CHALMERS
UNIVERSITY OF TECHNOLOGY

ATTACK
ARCHITECTURE

DESIGN BEYOND THE BUILT

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Author

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2016-2019 Chalmers - Bachelor in Architecture

2019-2020 TU-Delft - Master studio, Architecture
Form, Structure & Aestectics

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TABLE OF CONTENT

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ABSTRACT

Since the early 1900s, the oxygen levels in the Baltic sea have been decreasing in the deep-water basins due to nutrients emitted from infrastructure, housing and farming. The result is a rapid increase of algae blooms in the surface water, suffocating the sediments in a process called “Hypoxia”. This leads to the Baltic Sea dying at a pace faster than ever before. The dead zones of the ocean are now reproducing by themselves and our efforts of reducing the pollution is no longer sufficient to reverse the trend.

Through studies of up to date research and similar structures, this master thesis shows a design proposal working proactively with the issue. By breaking the layers in the brackish water with wind driven pumps, the oxygenated top layer of water can be relocated to the suffocated bottoms, activating the sediment and giving nature a chance to break down the algae and eventually heal itself.

This project shows an example of how it is possible to revive the anoxic deep water basins, making it possible for sealife to strengthen and enable a cultural coastal life in the future. This is done through the design of an “off grid” research station in the Baltic sea’s extreme environment, designed with regenerative architecture in mind, focusing on sustainable periodic living with zero impact on nature as well as human well being in an isolated environment. The design is based on an understanding of the site with the aim of showing how architectural design can be used to push sustainable inventions further.

We need to rethink design, design itself creates us, therefore we need to start designing who we are going to be tomorrow.

Keywords : Baltic Sea, Hypoxia, Oxygenation, Regenerative architecture, Flexibility, Invention.

(EUROPEAN SPACE AGENCY, 2019)

WHY DESIGN MATTERS

Design and innovation have always been driving forces in human evolution (Wigley, 2017).

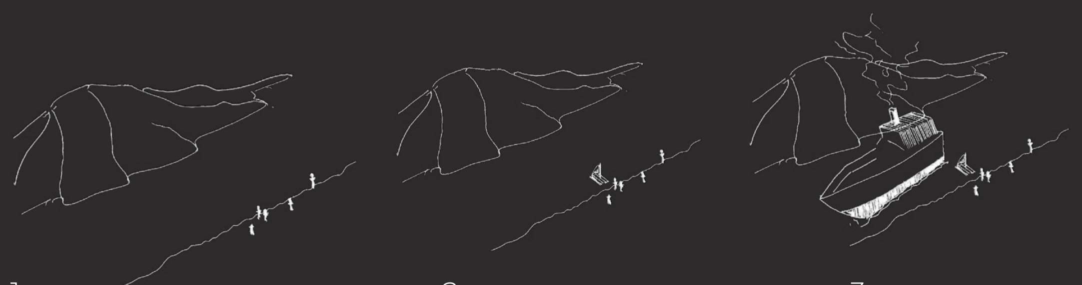
In a lecture by the architect and professor Mark Wigley he says that researchers now can prove that design not only changes us psychologically but also physically (Wigley, 2018). Looking back in history, we can see how design and the ripples of it, have shaped us as humans (Wigley, 2018).

If you take the hand axe for example, this is an object that we associate with the human evolution of tools and the new era of man. Researchers now mean that the object itself had a totally different function than what we first thought. It was an object that rather than cutting, was made to showcase an advanced skill level to impress mates. This lead to an evolution of those who designed as they attracted more mates and could thereby reproduce (Colomina and Wigley, 2016).

When the purpose of design is to solve a specific problem, the process rarely stops when the problem is solved. Each solution gives life to further development and pushes innovations further.

A practical example of this could be the evolution of the boat. In the beginning there was simply a problem that needed a solution. How do we cross the water to get from point A to point B? This could be solved with the idea of the raft. The raft fulfilled its purpose, but not only did it do that, it also opened up for an entirely new way of transportation, living and further development far beyond solving the original problem.

This to me shows the importance of design and how its' unpredictable nature can help pushing inventions further. I hope that my thesis project can have the same effect, opening up for new ideas in the future.



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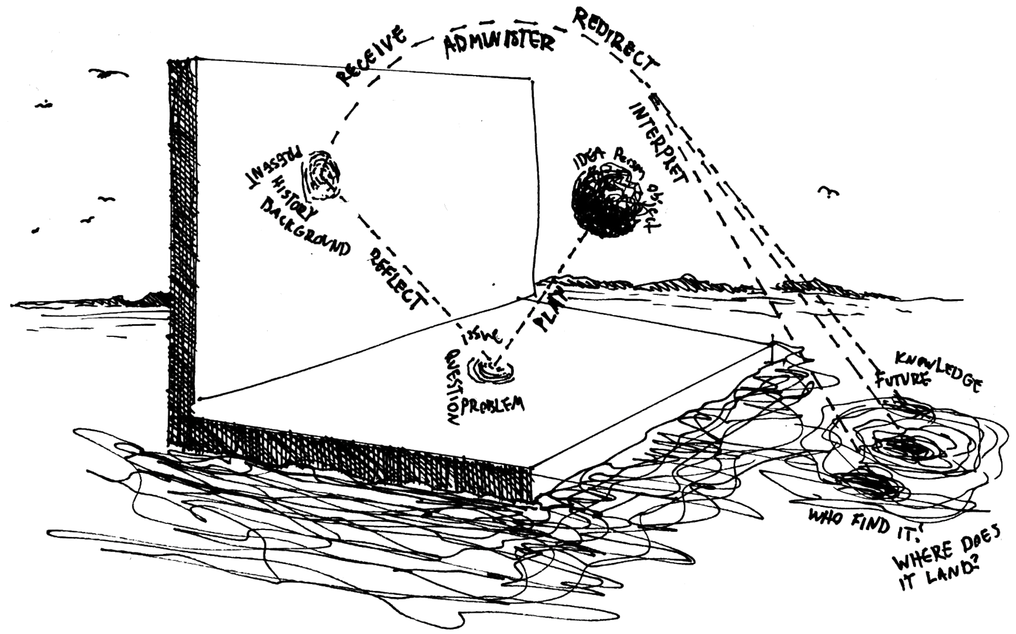


HOW AN IDEA GROWS

These sketches are my interpretation of how an idea takes form and evolves. The white dot in the middle represent a new idea. It creates ripples in every direction as it provokes different feelings or reactions in the receiver.

Some viewpoints will be received well and continue to develop while others will not. This process helps shape the path of the design and lead to an infinity of new ideas, maybe even greater than the original idea.

I believe that the ripples of an idea are even more important than the idea itself. **It is what the conceptual thoughts and crazy ideas awaken in us that generate change.**

It is not always important to show that something actually works, but rather that the thoughts of how it could work awaken something in the receiver, putting new thoughts into orbit.

This is what I intend to show with this thesis project. One conceptual solution that might cause further inventions to grow.

PURPOSE & AIM

The project will show the relevance of idea-based design, highlighting how it could lead to a more progressive architectural debate.

The rising CO2-levels and the global climate changes speaks its clear language. If we are to reach our goals of achieving a socially, environmentally and economically sustainable development in the future, we need to rethink the way we live and act and question our choices.

We can no longer be satisfied with leaving a small imprint on our surroundings, we need to take action and strive towards leaving our sites better than we found them.

We need to rethink design as not design for the sake of design, but rather design as a tool for change.

Through believing that all humans are designers and that we all relate to design, we are able to see humanity's progression over time in the many inventions and ideas generated along the way.

Herbert Simon the social scientist wrote in 1969 - *"To design is to devise courses of action aimed at changing existing situations into preferred ones."* (Simon, 1969).

Design shapes us and creates who we are, therefore we need to start designing for who we want to be tomorrow.
The focus will be on making an equally conceptual project as a realistic project. This will be done based on research within several fields including philosophy, marine biology, engineering and architecture.

The aim with the project is to show how architecture and design has a crucial role in taking inventions further, creating possibilities for humanity to live and work where we are needed. Taking a wider perspective of our professional role as designers and seeing to the effects that the things we create today will have on our future.

DELIMITATIONS

The project is of a conceptual nature with focus on possibilities. Precise calculations will therefore not be conducted throughout the thesis. Neither will economic or political issues be addressed.

The project touches upon current scientific research about the Baltic sea from Gothenburg University but does not claim to be a part of that research.

RESEARCH
QUESTIONS

1. How can design drive sustainable inventions further and be the driving force for change?

2. How could an isolated off-grid structure inhabit a sustainable way of living while improving the conditions of its context?

METHOD AND PROCESS

This section describes the different methods and processes leading up to a final design proposal. For the final proposal to be as well grounded as possible, the project attacks the issue from many angles, including studies of scientific data, research as well as designing through form studies and simulations. The problem highlighted in the thesis is the problem of the dying seabeds of the Baltic sea and the knowledge that we don't act upon. The result is a somewhat realistic, yet conceptual, design project showing an example of how the issue could be resolved.

1 SCIENTIFIC **BACKGROUND**

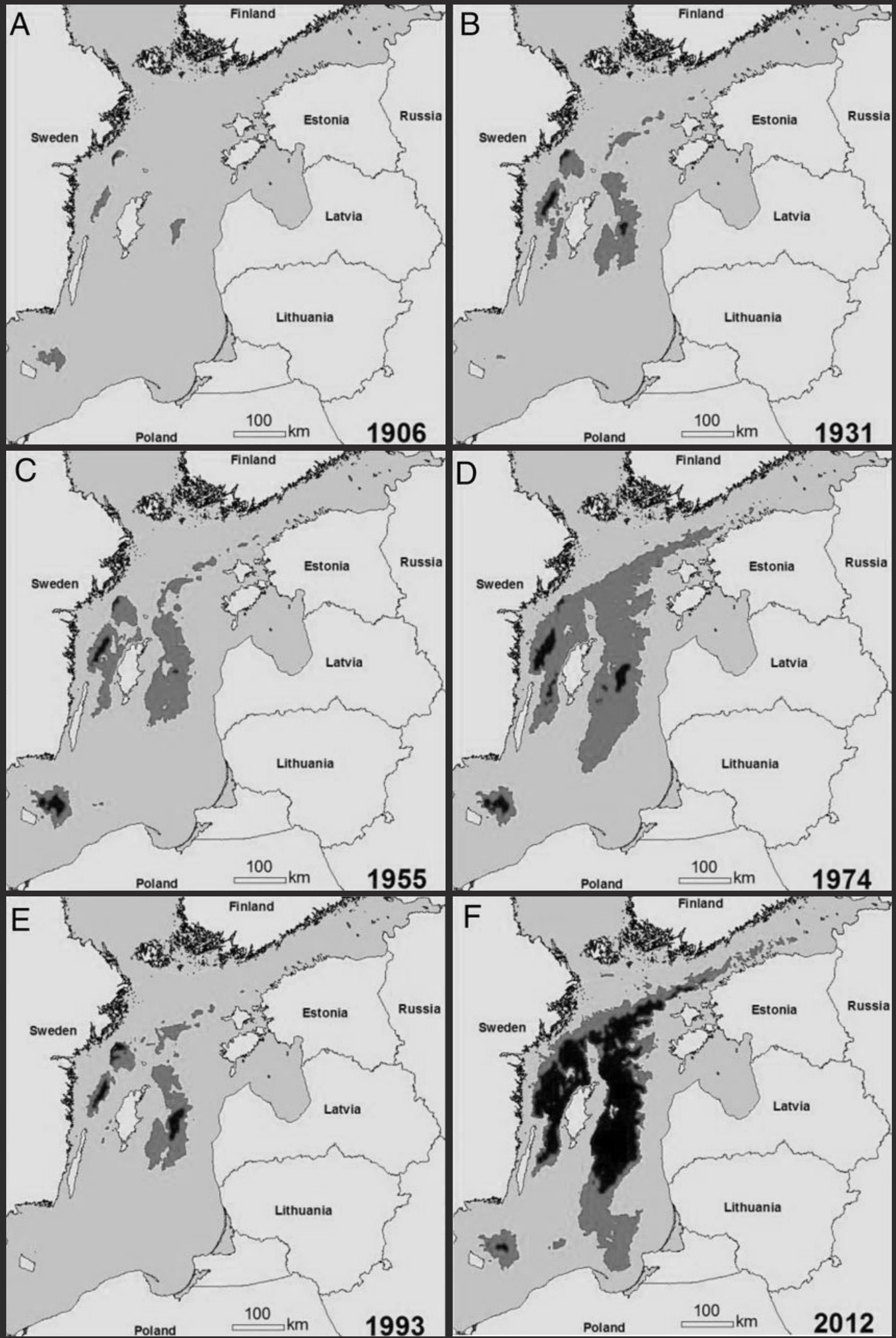
For the project to withhold a level of feasibility, previously made projects was studied where similar solutions have been applied. The technical aspects of this project is mainly based on a pilot project done by Gothenburg and Linköping University. The project contains much relevant information about oxygenation of seabeds and technical solutions for applying it in real life. For the housing function of the project, off-grid living situations and closed system living has been studied and implemented in the project. Here, remote research stations and oil rigs represent a similar isolated context.

2 RESEARCH BY **DESIGN**

The design has been an ongoing process throughout the full project where research on technical solutions, literature studies and the knowledge gained from references, has been interpreted and transformed into form and design for an increased understanding. This part mainly hold results in the form of graphic material such as drawings, models and renderings showing the process from idea to final proposal.

Physical simulations has been carried out on the design, evaluating aspects such as function, efficiency and behaviour during different conditions. This was documented and used to test the design and gain a deeper understanding of how different choices affected the function.


Photo - Physical model



(Earth Magazine, 2014)

BACKGROUND

Since the early 1900s, the oxygen levels in the Baltic sea have been decreasing in the deep-water basins due to nutrients emitted from infrastructure, housing and farming. The result is a rapid increase of algae blooms in the surface water, suffocating the sediments in a process called "Hypoxia". This leads to the Baltic Sea dying at a pace faster than ever before (Zillen et al., 2008; Carstensen et al., 2014).

Many people's livelihood relies on the ocean and industries are going extinct (Council of the European Union, 2022). I myself grew up next to the Baltic sea and have seen first hand how the changes have affected not only the marine life, but also the life of people around it.

Changes have been made to stop the release of nutritions from sewerage and agriculture and the amount of phosphorus released into the baltic sea is now less than the amount that gets out every year (SUBalticSeaCenter, 2022).

However, an indication has been seen that the dead zones with negative oxygen levels has started to eat up the still stable areas thereby reproducing themselves, leading to a systematic death of the Baltic sea (Stigebrandt and Andersson, 2020).

The emissions from 30 years back is still stored in the deepwater basins due to the low circulation, meaning that even if our emissions would stop entirely, the ocean would still have a hard time recovering (SUBalticSeaCenter, 2022).

Therefore we need to work more proactively with the problem and attack it from all fronts before it's too late (Pavid, n.d.)

There is still time to make the necessary changes, but we need to start now if we want to keep the living archipelago (WWF, 2021)

THE BOX PROJECT

The BOX-project is the first ever attempt to circulate water to recover dead zones in the ocean (Stigebrandt et al., 2014). This has become the scientific foundation of my project.

The experiment was carried out by Gothenburg and Linköpings University and is located on the Swedish west coast in Byfjorden outside of Uddevalla (Stigebrandt et al., 2014).

In the experiment, the researchers circulated the oxygenated surface water to the bottom layer and activated the bottom sediment through engineered water pumps (Stigebrandt et al., 2014).

The project started in 2009 and continued over a couple of years.

Due to high costs the project had to be put on hold and it is unclear what the current status is. However, the last test that was carried out in 2011 showed that the area was recovering and that the experiment had been successful (Baltic Deepwater Oxygenation, 2012).

This project has been a great inspiration for the design work, however the pumps used in the BOX project are driven by diesel which might not be sustainable on a bigger scale.

The master thesis aims to develop a design which uses the knowledge gained from this project but with renewable energy sources instead.

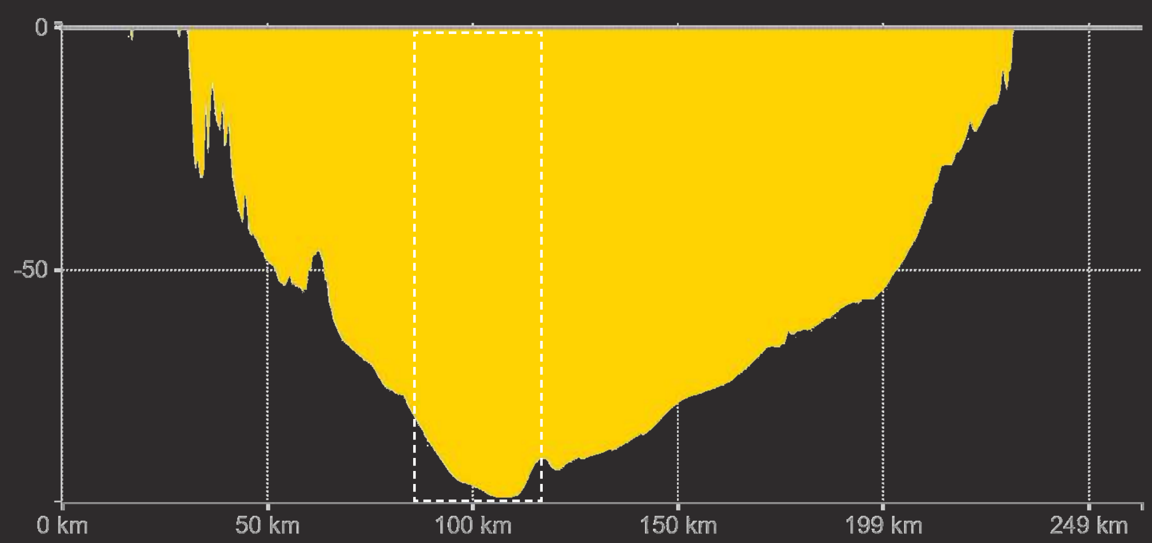
Visualization of the BOX pump station (Gothenburg University, 2014)

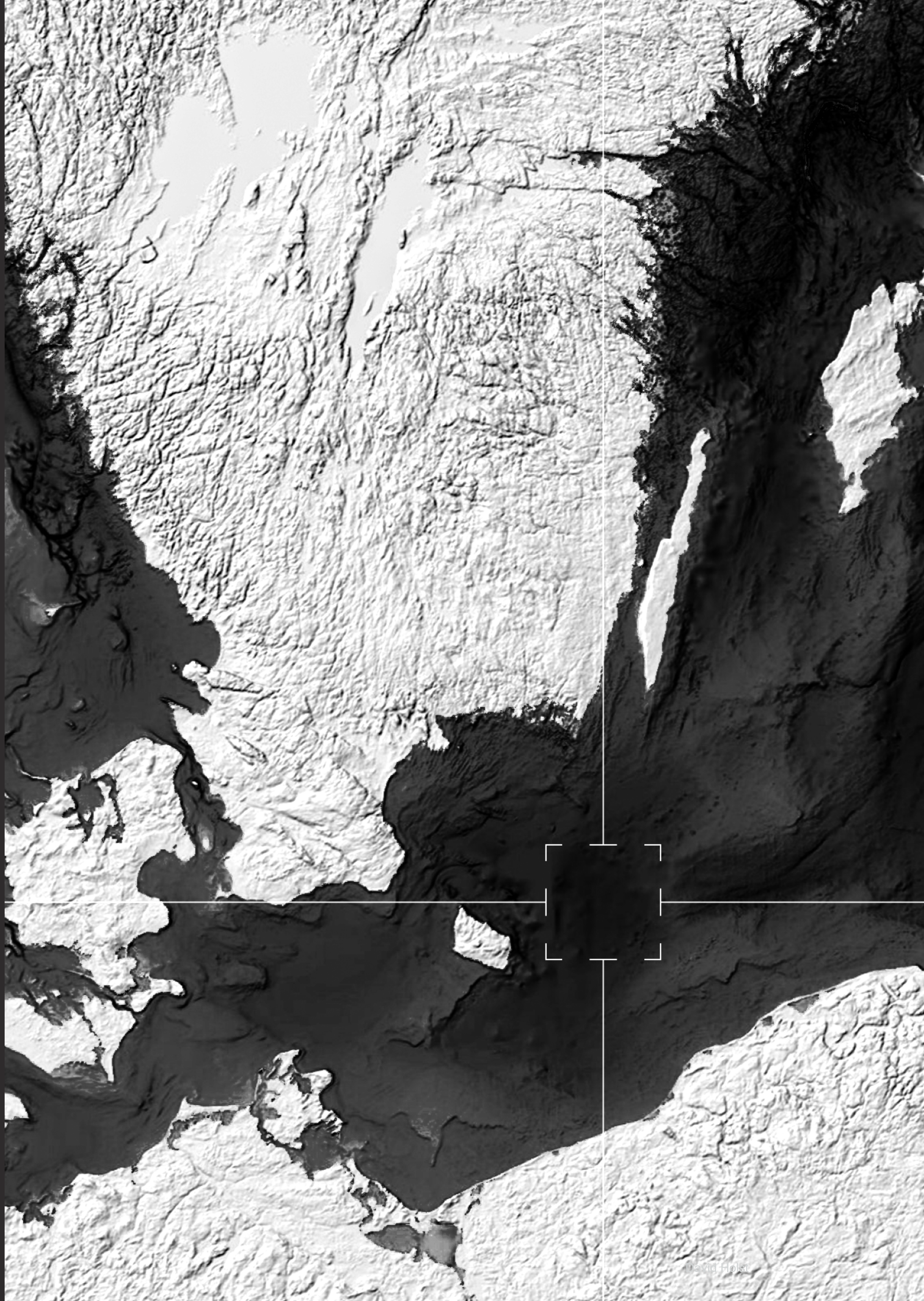
SITE:
BORNHOLMSDJUPET

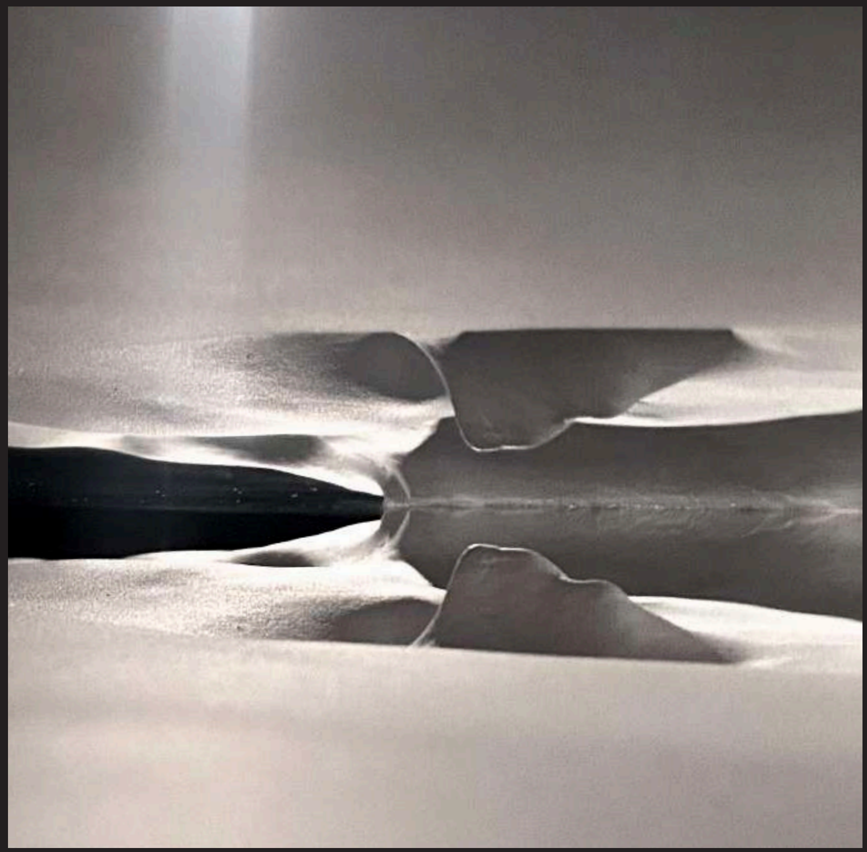
The site for this project is Bornholmsdjupet, an area of the Baltic sea in between Sweden and Denmark.

The section below shows a cut through one of the deep water basins of this area in which the oxygen levels are the lowest. Salt water coming in from the ocean gets trapped in the deep basins because of the low circulation. This creates problems for marine life as the oxygen levels run very low. The water is also contaminated by emissions, causing extensive algae blooms to occur (US EPA, n.d.). The sediment is not capable of breaking down the ammount of algae's, leading to dead sea floors, also known as "hypoxia". These deep water basins are therefore the most crucial parts of the site to work with to prevent the seabeds from dying. (US EPA, n.d.)

Another reason for working with Bornholmsdjupet is its size. In the BOX-Project the scientists suggest this site as suitable for further development of the technique (Ödalen and Stigebrandt, 2013). For this design project, it would be big enough to show the process on a larger scale yet small enough to be able to see the changes.

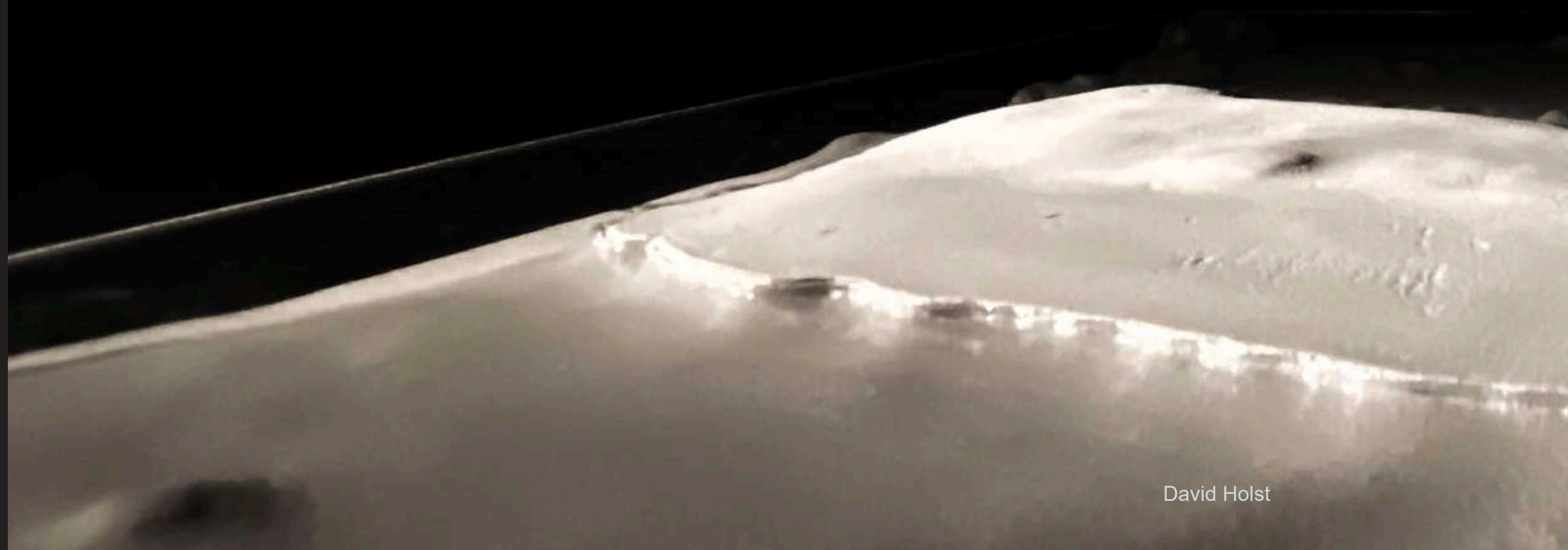






SITE MODEL

To gain deeper understanding of the site, I started the process with making a site model in scale 1:200 000. This helped me understand the topography of the site and where the critical areas will occur.



DESIGN PHASE 1

THE PUMP

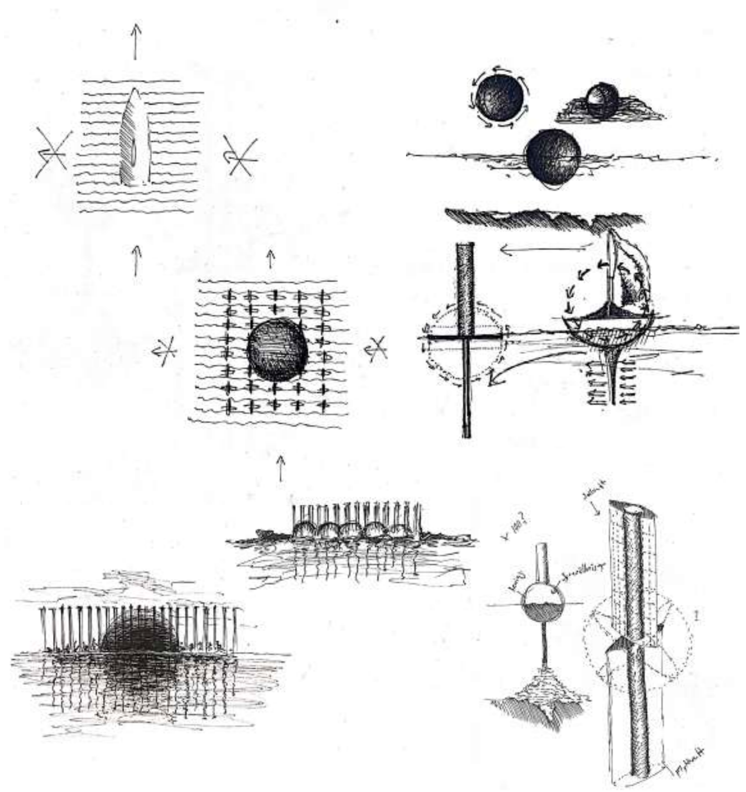
RE-READING OBJECTS

In the beginning of the thesis, the process of exploring an idea through its ripples was described. Using a present design that once was made for a specific purpose, and re-interperet the knowlegde gained from it. It's now up to me to be the retriever and administer previous thoughts of an object, using it to create something new.

In this section I studied existing inventions and structures in similar context as my project to see what I can take with me into the design. What parts can I use and how could they be optimized?

In this example I studied the sailboat. I saw specific significance in 3 pieces that make up a boat, the keel, the hull and the sail. However, a boat is designed to have a direction, it's not made to linger over the same area for a longer period of time. To solve this i turned the sail and the keel against each other to make breaking effects as seen in the sketches.

Later I added a vessel for the technical parts to circulate the water (Hull) . I multiplied the abstraction to better suit the scale and the program of the project and the result is showed in the illustrations and image on this page.



The feeling of the design was more important than the design itself in this result. The pictures created a feeling of being monitored, a propaganda picture of what's to come. Attack Architecture.

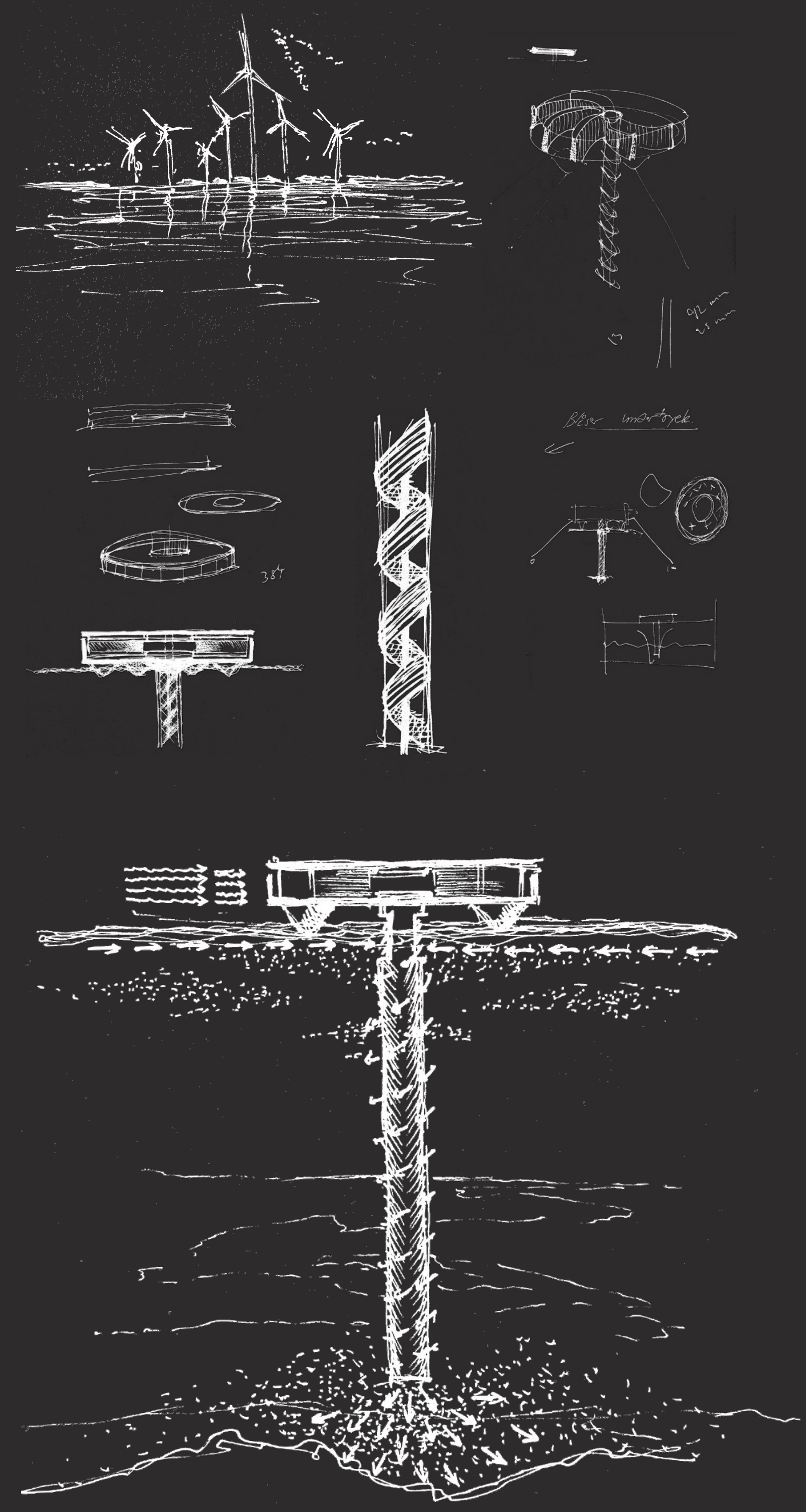
RE-READING
FINAL STAGE

Since the pump has to be driven by natural energy sources, I studied wind power mills in the ocean as a reference. This object itself could work as a design without any bigger interference but I wanted to see if I could turn it into an analog design where I could use the direct power of the wind instead of using technical aspects to transform the wind into electricity to circulate the water.

The result was in my opinion something that was worth continuing to develop and it became the base for the final design.

The idea is that you could just place these structures in the water and leave them there and they will work day and night without the need of fossil fuels.

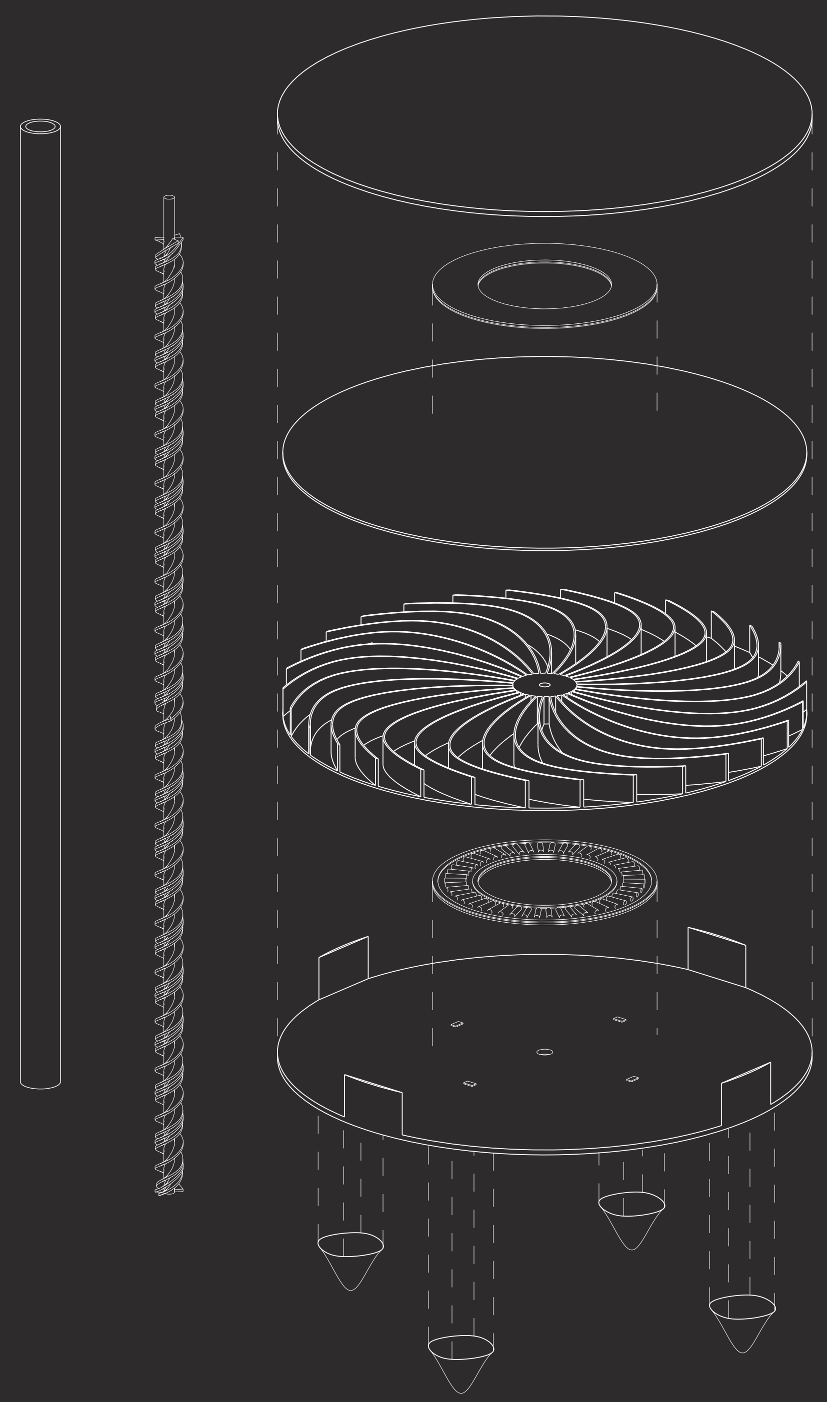
A series of simulations has been carried out with the design giving varying results leading up to an optimized design that could theoretically work in full scale.

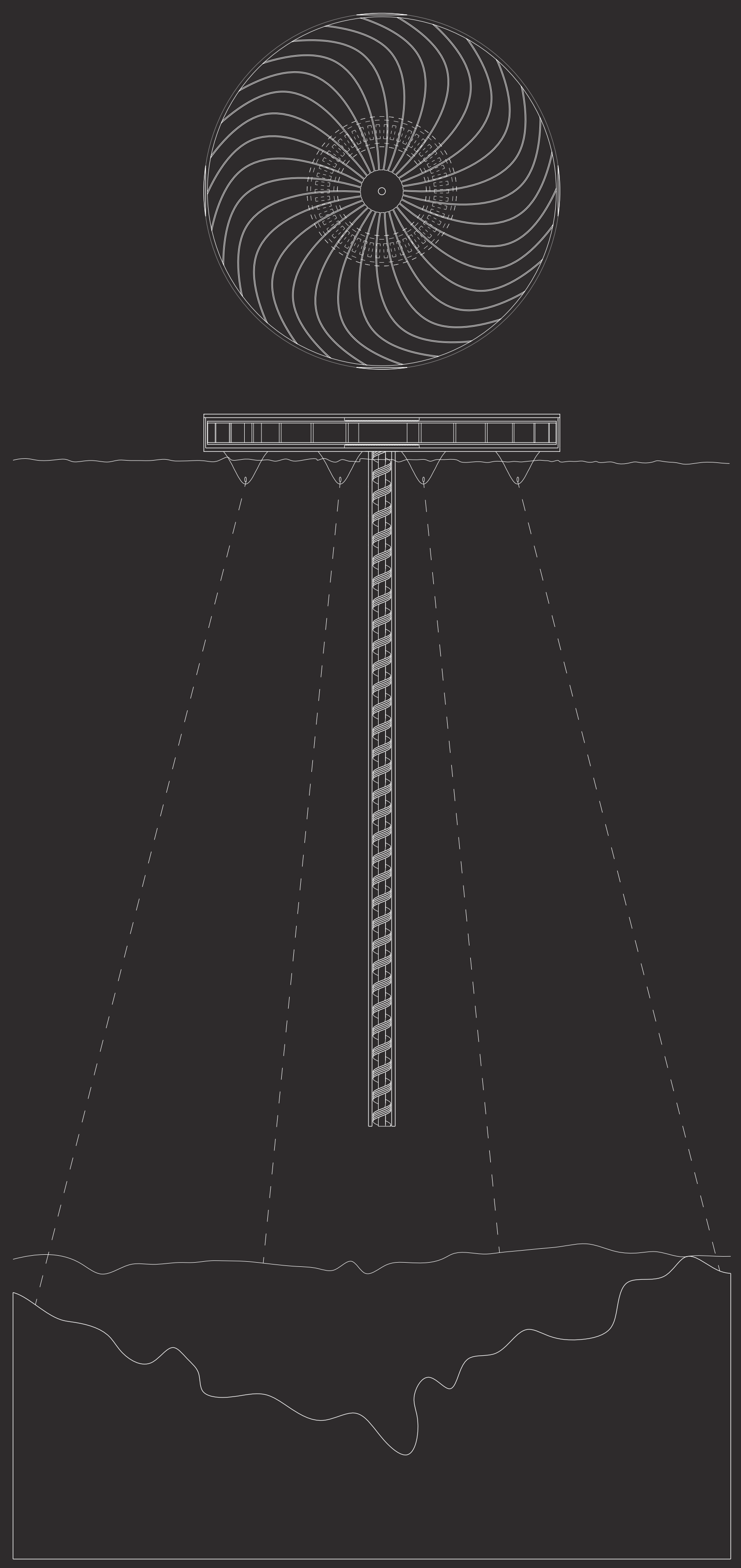


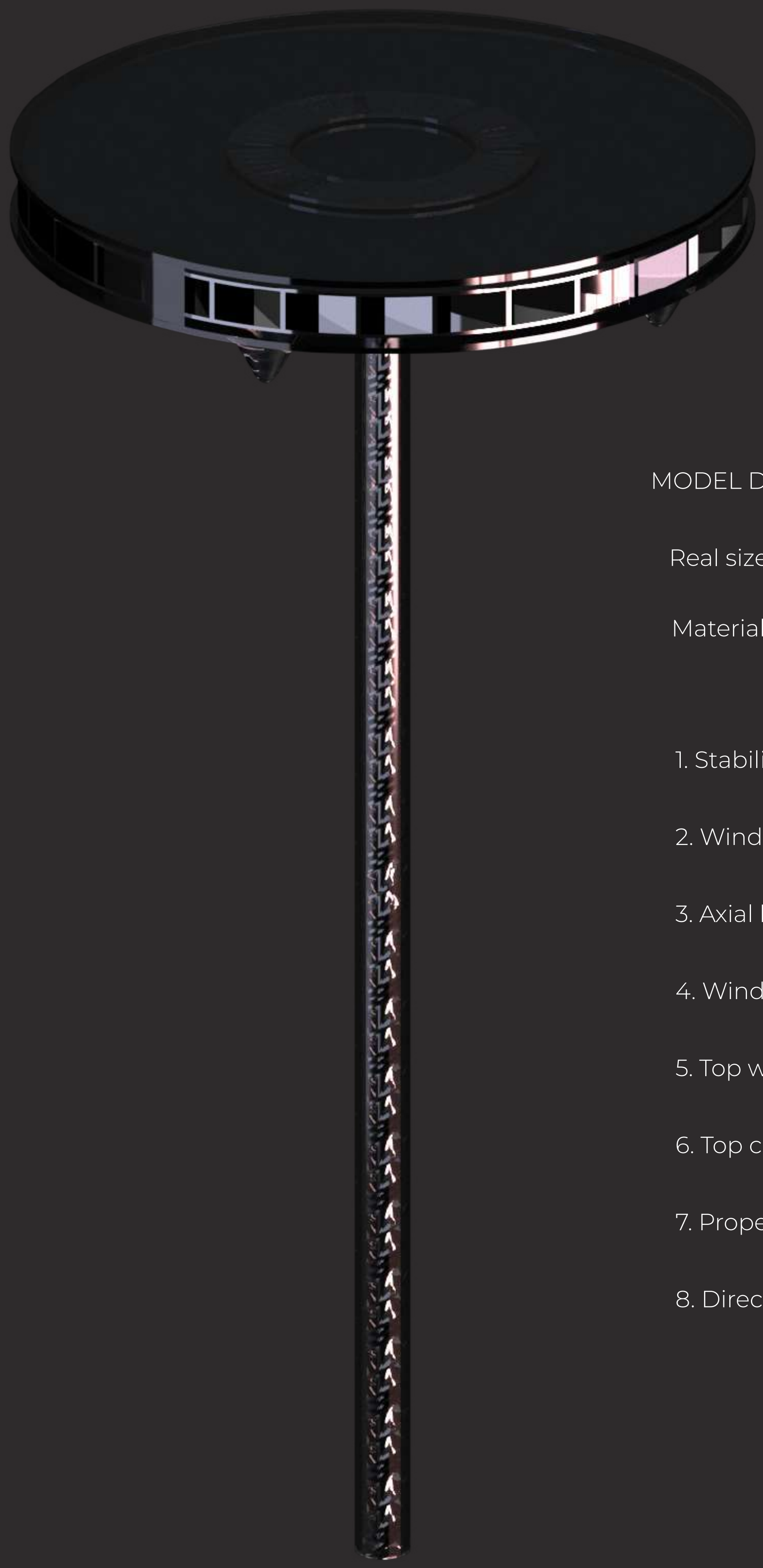
MODEL DEVELOPMENT.

In the second step of the design a drawing is made for a physical model consisting of components that could be bought and built within the span of a few weeks.

The detailing of the drawing is therefore in model scale, meaning that the full size structure might have additional components and alterations to deal with external factors.







MODEL DEVELOPMENT

Real size 20x20x60 m

Material renders 1:400

1. Stabilizers

2. Wind turbine case

3. Axial bearing

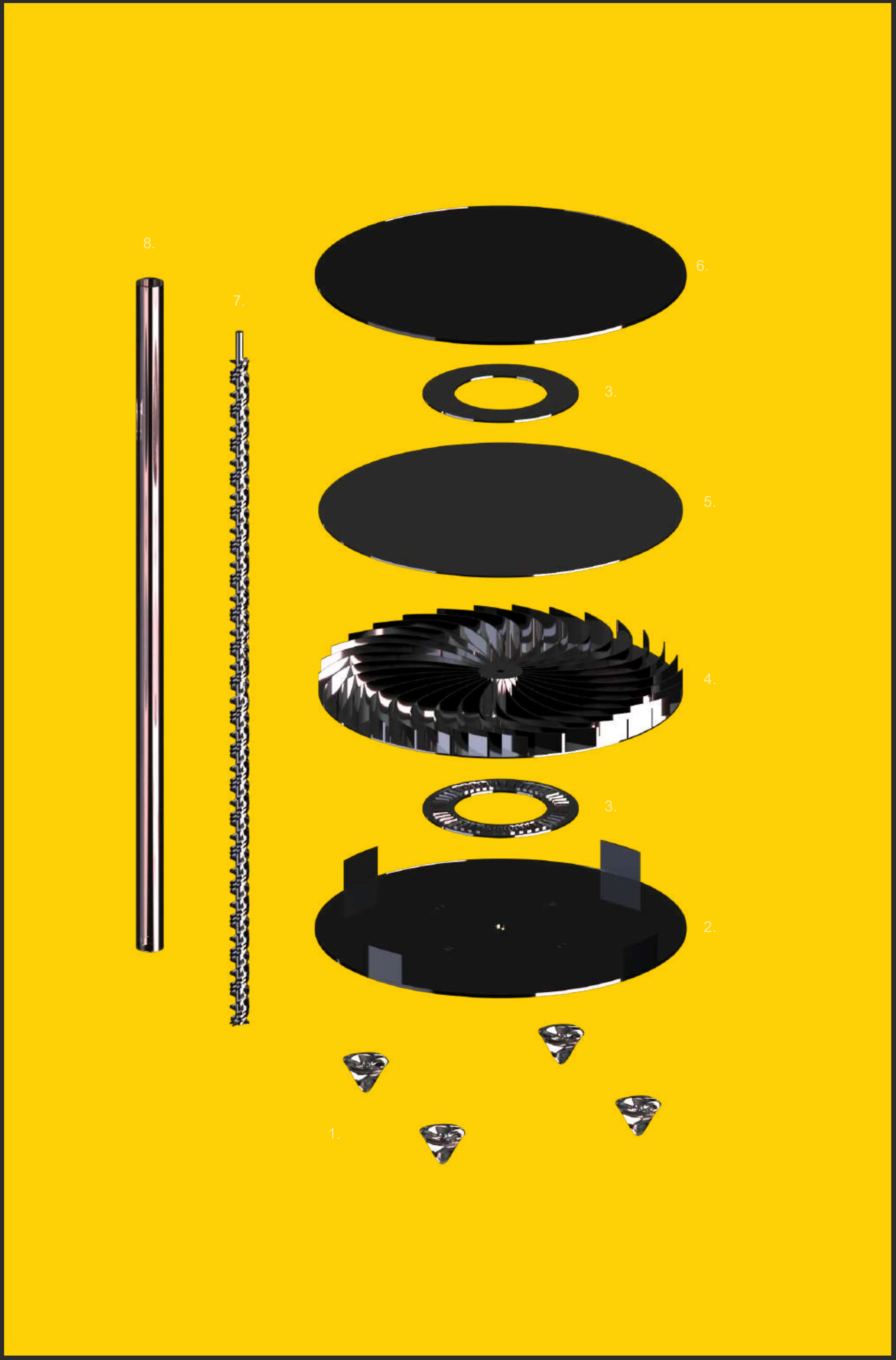
4. Wind turbine

5. Top wind turbine

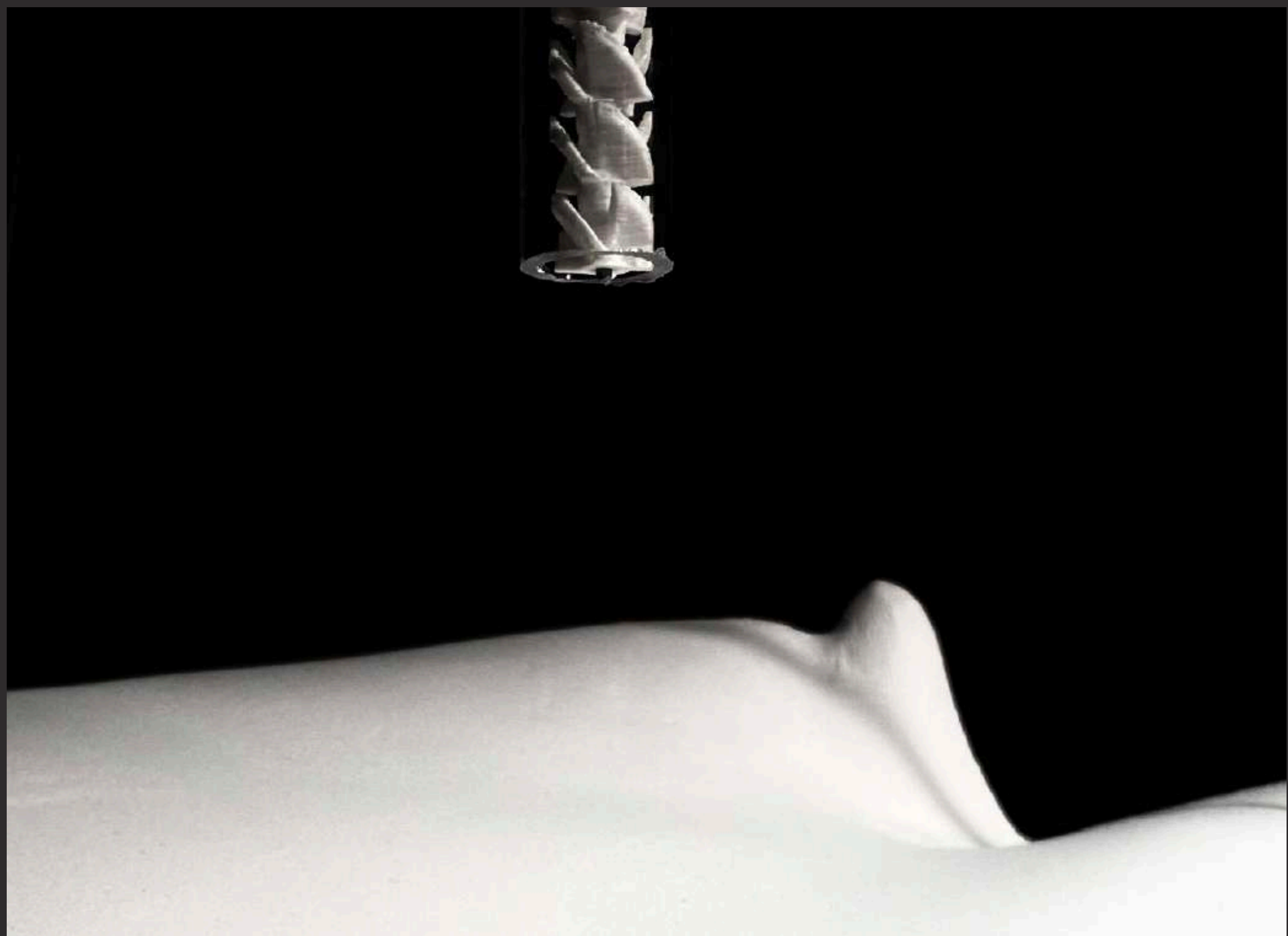
6. Top case

7. Propeller axis

8. Direction pipe



PHOTOS OF PHYSICAL MODEL



Test

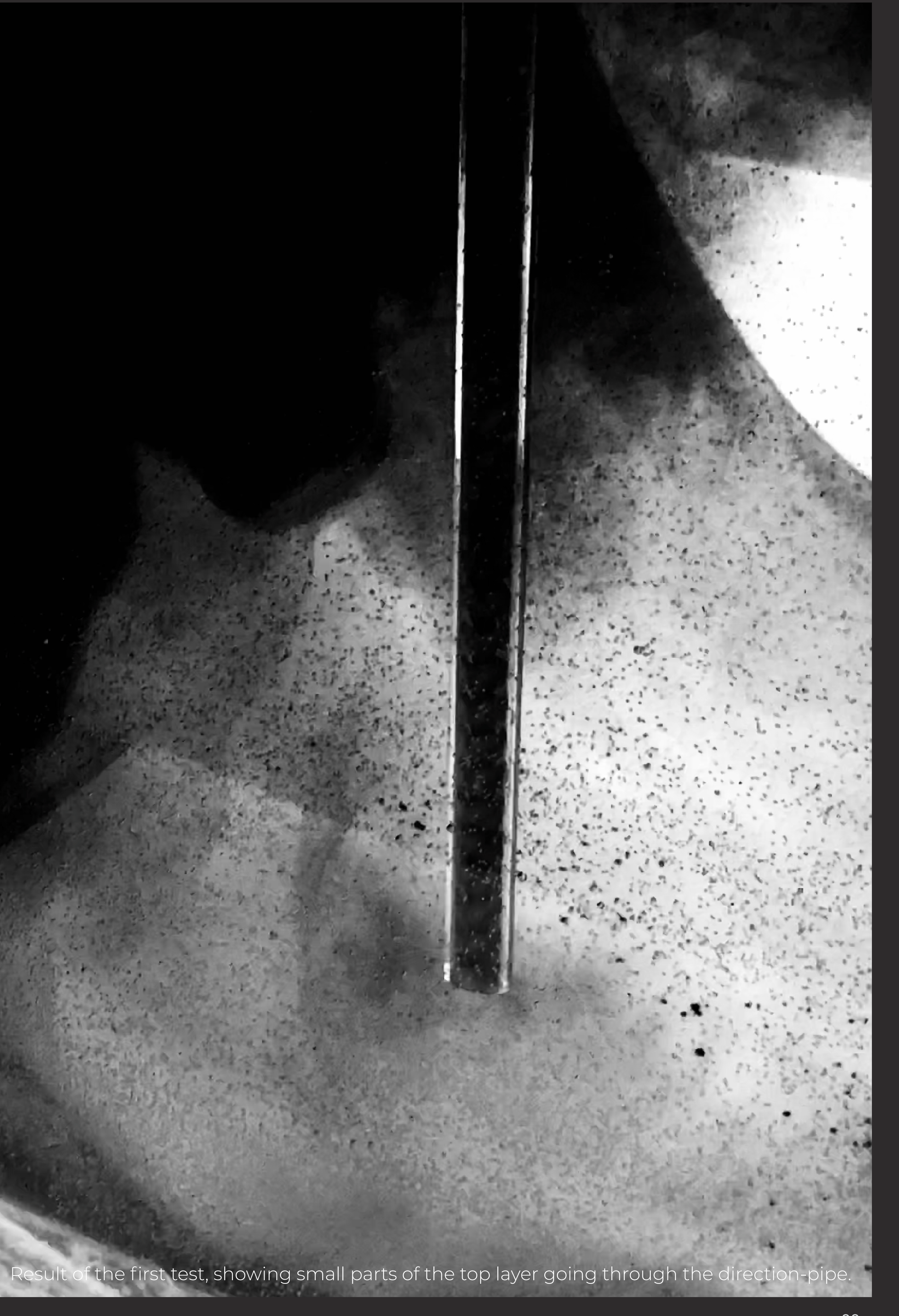
EVALUATE DESIGN PROPOSAL

To end this part of the project I needed to start doing real testing to be able to fully understand what impact the design could have.

Finding space to execute the experiment was not easy, the container I had access to is 70x70x70 cm which means that it will contain enough water to flood the building. Therefore I needed to refit a bathroom where I could direct the water in case of failure. I built new thresholds and covered all electrics so I could work without any present danger.

I used food coloring to layer the water. By heating the water that had pigments into it could I get an "oxygenated" toplayer symbolizing the brackish layer in the baltic sea.

The first experiment was not as successful as I wished. The food coloring used for layering the water was cooled down too quickly because of the large body of water that was used. This led to an even mix in the water and the result was a whisper of what the result could be. It showed that the principle was working but I needed to confirm with further testing.



Result of the first test, showing small parts of the top layer going through the direction-pipe.




FINAL TEST - PHASE 1

Here you can see the final test more clearly. I downsized the scale of the test to better fit the proportions of food coloring and water, as well as maintaining a better temperature of the water. This made it possible to layer the water in a more effective manner. This also made it possible to do the test over and over again. The test was successful and the design had the desired effect of circulating the water as can be seen in the series of pictures above.

INPUT AND CALCULATIONS - PHASE 1

After doing the testing, I was once again in contact with Anders Stigebrandt at Gothenburg University. I sent him the video and result of testing the model together with some questions about how to calculate water mass flow.

Translated e-mail response from Anders Stigebrandt 9/2-22:

”Hello David,

Thanks for the instructive video. To calculate the size of the water flow required for oxygenation, one must know how large the oxygen consumption is in the deep water. An estimate was made in Stigebrandt & Gustafsson (2007) (attached) which showed that the oxygen consumption in the Baltic Proper (Baltic proper) is about 100 kg / s. If the oxygen concentration in the pumped water is 10 g / m3, the required pump flow will be 10,000 m3 / s. The pumped water has a lower density than the deep water. When it is mixed with the deep water, a water is formed that still has a lower density than the deep water, which is why it has buoyancy and rises. In this way, the pumping creates a vertical circulation in the deep water and it is the downward flow induced by the pumping in the entire basin that transports oxygen down to the deep water. The size of the circulation thus depends on how much ambient deep water is mixed into the pumped lighter water.

Hope my answer is understandable. Feel free to contact us with questions / comments.

Best regards, Anders Stigebrandt ”

Continuing the dialogue, I asked for Anders input on the concept of making a wind driven pump in contrast to the pilot BOX-project.

Translated e-mail response from Anders Stigebrandt 11/2-22:

”Hello David,

It seems absolutely sensible to make a wind-driven variant of the pump in the model. An important factor to keep in mind is that the water should have a good speed (a few m / s) when it leaves the pump to achieve a good mixture with the surrounding water. The water should leave the pump horizontally so as not to interact with the bottom.

Looking forward to seeing your wind-powered pump,
greets Anders Stigebrandt ”

DESIGN PHASE 2

THE RESEARCH STATION

A CONTINUOS MONITORING

Research clearly states that a restored seabed will not stay that way forever if we continue to release nutrients in the ocean. Therefore it is necessary to have continous monotoring of the progress. This will be done in a similar way as oil rigs are monitored where workers are stationed at the rig for weeks or moths at the time keeping track of the processes and maintaining the equipment.

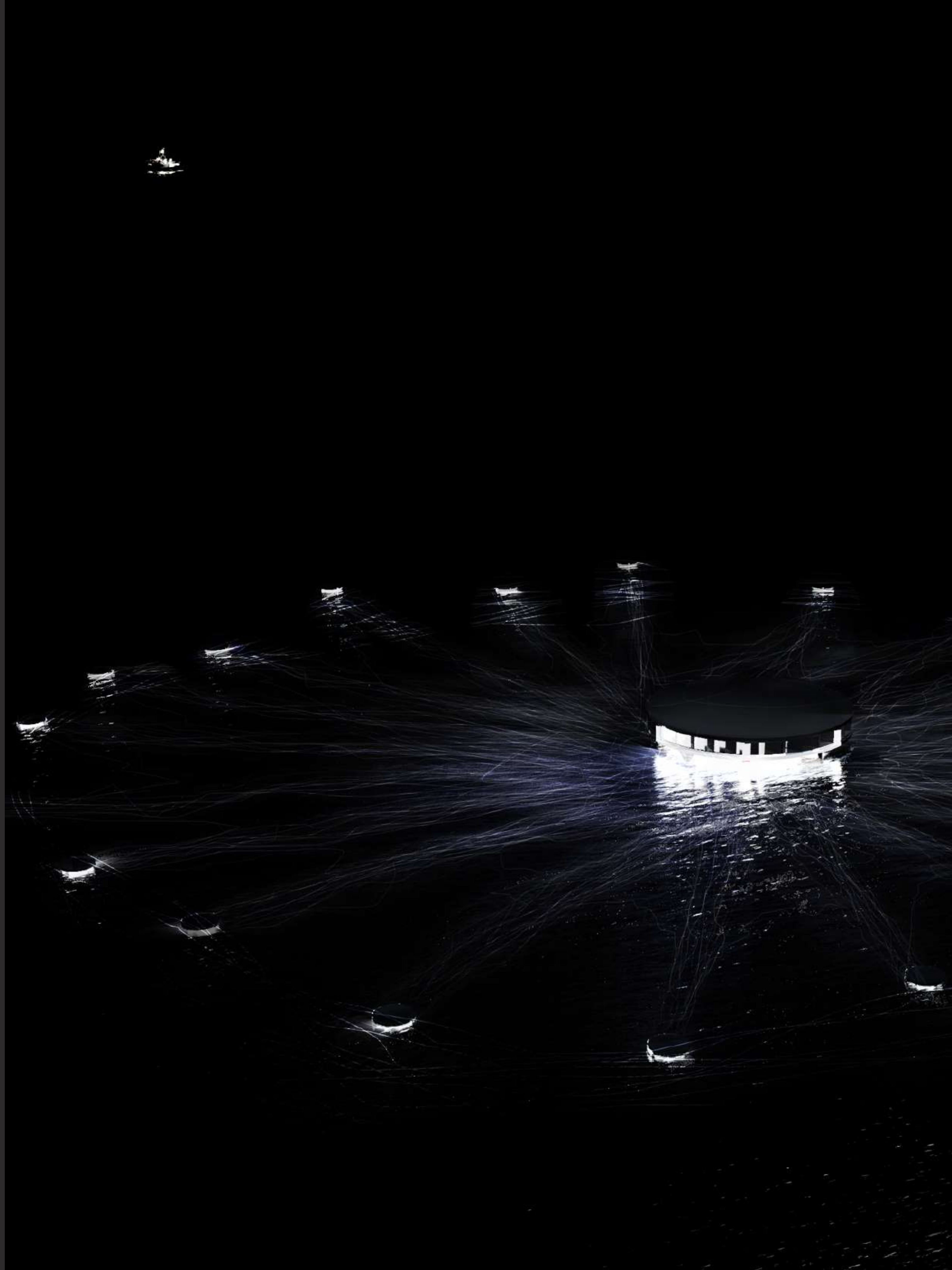
MICROPLASTICS

A large aspect to take into consideration is the amount of micro plastics that the Baltic sea contains. The average amount of microplastic in the baltic sea is 0.3-2.1 particles/m3 (State of the Baltic Sea, 2022). This means that the pumps' circulation filters needs to be cleaned and maintained on a regular basis to secure a good water flow.

To aid with this, a research/service station will be designed. The second design phase will combine research on how it is to live in an isolated environment and how you could design a regenerative system with a positive climate impact.

A HOLLISTIC APPROACH

The final project will not be one solitary design but rather a system for how to acess the issue of dying seabeds. Through a combination of hands-on technical solutions and a new way of living to prevent future contamination of the sea, the problem is attacked from both ends in an attempt to awaken thoughts and new ideas for the future.



Concept picture of circulation system and research station

David Holst

SUSTAINABILITY
GOALS

"The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future."

(United Nations, 2022).

In 2015, the UN General Assembly agreed on the Agenda 2030 with the aim to achieve a socially, environmentally and economically sustainable development worldwide by 2030 (United Nations, 2022).

The building sector alone currently stands for almost 40% of the world´s energy-related CO2-emissions (UNEP, 2020). Architects therefore play a significantly large role in the strive for sustainable development and we need to work conciously with the UN goals in all our projects to contribute to a better future.

The illustrations to the right show a selection of the UN goals that has been touched upon in this design project.

(United Nations, n.d.)

REFERENCE PROJECT

REFERENCE:
REGEN VILLAGES

Architects: EFFEKT
Year: 2016-on going
Location: Almere, The Netherlands

(EFFEKT Architects, 2016)

ANALYZING
THE CLOSED SYSTEM

One of the case studies I have looked into is the ReGen villages project by the danish architecture firm EFFEKT. The project has an ambitious and hollistic approach to sustainability and tackles a wide range of global sustainability issues.

"ReGen stands for regenerative, where the outputs of one system are the inputs of another"
(EFFEKT Architects, 2016).

The regenerative system is the idea of an environmental loop, where everything that goes into the system is being taken care of an re-used. The crops feed the fish - the fish residue feeds the plants - the plants feed the people - the rest products from are composted - back to the earth and so on (EFFEKT Architects, 2016).

One of the problems with conventional architecture is the one way energy system that goes into it (Holl, 2020). If you don't over-consume you can have a balanced circuit that will go on and on, growing stronger and more versatile with time (EFFEKT Architects, 2016).

The principle is simple, this is the way humans have lived for a long time, but somewhere along the way we lost track of the simple way of living and started to distance ourselves from the production of food.

38 % of the earth surface is farmland areas in which we have managed to clear out the natural fauna, plants and trees capable of storing CO2. We therefore need to find ways of preserving the still “unbuilt” areas, yet still handle the growing populations and demand for food. To meet these demands we will need solutions where food can be produced locally instead of transported halfway aorund the earth (Land use in agriculture by the numbers, 2020).

The regenerative system might not be the solution to the full current building stock due to the amount of space needed to make the system operational, however it is something to learn from and strive for in the extent possible if we want to reach a more responsible consumption and production globally.

REFERENCE:
HALLEY VI

Architects: Hugh Broughton Architects
Year: 2013
Location: Antarctica

(Hugh Broughton Architects, 2015)

ANALYZING
THE ISOLATED LIVING SITUATION

This project is the sixth in the British Halley series of research stations in Antarctica. In 2006 a competition was held to construct a research station in Antarctica where the architects from Hugh Broughton Architects won. The construction should not only be capable of enduring the extreme weather through architectural inventions, but more importantly house living in a remote site (Slavid, 2015).

Living in an isolated environment has its challenges and there are specific issues that need to be addressed. From the practical matter of resources to the psychological ones (Vannini and Taggart, 2015).

In a webinar held by Ruth Slavid, author of "Ice Station" (a book about Halley VI research station on Antarctica) and Hugh Broughton, the architect behind the station, they talk about the importance of belonging.

Especially when living in a such exposed and closed off environment the presence you feel from your colleges becomes highly important (Broughton,n.d.).

This aspect has been important throughout the design of the thesis project. Placing a large focus on creating a social floorplan that work to enhance the experienced precence of others and enable social interaction while still offering secluded spaces and privacy.

PROGRAM

What are the basic needs for a family of 3 / year?

TOTAL AREA: 639 M²

This program by EFFEKT architects shows the amount of space needed to provide for a family of 3 people. In the first iteration of the design proposal this was multiplied by 6, to create possibilities for 18 workers to live at the platform at the same time. When doing that iteration I felt that the possibilities to create a flexible and dynamic environment were limited. Therefore I chose to take steps away from the program. adding space where it was needed to open up for a more flexible living environment.

HOME	GREENHOUSE	AQUAPONIC	SEASONAL GARDEN	LIVESTOCK	SOLAR CELLS	WATER STORAGE
AREA: 120M2	AREA: 40M2	AREA: 300M2	AREA: 100M2	AREA: 25M2	AREA: 34M2	AREA: 20M2

PROGRAM EDIT - ITERATION 1

Basic needs for 16 people

TOTAL AREA: 4134M2

HOME	GREENHOUSE	AQUAPONIC	SEASONAL GARDEN	LIVESTOCK	SOLAR CELLS	WATER STORAGE
AREA: 720M2	AREA: 240M2	AREA: 1800M2	AREA: 600M2	AREA: 450M2	AREA: 204M2	AREA: 120M2


Renders - vision - iteration 1


Renders - vision - iteration 1

ITERATION 1
PROGRAM SKETCH

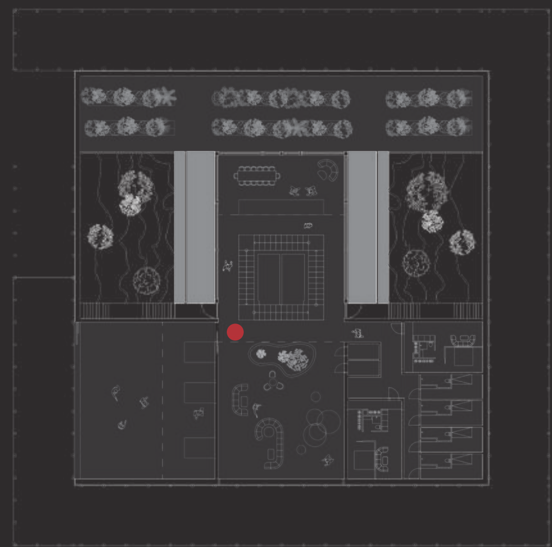
After studying reference projects and combining these with UN climate goals, the process of designing the research station began. A translation of what's been discovered during the case study was made in the first iteration.

The result of this exercise was really helpful. The size of the program needed was discovered and an atmosphere started to appear.

The Halley VI reference were of an engineer nature which became visible in this iteration. It focuses a lot on functionality and tends to steer the architecture towards a holding facility with only necessities, meaning that the architecture is pushed to the side by the realism of the built reference.

Going forward with the coming iteration the architecture should be in focus, how can flexibility and soft values be added to a very strict and rigid structure. Instead of a direct translation of the previous program a version will be made that is more free to interpret, letting a more conceptual architecture take place.

PLAN 4 - iteration 1



PLAN 5 - iteration 1

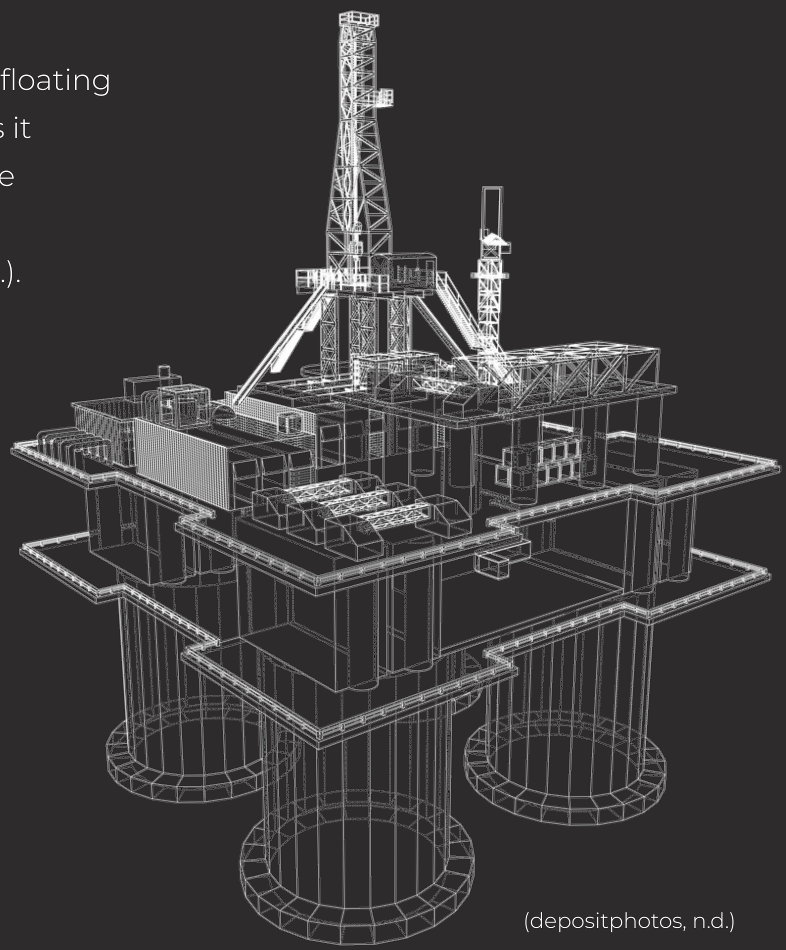
BUILD ON
WATER

To be able to design on the open sea, studies need to be made on structures that have tackled the difficulties before. The chosen object of reference is the oil rig partly because of the paradox and the similarities the thesis will have with this industry but as a complete opposite. Instead of taking natural resources the design proposal will give back to nature. Its very being has a focus on working for nature.

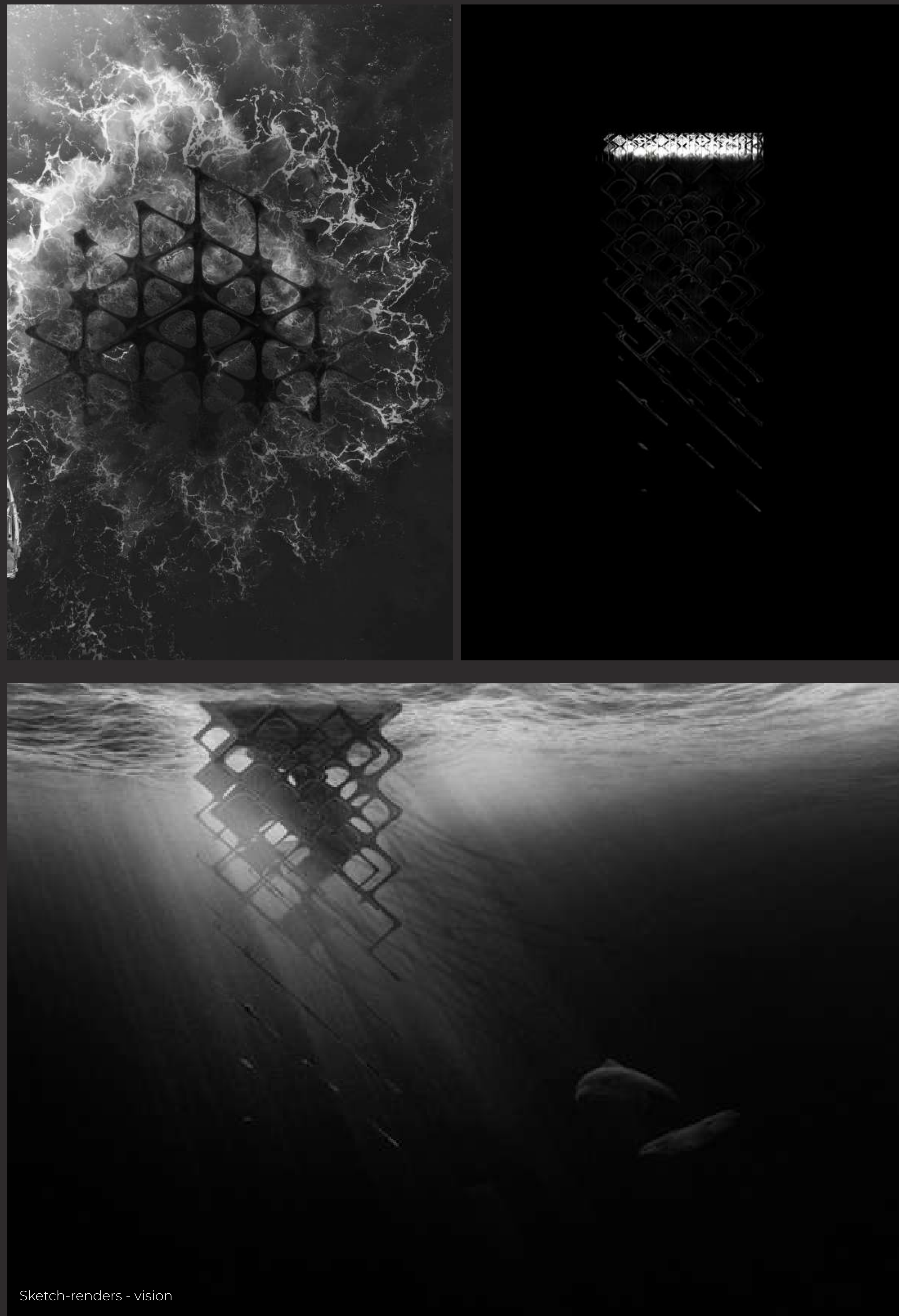
The type of oil rig that acts as a structure reference is the semisubmersible type that is floating on large protones. This makes it possible to move the structure once the job is done (How Do Semisubmersibles Work?, n.d.).

The same principles are used but with variations suiting the program for the research station.

For the next iteration of the project, I chose to implement the protone structure and use it as an element in the design. Combining the practical functions of floating and stabilizing the platform as well as making up the internal structure of the floorplans.



(depositphotos, n.d.)

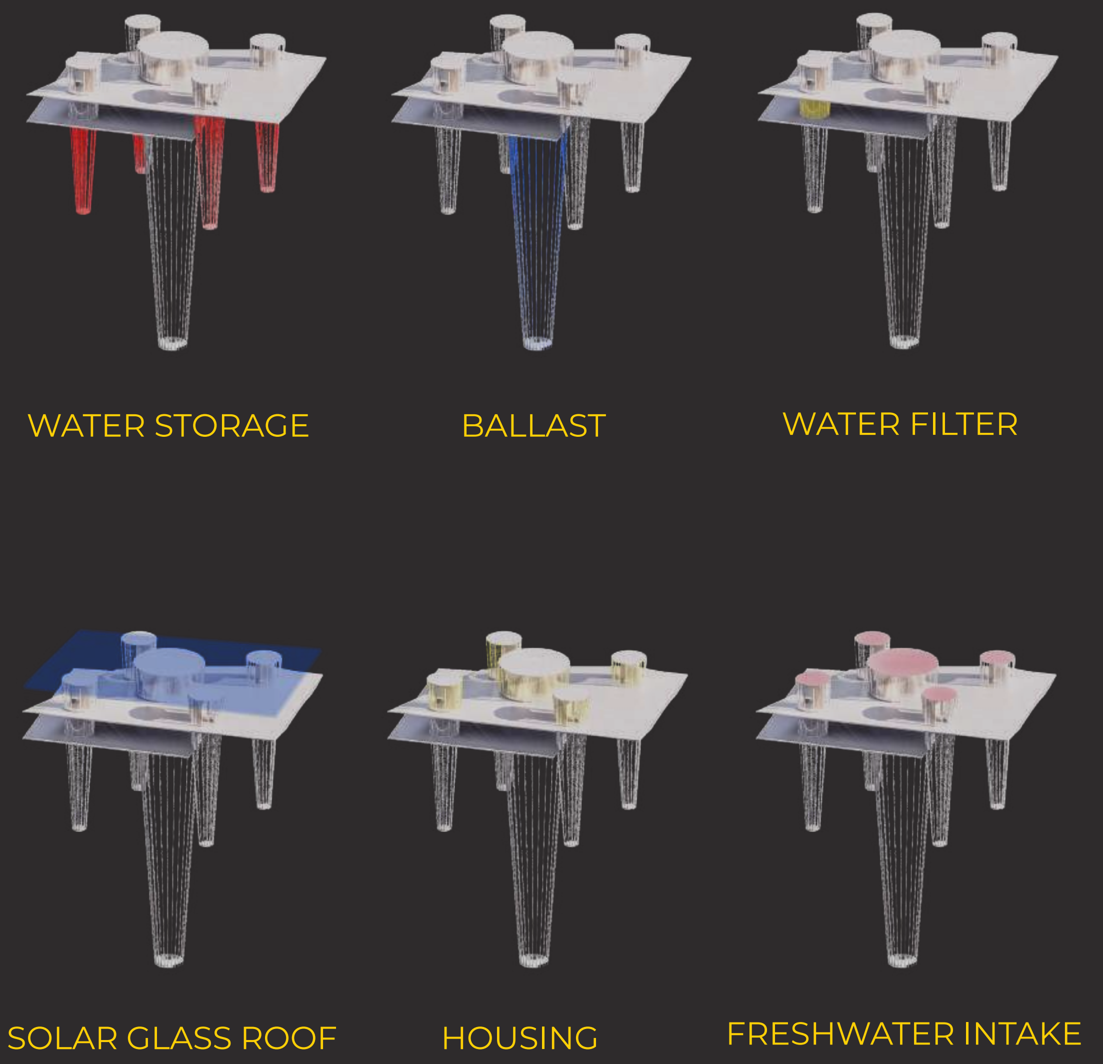


Sketch-renders - vision

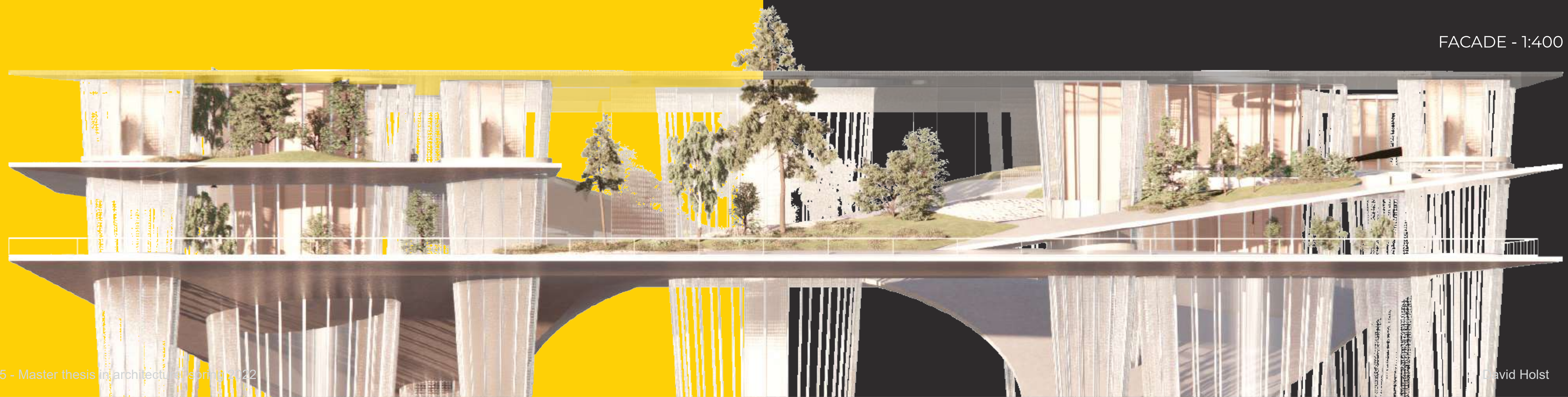
PRINCIPLES OF **STRUCTURE**

The aim for the structure is that it should be so much more than engineering. In the design the structure becomes the architecture and technique where the slabs lightly balance on the thin steel, lifting the platform out of the ocean. The rooms are directly defined by the load bearing structure and their properties exist in correlation with the technical aspects.

The diagram on the right gives an indication on where the different aspects of the structure are located.



FACADE - 1:400



PERSPECTIVE

APPROACHING THE STATION

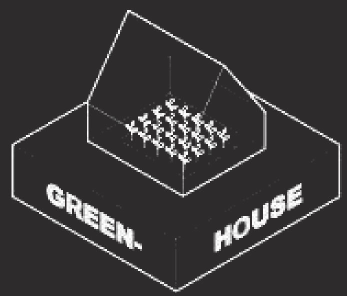
Facing the research station on the open sea. The vertical structures house all functions on the vessel, from keeping it afloat to collect, filter and distribute the water in between the floors. Ventilation and the load bearing layer is also integrated in the steel construction.

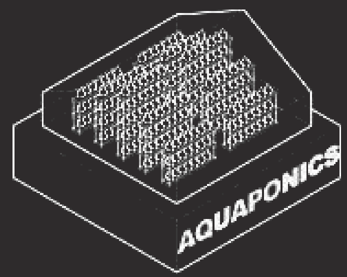
PROGRAM EDIT - SUMMER SEASON

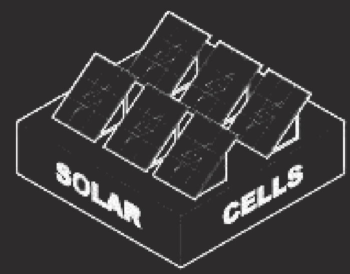
Basic needs for 16 people

TOTAL AREA: 4660M2

Due to circumstances of the research station and the living situations where the workers will live shorter periods around one week there are some aspects that differ from the original program.
One example is housing. In the first program the surfaces are planned after the general home, long term. therefore the surfaces are bigger. The gardening areas expand over the limit of the first program. This is because space is needed for exercise and so on, which otherwise would be conducted in an area outside of the program.







HOME
AREA:
600M2

The area shrinks from the original program due to the shorter periods you stay at the platform.

GREENHOUSE
AREA:
1000M2 + 1000 EXPANSION AREA

The garden areas increase, the garden acts as both outdoor living areas and space for exercise. By exceeding the program here was it possible to add more flexibility in the housing plan.

AQUAPONIC
AREA:
160M2

Due to the amount of outdoor gardening area I needed, the amount of aquaponic area did decrease. This area is mostly for fish and the excess from this production is used in the garden.

SEASONAL GARDEN
AREA:
1500M2

This part of the garden is located alongside the edge of the platform and is only in use during the summer and spring seasons. As in previous information about gardening also this square meters increase.

SOLAR CELLS
AREA:
200M2

The solar cells follow the original program. They are integrated into the glass roof that covers the indoor area which is fully weather control. The cells act as sun protection in the summer months.

WATER STORAGE
AREA:
200M2

Water storage will increase. The need for water will follow the amount of garden space.

PERSPECTIVE - BIRDS EYE VIEW

SYSTEM OF CIRCULATION & RESEARCH STATION

This is how the full system will look from the sky where the larger structure is the research station and the many smaller volumes are the circulation pumps passing though the station for cleaning and maintenance. Depending on the size of the area that needs to be circulated the amount on pumps will change.

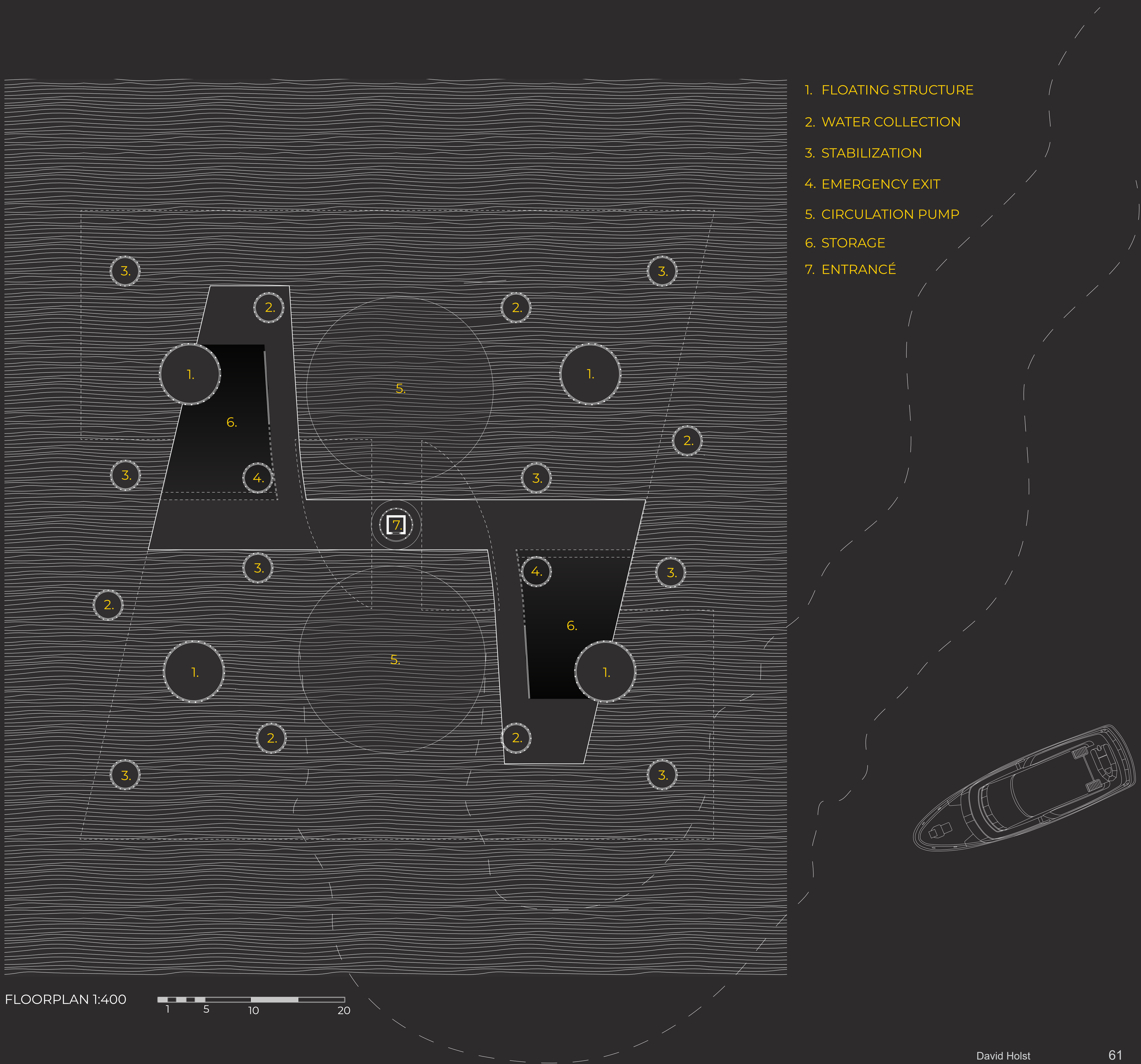
FLOORPLANS

FLOOR 1: MAINTAINANCE

The entrance floor is located alongside the water. The floating/ water protones combined with the platform makes a sheltered harbor where the maintenance will take place during the summer months when the weather is more predictable

You can dock two circulation pumps to the platform at a time to do necessary work of ensuring a sustained flow as well as cleaning the filters from ocean plastics that get collected in the process.

On this floor you can also find the structures that keep the platform floating, stabilized and collects water for the closed system.



FLOORPLAN 1:400

1. FLOATING STRUCTURE
2. WATER COLLECTION
3. STABILIZATION
4. EMERGENCY EXIT
5. CIRCULATION PUMP
6. STORAGE
7. ENTRANCÉ

PERSPECTIVE

HARBOUR

When you have arrived at the station you enter underneath the thin slabs where you find the harbor. Here most of the maintenance of the circulation pumps are made. Also the storage for collected ocean plastic is located here. It is stored and shipped back to the mainland with the next transport back.

FLOORPLANS

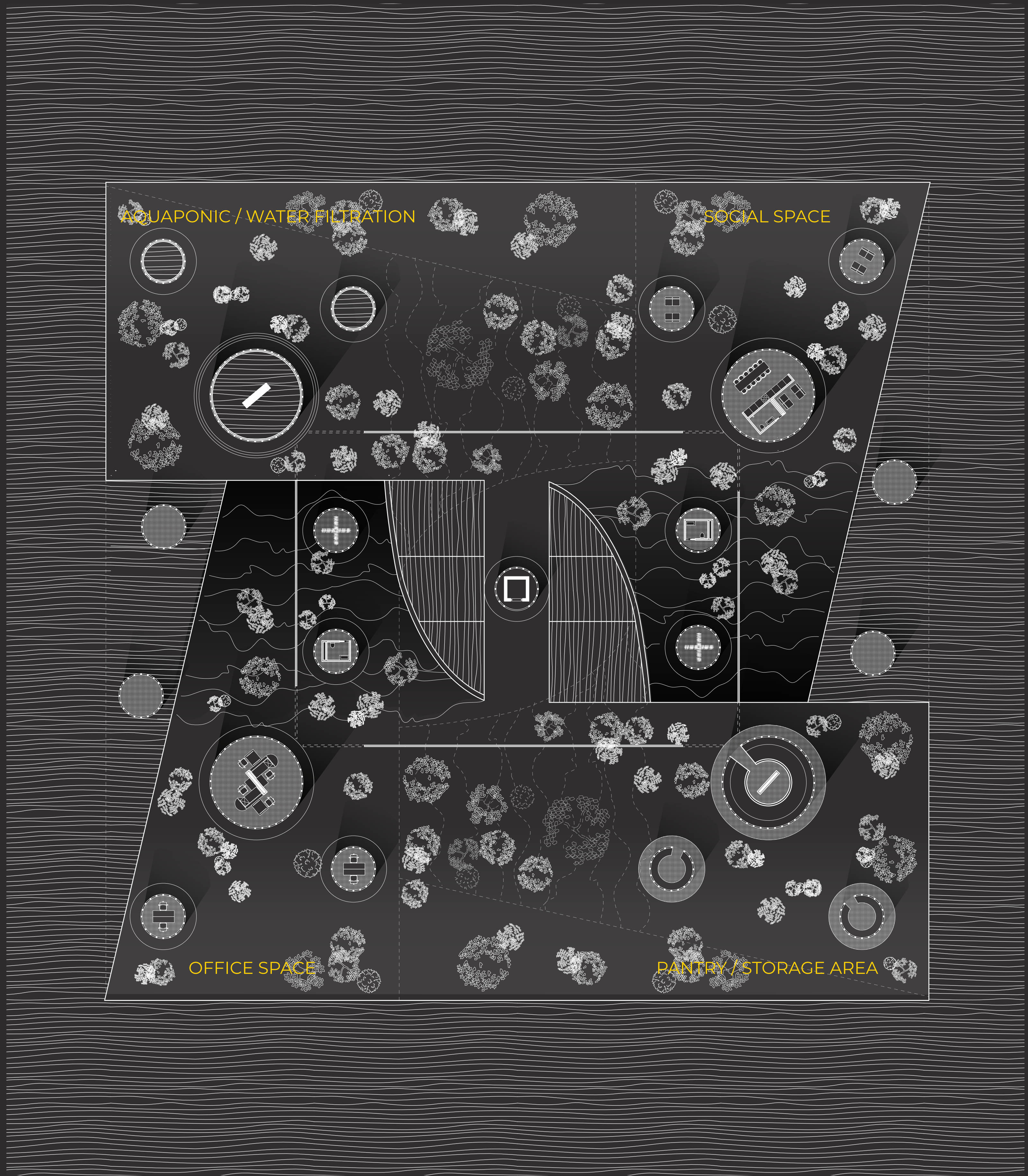
FLOOR 2: FUNCTIONS

This floor contains the main functions for the closed system to work. Here the social active spaces are mixed together with innovative farming solutions, food production and water storage in a dynamic environment.

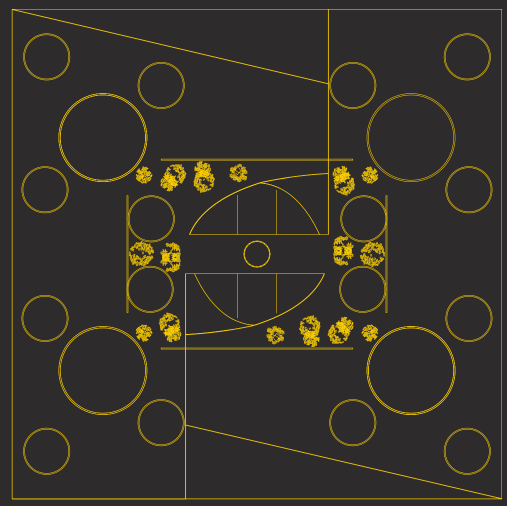
The social areas features a shared kitchen and dining area to promote social interaction and stimulation multiple times during the day.

The layout is adaptable and changes with the seasons and current needs. When the occupancy is higher, especially during the summers, the food production is allowed a larger part of the area to support the increased ammount of residents with locally produced food.

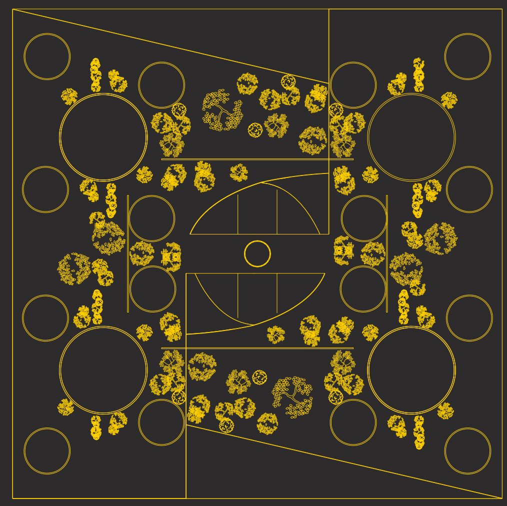
During the lower occupancy periods, the food production is limited and the summer season's crops are instead stored in a pantry over winter.



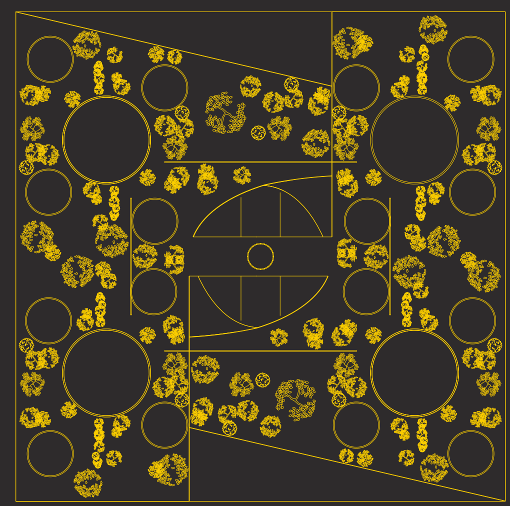
FLOORPLAN 1:400



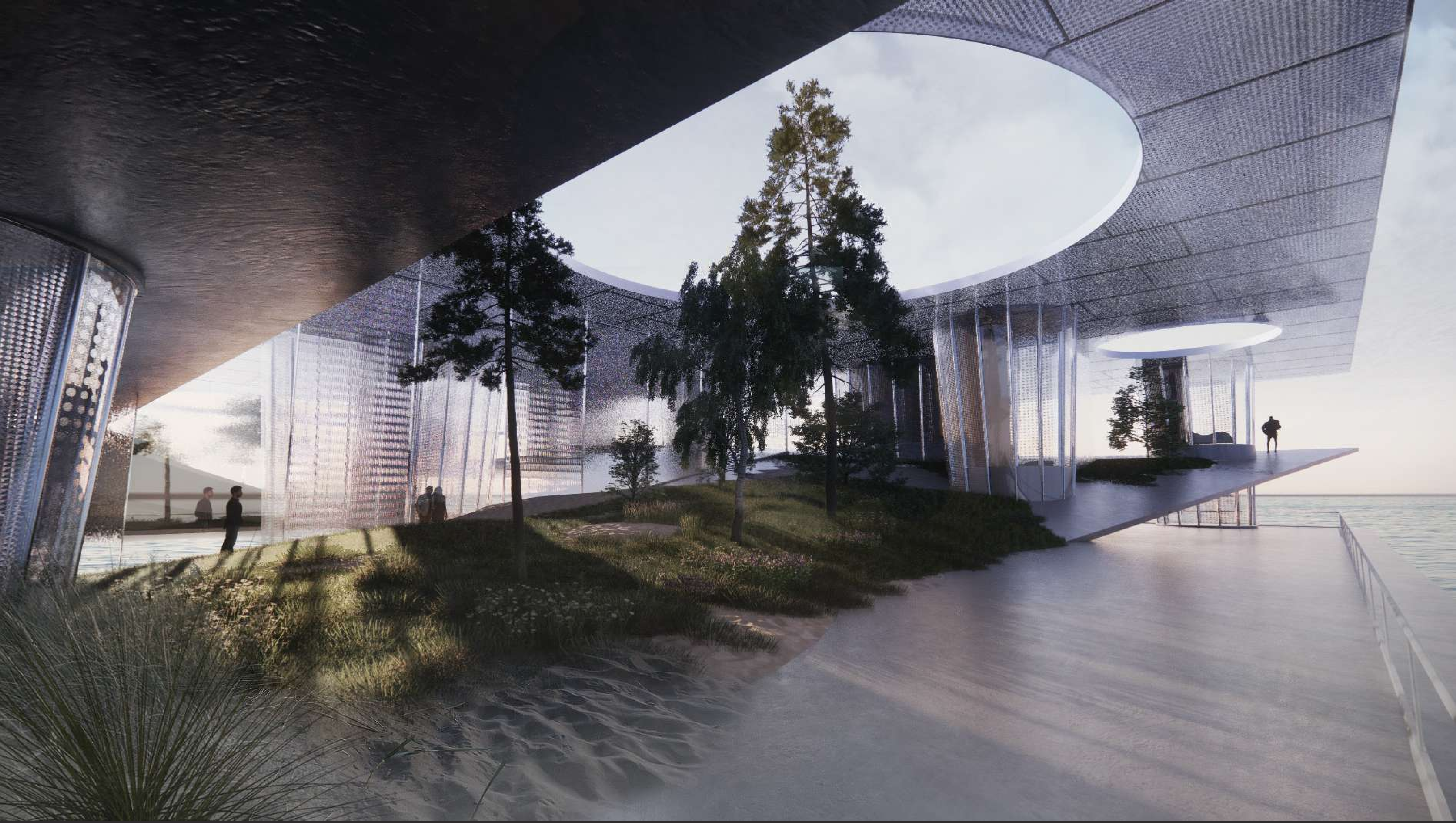
WINTER



SPRING



SUMMER



PERSPECTIVE

OUTDOOR LIVING AREA

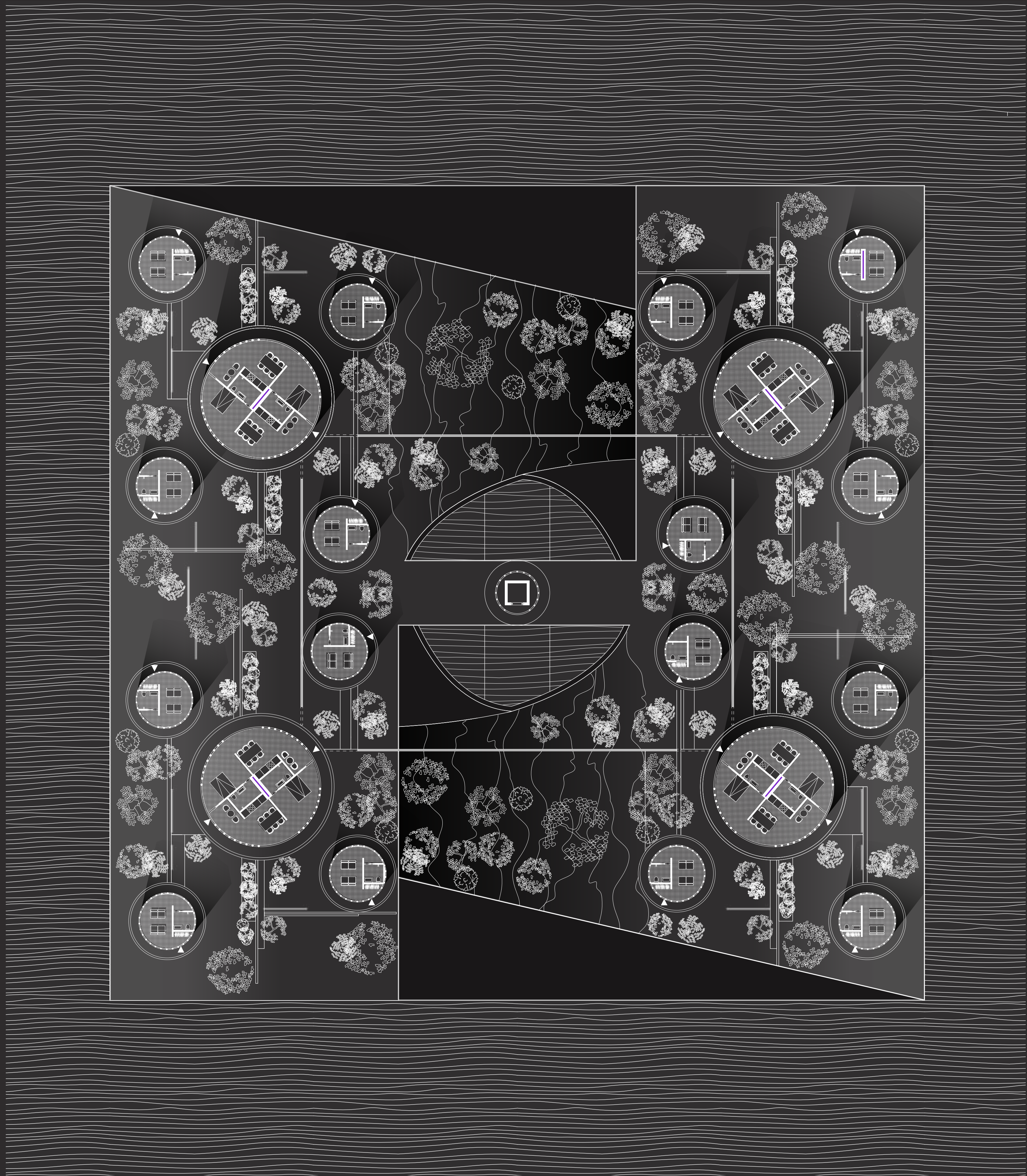
SUMMER

When summer is approaching the internal core of the research station starts to bloom and life on the station starts to expand. The crew doubled in size so now the full area of the plan will be used. Green spaces which house agriculture also generate semi private living areas outside the private rooms making it possible to either hang out in bigger groups or find a private area where you can connect with people back on the mainland.

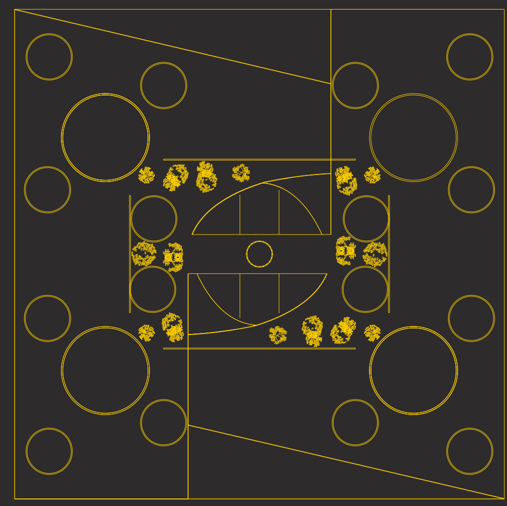
FLOOR 3: HOUSING

The housing floor contains the top of the structural cones that supply the station and creates the boundaries for the rooms. The slabs have 4 large modules and 16 smaller structures. Each one of the larger modules have possession over 4 smaller ones that could be divided in any way that the employees that live on it choose.

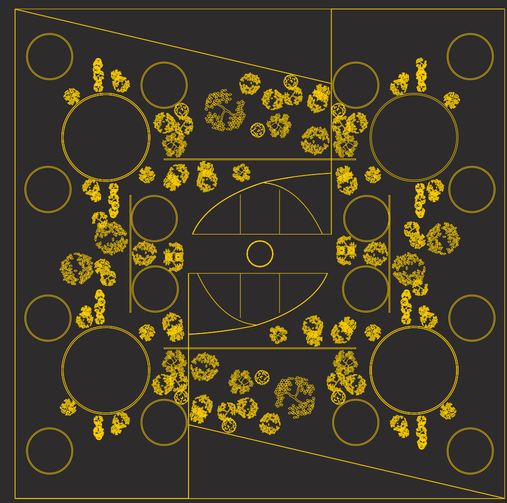
As the summer passes and the crew count starts to decrease, several of the living quarters are left empty, making it possible to winter store plants and crops that have been harvested in the late summer, enough to live through the coming winter.



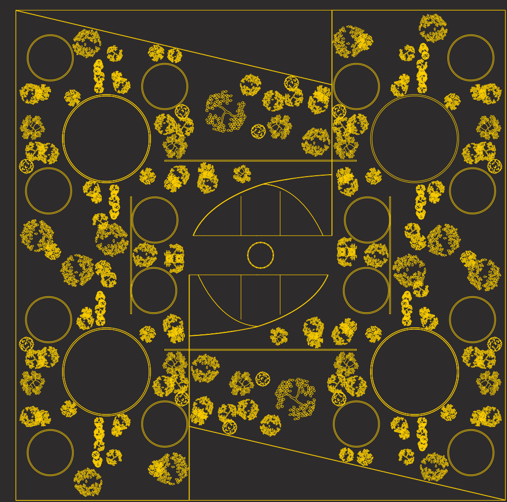
FLOORPLAN 1:400



WINTER



SPRING

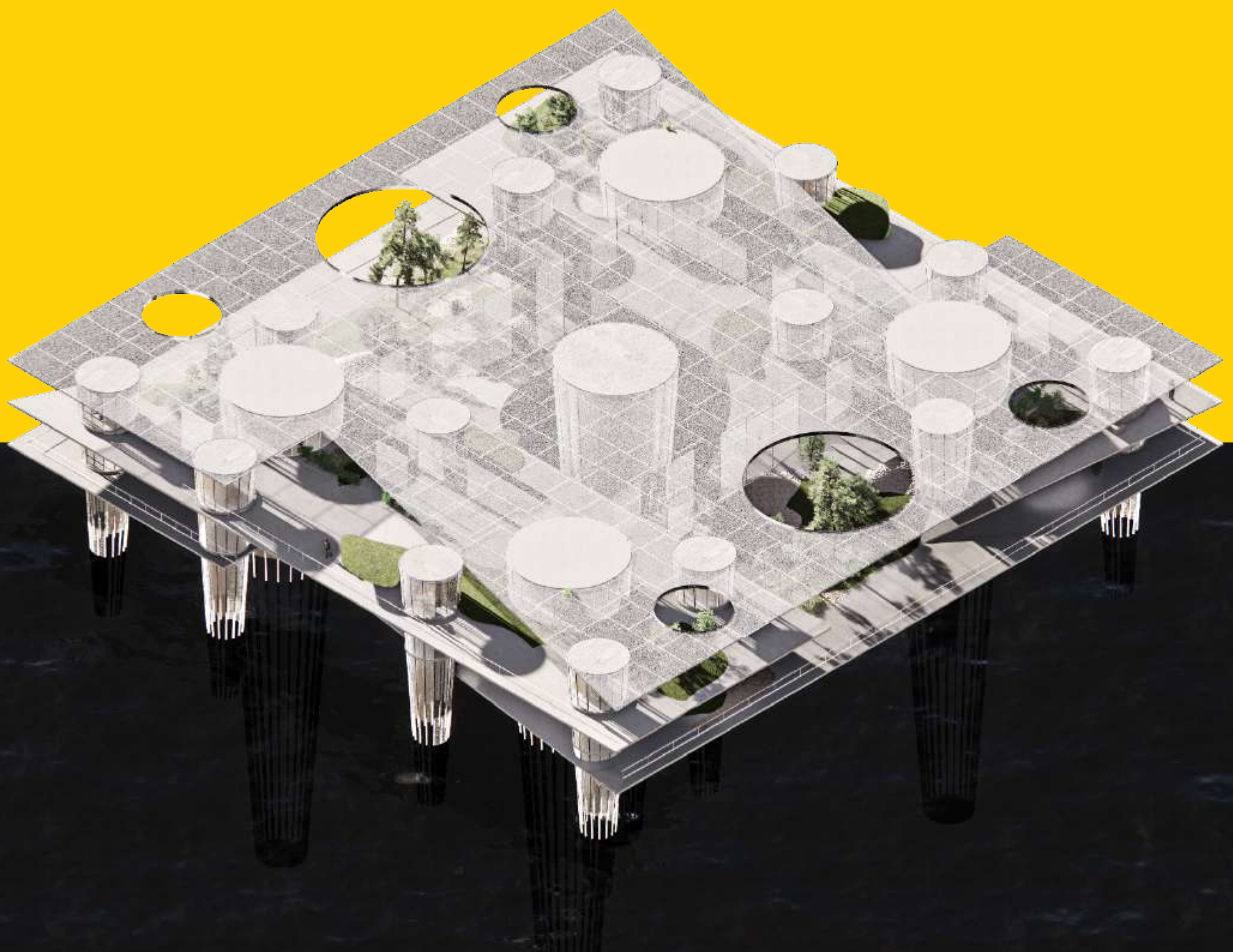


SUMMER

A PLAN FOR THE
NORDIC YEAR

The previously shown reference project of the research station in Antarctica, houses a static flexibility, meaning that when the work crew expands during the summer season they live on the same space as they would during the winter, using bunkbeds in each room (Broughton,n.d.). This translates to breached private spheres and more shared facilities. During a full season you don't have the possibility of going to private areas after a full day of work.

In the design proposal shown in this thesis the design has its base in a growing flexibility where the structure grows with the season and the demand of space. To the right, a few examples are shown on how that flexibility could look.



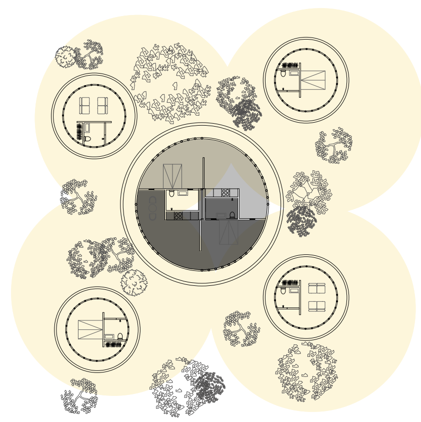
AXONOMETRIC VIEW

EXAMPLES

An important feature of the floorplans is that they should be capable of handling a different occupancy rate during the year. Creating different types of residential qualities throughout the seasons.

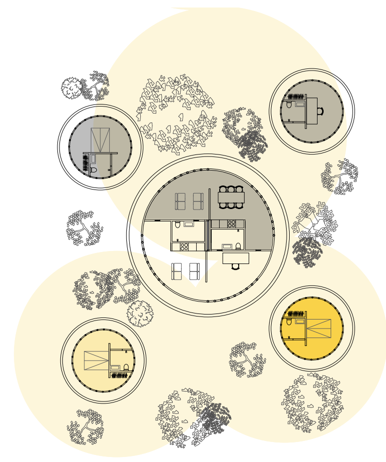
1 WINTER **2 PEOPLE**

In the low season the area that is suitable for living decrease to save energy. Here 2 people share the big pod with the possibility to close off and ensure your own private space.



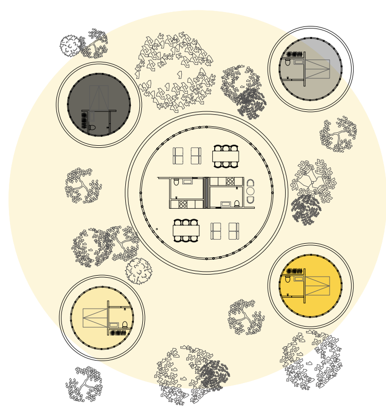
2 SPRING **3 PEOPLE**

More employees start to move in and the larger living areas starts to be divided between the workers



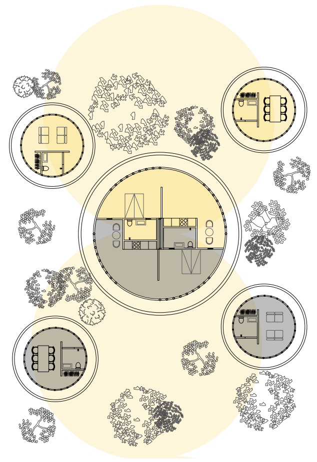
3 SUMMER **4 PEOPLE**

The maximum number of full time workers are on board and the housing is move into the smalers pods while the social functions are kept in the center pod.



4 AUTUMN **2 PEOPLE**

The amount of people decreases, which opens up for use of more area/ person. The pods can be furnished into larger private areas.

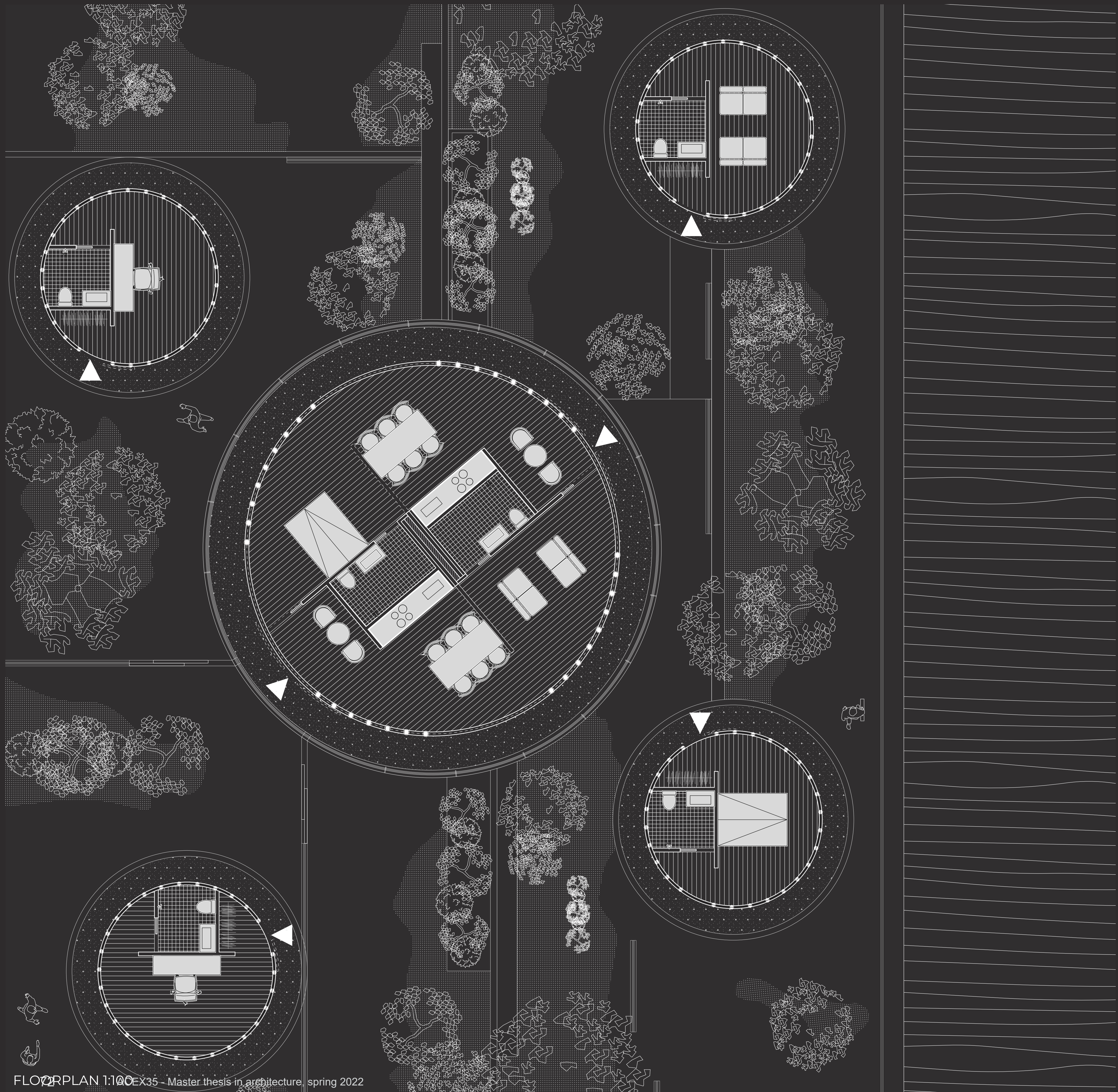


ZOOM OF HOUSING PLAN

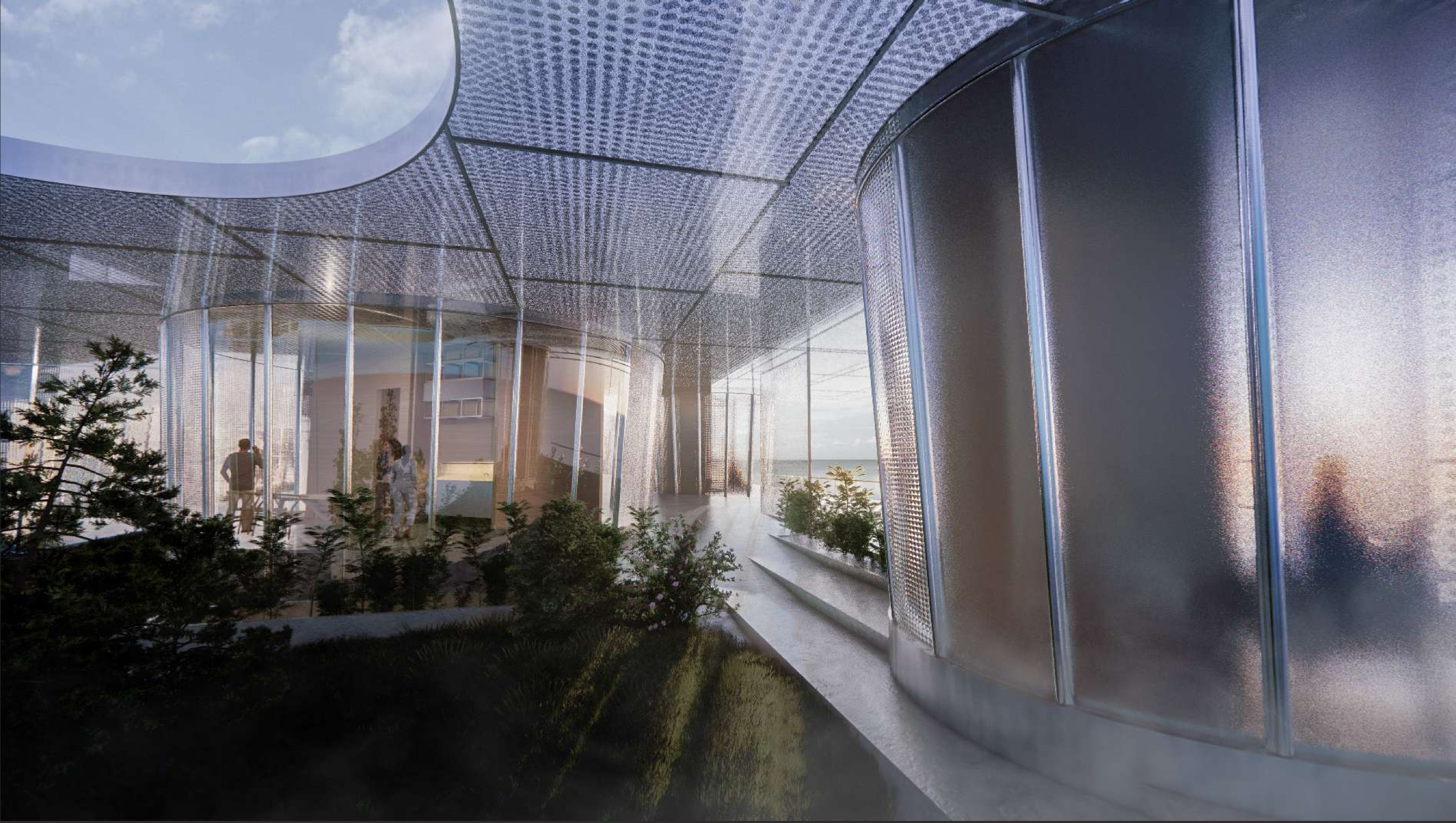
The plan is based around the bigger center pods. The area of these are 80 sqm each. They are in winter divided into two apartments. During this period a sliding door is used to divide the apartments to be able to create separate sleeping and living areas.

When summer arrives and more people move in, dividing walls are pushed into the core that contains bathrooms and kitchen and the floor plan opens up.

Depending on the preferences of the employees, the furniture of the smaller pods could be altered to suit living rooms, offices or bedrooms in the 17 sqm circular rooms.



FLOORPLAN 1:100



PERSPECTIVE
LIVING DIVISION
SUMMER

During the summer when all space is claimed it is of importance that there is possibility for a private space for contemplation by yourself. This is made possible by rotating the rooms into blind spots and constructing garden areas in between the pods that can be used as outdoor living areas as well as distance between the pods. In the Halley VI research station they talk about the importance of the presence of your colleges. In this example you have that but you also have the possibility to be on your own if you wish.

PERSPECTIVE
LIVINGROOM
AUTUMN

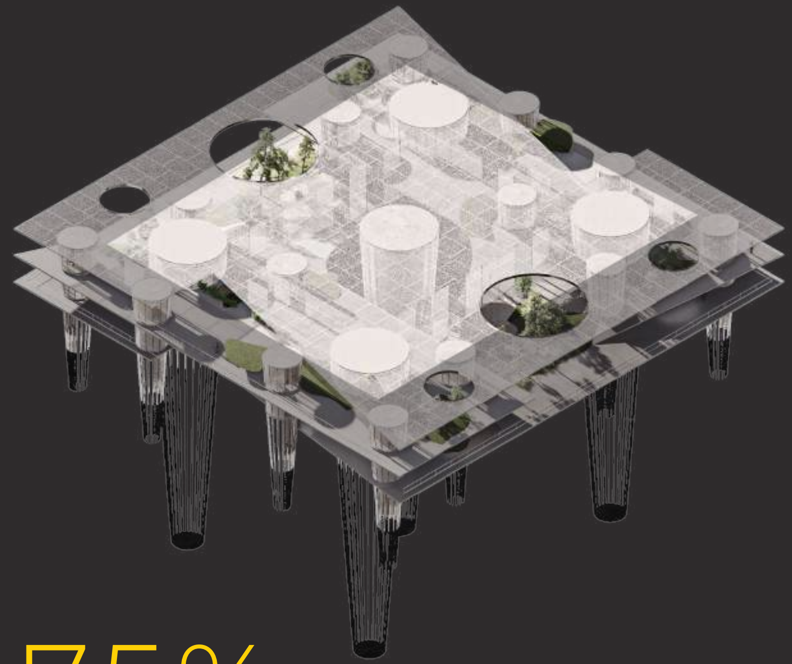
These are the bigger living area modules. In the summer the space is entirely a social space with a kitchen, dining and living room area that is shared with 4 living modules. On the platform there are 4 of those modules. In the winter these spaces transform into 2 apartments of 45sqm each with additional private spaces in the fully heated core of the research station. The pods can be altered over the season depending on the amount of people living out there or if you have other preferences.

50%

WINTER

AREA USE

In the winter the platform is optimized for a staff of 8 full time workers at a time. The area used is located near 50 % of the floor area. This space is sheltered at all times making it possible to continue to grow crops during the harsh winter period. By zoning the floor-plans according to seasons, energy can be saved on space that is not needed at this point.

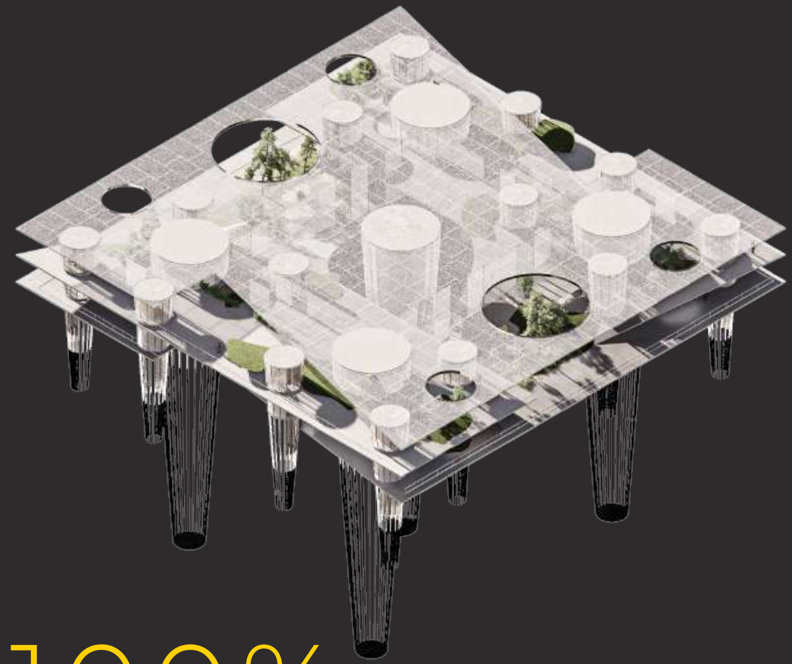


75%

SPRING

AREA USE

When spring arrives additional areas are added. This is an in-between zone that is partly protected from the weather where the outside farming takes place and living areas can start to move outside while the crew start to grow.

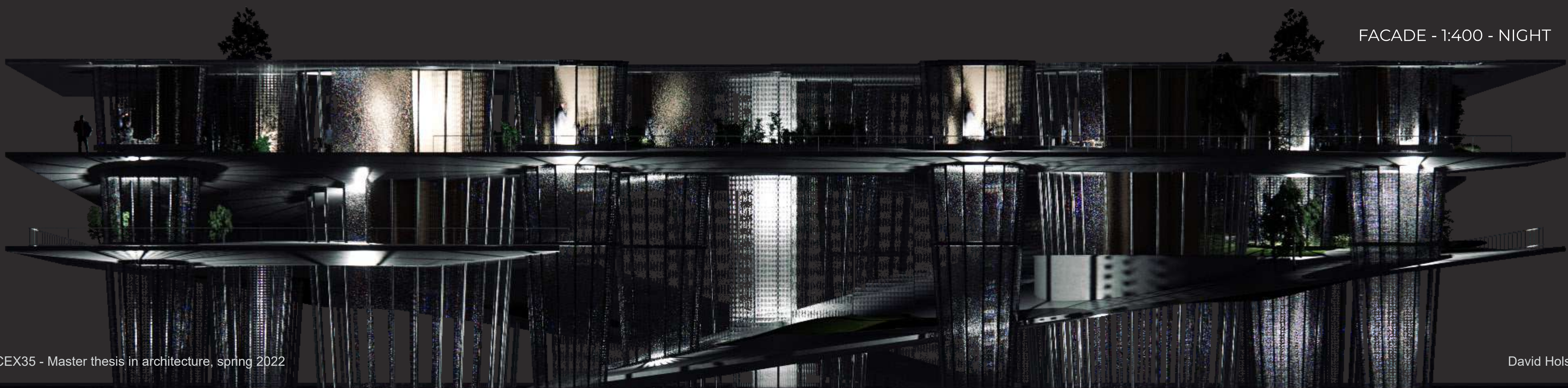


100%

SUMMER

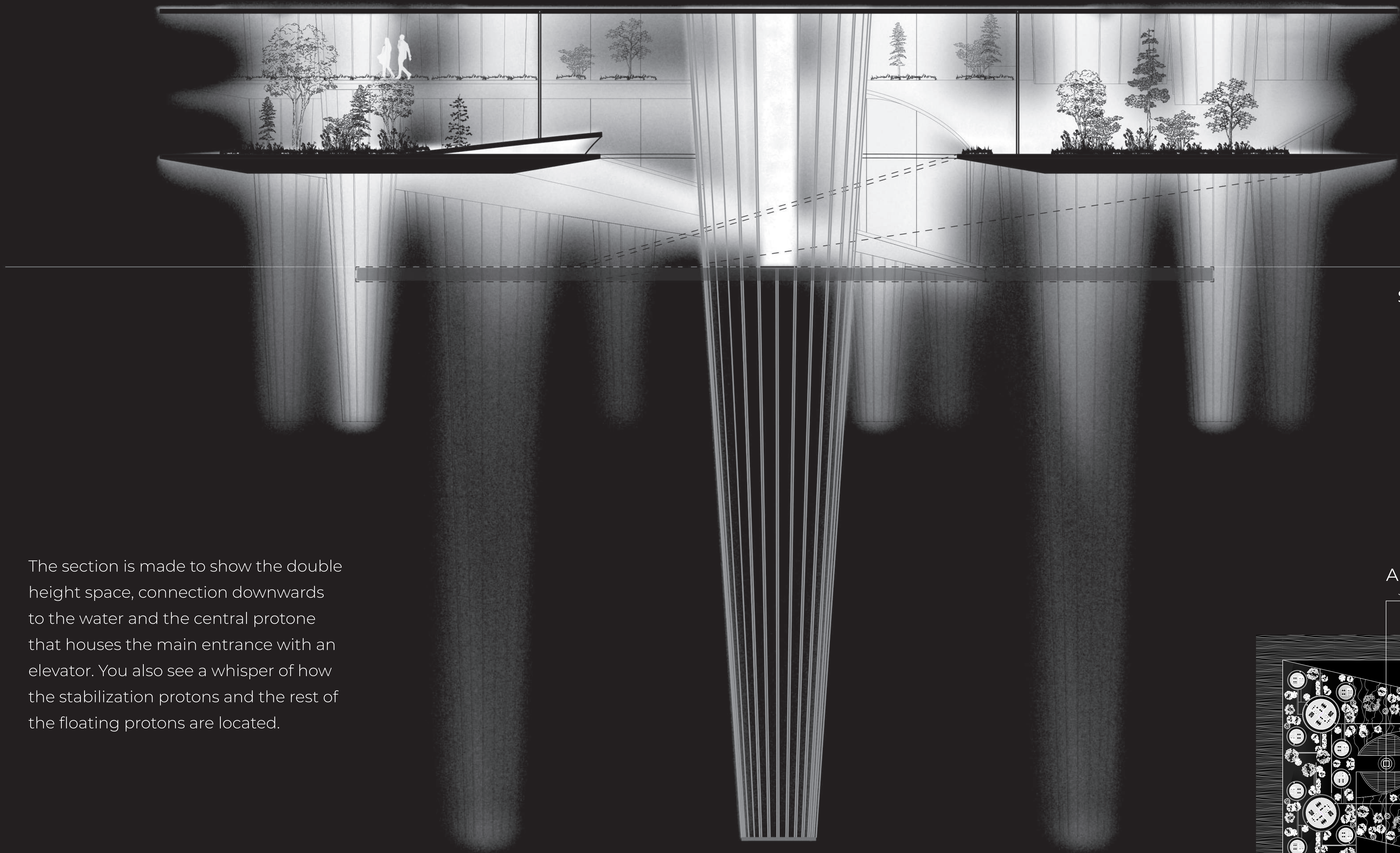
AREA USE

Summer, the full time crew is based on 16 people meaning that the full slab is in use. The flexibility in the plan makes it possible to have 8 additional guests if necessary. Now more of the floorplans outdoor areas are used and claimed for individual rooms.



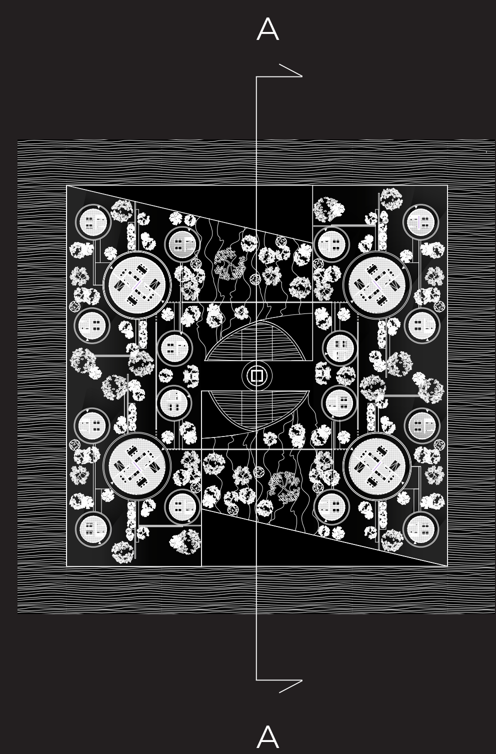
FACADE - 1:400 - NIGHT

SECTION DRAWING



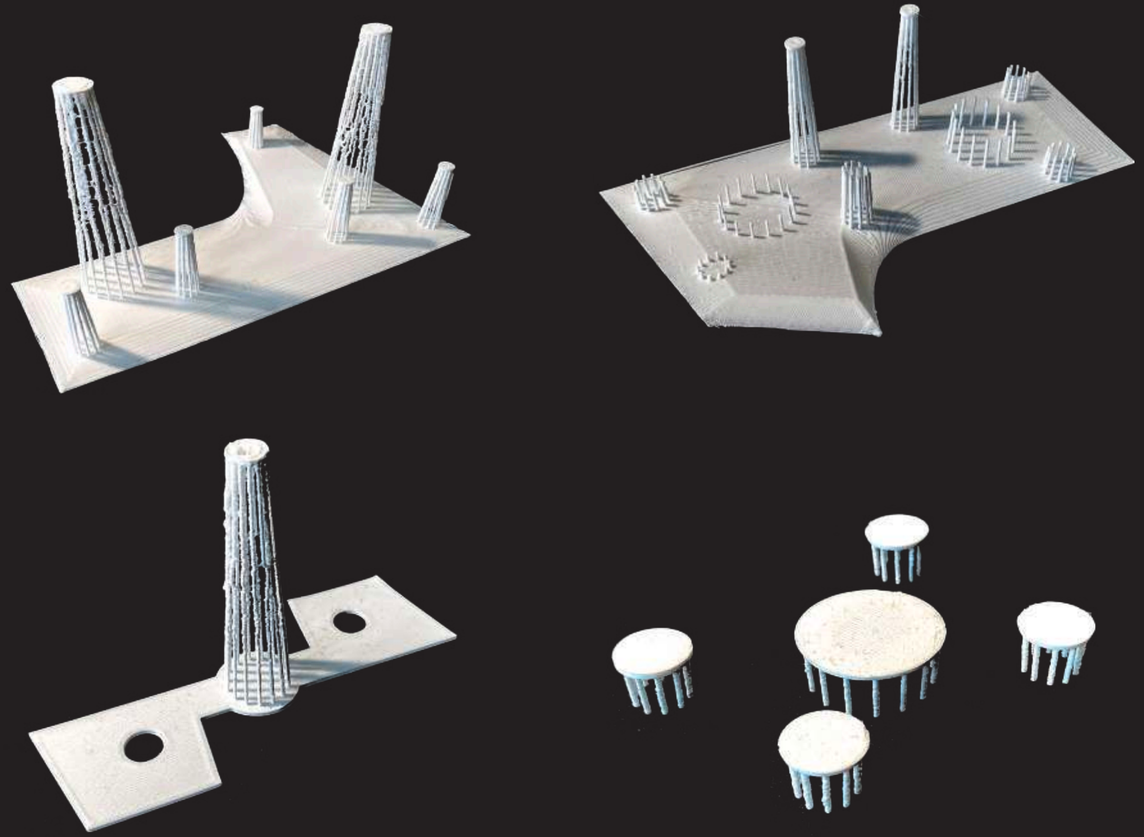
SECTION A-A 1:200

The section is made to show the double height space, connection downwards to the water and the central protone that houses the main entrance with an elevator. You also see a whisper of how the stabilization protons and the rest of the floating protons are located.

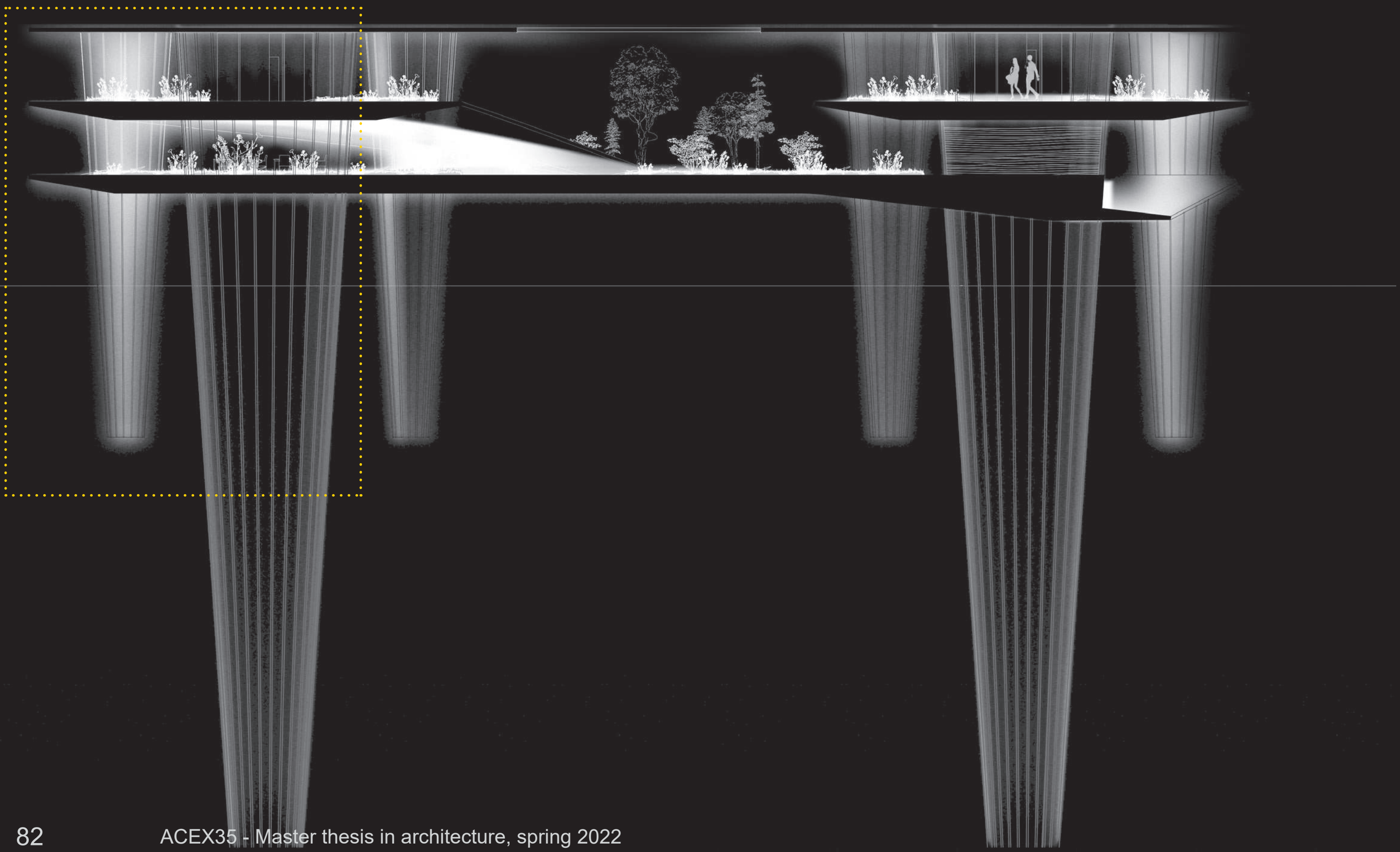


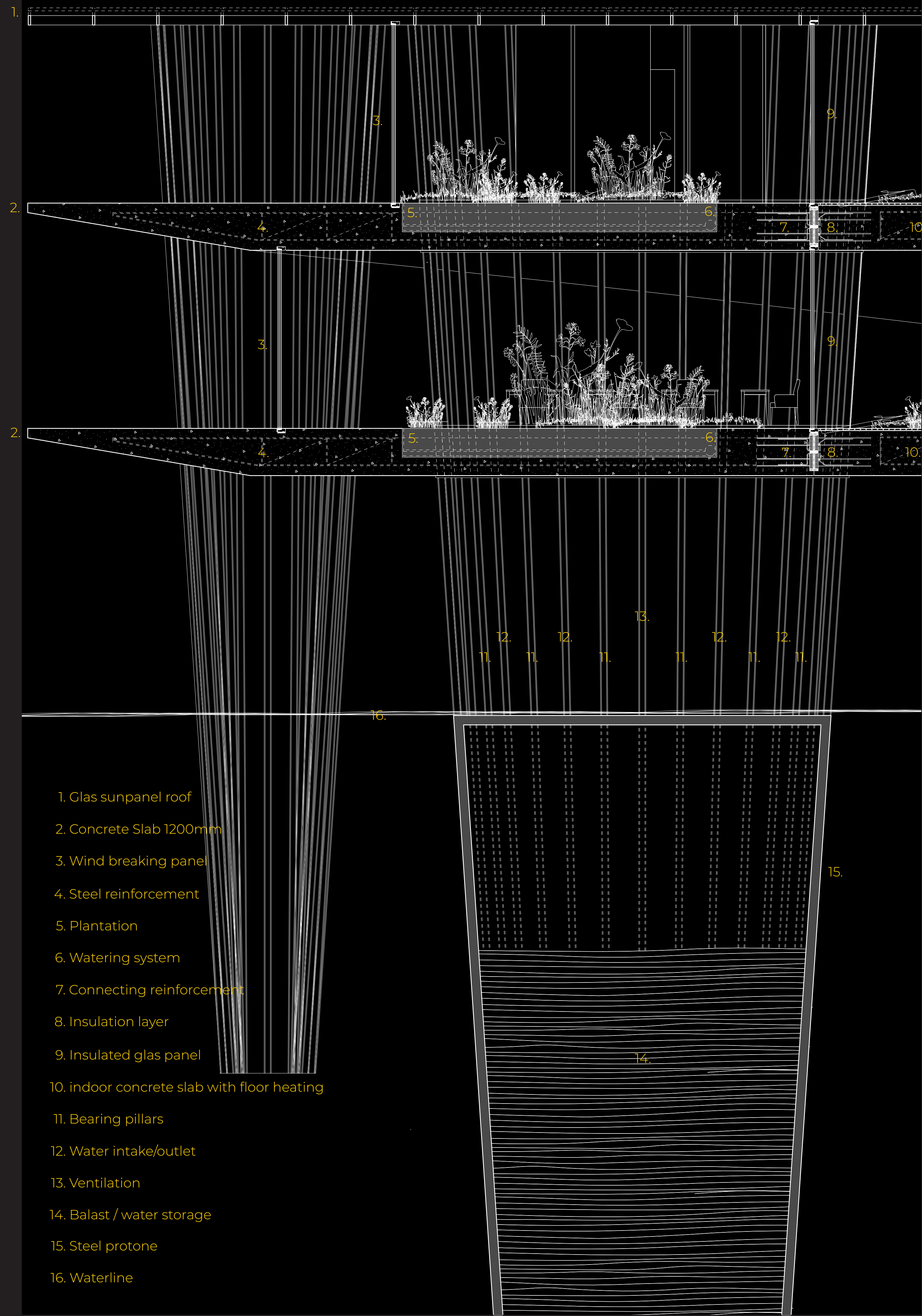
1:400
MODEL PHOTO

YET TO BE MADE



1:400
SECTION





PROJECT

CONCLUSION

This thesis answers the questions of how design drive sustainable inventions further and how it is a driving force for change. How an isolated off-grid structure inhabit a sustainable way of living while improving its context. However, as to any big issue, there are many possible solutions. This thesis should be seen as an inspiration to others to question common behavior and dare to work beyond the built, looking at alternative sites and existing solutions that enable new ways of living.

I believe the thesis shows one way of how we can put the architectural education to use in the larger perspective. It highlights the need of not being satisfied with having less bad impact but rather creating possibilities to improve our sites. In the thesis I show a role that should be addressed by designers giving an indication to how our ideas are a driving force for change, generating focus on what could be.

The scientific background with the base in research by Gothenburg and Linköping University was a great help to give the thesis plausibility and anchor the design in reality. Wether the designed pump actually works in real life would need further testing and calculations, however in theory, the design principle had the desired effect.

To be able to continue to expand the current building stock actions to improve our imprint needs to be made. This project shows a way to build without affecting the site and its surroundings. The research station chapter of the project shows that you could rethink the way we build, giving into nature, letting it be a part of the design process and the built environment. If I were to continue to develop the project I would like to investigate the idea of the “Nordic plan” built for an expanding flexibility to revere our 4 seasons. By doing this we could have a richer housing situation and still be able to keep the energy use down during the periods when the demand accelerates.

The importance of design has never been more clear to me when I worked with this project and the seriousness that will face us in the years to come. I believe that through our creativity and ideas we have a chance to design a better tomorrow.

PROJECT

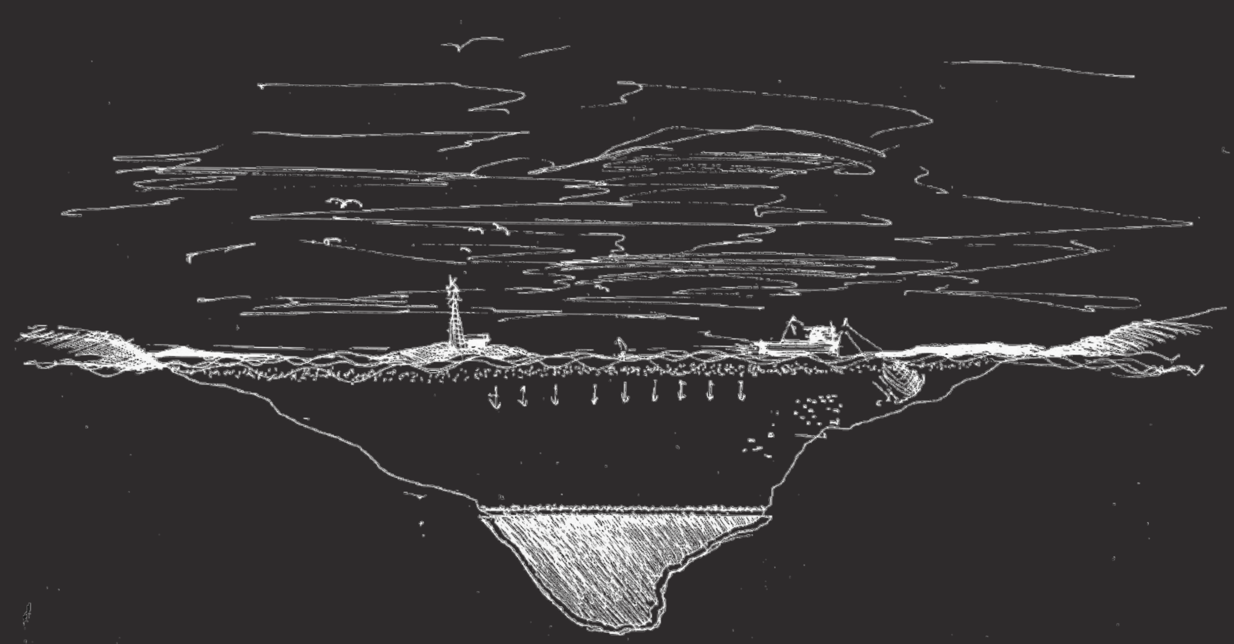
REFLECTION

Looking back at the thesis I realize that I had no idea what I was going to face when attacking this problem. There is much to take into account when doing a project of this magnitude.

The result of the design proposal ended up on the border between concept and realism which was the point and it will hopefully evoke thoughts and show that this might be possible if we continue to push it further. The design itself might not be the most important part of the project but that the idea now is out there for everyone to see.

I wanted to lift the possibilities, be naive, hopeful and show that we have the opportunity and responsibility to design for a better tomorrow.

We tend to design for dystopia in our future scenarios. This thesis aims to break that trend. Show that designers have a great toolbox for making programs, understanding the bigger picture and transforming that into buildings and structures. We have more to add to the context of climate change. We should want to break ground and show new ways, making ripples into our future.



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ACEX35 - Master thesis in architecture, spring 2022