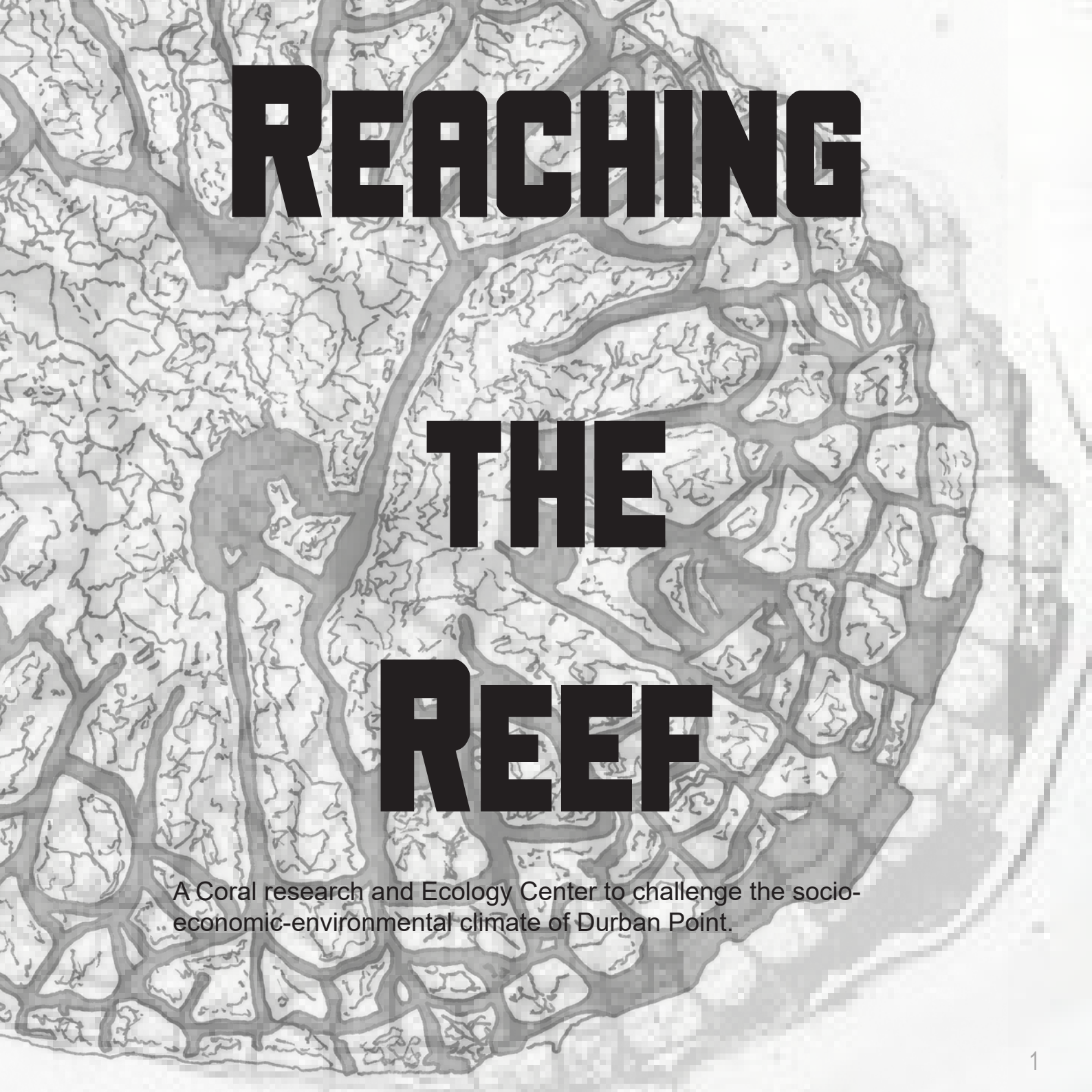




REACHING THE REEF

A Coral research and Ecology Center to challenge the socio-economic-environmental climate of Durban Point.

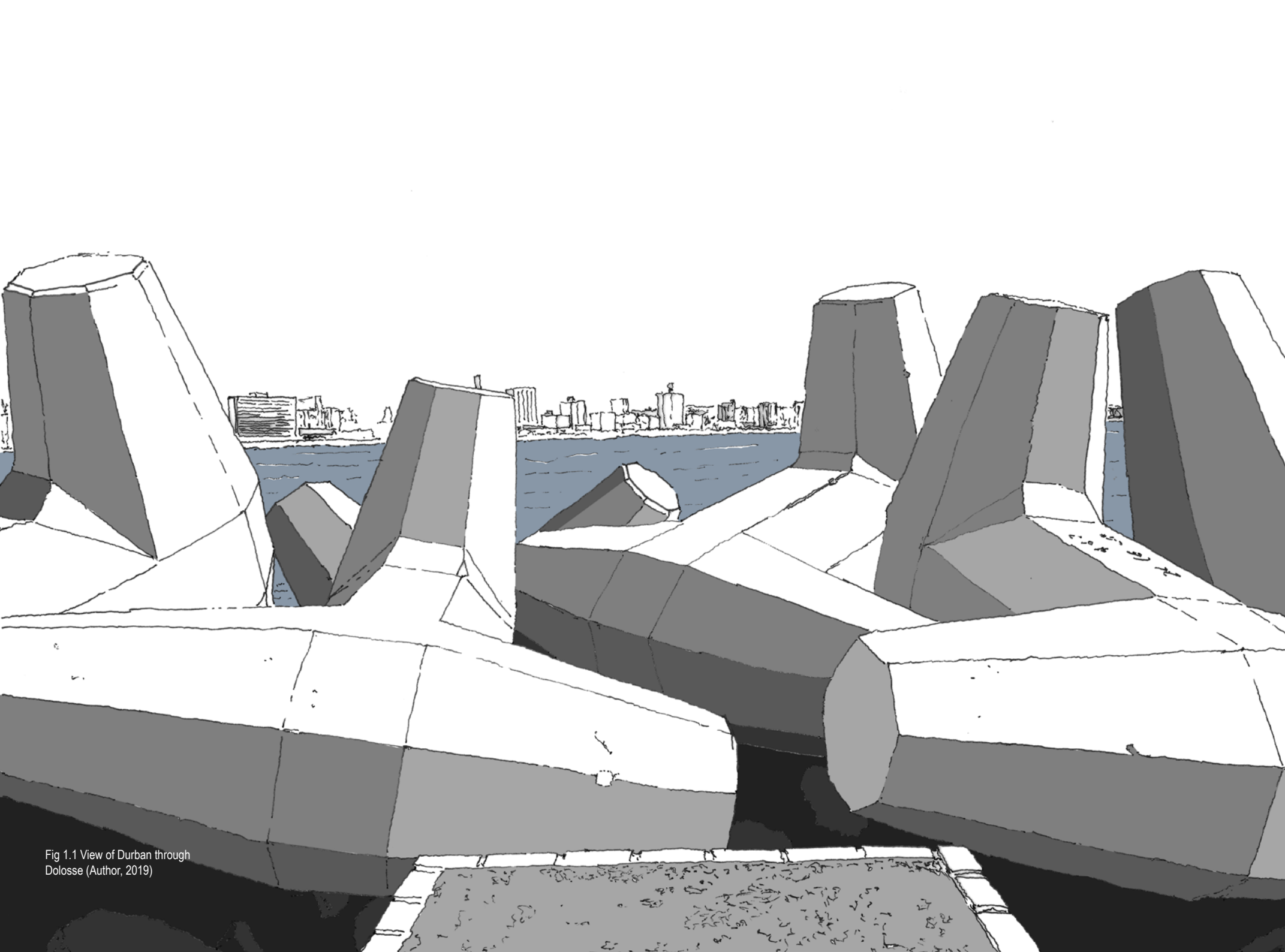


Fig 1.1 View of Durban through
Dolosse (Author, 2019)

ACKNOWLEDGMENTS

To Dadd, for giving me the opportunity to
further my studies,
And my Mom for all the support you have
given me over the years.

Sean, Dom, Rory, Ross, and 'Tony', thank
you for all the help over the years, we'll
always have 7th.
And to the Bolus's for the same thing.

And finally to the Titans, and our 3rd title.

"Up the SHAMS!"



Tug Boat

Fig 1.2 Globetrotter and tug bug in harbour entrance (Author, 2019)

DECLARATIONS

I, Lloyd Blakeway (Student number: 833117) am a student registered for MArch in the year 2019 at the University of the Witwatersrand. I hereby declare the following:

I am aware that plagiarism is wrong.

I confirm that all the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise. I have followed the required conventions in referencing the thoughts and ideas of others. I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

13.05.2020

CONTENTS

One.	Site	11	Three.	Coral & Architecture	83	Six.	Design Approach	133
	Site Profile			Coral around the world			Oil in water	
	Site Options			Types of reefs			Conceptual Models	
	Durban Point - North Pier			Coral Polyp			Initial Sketches	
	Contextual Mapping			Symbiotic relationship			Programme	
	Images of Site			Coral reproduction			Massing model	
	Durban Point Waterfront			Bleaching			Underwater Vernacular	
	The Golden Mile			Zooxanthellae leaving			Limestone construction	
	The Promenade			The way forward				
	The Extended Promenade		Four.	Phenomenology	113	Seven.	Design Drawings	155
	North Pier (Old vs New)			Experience of Phenomenology			Final Drawings	
	Durban’s Lady in white			Corals relation to phenomenology			The Lighthouse	
	Vetch’s Reef			Sounds of Environment			The Experiential Space	
	Vetch’s Pier			Site Influence			Perimeter Seciton and Details	
	The troublesome rise							
	Site Analysis							
Two.	Plastic & Oil	67	Five.	Precedence	123	Eight.	Bibliography	199
	Plastic in the harbour			Centre for Noonygar Culture				
	Oil on water			UNESCO World Heritage				
				Foro Boca				
				Under				

ABSTRACT

The ocean is facing dire conditions, this building aims to gather an understanding about the state of affairs the oceans are in while expanding the knowledge through public means in an effort to curve the current path trajectory leading to a better and cleaner environment for all. These issues can be highlighted through research into coral reefs and the devastating rate at which they are disappearing. As coral is very susceptible to these changes in climate and rising sea levels, without the additional threat of plastic and oil pollution.

The focus of this proposal is to design an architecture which encompasses the ocean crisis, while forming a sense of place in the Durban point. An experiential space that detaches the user from the outside world and focuses primarily on the edutainment aspect of the program, forming an outreach of education.

This research proposal is seeking to highlight the need for changing and the understanding of the issues that the current environmental habitat of 30 % of all ocean life on this earth are undergoing, the design incorporates the collection and recycling of the two pollutants at a separate site, that would be illustrated in the exhibition space.

The economical hub of shipping in South Africa, Durban Harbour and adjacent precinct Durban point house these issues in a perfect storm like manner. Starting off as a small industrial area, with some accommodation and beautiful beaches the Point has developed over the years. The locals commonly refer to the Durban point waterfront as vetch's bay. A small stretch of peaceful water and smooth long golden beaches, from uShaka marine world pier to North pier. The pier is the site for the Coral Research and Ecology Centre.

The research is aimed to create an environment that enforces an experience of space, to detach the user from the world and creating a sense of awareness of the space. The space thus is an edutainment theme, creating awareness and the harshness of reality and issues faced.



Prohibited Sign

Fig 1.3 Durban Point - North Pier entrance (Author, 2019)

“We must listen to poets.”

—Gaston Bachelard (The Poetics of Space)

SITE

This chapter will follow the process and decision making surrounding the choice of site, and reasoning behind the choice. It will also entail contextual mapping and further understanding of the site, with the history that accompanies it. The highlighting of possible site restrictions and conditions that need to be overcome. A comprehensive evaluation of the site.

CHAPTER ONE

SITE PROFILE

In order to determine the best fitting site for the ‘Coral Research and Ecology Centre’ a number of requirements need to be met. Creating a site profile will help narrow down the number of possible sites to a smaller batch before the final decision can be made. Due to the nature of the project the site choice is vital to its success, therefore these requirements are highly specific to the scheme and its program. The Centre aims to: create a facility that can test and grow coral in its laboratories and wilderness; provide educational facilities to the public on the importance of coral reefs and the dangers and effects that pollution has on them; a public space to hold events to raise funds and awareness.

The controlling requirements of the site have been broken down into the following main points:

Ocean: In order for the project to work the site has to be situated along the coast line of South Africa. The project has to be in close proximity to the ocean in order to run tests and take samples of coral growing in a natural environment. In addition to this the ocean waters need to be of tropical nature, warm enough to sustain wild coral growth. The body of water needs to be, within reason, calm and accessible to examine the wild specimens of coral, preferably a bay.

Reef: The site has to be able to accommodate an artificial reef, as well as be within a short distance to an existing reef or rock shelf. The scheme intends to grow and reproduce coral in the laboratories, growing a resilient strain of coral. The coral grown would be transferred to the existing or artificial reef in the ocean to be tested and examined over time. Allowing the scientist to view the difference in population and growth between controlled and uncontrolled environments.

Accessibility: Due to the nature of the project, and the focus around the public, and their use of the space, the accessibility of the site plays a major role. For the public to engage with the scheme the site has to be able to accommodate large numbers of the public, this would include being in a tourist destination / prominent city within walking distance of a prominent transportation hub, access for cars and pedestrians, as well as the opportunity for transportation by boat. Access to the ocean also needs to be available.

Land: One of the more architecturally challenging possibilities of the site is the connection to the ocean, and the realization that the site could possibly not be on land but rather in the corals natural habitat of the ocean. The relation to land and the need for access and services.

Public Space: The scheme is a public space by nature with the intent to invite the public into the space to create awareness and the pass on of information. The site has to be able to accommodate a high number of people in and around the building, preferably a large public fore court. There would need to be other public spaces in the facility to tie into the scheme. The program of the building reasons that the public space to integrate with would be the likes of, beachfronts, promenades, parks, water parks, and social sports clubs.

Facilities: Although not a heavily influencing factor, the site of the scheme should be near and able to work together with other ocean conscious institutions and businesses. Facilities that have been set up to monitor and preserve the ocean life, dealing with pressing oceanic issues. Institutions such as Sharks Board, and SAAMBR.

All of these points need to be taken into considered when deciding on the location and site of the ‘Coral Research and Ecology Centre’, as they all play a part in the success of the scheme. Some points are more important than others, and will influence the decision more. With the use of these points it is easier to evaluate which sites are the more viable options. This will help determine the site best suited to the scheme.

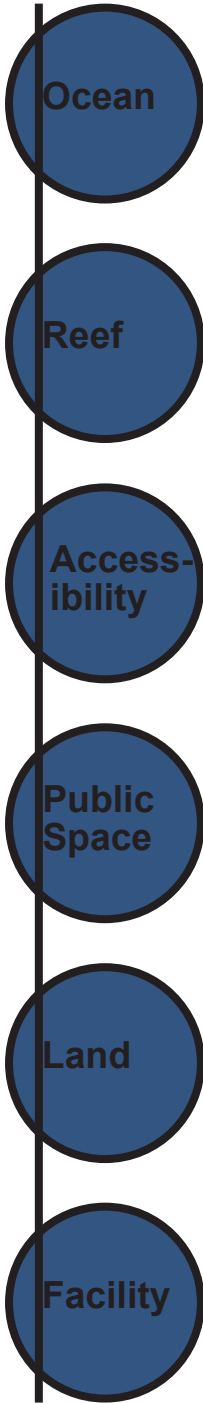


Fig 1.4 Diagram of Site Profile/ Importance (Author, 2019)

SITE OPTIONS

KwaZulu Natal / EThekwin

One of the greater influences of the site is the schemes need to be along a coastal region, this rules out a large number of provinces. Due to the need for warm ocean current, for coral to survive, the East Coast of South Africa is the best suited. Thus left with only two viable options of province for the site, the Eastern Cape and KwaZulu Natal. The Eastern Cape is too far south of the equator to be a viable option for Coral growth. KwaZulu Natal coastline being best suited for the facility.

The site needs to be highly accessible to the public, and connect to large public spaces. The more frequently used public beaches near large city areas, thus the eThekwin area. EThekwin makes up a large portion of the Durban city, covering the most commonly used public beaches of KwaZulu Natal, a well know tourist destination as Durban is known for its beaches and warm waters. The greater Durban bay allows for many great sites, but have been narrowed down to three most viable options.

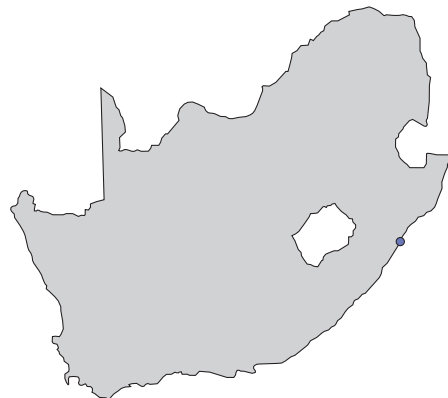


Fig 1.5 South Africa, with location of Durban Harbour (Author, 2019)

uMhlanga Beach

The first consideration was, uMhlanga Beach, the area is an economic and social hub. The popular beach north of Durban, the beach is used frequently throughout the day, and home to the uMhlanga Lighthouse. Apart of the sites appeal was the incorporating the O'Connor Promenade, a narrow strip along the length of uMhlanga public beaches, into the scheme of the project. The smaller of the promenades renovated for the 2010 world cup. The site is littered with large rocks and rock pools teeming with wildlife.

A site off the shore line of uMhlanga beach would be an issue for two reasons, the context primarily of the beachfront is dominated by Apartments, Hotels, and Guest Houses. All of which do not suit the nature of the scheme. With no precedence of construction in or near the ocean, with exception to the piers and lighthouse. And the second is the rough seas would prohibit frequent trips to the artificial reefs to observe the data.



Fig 1.6 KwaZulu-Natal, with location of Durban City Centre (Author, 2019)

Blue Lagoon (Lagoon Beach)

After the consideration of Umhlanga Beach, with the incorporation of the O'Connor Promenade. The Durban Promenade became a viable option. Already a tourist destination with multiple connections to land marks throughout the Durban Beach front.

The North most point of the Durban promenade is the blue lagoon, acts as the boundary to the promenade, it is also the Umgeni River mouth. Not as populated with foot traffic as the rest of the promenade, it is however a commonly used site for local fishermen.

The site offers many possibilities, as it reaches all of the site profile although there is no current reef in the area there is a chance an artificial would work. In the context of the site the scheme does not seem viable, there is no prominent activity in the area other than exercise and fishing, and the mix of the Umgeni river and Ocean would dilute the water possibly restricting life, but would cause the research results to be altered.

North Pier (Durban Point)

From the Blue Lagoon site, the link to the promenade became imperative for the success of the scheme and site choice. On the opposite end of the promenade is the north pier, one half of the Durban harbour mouth. The pier is a newly constructed site with the extension and rebuilding of the pier finishing in 2010. The site is surrounded by water but has connections to the beach and soon to be completed Promenade extension.

The site is unique as it was constructed, currently has multiple uses, and is surrounded by ocean water. It fulfils the site profile, and asks many architectural questions. In addition to meeting all the criteria of the site profile, the Durban Point area is currently undergoing a large scale renovation to the area, the area due to undergo a phased approach to and soon to be finished extension of the Promenade. The North Pier allows options of tying into the current alterations to the area.

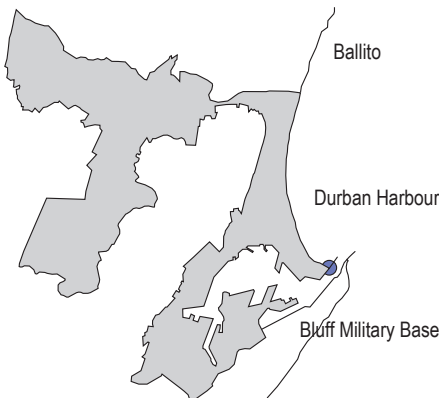


Fig 1.7 Durban, with location of the final proposed site (Author, 2019)

Fig 1.8 Photo of the site - North Pier
(Author, 2019)

WHAT'S THE POINT?



DURBAN POINT - NORTH PIER

Durban, S 29.8689 and E 31.0617.



Chosen Site

Fig 1.9 Durban Point - North Pier with location of Site (Author, 2019)

The North Pier met all the requirements of the site profile, but the site still has much more to offer the scheme; the history of the site, the many different forms contextual programs, the threshold between the public and industrial, the vernacular style of architecture in the Point, the materiality of site, and the constantly changing ocean and tides. The site choice creates many challenging architectural questions, as well as combatting pollution. The Durban Harbour waters, the site forming the mouth of the harbour, have gotten progressively worse and has becoming a problem for the wildlife in the area.

The ocean is a vital part to the livelihood of the Durban community, creates jobs through tourism and the upkeep of the promenade, but the pollution of the ocean, not only Durban, has become a state of disrepair if action is not taken. The site adds a connection to the scheme, as the intent of the scheme is to create awareness around the issues faced in the ocean, global warming and pollution effecting the ocean wildlife. Being close to one of the main contributors to the problem in the area adds a layer of realism of the issue to the public. In the aid of creating awareness and finding solutions to combatting the problems.

The Durban Point area is the south most precinct of the Durban Beachfront, and the site is the boundary of the last publically accessed beach. The North Pier is a man-made divide between the public and industrial, built to increase depth and width of harbour mouth. The Durban Point area is mixed in program with high rise buildings alongside single plot bungalows, with vast green open spaces between the properties (building on the sensation of being exposed to the ocean and beachfront). The ground floors of said high rise building are commonly retail space, with apartments above. The area also houses offices, training facilities, a canal waterway, and the uShaka Water Park.

CONTEXTUAL MAPPING

This is a large scale contextual map break down of the specific regions and programs illustrating the scale at which the Harbour dominates the surroundings. The Durban Harbours as a force in the context with its industrial outreach through transportation, transit, shipping, and growth; it's the second largest harbour in Africa and the fourth largest in the Southern Hemisphere.

The map defines the thin thresholds between the different programmatic areas, and the close proximity to the residential areas of the Bluff, and Durban Point area.

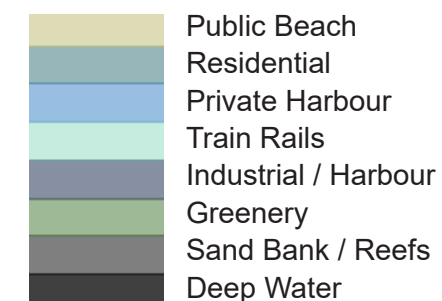


Fig 1.10 Durban, with location of proposed site
(Author, 2019)

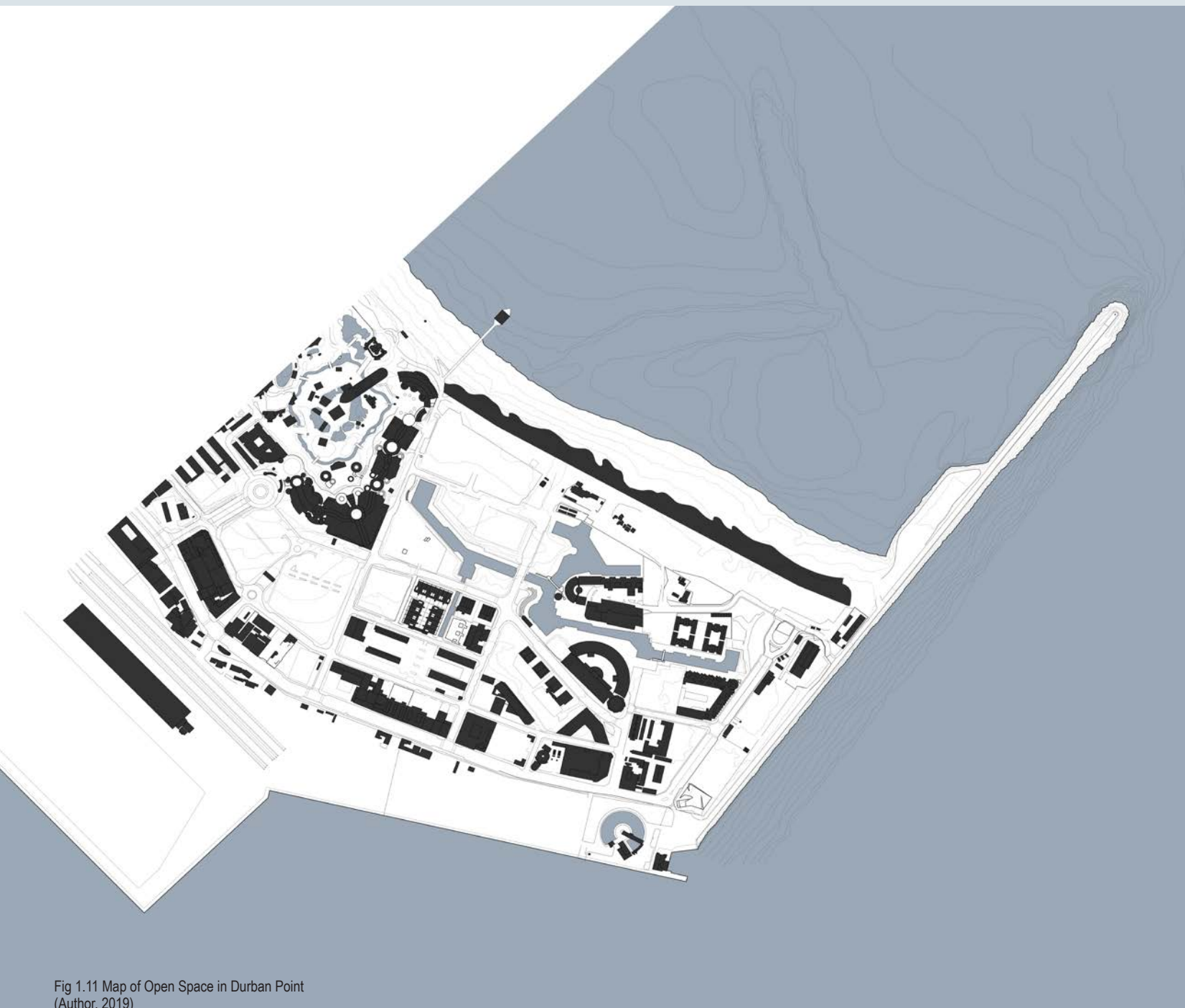


Fig 1.11 Map of Open Space in Durban Point
(Author, 2019)

This map was done to illustrate the building footprints in the Point area compared to the overall area of the Point. The other intent of the map was to show the diversity in scale of buildings in the area and how those large and smaller buildings relate to one another in the context, but what has become prevalent through this exercise is the number and size of the open spaces in the area. The larger buildings are juxtaposed by the empty spaces of the parking lots, parks, and the canal. This provides reason to the sensation of openness and why the tall buildings aren't overpowering the space, allowing for the connection to the beach and waterfront.

The new promenade extension is shown in the map, as part of the Point's renovation, however this new design does not fit into the approach of past architects as the map shows the extent at which the new promenade cuts off the rest of the area to the beachfront and ocean. This disconnect goes against that of the open spaces and the use of the canal. This canal ties the residential area together, running from the east, until the uShaka marine world to the west. There are four bridges that cross it, allowing for vehicles and pedestrians. This body of water brings an essence to the area and providing an oasis like space.

The Durban Point area encourages the use of the public spaces, as they are well managed and positioned within the context, the area feels comfortable yet still exposed to the elements. The openness of the area provides great views to the ocean and pier. The site, North Pier, is extremely open, having no coverage from the elements, but provides great 360 views of the surrounds. South pier and the accompanying beach is clearly visible across the harbour entrance. The context provides influences to the design of the building, there is a clear understanding of why the open spaces work and how the new promenade is undermining those qualities of the area.

The images that follow have all been taken by the author, and all photos are taken within the immediate context of site and the Durban Point area. The photos are to illustrate recurring themes in the Durban Point area.





Vernacular

The architecture of the Durban Point district tends to follow similar design principals from building to building, with no strict regulations with regards to the buildings aesthetics. This shows that the architects designing these buildings were trying to achieve a similar goal, creating a cool environment in the building through the use of passive cooling technics. These design principles can be seem even through the years of change and renovations of the Point; with sun shading devices and deep set balconies on the high-rise residential apartments, and the smaller single plot buildings such as the Bungalows and Row houses in the area.

The buildings in the area currently follow similar principals, this is large scale residential buildings and the smaller bungalows and row houses. The architects made great use of simple sun shading techniques such as deep set balconies, verandas, wooden slats, and other devices. These techniques allow the facades of the larger buildings to be broken up, and less dominating. The area itself makes use of the canal as a passive cooling technic, keeping the space between the buildings where the canal runs, filled with tall trees and vegetation. The canal allows for cool natural ventilation as the buildings open towards it. The cool air is picked up and brought into the buildings, this combined with the green spaces creates a great environment.

There has been a change in the most recent builds in the area, a contrast from the vernacular style that is the identity of the Point. The new designs are moving away from the technics that have worked in the area, such as the sun shading and deep set balconies, towards a modern approach. The new building in the area has turned away from the recessed balconies and natural ventilation and gone for a frameless glass façade approach; like the proposed new buildings for the area.

The area hints for the building to use simple passive cooling techniques, with the use of sun shading devices and encouraging the scheme to make use of public outdoor space, allowing for natural ventilation. Balconies and verandas as a pause space, and for shading purposes.



South Pier

The photos to the left;

This collection of photos is taken from the other side of the Harbour mouth. To illustrate the juxtaposing condition of the barren beach being claimed back by nature. The photos also showcase the delicate balance of boundaries between the beach, the heavily tree growth of the military base, and the restricted area of the harbour. The photos also show the iconic harbour signal tower while under construction.

(All photos taken by Author, 2019)

Gentrification

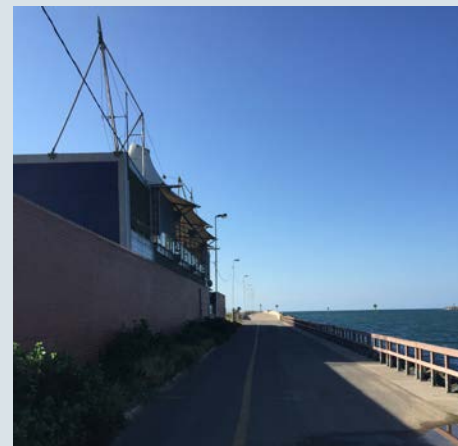
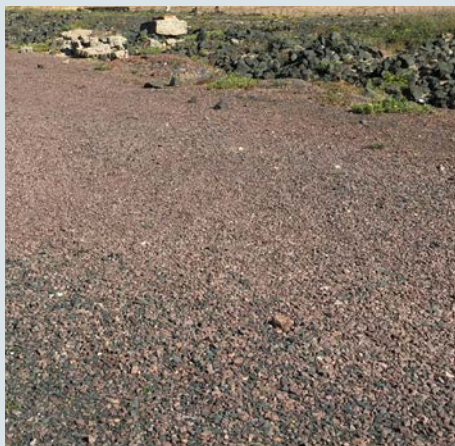
The page that follows;

All photos are taken along Mahatma Gandhi Road, they show a representation of the facades and shopfronts of the decaying architecture. As is visible in the photos arrangement that the area has begun the process of gentrification, with a number of the facades being taken back from abandonment and given new purpose. As is evident in the photos a number of the buildings are yet to be attended to, the facades left untouched and falling, while others have simply been demolished and left bare. In contrast to facades and empty plots on this short length of road is the new sewerage pump facility, poised at the end of the Street. A changing in the times and style of architecture unknown to the other buildings in its immediate proximity. Apart of the renovations made to the North Pier in 2010.

These photos illustrate the Durban Point area and its peoples want to create a more welcoming environment, one that is set for the good of the district.

(All photos taken by Author, 2019)





Materiality of Site

The photos are aimed at indicating the diversity of materiality found on the site. The site offers a rich tapestry of colours and textures, all of which will influence the decisions to be made about materiality of the scheme. A combination of colours appear on the pier from the large dark boulders that make up the base to the juxtaposing light golden beach sand and precast / cast in-situ concrete around the site. The Dolos form can also be used as a conceptual form to the scheme.

The pier itself is alive with vegetation and wildlife, forming a biodiversity. The boulders that make up the pier further along from the site are occupied by coral polyps already.

DURBAN POINT WATERFRONT



Fig 1.12 View of Vetchs Reef.(Point Yacht Club, 2019)
Fig 1.13 Current construction of the promenade extention (IOL news, 2019)
Fig 1.14 Proposed expansion of Durban Point (durbanpoint, 2019)

During the extreme low tides the top of Vetch’s Reef protrudes from the ocean surface. Vetch’s Reef has a lot of history behind it and there is a large outcry from the community to keep the reef safe from any development. During high tide the reef is roughly 4 meters under water at the base and the Limestone reef is in the 6 meter mark.

'THE GOLDEN MILE'



Fig 1.14 A map of the promenade in its entirety.(Author, 2019)

Numbered along the map are prominent buildings and public spaces that are influential along the boardwalk, the aim of the Coral Research and Ecology Centre is to tie into this large scheme of the promenade, creating an ending point of interest at the Pier.

1. Blue Lagoon -
Blue Lagoon is the river mouth of the Umgeni River which flows into the Indian Ocean. It is also the starting feature of the Durban Promenade, a common fishing spot and great views of the ocean and Durban. There are a two sports facilities that are arrange around the lagoon; The Kingfisher Canoe Club, and the Windsor Golf Course.

Fig 1.15 Photo of Blue lagoon, (5Star, 2015)



2. 4. 11. 13. 14. Public Pools -
Laguna Beach Public Pools
Kings Park Swimming pool
Rachel Finlayson Swimming Pool
Beach Front Swimming Pools
Beach Front Swimming Pools 2

There are five public pools along the promenade, frequently used to either train for sporting events or splash pools that are safe for children to play.

Fig 1.16 Photo of Beach Front Swimming Pool.(Buttigieg, G. 2015)



3. Moses Mabhida Stadium -
The stadium was completed in November 2009 for the 2010 Fifa World Cup, hosted in South Africa. Although the stadium is set back from beach fronts, it is linked to the promenade by means of bridge.

Fig 1.17 Photo of Beach Front Swimming Pool.(Buttigieg, G. 2015)



5. 7. 8. 9. 12. 17. Public Event Space -
Sun Coast Casino
Durban Mini Town
Durban Skate Park
Durban Amphitheatre
Durban Funworld
uShaka Pier, Moyo Restaurant

There are many public events spaces along the boardwalk, the promenade being one of them.

Fig 1.18 Photo of uShaka Pier, Moyo Restaurant(Moyo, 2019)



6. 10. 16. 19. 20. Water Sports Clubs -
Suncoast Pirates Surf Lifesaving Club
Durban Surf Life Saving Club
Marine Surf Life Saving Club
Point Yacht club
Durban underwater club

There are a number of different water sports clubs along the promenade, tying into the activity of the promenade.

Fig 1.19 Photo of Durban Life Saving Club. (DSLCLC, 2016)



17. Addington Hospital -
The Hospital was first constructed in 1879, having previously been located on the Victorian Embankment under the name 'The Bayside Hospital'. This was Durban's first functioning hospital. The building underwent many additions to increase the size, and was finally completed in November of 1967. The building has however recently undergone renovations to the façade.

Fig 1.20 Photo of addington Hospital (Swart, L. 2015)



18. uShaka Marine World -
The uShaka Marine World, was the ending of the promenade before the extension, home to great public spaces through the open air shopping experience. SAAMBR, is currently situated within the grounds of the Aquatic Park.

Fig 1.21 Photo of uShaka Marine World (Lotter, C. 2017)



21. North Pier -
North Pier is the current ending to the promenade extension, it is the site for the Coral Research and Ecology Centre. Currently used as over flow parking for the Point Yacht club, and Durban Underwater Club.

Fig 1.22 Photo of North Pier (Author, 2019)



THE PROMENADE



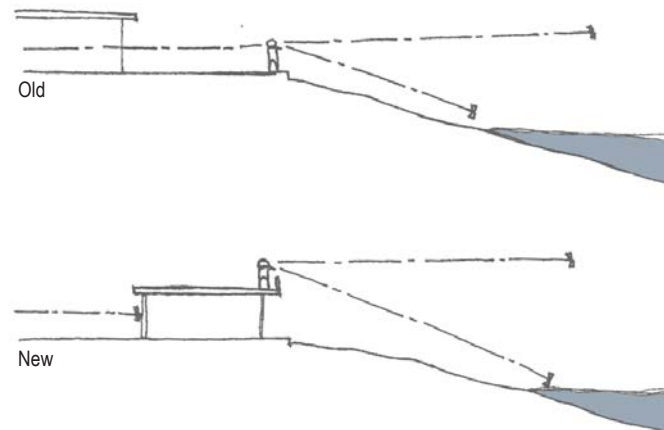
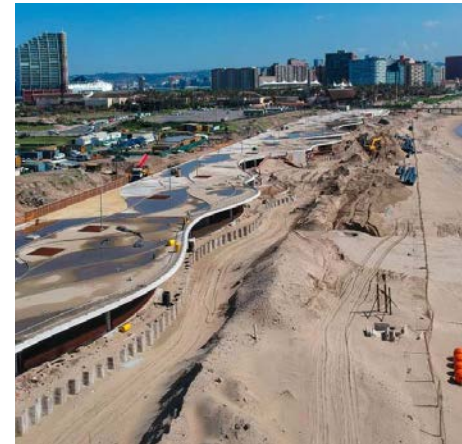
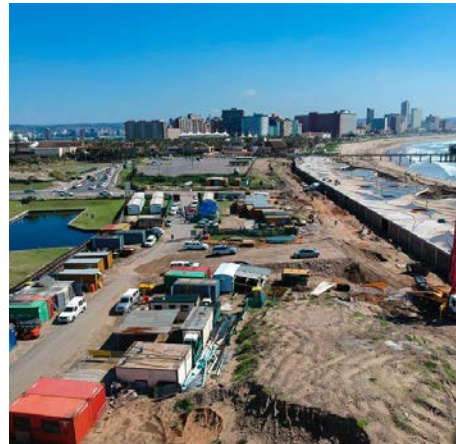
Fig 1.23 Durban Promenade, A photograph showing the common Saturday crowd. (



Fig 1.24 Below Durban Promenade, the thresholds between the ocean and Durban City Centre. (Bloc, 2016)

The Durban beach front is home to one of the most notable land marks in South Africa, The Durban Beachfront Promenade which is fondly referred to as ‘The Golden Mile’ by the locals. The promenade stretches along the length of the Durban City Centre Beach front, from Blue Lagoon in Umgeni Park to North Pier in the Durban Point Waterfront. The south most portion of the boardwalk has recently been completed, a raised platform that runs from uShaka Pier to North Pier. Making the entire experience of ‘The Golden Mile’ a length of 8.2 Kilometres. The strip includes three public splash pools, a number of public amphitheatres, and a connection to Moses Madiba Stadium. The boardwalk is littered with many water sports clubs, life guard stations, and public bathrooms are also found along the public space. The beachfront is also home to many restaurants that create a vibrant experience and a source of economic flow. The stretch of beachfront has become synonymous with early morning runs and weekend sporting events.

The promenade is however facing issues of rising sea levels and soil erosion on many of the beaches, this phenomenon has left a few buildings stranded and the golden beaches now a rocky shelf. “Further north on our main beaches, which are undoubtedly our biggest tourist attraction, the situation is completely different. People will remember the state of our beachfront earlier last year where there was not one grain of sand on our central beaches and sand bags were placed to defend our promenade from the crashing waves.”(Berea Mail, (2019). The problem is the dredging at the harbour mouth due to the requiring sandbank. When the harbour mouth was rebuilt the sand pumping station was moved to a temporary facility. This station could not handle the amount and the sand was dumped on the wrong beach.



THE EXTENDED PROMENADE

The promenade is nearing the final stages of completion earlier this year. This will bring an end to the first phase of the Durban Point Waterfront renovations, the extension was Phase One of Seven. The other Phases have not been initiated as of yet with the intention of the new promenade to bring in new investors.(Durban Point Waterfront, 2019) The extension is a big push by the municipality and private investors to rejuvenate the Durban Point area, which holds great potential for future growth.

The new portion of the promenade has lost the relation to the beach and ocean that made the public space so powerful. There is a disconnect between the promenade and beach as the new structure is raised to 4.5 meters above the beach level, with only 4 ramps allowing the user to access the beach and shoreline. The promenade is raised to allow shops, parking lots, and sports clubs to be built into the space beneath, it is a part of a large scale scheme with new buildings to be built into the master plan in phases. This is design of the promenade losses the essence of the existing 'Golden Mile' which made it so popular to the public. This is shown in the sketch (Fig 3.?) of the new promenade in relation to the existing promenade.

The reason this public space is so such successful is because it acted as a transitional space between the free standing buildings and parking lots, bringing the user onto the beach. The area between the buildings is vast and often used as open air parking lots. The entire length of the promenade has an essence of being open with unrestricted views to the ocean, including from the roads that run parallel. The new design contradicts this approach as the promenade does not act as this transitional space but rather a standalone structure that hinders the views and approach to the beach.

Runners, walkers, cyclist, tourists, and all Durban enthusiasts will be able to experience the full extent of the beachfront. North Pier acting as the anchoring point to the frequented boardwalk. The Pier has the potential to create a stand out destination, tying into the greater scheme of the promenade and the infrastructure planned for the future.

Fig 1.25 Construction of the promenade from beach (Author, 2019)

Fig 1.26 View of promenade towards North pier, from above (Lindeque, 2019)

Fig 1.27 View of promenade from West, full legth towards uShaka Marine World, from above (Lindeque, 2019)

Fig 1.28 View of promenade from East, full length towards uShaka Marine World.(Lindeque, 2019)

Fig 1.29 View of connection to old promenade (Lindeque, 2019)

Fig 1.30 Diagram representing the change in design approach and disconnect of the New and Old promenades. (Author,2019)

NORTH PIER (OLD VS NEW)



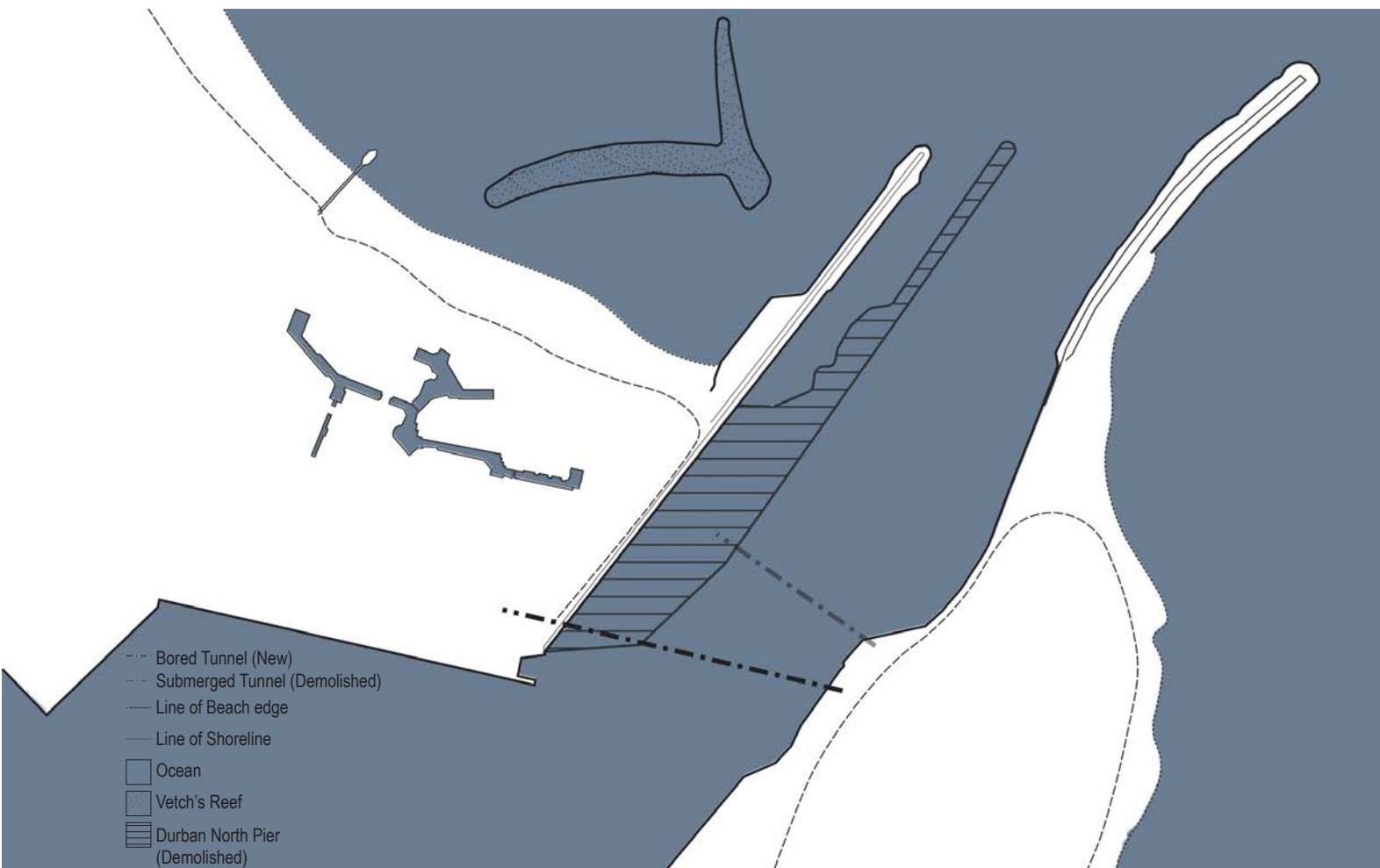
Fig 1.40 Historical image of the harbour mouth (FAD, 2019)

Naturally the North pier creates the divide between that of the Durban Harbour and that of Durban Point beachfront, creating a divide between the industrial harbour and the public and residential spaces of the Durban Point and its beachfront. This creates an interesting heritage and mix of uses along the pier itself.

“The [North] pier was built from 1850 onwards. It is currently 335 meters long. The pier has proved to be a fine barrier to the worst north easterly sea -swells and is popular with fishermen. A good view of the harbour entrance and beachfront is obtained from here.” (Durban tourism,2019) Since the first completion of the pier [1850] there have been several upgrade done to strengthen and lengthen the pier, most notably the works completed in 2010. Prior to the current configuration, the North pier was multi-functional.

Used by many local fishermen as a prime location, over flow parking as it was not regulated, train tracks reminiscent of times past, a monument to the ‘Lady in White’, and housing a restaurant complex that overhung the harbour water. (FAD,2019).

Before its latest up grade, the pier was fitted with a monument to the Lady in White, she would sing to troops of World War 2, those that were arriving and those that were departing. There was also a restaurant complex that over hung the harbour entrance at the base of the pier, this building was demolished once construction began. It also has the history of providing a dining experience while overlooking the Harbour mouth.



Many of the larger vessels would struggle to enter due to the depths of their hauls, and the weather would often effect the larger vessels from entering the port – extreme tides would also play a part in this.

The pier has gone under several renditions of groyne extension and strengthening on the south and North to increase the reliability of the harbour. To combat the constant evolution and improvements to technology and the increase in vessel sizes and traffic. The harbour has had to adapt to the increased pressure to perform and stay current in the market eye, thus upgrades to the harbour entrance and bordering piers needed to be completed.

The most recent and extreme of these renovations being completed in 2010, included the widening and excavation of the harbour entrance, leading to an entire redesign of the North Pier and a portion of Durban Point. The entire project cost R2.9 Billion and took 2 years and 10 months to be built, with the project coming to a close in February of 2010, a month ahead of schedule. All of this was done to increase safety and to allow post-panamax vessels access to the harbour.

This required a large portion of Durban Point to be cut back in order to be and reclaimed by the sea. This master plan required a new sewer substation as the previous fell within the demolition line.

A new deep service tunnel, which housed Durban's CBD main sewer trunk and electrical cables, this had to be bored at a greater depth, to the position of the new sewer substation.

As the construction process was split into phases to ensure that there was minimal disruption to the working of the Harbour, the 'new' pier was constructed first before the complete demolition of the existing pier. The new 'north groyne' or pier is built up large graded rock, and rubble from the old submerged tube tunnel. A layer of concrete dolosse at the pinnacle to protection against the waves, and topped with a concrete cap, which is now used as an access road for Transnet and often walked by the public.

The existing pier and portion of Durban Point was then demolished and dumped out at sea, or offshore in the construction process. Once the groyne was completed dredgers were then used to burrow the harbour and entrance channel, the suction dredger 'Mariske' and the largest grab dredger 'Pinocchio' were used to reach the depths Transnet required [marine museum], a depth of 19 m at the outer entrance and gradually sloping up to the necessary 16.5 m along the centre line. The projected was completed a month ahead of schedule and met with a water show to celebrate. The harbour widening is viewed internationally as an engineering feat and a complete success.

The Durban harbour is vital to the survival of the South African economy due to imports and exports for the country it is the second largest cargo port in Africa and fourth largest in the southern hemisphere. The harbour was established in 1824 and since then has gradually grown become an economic hub of South Africa. It started life as a natural harbour due to its sheltering shape and elements that could be protected from. The Bluff hill, known as Beacon Hill, covers most of the wind from the South, and the depth at which the port travels in land allows for easy access from land.

In the later years the North and South Pier were built to prevent waves entering the harbour and create more control in the harbour mouth, as well as the depth of the water. It was “1851 when John Milne, Durban’s first Harbour Engineer, put forward a plan for the construction of two piers which, it was hoped, would keep the channel open to a constant depth of 4.5m through a process of tidal scour.” (Durban Tourism, 2019)

South Pier [Bluff] “It was built during the 1890’s by engineer Edward Innes. It provides a marvelous place from which to fish for barracuda or shad.”(Durban Tourism,2019). The South pier is currently a length of 700 meters long and breaks the harsh choppy water conditions of the Indian Ocean to the south of the harbour entrance.

The South Pier is an extension of the sandy beaches that lay at the foot of a large mountain like hill, named ‘Beacon Hill’, which ends abruptly in the white soft sand of the Beach. This is a heavily vegetated hill side, and creates a striking backdrop in contrast with the industrialized harbour, as well as defending the harbour from harsh winds from the South. Set within this vegetated hill is the ‘Bluff Military Base’ which is currently still active and used for training purposes. The bank is littered with dated war relics that now sit idle and rusting. With the short beaches to the south of Beacon Hill named ‘Cave Rock’ including the thin length of beach linking to the pier falls in the Bluff district. This ‘outcrop’ of land is under the bluff district.

In the past there was a hotel, ‘Floating Hotel’, which was built to stand in the shallow water near the pier edge. The hotel would accommodate the workers in the harbour and visiting ship crew. This however was juxtaposed by the coal drop off location only a few hundred meters further along the harbour entrance. This site is still used to this day and is visible from the proposed site. The hotel has since been closed and removed from the shallow water in which it used to stand, now a vacant reach of calm water. On the opposing side of the ‘island’ further south along the Cave Rock coast is an abandoned Whaling Factory. A reminder remanence of times when whaling was legal in South Africa.

Whales would be brought into the harbour via ships, they would then be transported by train to the whaling factory on the south side of Beacon Hill. The railway tracks, would travel through a variety of conditions. Would pass the coal dump, floating hotel, and military bunkers in order to reach the factory. The off cuts from the whale meat would be dumped into the ocean this would then encourage a shark frenzy in the water.

The harbour entrance is now 122 meters wide and is 12.8 deep, which is maintained through dredging, there are moving seabed banks just off the coast of the entrance that have caused issues of delays in the past, before the incorporation the piers and dredging. The shipping does not stop at Durban harbour as it runs 24 hours a day, with the only delays arriving due to severe wind conditions, thus forcing the crane controllers to stop the movement of cargo.

In the past there was a hotel, ‘Floating Hotel’, which was built to stand in the shallow water near the pier edge. The hotel would accommodate the workers in the harbour and visiting ship crew. This however was juxtaposed by the coal drop off location only a few hundred meters further along the harbour entrance. This site is still used to this day and is visible from the proposed site. The hotel has since been closed and removed from the shallow water in which it used to stand, now a vacant reach of calm water.

On the opposing side of the ‘island’ further south along the Cave Rock coast is an abandoned Whaling Factory. A reminder remanence of times when whaling was legal in South Africa. Whales would be brought into the harbour via ships, they would then be transported by train to the whaling factory on the south side of Beacon Hill. The railway tracks, would travel through a variety of conditions. Would pass the coal dump, floating hotel, and military bunkers in order to reach the factory. The off cuts from the whale meat would be dumped into the ocean this would then encourage a shark frenzy in the water.

The harbour entrance is now 122 meters wide and is 12.8 deep, which is maintained through dredging, there are moving seabed banks just off the coast of the entrance that have caused issues of delays in the past, before the incorporation the piers and dredging. The shipping does not stop at Durban harbour as it runs 24 hours a day, with the only delays arriving due to severe wind conditions, thus forcing the crane controllers to stop the movement of cargo.



DURBAN'S LADY IN WHITE

The history of the North Pier is more substantial than the alterations and widening and deepening of the harbour entrance. It was once used as a symbol of hope and safety to the soldiers set off to war. It was the location where Perla Siedle Gibson, the Lady in White, would stand and sing to the passing war vessels filled with men and women ready for war. Perla would never miss a day or ship and the thousands of people on those ships would praise her and her beautiful voice, she became a symbolism of hope to them. A monument and plaque was place where she would once stand and sing, a place of remembrance to the lady that brought calm in a time of crisis.

Sadly the monument had to be moved during the alterations made to the harbour in 2010, but a statue was placed at the Durban Maritime Museum, with the same plaque was set into the stone of the statue. The North Pier has been used as a symbol in a time of need before and can be used again as change for the better.

The story behind the legend. "Between 1940 and 1945 three million WW2 personnel sailed through perilous waters to Durban en route to Burma and Mediterranean battlefields. With morale at low ebb, they were greeted by Perla Siedle Gibson, International concert soprano, singing a welcome to the crowded decks gliding by. She never missed a convoy. Not even the one that sailed the day she learned her eldest son had been killed while serving with the black watch in Italy."

To the Memory of Perla Gibson "The Lady in White" who sang to countless thousands of British Commonwealth and Allied Servicemen as they passed through Durban over the years 1940 to 1971. This tablet was presented by the Officers and Men of the Royal Navy.

The quotes above are from the statue at the museum.

Fig 1.42 Lady statue, (Aurthor, 2019)
Fig 1.43 Historical photo of lady (FAD, 2019)

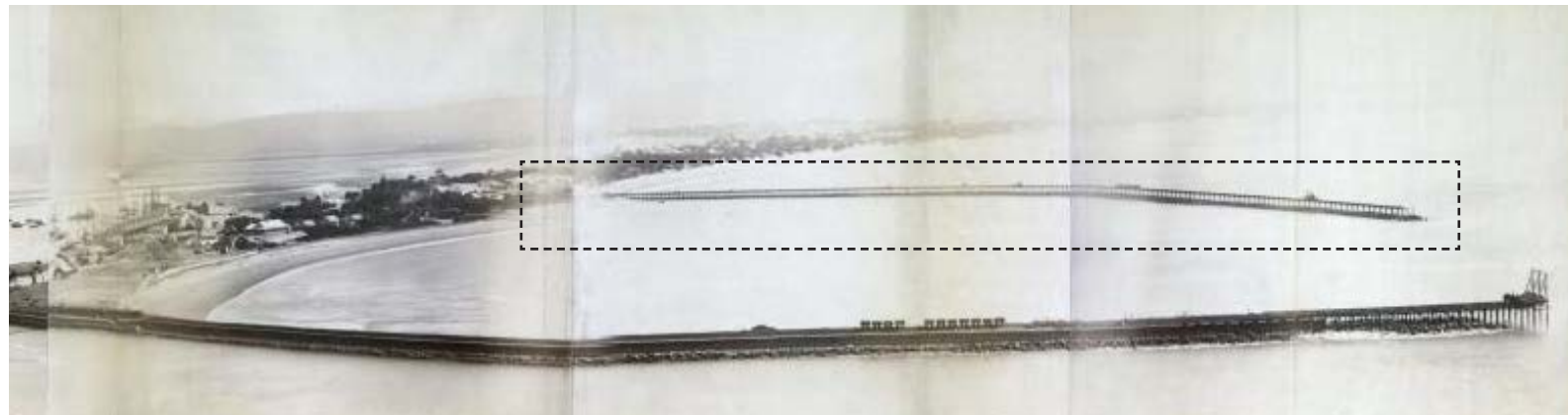
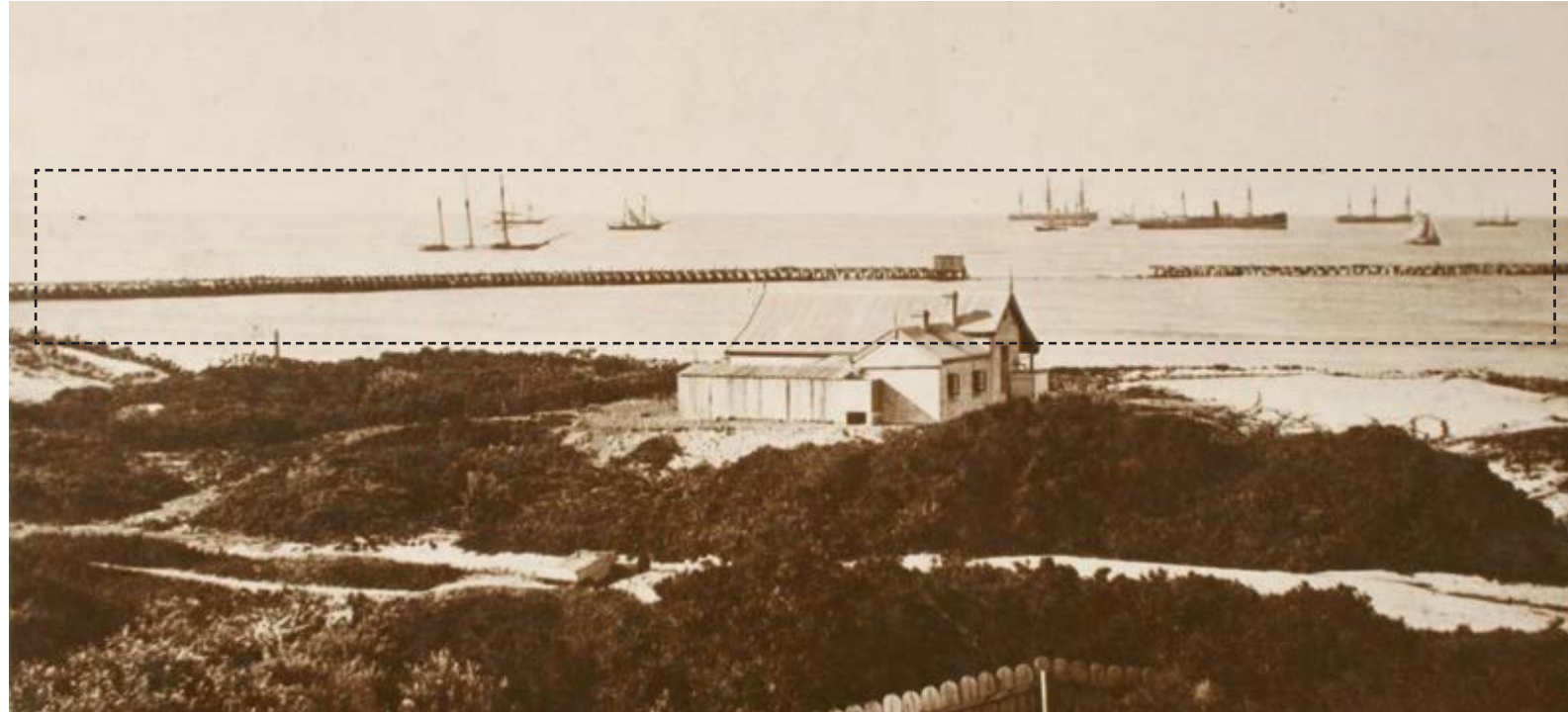


Due to the natural qualities of the Durban harbour it was destined to be a working harbour and financial hub for the country. Although, as previously discussed in this document, a lot of work was needed to be done in order to get the port working effectively and efficiently. There have been many great feats of engineering in the history of the harbour with the intention of bettering the safety and standardizing the water level in the harbour mouth. Possibly the most commonly known, in the eyes of the people, being 'Vetch's Pier' now more fondly known as 'Vetch's Reef'. Which is positioned towards the centre of the 'Durban Point Waterfront' which is also more commonly known amongst the locals as Vetch's Bay. The bay is the reach of ocean that lies between uShaka Pier and North Pier, typically a calm stretch of water with small waves lapping onto the shore. This was the municipality scandal of its day. The harbour mouth was in dire need of work as the boats were delayed. The public gave a cry of help to control the conditions of the harbour.

Over the many years since the abandoning of the project, the pier has slowly disintegrated to what is currently left today, leaving behind only the rocky skeleton of what once was. Now a predominant 'Rocky Shelf' which sits approximately 3 meters from the ocean bed and 1.5 meters below the sea level on average. Although during 'spring lows' the top few rocks can be seen from land piercing the water line. This outcrop of a rock shelf has become the home to a fairly large population of Moray Ells.

Fig 1.36 Diagram representing Vetch's Reef in relation to site. (Author, 2019)

VETCH'S PIER



Durban's bay was little more than a natural lagoon, it took extensive work to get the nearly inaccessible bay to become a working harbour, although to turn this harbour into a functioning seaport, there needed to be a process of dredging the bay, and construction of the North and South Pier needed to be finished in order to get the port working efficiently.

This still was a health hazard as the harbour entrance only allowed for small vessels to come into the bay and many of the large ships had to anchor off the coast, "66 ships were blown ashore on Durban's beachfront between 1845 and 1885." (Poverello, 2012). This was an issue that needed to be resolved if the Durban harbour was to be the economical hub that was intended. Captain James Vetch put forward a proposal to address the faults, he did so without ever visiting the bay. The proposal was pushed through the natal legislation in late 1959, it was rushed due to the dire need to get the harbour functioning. Vetch's Pier didn't start out as intended and eventually grew into an economic scandal and blunder by the Natal government.

Vetch's reef is not the only reef in the bay, there is a limestone reef that runs perpendicular to Vetch's. The reefs intersect towards the base of Vetch's. These reefs feed off one another, and creates a great spot for the wildlife to thrive, should the coral take off the reef provides enough shelter for the reef to thrive along with the wildlife.

Fig 1.37 Vetch's Pier, pre demolition
(BereaMail, 2019)

Fig 1.38 Vetch's Pier, pre demolition
(mpoverello, 2012)

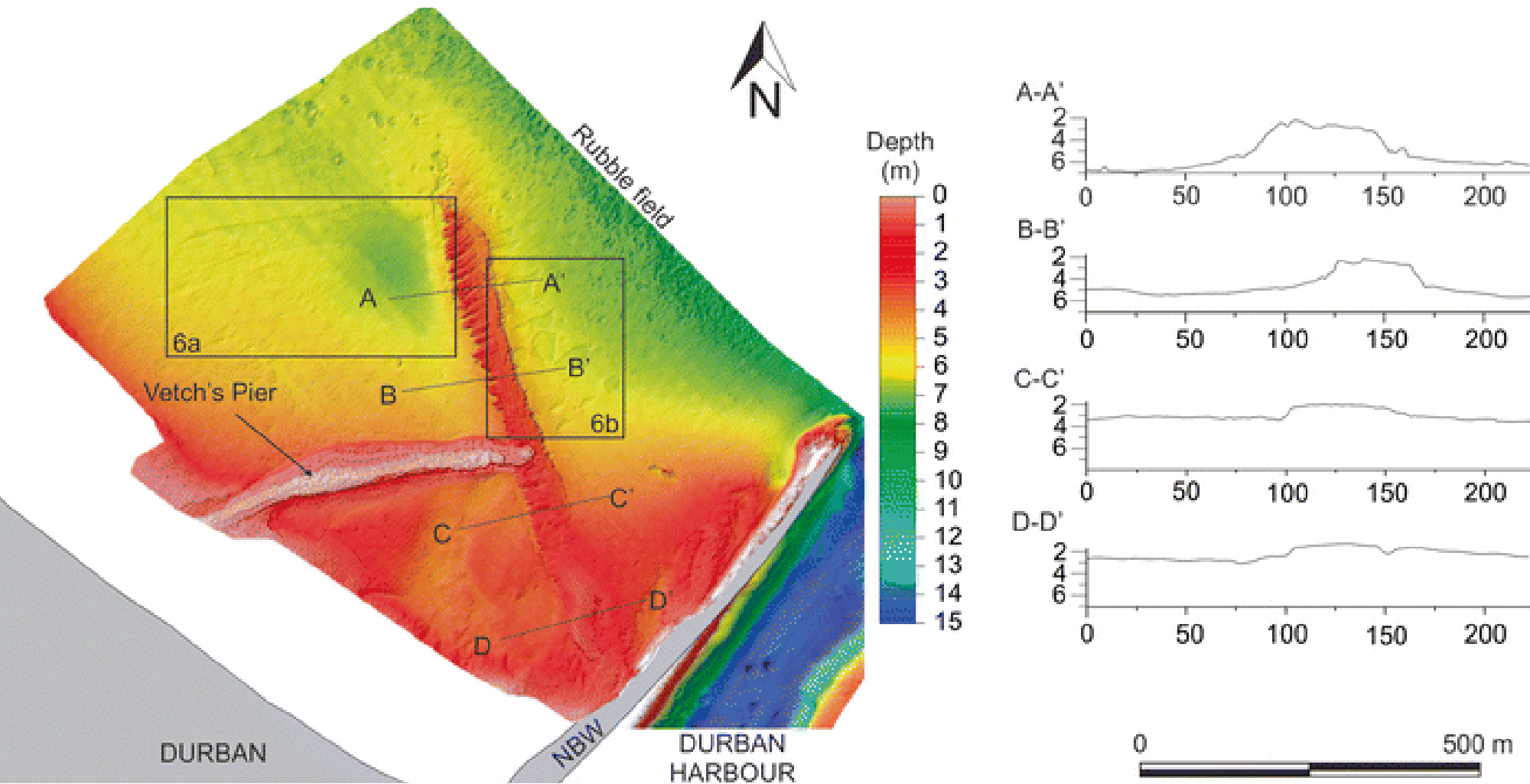


Fig 1.39 Diagram representing Vetch's Reef in relation to site and section.
(Pretorius, L, 2019)

Vetch's pier was to enclose the harbour through the use of two breakers, the South curving breaker from uShaka beach is now known as Vetch's Reef. The design had a number of flaws, there was no account for the prevailing winds and ocean current directions, and the engineering proposed for this build was impractical and a large amount of material was lost through the trial and error of this construction. Four years into the build the pier was not taking shape and far from being on budget, "£90,000 of the budgeted £165,000 had been spent while less than ten percent of the work had been completed" (Poverello, 2012). The pier was then abandoned once investigation into the finances surrounding the pier were underway,

Vetch's Pier once ran from shore line into the heart of Vetch's bay, now the once man made pier has become a rocky shelf, acting as a reef to the Durban Point beachfront. There was once an abundance of fish in the Vetch's bay during the 1990's, "a team of marine researchers counted at least 74 fish species at Vetch's" during this time, now this number has since dwindled to a handful, majority of the life in the form of Moray eels, and other smaller species of fish.

Vetch's Bay itself cannot be home to a 'coral reef' in its typical term as the definition of a coral reef is within the Mediterranean (Tropical Zone) (small diagram to fit) although coral can grow on the reef it cannot however be classified as a Coral Reef as Durban falls out of this category, but research and coral growth can still be accomplished.

SAAMBRE (The South African Association for Marine Biology Research) Founded in 1951, they are a Non Profit Company that was the keystone to uShaka Marine World and is situated on its grounds.

- Oceanographic Research Institute (ORI)
- uShaka Sea World
- uShaka Sea World Education

THE TROUBLESOME RISE

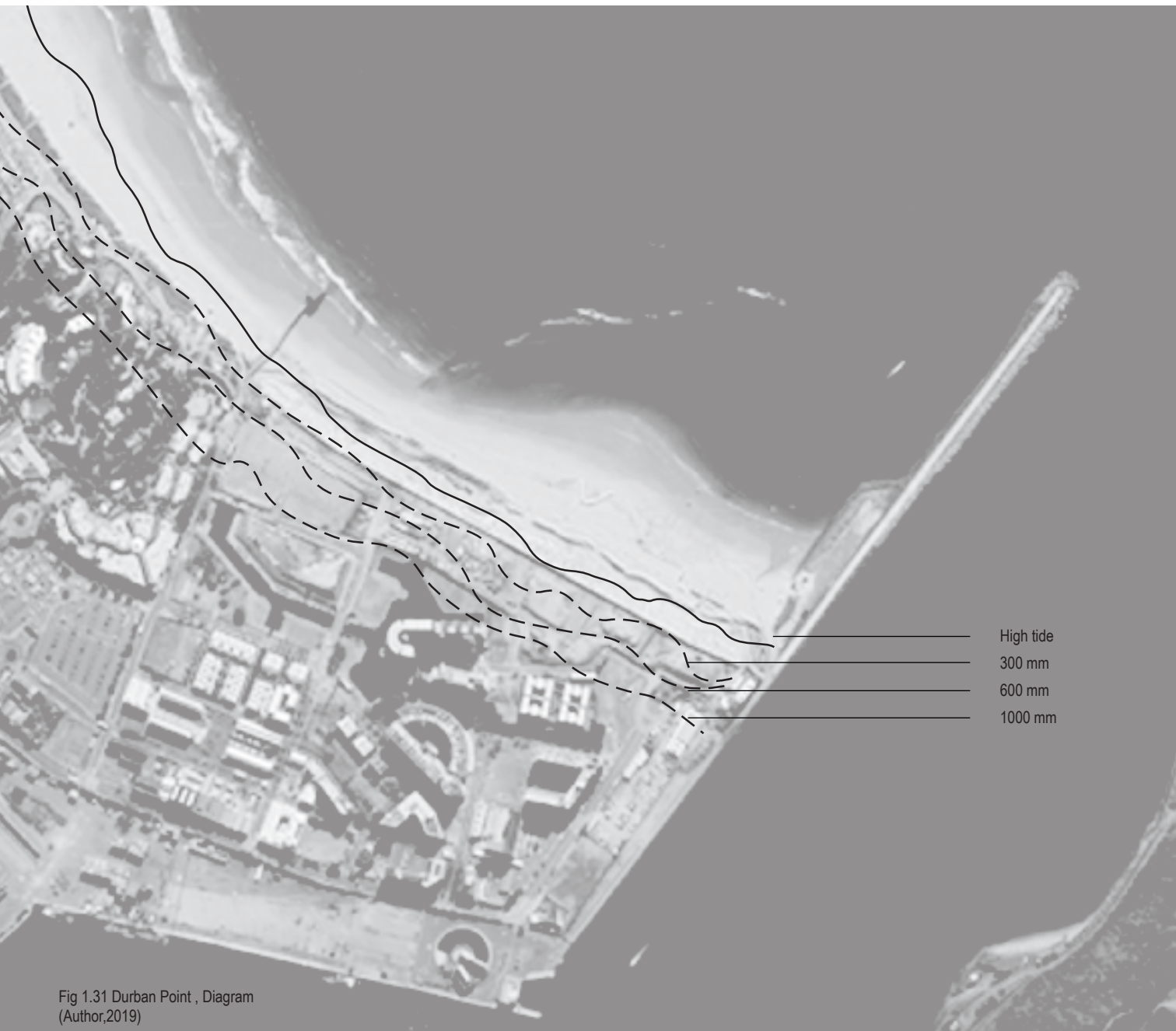


Fig 1.31 Durban Point , Diagram
(Author,2019)

The Durban beach front saw devastating impact in the year of 2007, a combination of Saros spring high tides, and a large marine storm resulted in an unprecedented high level of tides. The effects were felt all along the East Coast of South Africa. The high seas caused destruction along most of the Durban Promenade, flooding many of the restaurants that line the “Golden Mile”. Debris of rocks and bricks littered the promenade, while leaving large amounts of sand and vegetation behind as well. Refer to the images (Fig 5.2 and Fig 5.3) on the extent of damages. The high tides managed to break over the constraints of the South Pier (fig 5.1) allowing the harsh waves of the Bluff to enter the Harbour Mouth. Although these are the extreme conditions as the tide range reached 8 meters, compared to the average 1.8 meters, and some swells were recorded at 8.5 meters (Smith, 2007). If the sea levels continue to rise there will eventually be no beach front, and the shops and promenade will be lost.

This diagram represents the possible effects that climate change could have on the beach front, these are predictions of the ocean high tide line, should the sea levels raise by 1 meter.



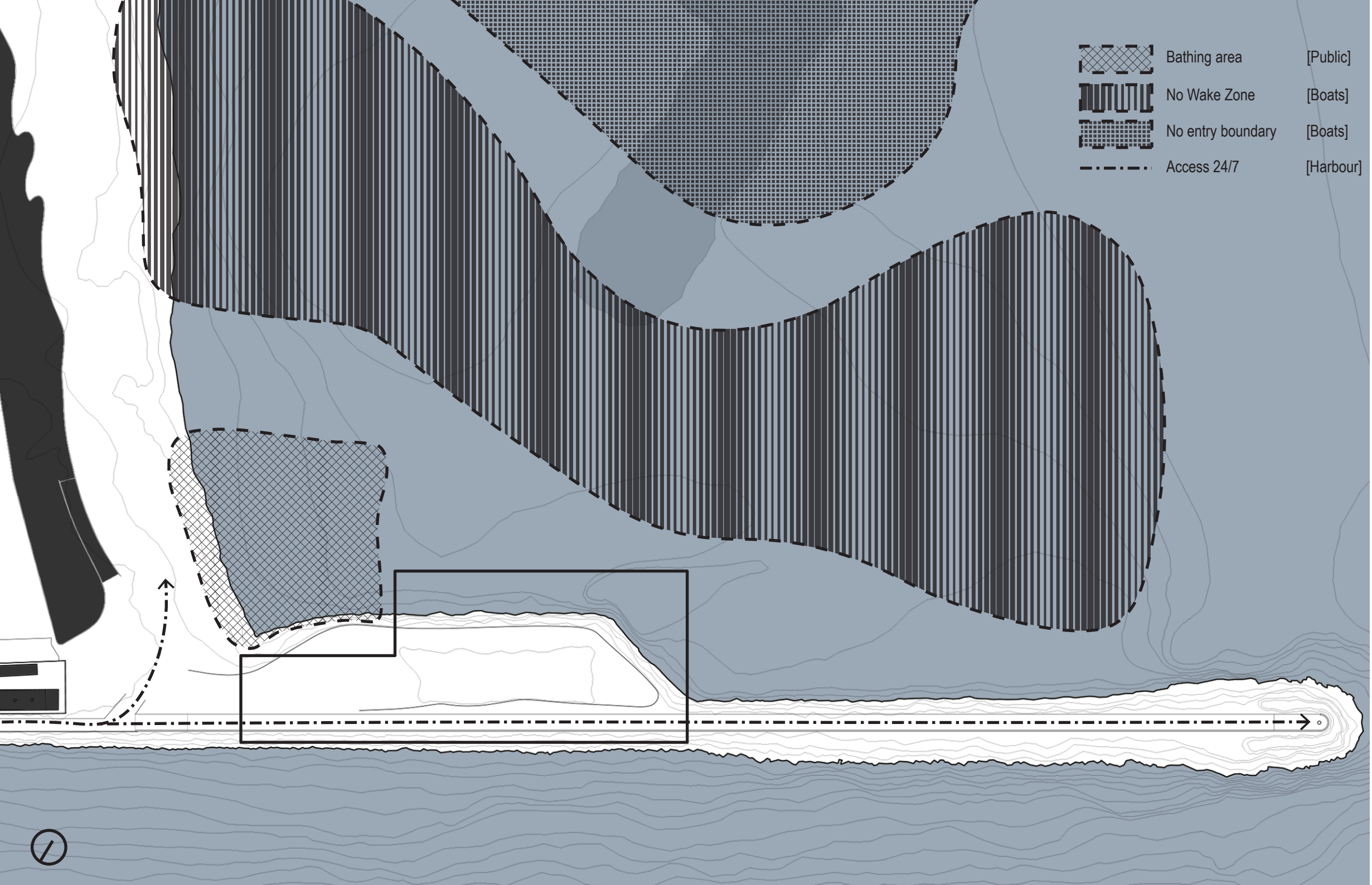
Fig 1.32 Durban Promenade, A photograph of the public during the high tides of March 2007.



Fig 1.33 Durban Promenade, A photograph of the public during the high tides of March 2007.



Fig 1.34 Durban South Pier, A photograph of the seas breaking the constraints of the pier during the Saros spring high tides, March 2007.

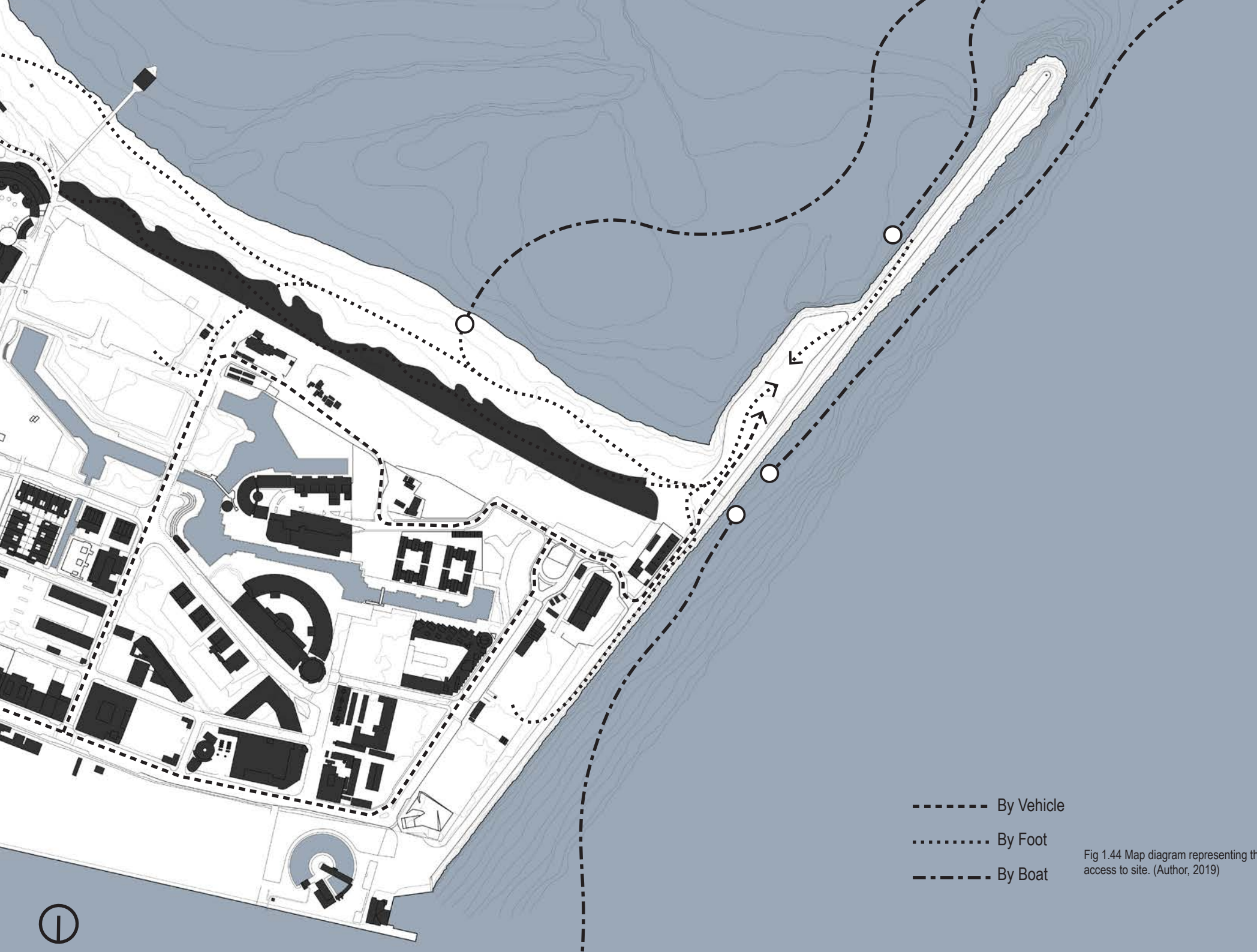


SITE RESTRICTIONS

Due to the special nature of the site there are no formal building restraints, following special zoning. Therefore all proposed builds need to be put through special evaluations before earth can be broken. The proposed site outline is consequently up to the discretion of the architect.

There are however strict restrictions for the 'Point Yacht Club'. All small vessels entering the bay my not leave a wake and are not allowed to pass within 50 meters of Vetch's Reef. The south most corner of the beach, where the pier and beach meet, is a small bathing area, where canoe enthusiasts can launch from.

Fig 1.35 Diagram representing the restrictions of site. (Author, 2019)



- By Vehicle
- By Foot
- . - . - By Boat

Fig 1.44 Map diagram representing the access to site. (Author, 2019)

ACCESS TO SITE

As the site is surrounded by water on all edges except for one, therefore there can be only one access point for both cars and pedestrians creating an architectural challenge. Signal Road is already in place and used by Transnet staff to do maintenance on the Communication tower at the end of the Pier. The site is currently used as overflow parking for the sports clubs in the vicinity.

As the Durban beach front promenade is such a public place with ease of access, and as the promenade extension is finished. The public's access to site via the promenade will allow for the beachfront parking to be used as overflow parking. The intention of the project is to tie into the new promenade extension and furthering the boardwalk to the end of North Pier.

The site also allows for access via vessel, either to beach the boats on the Point waterfront beach. Due to the nature of the new harbour mouth and the intent of the district to build a passenger terminal a few hundred meters south the site, will allow for docking facilities along the south edge of North Pier.

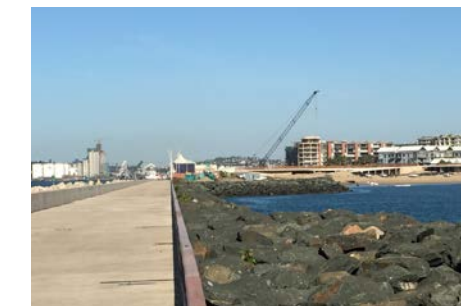


Fig 1.45 View along Signal Road to site, from north. (Author, 2019)

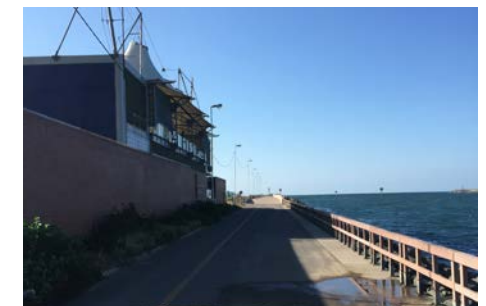
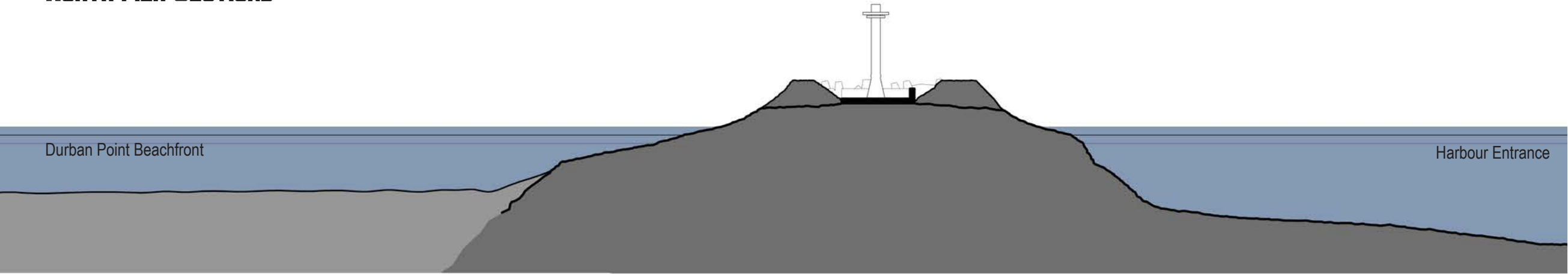
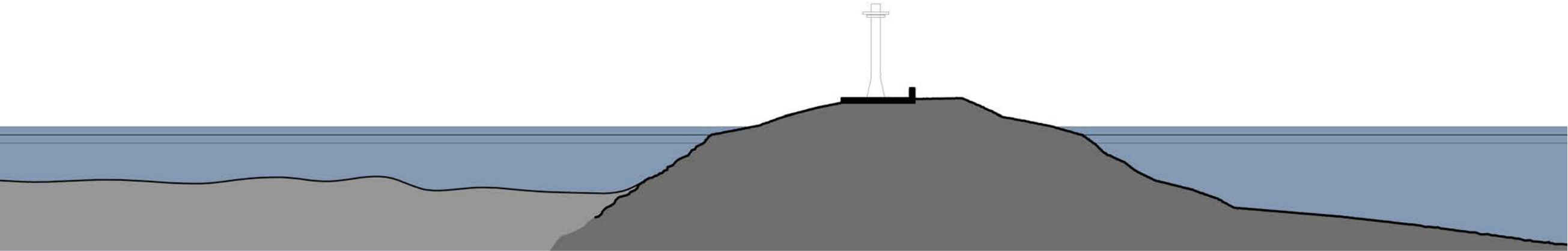


Fig 1.46 View along Signal Road to site from south. (Author, 2019)

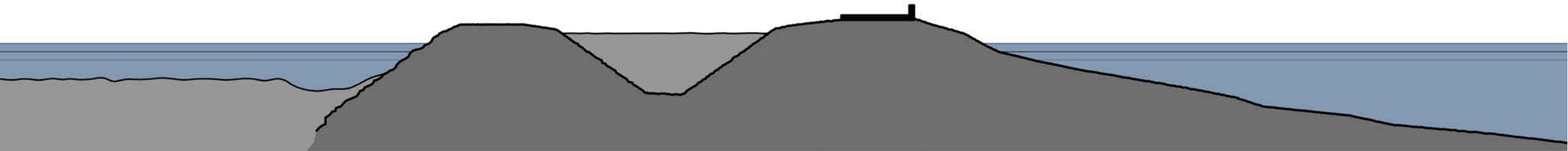
NORTH PIER SECTIONS



These sections are to illustrate the sites (North Pier) immediate context and the elevation differences that need to be addressed on the site. Also illustrated is the difference in ground type, the darker grey is the boulders and heavy rocks used as the base of the pier. The lighter grey is the beach sand, and the soft sand infill on the site.



On average the water level is four meters below the height of the Pier. This height difference changes depending on the tides. During the most extreme tidal swing of the year, the difference between high and low tide can be up to 1.8 meters.



This change in ocean height is a condition that the building needs to be designed with in mind.

Fig 1.47 Sections through the North Pier (Author, 2019)

“I see trees of green, red
roses too. I see them
bloom for me and you.
And I think to myself what
a wonderful world.”

—Louis Armstrong (what a wonderful World)

PLASTIC & OIL

Introduction

Every year an estimated 8 million tons of plastic ends up in the ocean. All these tons of plastic are infesting the waters. Is 8 million is adding to the estimated 150 million metric tons of plastic inhabiting the ocean (Mallos, N. 2019), Durban adds its fair share to this number. All of this is adding to the surmountable pressure that the ocean ecosystem is already facing. The majority of the Durban community is in the dark regarding the dire state of pollution in the ocean, this needs to change. It is the intention of the building scheme to educate the user on the issue of the ocean, creating awareness while providing solutions.

CHAPTER TWO



PLASTIC IN THE HARBOUR

Durban harbour has been dealing with plastic pollution for many years, and the issue continues to persist, causing the water quality to dilapidate in the harbour. The pollution has plagued the harbour as it has happened too many of the harbours around the world, and the Durban community has begun to take a stand against the continuing degrading of the Harbour pollution and its water quality. This year however has been devastating to the harbour, plastic and vegetation debris covered vast areas of the water surface, in response to images of this there is not a large social media presence with a cry for change from the community.

Over the last few years the port controllers have faced backlash and criticism due to the pollution levels, there has been an outcry of assistance from the citizens of Durban to lend a helping hand in the clean-up. This has become apparent through the many platforms of social media, voices being heard. Thus, the public has come out and helped where possible, cleaning the beaches and picking up the debris. It shows great initiative by the community, and a want for change, the sharing of this information has led to awareness within the small social circles consequently and promote a change. However it is the port officials, that need to set initiatives for change, they cannot rely on the community to constantly come to the aid of the harbour, stringent plans need to be put in place to prevent and protect the harbour from this happening in the future.

Fig 2.1 - Fig 2.9 An array of photos all taken of the durban harbour, showing the devastating effect that the rains have had on the Harbour water, and the pollution that has inhabited the harbour.

Fig 2.1 (SA People, 2019)

Fig 2.2 (Pretorius, J. 2019)

Fig 2.3 (IOL, 2019)

Fig 2.4 (IOL, 2019)

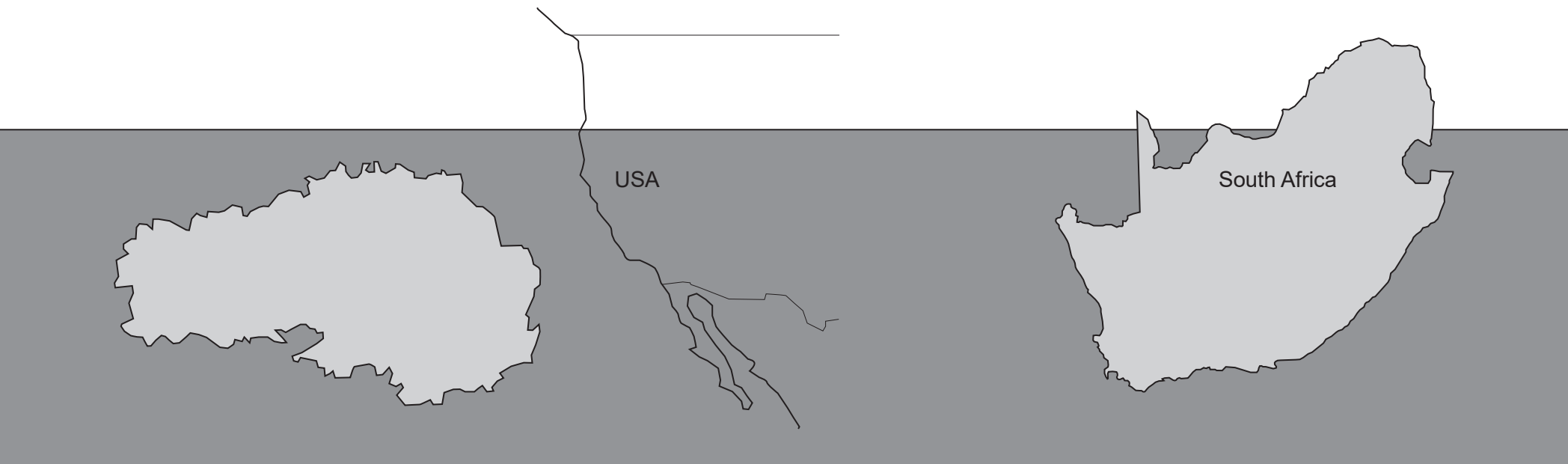
Fig 2.5 (SA People, 2019)

Fig 2.6 (SA People, 2019)

Fig 2.7 (Berea Mail, 2019)

Fig 2.8 (SA People, 2019)

Fig 2.9 (SA People, 2019)



The Eastern Garbage Patch is a large area of ocean that accumulates debris and rubbish, at the moment the garbage patch has a huge plastic island that is currently the same size as South Africa, but is continuously growing. Scientist believe it has formed in this space due to the California and Equatorial Ocean currents.

The Durban Storm water drainage systems, are laid out so that the water is let out directly into, rivers, the ocean, or harbour. The system works well when the conditions are not extreme, or are constant. But the Durban CBD can tend to have a pollution problem. When the annual heavy rains arrive, the storm drains struggle as they become congested with debris and rubbish. This rubbish and vegetative debris is picked up by the heavy current flow of the water, which is then dumped into the harbour and Coastline.

Fig 2.10 Diagram representing the size and position of the Eastern Garbage Patch with relation to South Africa and USA respectively (Author, 2019)



Generally there is an influx of pollution when there are heavy rains, such as that which started on the 24th April. After days of rain, the rivers and roads had flooded leaving the Durban harbour in disarray, and the citizen concerned with the pollution that had entered the ocean. This tends to happen on a yearly cycle, with the first heavy rain fall of the year, therefore the extent of the problem in turn depends on the intensity of the mentioned rain fall. And how the storm water drains have been maintained throughout the year.

The storm water pipes enter into the harbour and beachfronts at various points to drain at the marked out points on the map. Often these storm water pipes unwillingly dump tons of plastic and debris into the ocean through these outlets, with the pollution then settling in still water or collecting on the beaches. Although a large part of the fault lies in the storm water runoff of the roads, harbour loading docks, and the parking for the trucks waiting to load and offload. The roads in and around this district are often lined with plastic cast off, either from the factories and warehouses themselves, or from the trucks that often sit in traffic along the Bayhead Road. There is a large amount of plastic refuse around these areas due to the need to ensure cargo is packaged correctly, the on and off loading often results in unwanted materials like plastic wrapping and wooden pallets. All the rain water then becomes tainted water and debris then enters the harbour water system, a portion of these debris does eventually make it into the open ocean through the harbour mouth, because of the constant ship traffic in the harbour. This issues isn't just plaguing the Harbour, along the coastal shoreline there is a scattered line of plastic and vegetation debris covering the beaches, the threshold between land and sea. Making the pollution and devastation of the rains that has been caused apparent in the beach goer's eyes and general community.

Fig 2.11 Diagram representing the storm outlets into the harbour, and spaces in which the pollution settles. (Author, 2019)



Fig 2.12 Photo of two men helping in the clean up of the Harbour (Ward, R. 2019)

Citizens come out every year to help with the issue but these are done on small scales, this happens to regularly to be dealt with this way. Structured measures need to be put in place for this to be fixed, and that is what the proposed scheme plans to fix. There is a portion of program put in place to monitor the problem and take action, this would need to be done through the use of a barges, and a control room or office to keep tabs on the harbour and the acceptable level in which the water quality needs to be. But the only true way to address this issue is by involving the community, making them aware to the fact that the pollution is a problem and the reasoning behind it, such as the rubbish not being disposed of properly and the miss use storm drains. The only realistic solution is to face the problem before it arrives at the ocean, better care of the storm water drains and the initiative to not litter, but steps would be put in place such as the clean-up barge and keeping census on the situation as it unfolds to prevent it causing public outcry.

The plastic will be collected by groups of people and machinery, the plastic will then me recycled at a factory off site, this will be turned into a plastic that can be used to create new art pieces and expressive pieces of work to create awareness around the issues of plastic pollution in the ocean. Once recycled and transformed into merchandise or art installation, which will then be brought to the Ecology centre. Where it will be on display to showcase and educate around the issues of plastic pollution and the effects it is having on the globe. This will happen in the experiential space.



Build up of plastic and debris in the Durban harbour.



Collection
The plastic is collected from harbour and taken to a factory site for sorting.



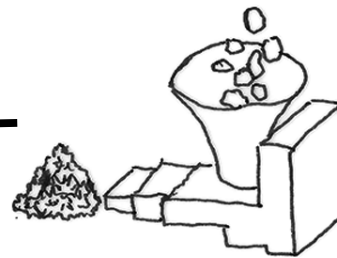
Sorting
The plastic is divided into the different plastic groups.



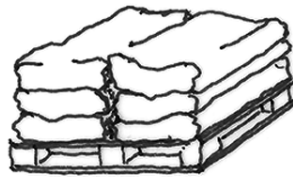
Bundle
The plastics with same qualities are bundled together, ready for recycling.



Wash
The plastic is then washed and prepared for to be cruched.



New Pellets
The plastic is cruched into small plastic pellets that are easier to handle.



Recycled Granules
The pellets are packaged and ready to be recycled into new products.



The Granules are then used to create either beads, string, tiles etc. to be used by the local community to create pieces to be sold in merchandise store, local artist also have the opportunity to use the recycled plastic to make expressive art pieces.

Local artists will be commissioned to produce sculptures, reclaimed or recycled, from the collection and will be displayed in the exhibition spaces of the building, expressing the problems faced in the ocean. The experiential space, with the aim to promote local artist, create jobs, and educate the community. Smaller items that have been manufactured from the recycled material will be able to be sold. The excess recycled plastic that is not used to create the merchandise will be sold to companies looking to make a greener impact change. This is not a problem that will disappear by itself, the public needs to be educated on the dangers of one time plastic use pollution and the effects that are felt by the ocean wildlife and coral reefs.

Fig 2.13 Diagram representing the process to recycle plastic (Author, 2019)

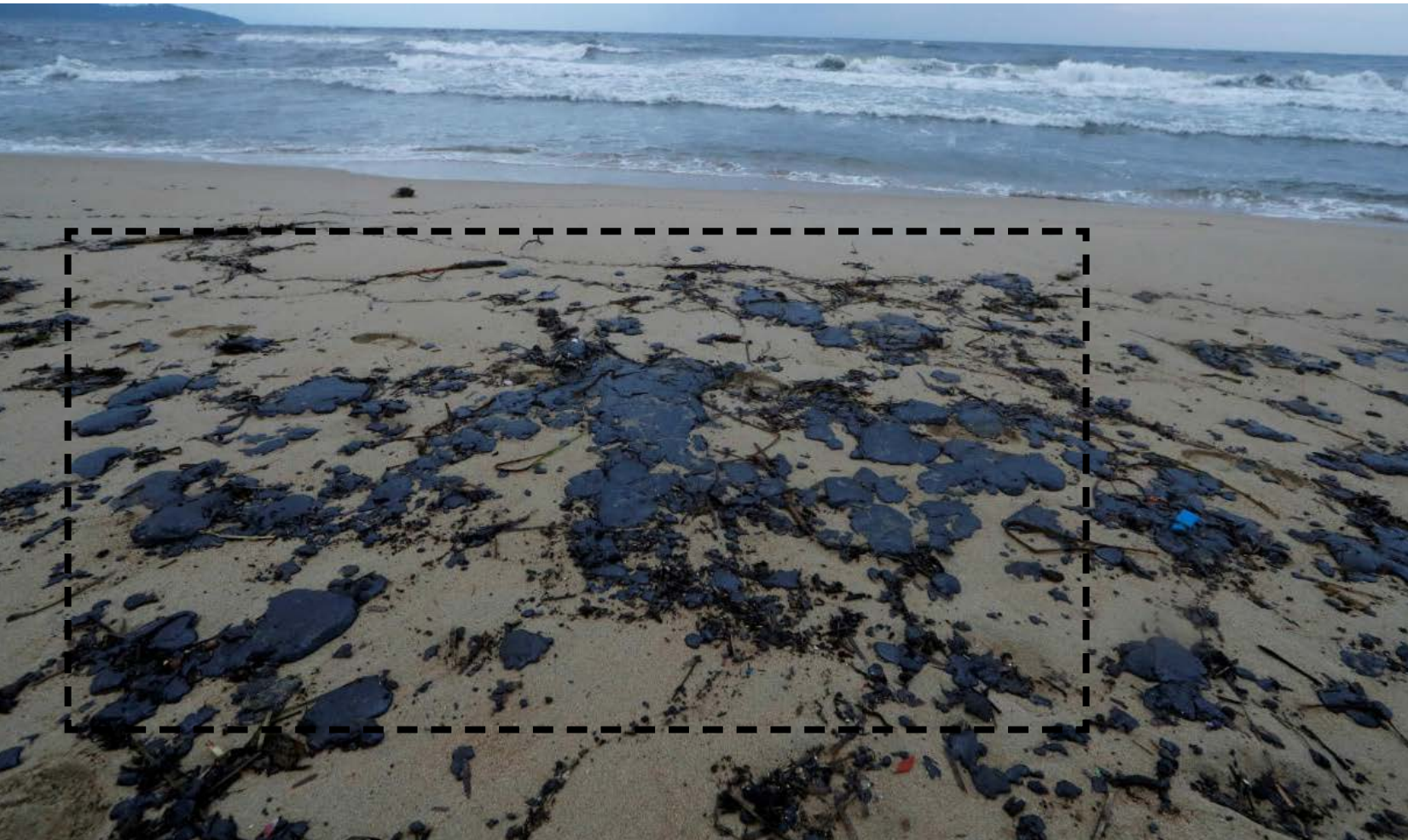


Fig 2.14 Photo of oil spill two weeks after incident. (Gaillard, E. 2018)

Oil pollutants are a major issue for the ecology of the ocean, due to the pollutants and chemicals that cause harm to the wildlife that rely on the ocean, leaving a permanent damage in its wake. The pollution can kill the animals that come in touch with it, if not given medical attention. Animals will accidentally ingest or become trapping in its viscosity. Oil spills and waste therefore have a devastating effect on the ocean life. It is not only spills though, land run off, unmaintained ships, and so on all add to the pollution.

These large scale oil leaks are happening constantly, the most infamous of recent times, the unprecedented disaster of the Deepwater Horizon well oil spill, it is estimated that the incident in 2010 spilt 650 million liters of crude oil into the Gulf of Mexico. This devastated wildlife habitat and population. (Nikiforuk, A 2016)

High levels of traffic, it is no wonder that the Durban Port, have a very of water inside the port terminals. This is an issue that is affecting all major ports, and harbour's around the world. The industrial field has become synonymous with pollution, it is the result of negligence that makes this so. Ships that have not be maintained such as the large cargo vessels that are constantly entering the harbour. The most recent being off the coast of France, the ship has sunk to a depth of 4600 mm yet it is still leaking oil which is evident by the 3 oil slicks that have occurred. (France 24, 2019)

Oil has a devastating effect on the water wildlife, birds get it in their feathers and beaks, while fish can be exposed to this by means of digestion and ventilation through the gills, once engulfed in oil there is not much these wildlife animals can do to survive without the help of humans. (NOAA, 2019)



Fig 2.15 Photo of Deepwater Horizon side effects 2 years after the incident. (Collins, B. 2012)

The dangers that these oil spills have on animals, entire ecosystems can be wiped out, this is especially true for ecosystems that rely on coral reefs. As coral is a sessile animal it is unable to flee from approaching toxins and pollutants like other ocean creatures. Thus leaving them in peril and susceptible to a stressing environment leaving no chance of survival, as previously mentioned when coral is stressed it will bleach. Bleaching is not the only concern, corals can become smothered by the oil, if it mixes with the sand or becomes mixed with water through turbulent waves the oil can settle onto the ocean floor, smothering the coral. Refer to Fig 2. .

It is the policy of Transnet that all oil leaks or spills are taken care of immediately, ensuring the quality of the water is high. With many of the vessels entering the harbour, there is a negligence surrounding the up keep of the ships. Thus spewing oil and diesel during its time docked in the port. Durban Harbour is an industrial feat, which requires many moving parts, creating wear and tear on the machinery used, but these need to be up kept. From a physical inspection of the harbour water, there are pollutants in the water. It is murky and very dark, while in other spots there are slicks of sheen to the eye. The texture is oily, as well as omitting a chemical smell.

All oil and polluted water that is removed from the harbour will be placed on display in the Ecology Centre to illustrate the importance of clean water and the state of ecology in the harbour. The building intends to highlight the poor conditions of the harbour water, spreading awareness through the community, with preventative manners and the safe way of disposing of oils. Show casing these worldwide issues, thus educating the community while enforcing an experience of the building to cement the ideas.

“Do we really care so little about the earth on which we live that we don’t want to protect one of the world’s greatest wonders from the consequences of our behaviour?”

– Sir David Attenborough (Great Barrier Reef)

CORAL & ARCHITECTURE

Introduction

The following chapter is to form a greater understanding of coral reefs and the effects they have on this plant, and the ecosystems in which they play a major role. Understanding the conditions they live in and how human contamination has negatively impacted their ecology. Creating a relationship between Coral and architecture, and how architecture can play a role forming solutions, focusing on aspects of the coral such as the structural arrangement in relation to architecture.

This research seeks to use the information gathered to inform the architecture of the research facility, with influences in structural arrangements and requirements of conditions in which coral growth is optimal. How the architecture can relate to the ‘Underwater Vernacular’ of the built reef, in forming a research facility that will be able to make scientific advances to ensure coral survival in worsening conditions.

CHAPTER THREE

CORAL AROUND THE WORLD

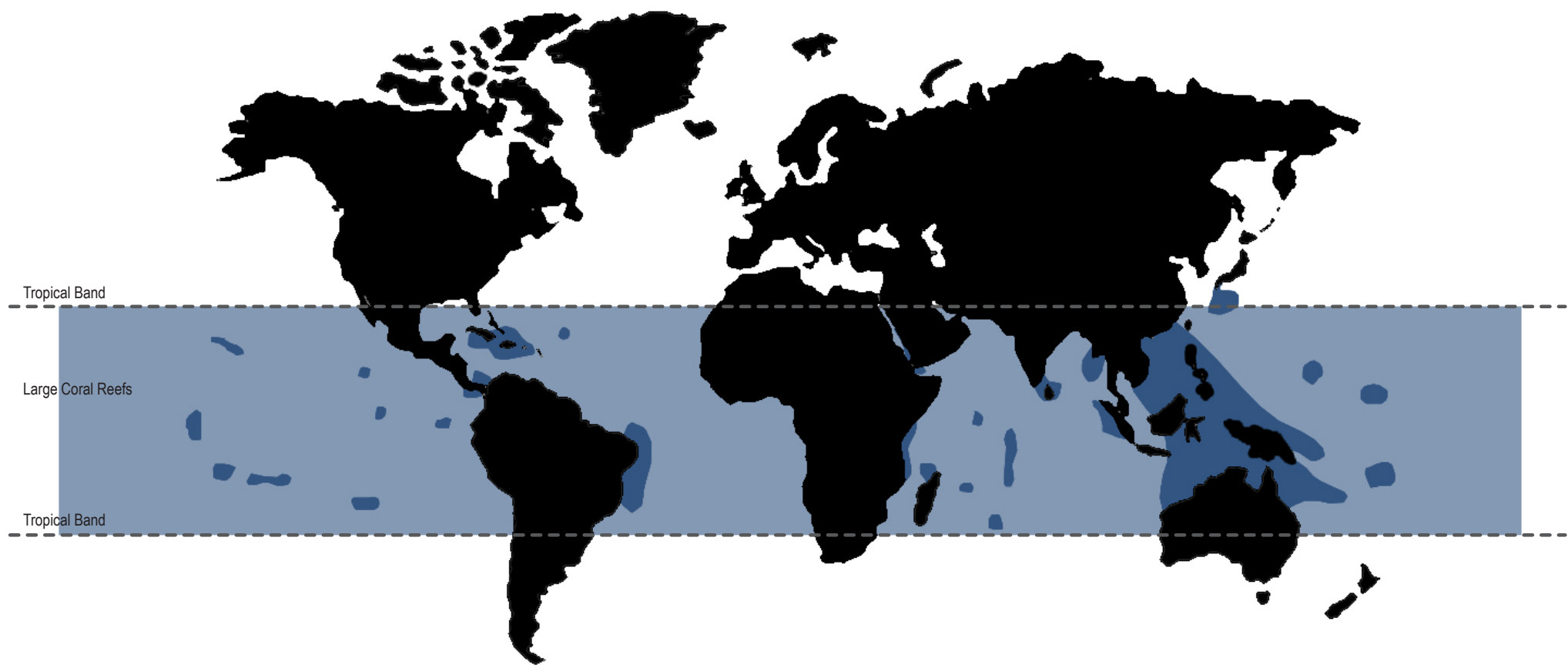
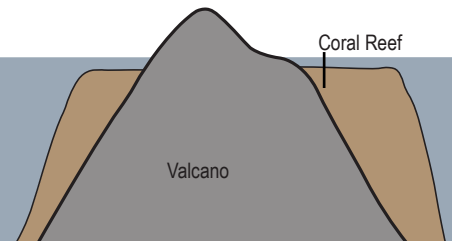


Fig 3.1 Diagram representing the tropical band n which coral reefs grow due to the climate.(Author, 2019)

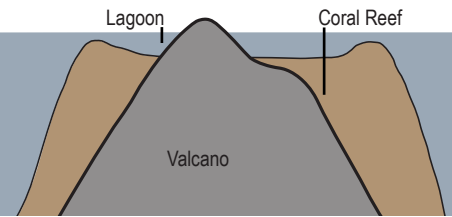
Coral reefs are vital to the ocean ecosystem, they take up roughly 1 percent of the ocean floor but support as much as 30 percent of all ocean fish. They provide many animals with nutrition and shelter they need, which without many of these species of wildlife could not survive. Not only do coral reefs shelter animals but they are similarly significant for the safety of many coastal towns and there shorelines. The reefs acts a protective barrier against larger waves and strong currents that would otherwise crash into the shore causing soil erosion and damages to the coast line. The reef absorbs the impact of the wave as it passes above it, most of the waves energy lost through this process causing the impact of the wave on the coast to be much less. This is due to the reefs interrupting the wave cycle and defusing wave before reaching the shore.

Coral can only exist under very specific conditions, of water temperature, nutrition in the water, and amount of sun light, and it is these conditions that restrict reefs classification to the Tropical Band (Fig 3.1). Coral reefs are currently under threat from global warming. The Coral polyps, name of the individual coral animal, are highly susceptible to changes in water temperature and seas levels. When these changes effect the coral it becomes stressed and a phenomenon called 'Bleaching' occurs, given the name as the coral will lose all of its colour and becomes pitch white. Reefs also add value to the communities and courtiers in its proximity as they provide a large source of economical resource, allowing commercial and recreational activities, specific species of fish, and tourism. (NSU, 2019)

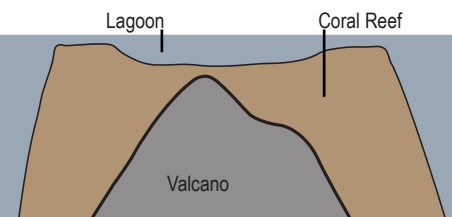
Types of Reefs



Fringing Reef



Barrier Reef



Atolls

Coral reefs require very specific conditions to survive and build reefs, these conditions therefore limit the coral geographically. All coral reefs are within the tropical band, 30 degrees north and south of the equator. The water has to be within a range of 6 degrees Celsius, as coral can only grow between the temperatures of 23 to 29 degrees Celsius. The water cannot drop below 18 degrees as coral will not survive these conditions but will be able to tolerate 40 degrees for a very short periods of time. The coral also needs a high level of sun light in order to survive, with all these conditions met the coral will be able to thrive and grow into a reef.

There are two types of reef families that represent how the reefs were created, Biotic Reefs and Abiotic Reef, if the reef formed naturally or if the reef formed due to human interaction respectively. These different families can be separated into three different forms of reefs, the categories represent the positioning of the reef compared to land mass. (Fig 3.2)

Fringing reefs – these are reefs that form at the shore line and move deeper into the ocean creating a protective border, it is also the most common form of reef.

Barrier reefs – these are formed further out at sea leaving a reach of ocean between the land and the reef.

Atolls – they commonly form around a volcano that has since sunk below the surface of the water.

These types of reefs can then be broken up into the distinctive zones, Reef flat, Reef crest, and Reef front, and the different qualities that they represent.

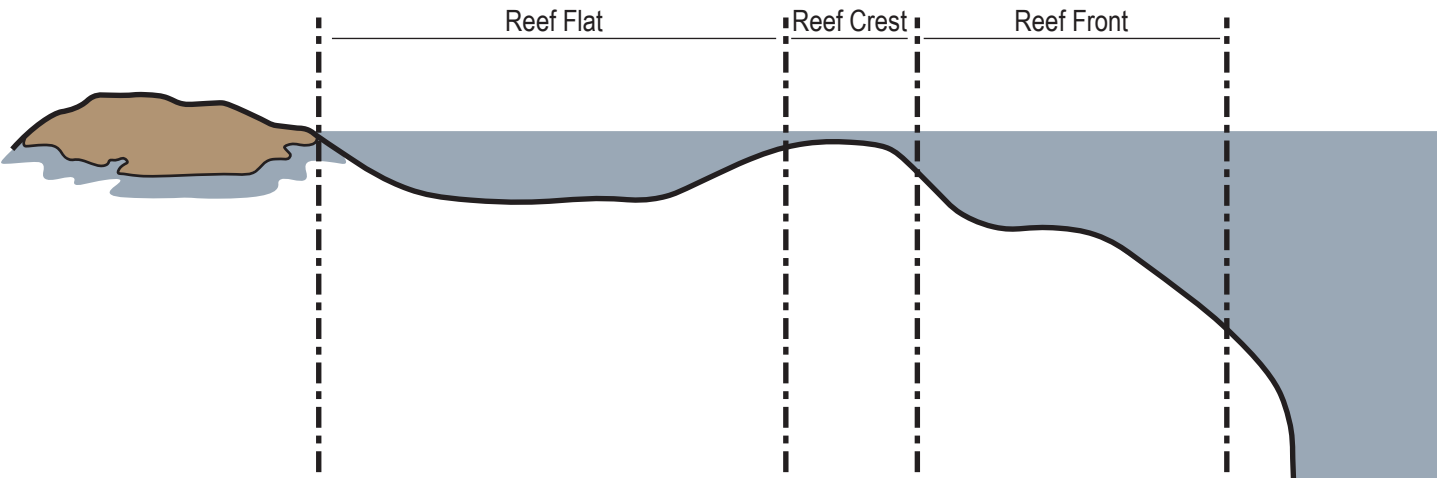
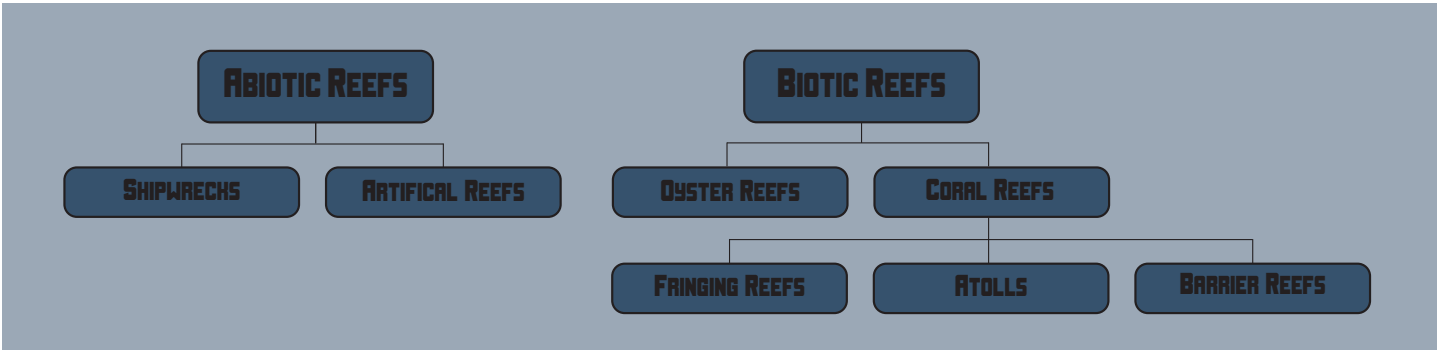
The reef flat is the portion of the reef most protected from waves and is closes to the shore line, due to the shallow water the coral life here would have had to adapt to the fluctuations of water temperature. Reef crest is the highest point of the reef and can often become exposed to air during low tides, the crest also breaks the waves and takes the brunt of the wave impact. The crest is the harshest environment of the reef and is often bare, or have stronger strains of coral. The reef front is the portion furthest from the shoreline and slopes downward towards the ocean floor, there is often flush with different forms of coral life as the slope allows for different depths, to which the coral polyps prefer.

In addition to the variety of marine life the reefs support, they are also crucial to the safety of many coastal villages. Coral reefs are immensely beneficial to humans as they act as a buffer along the shore line from large waves caused by storms that would otherwise obliterate the communities. Reefs also provide millions of jobs and a source of food for the people, as well as an economic fortune for the countries with reefs off their shores, the worlds reefs are estimated to be worth \$375 billion each year in goods and services.

Fig 3.2 (Left)Diagram representing the types of reefs, in relation to a land mass.(Author, 2019)

Fig 3.3 (Left, Lower)Diagram representing the different families of Coral Reefs. (Author, 2019)

Fig 3.4 (Below)Sectional diagram representing the different zones of a Coral Reef. (Author, 2019)

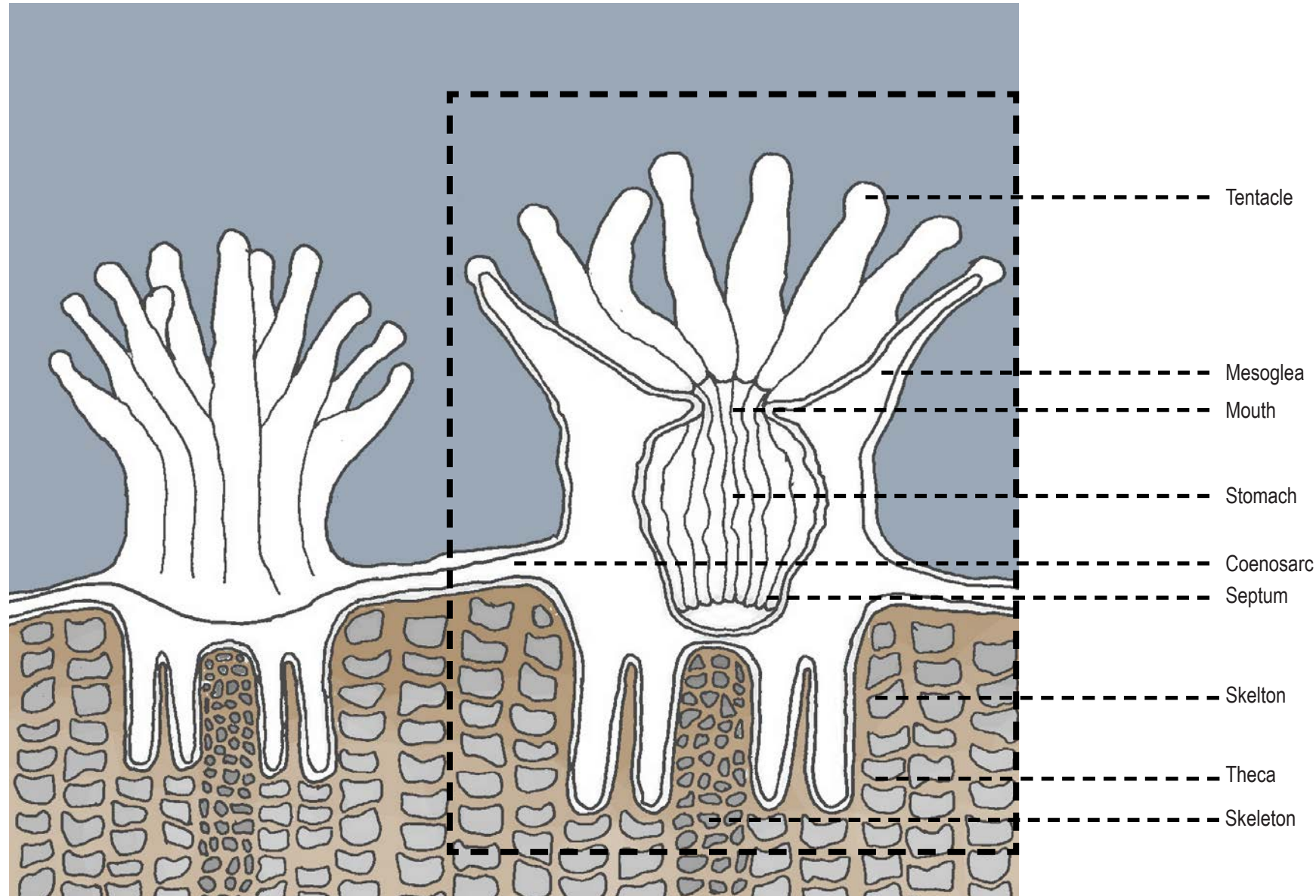




CORAL POLYP

Coral reefs are a collection of tiny animals called 'Coral Polyp', which have built up the reefs over thousands of years. Although reefs can cover a vast amount of space in the ocean, and take up approximately 1 percent of the ocean floor, these small animals can only grow to an adult length of 3 mm, and are distant cousins to Jellyfish and Anemones. The largest known single structure composed of living entities is the 'Great Barrier Reef'. A structure so large it can be seen from space, taking up 348 700 square kilometers (Slate Magazine, 2019). Spanning the length of 2.300 kilometers and is made up of 2900 smaller reefs. The reefs are often referred to as underwater rainforests, and are as diverse, if not more as the Amazon. (Horton, J. 2019)

Fig 3.5 Coral under uv light,
(Osche, R. 2019)



The majority of these small creatures are the coral polyp's stomach, and just above the stomach is the mouth of the coral. Tentacles are attached just above the mouth, these are used at night to catch prey, and are stored inside the stomach during the day. This animal sits within a hard limestone skeleton, which protects the polyp.(Fig 3.6). During the day the polyp is tucked inside the skeleton, it is only at night that the coral emerges from the skeleton to feed. It is this hard limestone skeleton part of the coral that makes up the reef (Coral.org, 2019). The coral takes in minerals from the water, it then mixes these minerals with proteins. It rises out of its skeleton slightly to create a small space below, it then deposits calcium carbonate, more commonly known as limestone, into this space below. This is how the coral develops its skeleton, constantly adding to its structure. It is this skeleton that it the mass of coral reefs. Coral growth is delicate and can take thousands of years before a reef of any substance can be formed.

These small living things that are actually carnivores and do not rely totally on the nutrients in the water, they are carnivores despite the fact that they are sessile, which means they are unable to move to hunt prey. Although they cannot move from where they are growing, at night they are able to rise out of their skeletons, stretching their tentacles to feed. The aim is to grab zooplankton and other small food particle. They use their tentacle because they are covered with thousands of poisonous stinging cells named, Nematocysts. The coral pierces their pray with these barbs injecting a toxin, it then uses the tentacles to bring the food to its mouth where the zooplankton is digested. Some polyps have the ability to catch nutrients and food on their skin with the help of an outer layer of mucus, which acts like sticky tap dissolving the nutrients that have become stuck. Small hair like projections named 'cilia' move the mucus towards the stomach. The Coenosarc, is a small piece of tissue that allows the polyps to become joined, this tissue allows the corals to share nutrition and energy to ensure the survival of the outcrop, making it one large organism.

Fig 3.6 Sectional Diagram of Coral
(Author, 2019)



SYMBIOTIC RELATIONSHIP

Scientists once believed corals to be a plant and not an animal, this is partly true due to the corals symbiotic relationship with the algae, Zooxanthellae. In this relationship the algae and the polyps need each other to survive, the polyp providing protection as the host and the algae providing a source of food for the polyp. The relationship works as the zooxanthellae produces photosynthesis, which it provides to the polyp. The polyp in turn converts the photosynthesis into a source of food and energy in the form of, proteins, fats, and carbohydrates. The polyp then uses this energy to form carbon, nitrates, and phosphates, as a byproduct that the algae receives and uses to perform photosynthesis. The zooxanthellae can provide the polyp with as much as 90 percent of the energy produced through photosynthesis.

As the algae lives inside the polyp's cell walls, it is the zooxanthellae that gives the coral its bright colours, another byproduct of this relationship is the corals production of limestone secretion, forming the solid protective skeleton structure. There is a hollow chamber in the skeleton called a 'cup', it is this cup that the polyp can retreat into during the day or for protection from predators.

Zooxanthellae require very specific water conditions to produce photosynthesis, they need clear water that allows sunlight to penetrate deep enough into the water to reach the coral. The water cannot be too rich with nutrition as it causes minimal sub rays to penetrate deep enough into the water affecting the productivity of the algae. On days that are sunny the coral polyp can produce limestone at twice the rate than on normal days, with an average growth of 10 centimeters a year. The zooxanthellae does not like to competition with other algae in the water, an excess of nutrition in the ocean water will attract other forms of microscopic algae and encourages their growth. (Horton, J. 2019)

Fig 3.7 Coral extreme close-up
(Osche, R. 2019)



Mass Spawning

Fig 3.8 the combined coral reef in the mass spawning process.
(For the reef, 2019)

Coral reproduction is a complex science, and in some circumstances scientist are not completely aware of how these phenomena can takes place in such a short period of time. There are two categories of reproduction, Sexual (Male & Female) and Asexual (By themselves) by which coral polyps can create off spring. These offspring in some cases can merge forming one large organism.

Sexual

The most common of the sexual reproduction amongst hard coral types is ‘**Mass Spawning**’. This occurrence only happens once a year, with coral colonies relying on all the corals to release millions of their eggs and sperm simultaneously. Scientist believe that the corals use lunar cycles and temperatures of the water to gauge when to release their gametes, name given to coral eggs and sperm. (oceanservice.gov, 2019). Once the gametes have been release from the female and male corals into the ocean there is only a gap of a few hours for fertilization to occur. This process causes a fish frenzy, lowering the chances of successful reproduction. Once the egg and sperm have become joined they form ‘coral planula’, and will float for weeks before finally sinking to the ocean floor where it will become attached to a substrate starting the process of forming a colony. (coral.org, 2019)

‘**Brooding**’ is similar to ‘Mass Spawning’ except the female coral does not release her eggs. The sperm that has been released via the mouth of the male coral. The egg and sperm combine to form the coral planula larva, this grows within the female coral until it is ejected from the female coral. This allows the planula to settle sooner with a smaller chance of being eat. (coral.org, 2019)



Budding

Fig 3.9 the coral polyp is mid way through the budding process.
(For the reef, 2019)

Asexual

‘Budding’ is the term given to the most common asexual reproduction, a singular coral will divide itself to create two smaller corals. Once the coral polyp reaches a mature adult size the coral will begin to divide itself into two. The polyp will begin to elongate itself, eventually forming two mouths. It will then finally separate into two individual corals. This will continue to happen throughout the life cycle of the coral. (Living Oceans Foundation, 2019)

‘Fragmentation’ as the name suggests, occurs when a piece of the coral has become detached from the original polyp. This phenomenon is often triggered by natural occurrences such as strong storms and hurricanes. When the coral is broken it is scattered by the ocean, this piece of coral can drift until it reattaches to a rock or coral outcrop, from here the coral can grow into a new colony. (Living Oceans Foundation, 2019)

The fragmentation process is commonly used in research laboratories as it allows an adult coral to be split into smaller pieces, often into 5 polyps, these pieces are then placed into growth chambers, the polyps recognize that they are of the same therefore are able to fuse and work together to harness resources. This process allows the coral to grow anywhere from 25 to 50 times faster than standard methods. (Wilson, A. 2018)

These laboratory grown corals can then be planted back into the ocean, and what could possibly have taken as long as 100 years to grow in the ocean can now be grown in a laboratory in just 2 years. Due to the sexual maturity of the corals used in the fragmenting process, reproduction of the coral can therefore take place immediately, without a delay of the coral reaching sexual maturity. “They have now successfully planted more than 20,000 corals onto depleted reefs in the Florida Keys.”(Wilson, A. 2018). This process can be best utilized when combine with strains of corals that have survive a bleaching event, creating a chance of coral restoration.



Fig 3.10 My Life Aquatic 07
(Burie, S. 2019)

Fig 3.11 My Life Aquatic 011
(Burie, S. 2019)

Fig 3.12 My Life Aquatic 03
(Burie, S. 2019)



BLEACHING

Bleaching is a shorthand given an otherwise serious phenomenon. Coral relies on very specific conditions to grow, when these environmental conditions rapidly change they can negatively affect the coral, triggering the coral to become stressed. When stressed the coral expels the Zooxanthellae from the polyps cell, this in turn causes the coral to turn bright white as it is the algae that gives the coral its colour. This does not mean that the coral is dead, or will die, but it is highly susceptible to diseases in this state, if the conditions do not change the coral will then become deceased. It is a serious problem that is currently affecting reefs around the world, with 50 percent of the Great Barrier Reef having died since 2016 due to this phenomenon. (James, L. 2018)



“Several million zooxanthellae live and produce pigments in just one square inch (6.5 square cm) of coral”.

(Coral.org, 2019)

Fig 3.13 Bleached Coral, Sekisei Lagoon (Straitstimes, 2019)

ZOOXANTHELLAE LEAVING

The current climate change patterns are having a direct impact on coral reefs as it is drastically affecting the oceans. An increase in sea levels and temperatures are putting immense strain the coral polyp and the ecosystem it is a part of. Ocean conditions however have undergone many changes in the recent years, and are currently continuing on this path.

When corals become stressed the symbiotic relationship between the Zooxanthellae and the coral comes to an end, as the coral expels the algae from its skin cells. The coral is therefore rejecting its main source of food adding to the issue. The polyp become pitch white as the algae in the skin cells is no longer present, giving the appearance of a ghost reef or that the coral has been bleached, refer to (Fig 3.14).

The most common cause for bleach is a sudden rise or fall in ocean water temperature, as little as 1 Degree Celsius can enact a bleaching occurrence, most likely a raise in temperature. Although it is not always due to an increase in temperature, this change in temperatures work both ways, the Florida Keys ocean water temperature dropped by 11 Degree Celsius below the average for the month of January in 2010, this resulted in some areas of coral in the reef to bleach and then die (Oceanservice.noaa.gov.2019). In Florida and the Caribbean coral cover has declined by as much as 50–80 percent in just the last three decades. (Wilson, A. 2018)

Excessive storm water runoff can lead to a diluted reach of ocean water, without enough salt in the water the coral cannot survive. Storm waters are often carrying pollutants that can contaminate the ocean water, as well as rubbish which can become trapped on a coral fan causing the polyps to suffocate. They are also prone to excessive sunlight on warm days, in addition to extreme low tides causing the coral to be exposed to air for great periods of time. All of which can stress the coral towards a bleaching event.

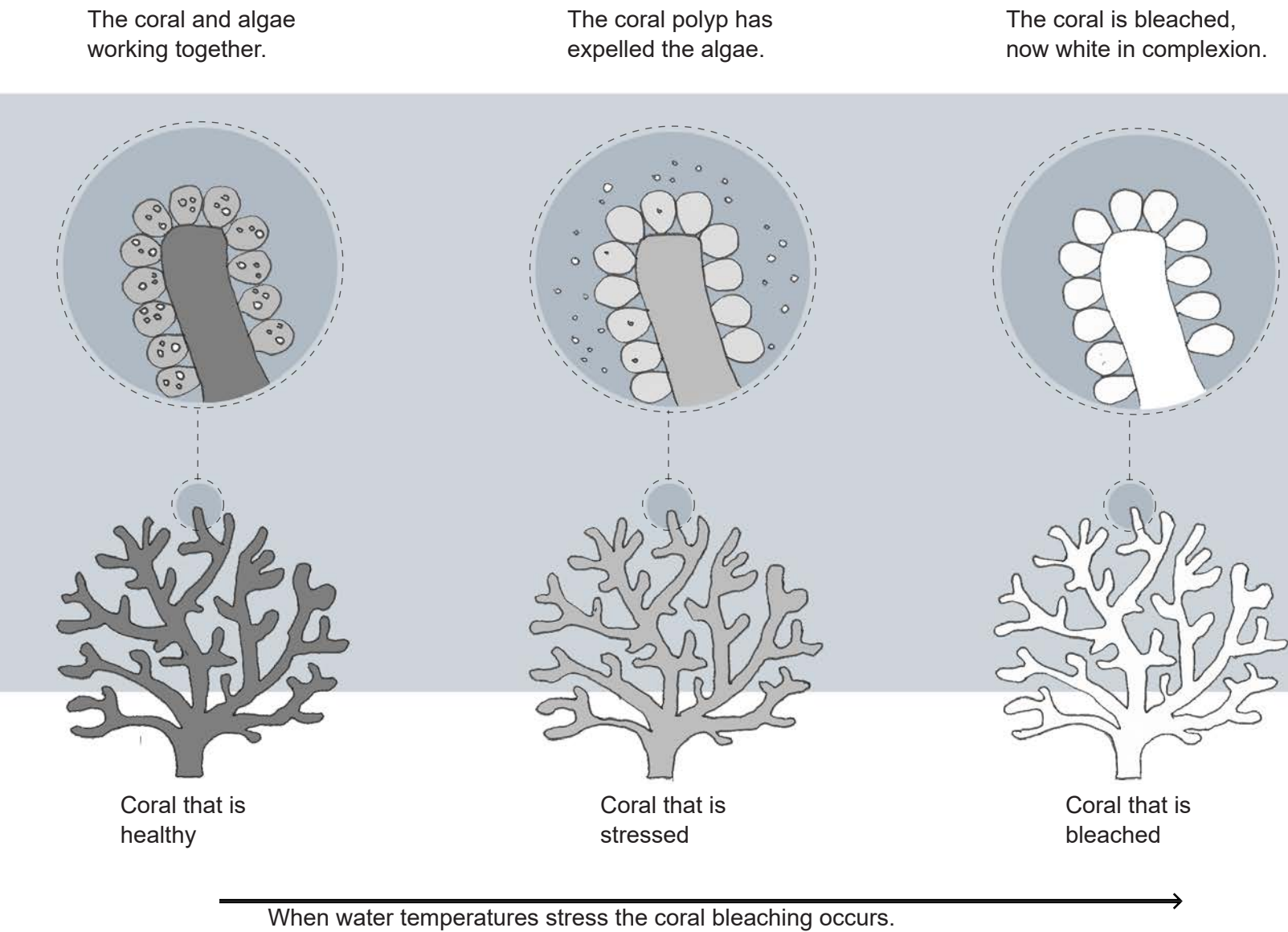


Fig 3.14 Diagram that explains bleach, (Author, 2019)

Coral bleaching does not necessarily mean that the coral polyp has died, the coral can often survive a bleaching occurrence. Although once bleached the polyp becomes a lot more susceptible to diseases, as well as having lost the majority of its food source thus is endanger of dying (Oceanservice.noaa.gov. 2019). Portions of the Great Barrier Reef seemed to be completely dead for six years, then coral larvae drifted in from distant neighbouring reefs, and by 2010 the reef had repopulated itself and recovered to the cover pre-bleach event. This whole process took the reef 12 year to come full circle, with the rise in sea temperatures the reefs are becoming bleached at a faster rate giving the corals less time to fully recuperate, which will ultimately lead to the death of the reef (Slate Magazine. 2019).

Should coral bleaching continue to occur, as the evidence predicts, the coral reefs will become helpless and die. The coral reefs provide nutrients and shelter for as much as 30 percent of all ocean life, a number of these reefs are off the coast of impoverished nations that rely on this source of food. Without the corals protection and source of food the wildlife will rapidly deplete in numbers, either migrating or dying out. Those countries that rely on the fisheries and tourism will be left hopeless. "The western Indian Ocean region is home to more than 220 million people, many of whom depend directly or indirectly on fishing, marine resources and maritime trade for their livelihoods. More than 60 million of these people live within 100km of the coastline." (SAIIA. 2019)

There is still a chance that the 50 percent of reefs that are currently bleached can make a recovery but those chances are becoming unlikely due to the between bleaching events. This phenomenon is happening around the world at an alarming rate, "Scientists predict that all corals will be threatened by 2050, with 75 percent facing high to critical threat levels." (coral.org, 2019) this would lead to a collapse of a global ecosystem, millions of people would be left without food, all species that rely on the reef would face extinction.

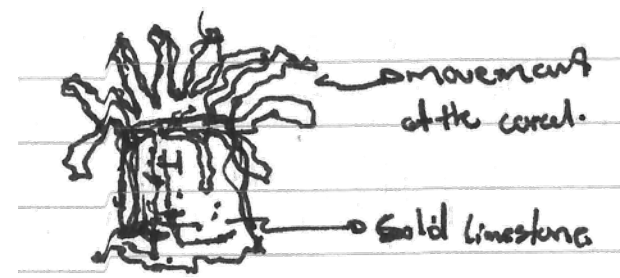


Fig 3.15 Sketch of coral polyp
(Author, 2019)



Coral Reefs actually protect the beach from erosion and larger scale waves that may impact the shore line. The wave length is disrupting as it moves through the reef causing the wave to be much smaller thus the force of impact on the beach to be much less when it hits. Similar to how the mangrove forest protects the coast of Malaysia by providing layers in which the water needs to pass to reach the shore line. This idea can be incorporated into architectural design, and in fact has been done. The Museum of Modern Art hosted an exhibition in which firms were given the challenge to design for the rising sea levels that are going to affect the New York waterfronts, protecting from aversive weather conditions like evoke flooding. In all there were 5 projects that addressed these issues in their own way. Matthew Baird took part in this project, incorporating an idea of using artificial coral reef like structures, made out of discarded glass, to break down the waves, also incorporating an oil tank in the hopes of creating bio fuel with the algae that forms in wastewater. The idea around creating an artificial reef as a precedent applies to this idea of breaking down the waves before entering into a building, causing areas of calm water.

Fig 3.16 My Life Aquatic 02
(Burie, S. 2019)



As found in the research scientists have already made progress to counteract the bleaching process, finding new ways to combat the death of a reef. The growth of laboratory coral, through the reproduction process of fragmentation, while promoting the growth of coral that is less likely to bleach. The Coral research facility will be able to push forward in these advances with the ability to provide research facilities and coral growth on the building.

The building can promote this growth by forming the structure in which the coral attaches itself to. With a built structure in the ocean the coral will be protected from harsh waves by the building as well as the support needed to grow, many companies have started investing in artificial reefs. Similar to the MoMA works previously mentioned, artificial reefs have already proven to be successful in the promotion of coral growth. The reefs supply an organic shape, to match that of an outcrop of rocks, the coral is then able to attach to. Advances have been made, that the reefs are now 3D printed and assembled on site. The Living Sea Wall is a small hexagonal plate that has been designed through the inspiration of coral. The intention of the building is to provide awareness and progress in research while creating a place in which a reef can thrive.

Fig 3.17 My Life Aquatic 08
(Burie, S. 2019)

“We know not through our intellect but through our experience.”

— Maurice Merleau-Ponty

PHENOMENOLOGY

CHAPTER FOUR

Introduction

The aim of this project is to create awareness around the issue of pollution in the ocean. Coral is facing dire conditions and is being lost at a phenomenal rate around the world as disgusted previously. Therefore the building is intended to educate the public on this issue through an entertainment platform; an experiential space that leaves a lasting impression of awe. Bringing awareness through the building. To accomplish this design intention, experiential space, or greater understanding of the ideology of Phenomenology with focus on distracting the user and to create a lasting impression with the intention to create awareness.

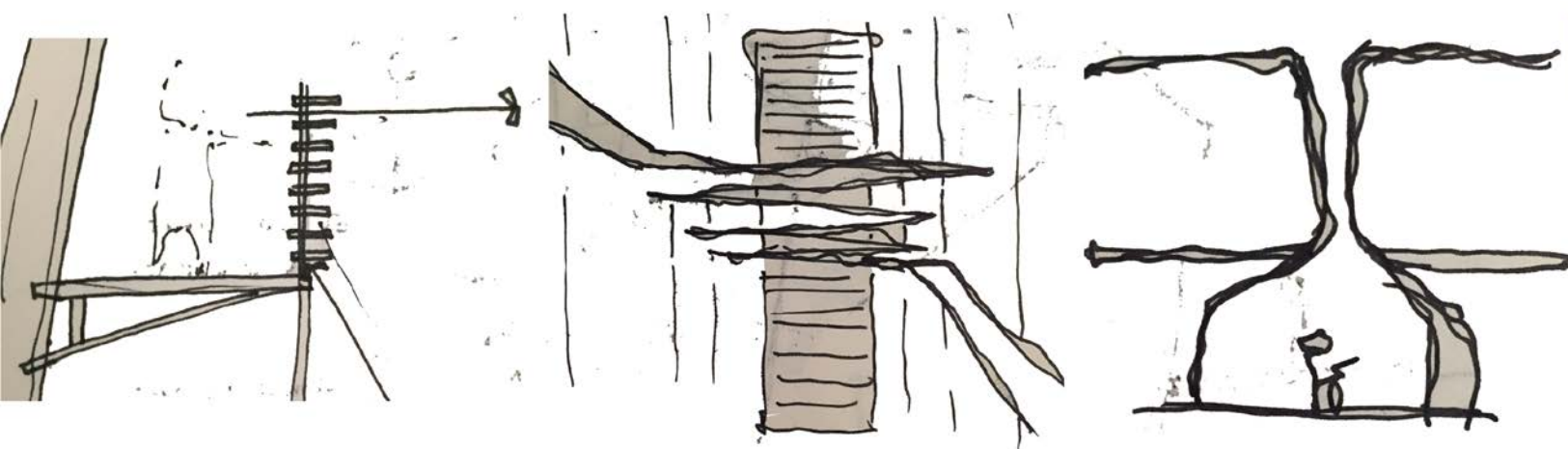


Fig 4.1 Phenomenological sketch
diagram of influential spaces in durban
point (Author, 2019)

Phenomenology is the essence of a place, it is the lasting impact that space has on the user, and it is the human body and minds reaction to entering a space. It is the emotion that is felt when immersed in the space, and phenomenology is the understanding of this sensation and how it can be recreated, possibly through built form of architecture. Due to the nature of phenomenology and that each experience is different, thus it is difficult to get exact answers to what make a space feel like a space. Through the precedence of a particular space, with the intent of following similar design principles to recreate the essence of the original space.

Following principles such a visual impacts, how the light enters the room and what does said light fall on, what thresholds have been overcome to be in the space, what textures and sounds are in the space, and other architectural influences.

Through the study of coral reefs and their structure and influences, there has been phenomenological aspects brought to light.



Coral reefs, natural barriers of the ocean that are formed under very specific conditions, the occurrence of these reefs alter the environment, which effects the experienced conditions of the surrounds. The creation of a coral reef encourages ocean wild life to the area, providing and protecting for full ecosystems. These structures interrupt the wave length in ocean waters, causing the waves to dissipate, creating calm waters and in harsh conditions, protect the coastline from erosion and other harms. In their essence coral reefs are nature's threshold to the environment. A natural phenomenological intervention of the ocean.

But how can the understanding of these reefs better the phenomenological understanding and be relate to architectural design.

The structural mass of the coral creates the varying thresholds, between the ocean and shoreline, beachfront and tidal pools. These bodies of water are effected by the reefs, thus changing the experience of the space. The reef diffuses the waves making the water in this area calmer, more user friendly and clear. Passing through this threshold from the open ocean, a divide, a structure that physically alters the environment. The calmer water allows the user of the space to move more freely, a clearer view into the area without the interruptions of the outside world. Allowing the user to process what they are seeing and gathering information.

The building needs to be able to take the user from the outside, leaving all the distractions to create an area of peace, a space where the user can be immersed within it. Allowing for the interaction with the space and therefore the passing of information without the distractions of the outside world to process. This could be achieved through understanding the essence of the place, what phenomenological aspects need to be used and incorporated to achieve this calm. When this aspect is approached through architecture, light entering the space, volume size of a space, texture, and sound within the space all need to be considered and how these effect the feel of the space.

For the success of the coral reefs to influence the design of the building, design principals need to be set out that follow the similar principles that occur in the reefs. The importance of the threshold, as a way of disconnecting the user to the distractions of the outside world, allowing for a fuller experience of the space. Within coral reefs there is smaller spaces and pathways that provide safety to the fish, these pathways and voids allow views through. The structure of the coral acts as the envelope of a building, providing protection while allowing sight out, through the voids. These voids in the structure can be likened to outdoor courtyards and the buildings relation to the surrounds.

Fig 4.2 Collage of sketches, relation to structure of reefs and architectural influences (Author, 2019)

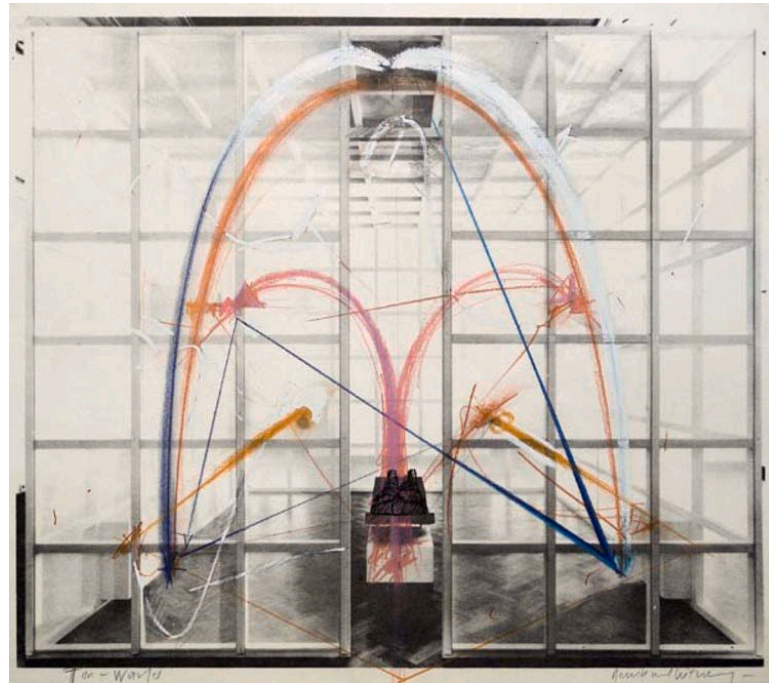


Fig 4.3 How sounds moves through a space. (Leitner, B. 2011)

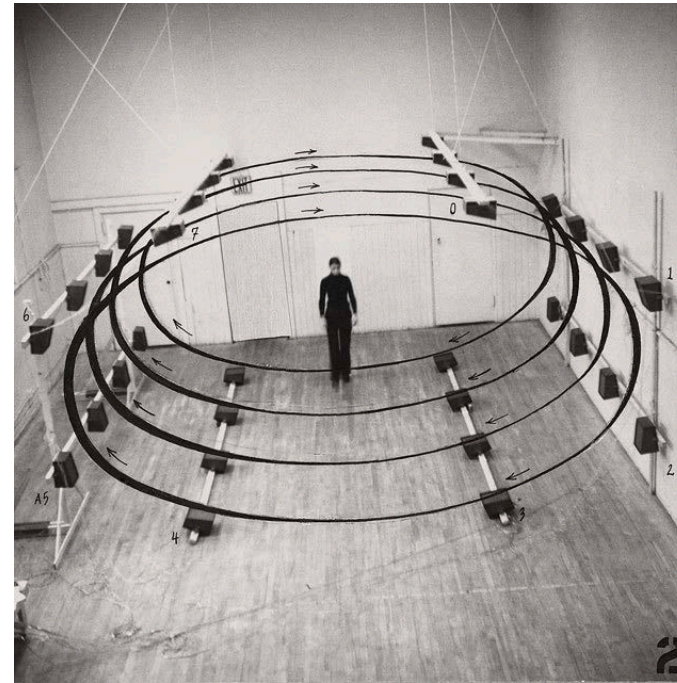


Fig 4.4 How the user moves through sounds. (Leitner, B. 2011)

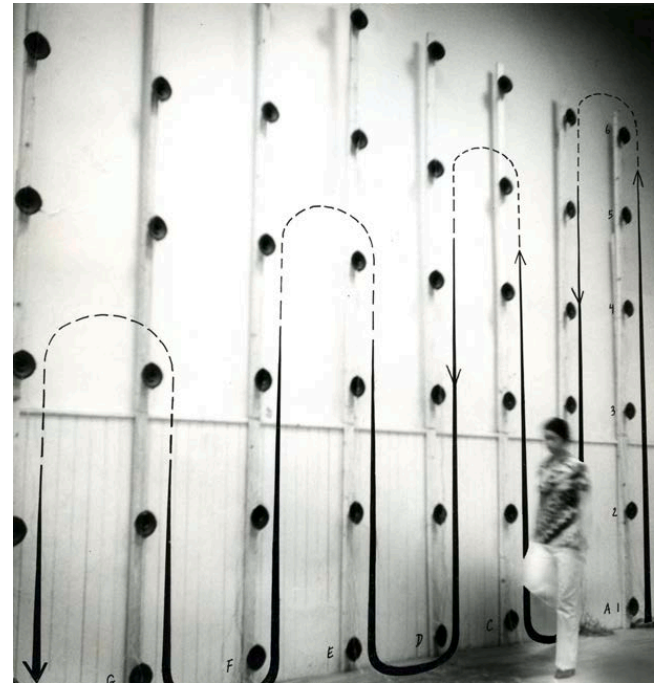


Fig 4.5 How the sound moves next to the user. (Leitner, B. 2011)

Phenomenology is a very subjective subject as it revolves around the users experience of the space, no two people may experience the space at the same time but both will take away something different from the experience, this can be effected by the sound of the space, or noise created at specific places as Bernhard Leitner experiments with in 'Sound Spaces'. How playing different frequencies heard at alternative heights might make the space be calm and still. Due to the continuous sounds from the ocean next to the site it is important that the understanding around sounds in the space is clear. The intent of bringing sound into the building through the use of outdoor spaces and connections to the sounds of the ocean, connecting the user to the site and place. Commonly sounds aren't used in the essence of the space, this would create a unique experience with lasting impression.



The Durban Beachfront is a very tactile environment, a place of many sounds, smells, sights, tastes, and sights to take in. Phenomenology is the acknowledgement of the person's experience of the senses when in the space. With the constant bombardment of senses the public space can become overwhelming and distracting. Like the coral reef the senses of the public space need to be filtered to be able to calm the environment, focus on a comfortable environment.

The promenade helps filter the public space, although it is only an open space with both edges not blocked. It still influences the user's experience of that space as it acts as a threshold, it is only distance between the street edge and the beach but the promenade creates this break between the city and the beach. Thus iterating that a threshold can be the distance between two opposing spaces.

The senses of the place, the views, smells, the textures, sounds all make up the individuality of the site and thus the essence of the space, to fully enjoy the experience space, the senses need to be controlled to moderation or separated for the full appreciation of the site. With reference to the promenade, using the travel to breakup and highlight different aspects of the space, creating a more enriched experience.

Fig 4.6 View along length of North Pier.(Author, 2019)

“God is in the details.”

— Mies van der Rohe

PRECEDENCE

Introduction

Architectural precedence that relate and influence the design of the Coral Research and Ecology Centre. The following buildings design are relevant to the design in one way or another, this will be expalined through the diagrams that have been drawn.

CHAPTER FIVE

CENTRE FOR NOONYGAR CULTURE AND ENVIRONMENTAL

Architects:	iredale pedersen hook architects
Location:	2 Grey Street Northam, Western Australia
Year:	2018
Area:	1450.0 m2
Category:	Cultural Center
Storeys:	One Storey

- Designed with the 100 year flood line in mind.
- The design incorporates the ecosystem of the river.
- The use of timber slats from the site.
- Environmentally conscious use of building techniques.
- The buildings organic shape resembles the river flow.

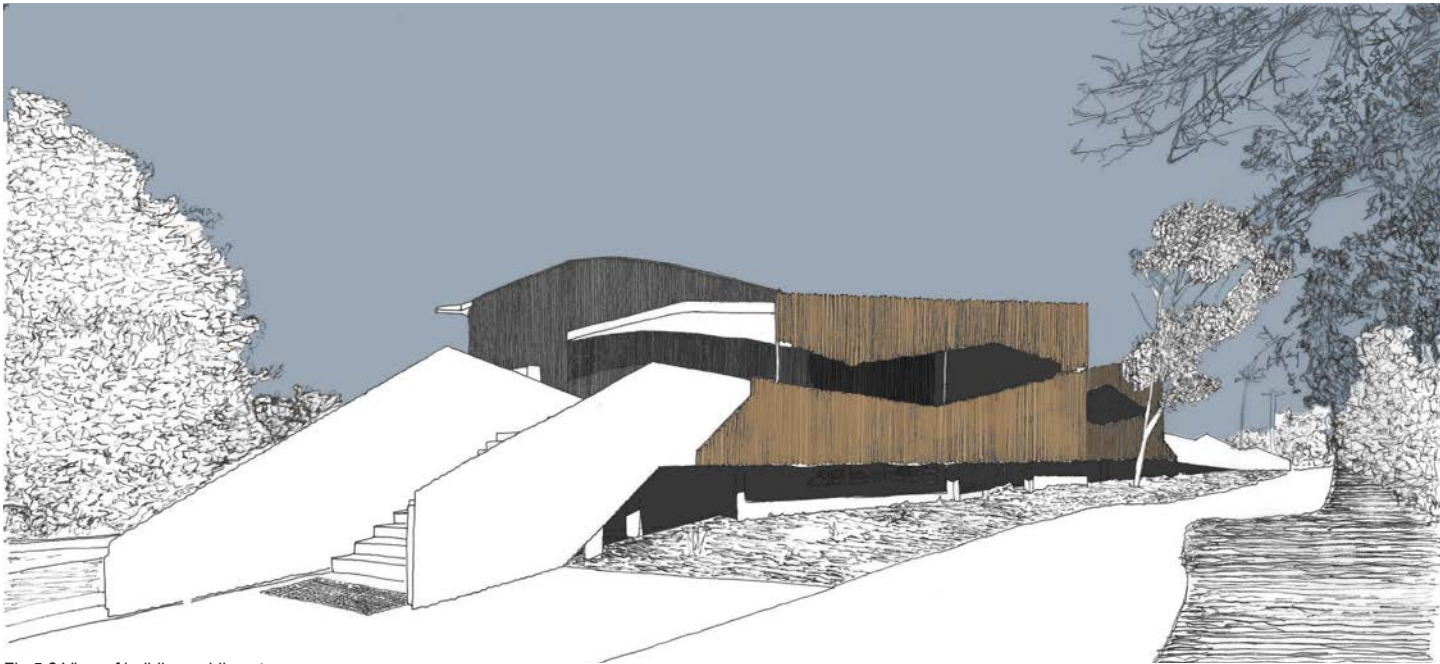


Fig 5.2 View of building public entrance (Author,2019)



Fig 5.3 View of building from across river Avon (Archdaily, 2018)



Fig 5.4 View of internal exhibition space (Archdaily, 2018)



Fig 5.5 View of building from over head (Archdaily, 2018)

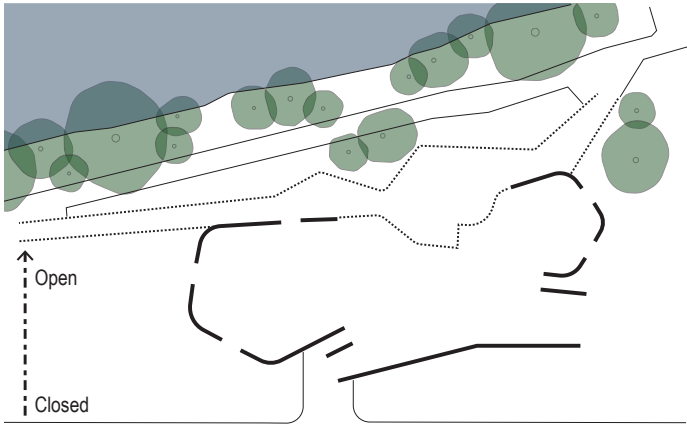


Fig 5.6 Plan showing envelope breakdown and site relation (Author, 2019)

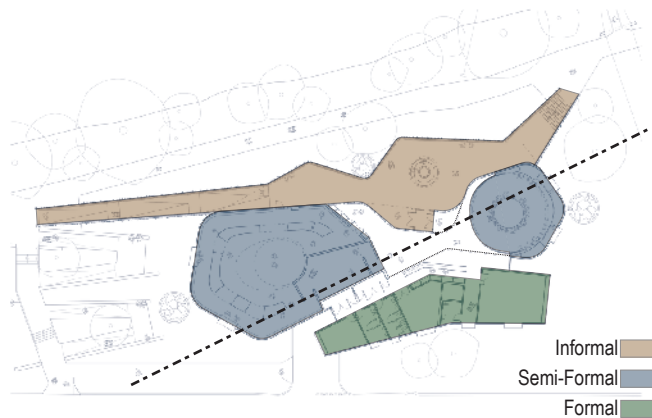


Fig 5.7 Plan showing program breakdown and site relation (Author, 2019)

The design approach consciously relates to the site and the strong differences between the North and South Façade, the road runs the length of the South Boundary and the River Avon flows along the North boundary, the river bank forming the boundary line. The facades relate as the river banks and trees control the fluid and organic form of the building and the street edge condition to the south elevation is more ridged and formal. As the plan transitions towards the river the envelop of the building becomes softer and more open, allowing the sounds and sights of nature to enter the building. Compared to the harder edge of the street conditions, which houses the practical needs of the building. These points are evident in (Fig 5.6) which demonstrates the phasing of the building façade design.

The program of the building is arranged in a similar manner. The Conference rooms and exhibition Space is positioned through the centre axis of the building. Place of reflection and entrance, the north façade is open and compiled with a number of wooden slats along the extreme edge. The entrance transitional space blurs the threshold between building and the environment. The permeable façade allowing the sounds and sights of the river to be captured in the spaces of the building. The building sits on columns that clear the 100 year flood line, addressing the natural site conditions.

UNESCO WORLD HERITAGE WADDEN SEA PROJECT

Architects:	Dorte Mandrup Architects
Location:	Wadden Sea
Year:	N/A
Area:	N/A
Category:	World Heritage
Storeys:	Five Storeys

- Incorporates the public interactions with the water.
- Research laboratories in a public building.
- The vertical thresholds experienced public.
- The style of architecture is very light.
- Passive sun shading techniques.



Fig 5.8 View of building across Wadden Sea
(Author, 2019)



Fig 5.9 View of building from Wadden Sea
(Archdaily, 2018)



Fig 5.10 Plan view showing relation to sea
(Archdaily, 2018)



Fig 5.11 View of building from Wadden sea
(Archdaily, 2018)

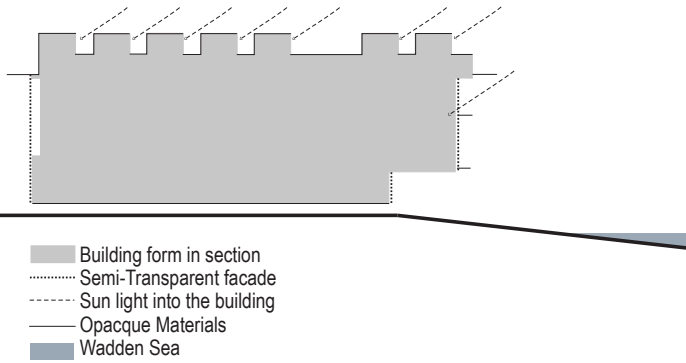


Fig 5.12 Section Diagram, building design
influenced by natural elements (Aurthor, 2019)



Fig 5.13 Section of Public to Private breakdown
(Aurthor, 2019)

The proposed building is influenced and designed around the ocean and sun. The building is slightly raised off the ground, to allow for possible flooding conditions. The design also incorporates passive shading techniques through balconies and courtyards, while the façade of the building is semi-transparent, allowing light into the building. The façade pulls away from the building to create voids as seen in (Fig 5.12). The roof top rooms are positioned to allow light through a courtyard, and provide privacy from others.

The building is broken up vertically by addressing the public interaction with the building through vertical circulation, from the public realm to the private spaces at roof level. The public entrance is along the ground level of the building, but due to the slope of the site, a public court is positioned beneath the ground floor. This court is a gradual slope that meets the water line, acting as a water pavilion, which allows the public to interact with the bay water. The roof is used as a viewing deck with a small hotel for private accommodation opening onto it. The laboratories and research facilities occupy the majority of the top floor, allowing the public an in depth look at the research process. These two spaces connected by a semi-public exhibition space, creating a transitional public space. The building focusses and is influenced strongly on the public approach to the spaces and use, creating an enjoyable public space.

FORO BOCA

Architects:	Rojkind Arquitectos
Location:	Boca del Rio Ver
Year:	2017
Area:	5410.0 m2
Category:	Music Venue
Storeys:	Five Storeys

- The building is positioned at base of pier.
- Informal public spaces within the building.
- The street edge condition is very hard.
- Courtyards incorporated into the design.
- The main public entrance positioning on site.

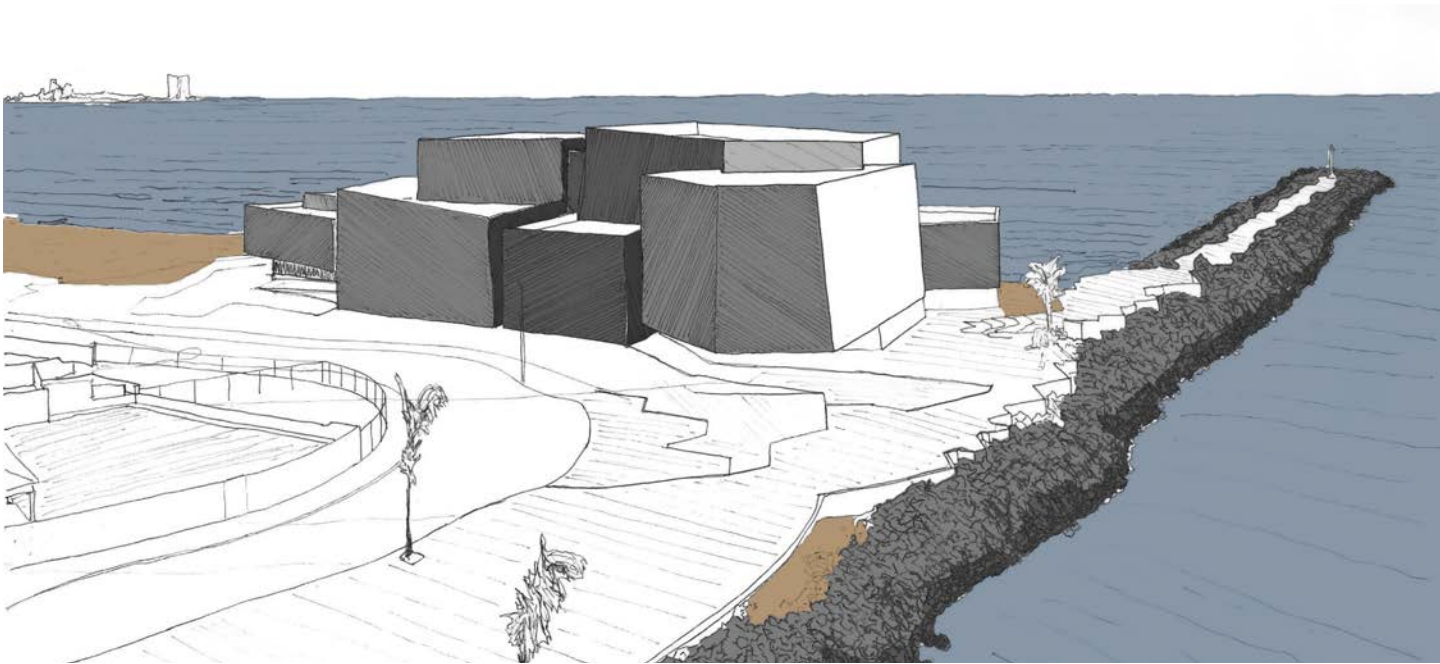


Fig 5.14 View of building from above (Aurthor, 2019)



Fig 5.15 View of building to public court and entrance (Archdaily, 2017)



Fig 5.16 View of the internal public space and void (Archdaily, 2017)



Fig 5.17 View of informal public amphitheater (Archdaily, 2017)

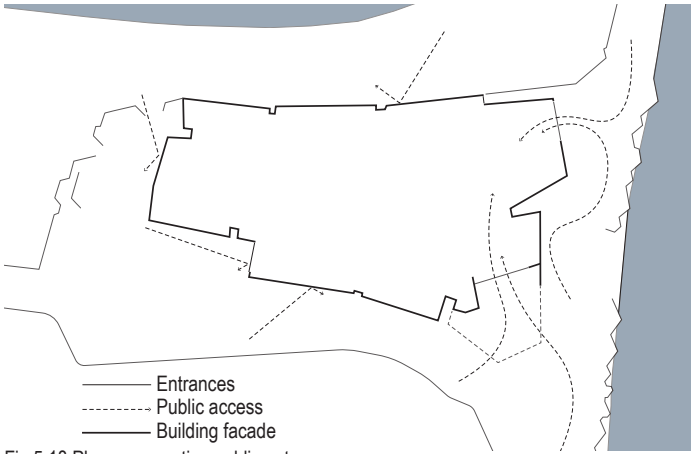


Fig 5.18 Plan representing public entrances, and facade conditions (Author, 2019)

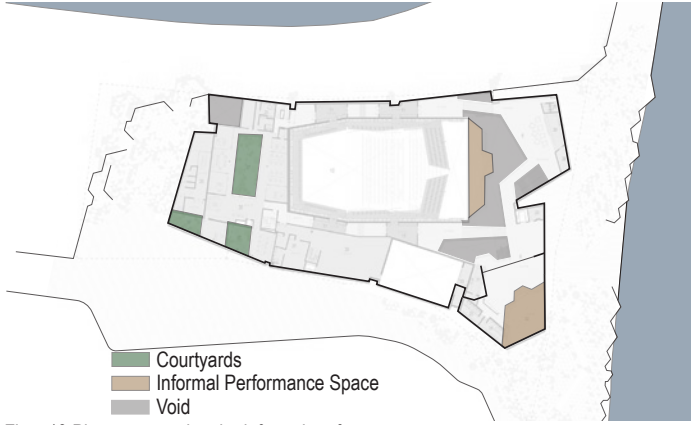


Fig 5.19 Plan representing the informal performance spaces and coutyards (Author, 2019)

The Foro Boca is a theatre, thus a very public building, situated on the base of the pier. The site is therefore similar to that of the research centre. The building plan does not relate to the influences of the site as the facades are heavy and harsh against the beachfront, and street edge condition on the south facade is very hard. It does not allow the pedestrians to have any interaction with the building. The building is set back from a public pier, the entrance to the theatre incorporates this into the design with the public fore court under a large portion of over hung building, facing the Harbour and perpendicular road.

The building seems closed off to the public from the exterior but once entered the building opens up through voids and grand circulation areas. The building has incorporated open air courtyards to bring light, air, and the sounds of the ocean into the building. This is forming a connection to the site, with the ocean sounds fulling the spaces yet the waves cannot be seen form these courtyards as they are centred to the building. The plan also allows for small scale informal performances. These smaller spaces form around the circulation and voids of the building. They create breakaway spaces within the greater scheme of the building to experience the space. The understanding of the space constantly changing depending on the performances taking place.

Architects:	Snohetta
Location:	Lindesnes Municipality, Norway
Year:	2019
Area:	495.0 m2
Category:	Restaurant
Storeys:	Three Storeys

- The building transitions below the water.
- The site’s rocky shelf and wave breaking zone.
- Experience of animals in the wilderness.
- The connection between land and ocean.
- The bridge acts an extended threshold.

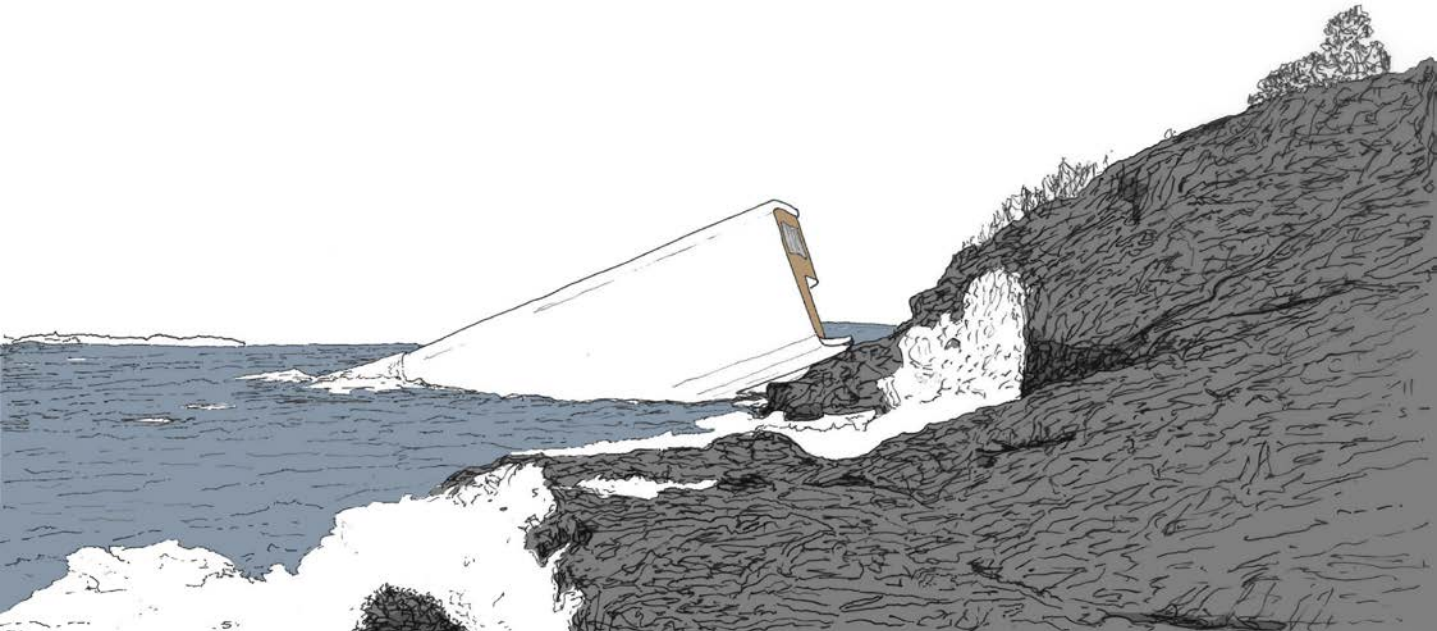


Fig 5.20 View of building from ragged sea edge (Aurthor, 2019)

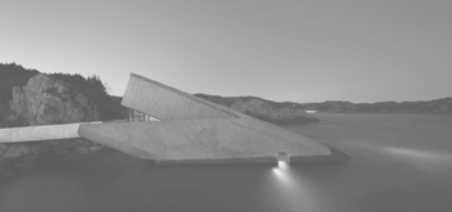


Fig 5.21 View of building from the ocean (Archdaily, 2019)



Fig 5.22 View of the restaurant and under water spectral (Archdaily, 2019)

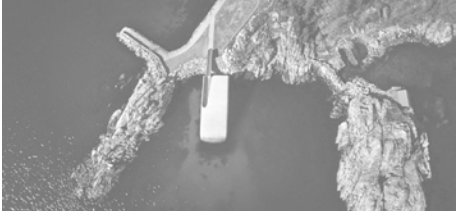


Fig 5.23 View of building from above (Archdaily, 2019)

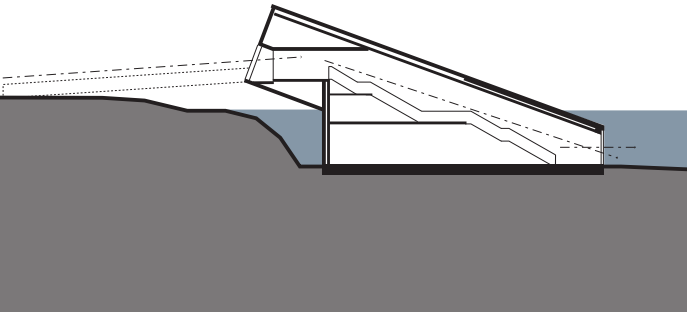


Fig 5.24 View of building from above, threshold of bridge (Author, 2019)

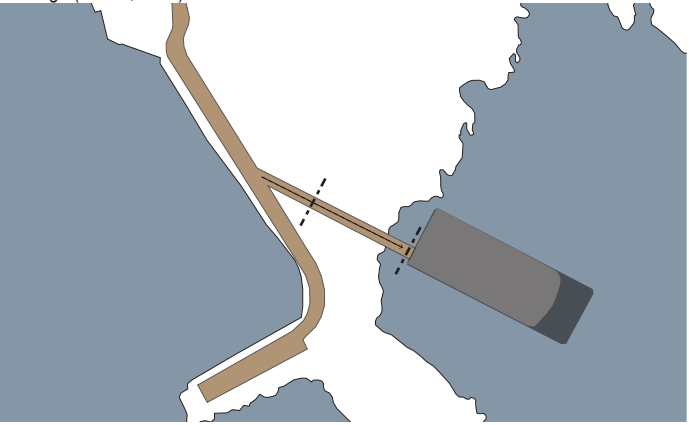


Fig 5.25 View of building from above, threshold of bridge (Author, 2019)

Under is a restaurant building by Snøhetta that forms a poetic transition through building to a below the ocean experience. The architects used a minimal material pallet, a large concrete shell and wooden cladding in small amounts. The orientation and positioning of the building on site enforces the experience, the building is set a few meters off a rocky shelf in the wave breaking zone of the ocean.

The building creates a transition from above ground to bellow water, this processes starts from the entrance bridge which is the only connection between the building and the land. The bridge acts as an extended threshold moving from solid ground to free standing building, as represented in (Fig 5.25). The solid modern brutalist form of the restaurant coupled with minimal windows creates an anticipation when approaching. It is this anticipation that builds while travelling the length of the bridge. Entry into the building leads with a view of the roof, due to the buildings design, orientation, and angle at which the building enters the water. This view of the roof is cast upon with the reflection of the light and water flickering from the large glass window in the restaurant area, refer to (Fig 5.22). The stairway then descends into the main eating area where the large underwater glass window supplies a view into the ocean, the design builds on the anticipation and holding it in this space.

“Architecture is the learned game, correct and magnificent, of forms assembled in the light.”

– Le Corbusier

DESIGN APPROACH

Introduction

The design approach is to create a space in which the public can interact and learn about the issues faced, in an experiential space that allows for education as well as entertainment. The site poses many changes and great opportunities for design. This is the rough design work, and there may be change to these ideas in the coming explorations.

CHAPTER SIX

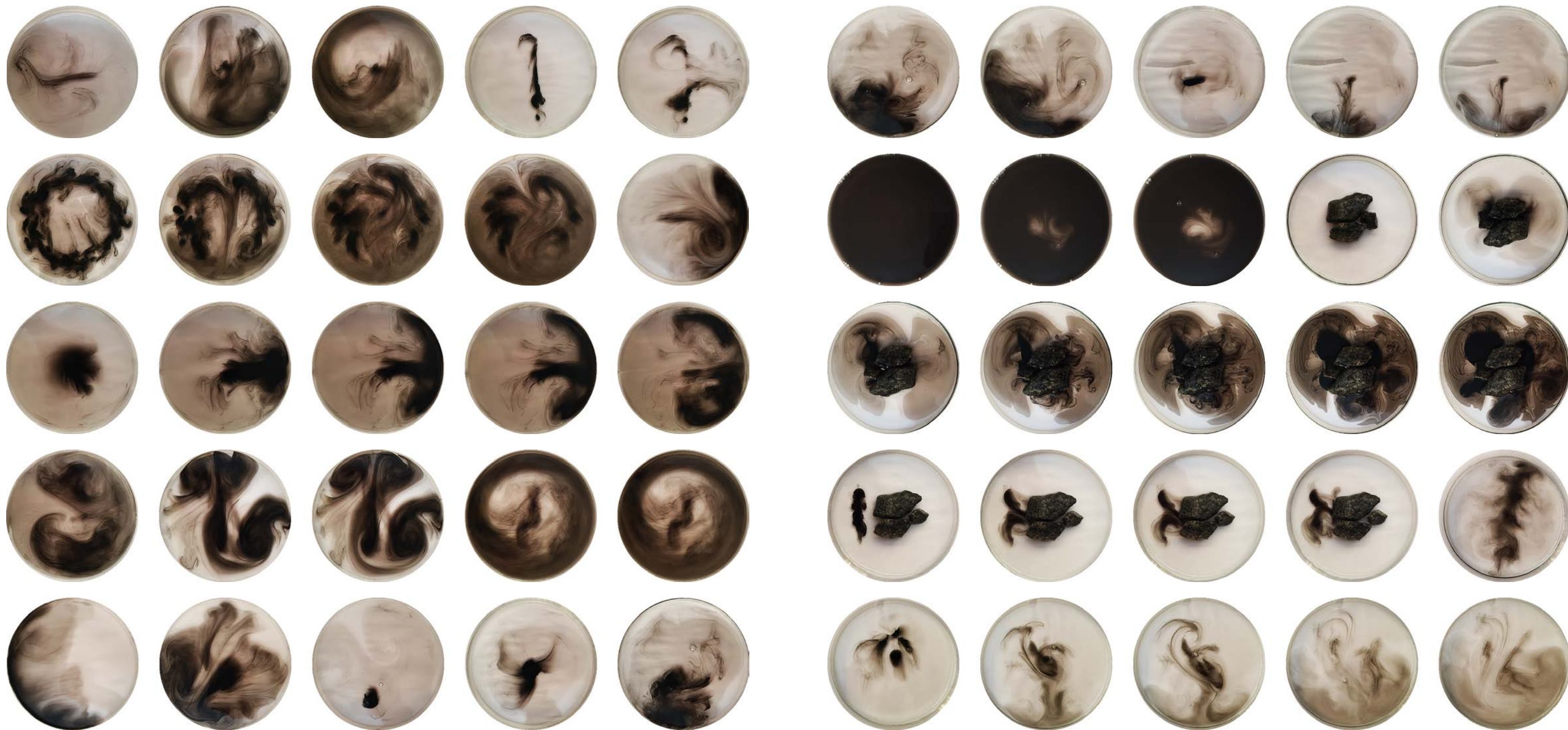


Fig 6.1 Oil in water, (Author, 2019)

CONCEPTUAL MODELS

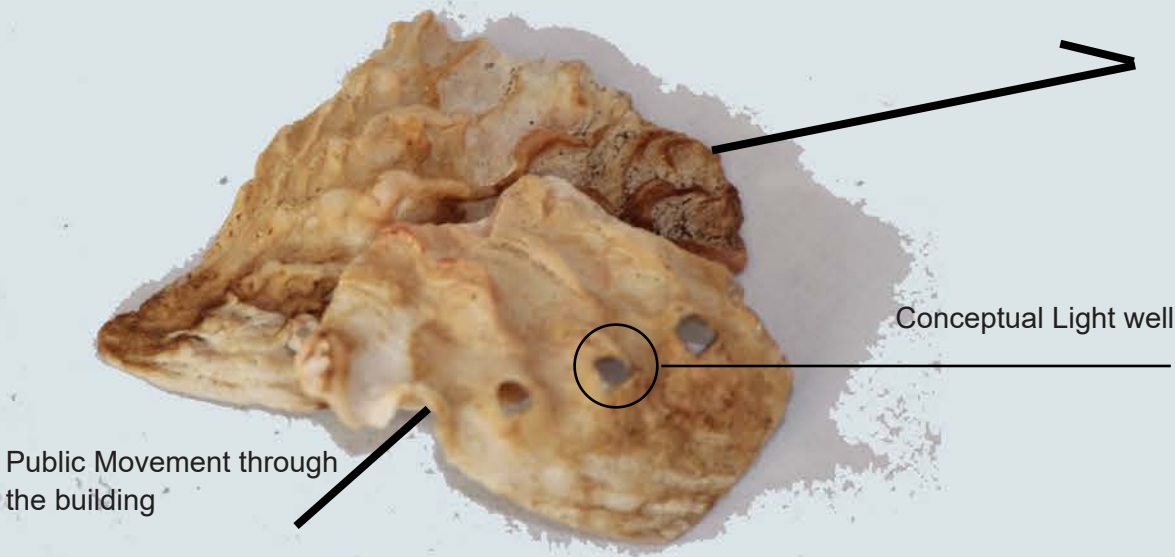


Coral Stuck

Fig 6.2 pollution in mass
(Author, 2019)

The page before is the illustration of oil in water design exercise, with the intent to document the oils spread and movement in the water. This was done during the design charrette, a conceptual exercise of circulation and movement in a body of water, currents and flows effecting the oils shape and form.

The model to the left (fig 6.2) is an expression of the pollution of the Durban Harbour, and how this pollution may lead to coral growth on the scheme.



Conceptual Light well

Public Movement through
the building

Fig 6.3 Coral stacked
(Author, 2019)

The collage of shells were arranged in a number of ways to represent building forms and envelopes, they were then photographed. The intent was to express the organic forms of the shells, which were then related to architectural interventions, such as the 'light well' (Fig 6.7). How circulation might interact with this space.





Water Platform

This conceptual model was a play on form, and how the scheme could integrate into the north Pier and further into the Durban Point Bay. The can is used as a conceptual mass and the idea that pollution can be used to form a better environment.

Adaptability as a concept, the coral reef and its conditions are constantly changing, growing and adapting. The same can be said for architecture that allows for change and adaptive qualities, encouraging the movement and outdoor experience into one. The model shows the delicate relationship that needs to form between the building and Vetch's Reef.

Fig 6.5 Conceptual Model
(Perspective) (Author, 2019)

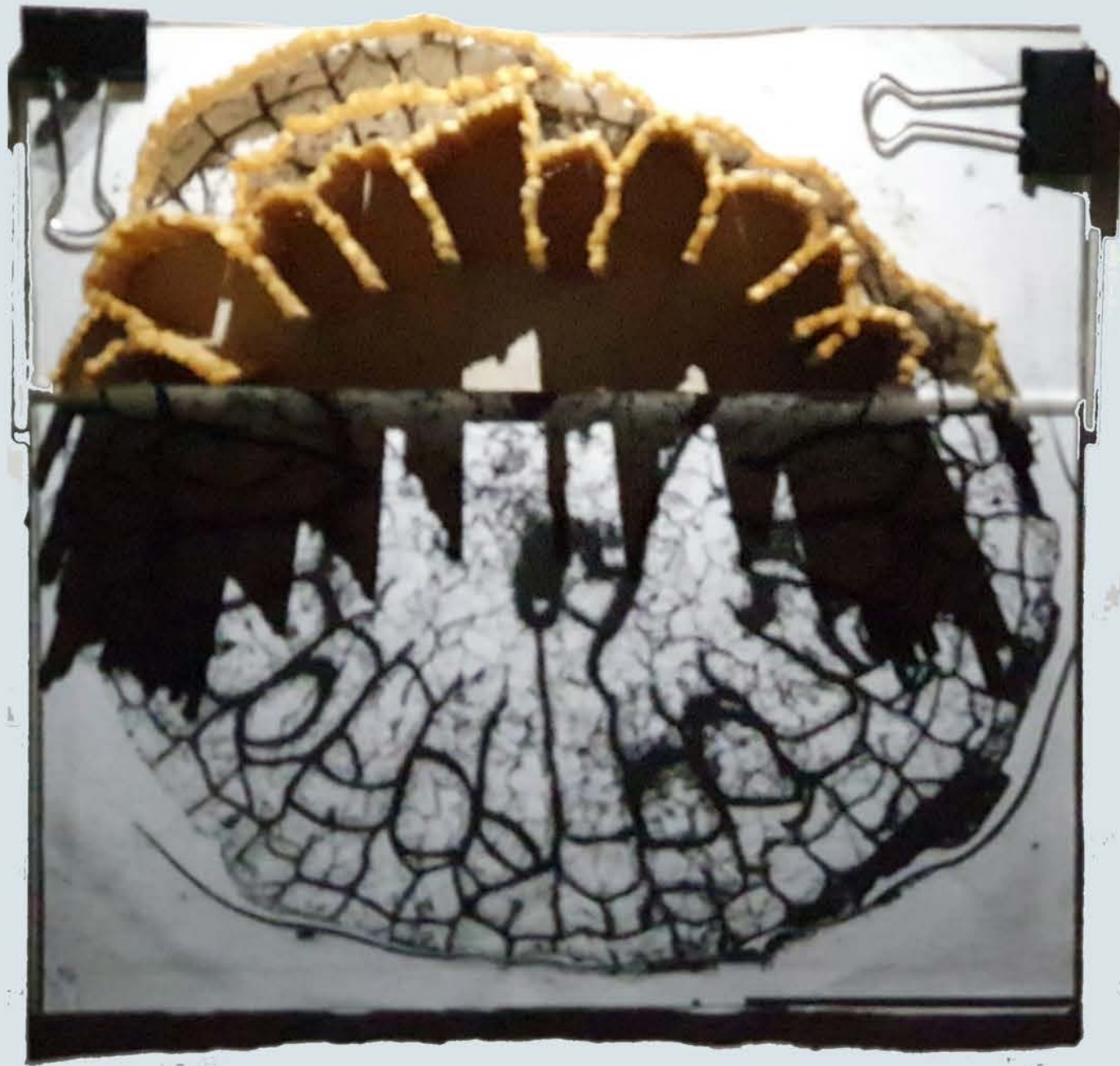
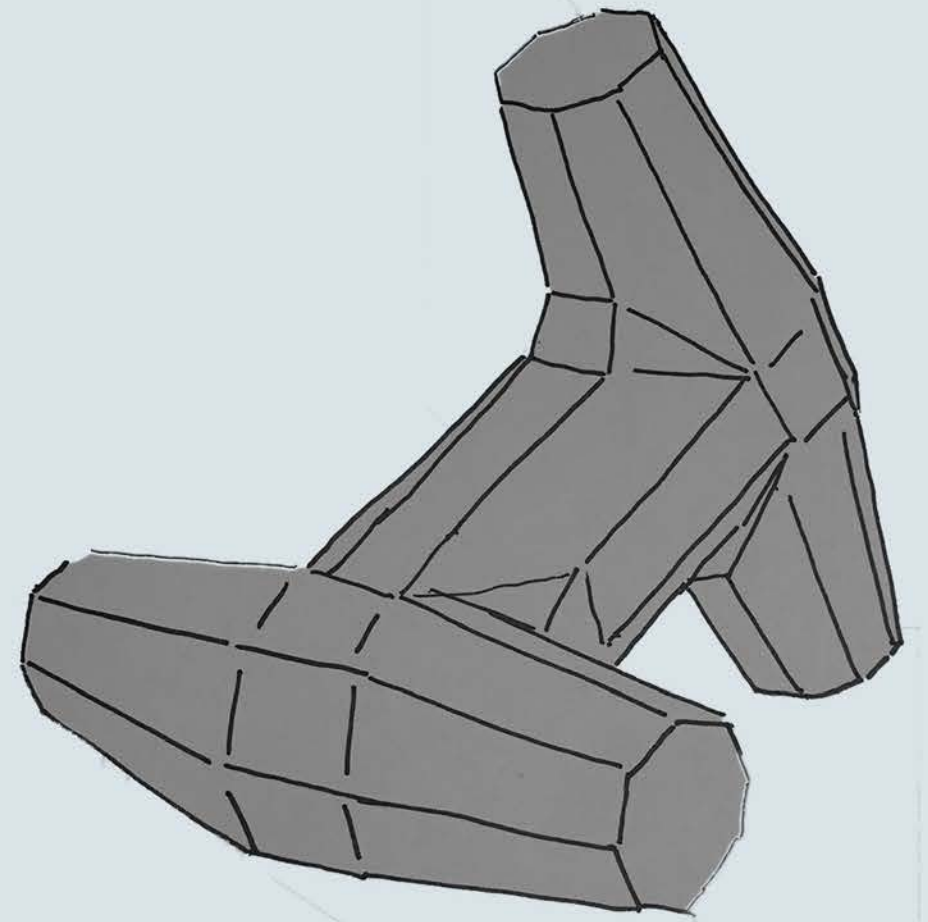


Fig 6.6 is a model of the structural section of the coral, in its natural structural arrangements. The organic shapes created in the organisms. And all parts of the coral serving their purpose, protecting the polyp. These can be referenced to the life lines and embodiment of the “needs of a building”

If you look at the coral section there are many architectural questions that begin to be asked, like the structure of the coral, the reef is an entity that is made up of many much smaller working parts to form and organic structure and how these can relate back to architecture, in terms of program and conceptual form. The relation of a living organism to the architectural structure, and envelope of the scheme. The coral offers to the design as a function, the breaking down of the wavelength, similar to the Dolos.



Dolosse, found at the end of the North Pier along its edges, the geometric shape is used to break down the force of the waves. The shape of the Dolos is used conceptually as the form design of the scheme. The structure is made from reinforced concrete, with intention to use this material in the scheme. Thus another way the project is tied back to the site and the Dolos, form and materiality.

Fig 6.7 Scaled Dolos as conceptual sketch (Author, 2019)

INITIAL SKETCHES

The sketch section gives off the appearance of a large craves or preferably void through a reef structure.

Architecturally the intent of the large void would be to allow light to filter down, forming a unique space on access level. Creating a strong spatial awareness when standing in the space. A 'shock' experience to start the journey.

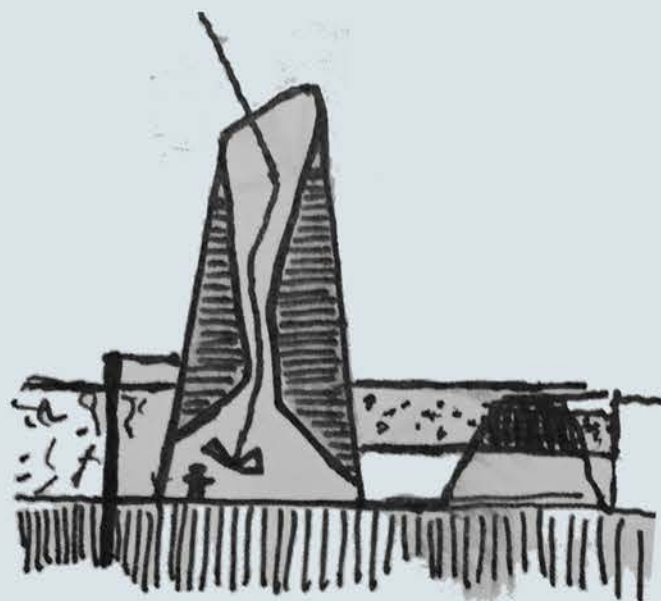
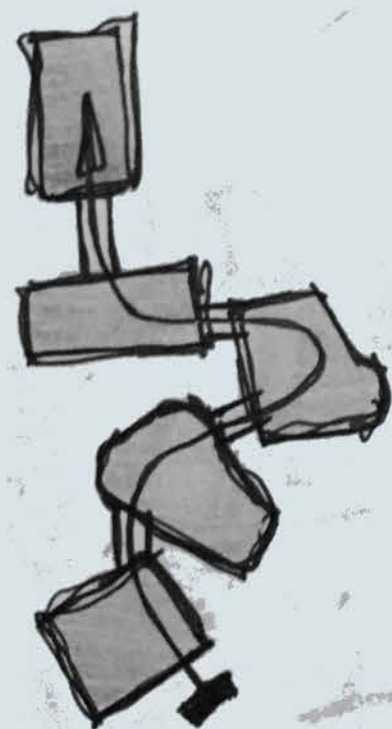
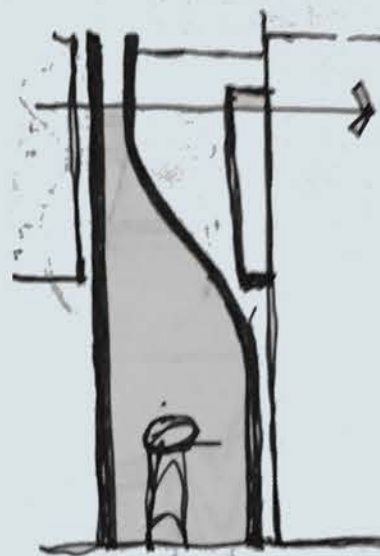


Fig 6.8 Conceptual sketches that relate to the design (Author, 2019)

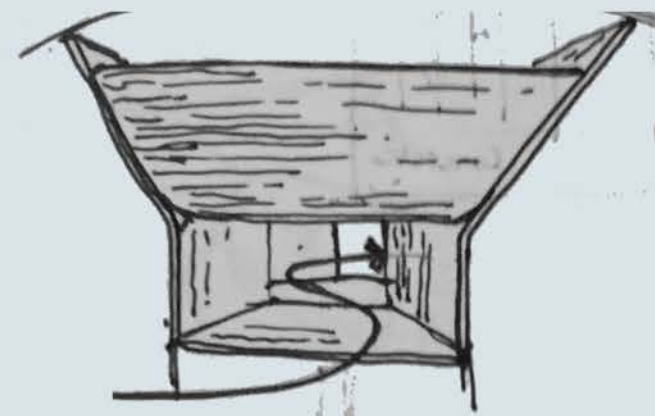
Forming a path through the building, connecting all the spaces and enriching the experience as a whole. As the user moves through the separate spaces, each specific and unique, with different objectives. These spaces leading to a final arrival point of the building and a place to reflect. This final arrival point bringing the different experiences into one.



A continuation of the travel concept. The passage leading into the centre of the exhibit spaces with the intent of distracting the occupant as they move through the 'moulded' space. Moving from a wide space, being compressed into the passage and then opening up to the gathering space. A light well the length of the passage to create a light space. Casting light onto the sculpted wall.

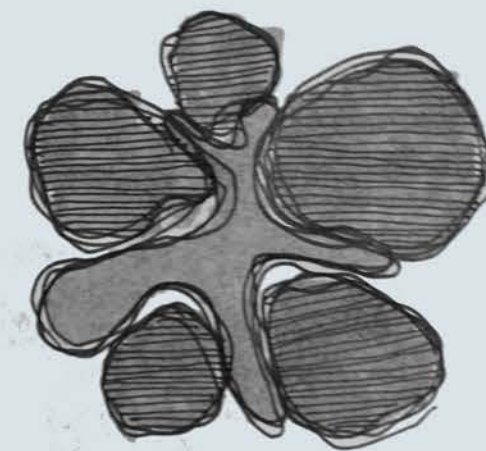


The idea of secondary spaces that add to the overall experience but are not vital to the buildings designated building. Through the connection to the outdoors, with the use of courtyards and a number of views out. An opportunity to use create unique experiences for each person using the space.



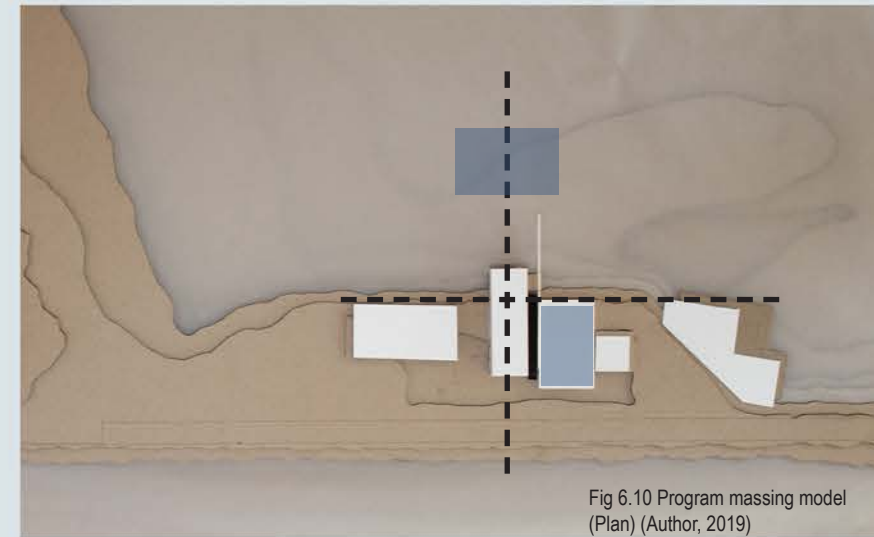
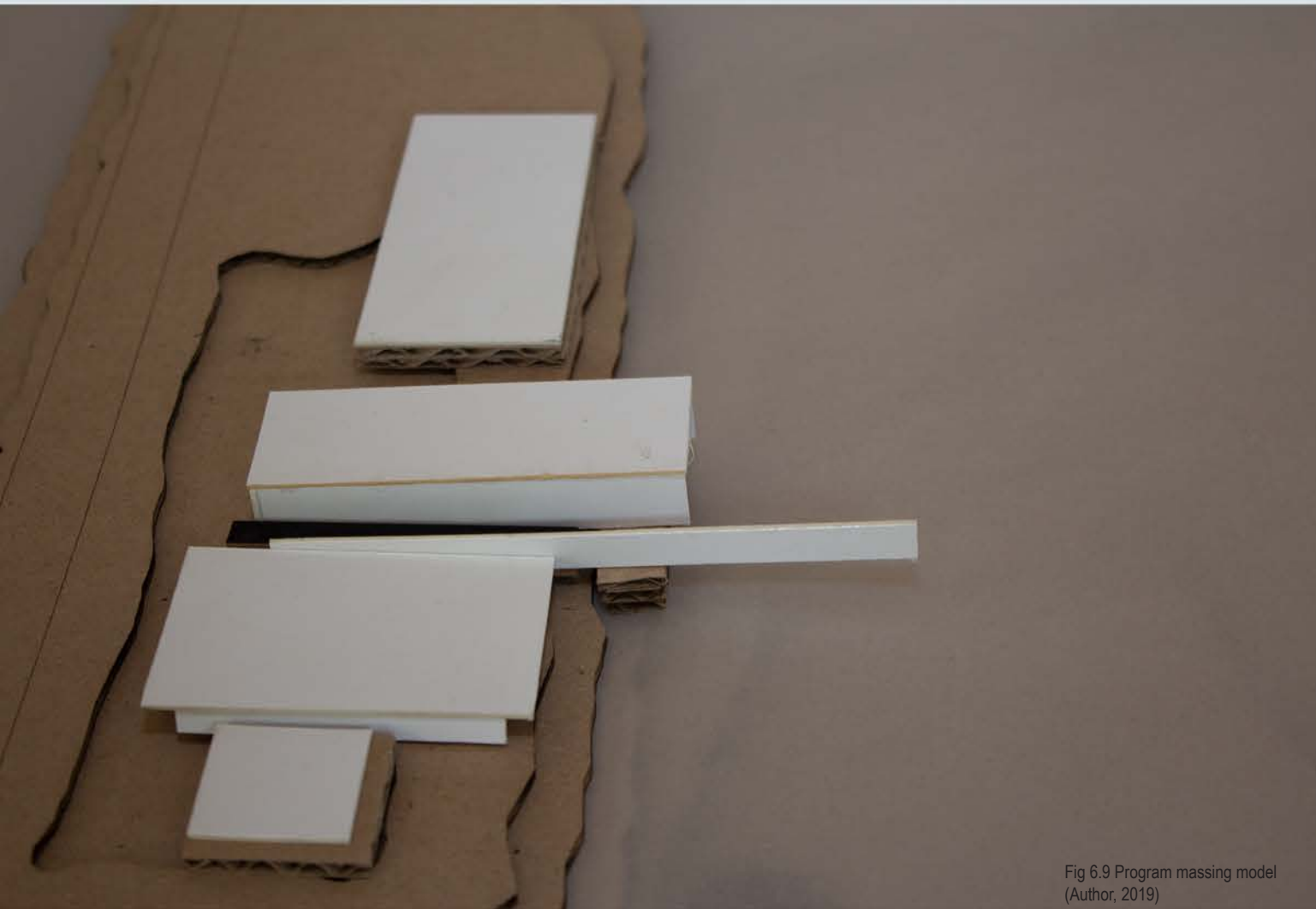
Similar resemblance to a coral polyp, the exhibits are individual, and the gathering space ties them together.

The gathering space between the Exhibition / Museum spaces to allow for interaction and the exchanging of information. It also acts a place to decompress and process the information before moving into the next exhibit space.



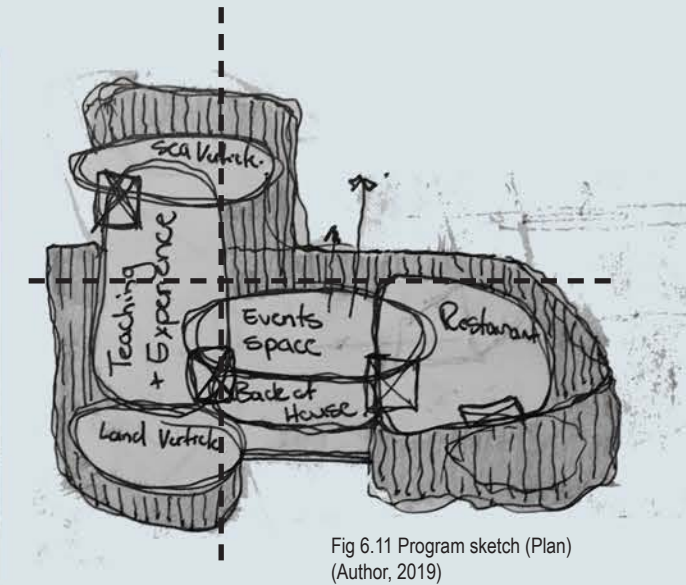
Coral Ecology Research Centre		
Program	Amount	Square Meters
Public amenities		
Public Fore Court	1	500
Entrance foyer	1	200
Reception Area / Information Office / Security Office	1	50
Bathrooms / Open air showers (for beach users)	1	100
Water stations (for runners)	2	N/A (promenade)
Public facilities		
Restaurant	1	250
Kitchen	1	200
Retail Space / Merchandize (local artist)	1	100
Experiential Space	1	1000
Events Space		200
Exhibition Space		100
Market Space		100
Viewing Deck	2	100
Water Pavilion	1	500
Administrations		
Reception / Waiting Area	1	30
Library / Open plan work stations	1	250
Kitchenette / Eating space	1	30
Boardroom	1	35
Meeting Rooms	2	25
Research cubicles / Offices	10	10
Managers Office	1	25
Finance Office	1	20
Ecology Research Centre		
Testing and Research Laboratories	2	150
Coral Growth Laboratories	1	150
Water Purifying for Coral tanks	1	100
Coral Phase Pools	5	50
Equipment Room	2	100
Guest Accommodations (Researchers)		
Overnight rooms for guest researchers	5	25
Bathroom / Shower facilities		
Shared Communal space	1	50
Bar / Canteen / Foyer		
Open Veranda (Experience Space)	6	5

Services		
Bathrooms throughout	4	50
Service core		50
Storage	2	50
Refuse area	1	30
Deliveries / Dispatch	1	100
Parking		
Public Parking	100	3000
Staff Parking	20	900
Guest Research Parking (overnight)	5	



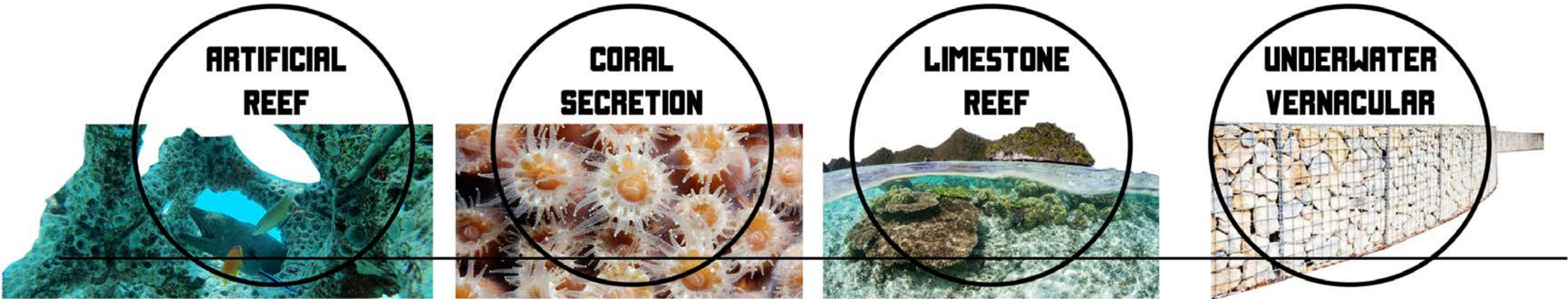
The massing model was a programmatic exercise of how the scheme would work best within the constraints of the site. This model later transcribed into three design principals of the scheme and the programmatic rough sketch (fig 6.11) of the ground floor plan. The Axes, the Underwater Vernacular, and the Transitions.

The building works off of two axes, one perpendicular to the pier and the other parallel. The educational experience of the scheme works from the pier towards the ocean, or North Axis. The social side of the scheme works along the piers edge, this allows for a large public fore court along the length of the scheme.



Through this model came the idea of the gabion walls and how these walls can be used to protect the building, as a reef would, and a viable way of creating a strong platform for which coral can attach, which lead to the 'Underwater Vernacular'.

The introduction of the axes later inspired the concepts of a transition, from land to sea, and land to air. This is explained later in the final design drawings.



Combination of Vetch's Reef, an artificial reef structure and the limestone found in the Durban Point Bay.

Fig 6.12 Diagram of process to 'Underwater Vernacular'(Author, 2019)

LIMESTONE GABION + ARTIFICIAL REEF

Limestone rock infill was used in the gabion wall as it is the by-product of Coral Polyp, and limestone is used throughout the scheme linking the underwater vernacular through materiality.

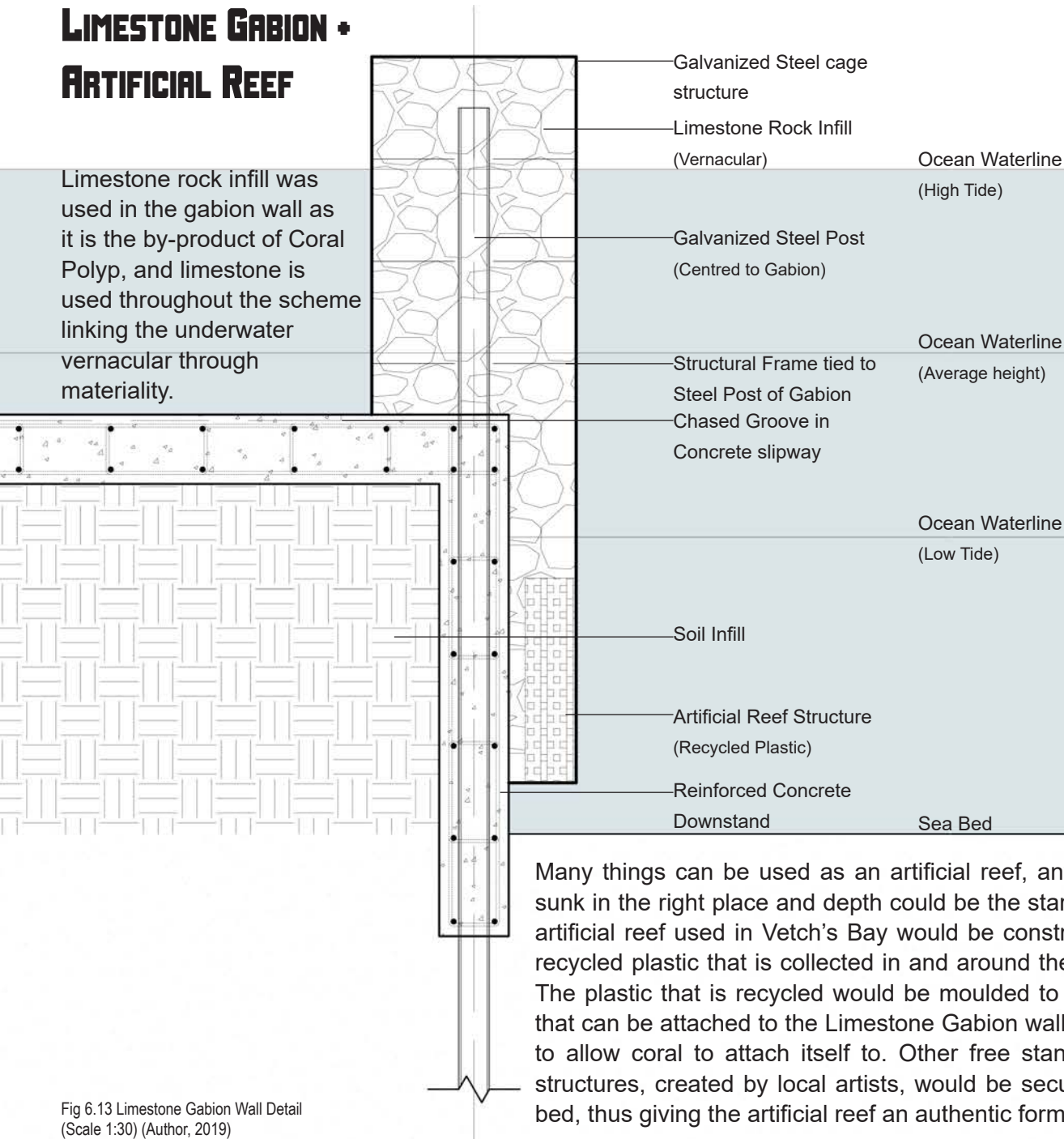
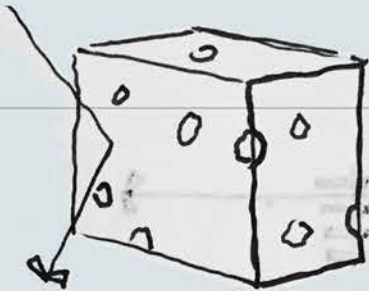


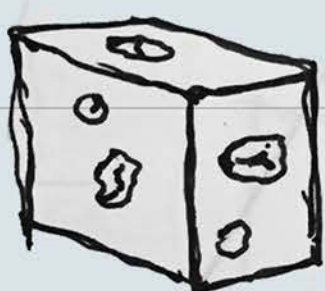
Fig 6.13 Limestone Gabion Wall Detail (Scale 1:30) (Author, 2019)

LIMESTONE CONSTRUCTION

Limestone mixed is with the other aggregate. Allowing for the strength of the concrete to remain.



Thin layer of the concrete chipped away to expose the aggregate.



Over time the limestone crumbles and dissolves leaving crevasses where the stone was.

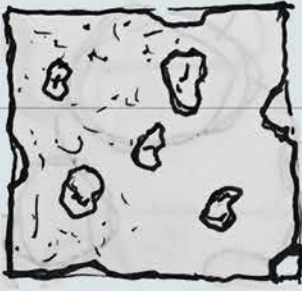


Fig 6.14 Sketch diagram of limestone concrete (Author, 2019)

Many things can be used as an artificial reef, any object that is sunk in the right place and depth could be the start of a reef. The artificial reef used in Vetch's Bay would be constructed from the recycled plastic that is collected in and around the harbour area. The plastic that is recycled would be moulded to a generic form that can be attached to the Limestone Gabion walls as 3D panels to allow coral to attach itself to. Other free standing sculptural structures, created by local artists, would be secured to the sea bed, thus giving the artificial reef an authentic form and feel.

Coral is a structural element, at its most basic form, there is an animal that is living symbiotically with algae. The coral its building its own structure, the structure is always changing, producing limestone, which has brought about the reasoning for using limestone in the construction process. Limestone is a very soft stone, and eventually dissolves over time, by introducing Limestone Gabion walls. The walls will slowly dissolve over time constantly changing its form.

Pushing this idea further to an 'Underwater Vernacular' smaller pieces of limestone will also be used throughout the building where concrete is being used, with the intention is to create a dense concrete wall. Over time small divots will begin to appear in the concrete envelop, resembling a living organism. Over time the exposed limestone will eventually dissolve or crumble, to revel the speckled look, allowing coral and other tiny animal's shelter.

Fig 6.15 Initial Dolos concept sketch of scheme
(South Elevation)(Author, 2019)



“I prefer drawing to talking. Drawing is faster, and leaves less room for lies.”

– Le Corbusier

DESIGN DRAWINGS

Introduction

This chapter illustrates the completed design of the Coral Research Facility, with completed drawings and renders.

CHAPTER SEVEN



Perspective of the project in its entirety from sea.



Site Model

Perspective from the pier towards Durban Point.

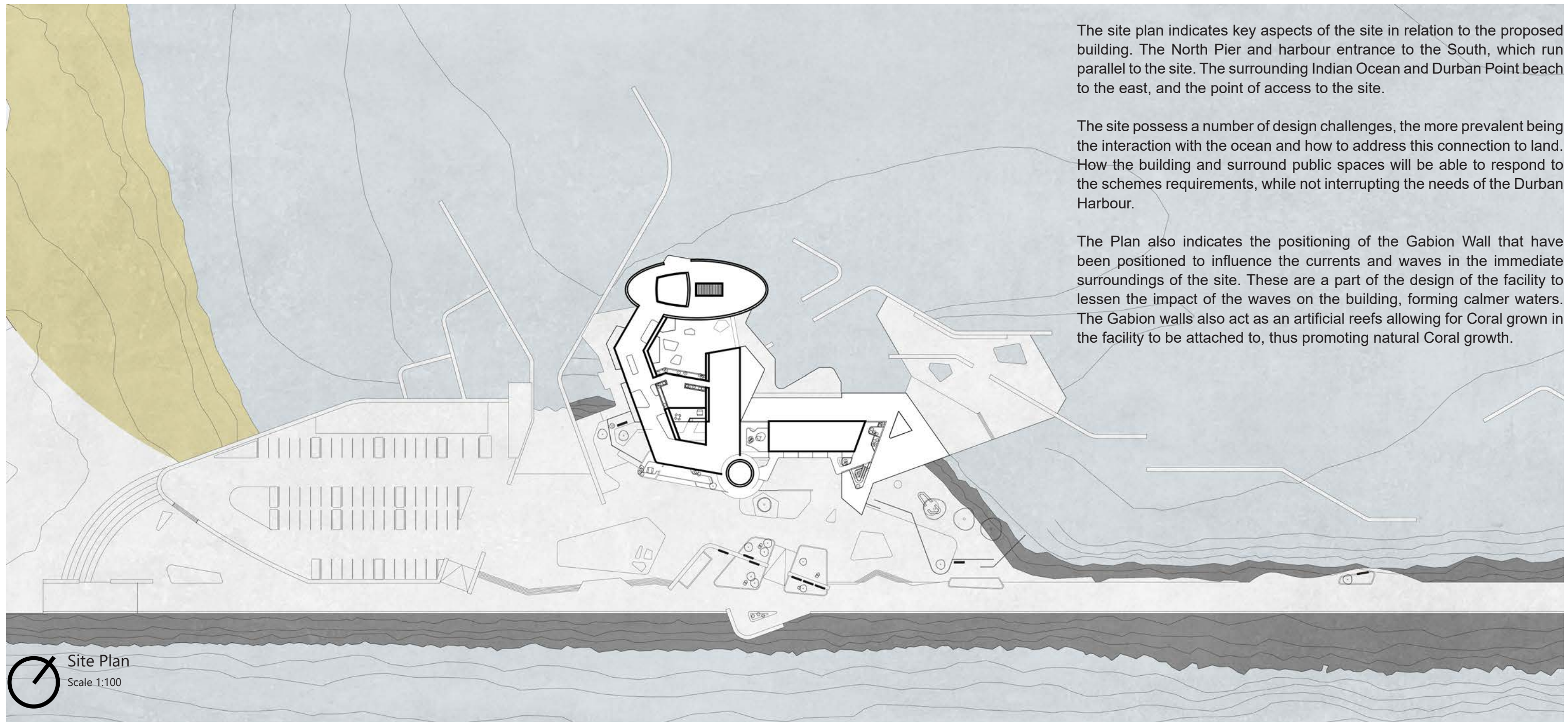


Perspective from the approach to site.



Perspective from the end of the Pier towards the site.





The site plan indicates key aspects of the site in relation to the proposed building. The North Pier and harbour entrance to the South, which run parallel to the site. The surrounding Indian Ocean and Durban Point beach to the east, and the point of access to the site.

The site possess a number of design challenges, the more prevalent being the interaction with the ocean and how to address this connection to land. How the building and surround public spaces will be able to respond to the schemes requirements, while not interrupting the needs of the Durban Harbour.

The Plan also indicates the positioning of the Gabion Wall that have been positioned to influence the currents and waves in the immediate surroundings of the site. These are a part of the design of the facility to lessen the impact of the waves on the building, forming calmer waters. The Gabion walls also act as an artificial reefs allowing for Coral grown in the facility to be attached to, thus promoting natural Coral growth.

The ground floor is geared to the public, with plenty of outdoor courtyards and verandas. the space is intended to feel open allowing the sights and sounds of the Durban Point into the space. The intent of the plan is to create unique experiences while moving through the plan.

The plan is organic in its layout with resemblance to a coral section. The plan aligns with two major axes. Perpendicular to the pier, from the 'lighthouse' and entrance through to the experiential space. And parallel to the pier, from the courtyard through to the restaurant area. Educational movement and social movement respectively. These spaces are arranged to create 'phases' throughout the journey of the scheme, and incorporating strong thresholds between the spaces, a clear beginning and end to the spaces. The courtyards and viewing decks are incorporated to encourage the user into these space to experience the natural environment of Durban Point.

Buiding Program

1. Reception
2. Lighthouse / Verticle Circulation
3. Courtyard
4. Events Space
5. Kitchen
6. Restaurant
7. Gathering Area
8. Exhibit One (Plastic + Artificial Reef)
9. Exhibit Two (Oil)
10. Auditorium (covered outdoor)
11. Exhibit Three (Coral Bleaching)
12. Exhibit Four (Coral Growth)
13. Aquarium
14. Experiential Space
15. Viewing Deck
16. Tidal Pools
17. Slipway
18. Storage
19. Parking
20. Water Station
21. North Pier

Four Exhibits

The exhibitions spaces are broken up into four individual spaces, each specific to the nature of the exhibit. They are divided to form views out, connecting the user to the space, and to allow for the information to be processed in the gathering space before moving into the next exhibit.



Ground Floor Plan

+0000

Scale 1:500

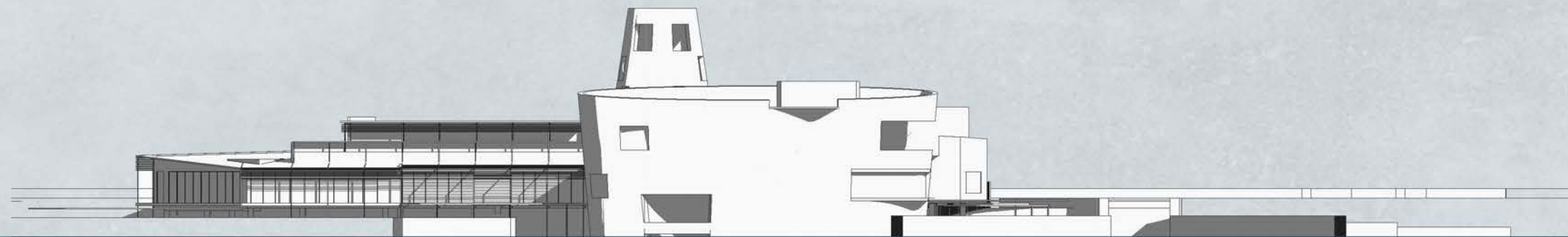
19

20

21

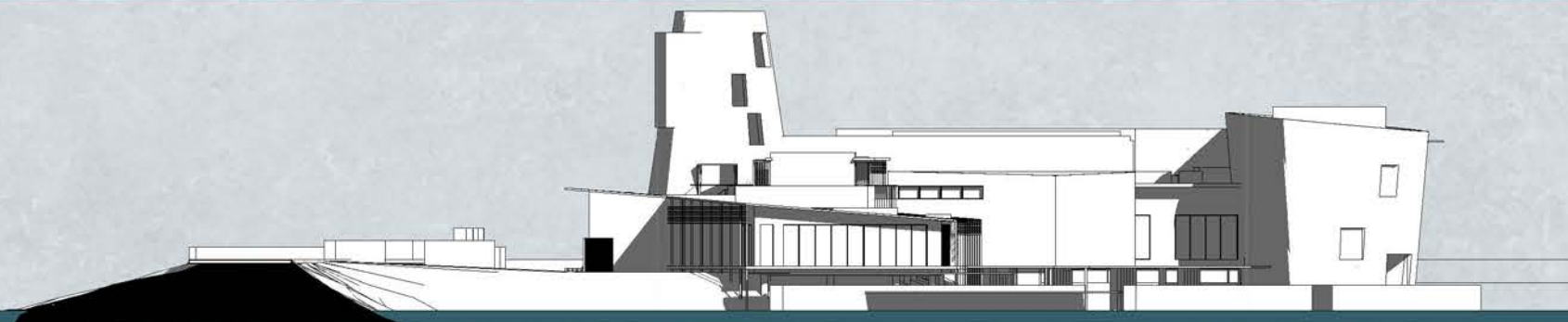
North Elevation

Scale 1:500



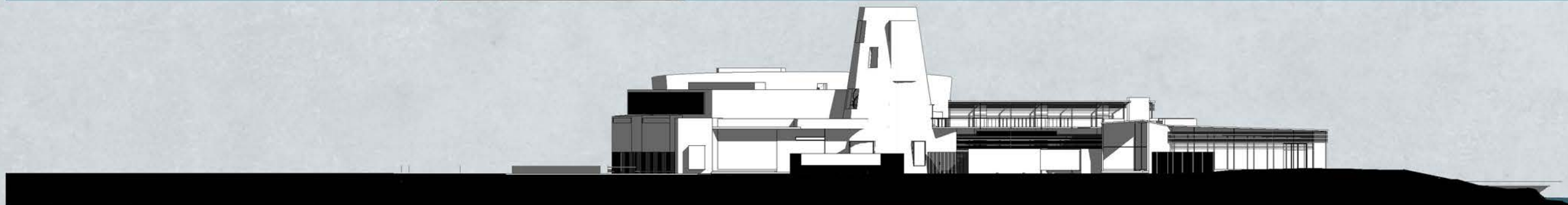
East Elevation

Scale 1:500



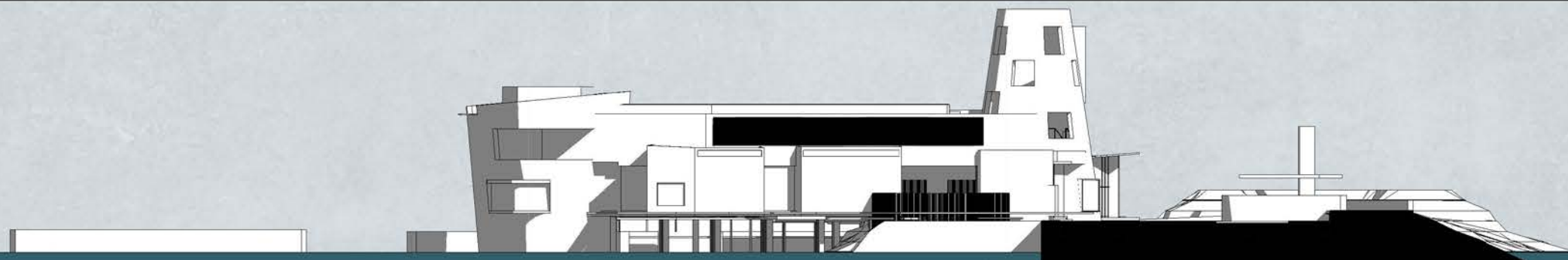
South Elevation

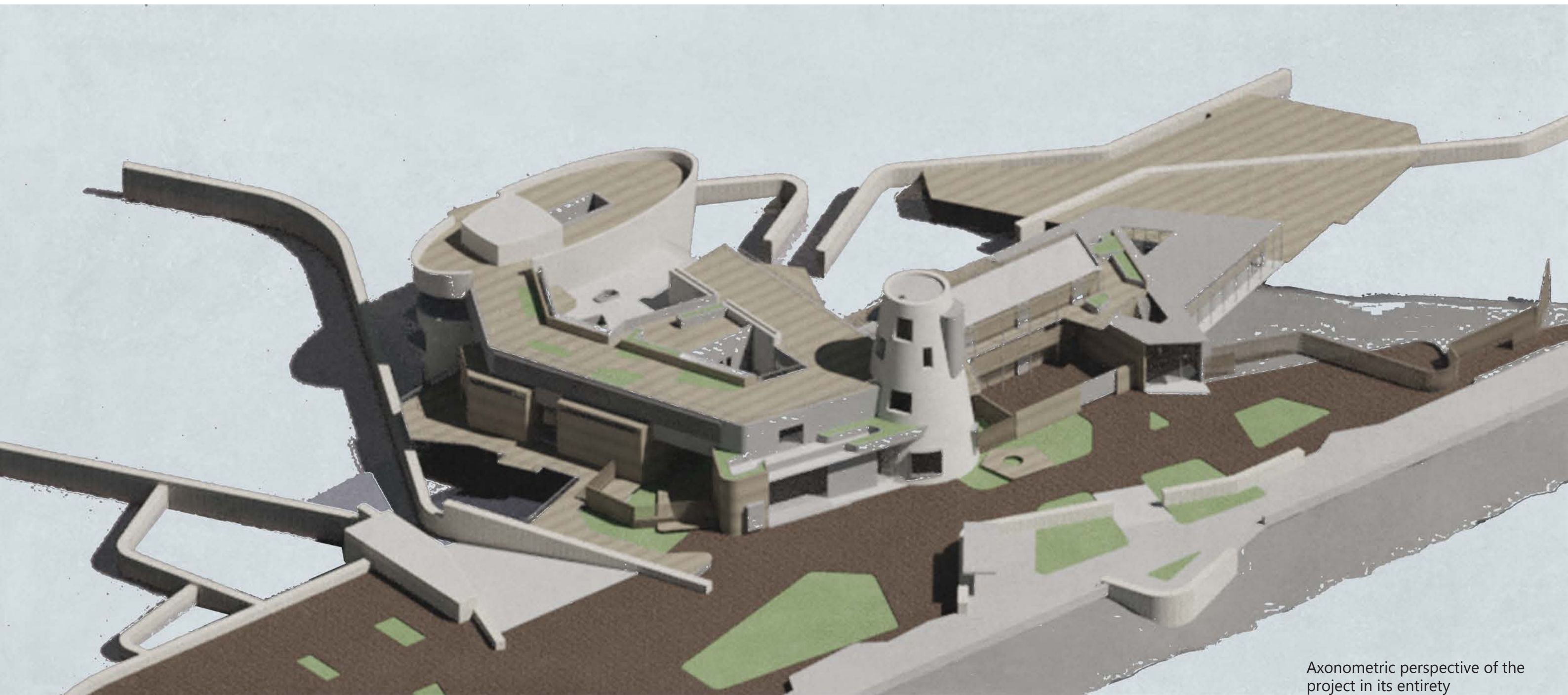
Scale 1:500



West Elevation

Scale 1:500

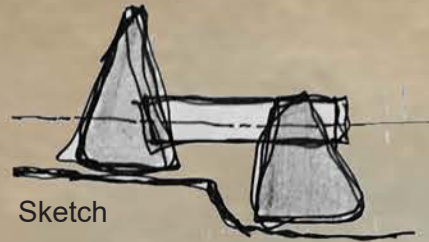




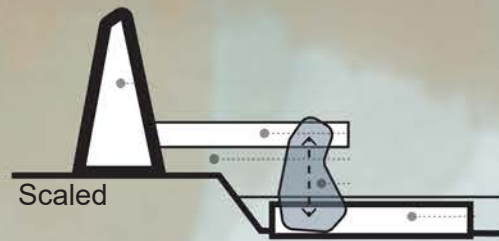
Axonometric perspective of the project in its entirety

Lighthouse

The section illustrates the two strong vertical elements of the building. These two concrete structures work together as the vertical circulation of the building, and conceptually as transitional phases. The 'lighthouse' from land to air, and from land to sea through the experiential space. These two elements are connected by the more organic and moulded spaces such as the museums and the gathering space.



Sketch



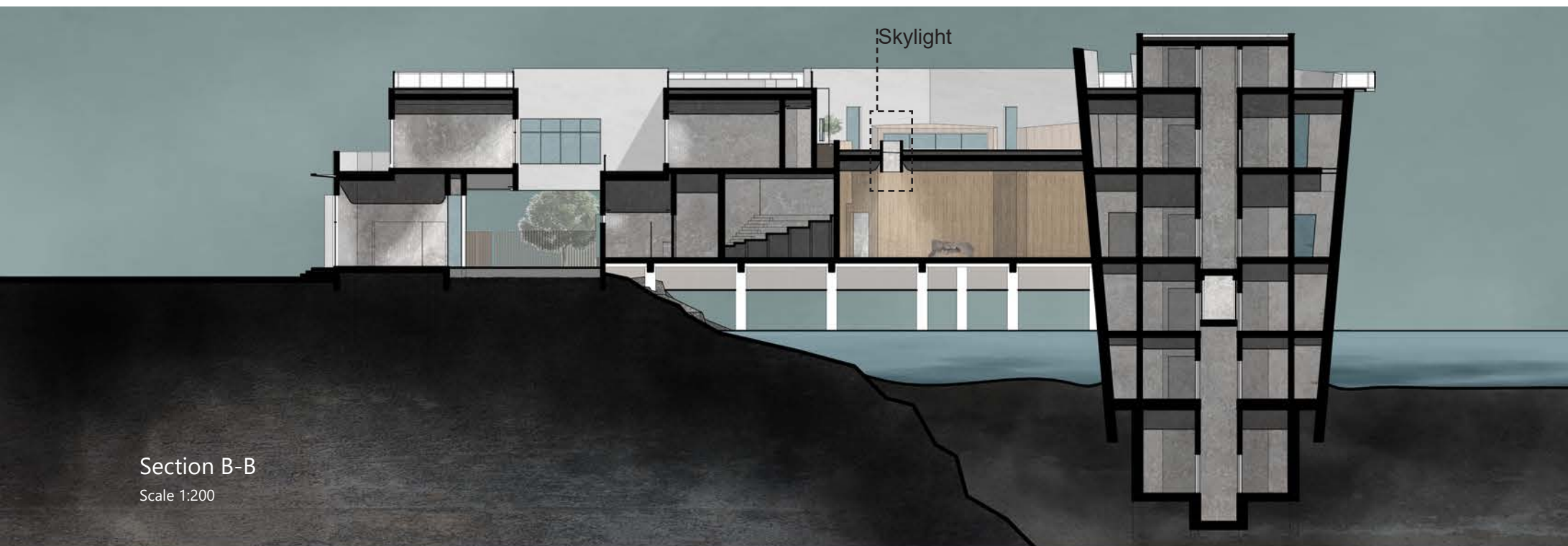
Scaled

Museum

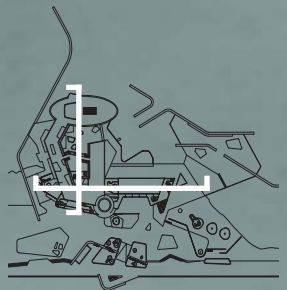
Experience

Section A-A

Scale 1:200



Section B-B
Scale 1:200



The two sections relay the positioning of the courtyard spaces and roof gardens with in the other programs. The intent through both sections was to produce outdoor spaces that can be utilized, while allowing light and air into the building.

(B-B) is a section from the reception to experiential space through the large courtyard on the first floor. Also illustrating the relation between the ground and first floor, through voids and outdoor spaces. A connection between the formal working spaces of the library and testing facilities to the informal spaces such as the reception and gathering space before entering the experiential space.



Section C-C
Scale 1:200

(C-C) is a section highlighting the relation between the large outdoor courtyard on the ground floor and the events space, including the use of smaller green spaces throughout the building. Such as the restaurant and accommodation green areas.

The events space is deep and incorporates the use of a light well, this doubles up as the balustrade for the accommodation and open air courtyard above. Timber slats are used along the length of the North façade to dull the impact and reflection of the sun from the North. Similar shading techniques have been used on many of the surrounding apartment buildings. The events space opens onto a viewing deck that extends over the ocean, additionally minimizing the effects of the reflection off the sea.



Section D-D

Scale 1:200

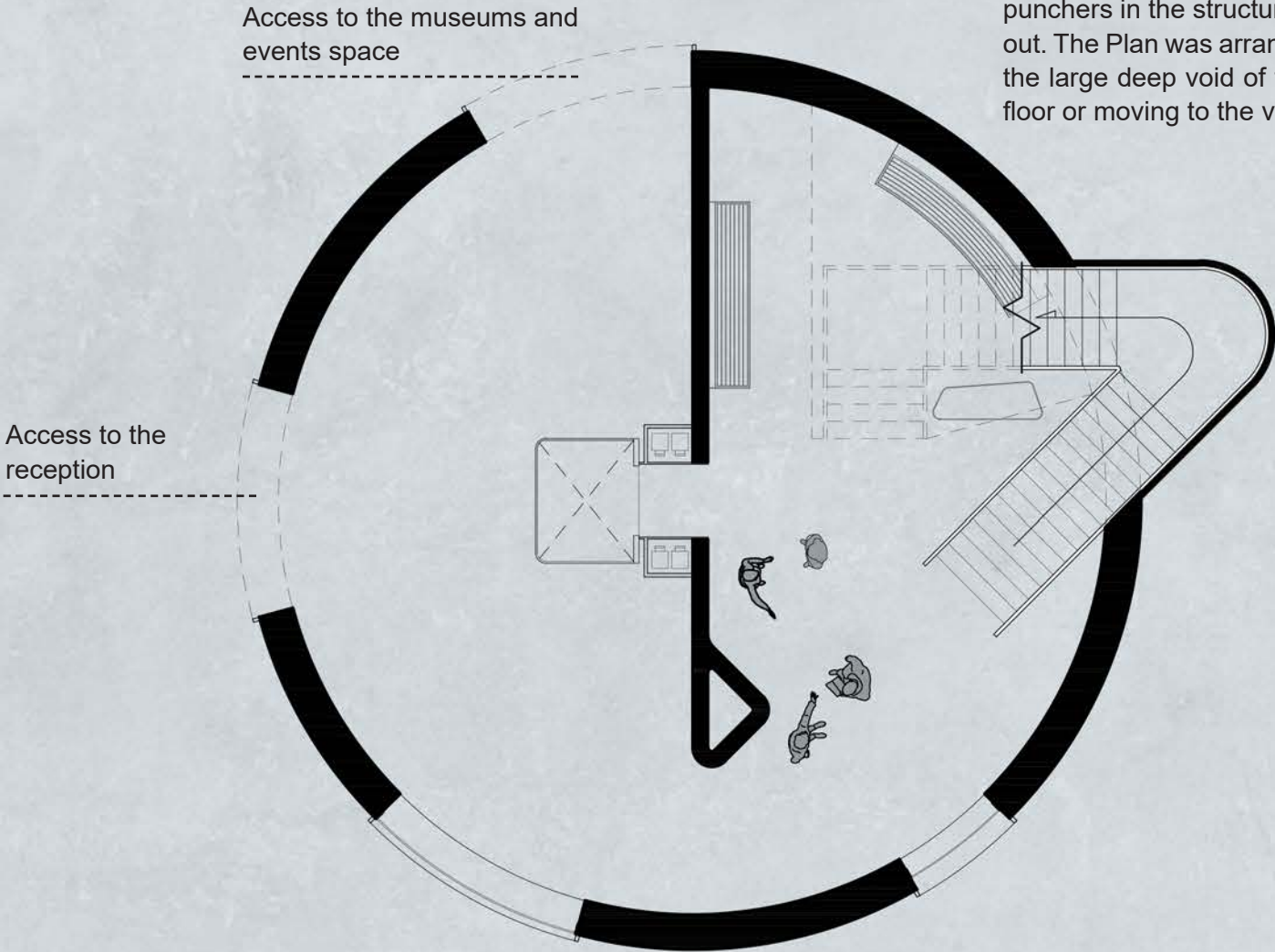


Perspective of entrance and
'Lighthouse'

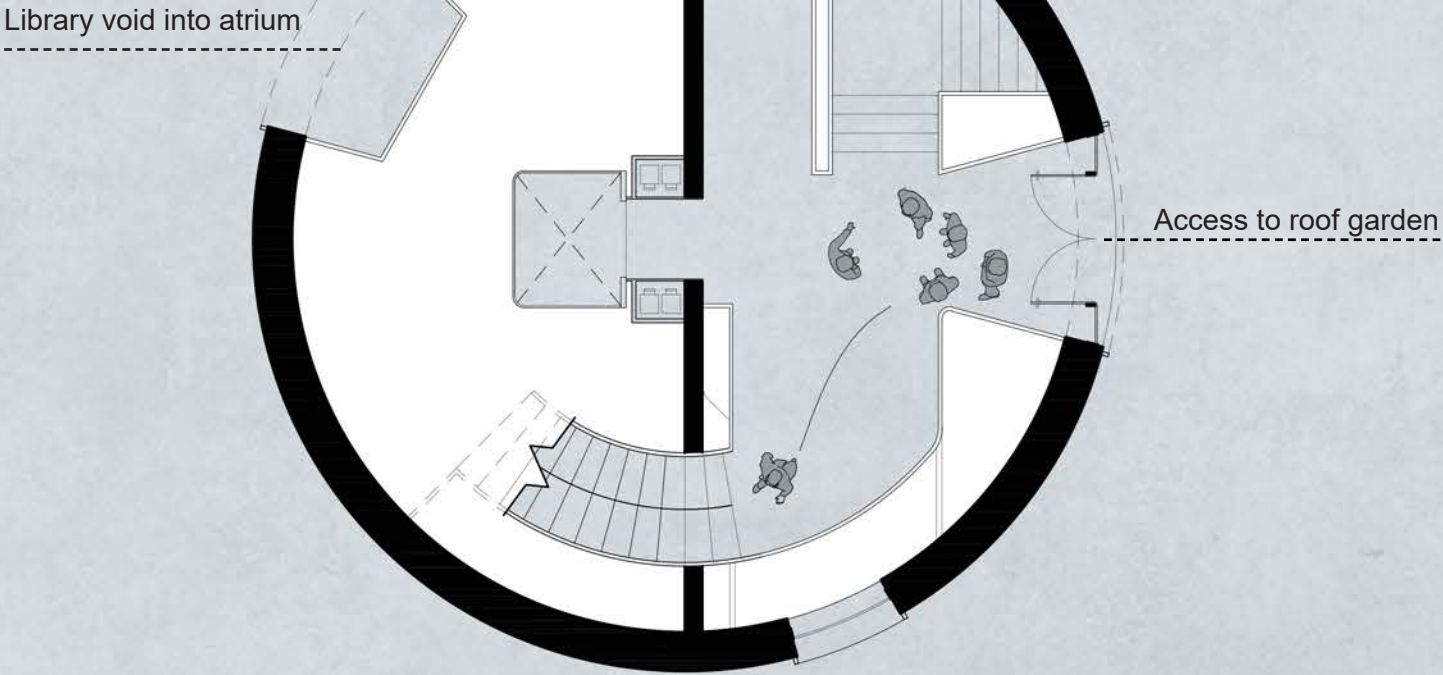
THE LIGHTHOUSE

The structure of the 'lighthouse' is a reiteration of the skeleton of the coral in the form of a concrete shell. The walls are exaggerated in thickness to strengthen the weight of the thresholds experienced, done through large punchers in the structure, to either create walkthroughs or framing a view out. The Plan was arrange that the user would be required to walk through the large deep void of the 'lighthouse' atrium before entering the ground floor or moving to the vertical circulation.

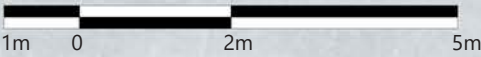
Small limestone stones were used in the concrete as part of the aggregate, with the intention of the exposed limestone on the exterior face to weather away over time. Creating small 'pockets' in the façade giving the concrete a rough finish, thus decorated in shadows and grains of beach sand giving the appearance of a living structure.



Ground Floor Plan
0000
Scale 1:100



First Floor Plan
+5440
Scale 1:100



The Third and Fourth floors of the 'lighthouse' programme are primarily to allow for elevated views, leading to the arrival point of the viewing platform on the fourth floor. The platform extends out of the concrete shell structure towards the Durban city allowing for panoramic views of the city, ocean, harbour, and beaches.

Access to the roof garden
and viewing platforms

Viewing station

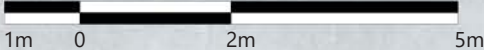
Viewing platform

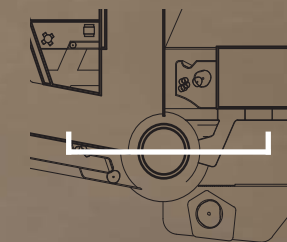
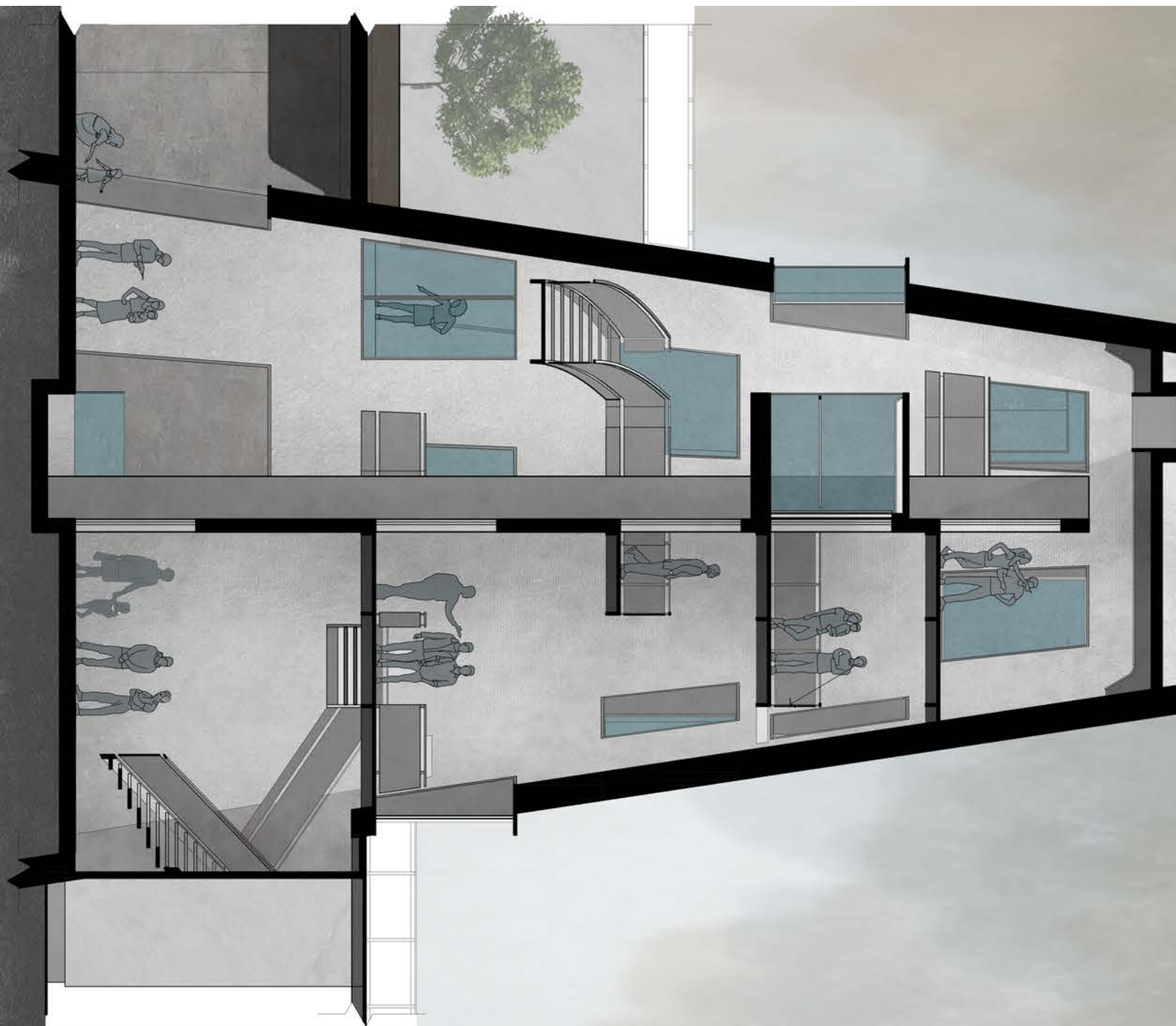


Second Floor Plan
+9520
Scale 1:100

Third Floor Plan
+12580
Scale 1:100

Fourth Floor Plan
+15640
Scale 1:100





The movement and spread of the oil in water, from the design charrette experiment, was later transformed into the concept of public circulation. This was then applied as a design aspect for the fluidity of movement through the 'lighthouse'. Specifically the vertical circulation and public interaction with the space. Pushing the idea of a fluidity of movement through the space to arrive at the viewing platform on the fifth floor (+15 640). Touching on the phenomenological idea of placing a number of thresholds throughout the travel. The combination of the travel and the voided structure together to create a unique and memorable experience of the building for which the public can interact.

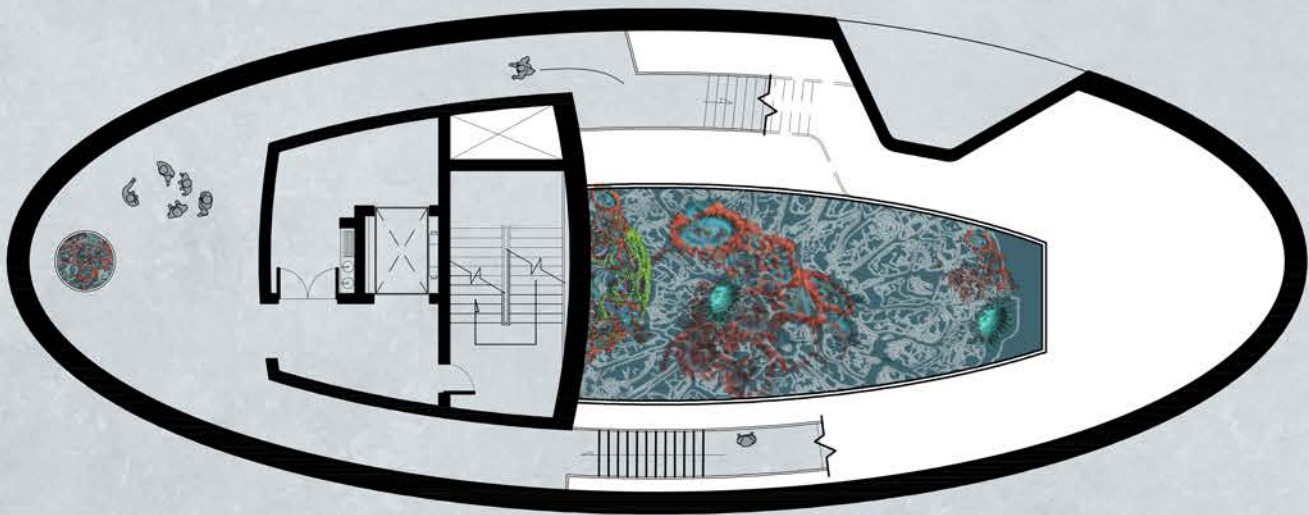
Section E-E

Scale 1:100

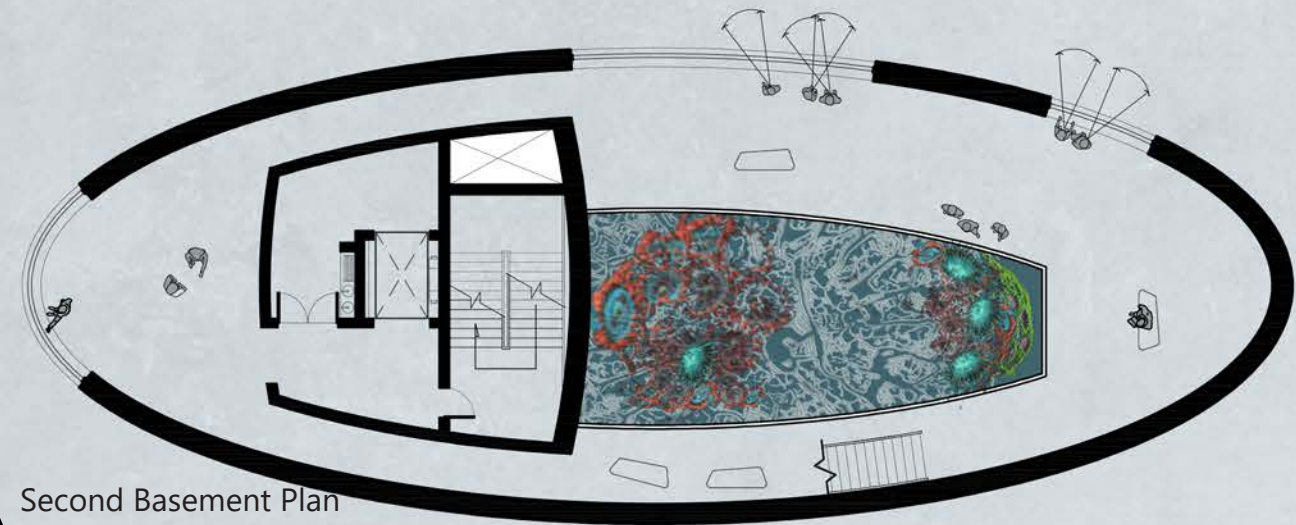


Perspective of the 'Experiential Space' from the sea.

THE EXPERIENTIAL SPACE

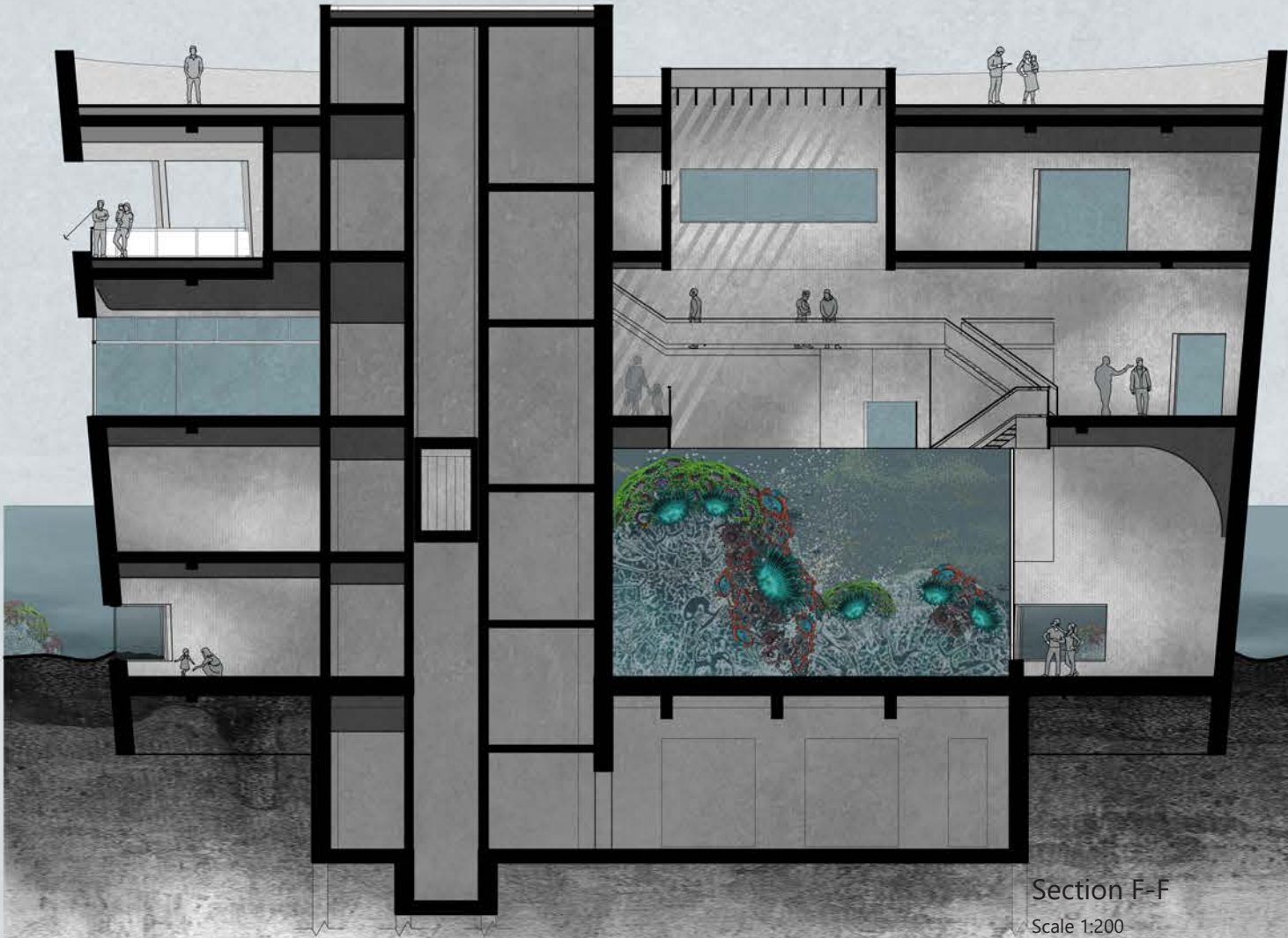
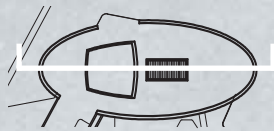


First Basement Plan
-3570
Scale 1:200

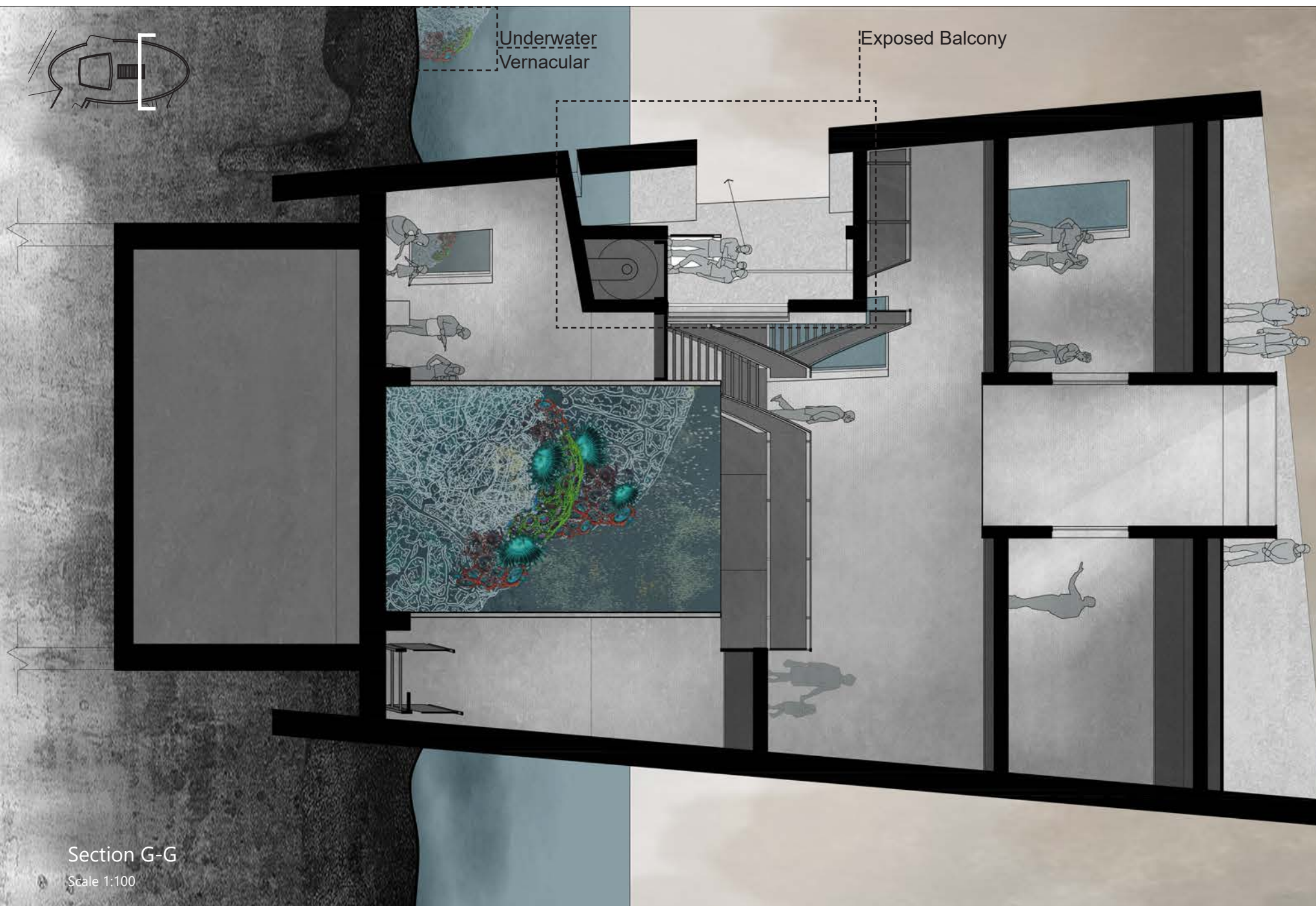


Second Basement Plan
-7310
Scale 1:200

The plans and section illustrate the relation of the circulation through the, expansive voided area that is the 'Experiential space', to the large central aquarium. This circulation was designed as a journey, taking the user through the different levels to arrive at views out below the ocean level. Finishing the user's transition from land to sea.



Section F-F
Scale 1:200



The 'Experiential Space' builds on 5 different experiences throughout the 4 floor levels, as mentioned the rationale was to create a journey of travel that links all floors through the connection of the voided space. The large aquarium is the focal point, as all entries to the space start with a view of/ movement along it. The core to this structure provides immediate vertical circulation and service ducts. The overall path of travel in the space is split with movement up and down as the intended arrival point is on the Ground Floor.

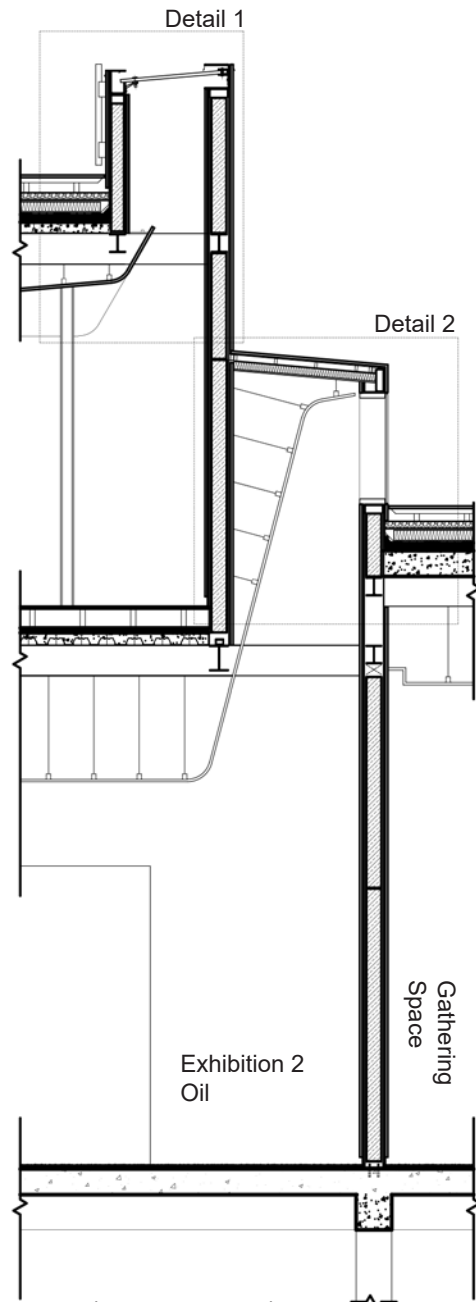
The roof top viewing platform is completely open with full views of the surrounding. The First Floor provides an open plan lecture room for the academics and students, with can be rearranged to create a space to display work or research, with an open balcony to the East. The Ground Floor provides gathering spaces and views out and an aerial view of the aquarium.

The intent of the small balcony was to create an area that the user would be able to experience the ocean at sea level, enforcing the theme of thresholds and heightening the user's senses. The building's façade opens to expose an open air balcony, a strip of the concrete façade remains to protect the area from large swells. The balcony allows for unrestricted views out towards the reef and greater Durban area, creating a place to reflect and experience coastline. In extreme conditions the balcony can be sealed off to the elements via the retractable barrier that is housed below the balcony.

From the balcony the passageway leads to First Basement Floor which opens to a smaller gathering space with information stands and smaller aquariums. With no view out the intention is to create a stage of limbo, an impression that the user is still above the water line, before moving to the last floor which is fully submerged below the ocean. The Second Basement Floor is the final arrival point with views out to the sea bed and wildlife in the proximity. The understanding around this arrival point was to see the ocean and its 'Underwater Vernacular' the of the artificial Coral reefs and to study first-hand the difference between coral that is surviving in the natural ocean conditions, to the coral that is grown in the controlled environment of the aquarium which is based on this floor level.



Internal perspective of the connection between, events space, courtyard, and gathering space.



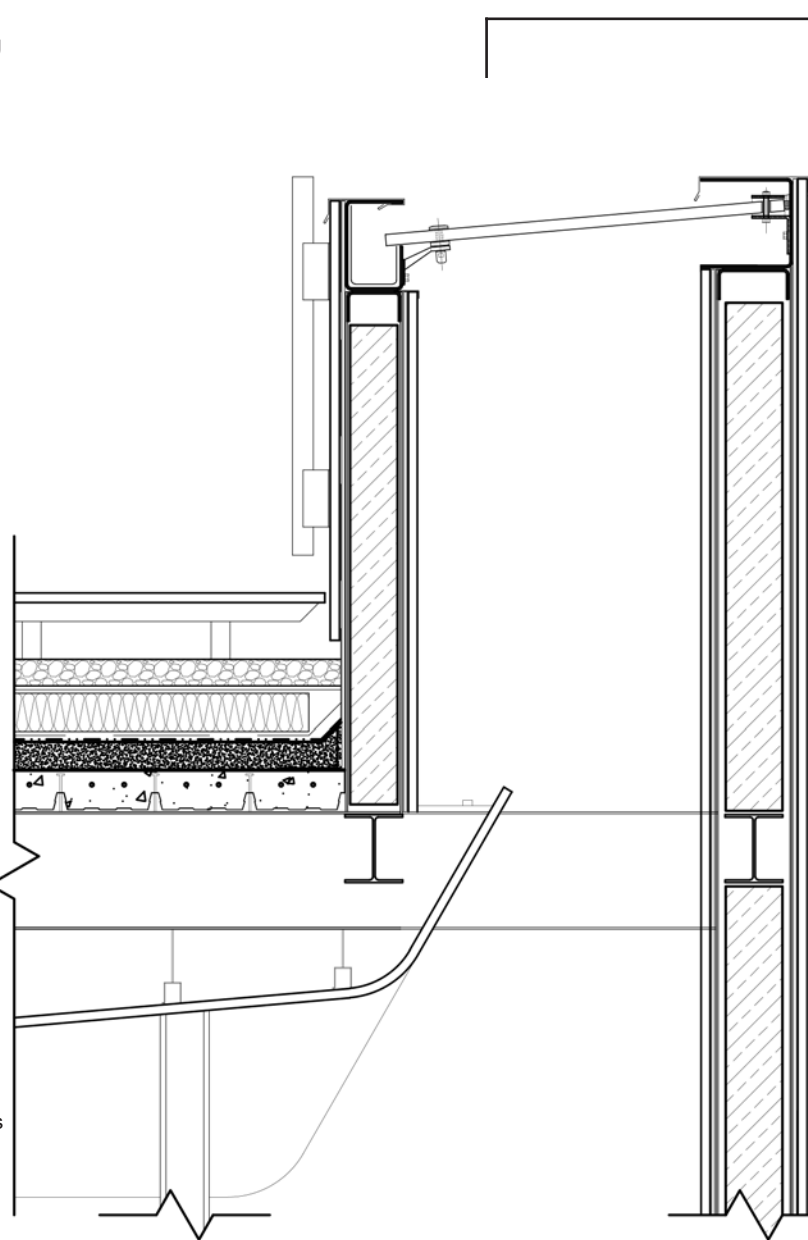
Section H-H (Perimeter)

Scale to fit page (1:75)

As the design of the exhibition spaces and the first floor being organic in shape and form, a steel framed system was incorporated as the structure of the spaces as it is best suited for its construction. The steel frame work would be quickly and easily erected on the reinforced concrete cast in-situ floor slab of the ground floor.

As mentioned the structure is a steel framed system, that is then insulated, waterproofed and cladded. The cladding of ground floor and first floor vary in material, to illustrate the different purposes of the spaces. The first floor walls are covered in a galvanized iron cladding that is powder coated light grey, while the ground floor is cladded in timber. These two materials expand at different rates so where that meet there needs to be a provision for a soft joint.

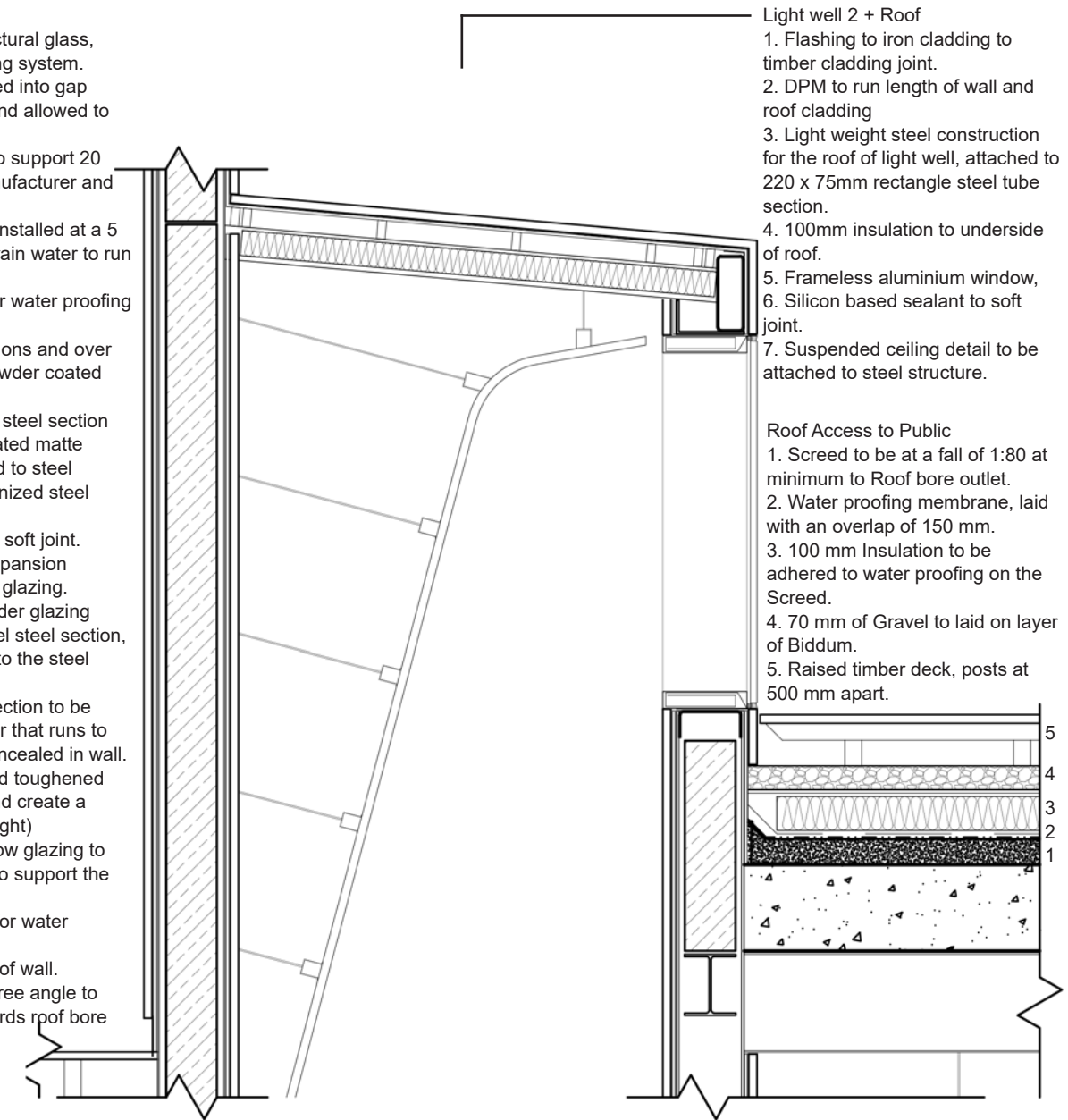
The first floor and second floor roof are 255mm reinforced cast in-situ concrete floor slabs with permanent aluminium formwork, which is attached to the 300 x 150 mm steel beams, to decrease weight.



Lightwell Detail 1

Scale to fit page (1:20)

- Light Well 1
1. 20 mm Toughened structural glass, supported by Spider glazing system.
 2. Clear silicon to be poured into gap between glass elements and allowed to set and harden.
 3. Spider glazing system to support 20 mm toughened glass, manufacturer and spec to be confirmed.
 4. Toughened glass to be installed at a 5 Degree angle to allow for rain water to run away from Steel Section.
 5. Silicon based sealant for water proofing to soft joint.
 6. Flashing to steel C-sections and over cladding, flashing to be powder coated black in a matt.
 7. Parallel Flange channel steel section galvanized and powdercoated matte black, section to be welded to steel structure of the wall, galvanized steel power coated black.
 8. Silicon based sealant to soft joint.
 9. Soft Joint to allow for expansion between steel section and glazing.
 10. M 10 bolt attaches Spider glazing system and Flange channel steel section, steel section then welded to the steel structure of the wall.
 11. Flange channel steel section to be inlaid with aluminium gutter that runs to down water pipe that is concealed in wall.
 12. Industrial rubber to hold toughened glass at 5 degree angle and create a water proof connection.(Right)
 13. 6 mm steel plate to allow glazing to be bolted to L-angle, and to support the toughened glazing.(Right)
 14. Silicon based sealant for water proofing to soft joint.
 15. DPM to run the length of wall.
 16. Screed pour to 45 degree angle to allow for water to run towards roof bore outlet.



Lightwell Detail 2

Scale to fit page (1:20)

- Light well 2 + Roof
1. Flashing to iron cladding to timber cladding joint.
 2. DPM to run length of wall and roof cladding
 3. Light weight steel construction for the roof of light well, attached to 220 x 75mm rectangle steel tube section.
 4. 100mm insulation to underside of roof.
 5. Frameless aluminium window,
 6. Silicon based sealant to soft joint.
 7. Suspended ceiling detail to be attached to steel structure.

- Roof Access to Public
1. Screed to be at a fall of 1:80 at minimum to Roof bore outlet.
 2. Water proofing membrane, laid with an overlap of 150 mm.
 3. 100 mm Insulation to be adhered to water proofing on the Screed.
 4. 70 mm of Gravel to laid on layer of Biddum.
 5. Raised timber deck, posts at 500 mm apart.



Perspective along the North facade of the restaurant

Perspective of building from the slipway.

Perspective of restaurant and 'lighthouse' from north pier access road.

Perspective from the lighthouse viewing deck.





Perspective of the scheme in its entirety from the sea.

BIBLIOGRAPHY

CHAPTER EIGHT

Pretorius, L., Green, A.N. & Andrew Cooper, J. Geo-Mar Lett (2018) 38: 19. <https://doi.org/10.1007/s00367-017-0503-9>

go, P., do, T., Guides, T., Go, P., Metro, D. and Pier, N. (2019). North Pier. [online] Zulu.org.za. Available at: <https://www.zulu.org.za/places-to-go/durban-metro/north-pier-P47814> [Accessed 16 Sep. 2019].

Fad.co.za. (2019). Facts About Durban - A last visit to North Pier. [online] Available at: <https://www.fad.co.za/Resources/npier/lastvist.htm> [Accessed 16 Sep. 2019].

Portagent.co.za. (2019). FAQs- PAS Durban. [online] Available at: <http://www.portagent.co.za/services/faq.php> [Accessed 16 Sep. 2019].

Kzntransport.gov.za. (2019). Port of Durban. [online] Available at: http://www.kzntransport.gov.za/public_trans/freight_databank/kzn/ports/Durban/index_xml.html [Accessed 16 Sep. 2019].

Portagent.co.za. (2019). FAQs- PAS Durban. [online] Available at: <http://www.portagent.co.za/services/faq.php> [Accessed 16 Sep. 2019].

Anon, (2019). [online] Available at: <https://www.transnetportterminals.net/pages/default.aspx> [Accessed 16 Sep. 2019].

Coral and Architecture

Heemsoth, A. (2014) 'Reef Zoning'. Khaled bin Sultan Living Oceans Foundation. Unit 11. pg 3

James, L. (2018) 'Half of the Great Barrier Reef Is Dead'. August

Bergdoll, B. (2011). Rising currents. New York: Museum of Modern Art.

Oceanservice.noaa.gov. (2019). Where Are Reef Building Corals Found - Corals: NOAA's National Ocean Service Education. [Online] Available at: https://oceanservice.noaa.gov/education/tutorial_corals/coral05_distribution.html [Accessed Sep. 2019].

Slate Magazine. (2019). Slate's Use of Your Data. [Online] Available at: <https://slate.com/technology/2016/05/heres-how-the-great-barrier-reef-could-still-recover.html> [Accessed Sep. 2019].

Coral.org. (2019). How Corals Reproduce | Coral Reef Alliance. [Online] Available at: <https://coral.org/coral-reefs-101/coral-reef-ecology/how-corals-reproduce/> [Accessed Sep. 2019].

Coral.org. (2019). CORAL POLYPS | Coral Reef Alliance. [Online] Available at: <https://coral.org/coral-reefs-101/coral-reef-ecology/coral-polyps/> [Accessed Aug 2019].

Horton, J. (2019). How Coral Reefs Work. [Online] HowStuffWorks. Available at: <https://animals.howstuffworks.com/marine-life/coral-reef.htm> [Accessed Sep. 2019].

Ocean, (2019) Zooxanthellae and coral bleaching, [Online] Available at: <https://ocean.si.edu/ocean-life/invertebrates/zooxanthellae-and-coral-bleaching> [Accessed Aug 2019]

Slate, (2019) Heres how the great barrier reef could still recover, [Online] Available at: <https://slate.com/technology/2016/05/heres-how-the-great-barrier-reef-could-still-recover.html> [Accessed Aug 2019]

Emily, M. (2019) emilymeng [Online] Available at: www.emilymeng.com [Accessed Aug 2019]

Straitstimes, (2019) Japans biggest coral reef healthy survey, [Online] Available at: <https://www.straitstimes.com/asia/east-asia/only-1-pct-of-japans-biggest-coral-reef-healthy-survey> [Accessed Aug 2019]

NSU. (2019). National Coral Reef Institute (NCRI) at NSU Halmos College of Natural Sciences and Oceanography. [Online] Available at: <https://cnso.nova.edu/ncri/index.html> [Accessed Sep. 2019].

Oceanservice.noaa.gov. (2019). What is Coral Spawning?. [Online] Available at: <https://oceanservice.noaa.gov/facts/coral-spawning.html> [Accessed Aug. 2019].

National oceanic and Atmosperic Administration (NOAA). (2019) CoRIS: Coral Reef Information System. [Online] Available at: <https://www.coris.noaa.gov/> [Accessed Aug 2019]

Living Oceans Foundation. (2019). Home - Living Oceans Foundation. [Online] Available at: <https://www.livingoceansfoundation.org/> [Accessed Sep. 2019].

Wilson, A (2018) Microfragmentation: a breakthrough for coral reef restoration. [Online] Available at: <https://medium.com/@amykwilson/microfragmentation-a-breakthrough-for-coral-reef-restoration-6a2e862c4e2> [Accessed Aug 2019]

Oceanservice.noaa.gov. (2019). Coral bleach? . [Online] Available at: https://oceanservice.noaa.gov/facts/coral_bleach.html [Accessed Sep 2019]

Oceanservice.noaa.gov. (2019). NOAA National Ocean Service Education: Corals. [Online] Available at: https://oceanservice.noaa.gov/education/kits/corals/coral09_humanthreats.html [Accessed Sep. 2019].

SAAMBR. (2019). Research - SAAMBR. [Online] Available at: <https://www.saambr.org.za/research/> [Accessed Sep. 2019].

The Nature Conservatory. (2018) [Online] Available at: <https://www.nature.org/joinanddonate/rescuereef/explore/facts.html> [Accessed Aug 2019]

NOAA, (2019) Corals economy, [Online] available at: <https://floridakeys.noaa.gov/corals/economy.html> [Accessed May 2019]

Osche, R. (2019) Coral under UV light [Online] Available at: <http://ramonaosche.com/> [Accessed May 2019]

For the reef. (2019) How do corals reproduce?. [Online] Available at: <https://forthereef.com/blogs/news/coral-reproduction> [Accessed Sep 2019]

SAIIA. (2019). East Africa: Marine-based 'blue economies' offer massive potential | SAIIA. [online] Available at: <https://saiaa.org.za/research/east-africa-marine-based-blue-economies-offer-massive-potential/> [Accessed 15 Sep. 2019].

Burie, S. (2019) My Life Aquatic [Online] Available at: <https://www.lensculture.com/articles/silvie-de-burie-my-life-aquatic> [Accessed Aug 2019]

Phenomenology

Norberg-Schulz, C. (1996). Genius loci. New York: Rizzoli.

Leitner, B. (1974). Sound architecture. The Journal of the Acoustical Society of America, 55(S1), pp.S28-S28.

ArchDaily. (2019). Bernhard Leitner: Sound Spaces. [online] Available at: <https://www.archdaily.com/168979/bernhard-leitner-sound-spaces> [Accessed 16 Sep. 2019].

Precedence

ArchDaily. (2019). Centre for Noonygar Culture and Environmental Design / iredale pedersen hook architects. [online] Available at: https://www.archdaily.com/920273/centre-for-noonygar-culture-and-environmental-design-iredale-pedersen-hook-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user [Accessed Sep. 2019].

ArchDaily. (2019). Foro Boca / Rojkind Arquitectos. [online] Available at: https://www.archdaily.com/884635/foro-boca-rojkind-arquitectos/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user [Accessed Sep. 2019].

ArchDaily. (2019). Dorte Mandrup to Design Her Third UNESCO World Heritage Wadden Sea Project. [online] Available at: https://www.archdaily.com/892464/dorte-mandrup-to-design-her-third-unesco-world-heritage-wadden-sea-project/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user [Accessed Sep. 2019].

ArchDaily. (2019). Under (Underwater Restaurant) / Snohetta. [online] Available at: https://www.archdaily.com/913575/under-snohetta/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user [Accessed Sep. 2019].