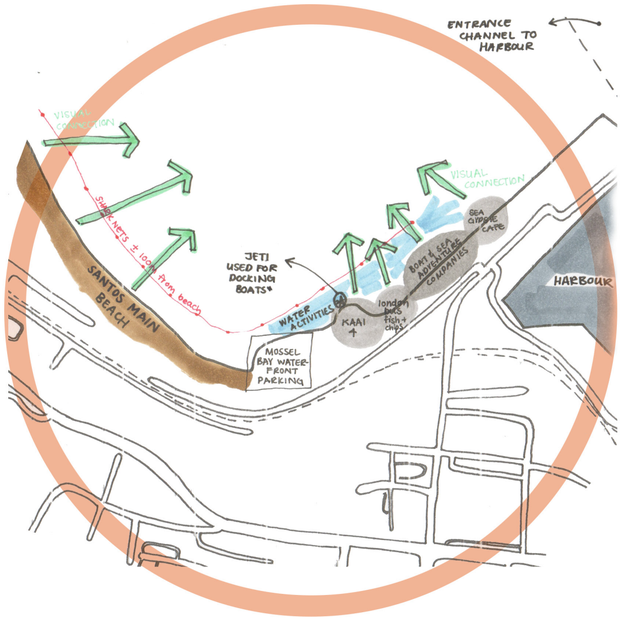
SURROUNDINGS & THE INTERACTION WITH THE CHOSEN SITE

The bay where the site is located is decorated with many activities and exciting sites to visit. The main beach nearby is Santos Beach which is popular amongst December vacationers. The harbour runs perpendicular to the beach, home to a few waterfront restaurants and boat and sea adventure companies. The restaurants include Kaai 4 Braai, The Red Bus Fish & Chips Restaurant, and the Sea Gypsy Cafe.

Some of the boat and sea adventure companies include the Romanza. These companies offer different sea adventures, such as boat rides, speed boat rides, shark cage diving, jet skis, and much more.

Recently, the water area in front of the restaurants became home to many different water activities. These activities include the Fat Boys Blob, snorkelling, boating, paragliding, and swimming.

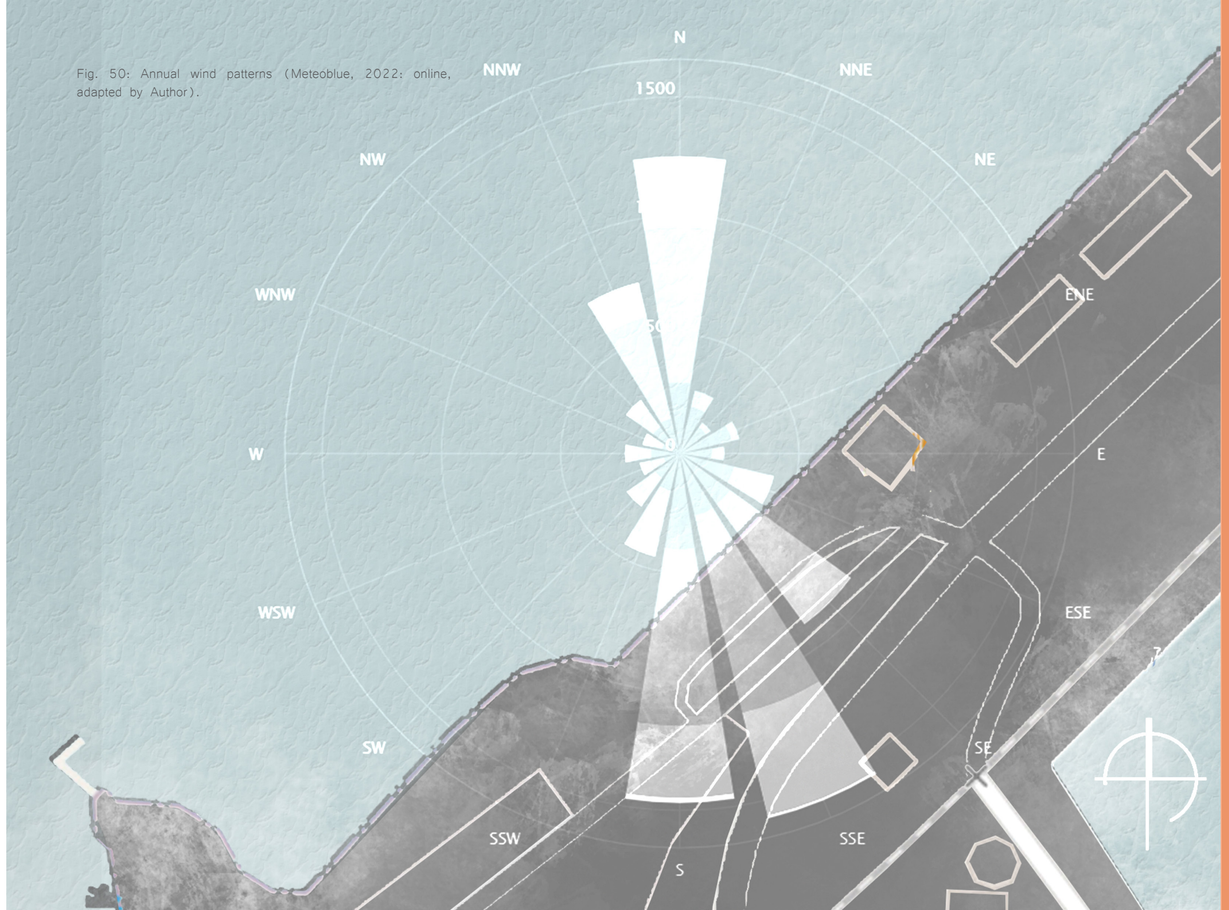
All of these surrounding sites and activities already draw a lot of tourists to this area and contribute to the vibe of the area.



SURROUNDINGS BUILDIGS & IMPORTANT SITES

Fig. 49: (Author, 2022).

Fig. 50: Annual wind patterns (Meteoblue, 2022: online, adapted by Author).



important locations surrounding the site



MOSSEL BAY MAP
Fig. 51: (Cape Farm Mapper, 2022 adapted by Author).



SANTOS BEACH
Fig. 52: (South Africa Tourism, 2021: online).



KAAI4BRAAI
Fig. 53: (Kaai4Braai, n.d.: online).



THE SEA GYPSY CAFE
Fig. 54: (Sea Gypsy Cafe, n.d.: online).



MOSSEL BAY ZIPLINE
Fig. 55: (Southern Tours, n.d.: online).



THE SHARK LAB
Fig. 56: (Visit Mossel Bay, n.d.: online).



ROMONZA BOAT TOURS
Fig. 57: (Dirty Boots, 2021: online).



FAT BOYS BLOB
Fig. 58: (Mossel Bay Boat Adventures, 2020: online).



SEAL ISLAND
Fig. 59: (Visage, 2021: online).

important locations surrounding the site

The locations mentioned on the previous page are important because each adds a different aspect of tourism to Mossel Bay.

1. Santos Beach

Santos beach offers tourists the opportunity to unwind and relax on a white sandy beach. The ocean at this beach is also located in the bay, and the waves are smooth, not rough, and perfect for the tourist who does not like an unruly sea.

2. Kaai4Braai

Kaai4Braai is located on Quay 4 and offers a beautiful ocean view. It allows parents to relax and have a bite while their children partake in the various oceanic activities in the immediate area. Kaai4Braai offers a series of *roosterkoeke* made right on the site.

3. Sea Gypsy Cafe

The Sea Gypsy Cafe is located on Quay 4, right next to the selected site. Much like Kaai4Braai, it offers beautiful views of the ocean and gives the feeling of eating on top of the ocean. Their menu consists of numerous seafood options and platters.

4. Mossel Bay Zip Line

The zipline opened in January 2020 and immediately encouraged a flock of tourists. This zipline is the longest over-water zipline worldwide and offers users an exhilarating experience. It is located at the point in Mossel Bay and takes you on a tour of the unruly waves crashing against the rocks.

5. Shark Lab

The Shark Lab is a mini-aquarium located at the endpoint of the zipline. This aquarium promotes the preservation of the area's marine life and creates a positive connotation with sharks.

6. Romonza Boat Trips

The Romanza boat trips and other companies like this offer a series of boat adventures in the sea by Quay 4. It offers boat rides to the Robbe Eiland, speedboat, and tube rides.

7. Fat Boys Blob

The Fat Boys Blob is a new addition to the activities at Quay 4. It is a large, yellow inflatable blob in the water and offers an exciting experience for anyone brave enough to attempt it. The user would lie down on the edge of the inflatable blob while other users jump down from a platform onto the blob. This sends the front user flying into the air and landing in the water.

8. Seal Island

Seal island is located near Hartenbos, and numerous boat rides take visitors out to it. You can experience a community of seals lounging in the sun and swimming around. The Seal Island is also notorious for attracting Great White Sharks as they have plentiful food.

high & low tides

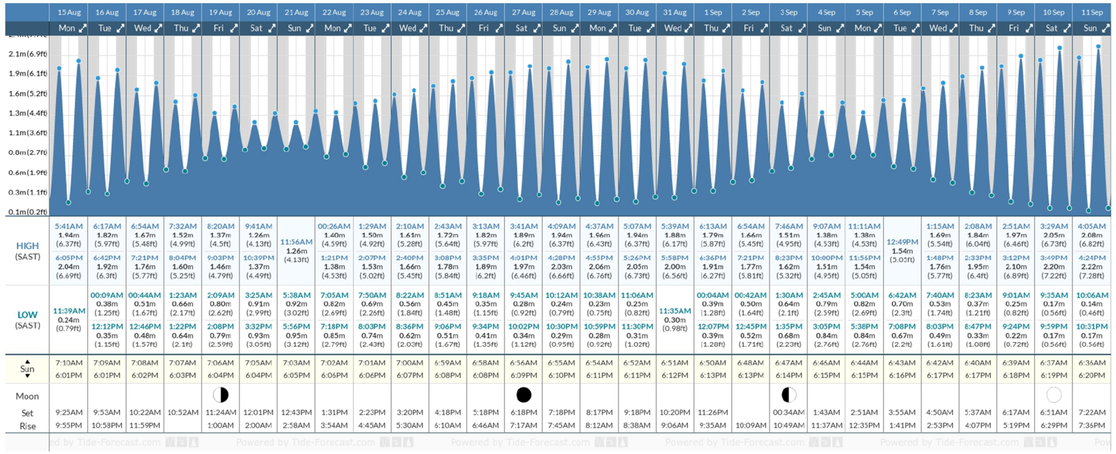


Fig. 60: Tide forecast of Mossel Bay (Tide-forecast, 2022: online).

Mossel Bay Tide Chart Key:

The chart above show the different height of water during the different tides in Mossel Bay, South Africa. The grey shaded areas represent the nightly hours after sunset and before sunrise. The chart shows the predicted tides from 15 August 2022, to 11 September 2022.

(Tide-forecast, 2022: online).

rock pools in the area



Fig. 61: Rock pools in surrounding area (Google Earth, 2022: online, adapted by Author).











Fig. 62-66: Mossel Bay rock pools (Bradclin, 2017: online)(Drake, 2012: online).





Fig. 67 & 68: Analysis of Mossel Bay rock pools (Bradclin, 2017: online, adapted by Author).

An analysis of the rock pools in the Mossel Bay area shows how the rocks protrude from and sits within the water. Most of the rocks protrude from the water at a slanted angle and do not necessarily have a flat top. The rocks also have naturally rough edges, which makes it easier for mussels, algae, and other organisms to cling onto.

This analysis will assist in the design process. The rocks in the surrounding area act as an excellent precedent for the three-dimensional development of the design. It gives guidance in what can be considered durable within the ocean and will guide the thought process on the construction of the building to ensure its longevity. The rough sides of the rock also open the possibility of different types of finishes for the building in order for the building to mend with the natural environment.

1.10 marine life



Apart from Mossel Bay's sandy beaches, famous attractions such as the Mossel Bay zipline, and generally being a popular holiday spot, Mossel Bay has a lot more to offer for tourists.

Mossel Bay has been blessed with an unusually large variety of marine life and species. This also serves as a great attraction and tourism potential. Mossel Bay offers numerous activities in which this marine life can be explored. It ranges from shark cage diving to boat trips to Robbe Eiland to diving at Santos Reef. Currently, there is also a mini aquarium (The Shark Lab) that showcases a fraction of the marine life.

Mossel Bay tourism has, in recent years, also called for increased awareness in the protection of the area's marine environment in order to preserve and look after the marine life and to ensure that tourists can, for many years to come, still enjoy and appreciate it.

sharks



Thresher Shark
Fig. 69: (Alexander, 2013: online).



Hound Shark
Fig. 70: (Murch, 2014: online).



Mako Shark
Fig. 71: (Getty Images, n.d.: online).



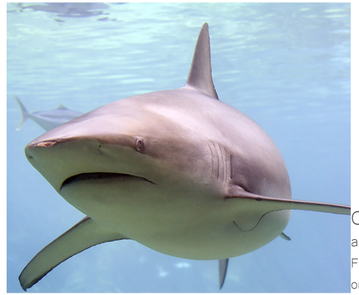
Sand Tiger Shark
also known as "Raggies"
Fig. 72: (Bently, n.d.: online).



Hammerhead Shark
Fig. 73: Dascher, 2020: online).



Great White Shark
Fig. 74: (Getty Images, n.d.: online).



Copper Shark
also known as "Bronzies"
Fig. 75: (Scott, 2022: online).

whales



Killer Whale
Fig. 76: (Pittman, 2006: online).



Sperm Whale
Fig. 77: (Scott, n.d.: online).



Humpback Whale
Fig. 78: (American Oceans, n.d.: online).



Southern Right Whale
Fig. 79: (Robinson, 2021: online).



Bryde's Whale
Fig. 80: (Meadows, n.d.: online).

dolphins



Common Dolphin

Fig. 81: (Dolphins-World, n.d.: online).



Bottlenose Dolphin

Fig. 82: (Tipling, 2019: online).



Black Ray

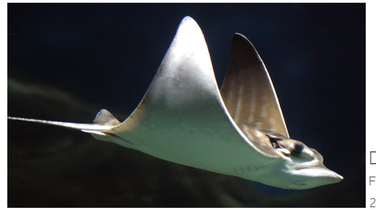
Fig. 83: (Papua Paradise, n.d.: online).



Diamond Ray

Fig. 84: (Ryan, 2013: online).

rays



Duckbill Ray

Fig. 85: (City of Arts and Sciences, 2005: online).



Marble Ray

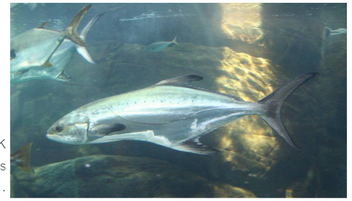
Fig. 86: (ScubaZoo, n.d.: online).



Blue-spotted Ray

Fig. 87: (Petersen, 2006: online).

fish



Garrick
Fig. 88: (Two Oceans Aquarium, n.d.: online).



Kob / “Kabeljou”
Fig. 89: (Spiby, n.d.: online).



White Musselcracker
Fig. 90: (Dreyer, 2015: online).



Yellowtail
Fig. 91: (SAFMC, n.d.: online).



Grunter
Fig. 92: (Spiby, n.d.: online).



Yellow Belly
Fig. 93: (Spiby, n.d.: online).



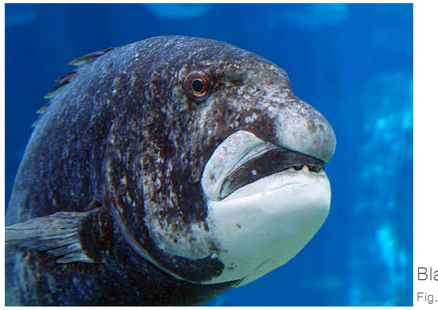
Atlantic Bonito
Fig. 94: (Svensen, 2020: online).



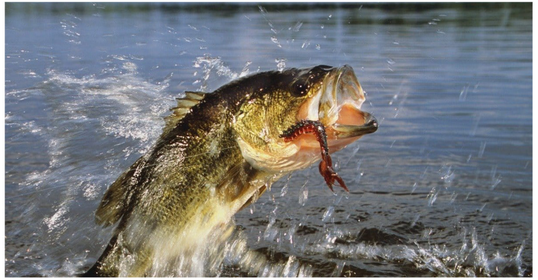
Galjoen
Fig. 95: (Bowen, 2018: online).



Steenbras
Fig. 96: (Two Oceans Aquarium, n.d.: online).



Black Musselcracker
Fig. 97: (Spiby, 2022: online).



Largemouth Bass
Fig. 98: (iStock, n.d.: online).



White Hake
Fig. 99: (Castro, 2014: online).

corals



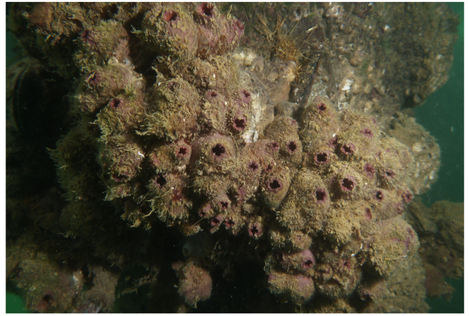
"Sand Dollar"
Fig. 100: (Ducarme, 2017: online).



Common Sea Fan
Fig. 102: (Divepix, n.d.: online).



Featherduster Worms
Fig. 101: (Waikiki Aquarium, n.d.: online).



Red Baits
Fig. 103: (Monceaux, 2018: online).

others



Cape Fur Seal
Fig. 105: (Ryan, 2016: online).



Octopus
Fig. 104: (Adamczyk, n.d.: online).



Knysna Seahorse
Fig. 106: (Fratwicke, 2012: online).

1.11 conclusion

This chapter aimed to shed light on the deciding factors of the thesis, including the site, client, and marine life. The chapter starts by identifying the problem: Mossel Bay has diverse marine life, but it is not widely known, and not enough is being done to preserve and promote it. This helped to develop the aims for the project and give an idea of what direction the project could go in.

The research question was introduced and led to the conceptual investigation in Chapter 02. When discussed in more detail, the research question calls for the investigation of related theoretical concepts such as diffused boundaries, phenomenology, and biophilia, along with the discussion of overlapping themes between the concepts and how they may be interpreted architecturally.

The following topics – the client, site, proposed functions, and marine life – introduced the important aspects that play an integral role in the design. It assisted in familiarising the surrounding area and the site itself, validating design choices, and creating a solid background for the project.

Chapter 01 provides a solid base for the project and an opportunity to work forward from it. Additionally, it jumpstarted the ideas for the conceptual development, and Chapter 02 will elaborate further on this.

Conclusively, the project was introduced along with important factors, such as the site, and built the storyline to the final design solution.

CHAPTER 02:



exploration

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2.2 Touchstone 63
2.3 Concepts 67
2.4 Theoretical Framework 71
1. Mediation between land & sea, people & nature 74
2. The way in which the ocean is experienced 77
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ii. Embodiment
3. A biophilic architectural intervention 82
2.5 Lessons Learned 85
2.6 Conclusion 89

2.1 introduction

This chapter will formulate the basis of the theoretical investigation through developing the touchstone and concepts. The theoretical essay aims to investigate new possibilities in the field of biophilic architecture and the connection between man, architecture, and nature.

Therefore, the conceptual and theoretical investigation aims to suggest and motivate possible design approaches appropriate for the surrounding area and the natural environment.

2.2 touchstone



The ocean covers more than 70% of the earth's surface. Despite the ocean's size and its impact on all organisms on earth, it is fairly underexplored. Less than 20% of the ocean is either mapped, explored, or seen by humans. It is fairly shocking, considering that a far more significant percentage of the moon and Mars' surface has been discovered (National Geographical Society, 2019: online).

Thus, this touchstone aims to capture the fundamental essence of the project: educating people on marine life and what is happening in the ocean. This is achieved through an interactive process and a "touch-and-feel box" replica. From one side (Side A), people can open the boxes, insert their hands and feel the object inside the box without knowing what it is. Once they are done feeling the object, they can move to the other side (Side B) and see the different objects they felt and admire the beauty thereof. This represents the process of visiting the Marine Research Institute & Aquarium. The basic essence is that people, who may know nothing or very little about the ocean, visit the building, experience and interact with everything in the building and leave with a greater knowledge of the ocean. This applies not only to visitors and tourists but also to researchers and marine biologists involved in the Marine Research Institute portion.

This represents that through a fun, interactive experience, people can be educated and taught about an important part/aspect of the earth and the importance thereof.



Fig. 107: Textures of different objects found in the ocean (Author, 2022).

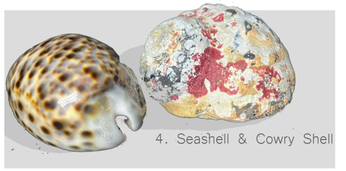
touchstone



Fig. 107: Touchstone (Author, 2022).


1. Perlemoen Shells

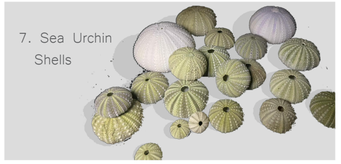

2. Coral & Seaweed


4. Seashell & Cowry Shell


4. Pufferfish (Blowfish)


5. Mussel Shells


6. Starfish


7. Sea Urchin Shells


8. Discord Fork Weed


9. Assorted Sea Shells


10. Scalop (R) & Murex Nigrospinosis (L)


11. Purple Barnacle

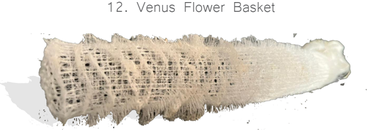

12. Venus Flower Basket

Fig. 108: Objects shown in Touchstone (Author, 2022).

2.3 concepts



The concepts developed for this project were all derived from the research question: How can a biophilic architectural intervention act as a mediator between the land and the sea within Mossel Bay while diffusing the boundaries and changing the way in which the ocean is experienced?

1. Interrelatedness: The artificial connection of land and sea
This concept aims to illustrate the possibility of bridging the gap between the land and the sea through an architectural intervention by diffusing the boundaries.

2. Vivarium: A world within a world
This concept aims to create a place of life within a place. It aims to bring the underwater world to the surface to encourage people to learn more about the marine life and experience it.

3. Interaction: The aquarium as a tidal pool
This concept aims to see the aquarium as a tidal pool to create a safe environment for people to interact with the ocean without facing the full extent of the ocean.

CONCEPT 01:
interrelatedness
The Artificial Connection between Land & Sea

KEYWORDS bridge – connection – entanglement – diffused boundaries

Although relatively well developed, Mossel Bay still has a harsh distinction between land and sea, man-made and natural. The only place connection happens is on the beach - the edge between land and sea. This project aims to bridge the gap between the land and the ocean, to connect the two distinct places through an architectural intervention while diffusing the boundaries where land and sea meet. It will allow people to engage, experience, learn about, and feel connected to the ocean.

This conceptual approach aims to reveal what will eventually occur on the site - bridging the gap between land and sea. There must be anchoring points both on the land and in the sea, with a connection happening between the anchoring points.

This concept model aims to illustrate the current division between land and sea - shown by the site cast into two separate sections: the land and the ocean. It also illustrates the different anchoring points on both sides of the model and the attempt and bringing them together and connecting them.

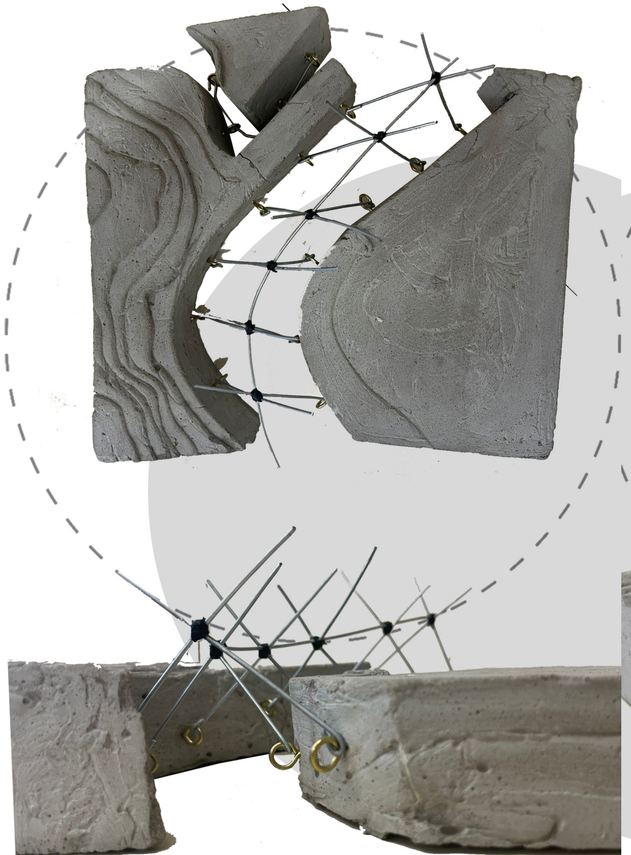


Fig. 109 & 110: Concept model 1 (Author, 2022).

CONCEPT 02:
vivarium
A world within a World

KEYWORDS: heterotopia – enclosed space – existing v new – aquascaping

Under the water, especially in the ocean, a whole new world opens up that people are not necessarily well-known with. A new world filled with fish, coral, sand, water, and more. Through architectural intervention, it is possible to bring the new underwater world to the surface for people to explore and appreciate it. A heterotopic place is created in return - a world within a world.

This conceptual approach aims to illustrate the main aim of the project: to create a place of life within a place.

The concept model aims to illustrate the "existing" above-water world as it is. The area where the site is located is portrayed differently in order to convey how a "world within another world" is created.

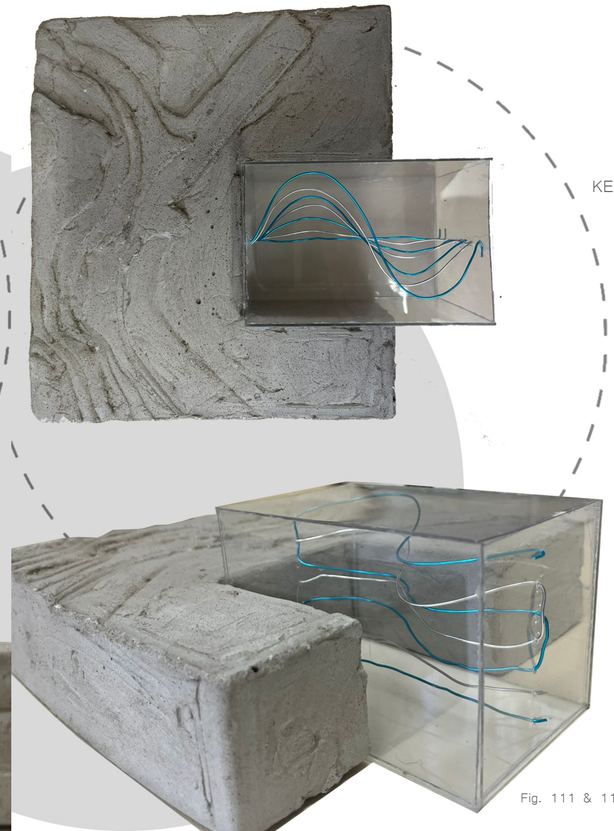


Fig. 111 & 112: Concept model 2 (Author, 2022).

CONCEPT 03:

interaction

The Aquarium as a Tidal Pool

KEYWORDS: tidal pool – interaction – active – passive

A tidal pool is a rocky, man-made pool built to give beachgoers a safe place to cool down in the ocean without worrying about being hit by the waves. It also provides people with a tiny peek into the ocean's ecological system. It allows for a controlled environment where people can explore and experience the ocean.

This conceptual approach aims to see the aquarium as a tidal pool of sorts, a safe place to observe, experience, and learn about the ocean without having to face the full extent of the ocean.

The concept model aims to illustrate the "existing" conditions: the vast expanse of the ocean next to the land cast in concrete, and then the new conditions: the man-made "tidal pool", which allows visitors to experience the ocean. The "tidal pool" is anchored in the land and is also entered from there. It opens up into the ocean and creates a protective barrier against the ocean. Within the barrier, people may still experience being in the ocean without actually being in the ocean.

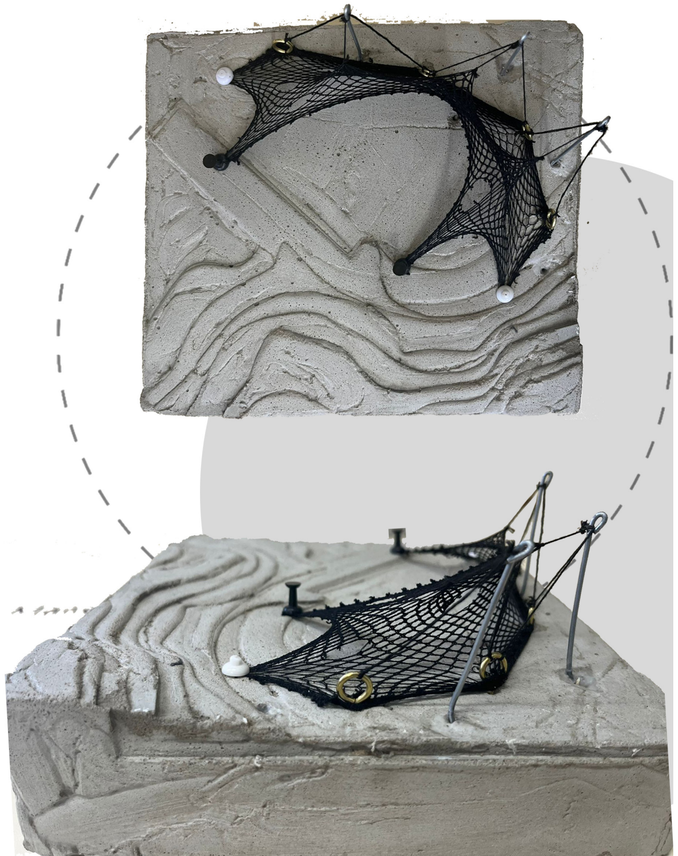
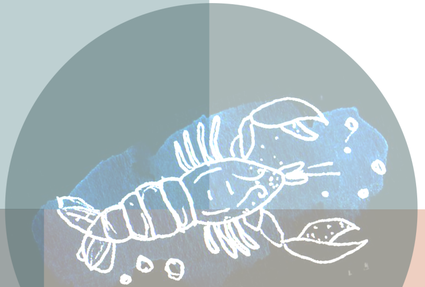


Fig. 113 & 114: Concept model 3 (Author, 2022).

2.4 *theoretical framework*



Mediation between land & sea, people & nature

The way in which the ocean is experienced

i. Phenomenology bridging over to eco-phenomenology

ii. Embodiment

A biophilic architectural intervention

Research Question:

How can a biophilic architectural intervention act as a mediator between the land and the sea within Mossel Bay, while diffusing the boundaries and changing the way in which the ocean is experienced?

The research question can be divided into three main concepts that the design wants to explore: 'a biophilic architectural intervention', the 'mediation and diffused boundaries between land and sea, and 'changing the way the ocean is experienced'. These three main ideas link to the concepts discussed in 2.3 Concepts.

This essay aims to investigate the above-mentioned three ideas with specific regard to a Marine Research Institute and Aquarium in Mossel Bay, with the main focus on moving away from a traditional aquarium. This will allow a paradigm shift in the visitors' interaction with and experience of the ocean. Therefore, the brief of this project depends on a new typology of an aquarium, one that does not divorce the users from the ocean life and natural landscape.

Firstly, it will explore how architecture can mediate the relationship between the land and sea while diffusing the boundaries and affecting how people experience the space. This will be discussed in terms of the interrelationship between land and sea and how defamiliarization can play a critical role in the diffusion of boundaries, the connection between land and sea, and creating a dialogue between the users and the building. Secondly, the user experience will be researched and discussed in terms of phenomenology, bridging over into eco-phenomenology and Pallasmaa's notion of embodiment and fragile architecture. Lastly, biophilic architectural design will be looked at, especially how it can assist in creating a design that can form part of nature and how it can motivate a connection between man and nature. It becomes evident that there are overlapping qualities rooted in nature and the environment, which form the basis of this project.



Fig. 115: Amalgamation of theoretical aspects, "blurring the lines" (Author, 2022).

1. Mediation between land and sea, people and nature

While Mossel Bay is relatively well developed, there is still a harsh distinction between land and sea, earth and water, man-made and natural. The only area where connection happens is on the beach, where the waves of the ocean lap on the shoreline, where people can enter the ocean. This project aims to bridge the gap between land and sea and connect the two distinct places through an architectural intervention while diffusing the boundaries between the two. Therefore, it is essential to firstly look at the interrelationship between land and sea, and understand it, in order to attempt to bridge the gap.

Interrelationship indicates the mutual or reciprocal relationship between two entities (Merriam-Webster, 2022: online). In this instance, the two entities are the land and the sea, man-made and natural environments. Unfortunately, we live in a world that is dominated by man-made inventions, and the effect thereof is evident in climate change. As architects, we have the opportunity to make a difference, to invoke change. The first step thereof is to ensure that each design has a dialogue with nature. After all, we owe everything to nature because without nature nothing would be.

To explore the interrelationship between land and sea, it is essential to start with a broader view: the interrelationship between architecture and nature. Architecture breathes nature. Architectural components come from nature. Contemporarily, nature becomes a material for architecture (Haupt, 2014: 38). Nature should be brought back into urban landscapes through architecture. This will allow for harmony between natural and built environments; the building should 'blur' into its surroundings and not be domineering.

This idea of blurring the lines between the building and its surroundings links to the notion of diffused boundaries. Diffused boundaries can be incorporated in architecture to break down known thresholds and change how people perceive and experience a space (Baydoun et al., 2015: online). In simple terms, a diffused boundary is the opposite of a rigid boundary. A rigid boundary indicates where one thing stops and the next begins, such as where the sidewalk stops and the road begins. With a diffused boundary, that highly defined threshold is no longer an aspect. A person can transition from one space to another without fully realising the difference. In this project, the building will act as the diffused boundary, leading the visitors from the land and into the ocean.



Fig. 116: Diffused Boundaries (Author, 2022).

Incorporating diffused boundaries can assist in the connection between land and sea. It can be incorporated in such a way that the visitor can move from the land to the sea while on the same walkway. It can assist in blurring the distinct edge where the land ends, and the ocean begins. This can be done through an architectural intervention that acts as a transitional space of sorts.

However, when approaching a project such as the one on hand, it is essential to take clues from the surrounding environment and incorporate them into the design to create appropriate and sustainable architecture. This refers to critical regionalism, taking into consideration the topology, typology, and morphology of the surrounding area (Norberg-Schultz quoted in Lefaivre, Tzonis, 1990: pp. 483-491). The clues taken from the environment are based more on the natural environment, such as the ocean water and rocks emerging from the water. However, for this project, critical regionalism is not focussed on in terms of theory. Instead, defamiliarization is used, and objects in the vicinity are presented differently to give the visitor a new perspective and experience.

Defamiliarization, by definition, is a method in which an artist can present an object in a new, unfamiliar way to stimulate a fresh perception and encourage the viewer to see the world differently (Merriam-Webster Dictionary, 2022: online). The building can appear as entering into an imagined dialogue with the viewer if the appropriate poetic device of defamiliarization is chosen (Levaivre, Tzonis, 1990: pp.489-490). The defamiliarization of objects in architecture can range from objects in the natural environment, such as trees, to objects in the built environment, such as a steel shed. It is important to note that defamiliarization draws its form from the context (Levaivre, Tzonis, 1990: pp.489-490). For this project, the design will draw strongly on the natural environment. The design will be inspired by the ocean and its process, different structures that come to light through marine life, and the way of water. These 'objects' of sorts will be defamiliarized and incorporated in the design in order to connect the built, man-made design to the natural, oceanic environment. An exploration of how water can influence the design is done in Chapter 03.

After the investigation, it comes to light that in order to mediate the relationship between land and sea, built environment and natural environment, people and nature, it is important to take the relationship that people have with nature into account. Manners in which nature can be brought into the design to create a diffused boundary will be explored throughout the design process, focusing on how it will affect people's experience. This will be explored more in the following section of the document. Lastly, the method of defamiliarization needs to be incorporated in order to create an appropriate, sustainable architectural design for the local culture and natural environment.

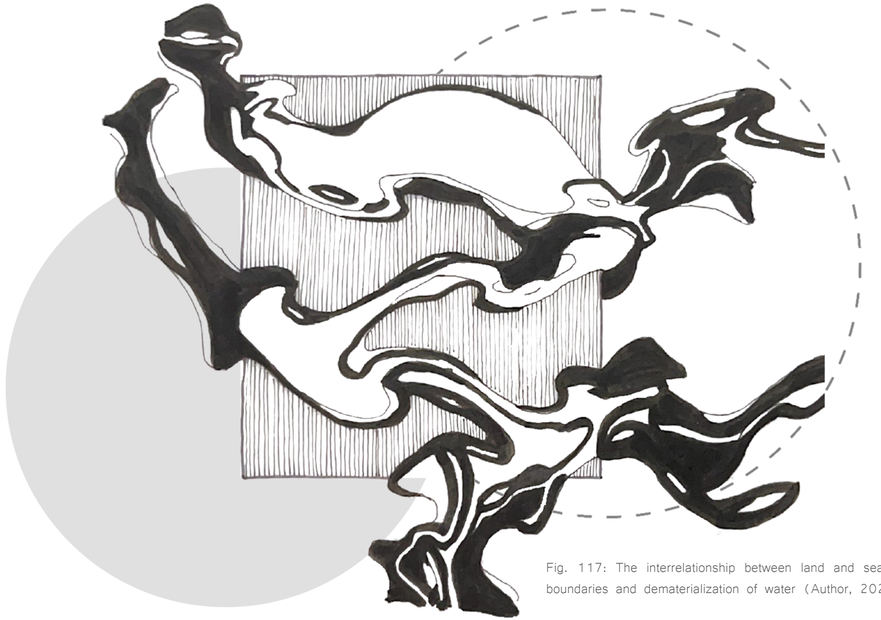


Fig. 117: The interrelationship between land and sea, diffused boundaries and dematerialization of water (Author, 2022).

2. The way in which the ocean is experienced

2.1 Phenomenology bridging over into eco-phenomenology

As humans, we have a connection to different places that has different meanings. Our experiences dictate how we feel within a certain environment. These experiences are cultivated through interacting with our emotions in architectural spaces, even when we do not realise it. Experiences can leave us with memories and a lasting impression that might affect how we encounter other places. Architecture can play a vital role in the experience of a place, but in order to accomplish that, it is important to understand phenomenology and the connection to the environment.

In its most basic essence of meaning, David Seamon describes phenomenology as the interpretive study of human experience. It aims to examine experiences as they spontaneously happen during the course of daily life (Seamon, 2000: 1). Phenomenology can be linked with environment-behaviour. It could be the first step in reconciling the tension between feeling and thinking, between observations and memories. Therefore, any human experience has the potential for phenomenological investigation and appreciation. Thus, a crucial part of the design process is to talk to people and investigate how they currently experience the site and how they would want to experience it. To take the phenomenological approach when designing, it is important to determine what approach should be taken: people and the world as one or concepts originating through experience. These two assumptions are, according to Seamon, at the core of a phenomenological approach (Seamon, 2000: 4).

Looking at the approach of the people and the world as one, the focus of phenomenology can be seen as the way people exist in relation to the world (Seamon, 2000: 5). People and the world can only be classified as a holistic relationship; being intimately interconnected and existing together. The people make the world, but the world also makes the people. However, the sad reality is that a significant portion of humans take the everyday world for granted and accept it unquestioningly. Humans become immersed in a world that normally unfolds automatically (Seamon, 2000: 6). As architects, we have an opportunity to reconnect people to the world through architecture, to create a place that allows people to be. A phenomenological approach must therefore strive to find the balance between people and the world, feeling and thinking.

Phenomenology thus focuses on the human experience of a place and the connection between people and the world. However, for this project, it is important to connect to nature and the environment. Thus, the phenomenological approach will be discussed in terms of eco-phenomenology and how it affects architecture.

We have become accustomed to living in a man-made world with man-made technologies and interacting almost exclusively with humans. We have become alienated from the world. It is important to remember that everything we know is of nature. Architecture is in and of nature. Introducing eco-phenomenology to architecture opens a path that focuses on designing a sensuous reality instead of human-mirrored aesthetics (Macklin, 2007: online). Architecture can therefore be viewed as an experience instead of a catalyst for an experience. Our everyday being in architecture allows for new ways of thinking, feeling, and awareness.

Furthermore, eco-phenomenology allows for the interpenetration of humans and nature. Nature is the ever-present catalyst that transforms spaces into landscapes that we, as humans, can experience and appreciate. Nature brings architecture to life, and in turn, architecture should translate nature's happenings into tangible experiences that affect people's beings. In the words of Merleau-Ponty, architecture is therefore responsible to "make visible how the world touches us" (Macklin, 2007: online). Eco-phenomenology is, in essence, a manner of designing that shows nature and the world's presence in human creativity. It is about returning to reality, of oneself, and of nature.

A large majority of humans have come into the habit of viewing nature as a dead entity – a thing we can manipulate, use and dominate to the fullest extent. This mindset needs to change. We owe everything to nature because without nature, nothing would be. Architecture should thus uplift and work in collaboration with nature. It should allow users to have an experience of nature while being in a built environment. Eco-phenomenology links with the idea of architecture rooted in care: care for the environment and care for people. A 'care'-ful approach should be taken when designing in nature. There should also be an aspect of care within the design of the experience.

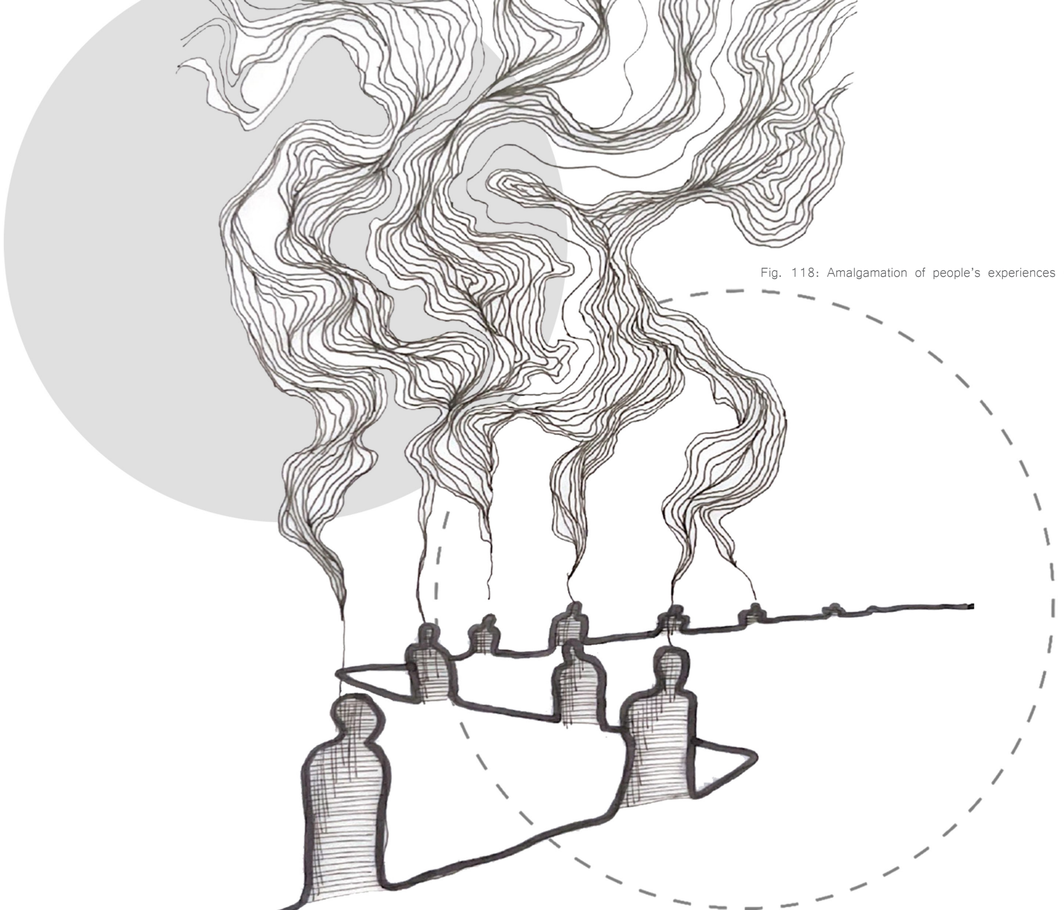


Fig. 118: Amalgamation of people's experiences (Author, 2022).

2.2 Embodiment

In *The Embodied Image* (2011), the Finnish architect, Juhani Pallasmaa, opens with the thought that buildings are often presented as detached from their surroundings – the landscape, culture, and social reality. He described buildings as "independent aesthetic objects separated from the world" (Pallasmaa, 2011: 118).

However, on the contrary, architecture is, in its nature, a metaphoric representation of what they want to communicate, and it should guide the visitor's perception and thoughts. In a sense, architecture embodies these metaphors and tells its own story, its own origin. This is achieved through the poetic power of tectonic language in constructing a building. A truly meaningful building has a component of the world, life, and architecture itself (Pallasmaa, 2011: 124-125). It should tell the visitor a story and guide their experience through construction and finer details. The user should touch, listen, hear and see the world with their whole body within a place organised around the human body. The construction should relate to the lifeworld surrounding the building, telling the story of the site, the area, what used to be, and what is.

Architects have become accustomed to scientific thinking, looking on from above and thinking of objects in general. However, scientific thinking in architecture must return to what was there before; to the site, the soil of the modified world (Merleau-Ponty, 1993: 122) to create architecture that matters, architecture that connects back to the earth.

Western culture should thus move away from the need for power and dominance, from architecture that is forced in order to make an impact. Instead, the notion of 'fragile architecture' should be explored. It is architecture rooted in vulnerability, it is contextual and responsive, and it is architecture concerned with sensory interaction. It grows and opens up to the concept of details. This type of architecture allows visitors and dwellers to interact with the building and participate. The structure is not domineering, egotistical, or intimidating. Another key aspect of fragile architecture is vulnerability in the architect. Vulnerability in the architect allows for humanism in architecture. When the architect allows themselves to be vulnerable with the thought that they can create architecture that can make something better, fragile architecture is born (Ford, 2017: 22). This notion connects to phenomenology's strive to create a balance between the people and the world.



Fig. 119: The buildings and the world as one (Author, 2022).

Embodiment and how it is translated into structure have the power to shape a person's experience. It is the architect's responsibility to decide which approach is appropriate for the site – egotistical, domineering and forced, or fragile, responsive, and contextual. For this aquarium to be seen as part of nature, it is essential to take the fragile approach; to work together with the nature, learning from the natural structures and surroundings and incorporating that into a design that tells the story of the ocean.

Bringing the concept of eco-phenomenology and embodiment together, it becomes evident that human experience defines a place. Place is defined by a web of different peoples' lived and imagined realities, and these realities can be shaped by the built as well as the natural environment. There should not be a divide. Instead, they should be infused together, guiding the user through an experience of both worlds and allowing them to just be in the space.

It also becomes evident that nature should be ever-present within this design. Nature should inspire the architecture in different manners, one being in terms of the experience that wants to be cultivated in the design and the other being the structure. While interacting with the design, the user should be able to experience the influence that nature had and should leave with a sense of being closer to nature (in this case, the ocean) or a better understanding thereof.

3. A biophilic architectural intervention

Biophilia can be directly translated into the love for life or anything that has life. In Greek, 'bio' means life, and 'philia' means the love of something. Biophilia refers to the innate human need to connect with nature or other living things. Similarly, biophilia can be described as the connection humans seek with the rest of life (Modi, Parmar, 2020: online). It is possible that this desire we feel can be rooted in our biology, as we all come from nature.

Biophilia in architecture aims to communicate this need for connection to nature and life. Biophilic design focus on adding natural aspects to the building, such as green roofs or water features. In order to successfully apply biophilia in architecture, there are five key principles that are important to remember (Modi, Parmar, 2020: online):

Principle 1: Repeated, sustainable engagement with nature.
Principle 2: Focus on adaptions to the natural world that helps to advance people's health, fitness, and wellbeing.
Principle 3: An emotional attachment to the place is encouraged.
Principle 4: Positive interactions between people and nature is promoted to encourage a sense of relationship and responsibility.
Principle 5: Mutual reinforcing, integrated and interconnected architectural solutions is encouraged.

Biophilic architecture also focuses on the experience it can create. These experiences can be divided into three basic types (Modi, Parmar, 2020: online):

1. Direct Natural Experience
2. Indirect Natural Experience
3. Space and Place Experience



Fig. 120: Natural and build environment together as one (Author, 2022).

It can be argued that due to rapid urbanization, humans have started to lose their connection to nature at a fast pace, which in turn affects our wellbeing and health. Over the course of evolution, nature has become a 'safe' space for people; a space where one can go to destress or relax. The artificial built environment struggles to have that same effect on people. Therefore, it is important to bring back a natural element into the built environment; this is where biophilia plays an important role. An integral part of biophilic theory is the relationship between humans and nature. Humans have this desire to connect with nature; we see it as our 'escape'. It has the power to 'recharge' us and fill us with new life. Thus, many people would habitually prefer to live in natural surroundings if given a choice.

In an urban setting, the most common attempts at biophilia are parks – a green haven in the middle of an artificial world. However, biophilia should reach further than that. A natural element should be added to skyscrapers, offices, homes, shops, and more. Not only will it promote sustainability, green architecture, and eco-friendliness, but it will also improve the physical and mental health of the people. The principles of biophilia mentioned above advocate for the integration of nature in our buildings for this exact reason (Modi, Parmar, 2020: online). This theory highlights the importance and beneficial aspects of vegetation and how it can be successfully included in architecture. Interior and exterior green spaces are vital to creating architecture that promotes a connection to nature. The incorporation of this theory in architecture is one of the ways to bridge the gap between people and nature, built environment and natural environment.

Therefore, a design must include elements of nature on the interior or exterior to be considered a biophilic design. If applied correctly, people may experience being in the ocean and interacting with it rather than simply looking at fish in tanks.

The notion of biophilic design also links back to the first topic discussed: Mediation between land and sea, people and nature. If biophilic design is applied appropriately, it can create a diffused boundary between what is built and what is natural. It can also be a valuable tool in connecting the land and the sea and bridging the gap.

To conclude, all three topics come down to the essence that the idea of how people experience the place and the connection to nature is the main focus of this design. The theoretical aspects will therefore guide the design process and form a solid base on which the design can build. The theoretical aspects allow for an architecture of care to come to light and enable spatial and functional influences in the design, which are relevant to the design proposal – a marine research institute and aquarium. All of the theoretical concepts discussed interlink with one another and aim towards an architecture in harmony with nature and people that focuses on cultivating positive experiences and educating people throughout this process about an essential part of our earth – the ocean.

It's shown that we should move away from the need to dominate and have power over nature and instead take an approach that elevates the importance of, and interaction with, nature.

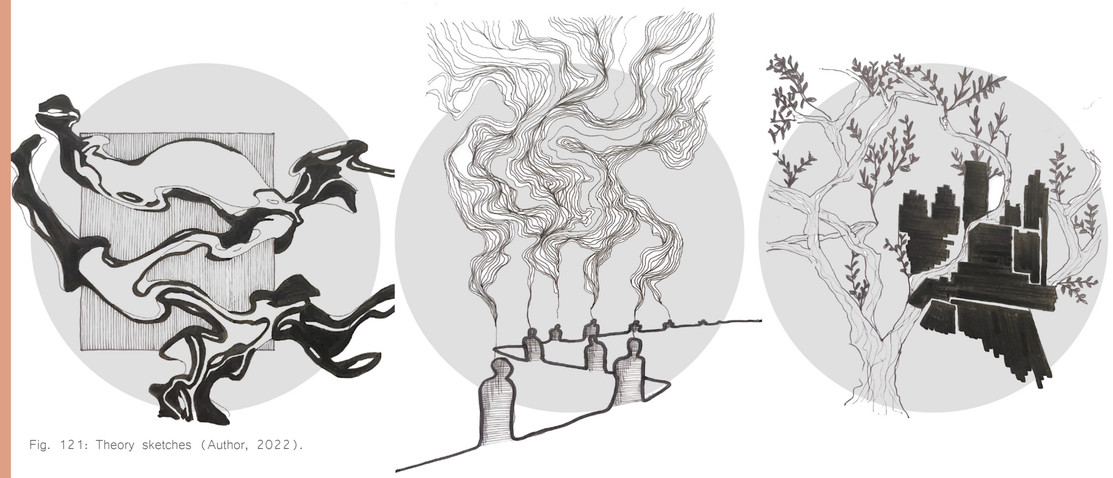


Fig. 121: Theory sketches (Author, 2022).

2.5 lessons learned



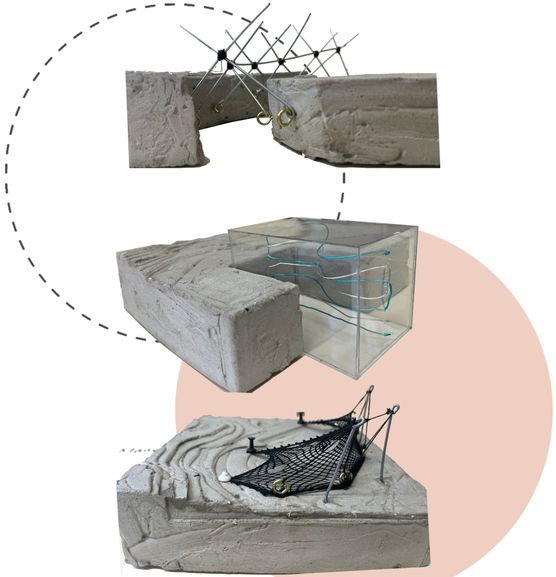
Through the conceptual phase, a few important lessons were learned that will inform the design process and set it in motion. The main lessons were learned from the following:

1. Touchstone
2. Concepts
3. Theory 1: Mediation between Land and sea, people and nature
4. Theory 2: The way in which the ocean is experienced
5. Theory 3: Biophilic architectural intervention



Touchstone

The touchstone sets in motion the fundamental essence of the project, which is to educate people. It poses the theory that through interaction, people can have a fun, exhilarating experience while being educated. It opens the design to the possibility of moving away from a traditional aquarium design, creating an alternative, interactive model.



Concepts

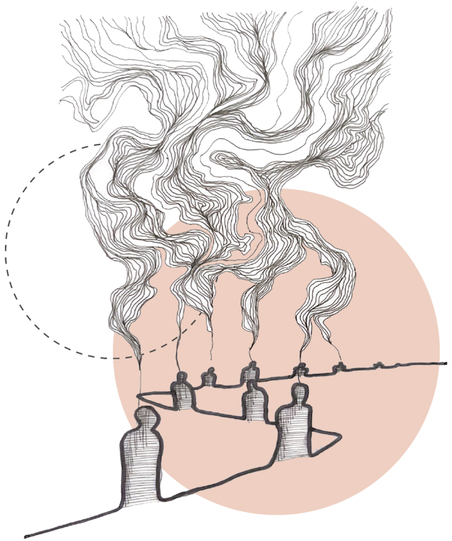
The three concepts of interrelatedness, vivarium, and interaction each explore a different aspect that could be included in the design and helped to inform the theoretical lenses.

Fig. 122 & 123: Theory sketches (Author, 2022).



Mediation between land and sea, people and nature

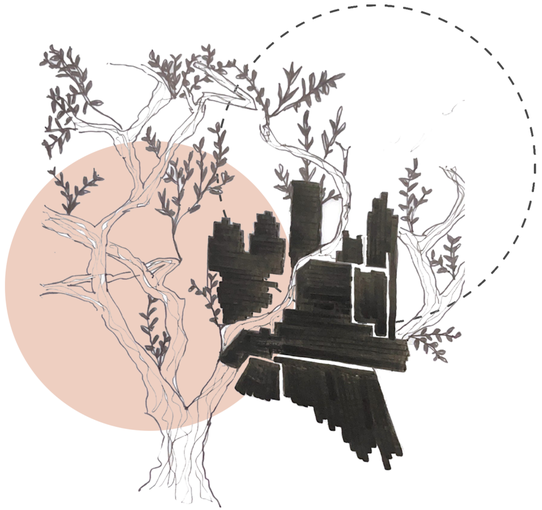
It came to light that the relationship people have with nature is an essential aspect in the goal of mediating the relationship between land and sea. Solutions were prompted in terms of diffusing the boundaries by extending the built environment into the natural environment and bringing the natural environment into the building.



The way in which the ocean is experienced

An important design aspect should revolve around how people experience a place and how these experiences influence them. These collective experiences also define the place; therefore, the built and natural environment should be infused together. Nature plays an integral part and should be ever-present in the design.

Fig. 124 & 125: Theory sketches (Author, 2022).



Biophilic architectural intervention

The inclusion of biophilic architecture may change the way people experience the aquarium. It may add the element of feeling submerged in the ocean and interacting with marine animals. If this aspect is applied correctly, it can link together all the theories discussed and have a cohesive design.

Fig. 126: Theory sketches (Author, 2022).

2.6 conclusion

RQ: How can a biophilic architectural intervention act as a mediator between the land and the sea within Mossel Bay, while diffusing the boundaries and changing the way in which the ocean is experience?

The theoretical framework dove deeper into the three main subthemes identified:
1. Mediation between land and sea, people and nature
2. The way in which the ocean is experienced
3. A biophilic architectural intervention

The investigation provided deeper insight into what the three subthemes entail and how it can be incorporated into architecture. It started to answer the research question posed, as well as provided appropriate architectural implementations that will amalgamate the architecture and theory.

In Chapter 03, the design development will be discussed in terms of architectural decisions made and how the theory is applied to create an appropriate design solution. The chapter will aim to illustrate how the research question is answered and how it translated into architecture.

CHAPTER 03:



design synthesis

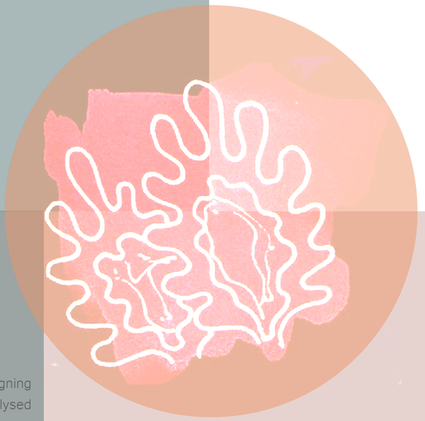
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3.1 introduction

This chapter aims to indicate the design and thought process from the start to indicate this project's development. In this chapter, all the aspects discussed in the previous chapters amalgamate into one design that succeeds in creating a diffused boundary and a connection between man and nature.

Section 3.2 focuses on analysing different precedent studies that look at different aspects, such as function, appropriate design solutions, and construction methods. Section 3.4 introduces the design's accommodation list and the sizes of each function. Section 3.5 discusses the design development from initial to final ideas, and section 3.6 showcases the final design solution.

3.2 precedent studies



This section consists of precedent studies that aim to assist the process of designing an appropriate, sustainable solution. Each precedent study is assessed and analysed in a way that is purposeful to the design of this dissertation.

The precedent studies to follow consist of an in-depth study relatable to the project, focussing on key elements and attributes relevant to this dissertation's specific design. The different precedent studies that were looked at are:

- Focussed on accommodation and spatial organisation
- Focussed on connecting with the water
- Focussed on materiality and designing in the environment
- Focussed on the brief of the dissertation (Construction Precedent)
- Focussed on structural systems and construction methods

Two Oceans Aquarium

location: Cape Town, South Africa
year completed: 1995

This aquarium is located in the V&A Waterfront of Cape Town, South Africa. The name of this aquarium, Two Oceans Aquarium, is inspired by the two oceans that meet at the southern tip of Africa: The Indian Ocean and the Atlantic Ocean. The main goal of this aquarium is to show the diversity of marine life within these two oceans. They aspire to encourage respect, love, and understanding of the ocean and hope to encourage visitors to use marine and other natural resources sustainably (Two Ocean Aquarium, 2022: online).

In terms of exhibitions within the aquarium, there are two main focuses: 1. The exhibition design and layout, and 2. The friendliness of the exhibition for the marine life and visitors (Lockhart, 2015: online).



Fig. 127: Image collage of Two Ocean Aquarium (Two Oceans Aquarium, 2022: online).

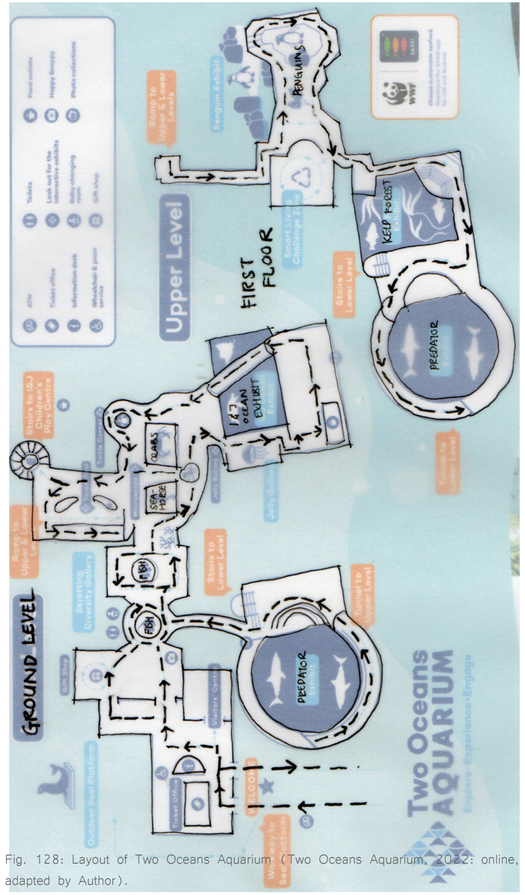


Fig. 128: Layout of Two Oceans Aquarium (Two Oceans Aquarium, 2022: online, adapted by Author).

Exhibition Design and Layout

The aquarium moved away from a static, museum-like experience where you view small exhibits lined with the wall to a dynamic space that gives the visitors the feeling of being immersed in the underwater world. The exhibitions try to focus on mimicking the ecosystem in which the marine life is usually found. Thus, communities and ecosystems are shown instead of displaying the animals individually.

The spatial layout of the aquarium also focuses on taking the visitor through a journey of the aquarium. It is laid out in a manner that allows you to walk a singular route while still experiencing all of the exhibits. In some of the big exhibits, such as the predator exhibit and the kelp forest exhibit, there are moments created where the visitor can pause, sit down and enjoy the marine life. Two tunnels were designed so the visitor could walk through to create the feeling of actually being immersed in the ocean.

Friendliness of the exhibition

The exhibitions should not only be friendly and accommodating to the visitors, but especially also to the marine life within. Certain measures should be taken in order to create a happy, stress-free environment for the marine life within the exhibition. This includes mimicking the natural oceanic environment where the animals usually find themselves. The tanks should also be kept clean and healthy. This does benefit not only the animals but also the visitors because it gives them peace of mind that the animals are being taken care of.

This precedent study helps to indicate how spatial organization and exhibit design plays a significant role in the overall view of the aquarium. It also gives a peek into the world of ‘aqua-scaping’ and its importance. This precedent study also assisted in creating an accommodation list for my own design.

2. A precedent study fo connecting with the water

Kastrup Sea Bath

architect: White Arkitekter
location: Kastrup, Denmark
year completed: 2004

The Kastrup Sea Bath reaches out into the strait from Kastrup Sandpark, forming a vital part of the new beachfront. It consists of the main building on the water, a new beach, and bathrooms which also allows for the accessibility of handicapped persons (White Arkitekter, 2008: online).

A wooden pier leads visitors from the beach to the building in the water and gradually rises, ending in a diving platform 5m above sea level. The building has ramps and other special features that allow handicapped persons to use and experience it. The building is gracefully elevated about 1m above the water, balancing on slender legs that are exposed to the exterior. It is made of Azobé wood, specifically chosen for its durability in ocean water. It also has large uplights that light the building and LED strips running along the pier to allow the building to be visited in the evening (White Arkitekter, 2008: online).



Fig. 129: View of Kastrup Sea Bath (White Arkitekter, 2008: online).





Fig. 130 & 131: Elevated pier that leads to bath (White Arkitekter, 2008: online, adapted by Author).







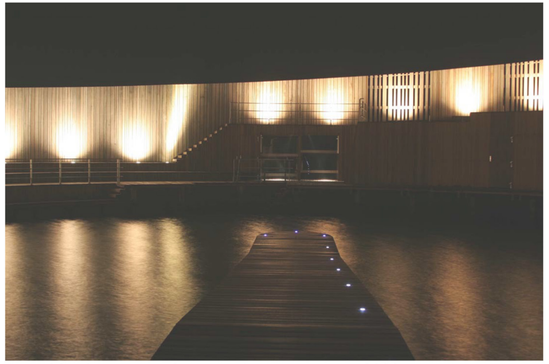


Fig. 132-135: Kastrup Sea Bath (White Arkitekter, 2008: online).

The circular shape of the building was chosen to create a safe area where visitors can enjoy the ocean. It is shielded from harsh winds, and the sun is concentrated. It also opens up to the landside in order to invite visitors in. A bench lines the pier to allow for resting opportunity when approaching the building. There is also numerous seating space provided in the design itself (White Arkitekter, 2008: online).

A big focus of the design was to ensure that all people would feel comfortable and secure here. It provides accessibility for less mobile persons to enjoy the space. An interesting approach to exercise and sport is also taken. They want older people (who may be less active) to feel as comfortable in the space as younger, more sports-orientated visitors. This design has room for both peacefulness and playfulness, and it is always open to the public, no matter what time of the day or season (White Arkitekter, 2008: online).

This precedent was chosen in order to explore a manner in which architecture can be added in the ocean. It helped to provide insight into what material could be used, as well as certain design aspects of the pier in terms of accessibility and the message that wants to be conveyed. It also assisted in how to create a safe space in the ocean where people can still experience the ocean (White Arkitekter, 2008: online).

Leça Swimming Pools

architect: Álvaro Siza Vieira
location: Matosinhos, Portugal
year completed: 1966

The Leça Swimming Pools in Portugal has gracefully retained its architectural integrity over the course of almost 60 years. This design is a prime example of the careful connection between nature and architecture. The materiality choice (concrete) showcases a certain level of respect towards the nature (Balters, 2011: online).

The pools are located between the ocean and a road that follows the coastline. However, the architect did an extraordinary job positioning the pools out of sight. It is sunken behind the road, promoting disconnection from the city while still being respectful towards the view of the ocean. Through a careful approach, he was also able to preserve a large portion of the natural rock formations found on the site. The pools blended easily into the surroundings, reaching out into the ocean and mimicking the natural pool formations along that can be found on the coast. The shade of the concrete used was lighter than the natural rock of the surroundings. This was done intentionally to avoid directly mimicking and imitating the surroundings but rather to show appreciation for the natural environment (Balters, 2011: online).









Fig. 136-139: Leca Swimming pools (Balters, 2011: online).





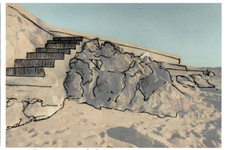


Fig. 140-142: Leca Swimming pools (Balters, 2011: online, adapted by Author).

Blurring the boundary between the pools and the ocean assists the visitors' experience. It adds to the feeling of being in the large expanse of the ocean without actually having to face the ocean itself. These pools indicate a great connection with nature while holding on to architectural individuality (Balters, 2011: online).

This precedent was chosen because it shows how materiality affects a design and adds to the experience of being one with nature without literally imitating it. It also illustrates how architecture can carefully connect with nature and blur the lines between the two without being imposed or forced (Balters, 2011: online).

Monterey Bay Aquarium

architect: EHDD
location: Monterey, California
year completed: 1984

.1 Introduction

Monterey Bay Aquarium, designed by EHDD, was the first of its kind. The aquarium moved away from a traditional aquarium design and focussed on the ecology surrounding the site: Monterey Bay and the shoreline. The aquarium aims to amaze and delight families, spark a love for the ocean, offer a sanctuary for marine life, and create a memorable experience. It sits half on the land and half in the water and encourages active participation with the environment.

This precedent has numerous aspects that make it an appropriate precedent study. The building is an aquarium, partially situated in the water, that focus on the experience users have with the environment. It also has different functions that move away from a traditional aquarium to accentuate the immersive experience. It may provide insightful information on the workings of an aquarium and the incorporation of additional functions.



Fig. 143: Monterey Bay Aquarium (Monterey Bay Aquarium, 2022: online).





Fig. 144 & 145: Monterey Bay Aquarium, connection to site (Monterey Bay Aquarium, 2022: online, adapted by Author).

.2 Connection to the site and environment

One of the main aspects of the aquarium is the importance of integrating the site and the surroundings. This was achieved through specific design methods, material choices, and technical aspects. The aquarium is placed sensitively between sardine processing plants and cannery buildings. It especially utilized and rekindles the spirit of the old Hovden Cannery, thus adding an extra layer of adaptive reuse to the building (EHDD, 2016: online).

This aquarium leaves a pivotal architectural legacy in terms of its seamless integration with the surroundings on an experimental and operational level. Half of the building rests on the land, and the other half hovers over the Atlantic Ocean, actively participating with the environment and visually bridging the land and the sea. It creates the experience of being part of the bay when you are in the structure. This counts not only for the visitors but also for the animals in the exhibitions (AIA, 2016: online).

Certain architectural decisions were made to create a specific experience for the visitors. These decisions include broad windows that allow the bay to be the backdrop to the exhibitions and transitional spaces that lead you from indoors to outdoors and back in again. This ensures that the memory of Monterey Bay is ever-present in the visitors' minds (AIA, 2016: online).

The experience that the animals have of being part of the bay is linked to the technical system of pumping water into the tanks directly from the bay. This allows the natural ecosystem to be present in the tanks and generate the experience of actually being in the open ocean. This allows the aquarium to bring marine life from the ocean, add them in an exhibition that imitates their actual natural living environment and showcase them to people (AIA, 2016: online).

The design is not contextual in a subservient manner. It instead adds more to the surroundings and respects what is already there (AIA, 2016: online).

.3 Spatial planning

Linking with the idea of moving away from a traditional aquarium design, the Monterey Bay Aquarium did not simply want a 'display' of marine life. They wanted to create an immersive experience, activating people's senses and imagination. The aquarium has more than 100 galleries and exhibitions showcasing the diverse marine life of Monterey Bay (EHDD, 2016: online). The exhibits were laid out in such a manner that it created various spaces and did not force a visitor to take a prescribed path. The visitor can meander along the different routes and exhibits and go on their own discovery journey (AIA, 2016: online).

The aquarium is divided into three zones: the Open Sea, the Splash Zone, and the ocean's edge. Each of these three zones has exhibitions showcasing the marine life peculiar to them. There is also a tide pool where visitors can swim around to enjoy and experience the actual ocean life in a safe, controlled environment. Numerous look-out and viewpoints are created around the building facing the ocean to allow the visitor to spot wildlife in the ocean (Monterey Bay Aquarium, 2022: online).

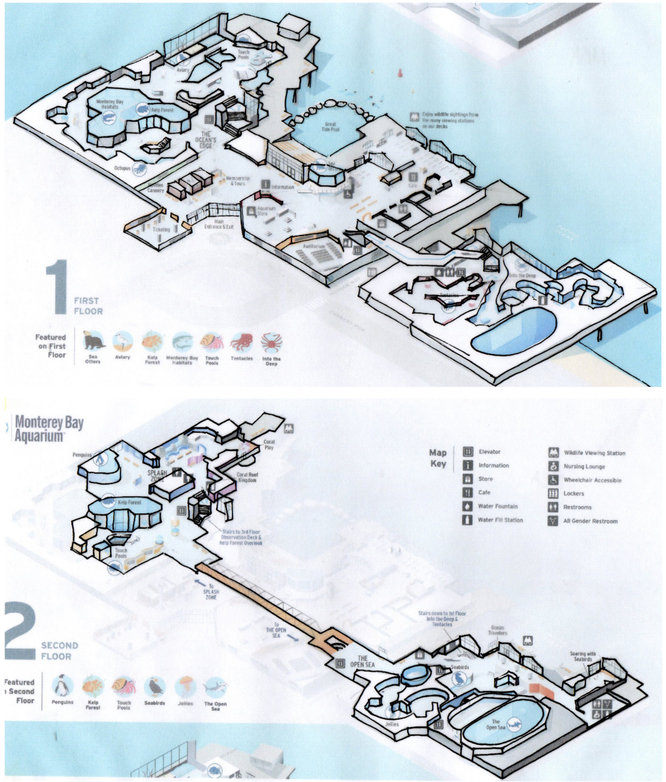


Fig. 146: Monterey Bay Aquarium spatial layout (Monterey Bay Aquarium, 2022: online, adapted by Author).





Fig. 147 & 148: Monterey Bay Aquarium (Monterey Bay Aquarium, 2022: online, adapted by Author).

.4 Moving away from a traditional aquarium

As mentioned, the aquarium is the first of its kind, moving away from a traditional aquarium design. Traditional aquarium design can be viewed as designing a museum for marine life exhibitions. Static displays lined the wall, and visitors would simply walk down a path and look at the different exhibits.

However, Monterey Bay Aquarium focuses on creating an immersive experience for its visitors. It tries to create the feeling of diving into the ocean, exploring the marine life firsthand, without actually getting wet or facing the dangers of the open ocean. The design of the aquarium also encourages the visitors to learn more about the surrounding environment and the marine life within Monterey Bay. A key aspect to this as well is the focus being solely on the marine life in the surrounding area and shoreline. It does not focus on marine life in general but rather on marine life very site-specific (AIA, 2016: online).

Different functions are also included, which leans away from a traditional aquarium. There isn't a prescribed route that visitors have to take through the exhibitions; they can go on their own exploration journey. Touch pools are incorporated in order for visitors to touch and feel certain marine life. The visitors can even swim around in a controlled tide pool and really be immersed in the ocean.

All these aspects lead the aquarium away from a traditional aquarium. It takes the visitors' experience from static to dynamic, and in turn, the visitors leave with greater knowledge and a sense of wonder.

.5 Technical aspects

The technical aspect of an aquarium is always a crucial part of the system. This part focuses on pumping water in and out of the tanks to ensure a healthy, clean environment for the marine life. The Monterey Bay Aquarium sets the bar for aquariums everywhere in terms of the technical aspect.

It was already discussed how the aquarium connects to the site. However, the aquarium also draws from the site in a literal, sustainable manner. The water of the exhibits is drawn directly from the bay itself. This allows natural nutrients and organisms to enter the tanks only during non-visiting hours. During visiting hours, the water is filtered in order for it to be clearer for the visitors. In a sense, this filtration system literally extends the bay into the building. It also allows the visitors to experience, explore and enjoy the natural ecosystem without disrupting the bay ecosystem (AIA, 2016: online).

Consequentially, some unique architectural challenges arose by inviting seawater into the building. Seawater is one of the most corrosive substances known to man, and innovative solutions had to be thought of to make this aquarium sustainable and resilient. Some of these solutions included “the use of epoxy-coated rebar and aluminium ductwork coated on both sides against airborne salts” and “concrete pilings encapsulated within fibreglass sleeves in order to prevent damage from marine-bound organisms” (AIA, 2016: online).
The building temperature control system also makes use of the bay’s water. It is a heat-exchange system that uses the water from the bay for cooling (EHDD, 2016: online).

However, the best technical accomplishment is the fact that the aquarium remained in nearly the same, unchanged condition for over 25 years. In 2010, when the aquarium was re-evaluated, it was found that very minimal repairs had to be done. These repairs were mostly only related to outdated equipment and not the structure or technical aspects of the building. It was also found that the concrete used in the exhibits could withstand an additional 490 years (AIA, 2016: online).



Fig. 149: Tentacle exhibition (Monterey Bay Aquarium, 2022: online).

.6 Conclusion

Given the different points discussed, the Monterey Bay Aquarium is a valuable precedent due to numerous factors. Similarities between the connection to the site, functions, and exhibition spaces and moving away from a traditional aquarium are brought forward. It gives insight on how to approach designing in a natural, oceanic landscape, as this proves to be significantly difficult to do so without intruding. The spatial layout should also be considered seriously when wanting to focus on the type of experience that wants to be conveyed in the building. The technical aspect of pumping water from the surrounding area into the tanks creates a sustainable, healthier manner in which marine life can be kept and displayed. This precedent study, in general, gave valuable insight on how to approach building on and connecting to a site, as well as how the shift between a traditional and non-traditional aquarium can be facilitated.

Under

architect: Snøhetta
location:Lindesnes, Norway
year completed: 2019

Under is a restaurant located on the southernmost rocky shores of Norway and is Europe's first-ever underwater restaurant. This restaurant transports its visitors from the unruly outdoors to the serene underwater world of Norway (Pintos, 2019: online). This concrete monolith structure rests 5 meters below the water's surface and merges with the ecosystem of the coastline. Below the water surface, a 30 cm thick 11x4m acrylic panel frames the underwater view and gives the visitors an insight into what the underwater life is like (Hedmond, 2018: online).

Different materials are used to convey different feelings as one moves through the building. The materials and the colours used act as a metaphor for the journey of descent. The interior becomes darker and more intense as one goes deeper below the water's surface. The interior colours were chosen in order to represent a sunset dropping into the ocean, starting from a neutral colour and changing to sunset pink, intense coral, sea green, and midnight blue in the dining room (Pintos, 2019: online).

There is a bar area on the tension level where the building touches the ocean water and a dining room below the water level. The building also functions as a marine biology research centre during the restaurant's off hours (Pintos, 2019: online).

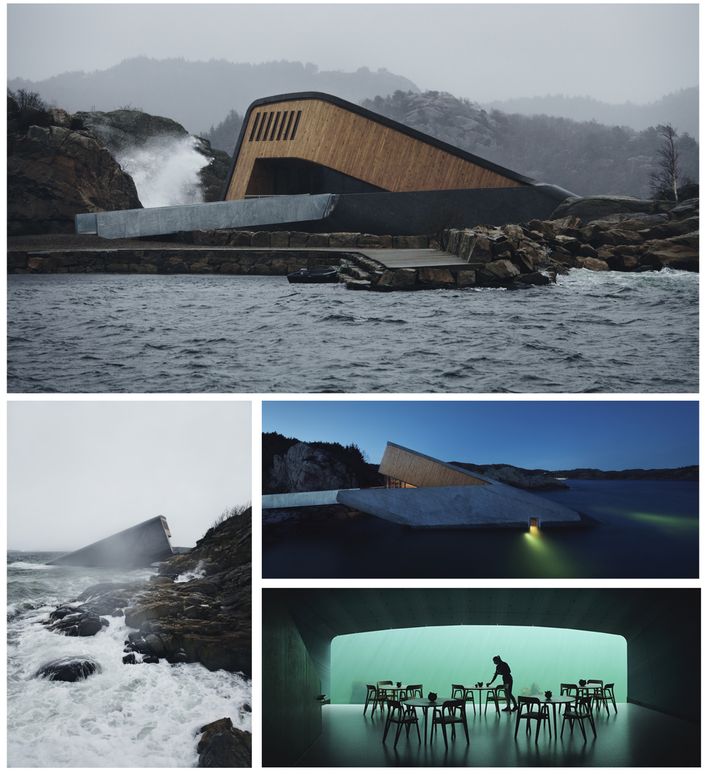


Fig. 150-153: Under, Snohetta (Kvaal, 2019: online).

Construction

This underwater restaurant has numerous construction challenges it faced due to the fact that it is underwater. Different aspects, such as water pressure and saltwater corrosion, had to be taken into account, as well as different construction methods, in order to enable this building to be underwater (CLAD, 2019: 73).

The building sits approximately 5 meters below sea level and has an enormous acrylic panel that offers a view of the underwater environment. To withstand water pressure, reinforced concrete was used to build a shell structure of 0.5 meters thick. The acrylic window panel is approximately 25cm thick. A slightly curved shape and rounded edges allow the building to withstand water pressure and wave impact better. The structure should be able to withstand a one-hundred-year wave occurrence (CLAD, 2019: 73).

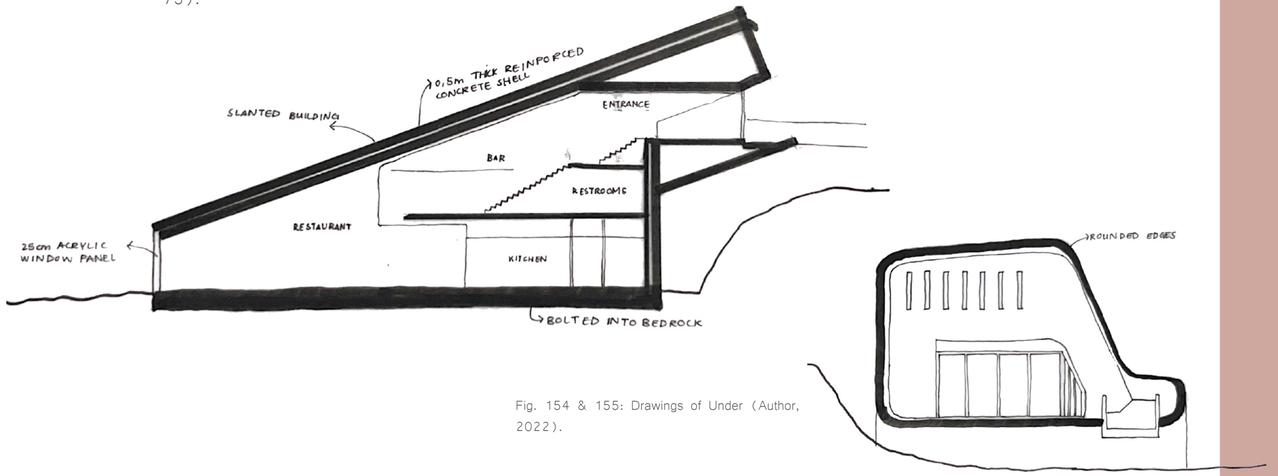


Fig. 154 & 155: Drawings of Under (Author, 2022).

The reinforced concrete shell of the building was constructed off-site on a barge. Once the construction was finished, the shell structure was lowered into the water using steel rods to guide it. The shell on its own floated and was therefore filled with water in order for it to sink. The structure was secured in place on the ocean bottom by bolting it to the bedrock beneath. After securing the structure, the water was drained from the inside, and the interior work began (CLAD, 2019: 73).

The structure was designed to become a part of the marine environment. The exterior concrete shell is coarse and allows mussels to cling onto it. As a result, the building becomes an artificial mussel reef. The mussels assist in purifying the water surrounding the building, attracting more marine life in the process and giving visitors a better view of the underwater world (CLAD, 2019: 73).

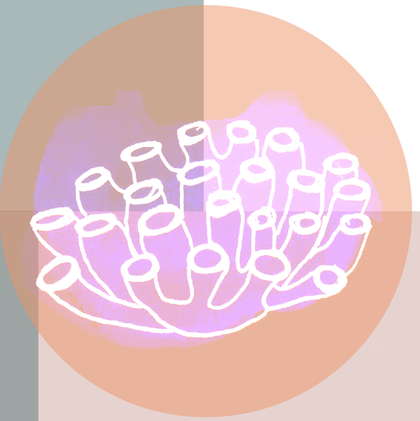


Fig. 156-160: Construction of Under by Snohetta (Amoretti, 2018: online).



Fig. 161-166: Submergion of Under (via Dezeen video, 2018: online).

3.3 concept to form



The three concepts developed for this project, as discussed in 2.3 Concepts, each posed valuable design options that could be taken into consideration.

As the concepts were developed on-site, architectural interventions came to light. This process developed the foundation of the possibility of what the design might become. Each concept had key elements that could be translated into architecture.

concept to form

Concept 01: Interrelatedness
Artificial connection between land & sea

This concept posed the first connection between land and sea by having anchoring points in the land and the sea. The concept of having an architectural intervention function as a metaphorical bridge between land and sea was carried through during the design development process and taken into consideration.

Concept 02: Vivarium
A world within a world

This concept posed the idea of framing the ocean within the ocean and making it accessible to humans. This concept initiated the idea of building within the ocean and reversing the roles: humans in a tank with marine life looking in.

Concept 03: Interaction
The aquarium as a tidal pool

This concept posed the inclusion of interactive aspects that is safe but still allow users to experience the ocean. Interactive aspects may include a regulated tidal pool in the ocean that forms part of the building or rock pools that functions as touch pools.

These key aspects played an integral role in the design development process and were carried throughout the design.

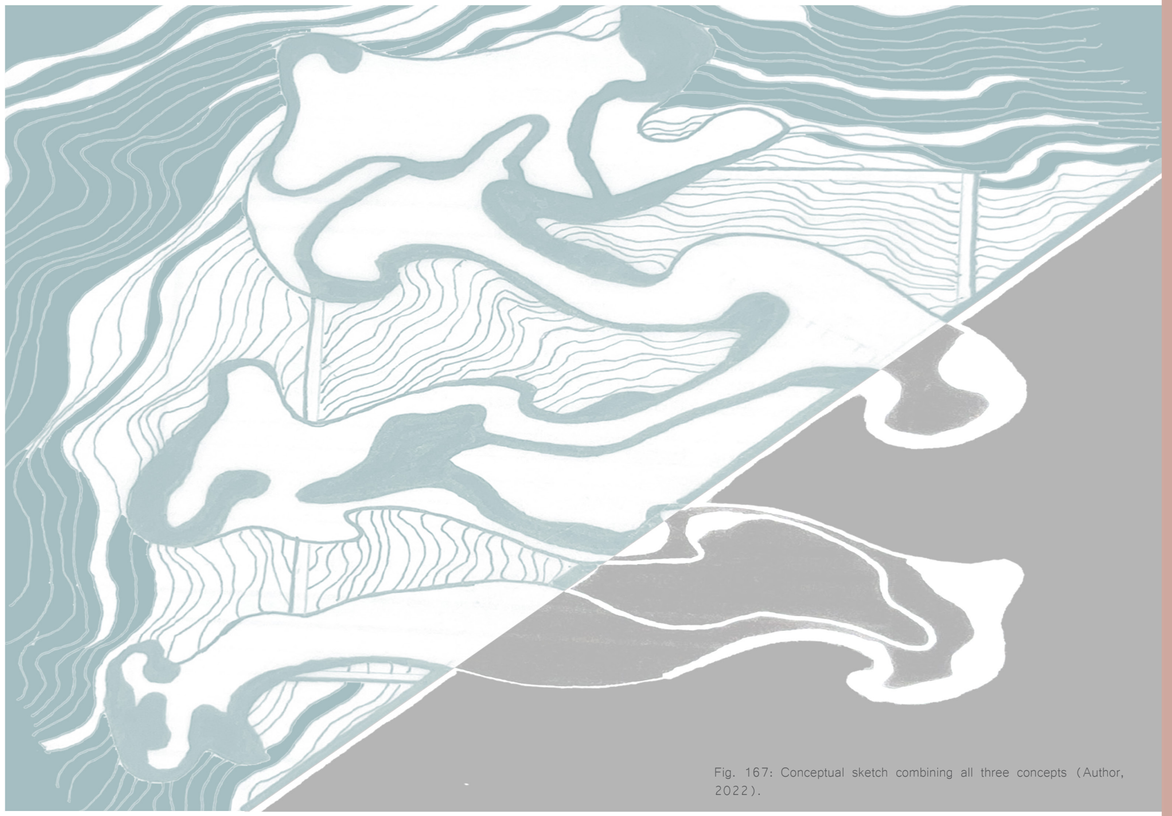
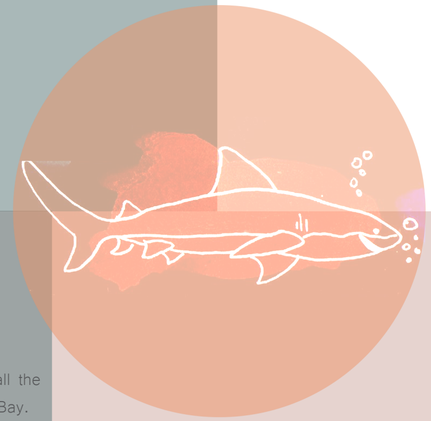


Fig. 167: Conceptual sketch combining all three concepts (Author, 2022).

3.4 accommodation list

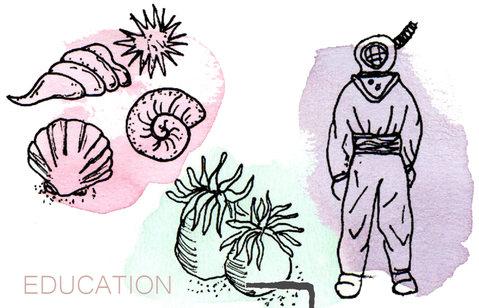


The accommodation list was compiled after extensive research on all the amenities needed for the proposed design at Quay 4 in Mossel Bay.

The accommodation was divided into three main categories, as shown in 1.7 Proposed functions. These categories are: Education, Entertainment, and Interaction.

accommodation list

Category 1: Education

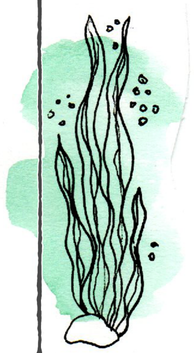


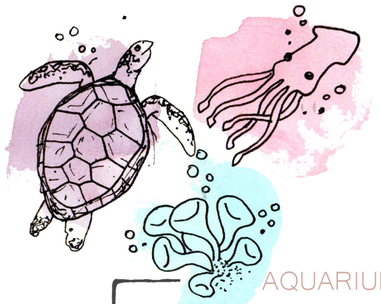
RESEARCH FACILITY

Lab	±55m²
Analytical Lab	±55m²
Coastal Biology & Greenhouse	±50m²
Equipment Room	±36m²
Tank Farm	±42m²
Tray Room	±16m²
Core Seawater Lab	±60m²
Mechanical Room	±112m²
Chemical- & Waste Storage	±8m²
Environmental Rooms	±32m²
Specimen Room	±20m²
Lab Assist	±75m²
Changing Rooms	±35m²
Diving Access	±7m²
Boating Dock	±14m²
Reception	±48m²
Staff Room & Kitchen	±64m²
Boardroom	±28m²
2x Offices	±35m²
Ablution	±40m²

EDUCATION

2x Classrooms	±72m²
Auditorium	±240m²
Reading Room	±144m²





accommodation list

Category 2: Entertainment

AQUARIUM

Exhibitions	±2320m²
Aquarium Technology	±350m²
Souvenir Shop	±195m²
Seating	±60m²
Look-out Platform	±180m²
Entrance / Exit	±72m²
Staff Room	±54m²
2x Offices	±32m²
Ablution	±60m²
Cleaners (Breakroom & Storage)	±40m²

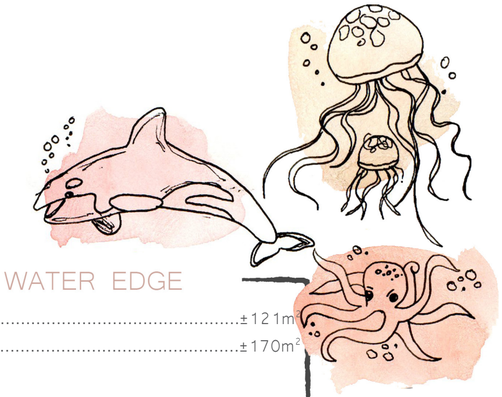
RESTAURANT

Seating Area	±126m²
Kitchen	±56m²
Serving Counter	±9m²
Deliveries	±16m²



accommodation list

Category 3: Interaction

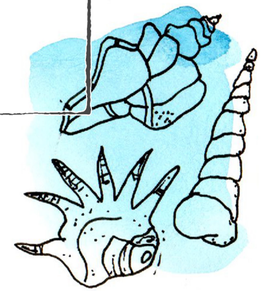


TIDAL POOL

Pool.....±1308m²
Changing Rooms.....±32m²
Access Platform.....±49m²

WATER EDGE

Seating.....±121m²
Walkway.....±170m²



3.5 design development



This section of the document aims to indicate the design process and development of the Marine Research Institute and Aquarium in order to reach the final design. It addresses the thought process behind the design and focuses on certain aspects, such as interaction with marine life and construction in the water. The design synthesis of the theoretical stance and influences is also revealed.

It aims to show the design development from initial decisions made to the final product and all the processes within. It addresses research and investigation done in the previous chapters and aims to resolve challenges brought forth throughout the design process. The technical aspect of the design was also investigated, and different options were looked at. Chapter 3 is an amalgamation of design and technical decisions made.

site investigation

The design development process was influenced by the conceptual phase, the proposed accommodation list, precedent studies, and explorations done (page 126). The final product is an amalgamation of all the influencing factors.

The design process started by choosing the site. The first location chosen, indicated by 1, was located in the middle of the ocean. However, after deliberation and investigation, it was decided that the site would be hard to reach as it would only be accessible by boat, and the construction thereof would be difficult. It also nullified some of the objectives set out, such as bridging the gap between land and sea and diffusing boundaries.

Therefore, the decision to relocate the site was made in order for the site to be more accessible and to reach more objectives. The new location starts on the land and stretches into the sea to create a diffuse boundary, as seen at 2.

Thus, the chosen site was moved to Quay 4 in Mossel Bay. The original idea of designing in the ocean was kept, but instead of building entirely in the ocean, only a portion of the design stretches beyond the quay's boundaries. This site aligns with the set objectives. The new proposed location for the research facility can be seen at 3, and the aquarium at 4, and it is located in the ocean.

By stretching the design from the land and into the ocean, the design can take the visitors on an exploration trip of going from the land into the sea. Thus, the proposed locations of the entrance and cafe can be seen at 5.

1. Old proposed site

2. New proposed site

3. New proposed Research Facility

4. New proposed Aquarium

5. New proposed Restaurant and Entrance

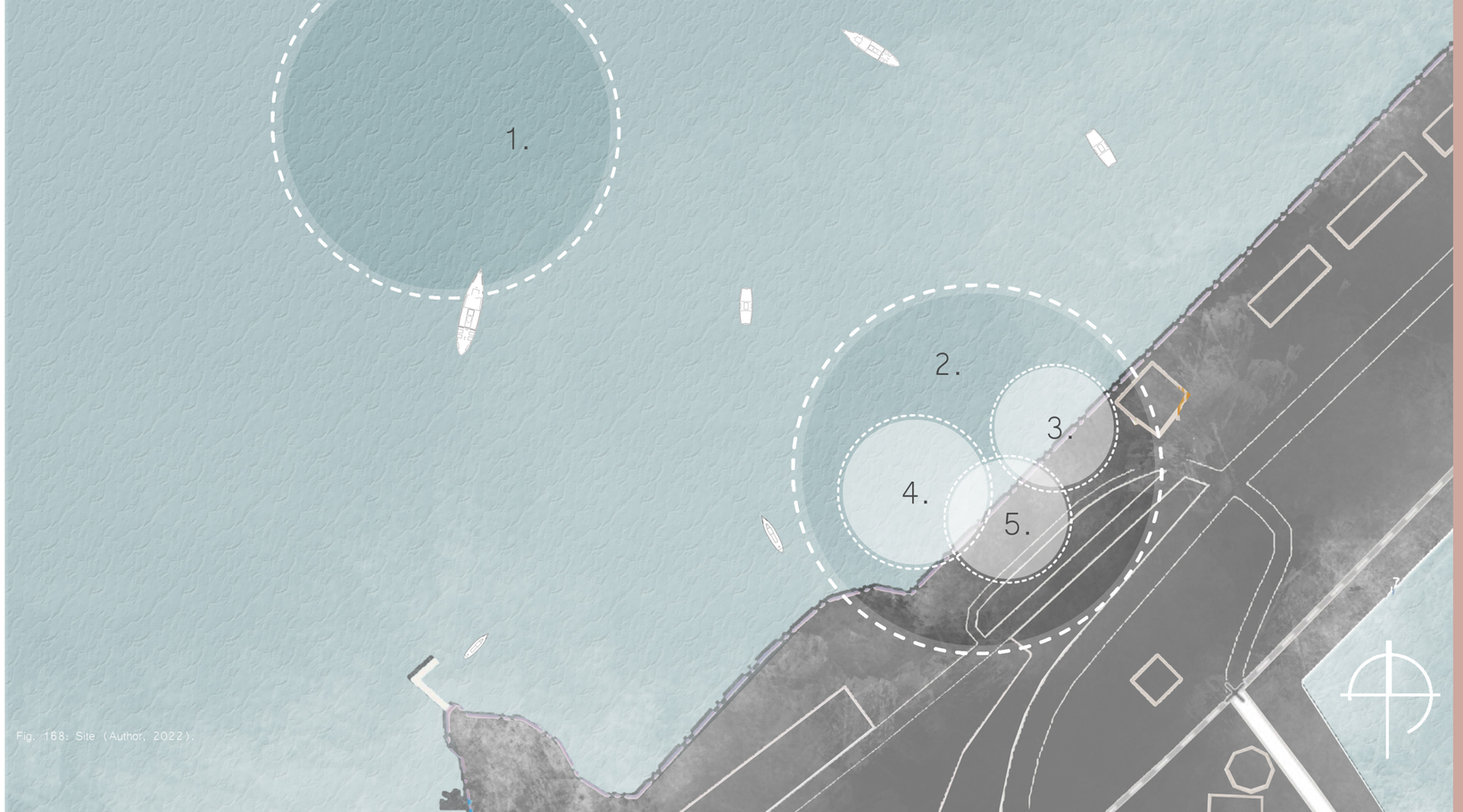


Fig. 168: Site (Author, 2022).

DESIGN APPROACH 1:

concept overlay

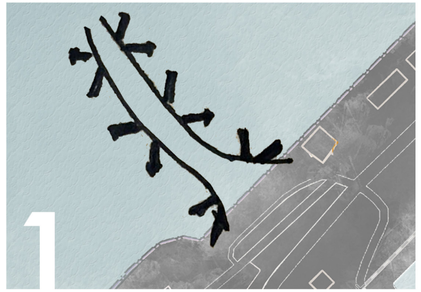
The first approach to the design process was to overlay the concepts – explored in 2.3 Concepts – on the site and see what comes to light. The decision was made to continue with option 2.

The first design was focused on building primarily in the ocean, with only the entrance to the building connected to the land. The design was split into two main hubs: entertainment and educational. The design, as whole, gradually transitioned from public space to private space. The entertainment hub was located directly next to the land and led the visitors on an exploration journey from above the water to below the water. The tidal pool was enclosed in the circle created by the entertainment hub and could be accessed from the roof of the portion below the water.

The educational hub branched out from the entertainment hub, moving from semi-public to semi-private to private, with a reading room and classrooms starting the transitions. At the point farthest in the ocean from the design, the marine research facility was found. A walkway connecting the whole design gave the visitors the opportunity to see what is happening in the research facility without going in.

This design succeeded in creating an enclosed space for the tidal pool, creating an experience of moving from above the water to below the water and splitting the entertainment and education. However, the shape of the design was arbitrary and felt forced in the Mossel Bay area. The design was not influenced in the slightest by the context of Mossel Bay.

Thus, this design was scrapped, and the process started over, carrying some of its successful ideas to the next design.





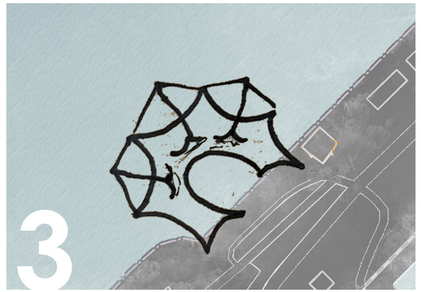
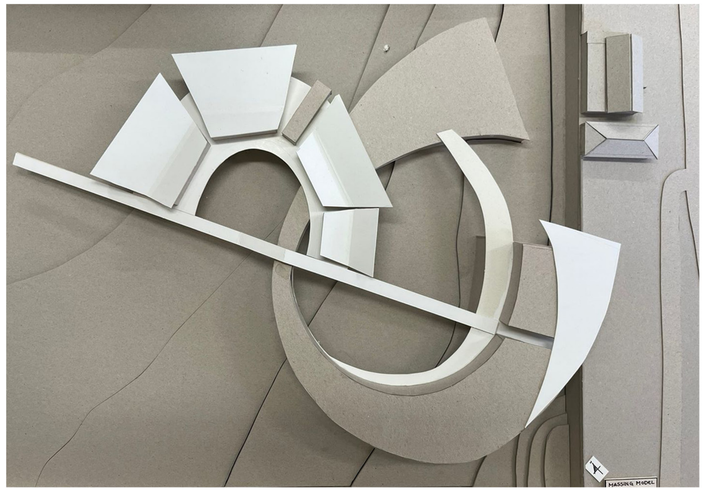
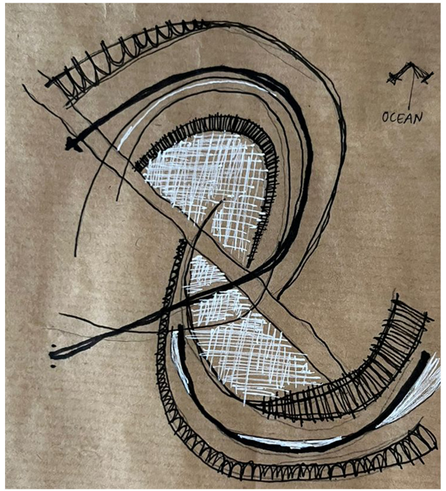
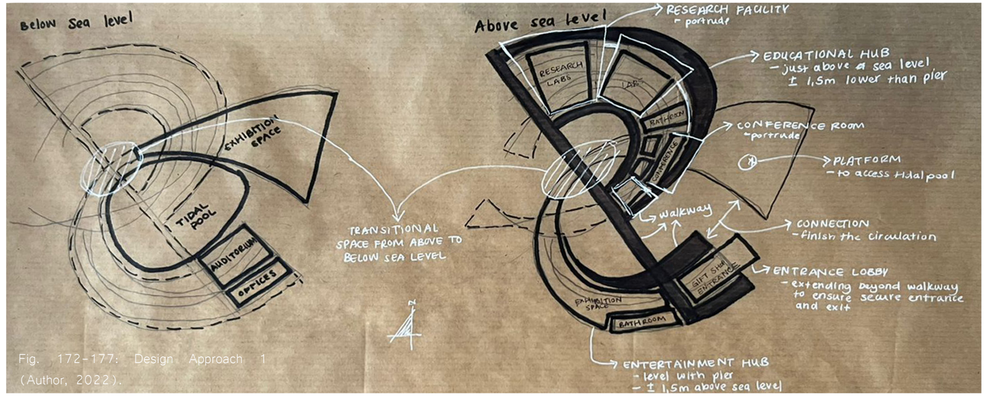


Fig. 169-171: Concept sketches (Author, 2022).









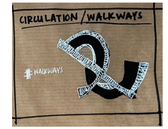




Fig. 172-177: Design Approach 1 (Author, 2022).

DESIGN APPROACH 2:

building from land to ocean

The second design approach was led by seeing the design as an extension of the land and diffusing into the ocean.

The successful ideas from the first design approach were splitting the design into two hubs: entertainment and education, creating an above water and below water experience, and having the building gradually transition from public spaces to private spaces.

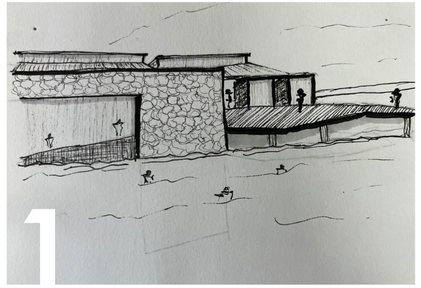
The second design was primarily designed in the ocean, with just the entrance and bathrooms located on the land. The placement of the entertainment hub was again directly next to the land to ensure easy access for visitors and to rule out any confusion about where they had to enter. This design was based more on a traditional aquarium design that included exhibition tanks with fish. The only section that gave an underwater experience was at the circulation cores, where the ramp and stairs showcased the transition. From the aquarium, two legs reached into the ocean, one leading to a look-out point and the tidal pool and the other to the research facility.

The research facility was removed from the aquarium to make it private and separate from the entertainment portion of the design. New additions to the research facility included a boating dock and a diving access point to further allow the marine biologist access to the ocean.

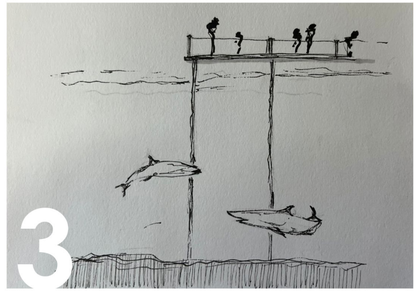
This design succeeded in seeing the design as an extension of the land to promote diffused boundaries. It also brought to light the opportunities to include look-out points into the ocean. The decision to create an accentuated entrance was also successful, combining it with one primary circulation route to ensure that visitors do not get confused. The new features added to the research facility were also important. However, the inclusion of the tidal pool was sloppy, and the interactive aspect of the design felt like an afterthought, even though it is one of the main objectives of the design. The design was not influenced by the surroundings or adapted to the water, and while a diffused boundary was the goal, as a result of this design, the boundary was simply moved a bit more into the ocean.

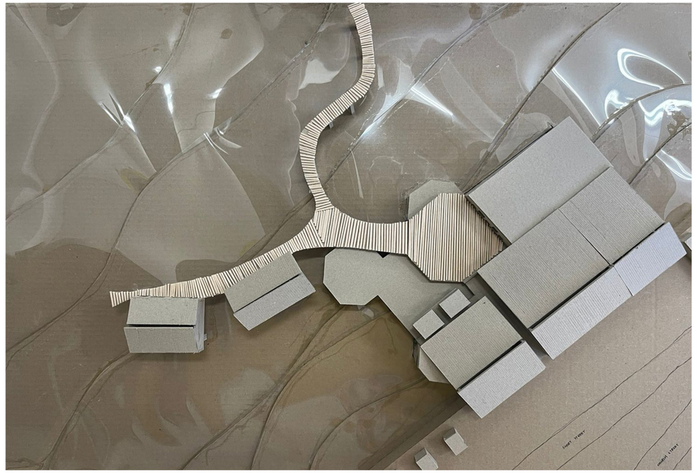
Thus, the design process had to redevelop in a more applicable way. The successful ideas were carried over into the next design. However, some additional explorations were done to create a design that adapted to water. This will be elaborated on.

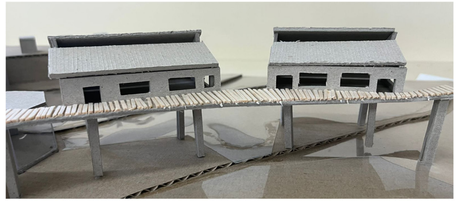
Fig. 178-180: Perspectives Design Approach 2 (Author, 2022).

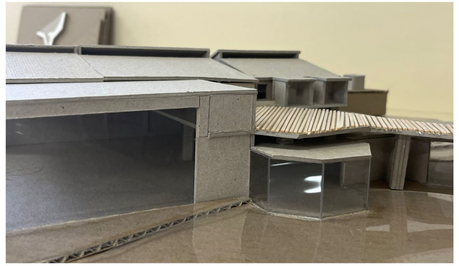


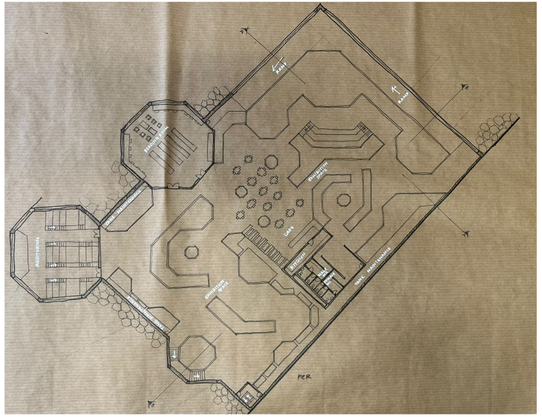












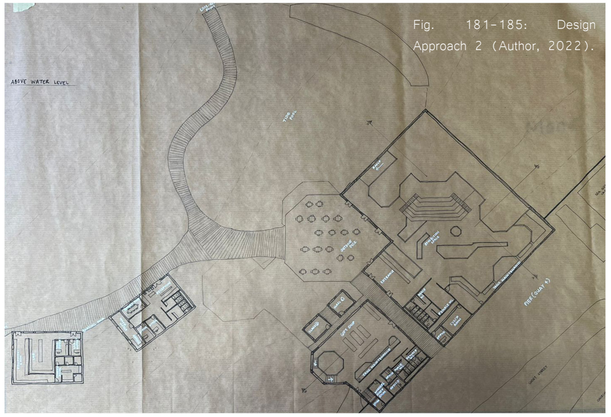


Fig. 181-185: Design Approach 2 (Author, 2022).

DESIGN APPROACH 3:

water explorations

Considering that the ocean plays an integral role in the design, it was essential to find a design that was influenced by water and adapted according to it. The previous design attempts lacked in adapting to the water. Thus, a series of explorations lead the third design approach.

Different sized sheets of Perspex were melted in a relatively unpredictable manner to represent water. These sheets were then placed into water and photographed. The sheets represented the potential design in the water, and the manner in which some parts extruded from the water or dipped below the water could be interpreted in an architectural intervention.

After photographs were taken, they were printed out and sketched over to see what spaces could be formed and how they could be interpreted through architecture.

A series of emotive sketches was the result that showed promise for a possible design or the start of a design approach that was lead and adapted to water. The different sketches were then built into concept models on the site to discern which approach would be the best for this project.

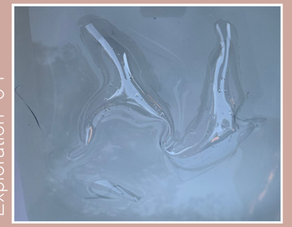
After much deliberation and consideration, exploration three was chosen as the best option.

1 Exploration 01

2 Exploration 02

3 Exploration 03

4 Exploration 04











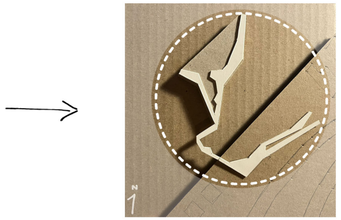





Fig. 186-197:
Exploration (Author, 2022).

DESIGN APPROACH 3 (continue):

exploration to architecture

The chosen exploration, exploration 3, proved to have the best opportunity to lead visitors from the land into the ocean, creating a diffused boundary. It also opened the possibility of splitting the research facility and aquarium - an aspect successful in the previous two design approaches. The exploration also successfully created a space in the water enclosed by the building and perfect for the inclusion of a tidal pool.

The concept model built for exploration three already showed some architectural qualities and possibilities for space allocations. A series of bubble diagrams were drawn in order to find the best possible design solution.

The first bubble diagram represented the initial attempt to allocate functions within the space created by the exploration. It focussed on splitting the design into two hubs: education and entertainment. The entertainment hub contained the aquarium, cafe, souvenir shop, entrance, and all of the needs of the staff. The education hub was essentially only the research facility, boating docks, and diving access. This bubble diagram proved to already be more successful than the previously discussed design approaches.

This diagram succeeded in enabling the research facility to be private with a separate entrance and creating an enclosed tidal pool between the buildings. It also created the effect of leading visitors from the land into the sea, thus creating a diffused boundary. However, the placement of the souvenir shop was in the middle of a plaza where people could enjoy the water edge. The placement of the cleaners' breakroom was also problematic as visitors would have to pass it to reach the aquarium. The water edge was also not explored and included properly. Other placements that were problematic included the auditorium. The entrance to the "entertainment" portion of the design was not emphasized enough and could cause confusion for the visitors. The sizing was too cramped for all the functions. There was also no space included for the aquarium technology, such as pumps and ventilators.

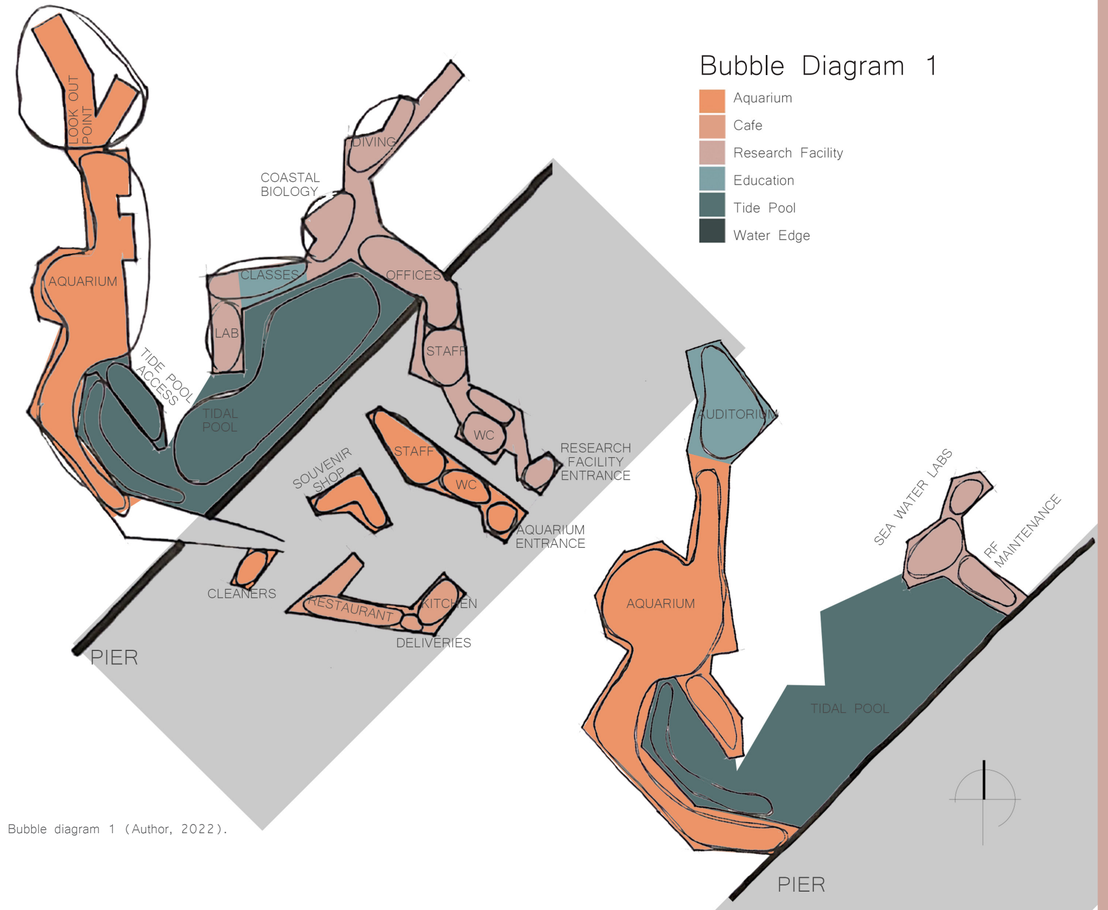


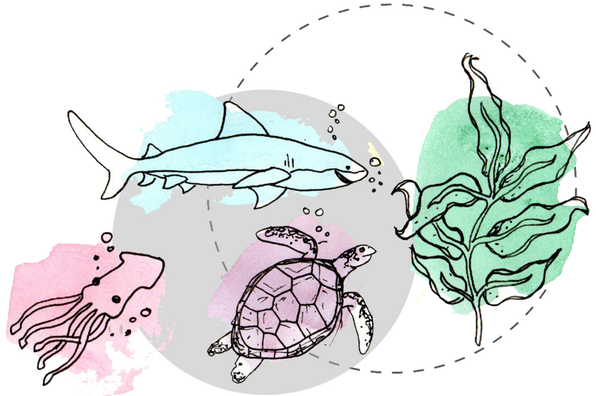
Fig. 198: Bubble diagram 1 (Author, 2022).

DESIGN APPROACH 3 (continue):

exploration to architecture

The second bubble diagram took the lead from the first one, and all successful aspects were included. This diagram explored a new placement for the souvenir shop, creating an open space for visitors to enjoy the water edge and moving the cleaners' breakroom to an area where no visitors would enter. The auditorium was moved to act as a "transitional" space between education and entertainment as it is a space that both hubs can use. The entrance to the research facility was pushed back to accentuate the aquarium entrance. An allocation for aquarium technology was provided, and the original sizes were enlarged to allow more space within the building. The idea of the original two hubs, education, and entertainment, was kept, but a third hub was added: interaction.

This bubble diagram was mainly successful and only lacked technical aspects. Some of the corners created were dead space and unnecessarily created. There was no space for maintenance regarding the aquarium technology, and the souvenir shop did not have an office or storage space.



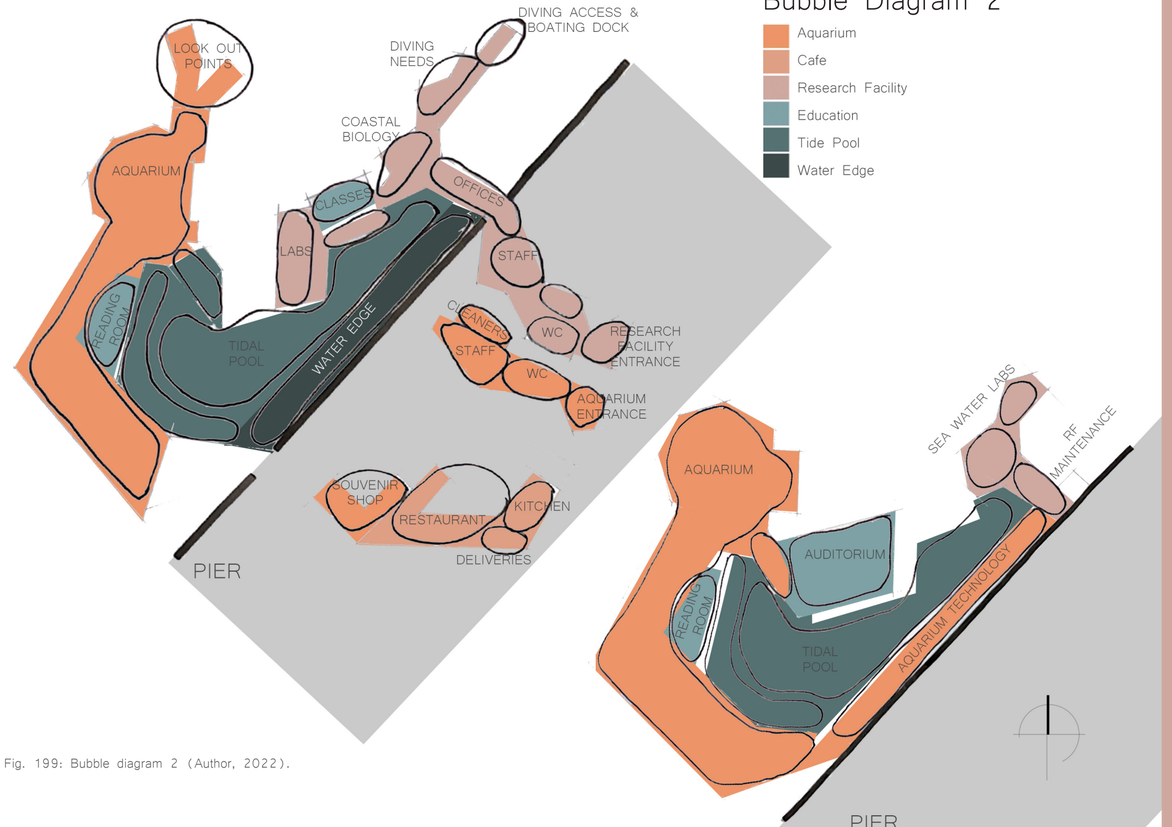


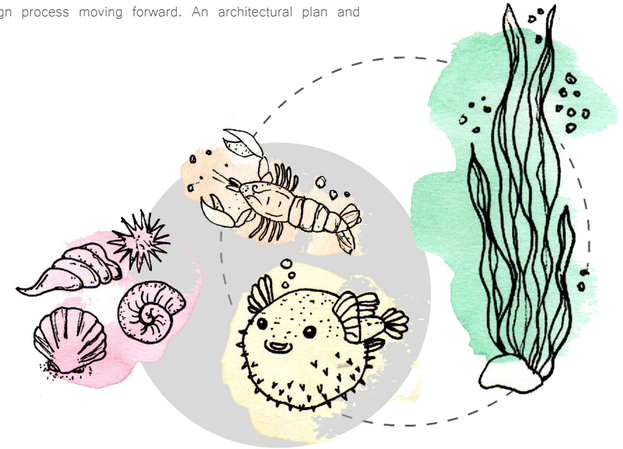
Fig. 199: Bubble diagram 2 (Author, 2022).

DESIGN APPROACH 3 (continue):

exploration to architecture

The final bubble diagram focussed on improving the previous diagram to possibly the best design solution. This diagram concentrated on smoothing out the corners in an attempt to avoid awkward spaces. Access for maintenance to the aquarium technology was added with a separate entrance road for delivery vehicles. An office and storage space for the souvenir shop and the delivery road to the kitchen was extended to reach the souvenir shop. At the entrance and staff area for the aquarium, the staff area and bathrooms switched places to ensure that the staff had easy access to the offices and staff room. A decision was made to move all the research facility functions above the water to allow circulation in the tidal pool.

This diagram was the final exploration and was used in the design process moving forward. An architectural plan and design were generated from this diagram.



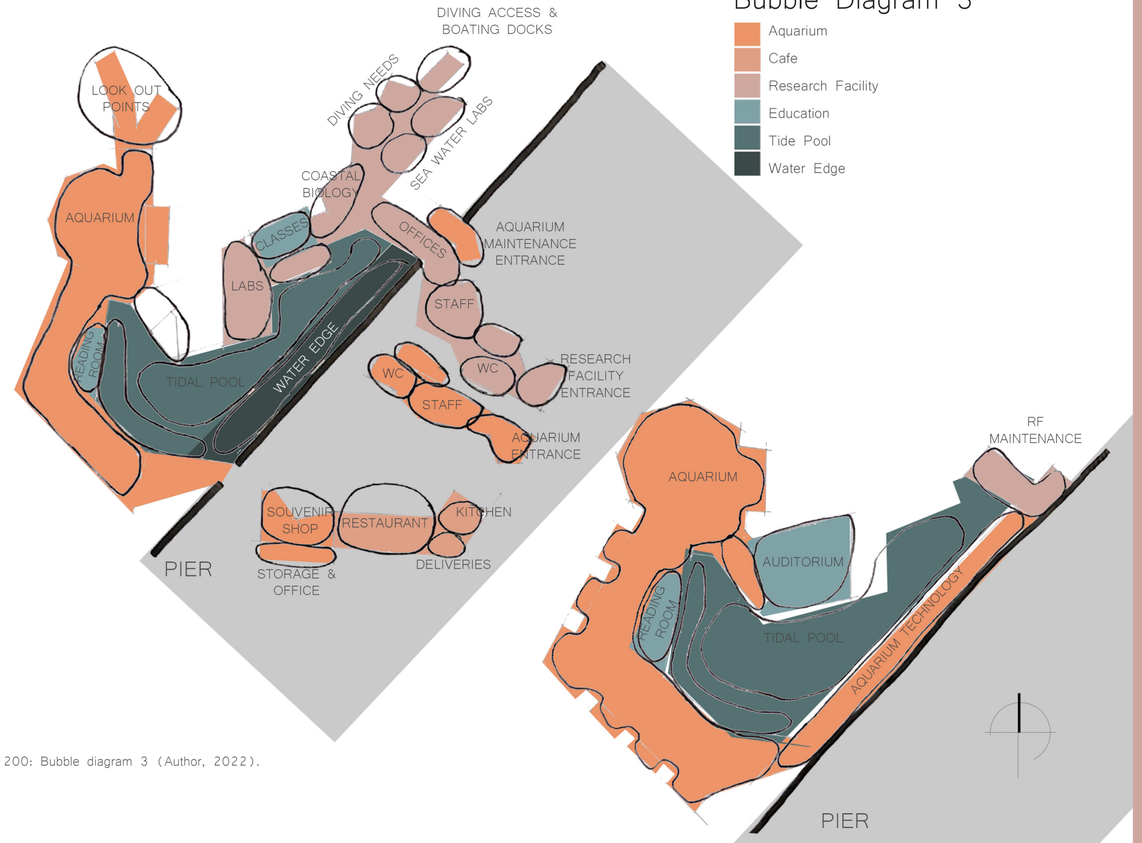


Fig. 200: Bubble diagram 3 (Author, 2022).

DESIGN APPROACH 3 (continue):

moving to a final design

As the design process continued from the bubble diagrams explored, the investigation was done on different construction methods of the design and how the design would connect the land and the sea. This is where the theoretical concepts researched played an integral role, and the design took the lead from the theoretical chapter.

This three-dimensional design process took inspiration from the numerous rockpools and rock outcroppings in Mossel Bay and the surrounding area. Considering that the design is in the ocean, it was important to design it in a way that does not seem out of place. When designing the three-dimensional aspect of the building, the main idea was to consider the rockpools and analyse how they protrude from the water and sit in the water.

Materiality was also strongly considered during this process. It had to be taken into consideration that the part of the design in the ocean would be subject to strong water tides, saltwater, and water pressure. The connection of the building to the bottom of the ocean proved to be an important aspect to consider. It is evident that this connection must be able to withstand significant forces in an ever-changing environment. However, the technical synthesis of the design will be further explored in Chapter 4.

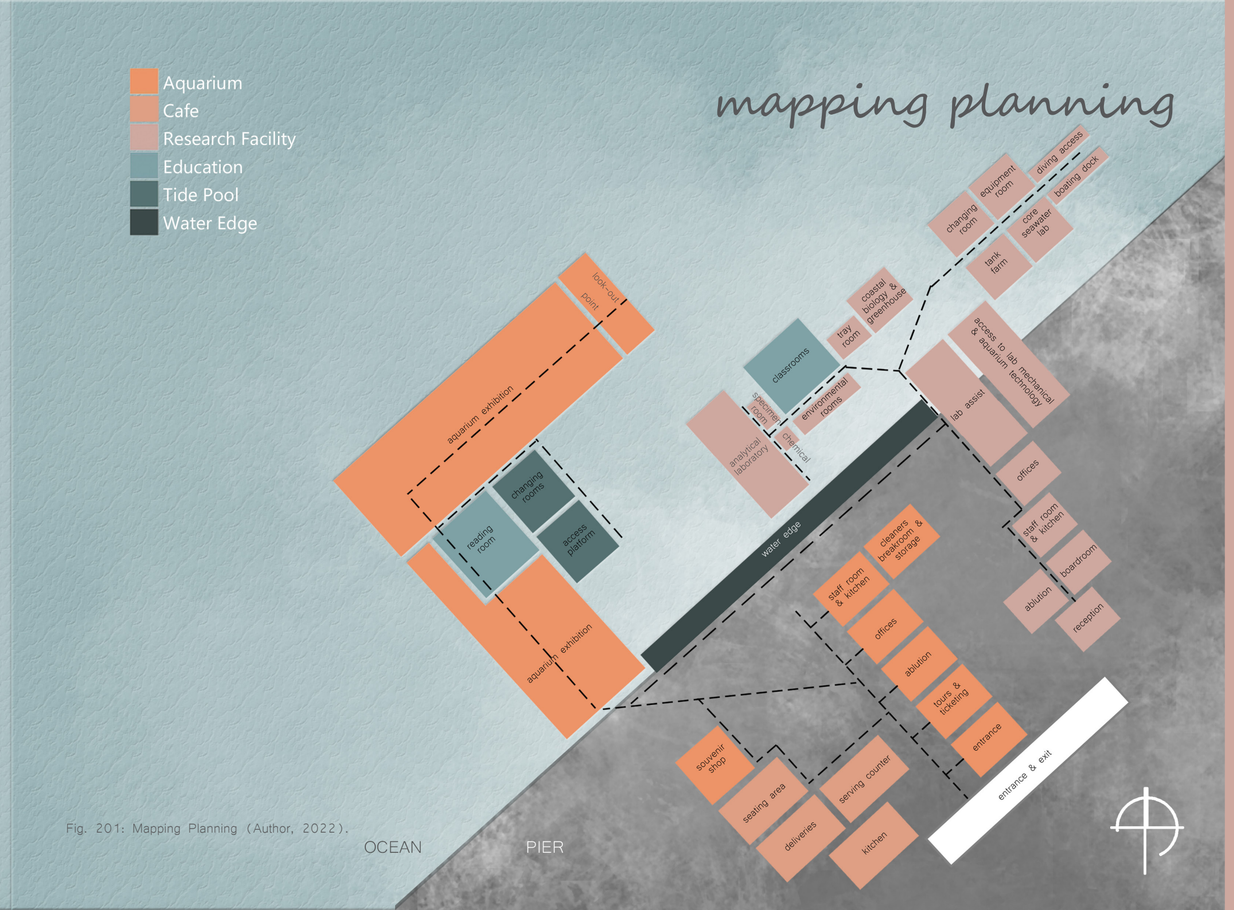
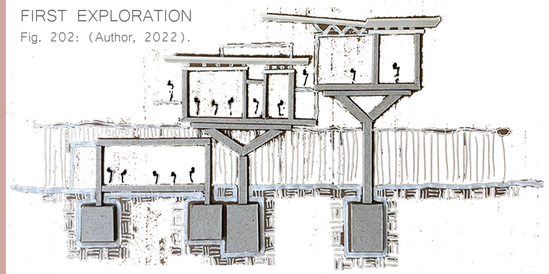


Fig. 201: Mapping Planning (Author, 2022).

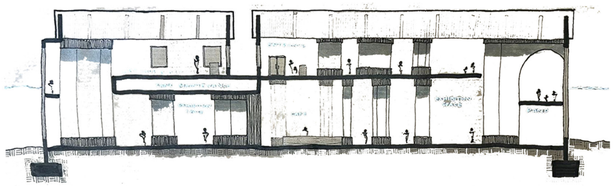
FIRST EXPLORATION

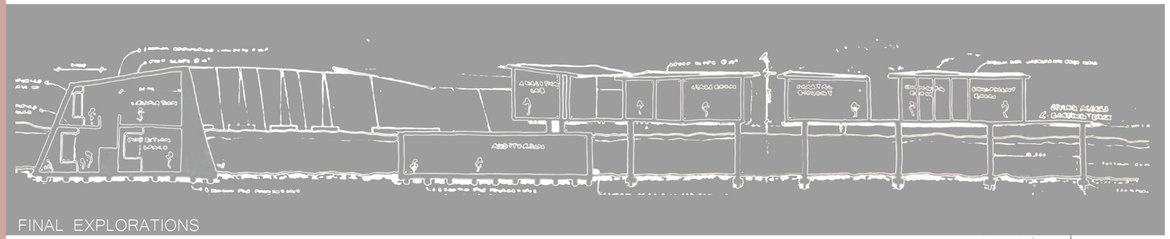
Fig. 202: (Author, 2022).



SECOND EXPLORATION

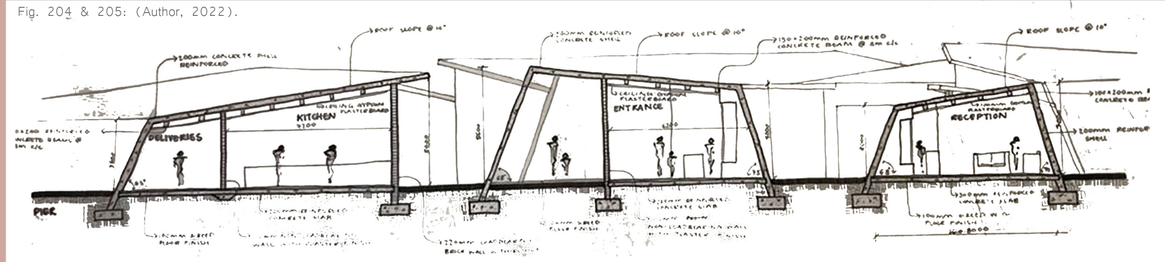
Fig. 203: (Author, 2022).





FINAL EXPLORATIONS

Fig. 204 & 205: (Author, 2022).





Here the design development of the walls of the design can be seen. The process started with simple 90-degree walls that rested on a concrete slab. However, an investigation into the ocean's tides, water pressure, and the possibility of waves proved that 90-degree walls would not be able to withstand the force for a long time. Thus the longevity of the project was in question.

Investigation into different methods to ensure the longevity of the building was conducted. These methods included using thicker walls, including dolos to break waves, slanted walls, finishing methods, and avoiding too large spans of a flat surface (specifically relating to the walls).

Thus, it was decided to include the use of thicker and slanted walls, as well as indents in the wall where the force of the water was most prominent. While the inclusion of dolos would be considered the most effective, it did not add anything to the design and could be seen as sloppy and unsophisticated. The slanted walls also gave the impression of the building rising out of the sea, much like the rocks in the surrounding area.

On the image, it can be seen that the walls were slanted at different degrees, ranging from 60 degrees to 75 degrees. The walls were also thickened to 500mm, or half a meter, to prolong the lifespan of the building. On the southwestern side of the building, where the largest span of flat wall surface was found, indents were made into the building to break the water pressure down.

In an attempt to include biophilic architecture into the design, the concrete will be left with a rough finish. This would allow mussels and algae to cling onto the design and become an artificial mussel reef.

Fig. 206: Render exploration of walls (Author, 2022).

The roof design of the building was led by the concept of rocks protruding from the ocean. The base of the roof was slanted at 10 degrees in different directions to mimic a rock. Furthermore, the triangulation of varying roof sections mimics the 'unpredictability' of rock outcrops. The roof is also left with a rough concrete finish for mussels, algae, and other organisms to cling onto.

This aspect added to the design will encourage the look and feel of a rock emerging from the ocean and allow the building to have a more natural appearance.

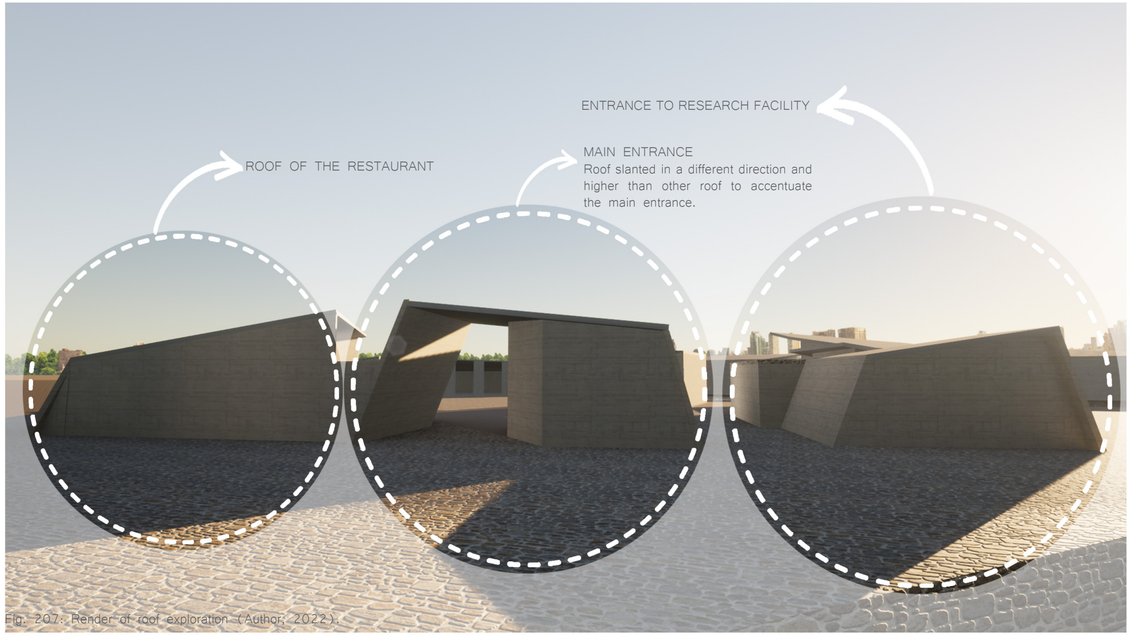


Fig. 207: Render of roof exploration (Author, 2022).

RENDER EXPLORATIONS OF ROOF SHELL STRUCTURE





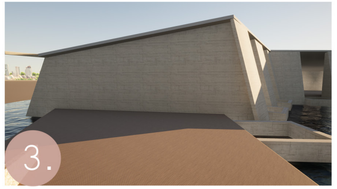




Fig. 208-211: Render explorations of roof (Author, 2022).

The roof structure was explored in collaboration with the slanted walls in order to create a shell that envelopes the building partially or completely.

The render explorations done, shows the concrete shells in different parts of the design.

1: View from the Research Facility to the water edge, illustarting the slanted concrete wall connecting to the roof structure.

2: View from the Aquarium entrance showing the slanted concrete wall connecting to the roof structure, emphasizing the shell effect a visitor would experience when entering the space.

3: View of the entrance to the Aquarium exhibition space illustrating the concrete shell that consists of two slanted walls and the roof structure. This portion of the design is situated in the water and starts to illustrate the idea of rocks protruding from the water.

4: View of the Aquarium exhibition space as seen from the lookout points.

The sectional explorations done aim to illustarte the connection between the slante walls and the roof structure, and illustartes the shell that will envelope the building.

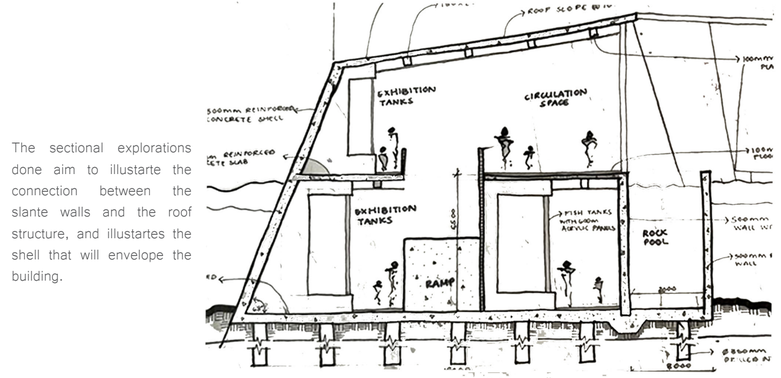




Fig. 212 & 213: Sectional explorations of the concrete shell structure (Author, 2022).

In this section, different methods in which to design the research facility were explored. This portion of the design is located above the water and follows a pier-like structure. Different explorations were done on the supporting structure to find the best possible solution for this portion of the design. The sketches indicated the different explorations done and included elements such as in which directions the supporting beams should be laid, the span between the columns, the designed columns, and the different types of structure needed to support the design.

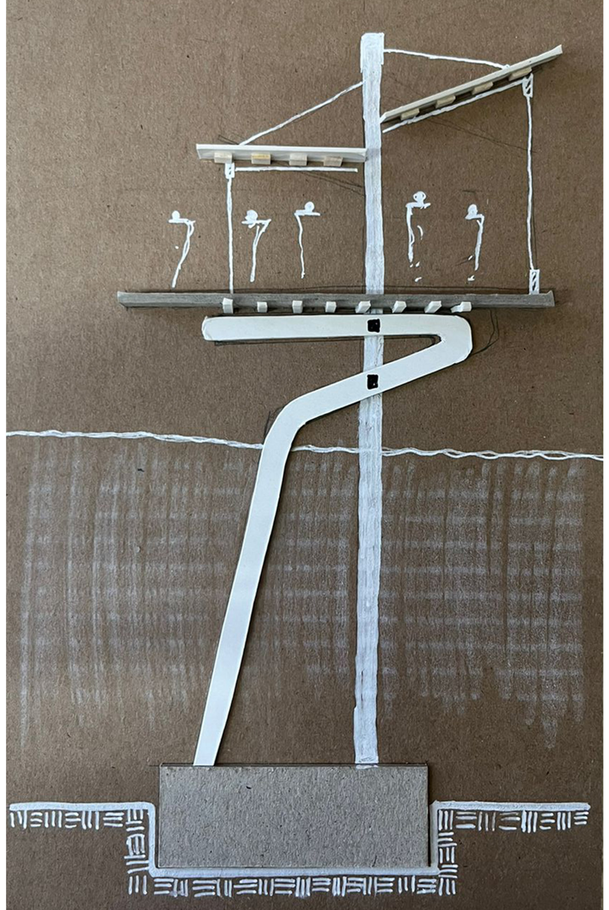
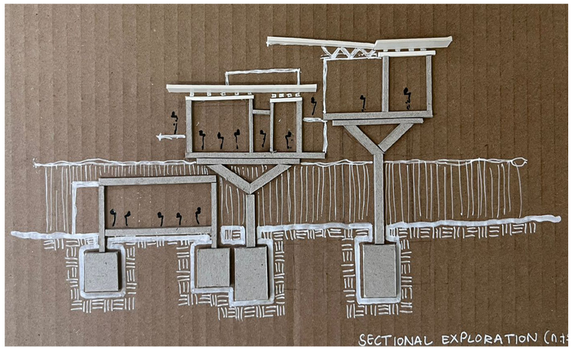
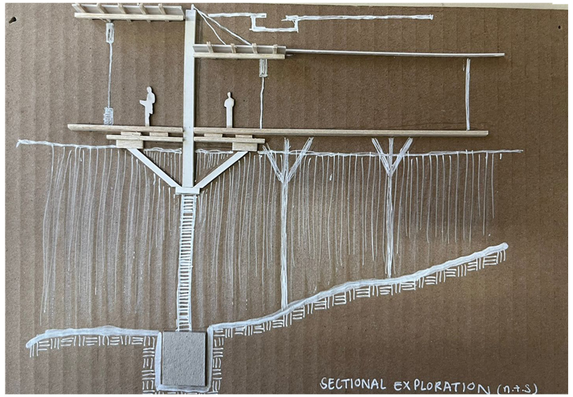
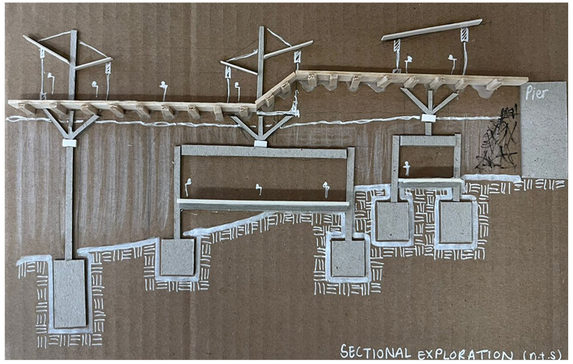


Fig. 214: Initial sectional model investigating different column structures (Author, 2022).







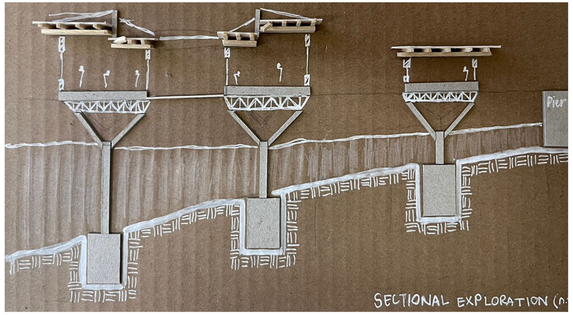
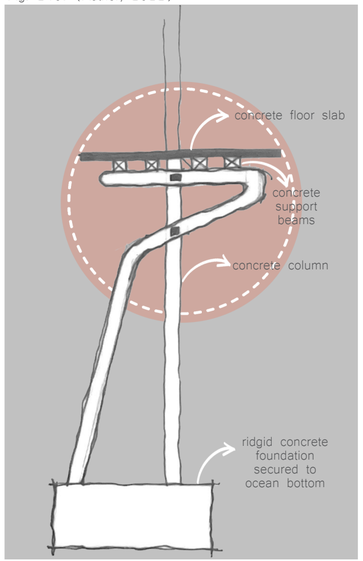


Fig. 215-218: Initial sectional explorations (Author, 2022).

PIER INVESTIGATIONS

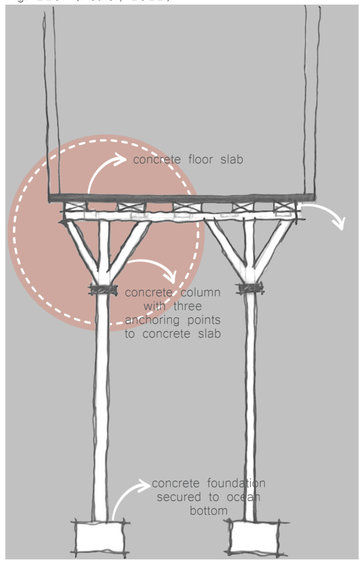
FIRST EXPLORATION

Fig. 219: (Author, 2022)



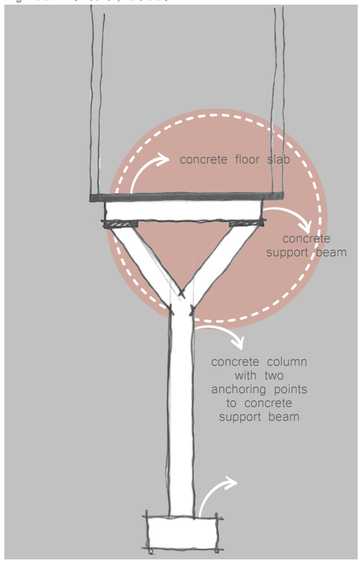
SECOND EXPLORATION

Fig. 220: (Author, 2022)



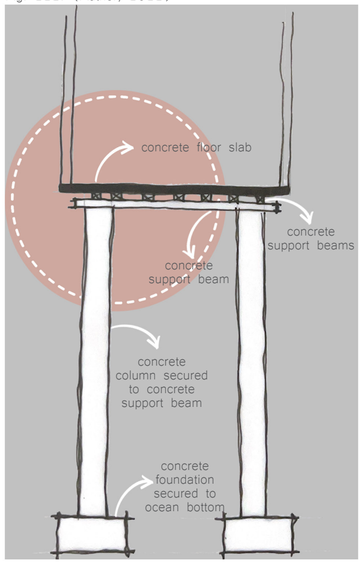
THIRD EXPLORATION

Fig. 221: (Author, 2022)



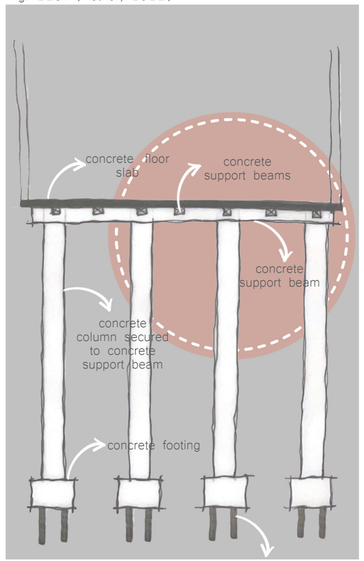
FOURTH EXPLORATION

Fig. 222: (Author, 2022)



FIFTH EXPLORATION

Fig. 223: (Author, 2022)



FINAL EXPLORATION

Fig. 224: (Author, 2022)

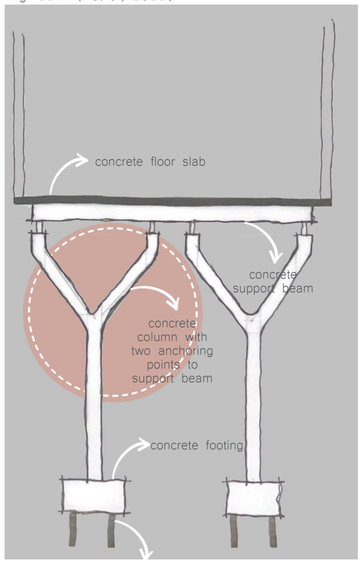


Fig. xx-xx: Pier explorations (Author).

Overall, the design development was an exploration process to understand the different aspects of the design and the connection between them, especially between land and sea. It brought to light all the aspects that should be considered moving into the final design and highlighted the importance of the theoretical chapter. The accommodation list, ocean, and longevity of the design were taken into consideration for the final design proposal, which will be showcased in the following section 3.6 The Final Design.

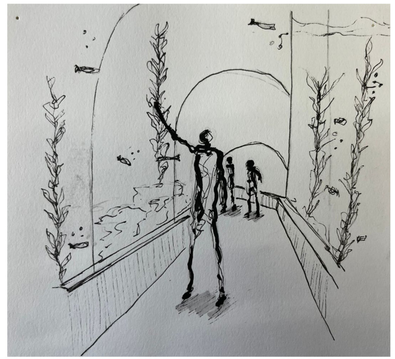
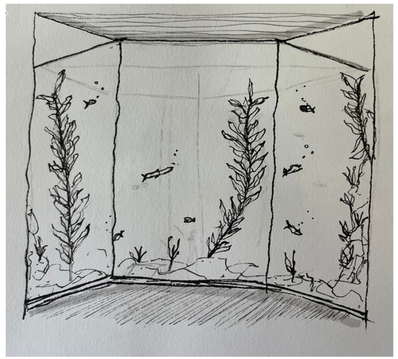
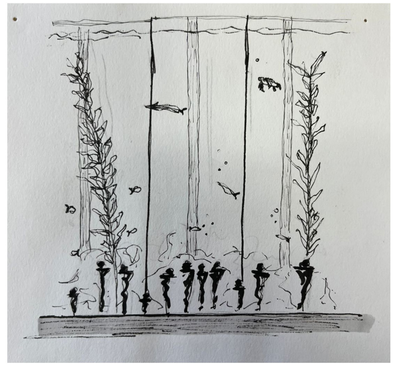
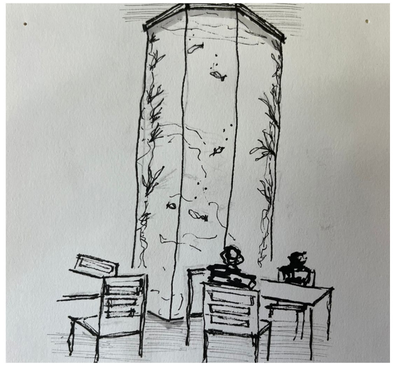
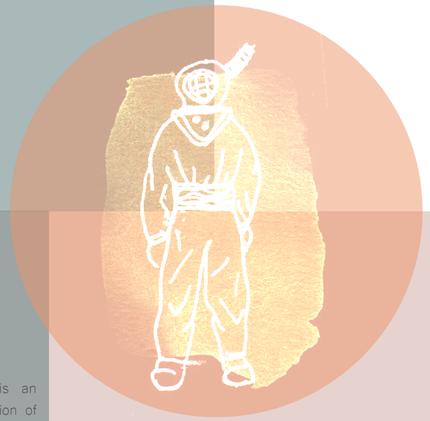





Fig. 225-228: Perspective explorations of interiors (Author, 2022).

3.6 the final design



This portion of the document showcases the final design proposal. It is an amalgamation of all discussed topics in the book thus far. The technical section of this document follows (Chapter 4).

SITE PLAN

This plan indicates the new proposed functions on the site on Quay 4, in Mossel Bay.

1. Proposed Research Facility
2. Proposed Aquarium
3. Entrance
4. Proposed Restaurant
5. Outdoor Area
6. Water Edge
7. Tidal Pool

0 5 10 15 20 25m

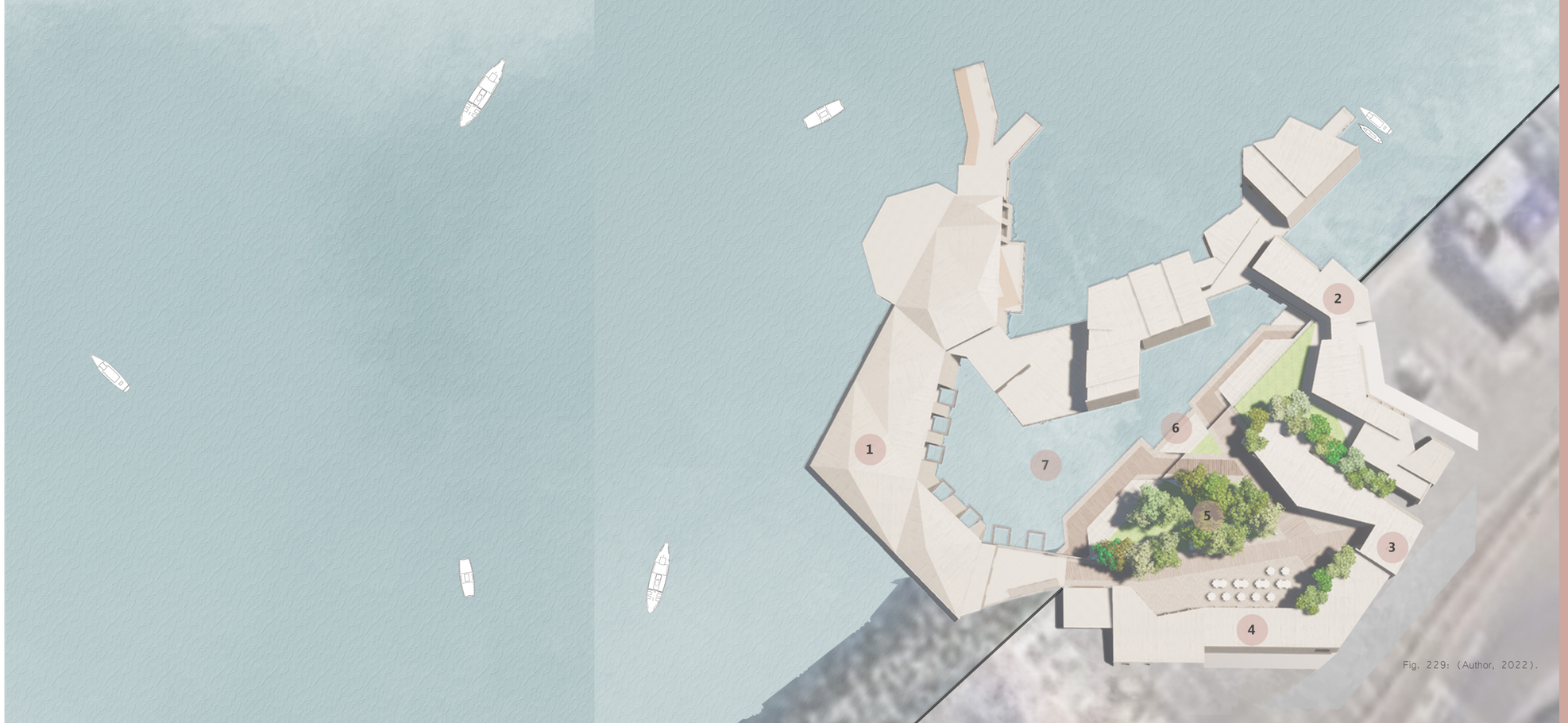


Fig. 229: (Author, 2022).

GROUND FLOOR PLAN

1. Aquarium Exhibition Space
2. Multi-media Room
3. Wind Portal & Checkpoint
4. Changing Rooms
5. Souvenir Shop
6. Office
7. Storage
8. Restaurant
9. Deliveries
10. Kitchen
11. Cold Storage
12. Dry Storage
13. Outdoor Restaurant Seating
14. Aquarium Reception
15. Ticketing & Tours
16. Staff room & Kitchenette
17. Office
18. Disabled WC
19. Bathrooms
20. Cleaners Breakroom & Storage
21. Research Facility Reception
22. Bathrooms
23. Boardroom
24. Maintenance Access
25. Lab Assist
26. Core Sea Water Lab
27. Tank Farm
28. Change Rooms
29. Equipment Room
30. Diving Access
31. Boating Docks
32. Coastal Biology
33. Tray Room
34. Environmental Rooms
35. Chemical Storage
36. Classroom
37. Analystical Lab
68. Wind Portal
39. Lookout Point
40. Sharks of Mossel Bay Exhibition
41. Tidal Pool

0 5 10 15 20 25m



Fig. 230: (Author, 2022).

BELOW WATER PLAN

1. Aquarium Exhibition Space
2. Multi-media Room
3. Aquarium Technology
4. Research Facility Maintenance
5. Sharks of Mossel Bay Exhibition
6. Aquarium

0 5 10 15 20 25m

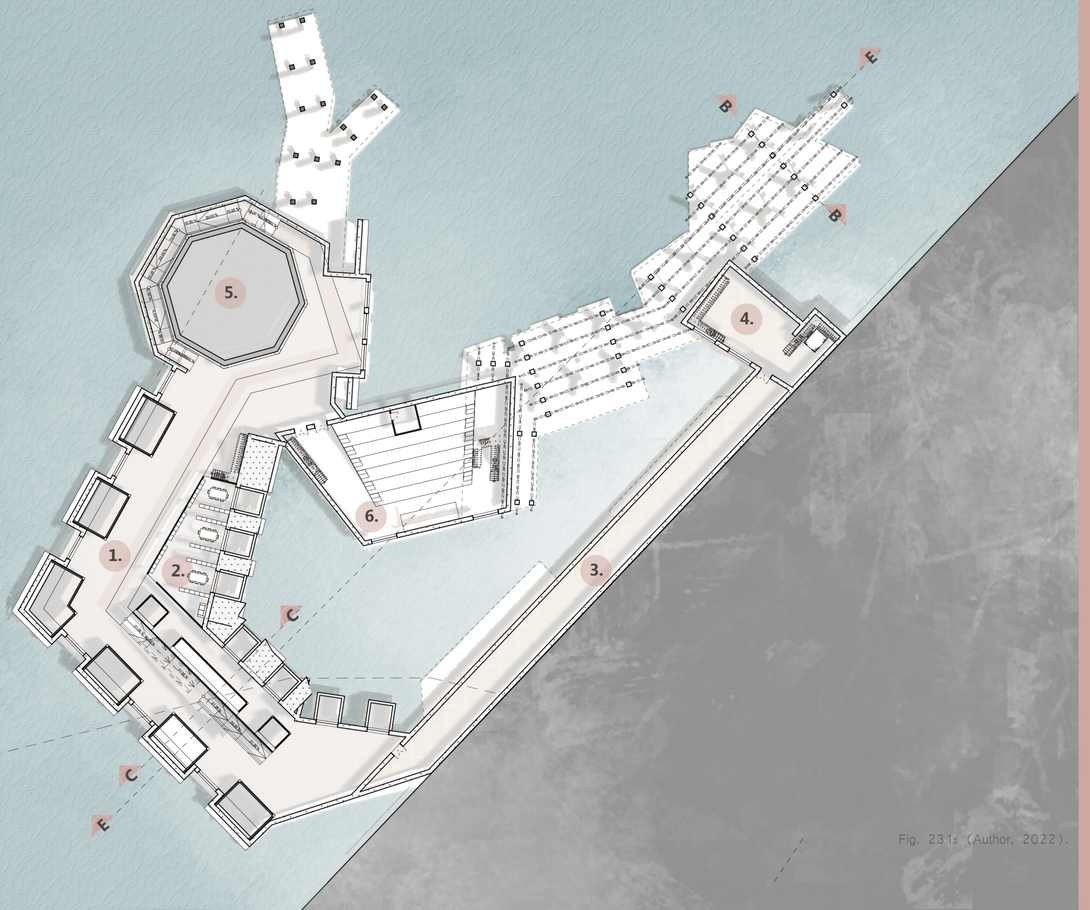


Fig. 231: (Author, 2022).

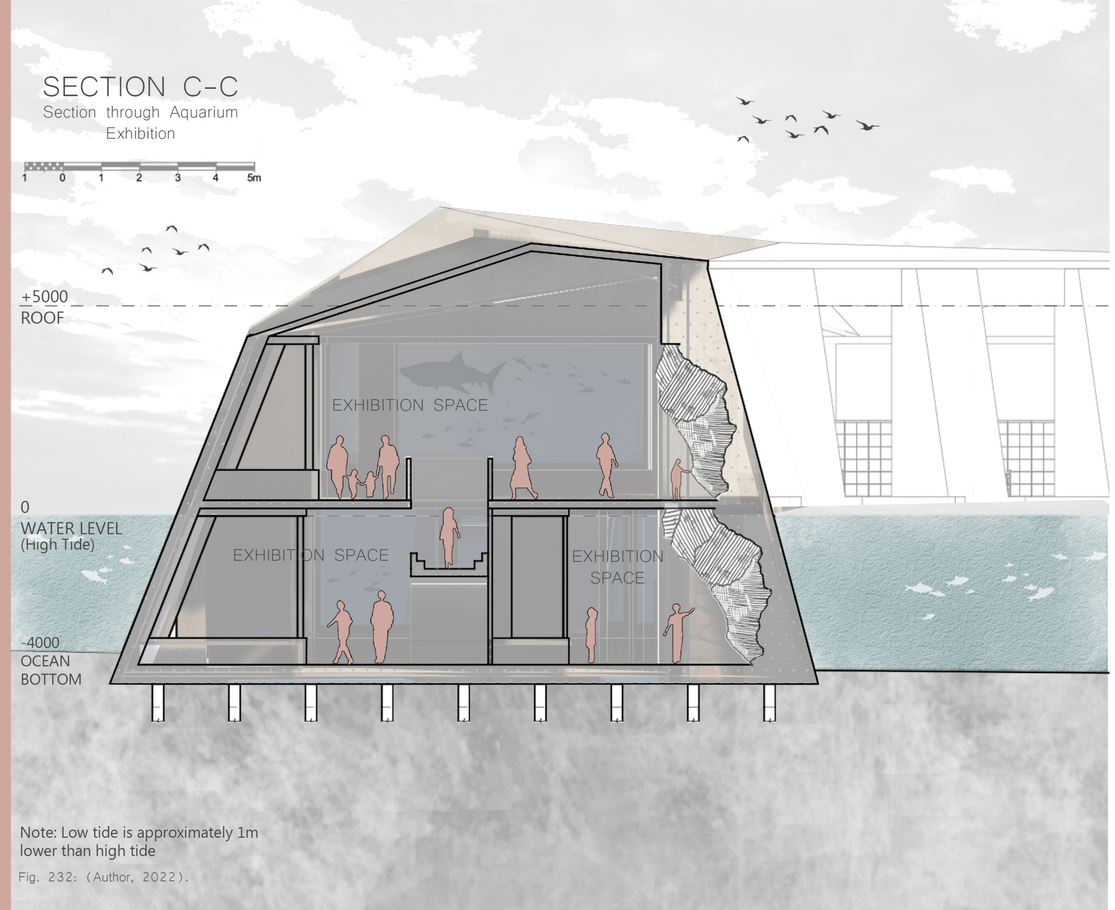


Fig. 232: (Author, 2022).

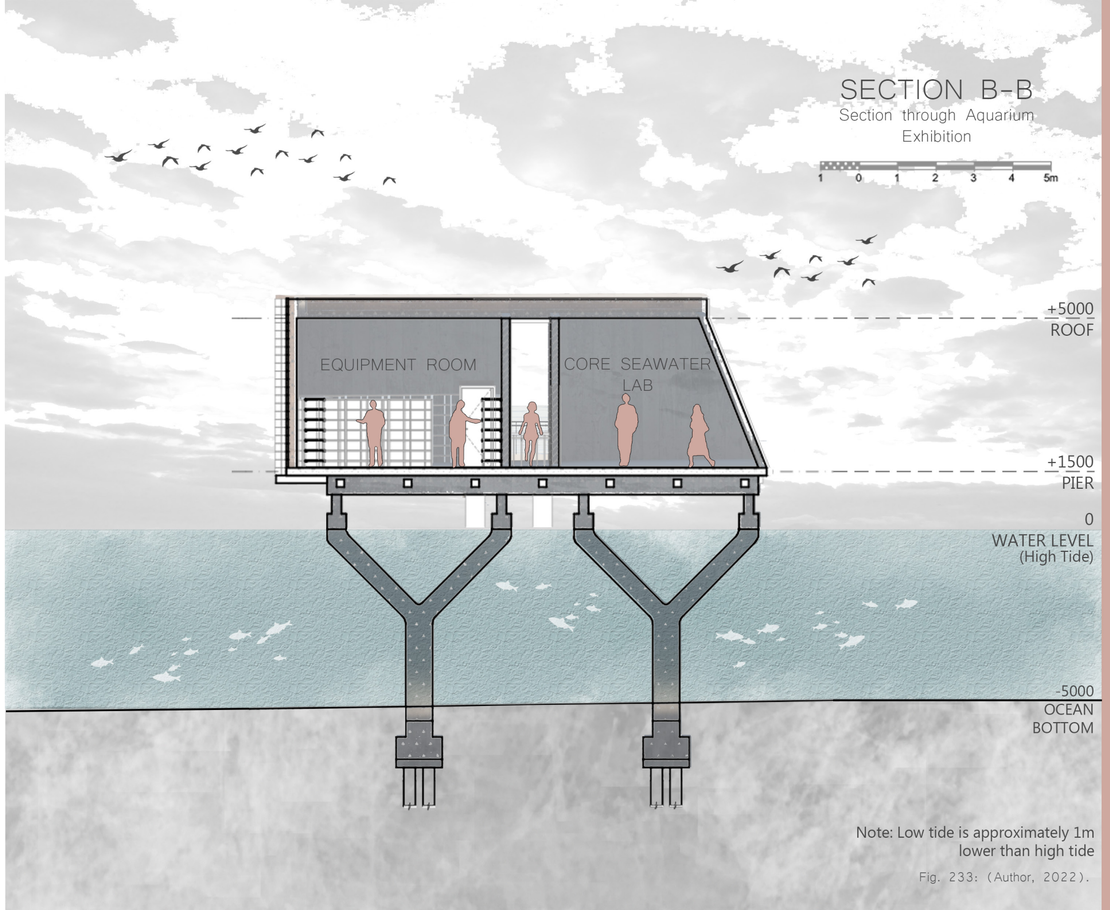


Fig. 233: (Author, 2022).

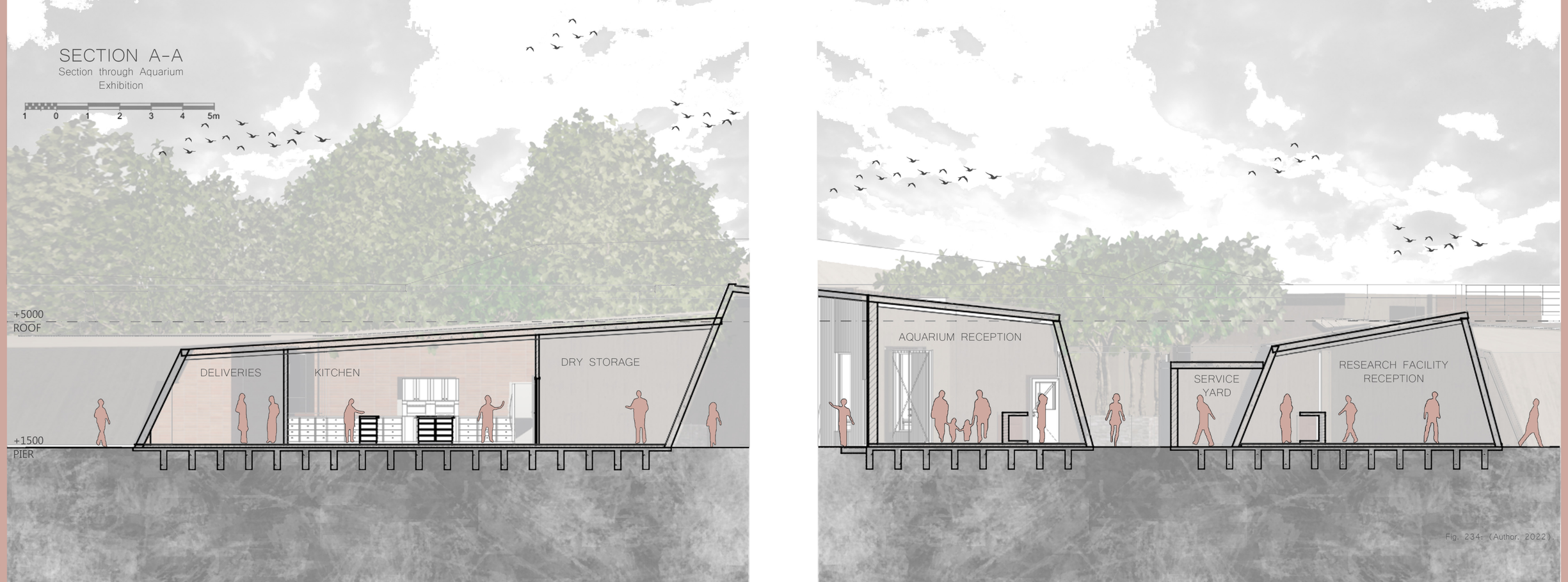


Fig. 234: (Author, 2022).

SOUTH EASTERN ELEVATION

Elevation of the entrance to the Aquarium & Research Facility





Fig. 235: (Author, 2022).

NORTH WESTERN ELEVATION

Elevation of the Research Facility as seen from the sea

Fig. 236: (Author, 2022).



ENTRANCE

Perspective from Aquarium Entrance

Fig. 237: (Author, 2022).



TIDE POOL

Perspective of tide pool and Aquarium

Fig. 238: (Author, 2022).

AQUARIUM & RESEARCH FACILITY

Perspective from the ocean



Fig. 239: (Author, 2022).

Fig. 240: (Author, 2022).

OVERVIEW

Perspective of Marine Research Facility & Aquarium

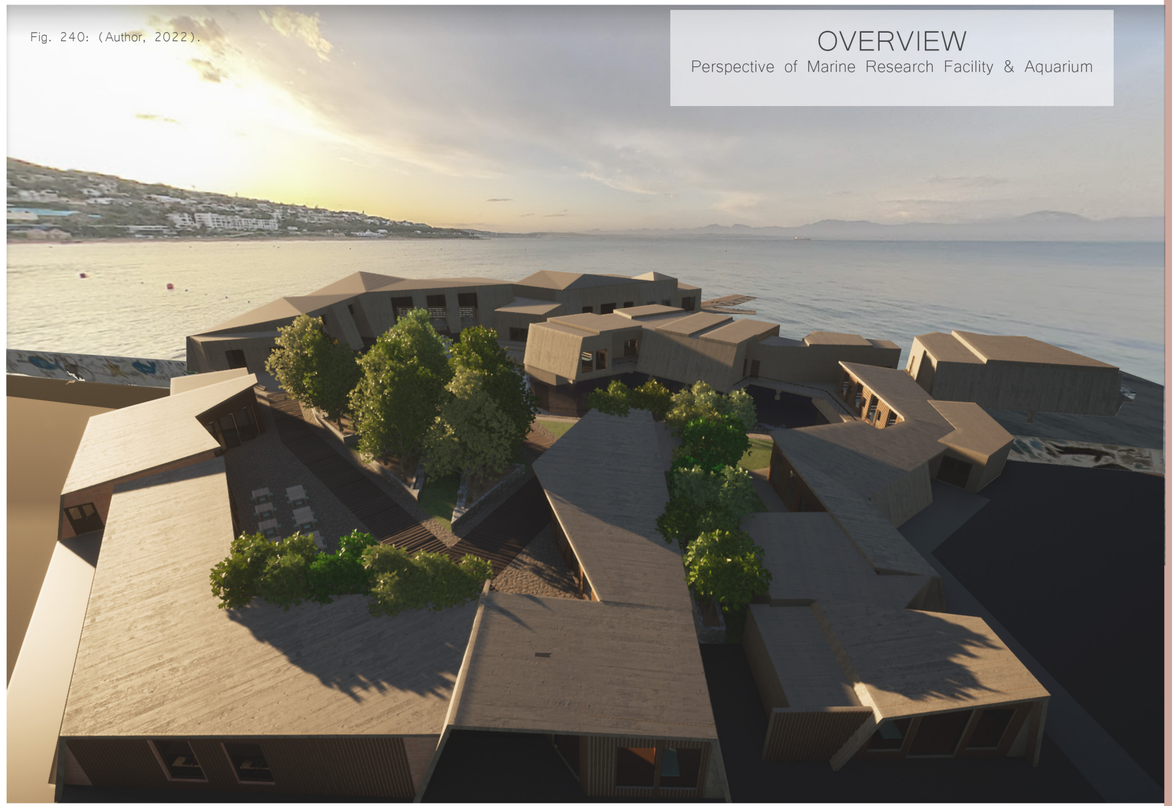










Fig. 241-44: (Author, 2022).

Fig. 245: (Author, 2022).





TIDE POOL

Perspective of tide pool and Aquarium

Fig. 246: (Author, 2022).

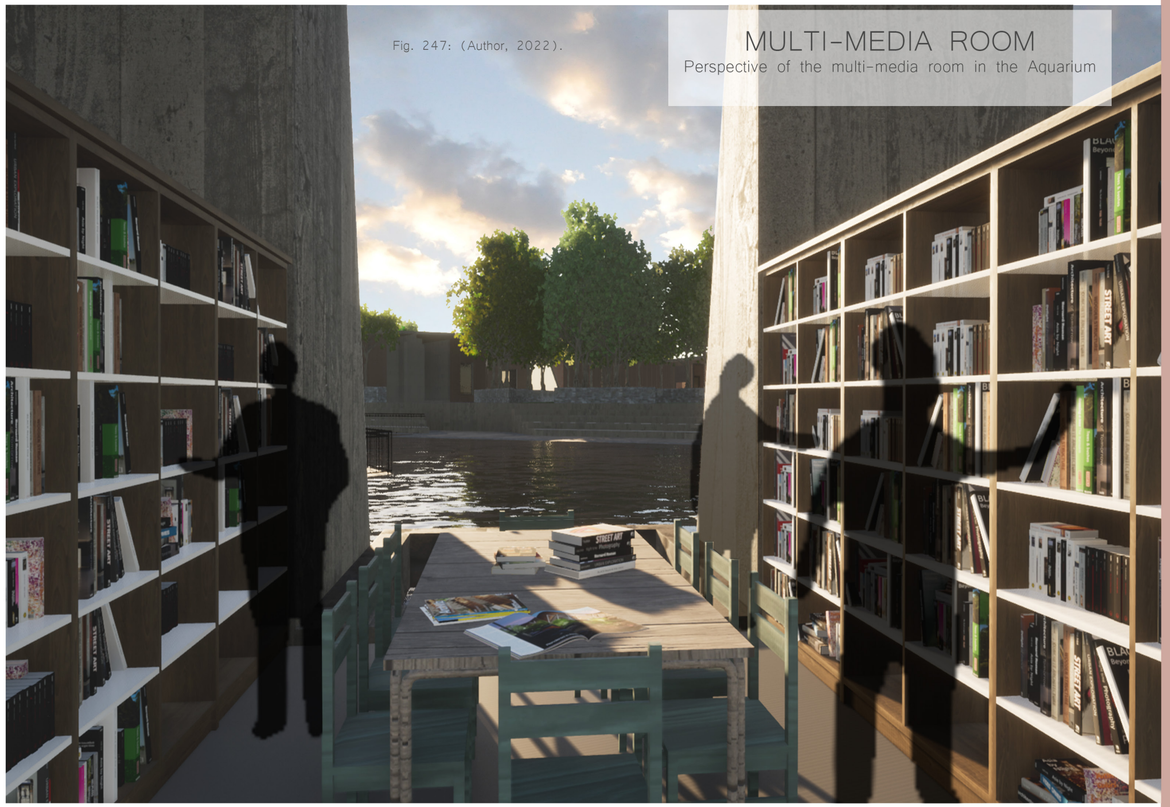


Fig. 247: (Author, 2022).

MULTI-MEDIA ROOM

Perspective of the multi-media room in the Aquarium

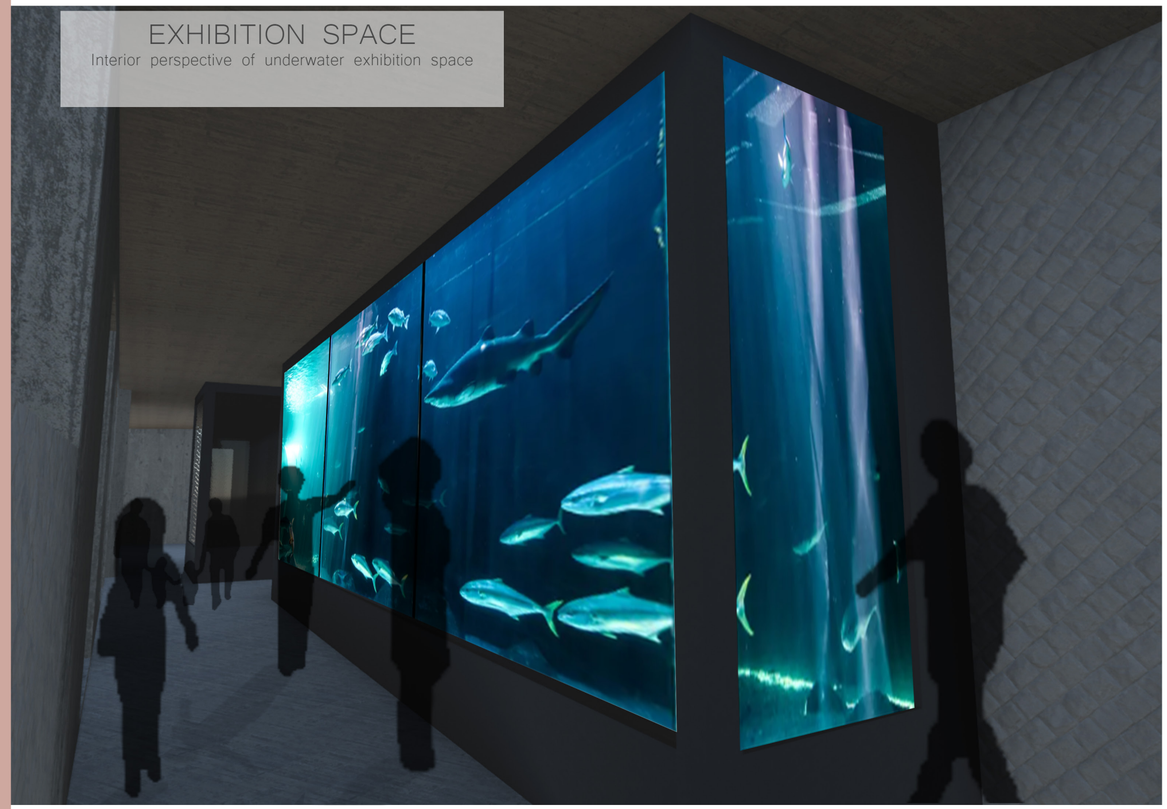


Fig. 248: (Author, 2022).

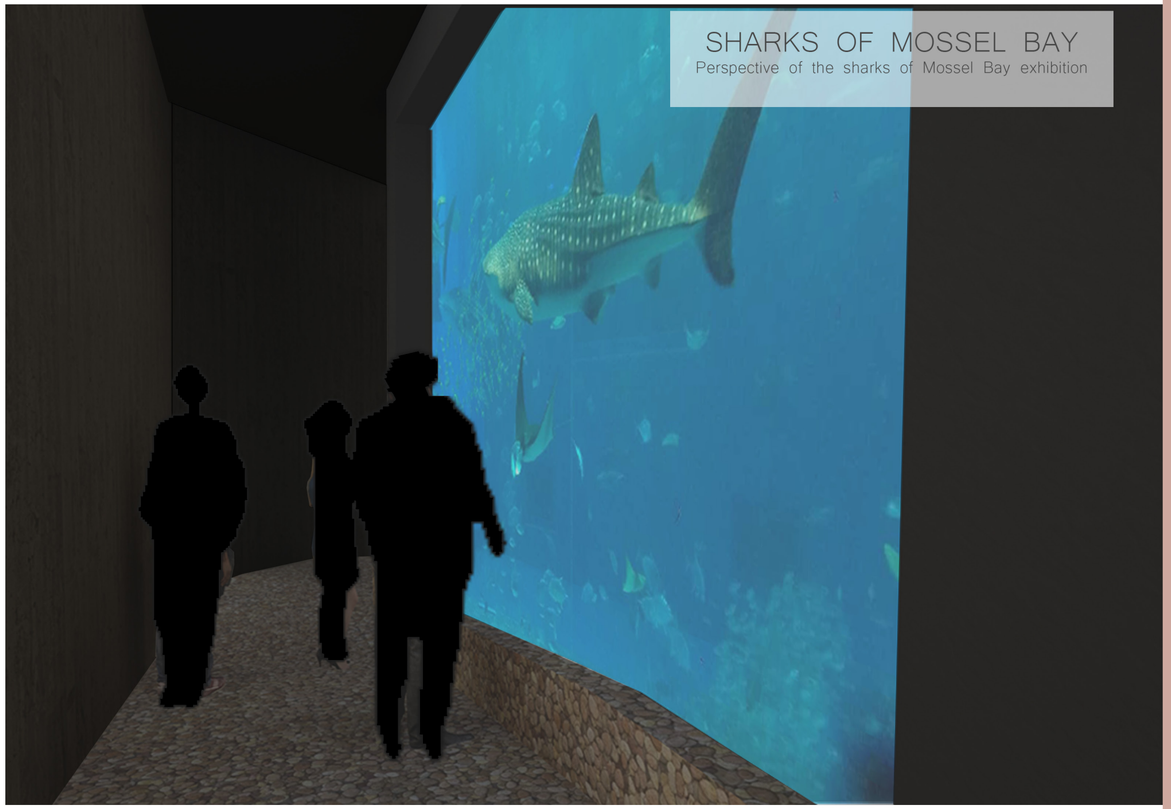


Fig. 249: (Author, 2022).



CLASSROOM

Interior perspective of the classrooms

Fig. 250: (Author, 2022).



RESTAURANT

Interior perspective of the restaurant

Fig. 251: (Author, 2022).

3.7 final model



Fig. 252: Overview of final model built (Author, 2022).



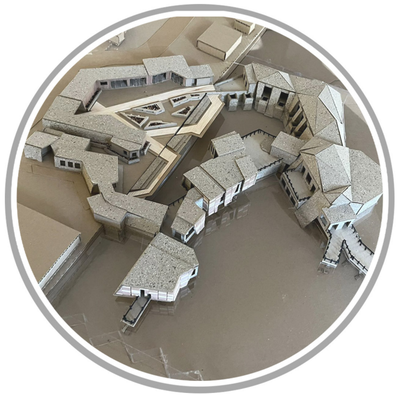






Fig. 253-256: Overview of final model built (Author, 2022).

Fig. 257-259: Overview of final model built (Author, 2022).



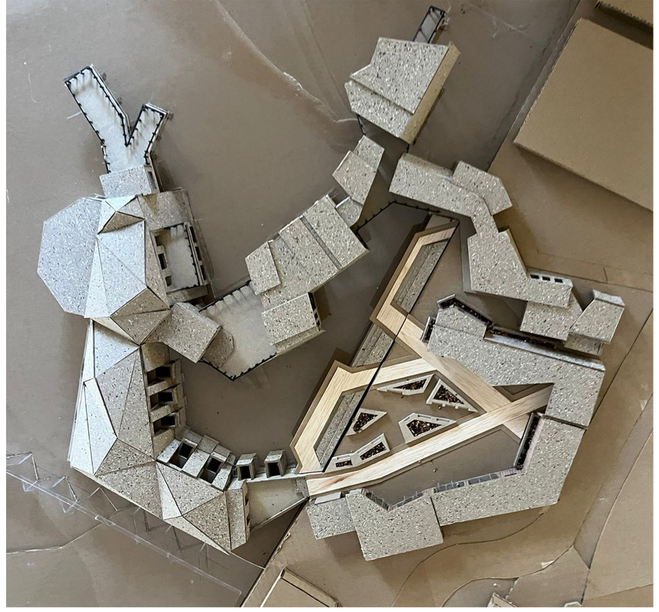






Fig. 260 & 261: Interior courtyard of model (Author, 2022).





Fig. 262: Overview of final model built (Author, 2022).





Fig. 265: Aquarium view from ocean (Author, 2022).

Fig. 263 & 264: Interior courtyard of model (Author, 2022).







Fig. 267: Section Model (Author, 2022).

3.8 conclusion

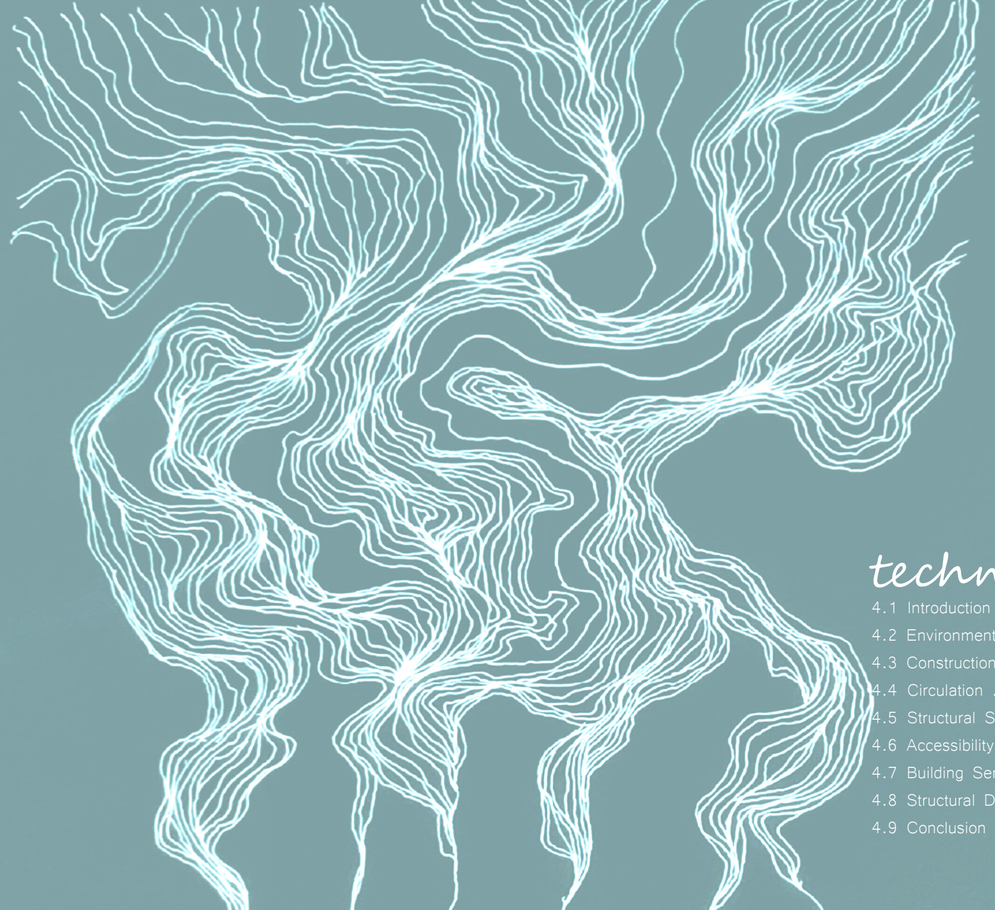
The design attempted to do the theory discussed in Chapter 2, justice. It aimed to incorporate all the lessons learned from the conceptual phase and bring them to life in the form of an architectural intervention. The main influential factor was the idea of bringing man closer to the ocean for them to experience and enjoy it, as well as creating a diffused boundary to challenge the set boundaries between land and sea. As a result, the building became a conduit between man and nature and acted as the diffused boundary.

The design focuses on the experience of the people who visit it, allowing them to submerge themselves in the ocean and marine life. It gives them a peek at the open ocean and the marine life's natural habitat and allows them to swim along with ocean critters in the tide pool.

In Chapter 4, the technical aspects of the design will be discussed. This chapter will bring to light how the construction of the building will proceed, as well as aspects such as circulation, fire strategies, accessibility, and more.

Conclusively, the design was successful in taking the influencing factors into account and serving as a diffused boundary between the land and the sea. Furthermore, it successfully adapted and adjusted to the challenges presented by building within the ocean. In the end, all of the factors contributed to creating Aequoreal Mediation and bringing people closer to the beauty of the ocean.

CHAPTER 04:



technical synthesis

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4.2 Environment & Micro-climate 182
4.3 Construction Methods 187
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4.5 Structural Systems 196
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4.8 Structural Detailing 201
4.9 Conclusion 211

4.1 introduction

The objective of the technical synthesis is to present the design system used for the chosen site in Mossel Bay. The approach was based on the challenges faced when building within the ocean water in order to provide a durable building that could last for many years. Different underwater construction methods will also be discussed to understand and decide what the best possible solution would be for this project. This chapter will also discuss certain systems, such as the fire strategy and water connection. Section 4.8 will showcase the final technical drawings and chosen construction methods.

4.2 environment & micro-climate

Locality & Design proposal

The proposed design is situated in Mossel Bay in the Western Cape, a town that attracts many tourists, especially over the December holidays. The site chosen for this project is located in an up-and-coming tourist hub. However, Mossel Bay only has a fairly unknown mini-aquarium and cannot handle the tourism boom in December. In general, the tourists know very little about the area's ocean and marine life. This resulted in the proposed design.



Fig. 268: Mossel Bay harbour and Quay 4 (Mossel Bay Advertiser, 2017: online).

Site Conditions & Challenges

The identified site is located half on the land on Quay 4 and half in the Indian ocean. This calls for alternative and challenging construction methods and a sensitive approach to the design.



Fig. 269: Current Site Conditions (Google Earth, 2022: online).

Site Accessibility

The accessibility to the proposed site is primarily by vehicle. The site cuts into an existing parking lot already being used for the surrounding locations. This enables the construction process to commence fairly easily as the site is easily accessible. Tourists and the general population of Mossel Bay and the surrounding areas will also be able to access the site without a problem once the project is finished.

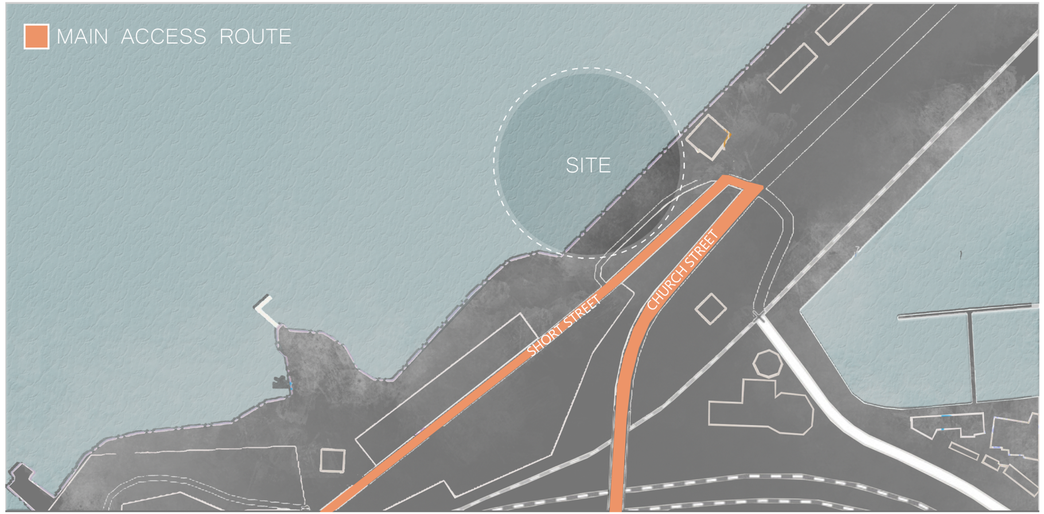


Fig. 270: Access route to site (Author, 2022).

Natural Environment Surrounding the Site

The site's natural environment consists of the ocean and the marine life within it. The focus of the design is to capture the natural environment and showcase it to the people sustainably and safely. The design plans to add to the environment by acting as an artificial mussel reef and having a rehabilitation program for marine life that may have been injured in any way. This project acts as a mediator between land and ocean, educating people on what is happening within the ocean.

The research facility will commence with projects on preserving marine life and exploring more of the ocean.



Fig.271: Rock pools in the surrounding Mossel Bay area (Bradclin, 2017: online).

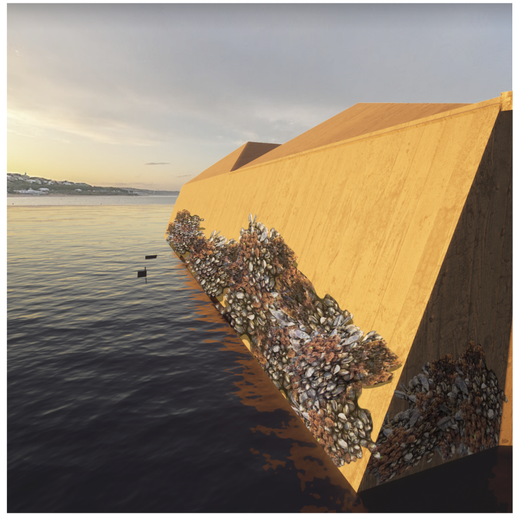


Fig. 272: Aquarium with Mussels growing on it (Author, 2022).

4.3 construction methods



Considering that a big part of the design focuses on diffusing the boundaries between land and sea, built environment, and natural environment, the chosen design stretches beyond the pier and into the ocean. As a result, a considerable part of the design is located within the ocean, and half of the aquarium is underwater.

Therefore, it was important to consider different construction methods within the water and choosing the best method for this project.

CONSTRUCTION METHODS:
general challenges

Building on the land is already a complex process and involves many challenges. However, with construction in the water, unique challenges surface. These challenges may include:

Construction Methods

To be able to build in the water, additional construction methods must be used. These methods include Caissons, Cofferdams, Driven Piles, and Off-site Building. These methods will be discussed in more detail over the following several pages (pg. 185-188).

Materials

Materials such as wood and steel frequently used in land construction are not suitable for long-term underwater use. Even with proper treatment and finishing, these materials will corrode quickly, especially in saltwater, and will, therefore, not be structurally sound. Materials typically used in underwater construction include concrete (due to its durability), steel (enclosed by concrete to prevent direct contact with water), and acrylic glass.

Water Pressure

During and after construction, the water pressure will play an integral role. It is, therefore, important to ensure that the materials used in the building are strong enough to withstand it, and additional aspects such as rounded corners and slanted walls can be used to ensure that the building's lifespan is prolonged.

Saltwater Corrosion

If the building is in the ocean, it is important to consider saltwater corrosion, and preventive steps must be taken to ensure the longevity of the building.
(BigRentz, 2021: online).



Fig. 273: Cofferdam (Hans India, 2017: online)

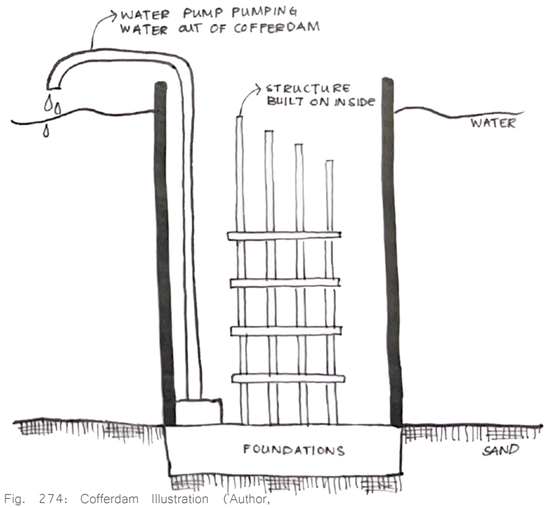


Fig. 274: Cofferdam Illustration (Author, 2022).

CONSTRUCTION METHODS:
cofferdams

A cofferdam is typically a temporary structure in the water that allows the water to be pumped out to ensure a dry working environment. It prevents water from entering a specified area and typically looks like a large, walled pit in the water.

There are several types of materials that can be used when constructing a cofferdam, such as steel, rocks, and dirt. The most basic cofferdam can be made by simply piling up dirt. This method, however, needs extra reinforcement to ensure that no erosion takes place.

Cofferdams have a variety of structures that can be erected, ranging from piers to partially or fully submerged buildings to dams. A well-known example of where cofferdams were used in construction was the Hoover Dam.
(BigRentz, 2021: online).

CONSTRUCTION METHODS:
driven piles

Driven piles are used as foundational elements underwater and allow the building team to create a strong foundation without the need to remove the water. Piles take the form of long, vertical columns and are drilled or hammered into the soil or bedrock, creating stable foundations for overwater or underwater structures.

Materials typically used for pile foundations include steel and concrete. Generally, a partially hollow steel tube is put in place and then filled with concrete which displaces the water that was previously in the tube. The end result is a steel-reinforced concrete pillar. The piles must be securely attached to the building to prevent it from moving with the water's currents. This method of underwater construction can be regarded as one of the most cost-effective methods.

An example of driven piles being used is the Apple Store in Singapore.
(BigRentz, 2021: online).



Fig. 275: Drive Piles (MSB, n.d.: online).

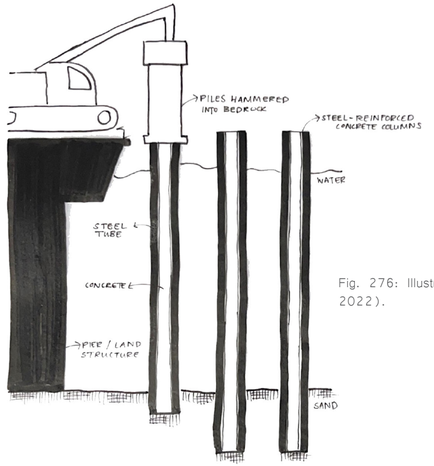


Fig. 276: Illustration of driven piles (Author, 2022).

CONSTRUCTION METHODS:
off-site building, float & lower



Fig. 277: Construction of Under (Amaretti, 2018: online).



Fig. 278: Submersion of Under (via video by Dezeen, 2018: online).

A big goal of underwater construction is to avoid having to actually build underwater. Therefore, this method is commonly used when dealing with underwater structures.

This method is fairly straightforward. The building is typically constructed and assembled off-site and then transported to the site. The structure is then lowered into the water, using its own weight to sink. If the structure is unable to sink by itself, additional weights can be used. Another method that can be used is filling the structure with water to help it sink. The water can then be pumped out when the structure is securely placed.

This method of underwater construction can be expensive but is still more cost-effective than building directly underwater, which requires complicated tools, skilled divers, and massive risks.

An example of this method is the restaurant Under by Snohetta.
(BigRentz, 2021: online).

CONSTRUCTION METHODS:
caissons

A caisson is a watertight structure that preserves a dry interior while being lowered into the water. On the inside, the builders can dig until a solid surface is reached, on which the caissons will rest. This structure will eventually become a part of the foundations and is most commonly used when building bridges or dams. A well-known example of caissons used in construction is the Brooklyn Bridge. Although caissons are still used today, their use is minimal, and therefore it might be a good option to use a different method of underwater construction.

There are three different types of cassions that exist, although they all use the same basic principles:

Open Caisson
This type of caisson only makes use of vertical walls, in whichever shape is required. It does not have a bottom, which allows the builders to dig until a solid surface is found.

Pneumatic Caisson
This caisson is similar to an Open Caisson. However, to ensure that no water seeps in, compressed air is pumped into it.

Box Caisson
This type of caisson contains a bottom and can, therefore, only be lowered onto pre-existing foundations.
(BigRentz, 2021: online).



Fig. 279: Caisson Foundation (Mahajan, n.d.: online).

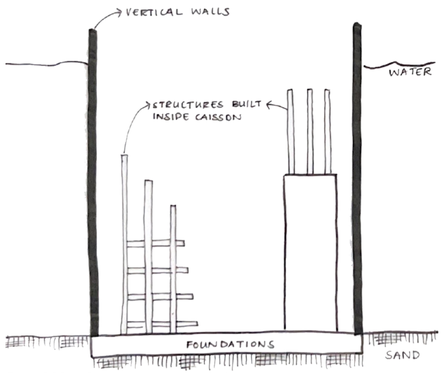


Fig. 280: Caisson Illustration (Author, 2022).

CONSTRUCTION METHODS:
conclusion

Following research on underwater construction and the different methods that can be used, an appropriate method must be chosen for the project at hand. Three of the methods are viable for this project. However, a combination of only two methods will be used.

Cofferdams & Driven Piles
Using the cofferdam construction method will enable the building team to build the building directly on site and secure it from the beginning. However, considering the structure at hand, a large cofferdam would need to be used, in the depth of 4-5 meters, in order for the building to be constructed. Driven piles would definitely be used to ensure the foundations are grounded in the bedrock instead of the sand, which can be unsteady.

Off-site building & Driven Piles
Through building the structure off-site, it eliminates the need to remove water altogether. The structure can be built normally without first having to build an additional structure. The off-site construction can also happen right on the pier by the chosen site or on a barge. However, this method is more expensive, and the sinking of the structure may cause additional problems. Driven piles would still be needed to secure the building to the bedrock instead of placing it simply on the sand.

4.4 circulation

Horizontal

The circulation throughout the aquarium portion of the design works in a 'one-route' system. This route isn't predefined that all visitors must take. However, whichever route the visitors take will form part of this circulation structure and take them through the whole exhibition space.

The circulation for the design portion located on the land is not predefined, as a plaza connects the different buildings and the water edge. Visitors can take any route they want between the different buildings once they have entered through the entrance.

The circulation for the research facility follows along an outdoor walkway that connects all of the spaces created.

Vertical

The vertical circulation is divided into public and private areas. The public vertical circulation cores in the aquarium consist of ramps connecting the two levels, the staircase by the reading room and the staircase leading to the auditorium. The private vertical circulation core is located in the research facility and consists of the staircase that leads to the auditorium and the staircase that leads to the maintenance rooms.

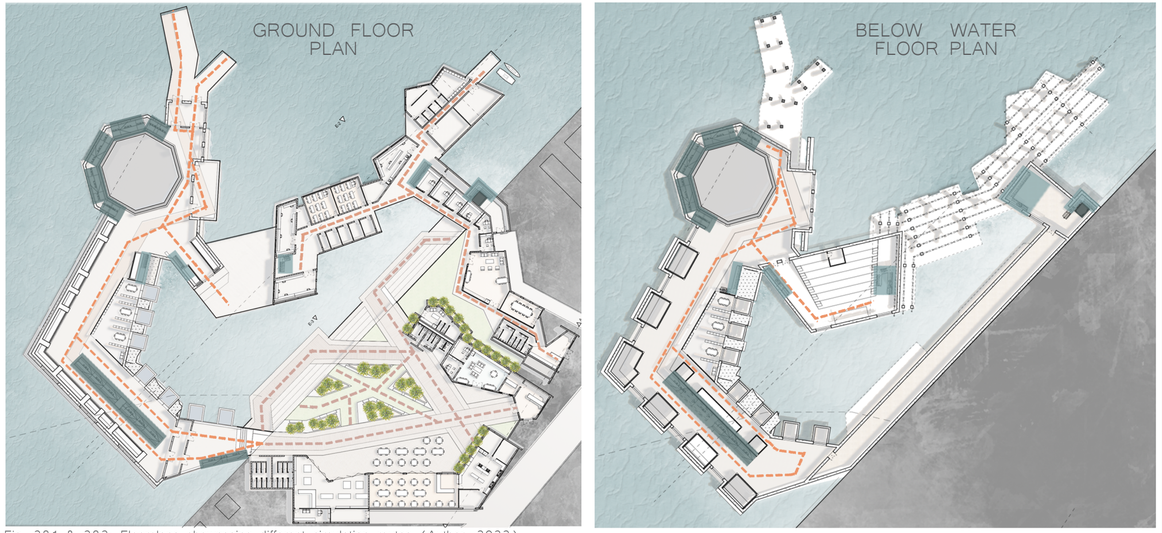


Fig. 281 & 282: Floorplans showcasing different circulation routes (Author, 2022).

4.5 structural systems

The portion of the design that is located within the ocean will be constructed primarily of concrete due to its durability and to ensure the longevity of the design. It will consist of a concrete shell of 0,5m thick that consists of the slanted walls and roof. Interior walls will consist of masonry. The windows in the bottom half of the building, which are directly located underwater, will be constructed through the use of 25cm thick acrylic panels. This will ensure durability and won't warp any of the sights on the outside.

The portion of the design that is on land will consist of a concrete shell for the slanted walls and roof. Masonry will be used for any other walls required with a plaster finish that will also give the concrete effect. Some of these walls will be cladded with timber cladding to pick up the vernacular of Mossel Bay holiday homes primarily constructed out of timber.

The research facility located within the water will follow the same materiality as mentioned above but will use a concrete column system to position it above water. The concrete columns are connected to the structure's concrete slab, and each column has a concrete footing. The concrete footings are each secured into place by a driven pile foundation that anchors the building to the bedrock.

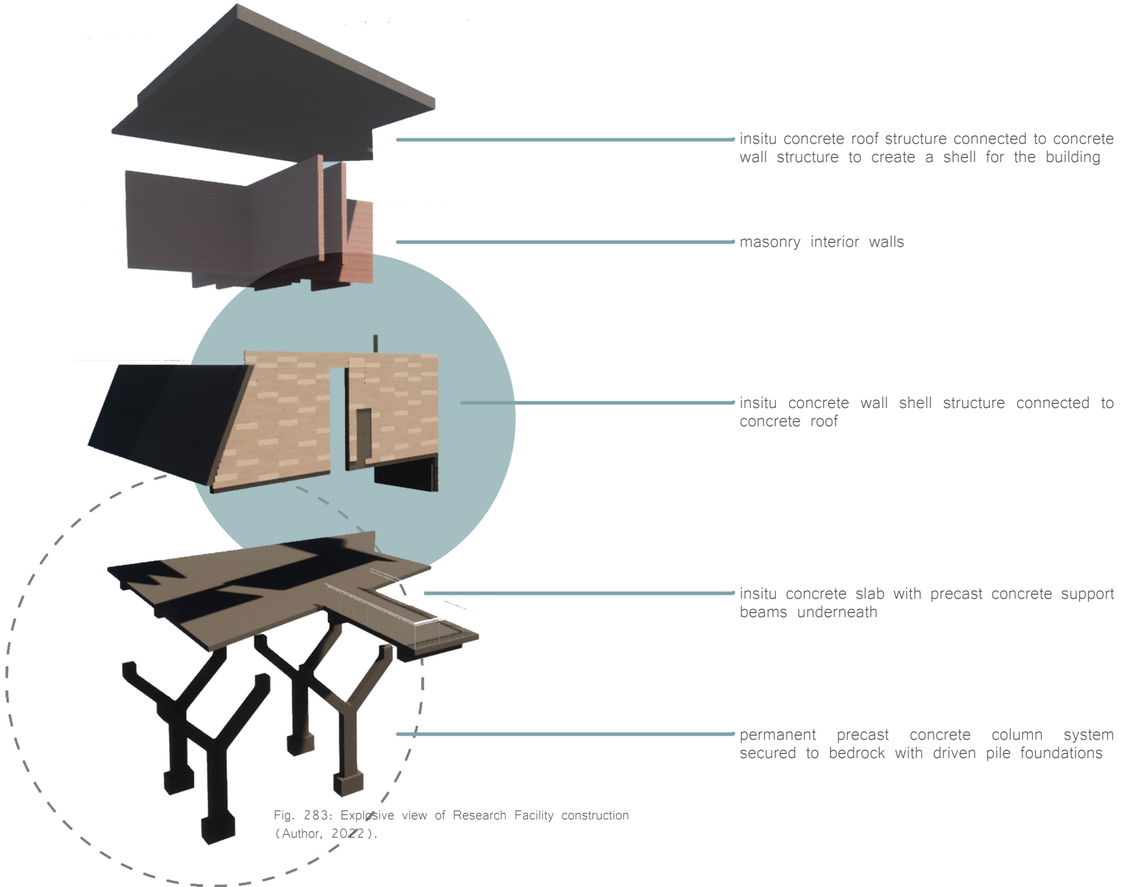
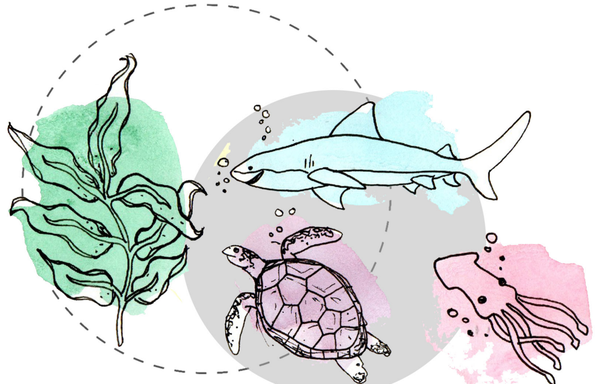


Fig. 283: Explosive view of Research Facility construction (Author, 2022).

4.6 accessibility

The design accommodates all accessibility needs. On the land, there is no difference in height levels. The aquarium is equipped with two sets of ramps, one located by the entrance and one located around the grand tank. Thus, the aquarium provides for easy accessibility to all the exhibitions. The transition from the land toward the aquarium's entrance is also equipped with stairs and a ramp. All the ramps are done to the specified requirements in order for handicapped persons to be able to use it comfortably. The bathrooms located in both the research facility and aquarium make accommodations for handicapped persons.



Ramps

Disabled Bathrooms

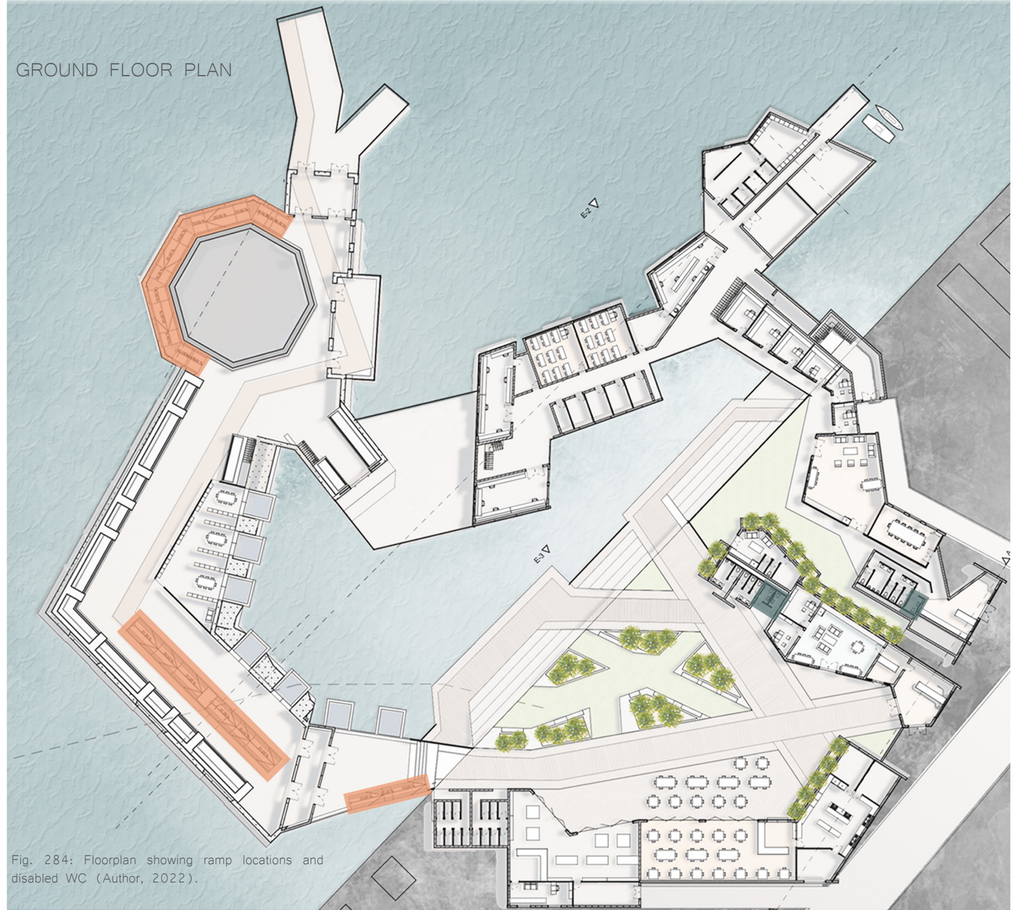


Fig. 284: Floorplan showing ramp locations and disabled WC (Author, 2022).

4.7 building services

Fire strategy

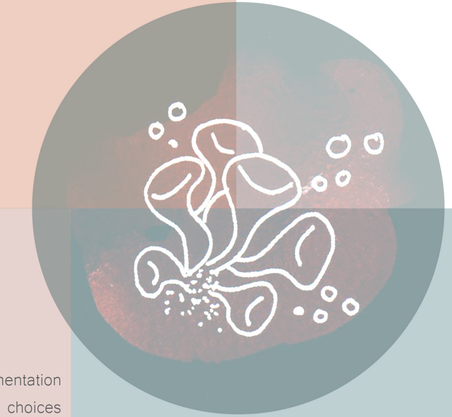
The building is in accordance with SANS 10400: Part T: Fire protection. There are numerous stairs and ramps throughout the building, which allows visitors to exit at multiple areas. The aquarium and research facility are fully fitted with a sprinkler system for the chance of a fire. All other rooms are fully equipped with portal fire extinguishers.

Water & Sewage disposal

The municipality supplies the majority of the building's water. However, the aquarium uses the ocean's water to pump and circulate through the exhibition tanks. The research facility also has a dedicated room with a pump to supply the core seawater lab and tank farms with ocean water.

The building's sewage line is connected to the municipal sewage point.

4.8 structural detailing



This section of the document will consist of all structural documentation for this project. It illustartes the amalgamation of all construction choices made including materiality, structural systems and construction methods.

LOCALITY PLAN
SCALE 1:1000



GENERAL NOTES

ARCHICAD EDUCATION VERSION

Concrete walls 500mm thick to engineer's specifications.
Loadbearing brick walls 220mm thick.
Non-loadbearing brick walls 110mm thick.
See sections for stated walls details.



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wcs number
discipline: ARCHITECTURAL

drawing title: LOCALITY PLAN

building number

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scale	1:500, 1:1000	student number	2017 029 683
date	2022/10/11	checked	

dpw drawing number: WORKING DRAWINGS

SITE PLAN
SCALE 1:500



GENERAL NOTES

ARCHICAD EDUCATION VERSION



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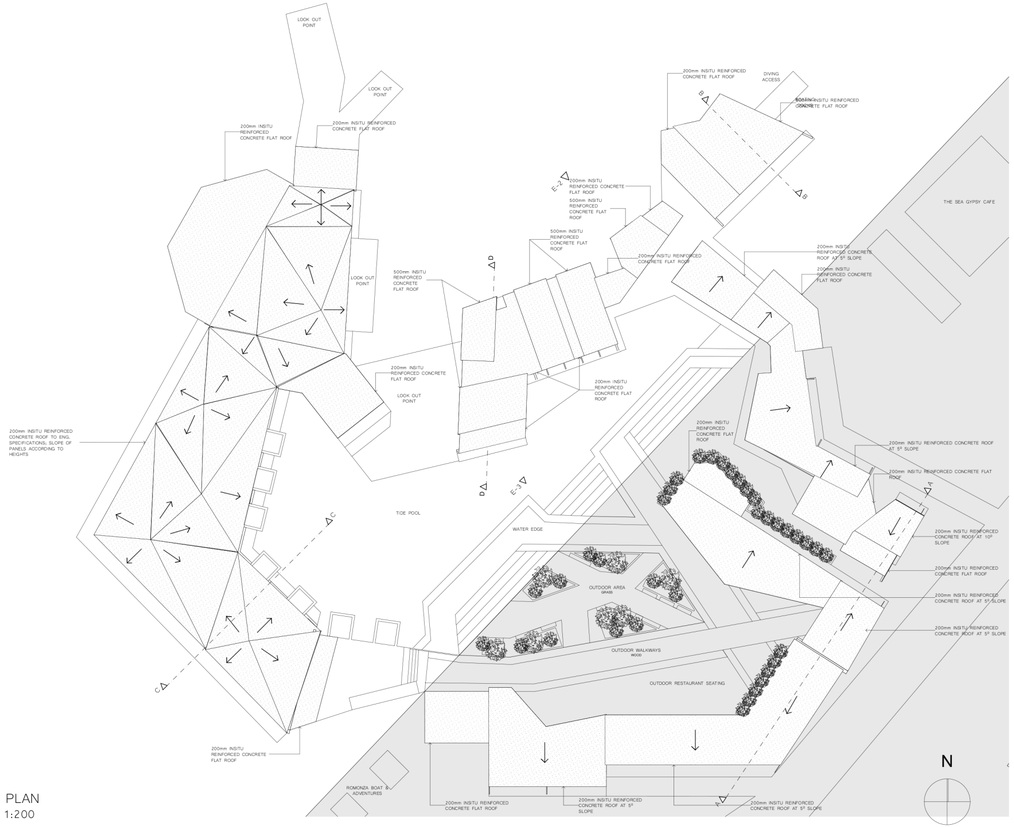
wcs number
discipline: ARCHITECTURAL

drawing title: SITE PLAN

building number

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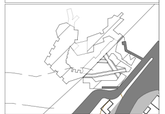
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ROOF PLAN
SCALE 1:200

GENERAL NOTES

ARCHICAD EDUCATION VERSION



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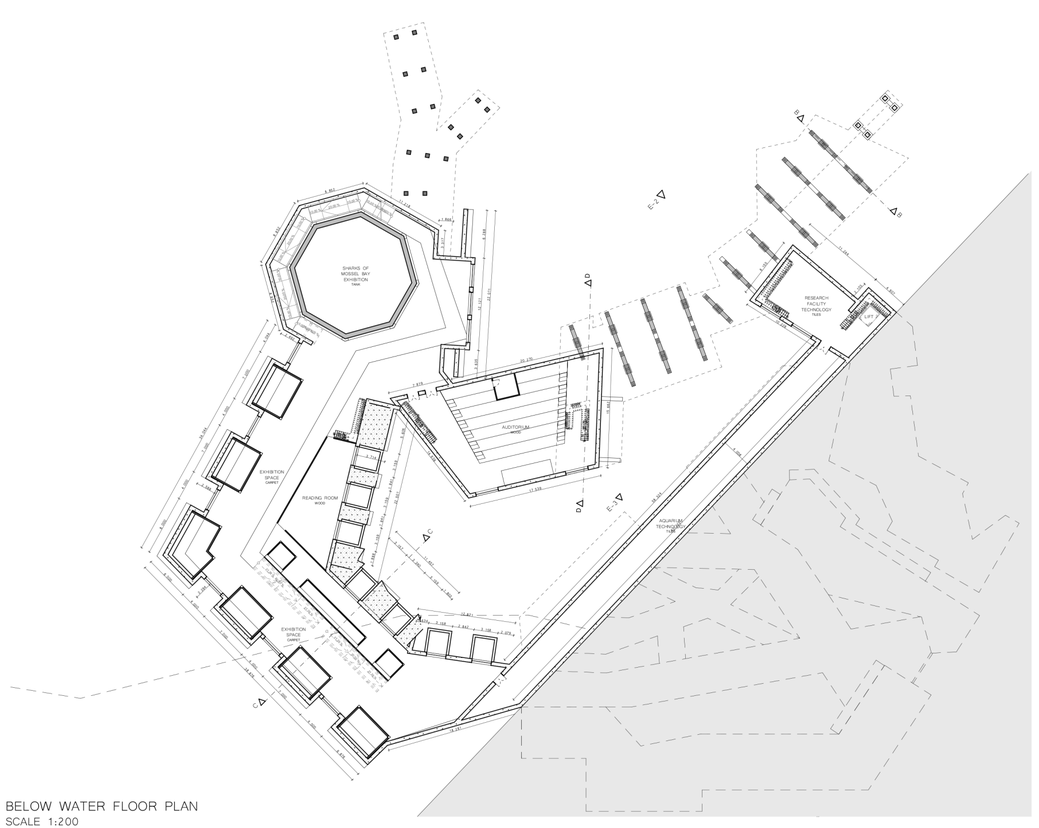
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drawing title: ROOF PLAN

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BELOW WATER FLOOR PLAN
SCALE 1:200

GENERAL NOTES

ARCHICAD EDUCATION VERSION

Concrete walls 500mm thick to engineer's specifications.
Loadbearing brick walls 220mm thick.
Non-loadbearing brick walls 110mm thick.
See sections for raised walls details.



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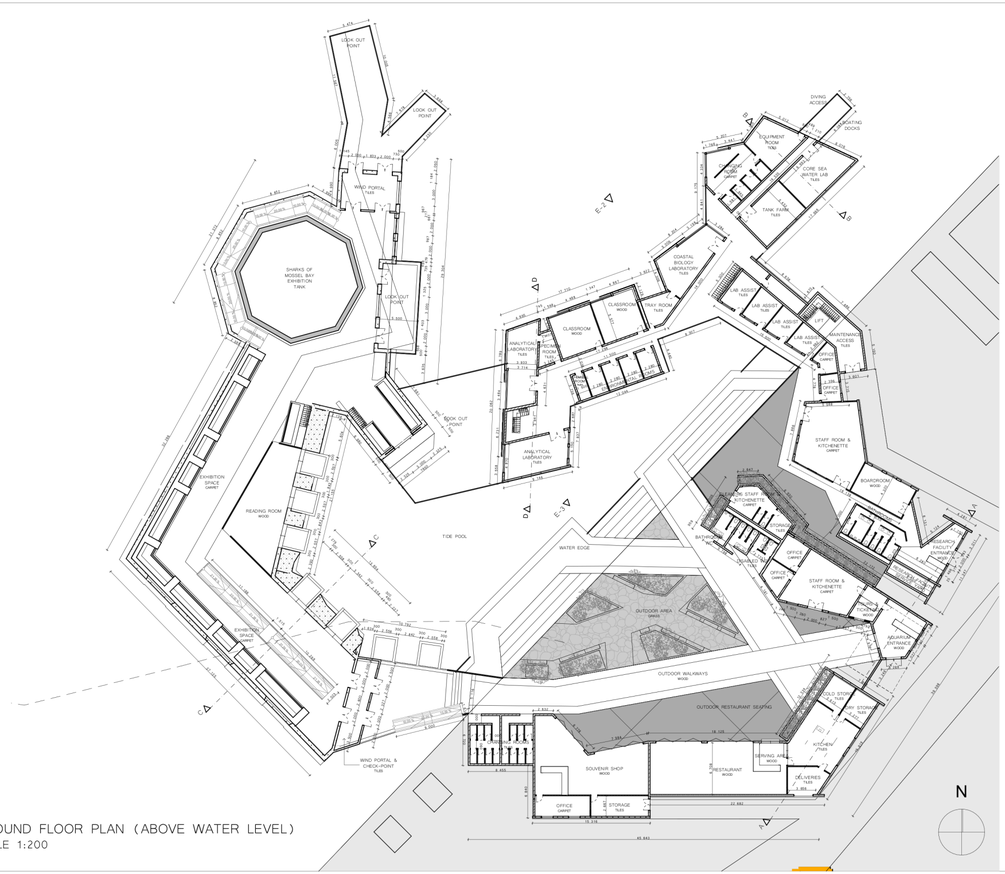
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drawing title: BELOW WATER FLOOR PLAN

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GROUND FLOOR PLAN (ABOVE WATER LEVEL)
SCALE 1:200

GENERAL NOTES **ARCHICAD EDUCATION VERSION**

Concrete walls 500mm thick to engineer's specifications.
Loadbearing brick walls 220mm thick.
Non-loadbearing brick walls 110mm thick.
See sections for stated walls details.



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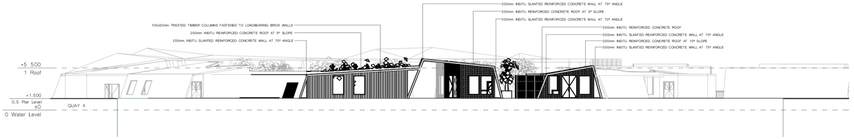
wcs number	discipline
	ARCHITECTURAL

drawing title: GROUND FLOOR PLAN (ABOVE WATER LEVEL)

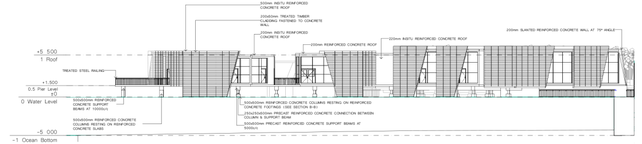
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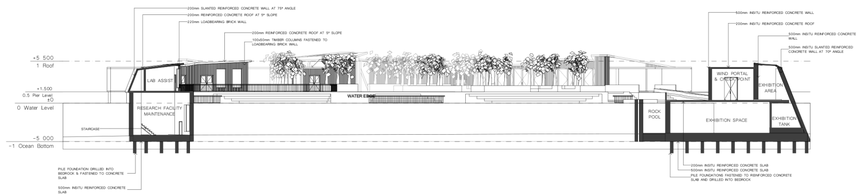
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NORTH-WESTERN ELEVATION (ENTRANCE)
SCALE 1:200



NORTH EASTERN ELEVATION (RESEARCH FACILITY)
SCALE 1:200



SECTIONAL ELEVATION OF WATER EDGE
SCALE 1:200

GENERAL NOTES **ARCHICAD EDUCATION VERSION**

Concrete walls 500mm thick to engineer's specifications.
Loadbearing brick walls 220mm thick.
Non-loadbearing brick walls 110mm thick.
See sections for stated walls details.



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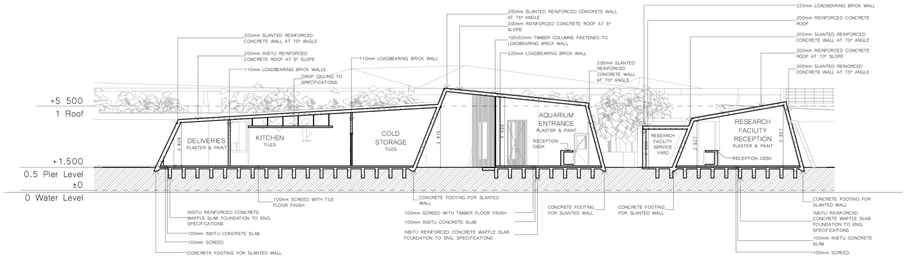
drawing title: ELEVATIONS

building number:

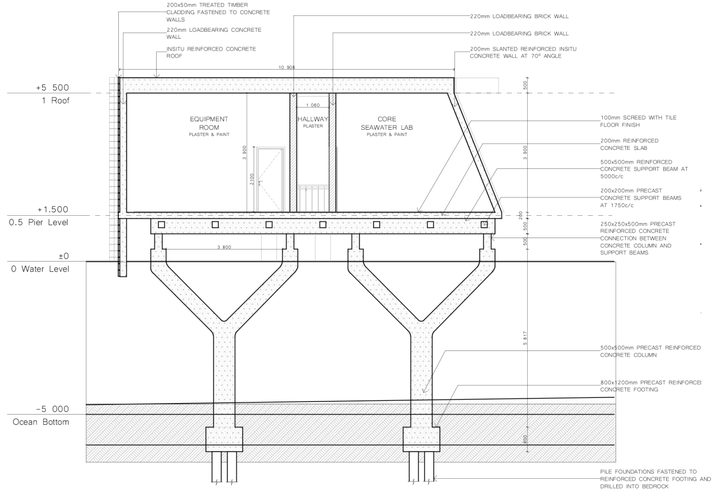
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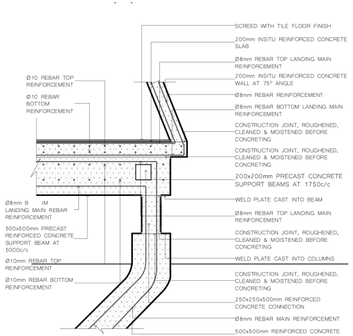
GENERAL NOTES ARCHICAD EDUCATION VERSION



SECTION A-A
SCALE 1:100



SECTION B-B
SCALE 1:50



DETAIL 1: PIER CONNECTION
SCALE 1:20



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PROPOSED NEW DEVELOPMENT AT Quay 4, Mossel Bay, Western Cape, 6506, South Africa

ecs number | discipline: ARCHITECTURAL

drawing title: SECTIONS & DETAIL

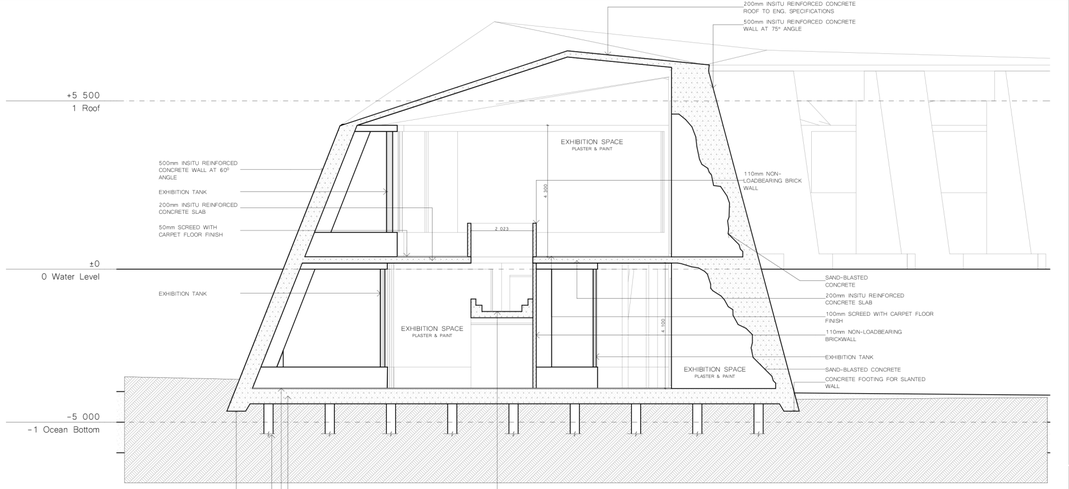
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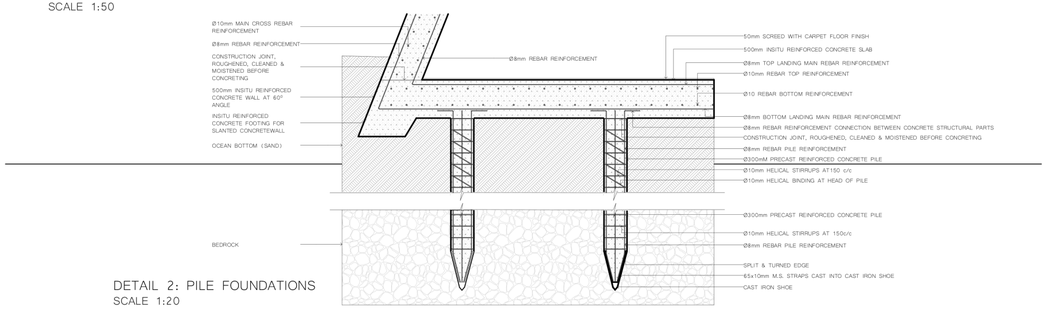
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SECTION C-C
SCALE 1:50



DETAIL 2: PILE FOUNDATIONS
SCALE 1:20

GENERAL NOTES ARCHICAD EDUCATION VERSION



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ecs number | discipline: ARCHITECTURAL

drawing title: SECTION C-C & DETAILS

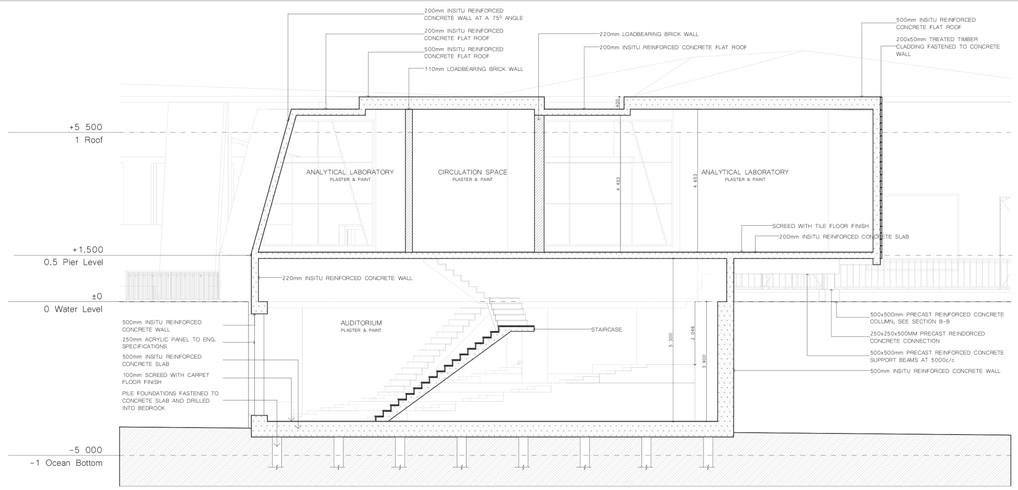
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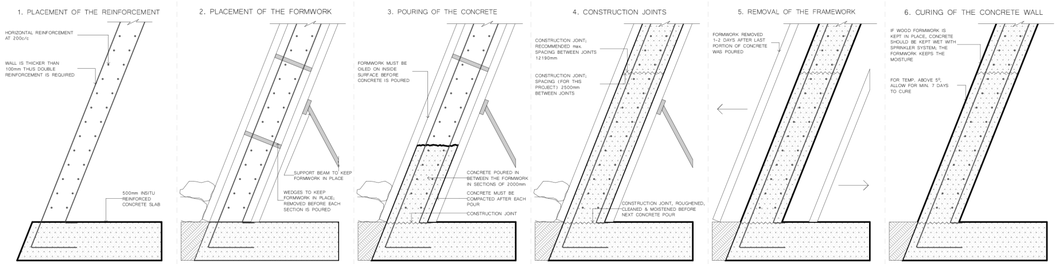
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date: 2022/10/11 | checked

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SECTION D-D
SCALE 1:50



DETAIL 3: CONCRETE WALL CONSTRUCTION
SCALE 1:20

GENERAL NOTES

ARCHICAD EDUCATION VERSION



Mané Breytenbach
A 6 0 4 1 6 5 1 4 8 4

MARINE RESEARCH FACILITY & AQUARIUM

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wcs number:
discipline: ARCHITECTURAL

drawing title: SECTION D-D & DETAIL

building number:

ref number: 2022
drawn by: Mané Breytenbach
scale: 1:50, 1:20, 1:500
student number: 2017 029 683
date: 2022/10/11
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4.9 conclusion

The chapter aims to bring to light the technical aspect of the design and answer some questions about the systems in place. It provides insight into the practicality of the design through a series of diagrams and drawings, as well as the construction of the project.

The construction methods that would assist the construction of the building are the use of cofferdams and driven piles. Considering the size of the project and the materials used, it would be too big and heavy for building off-site and then lowering it into the water. The driven piles will also assist in anchoring the building to the bedrock and keep it in place, even in the ocean's tides.

All of the aspects, in conjunction with the previous chapter, led to a sufficient design of a new aquarium typology and assisted in the project's final outcome.

CHAPTER 05:



findings & conclusion

5.1 Findings & Conclusion 214
5.2 Reflection 216
5.3 Works Cited 218
5.4 TurnItIn Receipt 224

5.1 findings & conclusion

The documentary *My Octopus Teacher* (2020) served as the creative trigger for this research project and manifested what the project would entail: the connection between humans and the natural environment. Throughout the project, this prevailing theme resurfaced time and again.

In Chapter 01, the problem was identified: Mossel Bay had an unusually large variety of marine life, which is not widely known. Thus, the need and importance of an architectural intervention that can celebrate the ocean and its inhabitants were established. Therefore, a Marine Research Institute and Aquarium was the remedy for this problem. The site analysis assisted in building a strong narrative of why the site was chosen and brought to light certain aspects that could be incorporated into the design, such as the analysis of the rock pools in the area.

The touchstone and concepts demonstrated early on the design's intent and what the building's final goal could look like. The touchstone and the concepts' main focus was on the connection between humans and nature and the education of the ocean.

This prompted the research question:
How can a biophilic architectural intervention act as a mediator between the land and the sea within Mossel Bay while diffusing the boundaries and changing the way in which the ocean is experienced?

The research question was broken down into three main parts that led the theoretical research. Through the theoretical research, it became clear that the experience of people plays a vital role in how a place is perceived. Thus this design should focus on cultivating these experiences. The incorporation of biophilia in the design proved to be the best manner in which nature could be introduced into the building and strengthen the visitors' connection to nature. The theoretical standpoints researched allowed for an architecture of care to come to light and allow spatial, as well as functional, influences in the design which are relevant to the design proposal. All of the theoretical concepts discussed interlinked with one another and aimed toward an architecture in harmony with nature. It's shown that we should move away from the need to dominate and have power over nature and rather take an approach that elevates the importance of, and interaction with, nature.

The design attempted to do the theory justice, and many of the lessons learned from the conceptual phase were incorporated within the design.

In this thesis, architecture acts as the mediator between land and sea and a diffused boundary. The architectural intervention made it possible for humans to enter the ocean safely and interact with the marine life. It offers a submerging experience that will, in turn, create lasting memories and a bond with these marine animals.

In the end, I believe the final design solution accomplished the goals set out and incorporated the theoretical concepts. As a result, a diffused boundary that brings man and nature closer was created, and Aequoreal Mediation was achieved.

Fig. 285: Interpretation of the ocean (Author, 2022).

5.2 reflection

After four years of admiring previous Masters students' work in the corridor, I finally made it. The long-awaited dreams of what my thesis topic will be and who I will share a cubicle with were suddenly realised, and everything I had imagined over the years was now a reality. I was now busy with the big M.Arch(Prof).

After a year's worth of research and hard work, it's good to look back at the year and reflect on everything: the setbacks and the victories.

I have always had a deep-rooted love and appreciation for the ocean, especially the one in Mossel Bay. We've been going to our family beach house there since I was born, and I was lucky to celebrate the majority of my birthdays there. The ocean was always my happy place; the place where I did not have a care in the world, and that was always good to me after a challenging year. I found it fitting to celebrate Mossel Bay's ocean through my thesis project.

Although, a Marine Research Institute and Aquarium was not my initial idea for my thesis. I stumbled across the idea after watching the documentary My Octopus Teacher in late 2021. During this documentary, I fell in love with the ocean and all its inhabitants all over again, leading me to the idea of creating a design that celebrates it.



Fig. 286: Interpretation of the ocean (Author, 2022).

My concepts and touchstone set the tone of my project early on and made clear what I wanted to achieve – the project being a mediator between land and sea, between humans and the natural environment. However, after this phase, I hit a bit of a speedbump. My initial designs did not communicate my aim for the building and did not integrate well with the surroundings. Only after I took a step back and went to the root of my project I really got going again.

This year was definitely not smooth sailing. It took a lot of hard work and long nights to achieve my goals, and there were some points when I thought I would not make it... but 'aanhouer wen', and here we are.

Therefore, in my subjective opinion, the exploration and design outcome was successful. As with all projects, there is room for improvement. However, I'm proud of myself for how far I've come and what I managed to create. This project will stay with me forever. Through this process, the ocean and its inhabitants crept into my heart and taught me a lot about architecture.
Thank you for taking the time to review my dissertation document and following my design process. Your time and effort are much appreciated.

"We are a part of this place, not a visitor."
-Craig Foster (Foster, 2020: online)

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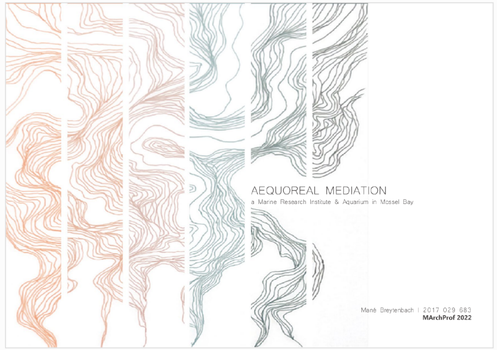
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