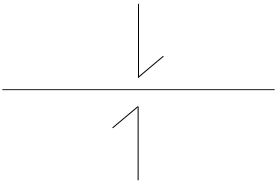
Land

Sea



Between Land and Sea

Dive Training Facility | Public Sea Bath

James W G Anderson

Master Thesis
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Supervisor | Joaquim Tarrasó
Examiner | Mikael Ekegren

CHALMERS

Tack så mycket

Firstly a big thank you to Dan Hedberg and Per Almbratt for helping to inspire this unique project and providing a wealth of knowledge and insight the Commercial Diving Industry that helped inform decisions throughout the design process.

Joaquim Tarrasó, my supervisor, for helping me to develop and focus ideas and for the sage advice and unwavering enthusiasm during each week.
Mikael Ekegren, my examiner, who's constructive criticism kept me on my toes and the project moving forward.
All my fellow master thesis peers for shared memories of the sleepless, bleary-eyed studio sessions to the skinny-dipping celebrations.

Finally my parents; Carey and Mark Anderson for their constant love and support

Abstract

Sweden has deep rooted links to the sea with its largest cities all located on the fringes between land and water. Its plentiful marinas and summerhouses further affirm an affinity with the ocean. A slightly more abstract element that is born of this dynamic is a healthy scuba-diving community.

Göteborg Commercial Diving School requires a new location to practice under optimal conditions. Svanesund on the island of Orust has direct infrastructural links with Göteborg with the fjords encompassing it boasting clear, deep and sheltered water. This is a prime location to establish a launch point for practical dive training whilst also inviting the public to become better acquainted with the aquatic. This project draws upon and echoes the areas history with the honesty of materiality and construction techniques. Consideration was given to flood adaptability with multiple typologies being utilised and an option to simply raise the horizontal supports of the sea bath if water levels exceed predictions.

Introduction

A Commercial Dive School

Göteborg Commercial Diving School is currently located in Lindholmen. It provides the basis for the theoretical arm of the school but due to logistical and environmental conditions practical training in the vicinity is unsuitable.

In the 1980's there was a push to build a school in a old industrial area of Göteborg, the plan was to utilise abandoned industrial vats and re-purpose them as large dive capsules. This would eventually fall through due to The Swedish Defence Ministry's intervention. A second even more ambitious project was set in motion to make Göteborg the home of Northern Europe's largest sea-faring education centre that would include dive facilitates. There was much hope at the beginning, but due to the vast scale and timeline of the project things eventually stagnated. Thus Göteborg Commercial Dive School finds itself in Lindholmen and must plan and travel long distances in order to engage in practical dive training.

Rescue Diver
This type of diver must gain experience working in close quarters with low visibility and at various depths

Scientific Diver
Qualified scientists first, divers second. Usually dive using self-contained underwater breathing apparatus (scuba) in fairly shallow water

Construction Diver
Surface supplied diving in-which 'diver's umbilical' is tethered to surface supplying air and communications

1975 Oil reserves in North Sea
big push for commercial dive school

1980 Plans set in motion for first dive school in Göteborg

1985 No oil for Sweden, plans dropped by Swedish Defence Ministry

1990

1995

2000 Ambitious project to build Northern Europe's largest sea faring education centre in Göteborg

2005 Second dive project cancelled, commercial dive school makes base in Lindholmen

2010

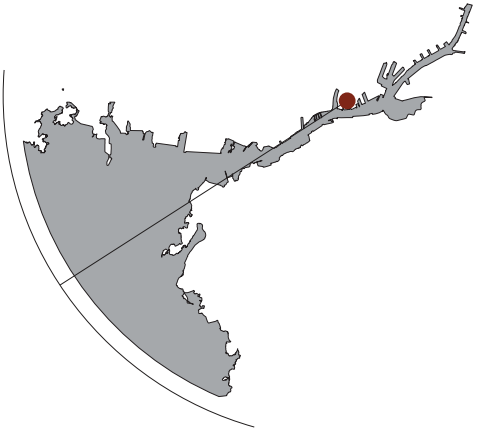
2015 School requires new practical training site located in close proximity to deep water

Place Finding

Göteborg | 20 min to 20 m depth

The Göta älv both divides and defines the city of Göteborg. However for divers there are some inherent problems that emulate from the river. As the waters flow through the city they bring with it sedimentation from inland that can causes visibility issues for divers. Equally throughout the river mouth there are large deposits meaning the water is to shallow to dive.

One of the most fundamental problems with diving is infrastructure and the amount of time to reach a suitable dive site and return. Given that in order to reach deeper water boats must navigate through traffic and the archipelago it becomes clear that Göteborg is an unsuitable location for a practical diving location.



Sedimentation

From Göta älv

Shallow

09m

Waters

Major

Harbour

1 H hydrogen

8 O oxygen

Brackish Water

Prone to Freeze

1 H hydrogen

A Place Within The Coastal Network

The west coast has been altered by the development of industries that took advantage of the maritime milieu, however in the wake of globalisation these are now in decline. Contrasting with the industrial exists another typology exemplified by the abundance of summerhouses, marinas and historic fishing villages.

In one form or another commercial diving is linked to all these typologies so it was important to appreciate the wider context in order to find a place within this rich tapestry. One key criteria was the site must be located within close proximity to Lindholmen base in Göteborg. Svanesund on the island of Orust has direct infrastructural links by rail and road as well as very deep water close to land.

Diver Types

Construction

The west coast is made up of a patchwork of industries commercial divers are often hired to carry out maintenance for industries in Uddevalla, Stenungsund and Göteborg harbour

Rescue

Sailing and other maritime recreation are very popular throughout the coast, when accidents occur rescue divers must react to emergency situations

Scientific

Our oceans and the fragile ecosystems they support are one of the best indicators of changes to our planet. With the ramifications of global climate change becoming increasingly apparent scientific divers are important. The fjords surrounding svanesund are protected nature reserves

Uddevalla
Uddevallabron
Havstensfjord Nature Reserve
Lysekil Recreational Dive Centre
Kalvöfjord Nature Reserve
Kristineberg Marine Research Centre
Henån Community Recreational Area
Orust Ö
Svanesund Ferry Point
Perstorps industri
Stigfjord Nature Reserve
Stenungsund
Tjörn Bridge
Concrete Dock Factory Wallhamn
Recreational Dive Centre, Kärevika
Infrastructural Link
SF Marina Systems

infrastucture
industrial
bathing
depth
shipwrecks
marinas
fjord nature reserves

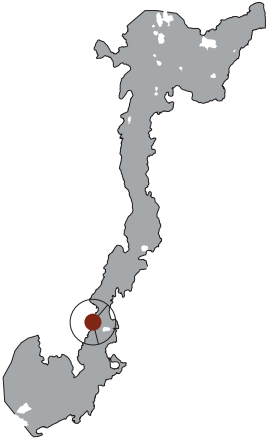
Proposed Practical Diving Location

Commercial Dive School Lindholmen, Göteborg

Skagerrak

Svanesund | 3 min to 20 m depth

Svanesund is one of only a handful of locations in Sweden that can offer the depth of water required for commercial dive training whilst at the same time lie close to land. The salt water that channels around this area mean it is less prone to freezing and the gentle current reduces the possibility of any sediment build up. The prime dive area lies between the Island of Orust and mainland, this offers shelter from storms and other coastal hazards. Surrounding Svanesund are marine nature reserves, this will be particularly useful to scientific divers who will be able to train in observing and studying marine life and co-ordinate studies with nearby Kristineberg Marine Research Centre.



Good Visibility

20m

Deep Water

Fjord Nature

Reserve

1 H hydrogen

8 O oxygen

1 H hydrogen

11 Na sodium

Salt Water

Less Prone

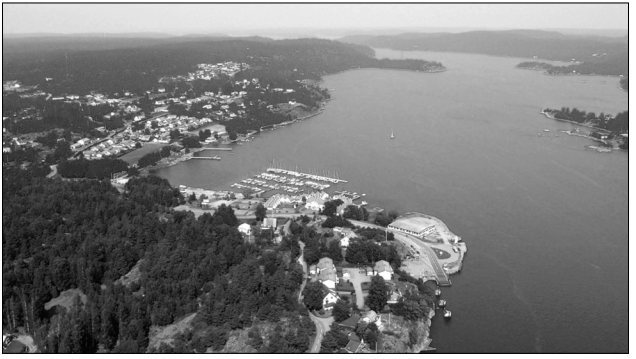
to Freezing

Site Conditions

Historical Context

The site is built on reclaimed headland that juts out towards the fjord, It was originally used as part of the automotive industry production line; wrapping new vehicles in film prior to being delivered. The industrial warehouse still remains however the facade has been damaged by fire. The previous owners used the concrete base to dock boats however as this was not its intended purpose the weight of tightly moored vessels at low tide caused the concrete to crack and fracture in places.

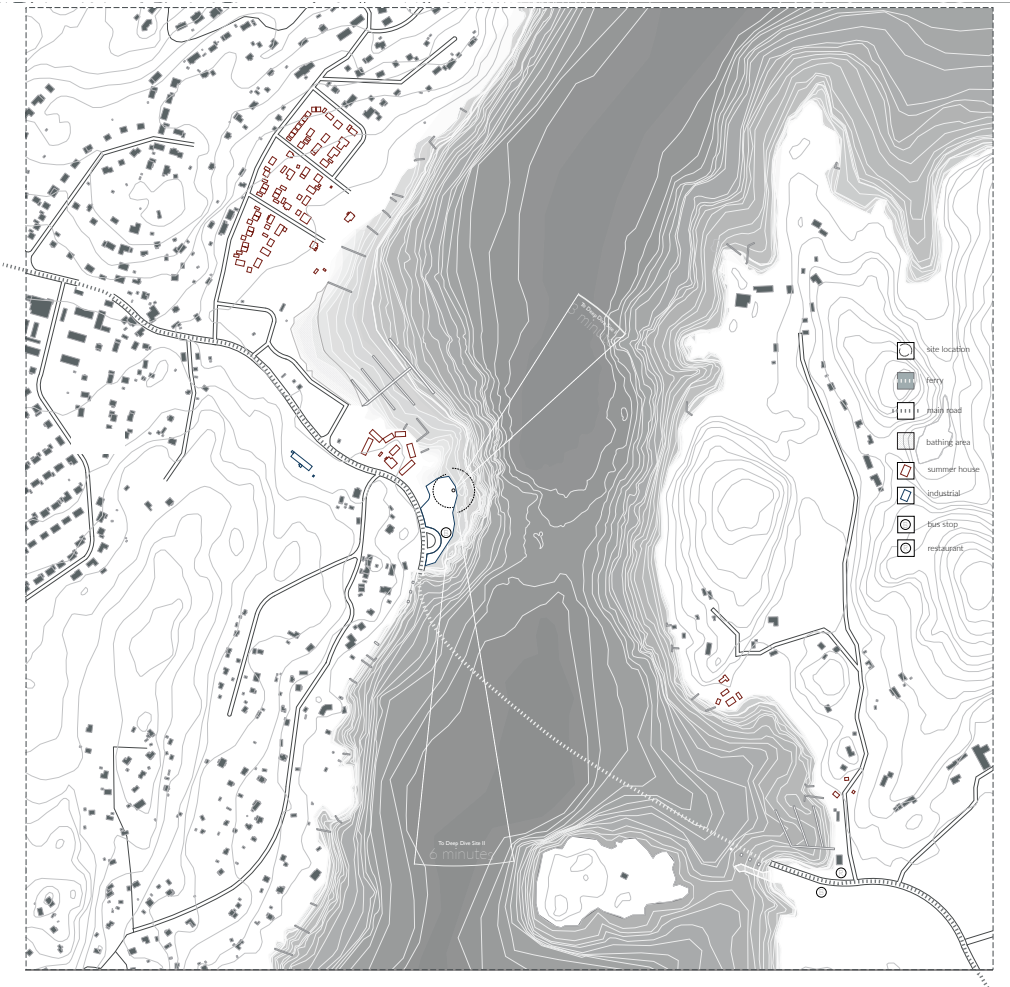
Svanesund is part of Orust Ö, it is one of the largest islands in Sweden and has long been associated with boat craftsmanship and is remains the home of a boat building school towards the north in Henån. Historically the islands location has also meant that fishing has been important source of food and income for the communities and although this is less the case today it remains a firm aspect of the culture with scattered small fishing houses, drying racks and mussel farms.



Site Analysis

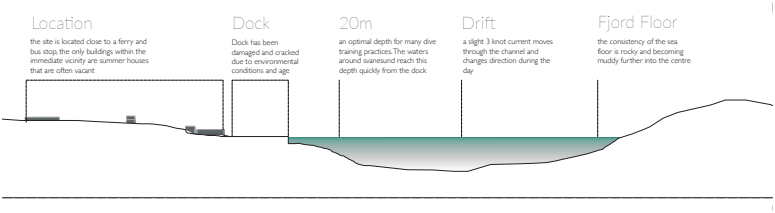
The site is a isolated industrial segment of Svanesund, cut off by road on one side and fjord on the other, however this road is one of the major routes of the island with a lot of people passing through. On either side of the ferry docks are bus stops and a new restaurant on the mainland side. The sparsely laid out surrounding buildings are mainly summerhouses such as the ones close to the site that are usually empty during the off season.

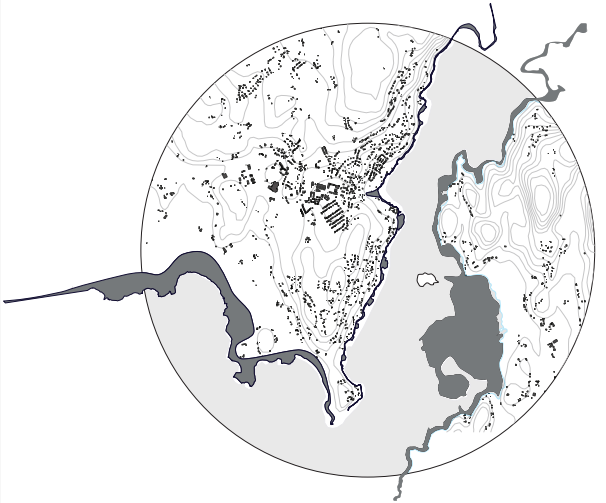
By using sonar equipment attached to a boat the underwater topography close to the site has been accurately mapped. Thus it is possible to see define different conditions from the relatively shallow water around the perimeter of the site to the considerable drop of an underwater ledge further into the strait.

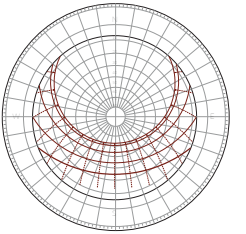

site location
ferry
main road
bathing area
summer house
industrial
bus stop
restaurant
To Deep Dive Site II
5 minutes

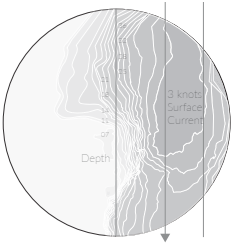
Environmental Conditions

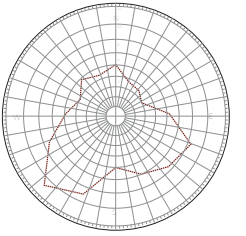
Designing close to any body of water has inherent risks. The diagram opposite indicates the areas of low-land at risk of flooding between 0 - 2.6m based on rising water calculated at high-tide during current climatic conditions. This data coupled with predicted global sea-level rises suggests that much of the fringes of Orust are prone to flooding. Other environmental conditions have also been analysed including the prevailing wind conditions and sun paths throughout the year that help indicate the climatic properties of any design. As well as identifying the underwater topography an aspect of particular interest the current that flows through the strait and changes direction daily.








3 knots
Surface
Current
Depth

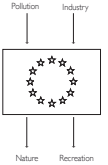


Social-Demographic Analysis

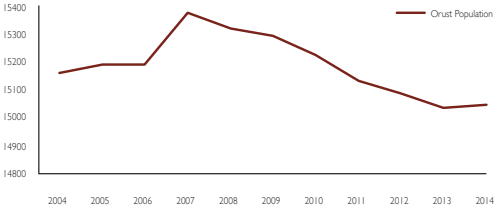
Orust saw its largest population rise between the 1970's and 80's but as due to competition on the global marketplace the industries slumped which pushed locals towards cities for the social and economic benefits. Today the area has seen a steady increase in population as more people look for a family villa or summer house in the country. Although inhabitants are generally of Swedish nationality there are also a significant number of Norwegian and Finnish minorities who purchase summer houses in the area. Consequently the population on the island fluctuates greatly throughout the year, peaking during the summer months when summer visitors outnumber year round inhabitants three to one.

As the area has begun to turn away from its industrial past the European Commission has set up multiple initiatives to improve the marine environment of the fjord region. The aim is to clear the remnants of industry and focus on developing new recreational and tourism activities, taking advantage of the natural beauty and helping to economically stimulate the region.

Orust Population



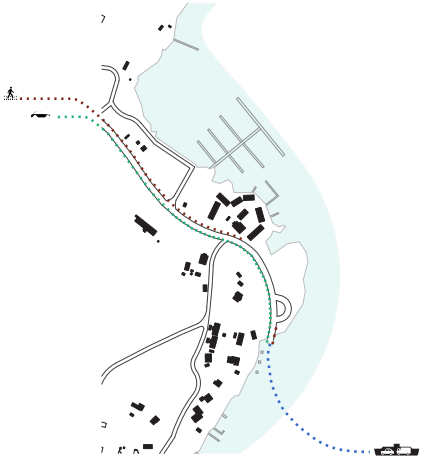
Regeneration Schemes



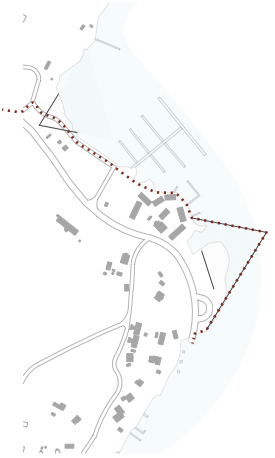
Site Potential

The site is located on the cusp of a transportation intersection. Mainland and island are connected by a car-ferry with a bus stop on either end of the crossing. There are often queues while vehicles wait to board and as a pedestrian there is no clear path to follow after immediately disembarking from the ferry. To the North of the site are seasonal summer houses and a bay area with a gentle slope used for bathing in the summer months. There are few public amenities for this area even though as part of a transportation hotspot any public intervention would be very beneficial.

One of the clearest opportunities here is to add a new pedestrian walkway onto the water which connects with the existing bathing area. The path could also serve to create a sheltered and safe space in the fjord for recreational swimmers



Local Infrastructure



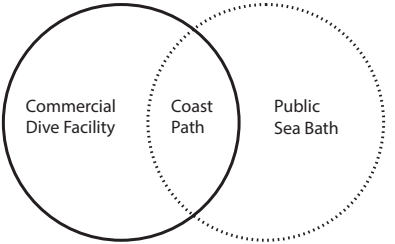
A Coastal Path

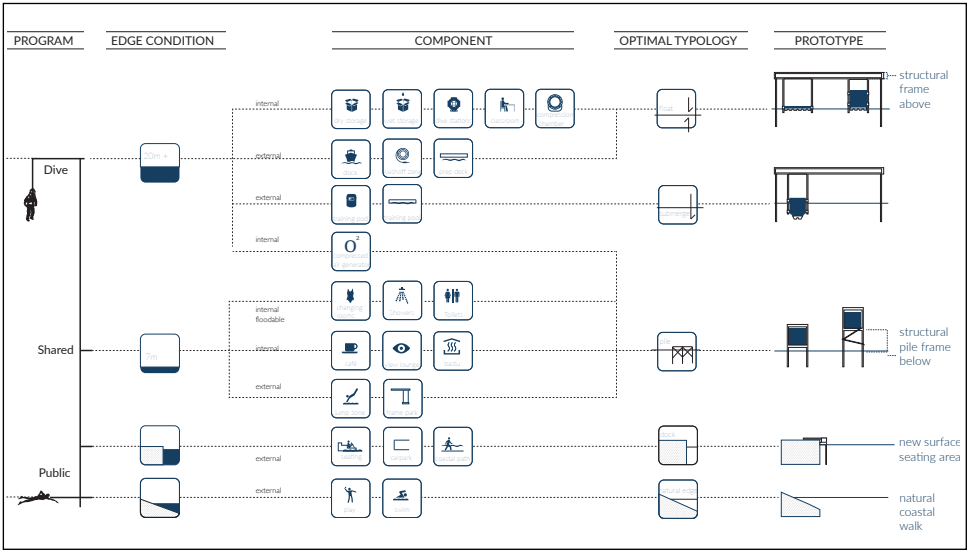
Concept

Strategy

From the analysis it was clear that the project should be more than a commercial dive facility, the social research had shown that this was an area actively being rejuvenated and had a high volume of seasonal visitors. The wider coastal network had highlighted various designated bathing areas throughout the coast which inspired the addition of a public sea bath program. Both the public and private elements will be linked with a coastal pathway.

In order to understand what was required of the project and better inform where both programs should be placed they were broken down into individual components. Each component was categorised by their best fit within the existing edge conditions. From this optimal typologies were set and prototype structures developed.


Commercial
Dive Facility
Coast
Path
Public
Sea Bath


PROGRAM
EDGE CONDITION
COMPONENT
OPTIMAL TYPOLOGY
PROTOTYPE
Dive
Shared
Public
internal
external
internal
floodable
structural
frame
above
structural
pile frame
below
new surface
seating area
natural
coastal
walk

Regional Synthesis

The island of Orust has large neighbouring ports to the north and south, Uddevalla and Stenungsund respectively. Both areas are born from an industrial hay-day. Today you can often see ships outside Stenungsund lying dormant in the water waiting to be unloaded of their cargo by the large port cranes, These industrial sites emanate a certain type of architecture and structure that is never more than what it needs to be and unashamedly functional. In the same way the fisherman's dying racks that are scattered around the islands convey a sense of honesty of materiality and construction.

North of Orust, on the edge of the town of Lysekil is a bathhouse that has stood the test of time. It uses the existing morphology of a rocky island and embeds itself into it like a limpet. The rocky island combination of the rocky edge and the surrounding walkways and changing rooms shelter sunbathers and keep swimmers in a safe environment.

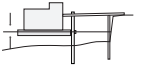
Construction
& Materiality

Fish Dry Rack

traditional fishing racks scattered around Orust,express an honesty of materiality and construction

Uddevalla

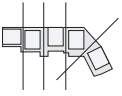
heavy industry, large structures with floating concrete jettys stretching into the water

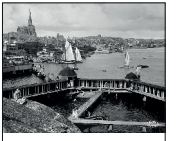


Typologies

Mollösund

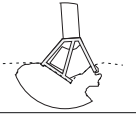
clusters of marinas and small timber structures stepping out over the threshold between land and water





Lysekil Badhuset

reacts to the existing site morphology by partly embedding itself in existing rock



Toolkit

Structure

The combination of programs requires alternate typologies. Diving facilities float in deep water whereas the majority of public functions on pile structures in shallower water.

01. azobé wood

the most prominent material in the project, also known as ironwood for its resistant to marine environments

02. timber pile

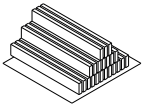
the consistency of the shallow water sea bed is rocky and drilled timber piles will be used

03. marine grade steel

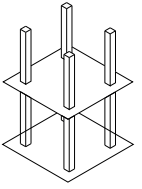
a steel truss is suspended over the floating diving area. It supplies breathing apparatus to the divers and can be used to facilitate some training programs

04. concrete pontoon

modules can be made to order. They are extremely durable, tolerate extreme loads and absorb wakes from passing ships



01.



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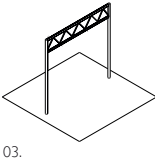

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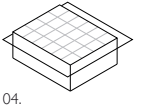


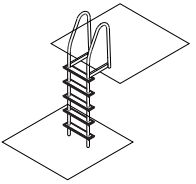
04.

Movement

Movement between waters edge and land, static and floating

05. sea stair

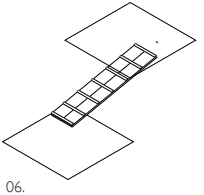
stairs connect to platforms that sit 1.3m above water level in order to connect with the dock and remain functional in most of weather conditions.



05.

06. gangway

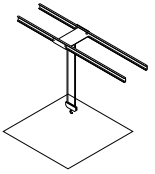
straddling the void between static and floating these gangways can also be incorporated as an alternative water entry



06.

07. rail crane

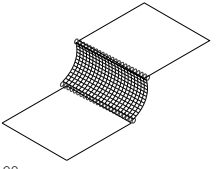
although reaching deep water is a important aspect for the scuba program, it is also important to transport equipment



07.

08. cargo net

attached to the exposed structure of the sea bath the net is a playful way for a large number of people to exit the water whilst remaining unobtrusive to the views from the dock and past the sea bath



08.

Diving

columns have been minimised and the entire program floating due to the potential danger of tethered helmet divers becoming entangled.

09. guide rope

to aid controlled descents a guide rope leads divers to the sea bed, it is usually held at the surface by buoy or boat, however it could also be tethered to the frame above

10. floatation components

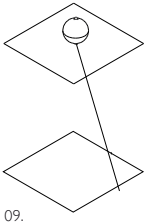
smaller additional components such as; pile rings, pontoon connectors, bollards and fenders attach to the main concrete modules

11. training container

divers practice at varying degrees of control, the containers can be raised and lowered on the frame and students can be viewed while practicing welding/ rescue techniques in a closed safe environment

12. air supply

cables and equipment can be hung from the frame feeding directly into the dive site. dives are monitored by video feed monitored from dive station



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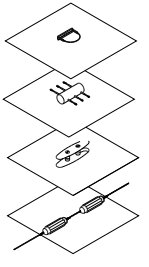

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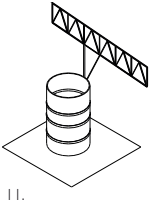

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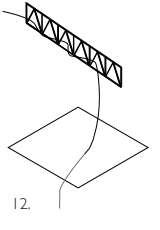
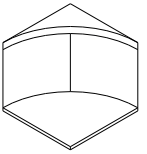


12.

13. training ledge

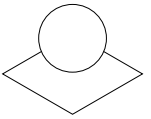
instead of a conventional training pool this hangs of concrete pontoons and allows for shallow training descending to deeper depths



13.

14. deep water training

on the seabed lies a steel structure for divers to simulate activities such as hull beaching in close quarters



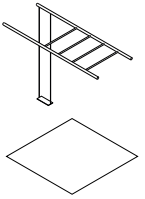
14.

Sea Bath

Exposing the basic framework of the sea bath structure allows for playful additions

15. Exposed Frame Park

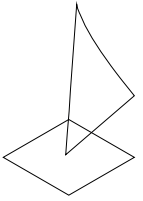
such elements can be added as monkey bars, diving boards and swings suspended just above the water



15.

16. Windbreaks

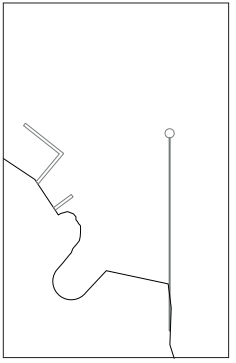
there is a risk of feeling too exposed out on the water due to the south westerly prevailing winds. Windbreaks can be integrated into the building structure and can adapt to different conditions without sacrificing sunlight



16.

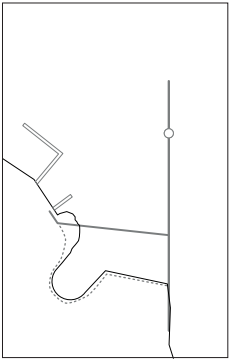
Design Proposal

Methodology



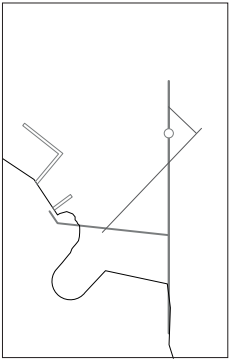
I. Depth

In order to dive a lot of time is often devoted to travelling between dive sites. The topography below the surface of this site grants a unique opportunity to base the entire dive program over deep diveable water



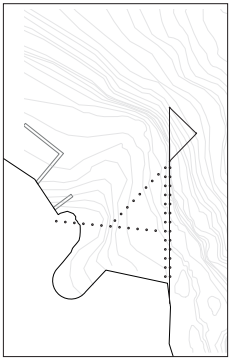
II. The Coastal Route

The public are able to transverse across the sea bath and onto a rocky outcropping that eventually connects with an existing path and traditional bathing area. There is also an opportunity to make the same journey by stepping down from the dock and hugging the natural contours of the bay area



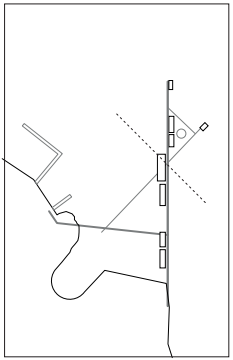
III. Program Designation

Using both the surface contours and underwater topography the main program spaces can be allocated with the larger sea bath embedded within an area of shallower water whilst the smaller dive area floating above an underwater ledge



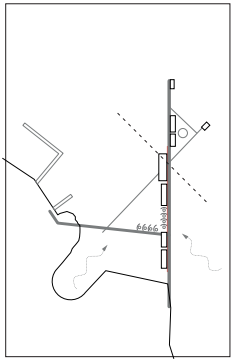
IV. Structure

Timber piles in concrete footing provide the basic structure for the sea bath. In deeper water. The entire dive zone floats on concrete pontoons allowing the facility to adapt to flood levels whilst providing the possibility for expansion in the future. A marine-grade steel frame can support all diving and training apparatus whilst also retrieving equipment from mainland via a horizontal crane



V. Placement

Low risk functions such as changing rooms, toilets and showers lie at the same level as walkways, whereas the plant-room, store and café are raised higher to reduce any future flood risk. The café is situated within the central axis of project and programs, providing both a centre of intensity as well as creating a gentle division between divers and public



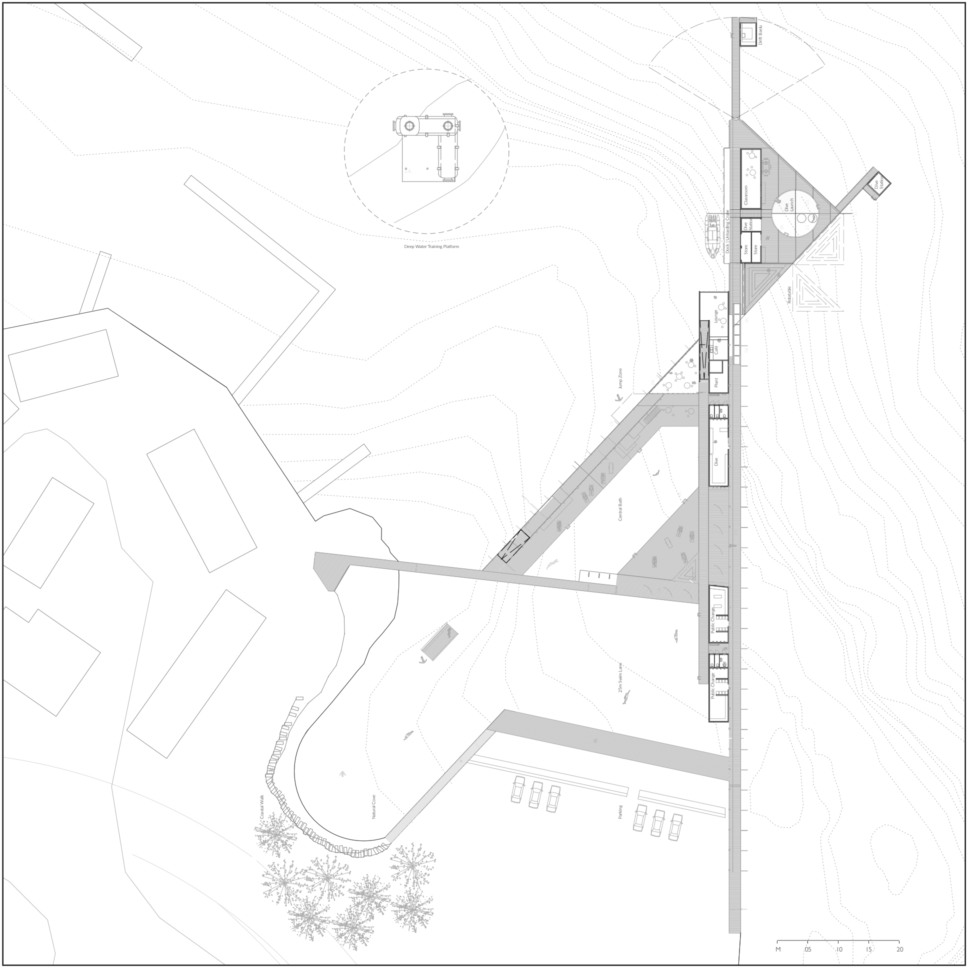
VI. Adaption

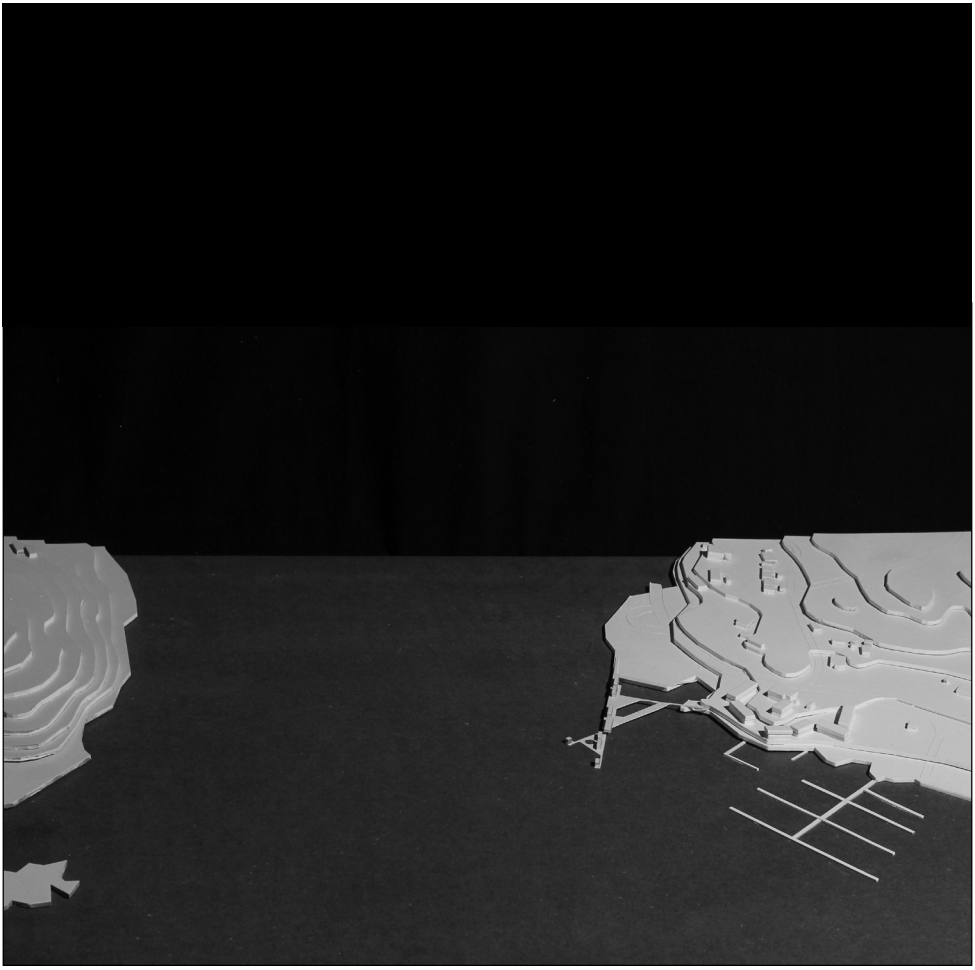
Due to the project lying in a exposed area there is an ability to install canvas windbreakers and store them during the summer months. As sea levels continue to rise the dive area will continue to be usable given its floating properties, but the sea bath can too adapt by removing the simple horizontal members and re-attaching them to the vertical piles at a more suitable level.

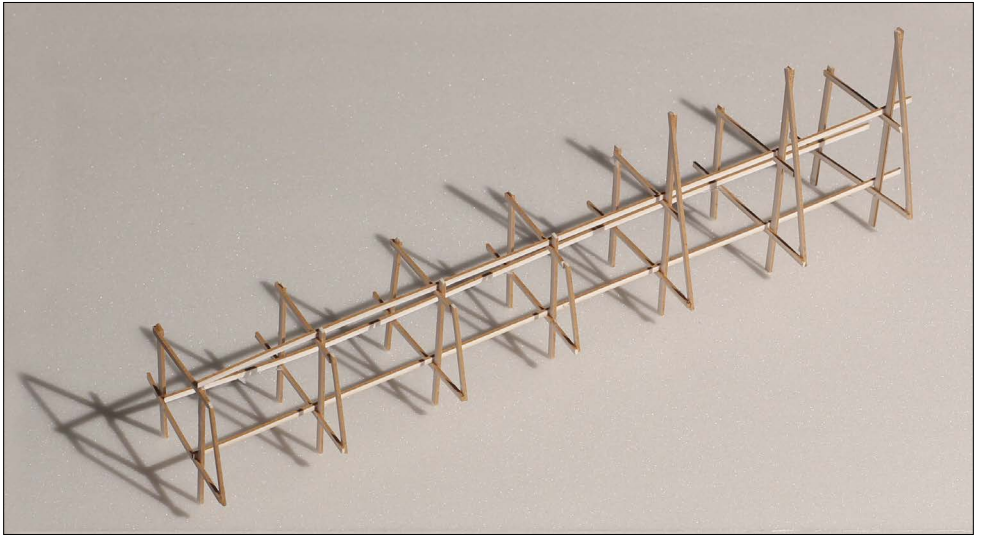
Aqua Dweller

The project embeds itself within concrete and rock of its surroundings before stretching out over the water. The existing concrete site has been utilised as car-parking with enough room for a helicopter to land in-case of emergencies. The main pathway onto the structure invites ferry foot passengers to take a stroll along the coast or use the changing rooms running along the main walkway to take a dip. The Aqua Dweller shape has created unique spaces on the water that enhance what is already existing from the deep water of the jump zone to the more relaxing bay of the natural cove.

Suspended above the main pathway is a horizontal crane that moves directly between land and dive program allowing easy movement of equipment to the boat dock. The entirely floating dive program focuses around a specific dive zone that has training elements attached to the steel frame. At the very pinnacle of the project is a bastu that is fixed on a hinge allowing it to drift with the daily change in current giving visitors a different vista of the fjord from day to day

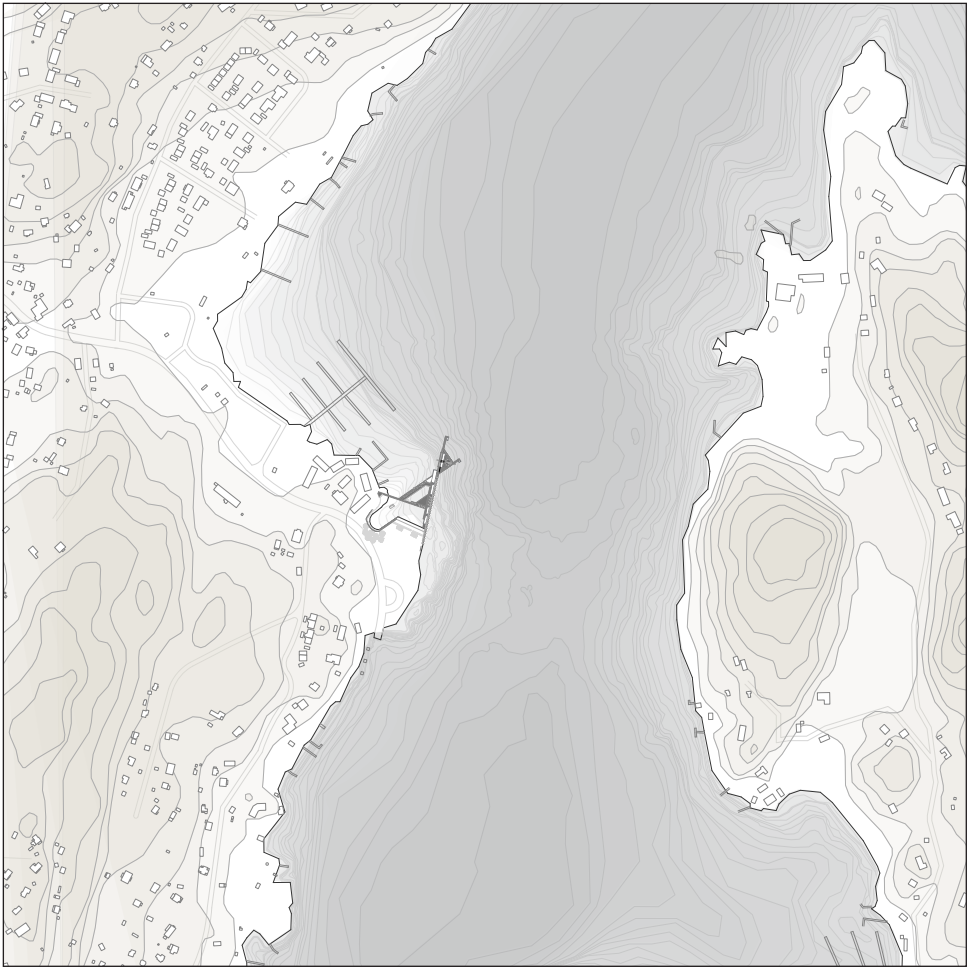

Drift Bastu
Deep Water Training Platform
Classroom
Dive Launch
Dive Station
Dive Station
Dock | Unloading Crane
Store
Store
Rotatable
Lounge
Cafe
Plant
Jump Zone
Dive
Central Bath
Public Change
Public Change
25m Swim Lane
Coastal Walk
Natural Cove
Parking
M
05
10
15
20





Aqua Dweller Within The Greater Context

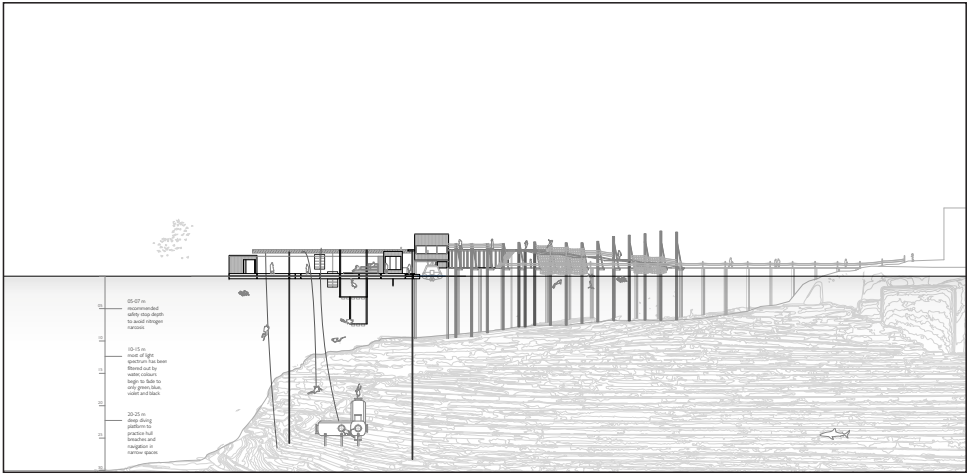
In order to incorporate multiple user types whilst also extend over deep water the project grew to a considerable scale. However it does not look out of place within its milieu. It is orientated in such a way that it does not obstruct passing vessels but still straddles multiple water depths. Although nearby summerhouses will benefit from the facilities provided by the sea bath it was important to minimise any impact to properties views. This means that any inhabited spaces are distributed along a single primary walkway some distance away from the summer houses. Similarly all the inhabitable spaces (bar one) lie low on the water and remain unimposing.

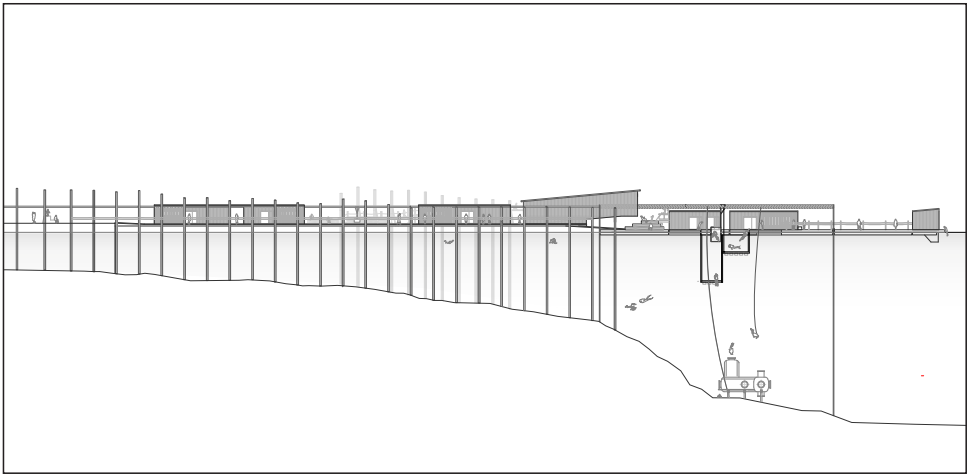


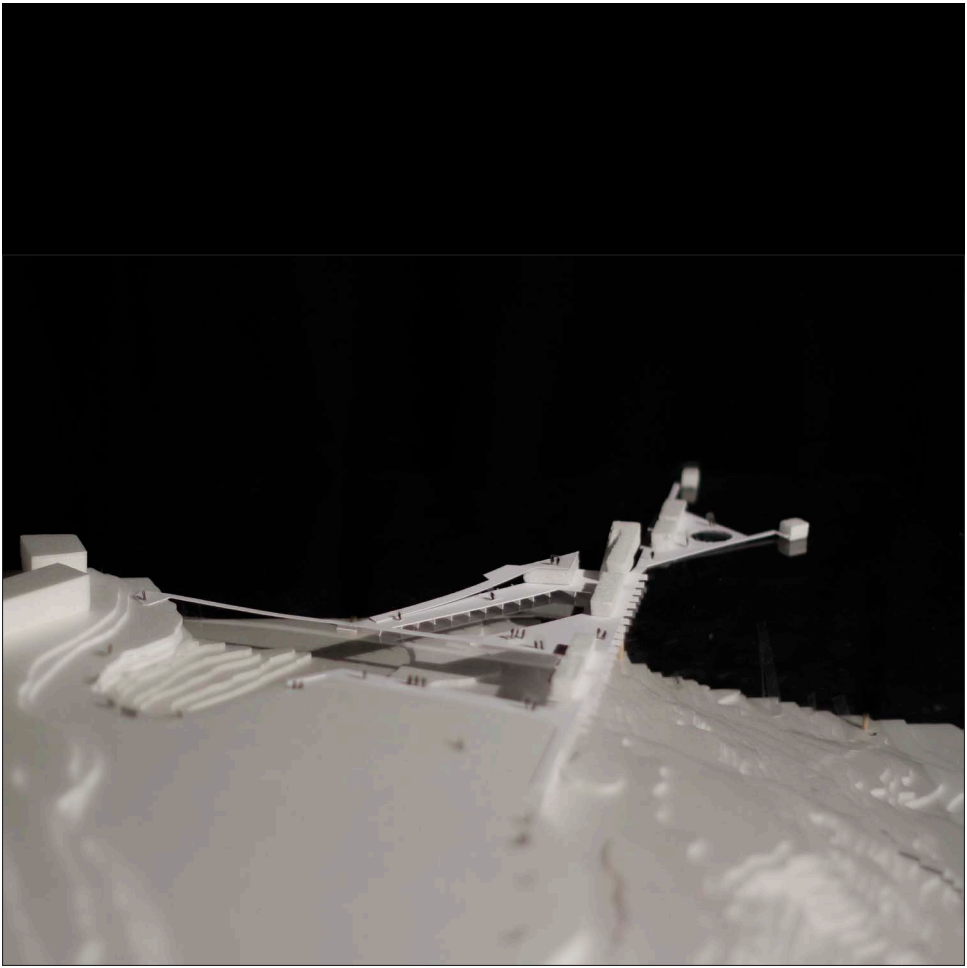
Section + Front Elevation

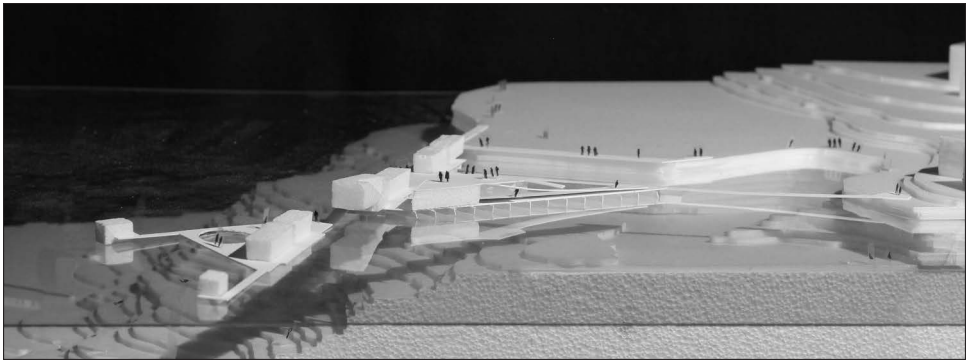
A distinction between programs; public and private, deep and shallow is described by the architectural language running throughout the project. In the deeper water, minimal fine steel piles rise from the seabed and form a structural frame to support diving equipment. The project descends below the surface to form of ledges that replace the traditional swimming pool as well as allow divers something to perch on whilst carrying out safety stops and avoid decompression sickness. Lying on the bottom a steel training capsule for rescue divers to practice negotiating tight spaces. In the centre of Aqua Dweller, rising above the water is the cafe that enables the public to overlook divers and enjoy panoramic views of the surrounding fjord.

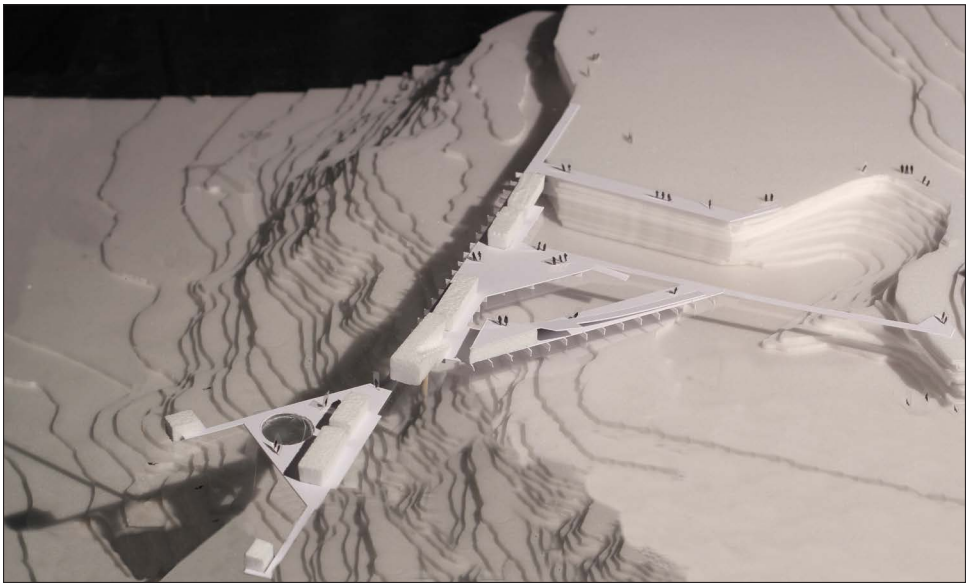
The heights timber piles that form the sea bath ungulate in a playful rhythm informing visitors of the hidden topography metres below. A path leads visitors up a slope towards the cafe and inviting you to take a plunge.


05-07 m
recommended
safety stop depth
to avoid nitrogen
narcosis.
10-15 m
most of light
spectrum has been
filtered out by
water, colours
begin to fade to
only green, blue,
violet and black.
20-25 m
deep diving
platform to
practice hull
breaches and
navigation in
narrow spaces.



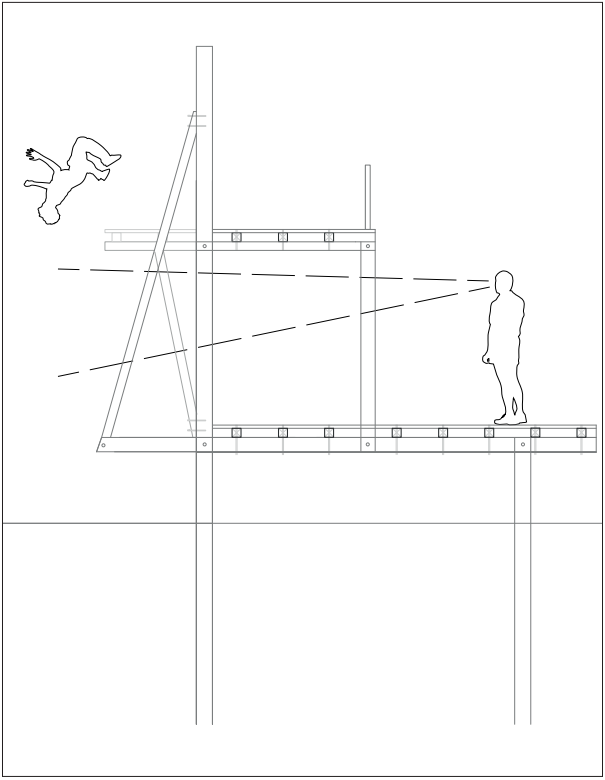






Structural Detail

Given that there has been a push to restore the natural beauty of Svanesund it was critical that the Aqua Dweller did not impinge on this. The overwhelmingly timber based structure of the Sea Bath is elegantly simple in its construction being pinned together with marine grade steel. As much of the structure is exposed it is possible to see the look through and past the building and to the vista beyond. Another advantage of the simple construction is that it is possible to adapt to steady sea levels rises by removing the horizontal members and reattach them at a higher point to the vertical timber piles.

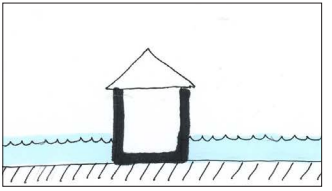


Materiality

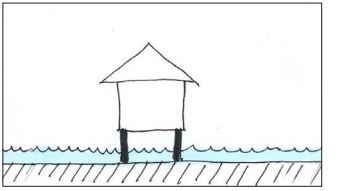
The most abundant materialistic aspect of the sea dweller is azobé wood. Although this material must be imported from other continents its benefits of longevity and ability to withstand a harsh marine environment far outweigh this downside. The rest of the project expresses nautical undertones with tactile rope guardrails and cargo net reminiscent of the vessels of history. Similarly the canvas of the wind breakers can be hoisted and rotated in a similar fashion to a sail-ship and will howl as the wind passes through. The hard wearing concrete that the dive program floats upon helps distinguish the threshold between public and private areas whilst reflecting the more industrial nature of commercial diving. The pontoons are sourced from a factory on an island close to Svanesund.

Azobé Wood Cargo Net | Rope Concrete Canvas

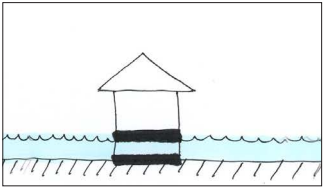
Appendices I



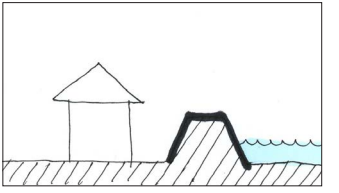
Dry-proofing (sealed outer skin)



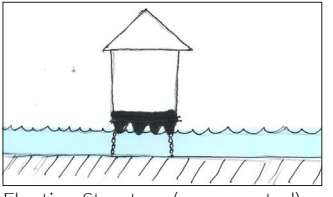
Raised Structure (pile supports)



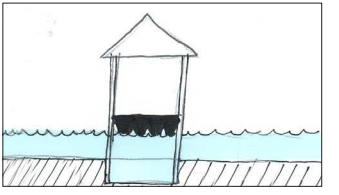
Wet-proofing (flood first floor)



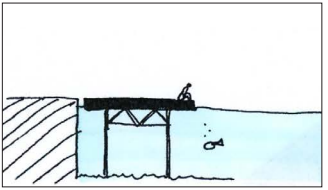
Levee



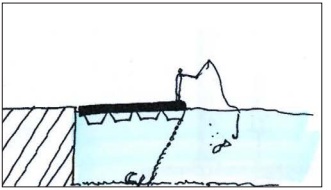
Floating Structure (unsupported)



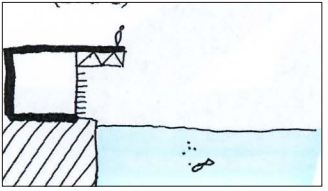
Floating Structure (supported)



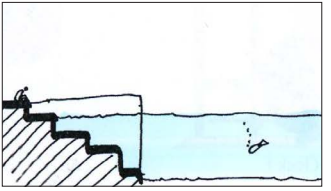
Piles (static)



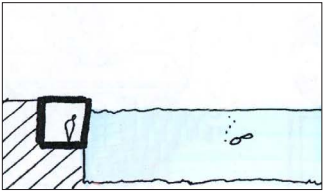
Floating (dynamic)



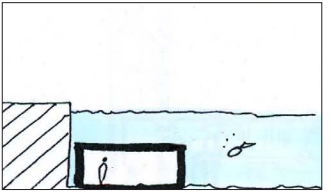
Structure (raised levels)



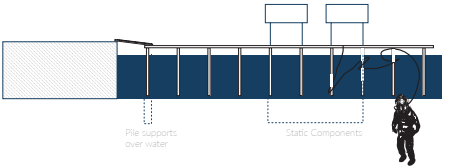
Edge Condition



Integrated in Existing Structures

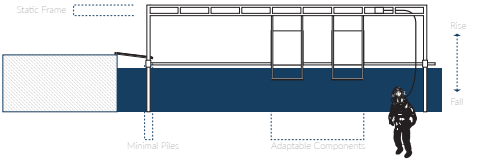


Underwater



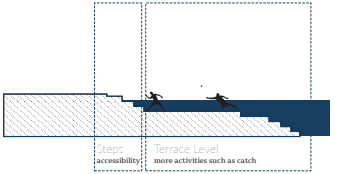
Traditional

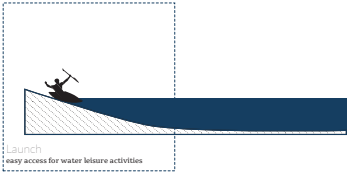
Structure built onto water with many supports. This is not good for tethered divers as they can become untangled in chains or support structures

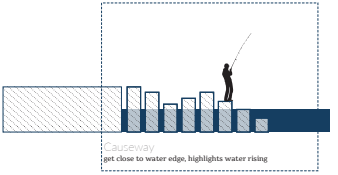


Concept

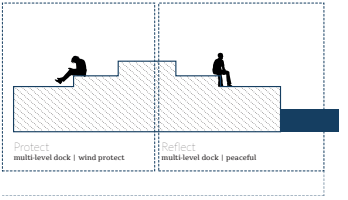
Frame straddling over water with minimal supports hold floating components in-place. Reducing risk of diver entanglement

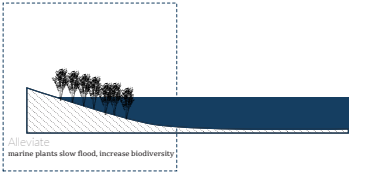

Steps
accessibility
Terrace Level
more activities such as catch

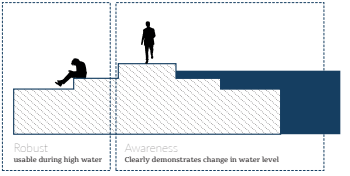

Launch
easy access for water leisure activities

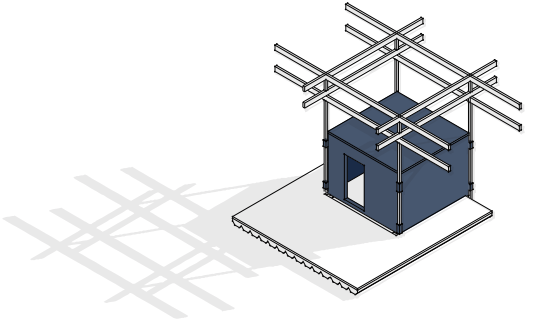

Causeway
get close to water edge, highlights water rising


Sand
sand added to cove to enhance experience and play


Protect
multi-level dock | wind protect
Reflect
multi-level dock | peaceful


Alleviate
marine plants slow flood, increase biodiversity


Robust
usable during high water
Awareness
Clearly demonstrates change in water level



Frame

The skeleton of the building. Services and mechanisms celebrated throughout

Component

Floating components reminiscent of sparse fishermen villages

Float

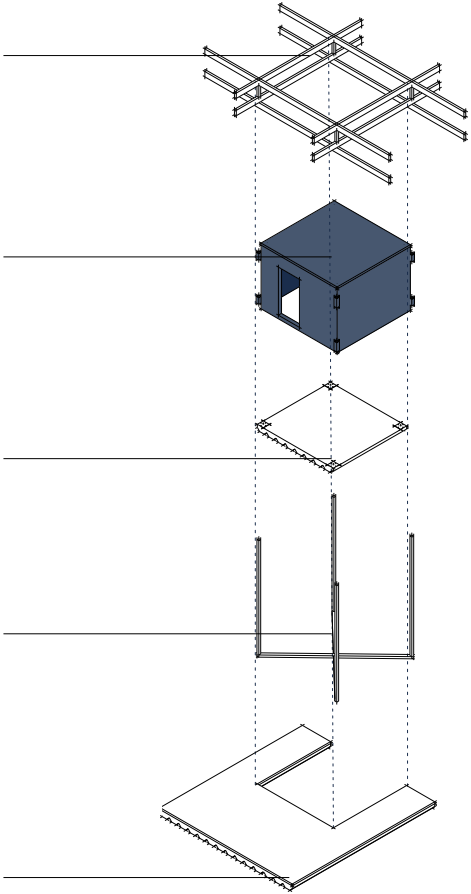
Reinforced concrete and polystyrene is a proven material for building on water

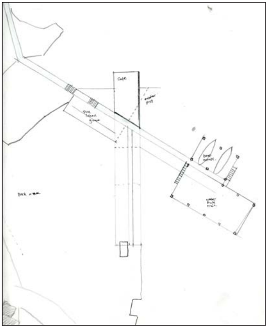
Cage

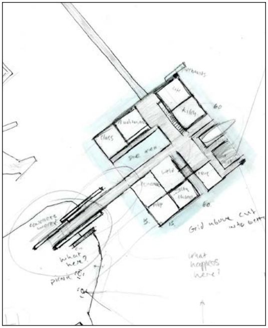
Marine Grade Steel cages attached to frame prevent component from drifting

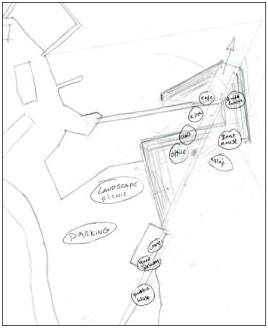
Pontoon

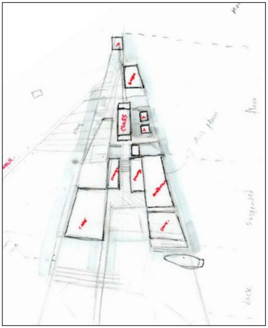
Working on the same principles as the component float with rings encircling main frame supports

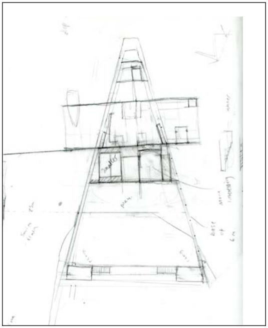


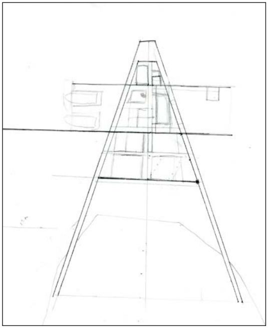


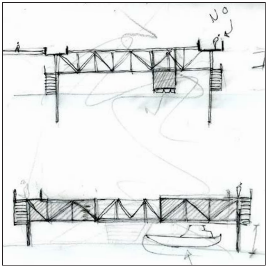

Grid above cut into berth
what happens here?


Cafe
office
Boat House
LANDSCAPE picnic
PARKING
public walk





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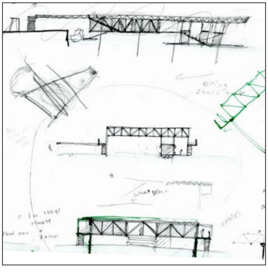

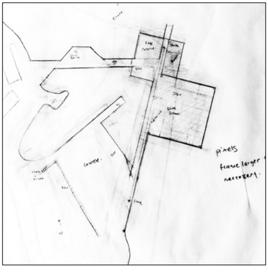

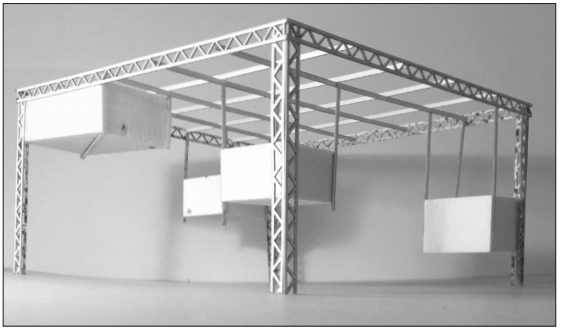

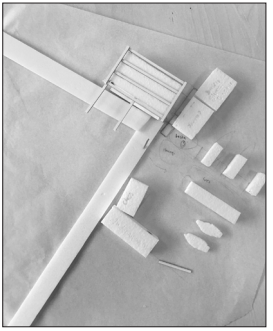

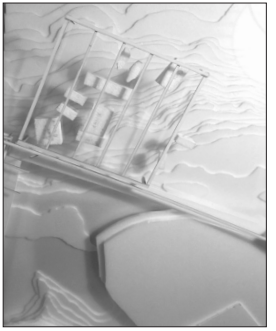

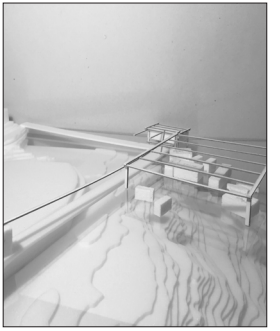

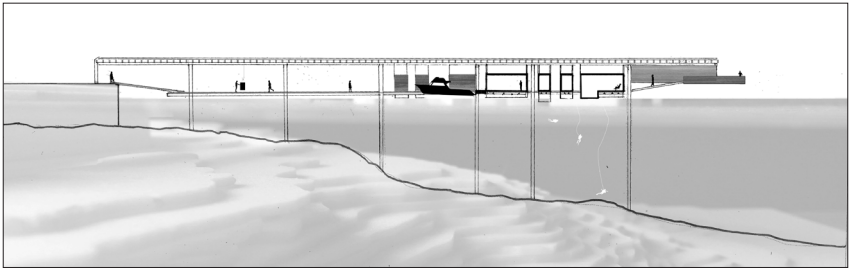

Appendices II

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Conclusions

Aqua Dweller

Given the specialised nature of the program this thesis was heavily driven by research. Delving deeper into the requirements of divers continued to shape and morph the project.

Ultimately the Aqua Dweller is defined by the combination of functionalism and the relationship with its surroundings. The structure and materiality choices echo a memory of place with its myriad of contrasting dimensions. The Aqua Dweller is intrinsically linked between the line of surface and below; a bridge between dry and wet, a platform to celebrate and explore water.

Thank You