Abstract

Climate changes are a global problem, a global problem experienced by humans in their local environment and society. Holstebro is one of the threatened cities in Denmark. This Project takes point of departure in an overall strategy made by the municipality of Holstebro. The overall strategy faces climate change related problems in the local environment. As parts of the overall strategy, pilot projects have to be developed, these pilot projects are placed in point of impact.

This thesis aims to design a Nature Laboratory as one of the pilot projects in relation to the overall strategy. The nature laboratory will preform a framework for, learning, knowledge sharing and public awareness and thereby affect the city in a larger scale. Designing for a functional and enriched sensorial experience are two major factors in designing and planning of the nature laboratory.

This project works with various dynamics, the changeability of nature, the changing water conditions, the diversity in users and the diverse understanding of nature. This thesis focuses on turning these dynamical aspects into qualities and potentials for Holtebro Nature Lab and the city.

Title page

Title

Holstebro Nature Lab –
Framework for Education and Public Awareness

Project group

MSc04 Urb05

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Appendix

7

Issue

6

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Table of contents

Preface

Group 5 consisting of Jeppe Frahm Koefoed and Tomas Werner Sejtved, from MSc04 Urban Design, Aalborg University, has produced this thesis within the project period from 01-02-2016 to 25-05-2016. The site of the project is located approximately 3 kilometres outside the city center of Holstebro.

The Report is divided into five chapters, introduction, program, presentation, evaluation and appendix,which together creates the genesis of the design proposal for a nature laboratory. The thesis focuses on the dynamics attached to nature, and the results of implementing a water management into a city. The Harvard Metode is used for references throughout the report. The references are listed respectively under source and illustration list in the back of the report.

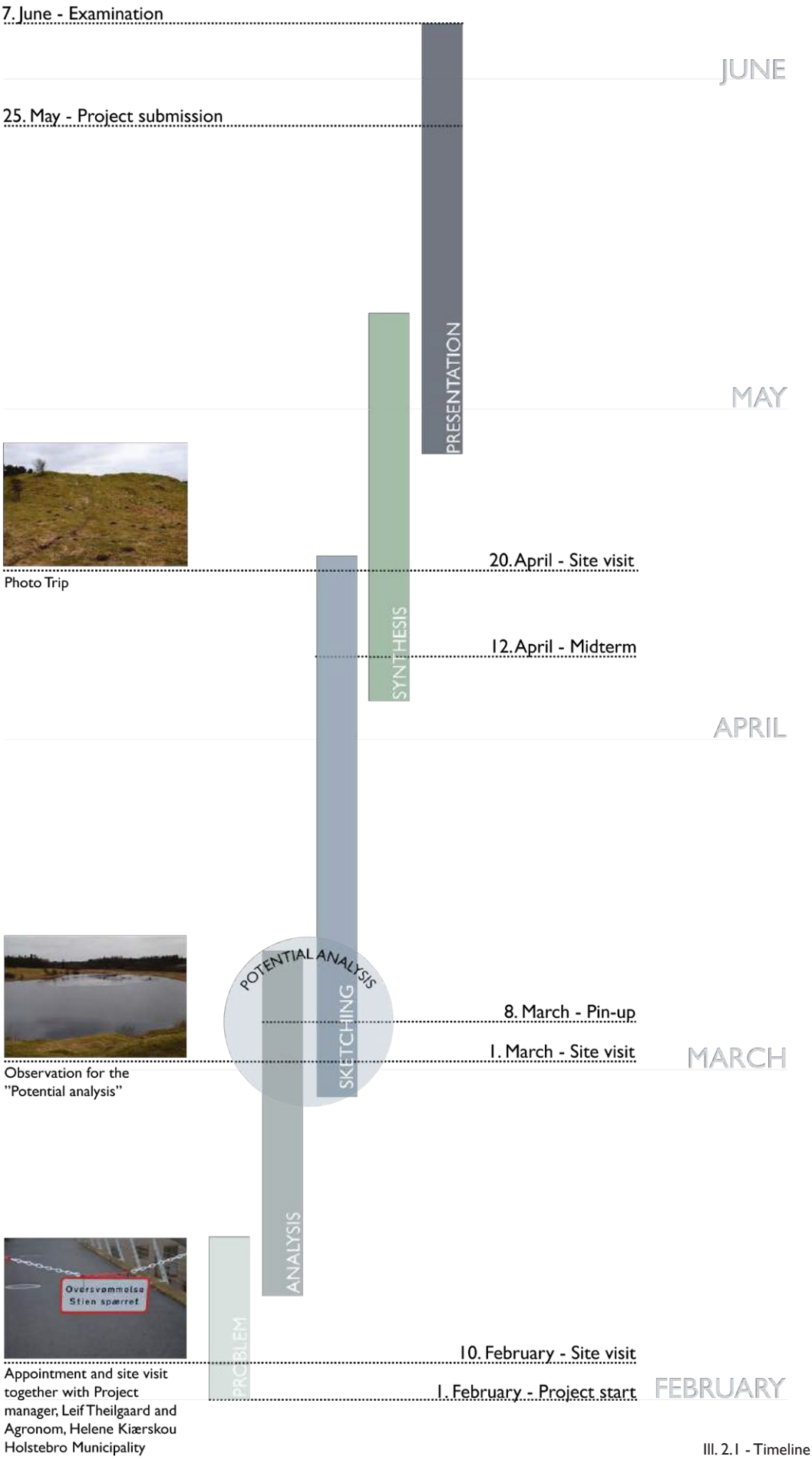
The group will send a special thanks to Leif Theilgaard and Helenae Kiærskou from the municipality of Holstebro, for spending a day on talking and discussing the ideas and intetions for Tvis Mølle Natur Laboratorium.

Introduction

Timeline

The timeline has during the project transformed from a tool to manage time, to a presentation tool. The same is true for several other elements in this report and project; this way of approaching elements, is part of the integrated design process.

The timeline has been a tool for project management, both internally and externally deadlines and appointments were added to it and thereby the full overview of the project and process was received. Through the project the timeline has turned into a presentation tool, which only contains the most important parts, deadlines and appointments of the project. Pictures and short description of the purpose are added to the timeline to give a better understanding of the process. The phases of the integrated design process, has also been implemented into the timeline, to give an understanding of the integrated design process in relation to the timeframe of this thesis.



Ill. 2.1 - Timeline

Ill. 2.2 - Location of site

The world is suffering from the global warming. The temperature is increasing. The water table is rising. The storms are getting stronger and occur more often and the same applies to rainfall events.

Holstebro has around 57.500 inhabitants (Holstebro.dk, 2016), the city is located in the western part of Jutland and the city has been exposed for flooding several times, the last extreme flooding was in January 2011. (Appendix 3)

The flooding of the city was caused by storåen, which streams trough the city centre. When the water level in storåen rises and it floods the area around the stream, the water from the stream applies major damage to the surrounding facilities, buildings, properties and environment.

Citizens and the public needs to be aware of the risk of the increasing water level and risk of flooding. Almost everybody has noticed the global warming and its consequences. The people living in Holstebro are in a need for a place, which can inform them about flooding, increasing water level and the challenges. The place should at the same time be used for several other purposes, education, rehabilitation and appointments.

Overall problem

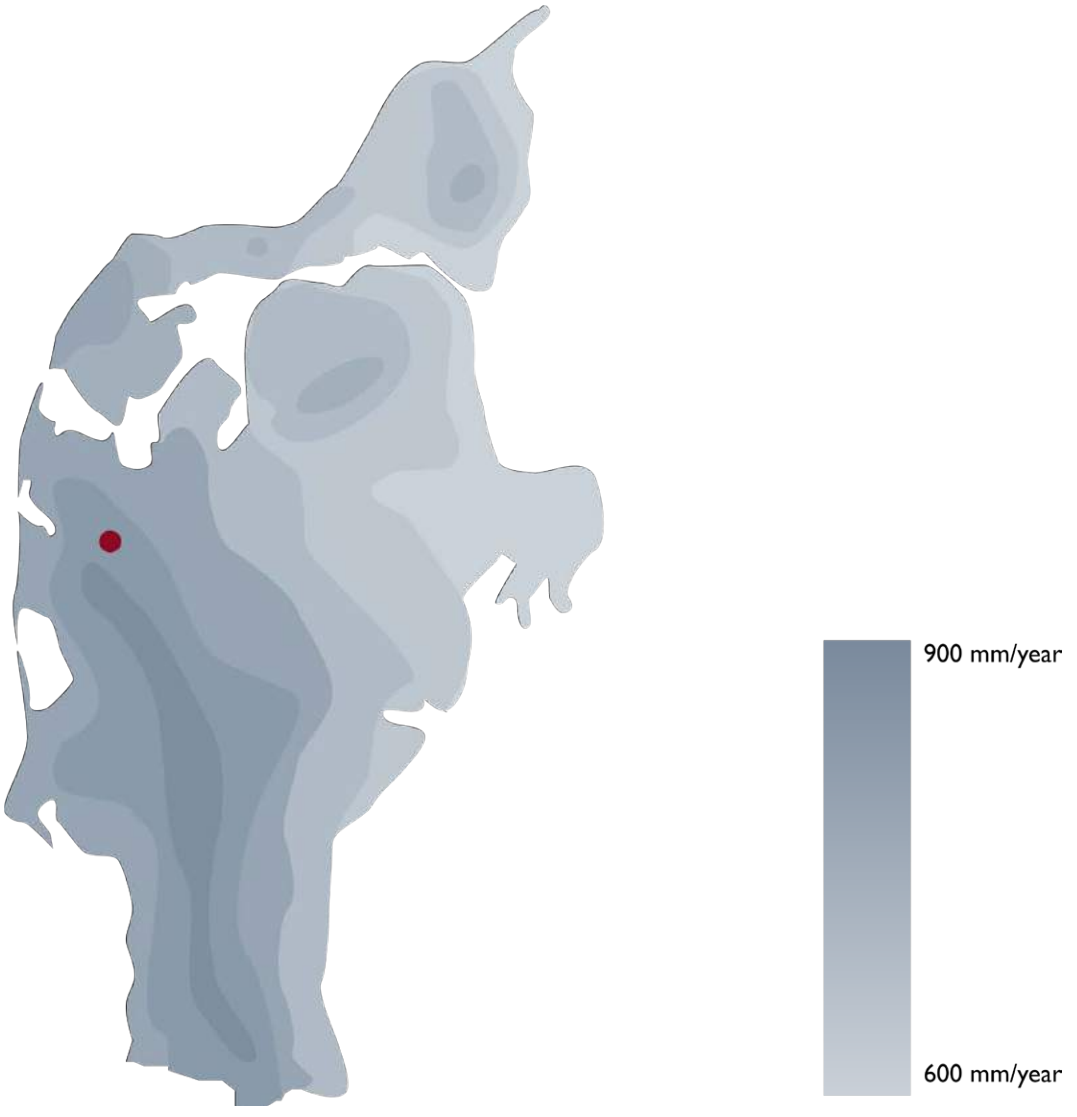
The citizens in Holstebro are in a need of information about what the global warming and the climate changes do to their local environment. There is a need for information on different levels according to, educational level, age and interests. The city needs a location, where the students of the local schools can make investigations on water and nature related tasks. The municipality of Holstebro has already defined some of the uses according to the building and surroundding site. The municipality are working with four key points that they want incorporate in the design. The four key points are: health, water, science and cultural heritage. Four elements that already is incorporated in the Danish education system.

Theme

Conserning the overall theme of this master thesis is about turning water into a potential for urban design and not a problem. Flooding and increasing level of water is overall seen as a problem, according to building designs and accessibility. But water has a lot of potentials both in relation to the human but also in relations to the build environment. Water is able to increase the economical value but also the esthetical value of buildings and designs.

The relation between the water, the build and the humans as users, is also a theme that will be investigated through theoretical studies, and used in the design process of the project. Storåen is a hot topic in the overall planning of Holstebro. Storåen streams trough the inner city and has a great potential of attracting life, but at the same time is the stream a demolishing element rushing through the city, eroding the banks and ruins the city.

Ill. 2.3 - Location of site, catchmen area and Storåen.

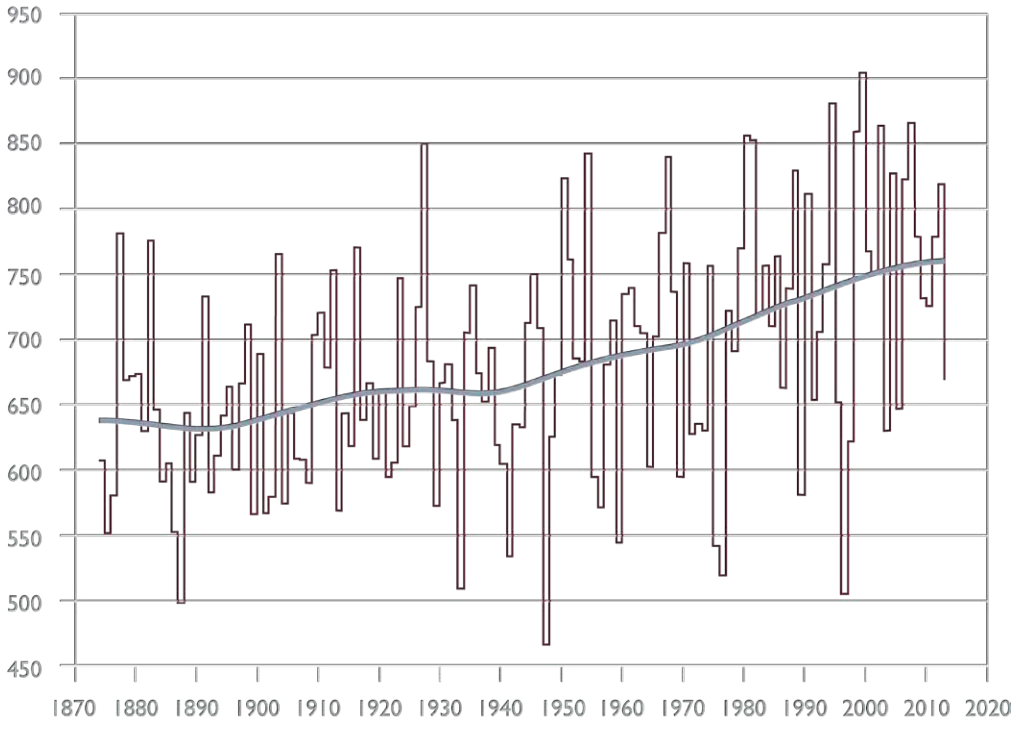


Ill. 2.4 - Avarage rainfall in Jylland and location of site

The primary part of the thesis is addressing the problem "lack of knowledge and awareness in the general public". Denmark is faced with a change in the upcoming climate. (Olesen et al. 2012). The society needs a higher understanding. The public is able to do a lot, if they are rightly informed; this is not just relevant for the people living in Holstebro but for everybody. This thesis has the purpose of explaining the need for a higher public awareness that can be solved, by a nature laboratory.

The increasing water level and amount of water in the stream can be solved in different ways, the municipality of Holstebro has already decided to make a dam outside the city, to prevent flooding and apply a delay to the increased amount of water. But the municipality could have decided other solutions. There are two essential approaches to save the inner city of Holstebro from flooding. The first approach concerns about increasing the volume of the stream through the city so the stream can handle more water, before it floods. The second, is the approach that Holstebro will implement, it concerns about delay of increased amount of water outside the city. Theses two approaches can been accomplished in several ways, according to design and politics.

The municipality has four strategies for the upcoming climate change.
The first is the Danish emergency management agency react and help the most threated places, with sandbags and other tools to save life and secure good health in small situations.
To make sure that the water can leave the city after it entered, the municipality is planning to widen the river and straighten the flow of the river. By increasing the size of the banks along the stream the capacity in the most vulnerable places can be increased, and make the city in robust and capable of handleing more water. The main solution is to build a dam further outside the city, to control the amount of water running into the city.



Ill. 2.5 - Avarage rainfall in Denmark

By doing this, some areas outside the city are getting flooded which don't cause much damage.

Because of all this and the extend of the problem, this thesis will not be addressing the water management problem. (Theilgaard, 2016)

Investigation

The thesis will investigate on the potentials that lie in having nature in our daily life. Nature does have an impact on our wellbeing, health and welfare, but where does the line go between nature and what do we apprehend as manmade. The theories used in this thesis have different takes on how we humans decipher the world around us, how we perceive it and how we understand it. All together the thesis focus on the relation between the built, the nature and the humans. These elements will be the focuses during the whole project.

Landscape urbanism is a movement describing why it is important to have nature in our cities and that nature is as an important "building block" of our cities. Landscape urbanism is based on a scientific, social, esthetical and experience approach. The approach intersects the technical elements as infrastructure, with esthetical elements as the nature. The approach causes a boundary less relation between nature and the city (the built).

Disagreement is present between the theoreticians used in this thesis. Mainly because the understanding is diverse according to nature, to assist the understanding the notion of nature, the theory by Hans Fink, "Et mangfoldigt naturbegreb" (Nature as a divers expression) is used.

To get a better understanding of how we as humans perceive and acts in different environments the perception theories from Juhani Pallasmaa is used both in the discussion phase but also in the design process, according to materials and proportions.

Is it possible to use these increased amount of water as a potential in relation to the building design? Is the water able to increase the natural value, and how can we design with the water instead of against it?

Tvis Mølle Nature Laboratorium

The point of departure of this thesis is an already made program, made by the municipality of Holstebro. The program consists of a description of user groups and four main themes, which has to be integrated into the design. The location of the nature laboratory was decided by the municipality, which bought an old trout farm outside the city.
The idea was to create a building and a park as framework for education and public awareness. It was a goal for the municipality to implement the four main topics, water, science, cultural heritage, and health as aspects in the final design.

The city is aware of its old history, which is visible in the city slogan "There is a drop of culture in everything". This is one of the reasons why culture heritage is one of the topics according to the nature laboratory. Another is that the site is an old production landscape and traces from it are still visible in the topography and landscape. The vision of the Nature Laboratory is to create a close connection to the nearby schools, and create a learning environment in relation to the surrounding nature, will result in play, perception, reflection, physical activities and education. The visitors at the nature laboratory will achieve knowledge on the four main topics through interaction with water, nature, animals, etc.
These types of learning environment are complementing the new school reform, which is based on, more physical activity during and longer days at school.

Science
Knowledge through movement and physical activity, are complementing the new school system. The municipality plans to have a close collaboration with the nature and science teachers to create some of the education material for the nature laboratory.
The visiting students are going to develop tools and methods, which gives them a perspective on the resource consumption in different installations. This could for example be a comparative analysis of plants exploitation of the suns energy compared to modern day solar panels.

HOLSTEBRO KOMMUNE

Ill. 2.6 - The Municipality of Holstebro

Water

The topic takes point of departure in Tvis Å and Storåen, to teach metrology, hydrology, climate changes and climate adaption. This is in particular important since Holstebro is the only inland city in Denmark, which is threated by climate changes according to EU's flood directive. Other Danish cities threaded by water according to EU's flood directive, are located in coast near areas (Risikostyringsplan for Vanddistrikt Jylland og Fyn, 2016). To teach the climate issue and the water problem, a small scale model of the water problem in Holstebro is implemented into the park. Other issues like pollution of the groundwater and food production are also addressed via the park. The visiting students are given a general understanding of the circuit of water, and biological values.

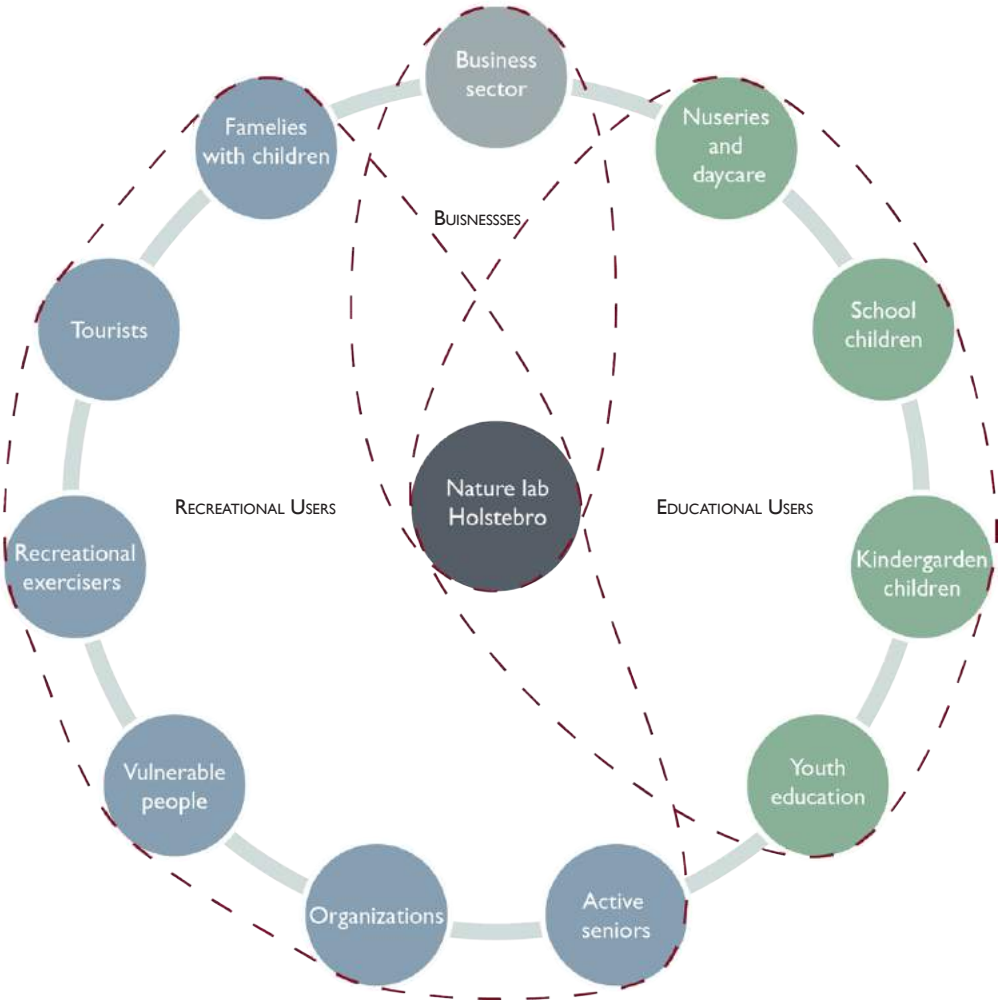
Cultural heritage

The area around Tvis Mølle is full of cultural heritage. The land has been used for several purposes, which have had an affect on how the landscape is expressing it self today. The area has been used for trout farming, marl mining, agricultural farming and forestry. These purposes will also be described in the educational material, to teach the students both in the past but also in the future.

Health

Health has a lot to do with the environments that we are surrounded by in our everyday life. The nature laboratory is also a place, which frames health in several ways, mental health, physical health but also healthy eating and exercise. The area around the building frames a number of different elements, from active to passive and observing. Meditation areas where the sound of water and animals, will help the visitors ability to obtain new energy and recover after a stressful day. But also playful area that challenges the visitors' physical shape and knowledge of what the human body is capable of.

User groups



Ill. 2.7 - Dividing user groups in three categories

The municipality of Holstebro has in the program for Tvis Mølle Natur Laboratorium, made a model of the target groups that they are expecting as users in the building and park. The design must frame a wide variety of users and visitors. Three groups of users, businesses, recreational users and educations dominate the user group model made by the municipality. The three groups of users have different needs according to their profession and interests. The overall goal for the municipality is to reach and inform as many people as possible. This will affect the future inhabitants in the city and it will increase the general knowledge and awareness over time. Building and landscape achieve the best performance if there are a good relation between the users and the design. It is important to take into consideration which types of users the design is going to host and what their needs and interests are.

Educational users, students and pupils need a place where they can go and do experiments in nature related tasks. But also a place where they can immerse themselves in nature linked topics. During their educational stay at the nature laboratory, they will achieve knowledge and be more aware of how long time they spend in the shower and how much waste they are producing during a day. This knowledge is going to be a part of the overall public awareness, and some day the educational users will be the majority of the city's inhabitants. First priority for the educational users is to gain knowledge, but if the knowledge could be gained in a fun or interesting way, the educational users would be more engaged with the tasks.

Different organizations, companies and businesses can use the park and building for meetings, activities, teambuilding and workshops for the employees and collaboration partners. We are all living in a society base on economy. The first priority for the local businesses and firms is to gain money and increase their economical power. A lot of businesses are aware of their production

Ill. 2.8 - The three categories of usergroups

of CO2 and greenhouse gasses and are in a green transition period, with reorganizations and innovation. If they could turn their green transition into profit then both the business, the city, the country, and the environment would gain value from it.

Recreational users have several uses according to their age, level of education, profession and interests. Therefore the design has to be flexible and frame the all the uses at the same time. The design has to frame all this demands and al the recreational users. One of the main topics in the vision of the nature laboratory is health. Health is a diverse expression and health can be gained in many ways. The design will focus on some of the aspects of health, healthy food, exercise, recreation and recover.

Ill. 2.9

SUB-CONCLUSION

The result is a physical design, which facilitate and frames the visions of the municipality of Holstebro's envisions for the nature laboratory. A laboratory, which focuses on the four key points from the vision from the municipality, cuiltureral haritage, water, science and health.

The building must involve water as an active element in the expression and in the use of the building. The rising waterlevel on the site should be seen as a potential for designing and not as a problem or a limit.

The building is going to host several user groups and equally uses. The building should inspire and work with different expressions, atmospheres and perception according to the use of the room or area, but also according to the water and the bodily experience.

The area around the building focus a lot on the natural processes which occurs now but also in the further after the building has been build. Both the building and the area around the building must appeal to the human senses through different atmospheres and several expressions.

This thesis focuses on the human perception and perception through the senses and a full bodily experience. Thereby we want to work both in the large scale with planning of the area, and in the small scale, for an example with the use of materials and tactility. The use of materials has impact on the perception and the experience of the final design.

"Architecture has its own realm. It has a special physical relationship whit life. I (Peter Zumthor) do think of it primarily as either a message or a symbol, but as an envelope and background for life which goes on in and around it, a sensitive container for the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep" (Zumthor, Oberli-Turner and Schelbert, 2006, p. 13).

III. 2.10

VISION

The aim of this project is to design and create the framework for education, knowledge sharing and public awareness. The design needs to be flexible and prepared for changes in relation to the various users and the changing uses. The area in which the design is intend to be located is also constantly changing, both in relation to the changing seasons of the year, but also in relation to the changing water table.

METHOD

The overall problem of this thesis is related to climate adaption of Holstebro and has to be solved trough design of facilities, which accommodate the users need and create a greater public awareness. The design will serve as a learning environment for kids as well as citizens of Holstebro. The design must also be a showcase for how we as humans can gain a greater natural diversity biota, vegetation and nature types.

The Integrated Design Process

The working methods that we have used in this master thesis are based on the integrated design process in collaboration with problem-based learning. The integrated design process is separated into 5 phases, Problem or idea Phase, analysis phase, sketching phase, synthesis phase and presentation phase (showcased on the illustration).

Finding a problem or creating an idea, is the first phase of the integrated design process. The problem that we are going to solve is formulated in the problem formulation, and described in the chapter "problem".

The second phase is the analysis phase. The analyses are based on quantitative and qualitative analysis. The analysis phase contains site analyses with different purposes, Topographical, infrastructural, protected nature, potentials, cultural history and sensorial perception. The purpose of these analyses is to achieve a better understanding of the site, how it is organised and how the site functions. The quantitative analysis is presented through mappings and texts and the qualitative analyses are represented in pictures and texts.

Another part of the analysis phase is the discussion of the theory that we find relevant for this thesis. The theory is understood through reading and discussing internally.

The third phase of the integrated design process is the sketching phase. Several methods of sketching are used in this thesis, physical modelling, digital modelling, and drawing.

The different methods of sketching have different strengths and weaknesses. For example is the hand drawn sketch quick to do, but it is also imprecise compared to the computer drawn sketches, but both occurrences has equal strengths and weaknesses.

The forth phase is the synthesis phase, this is the phase were the physical design finds it final form. This is the phase were the demands are solved and the final expression shows. All the given problems should have been solved in the previous phase, but the final output shows in this phase.

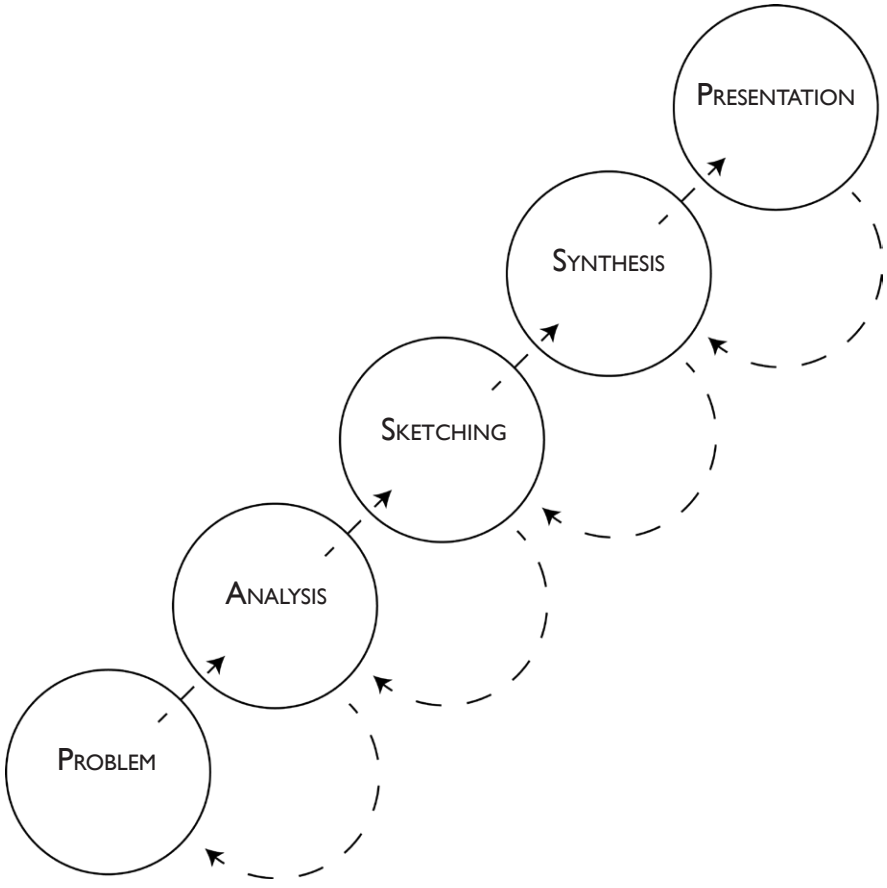
The fifth Phase is the presentation phase. Presentation of the thesis is equally important as the rest of the processes. A bad presentation is able to blur the key points in the project and drag the overall understanding of the project down.

One of the most important part of the integrated design process in our perspective, is the iterative process, which occur in the intersection between the different phases of the integrated design process. (Knudstrup in Botin, 2005)

The iterative process works as a tool to examine the purposed design, theory or analysis according to the specific project and phase. Illustration number 2.11 illustrate how the process is organized in a liner way and the iterations is illustrated by the back turning arrows. Each phase in the integrated design process put up demands for the following phase, if these demands not are fulfilled, the project have to take a step back to the previous phase and try to fulfill the requirements for the next phase.

One of the iterations that we have done, took place in the intersection between the sketching phase and the analysis phase. We have made the hydro-analysis of the site on a planar drawing, but to get a full understanding of the water situation, we needed to do a section of the site, with an indicator on contour +15.0.

Another iteration that we have done took place in the intersection between the presentation phase and the sketching phase. To examine the plan solution you have to imagine specific situations on the drawings, try to imagine several scenarios, but if scenarios are impeded by the design, the design has to be changed in order to fulfill the purpose of the design.



Ill. 2.11

Sections as a tool

Sections have been used in the architectural and design drawings for many years. The section functions by cutting into an object. A pictorial metaphor for the section could be the bread; one can only investigate the inside of the crust by cutting through it. The sections communicate information according to heights, widths and to some extend depths. The section is therefore not a planar drawing but a tool to understand a specific object in a three-dimensional way; therefore the section has the ability to affect the plan drawing. There is a three-dimensional relation between the section and the plan, by looking at a section and a plan in combination; one can get a full understanding of height, width and depth, which is equal to the volumes.

When walking trough a given area or design, the human body functions as some kind of a section, you can only get a visual perception of the objects in front of you, thereby a three dimensional understanding. The bodily experience is visualised in sections. The section is able to help one understand the physical setting of an environment and that is one of the reasons why we have used the section as a tool, both for analyses, sketching and presentation.

A dynamic level of water made by the adaptive dam dominates the chosen building site for this thesis and therefore the section has been a valuable tool to understand the dynamical aspects, the dynamical water level the dynamical change in perception during a walk around in the design.

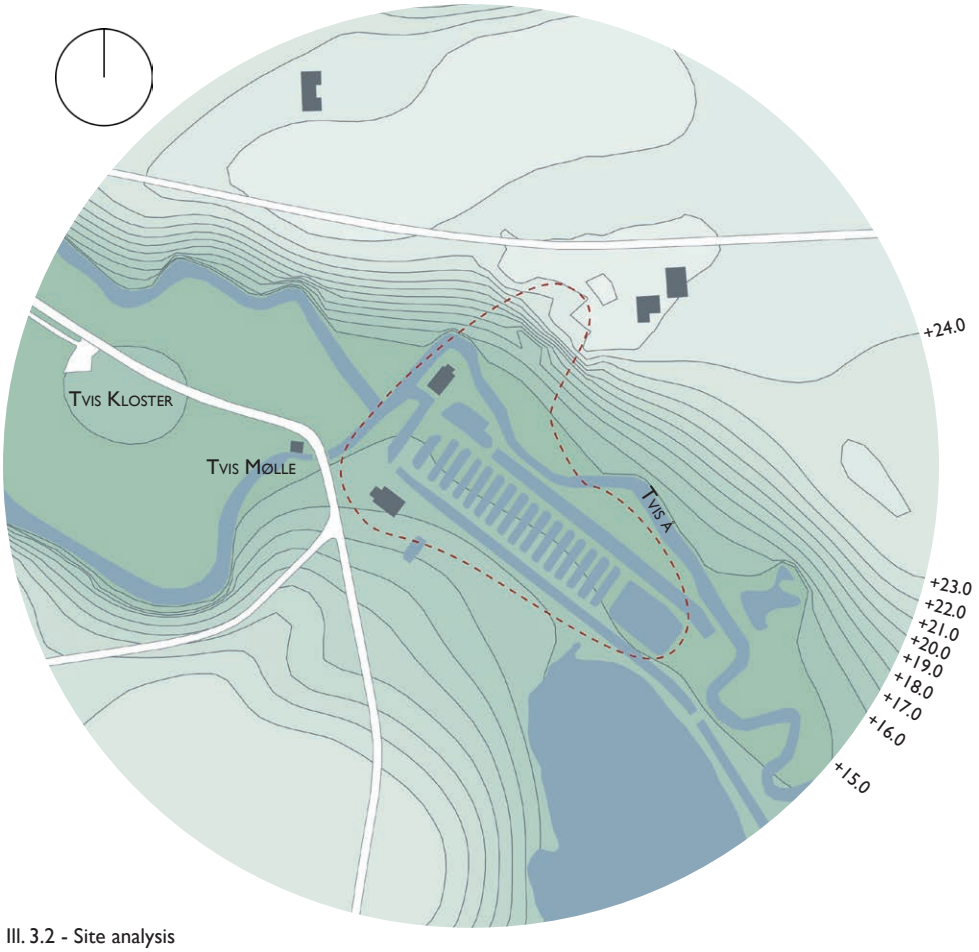
Site Potentials

The potential analysis seeks inspiration in a method developed by Raoul Bunschoten and his architectural office Chora. In his book 'Urban Flotsam – Stirring the city' he describes a way of reading and solve complex problems in the urban environment, the method is called "Urban Gallery". We want to use parts of the method to get a better understanding of the site and of the history of the site. The first step is to make sections through the landscape and find already existing physical potentials, which can be the future frame for a new type of developments. The already existing elements/ potentials leads to the next step, which is the mini-scenarios, made in a playful design process based on the previous found of physical potentials. In our translation of the method, the final mini-scenarios are presented in a catalogue of possibilities. All of the mini-scenarios are not necessarily incorporated into the final project, but the method is a way to investigate the site and start the design process. (Binet, Bunschoten and Hoshino, 2001)

This method can very easily be linked to the James Corners mapping methodology. James Corner is well known for his mapping methodology of urban environment and argues that there is two ways of do mappings. The first is mapping which is a selective and subjective way to get a better understanding of the selected site. The mapping gets subjective as soon as a selection or isolation is used in visualization of the mapping. The opposite as mapping are tracing. James Corner argues that tracing is an objective way of doing a site-specific analysis. James Corner argues that tracing is a direct image of the excising situation (James Corner in Cosgrove, 1999).

PROGRAM

SITE

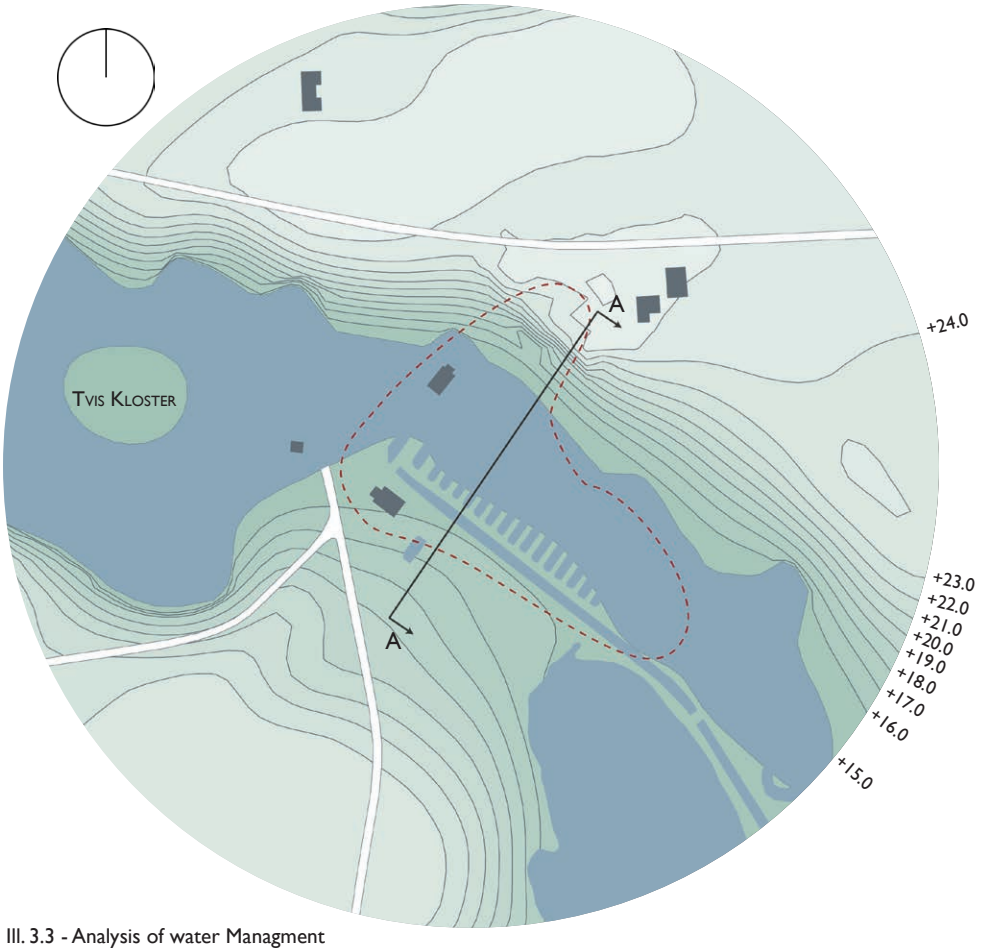


Ill. 3.2 - Site analysis

The site is located close to Tvis mølle outside Holstebro. Tvis mølle is then located approximately 5 kilometers east of Holstebro, between Mejrup and Mejdal. The site has previously been used for trout farming and marl mining, which is still visible in the landscape represented by the trout ponds and the diverse landscape. Old tracks from the previous uses of the area are still visible in the landscape. Tvis Å streams through the site from east to west and a small lake are located south of the site. Holstebro as a city is expanding against east in the direction of the site, and there are already several residential areas and two primary schools close by. The potential visitors and users are therefore nearby. The site is located in an area rich on nature, peace and changeability.

Because of its placement, behind the new dam between Vandkraftsøen and the city of Holstebro the water will occasionally raise to contour line +15.0, When the water level reaches contour line +15.0, parts of the site is flooded and the water will appear knee-deep. The changing water condition gives the opportunity to create a design with changeable surroundings. Therfor the design has the potential of using the flooding as active part of the expression of the design. The site is normally dry, but with occasionally flooding, which makes it ideal for a design that varies according to nature, expression and diversity. This site was chosen by the municipality of Holstebro in the process of Tvis mølle natur laboratorie, because of the relatively short distance to the city and the residential area with two primary schools close by. The site is owned by the municipality of Holstebro and is designated as the site for the nature laboratory.

Water managment

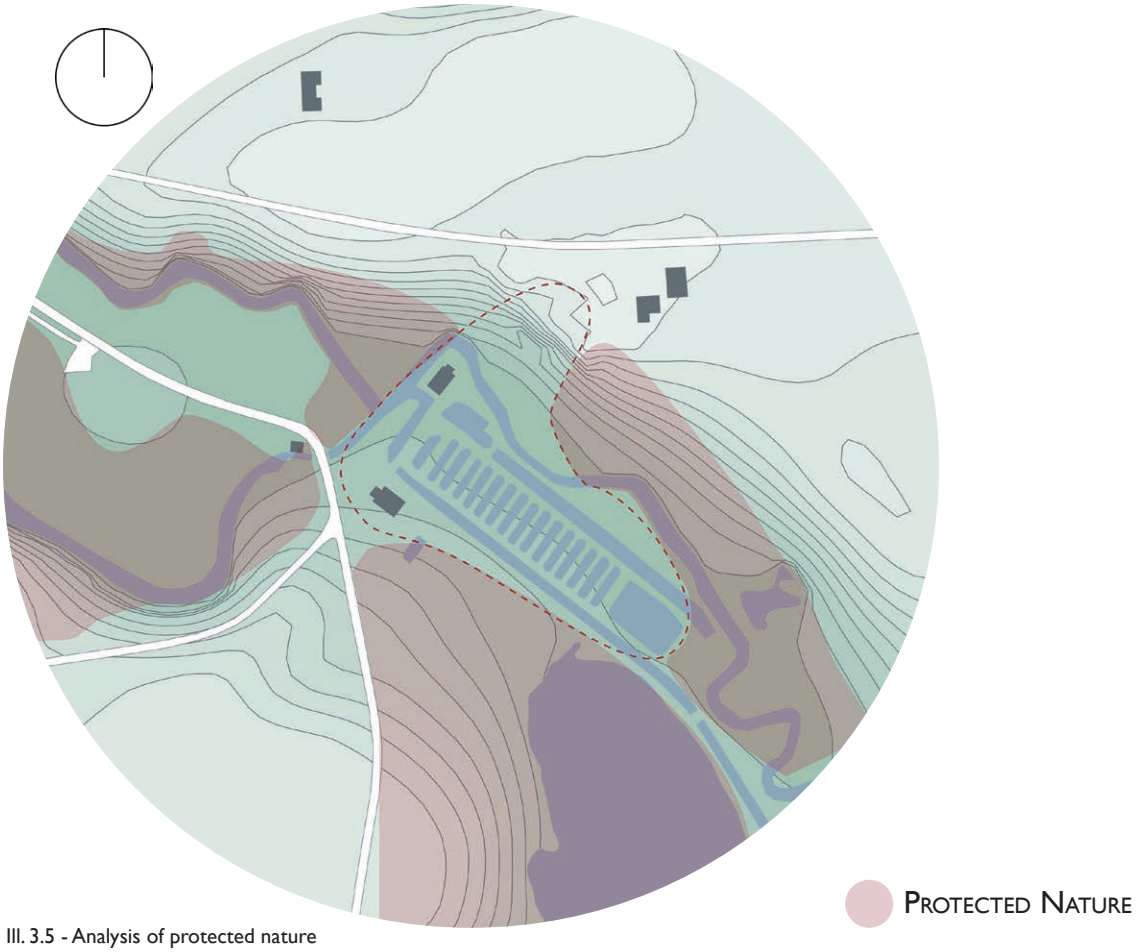


Ill. 3.3 - Analysis of water Managment

As a part of a bigger solution to secure Holstebro against flooding, Vandkraftsøen is going to be used as a water reservoir and detention pond. The municipality did a draft proposal where the water table was raised to contour line +16.0 in case of heavy rain. This plan was cancelled due to the ruin of Tvis Kloster, which will get flooded at contour line +16.0. Therefor the pressent plan is to raise the water table to contour line +15.0. This will store up to 1.5 million m3 of water. To further increase the capacity, the municipality have a plan to temporary lower the water table to contour +12.0, which will increase the storing capacity by 0,5 million m3 of water. Bringing the total amount of storing capacity to 2 million m3. This will take up to 12 hours to lower the water in Vandkraftsøen, and therefor it is necessary to create some kind of warning system, so it is possible to prepare the lake for the increased amounts of water (Vestforsyningen, 2015). This will be necessary when it has been raining at least 10mm per day for two to three days after a long period of rain so the ground is saturated with water. According to statistics this situation is going to happen between every 5th to 10th year (Theilgaard, 2016). But if the global warming keeps increasing the global temperature, and the pollution of greenhouse gasses don't stop. The flooding situation will happen more frequently than every 5th to 10th year. The increased water level do not only solve problems, but is also creates problems according to infrastructure. Parts of the road which previously has facilitated the site is flooded when the water level reach contour line +15.0.

Ill. 3.4 - Analysis section A-A

Protected Nature



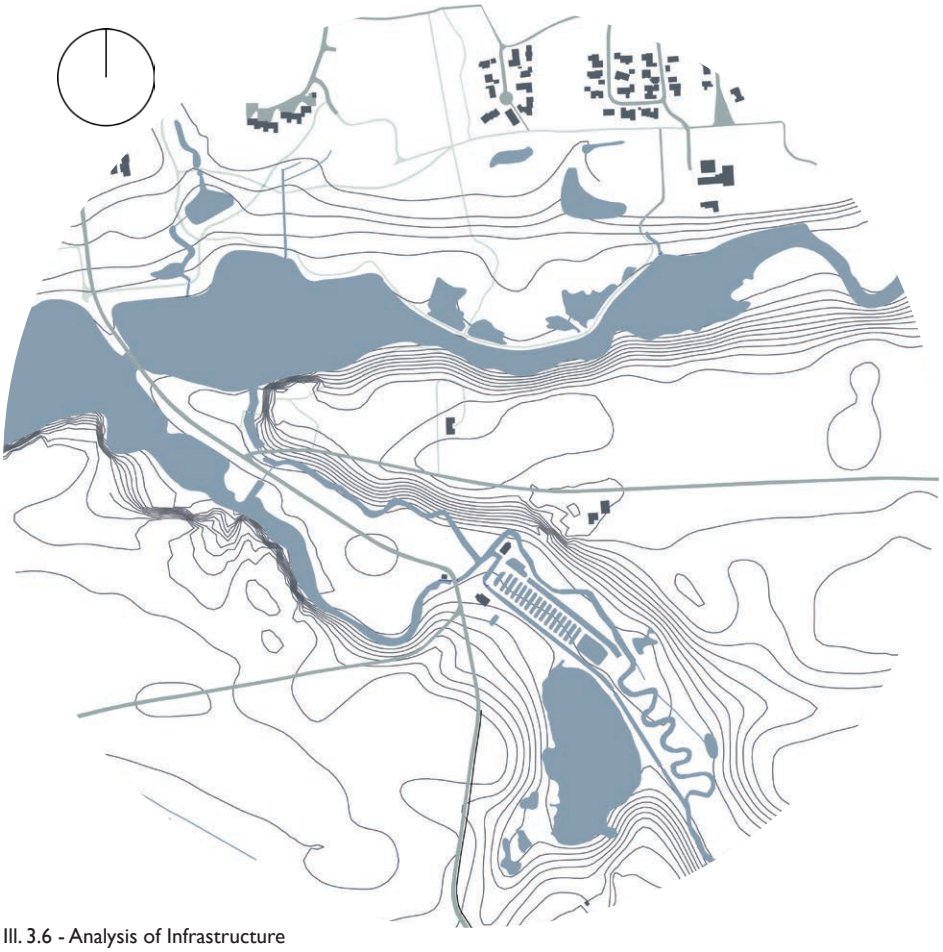
Ill. 3.5 - Analysis of protected nature

The areas around the site is protected by paragraph three in the Danish nature protection law (Naturstyrelsen.dk, n.d.) This means that it is not allowed to change the natural environment, build or in any cases harm these areas. The site is not protected in any way, but the southern area around the lake and the lake it self is protected. Tvis å that streams through the site is protected. Tvis å has been changed to be more efficient and useful according to the trout farm. The trout farmers have used the water and the stream in their production and that is explans the layout of the stream. The ponds and the bypass-streams are all created by the trout farmers and therefore not seen as "natural" and not protected.

The protected areas define the boarder of the site. The intention of this thesis is to keep within the borders of the site and absorb elements and subjects from the protected and unprotected nature into the site to create a connected identity in relation to the surroundings.

These areas could bee defined as "wild nature" according to Hans Fink. Natural maintenance and natural processes define "The wild nature" (Fink, 2003). The romantic vision of nature is based on the "The wild nature", untouched or non-maintained by humans. Hans Fink will be introduced in the chapter of theory in this report.

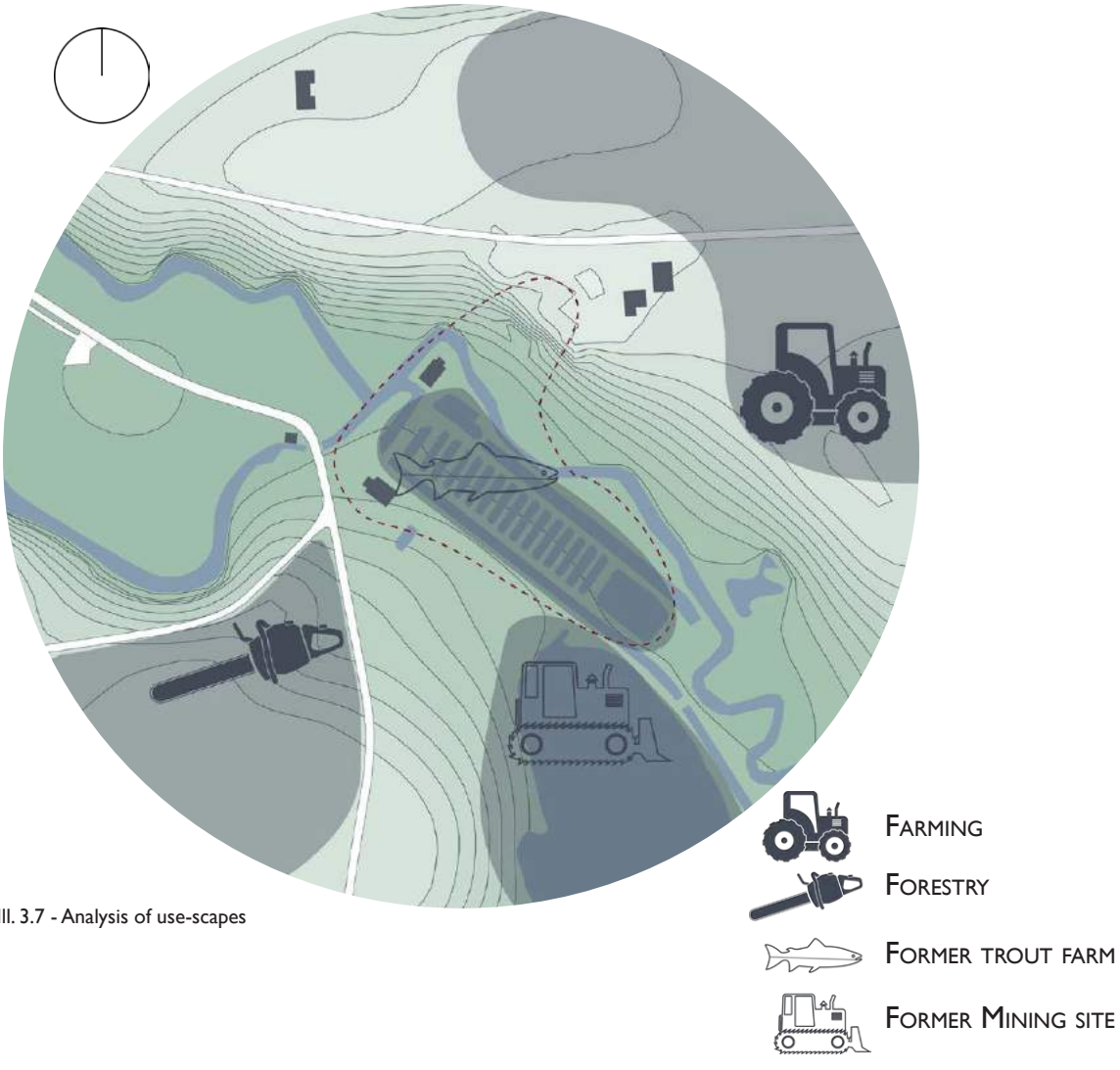
INFRASTRUCTURE



Ill. 3.6 - Analysis of Infrastructure

The Site is well integrated into the infrastructure of Holstebro and the surrounding suburbs; it is possible for pedestrians, bikes and cars to access the site, from every direction. By car two major roads leads to the site from the city center. One located on the northern side of Vandkraftsøen and one located on southern side. Pedestrians and bicyclists, can bike and walk along the northern shore of Vandkraftsøen and Storåen, all the way from the city center to the site. The path systems leading to the site are often used by the citizens thereby a possibility for visitors frequently. As mentioned in the part about water management is there difficulties in the accessibility of the site do to the increased water level. The roads west of the site leading north towards the city gets flooded when the water table is raised to contour line +15.0. The design has to deal with these situations during the design process.

Production landscapes



Ill. 3.7 - Analysis of use-scapes

Production landscapes, flat fields, and forests dominates the Danish landscape. The production landscape has through generations been optimized, organized and adapted to the common location of it. The site and the area around it, is also dominated production landscapes. The site itself is an old trout farm, tracks from the old trout farm is still visible in the landscape. One of them are the old ponds, the ponds are visibly very dominating at the site. The ponds are placed as low as a natural flow of water has streamed through them to maintain a high level of oxygen for the trouts and low levels of nitrites and nitrates. North of the site is a agricultural landscape located. The agricultural landscape is characterized by it large fields and strict structures. This landscape is optimized to deliver, as must crop as possible. For farmers crops is equal to money. South of the site is an on marl mining lake located, the landscape here is very dives and are characterized be the lake and small hills made by the unusable soil. Forestry is also represented in the local area. The forestry is defined by heavy vegetation, trees and scrubs. All these production landscape has elements in common. Humans maintain them all and they are all optimized for production.

The Production Landscapes could bee seen as "The rural Nature". The rural nature is optimized in relation to production, strict, rigid and maintained or created by humans. "The rural nature" is deeper described in the theoretical chapter about nature.

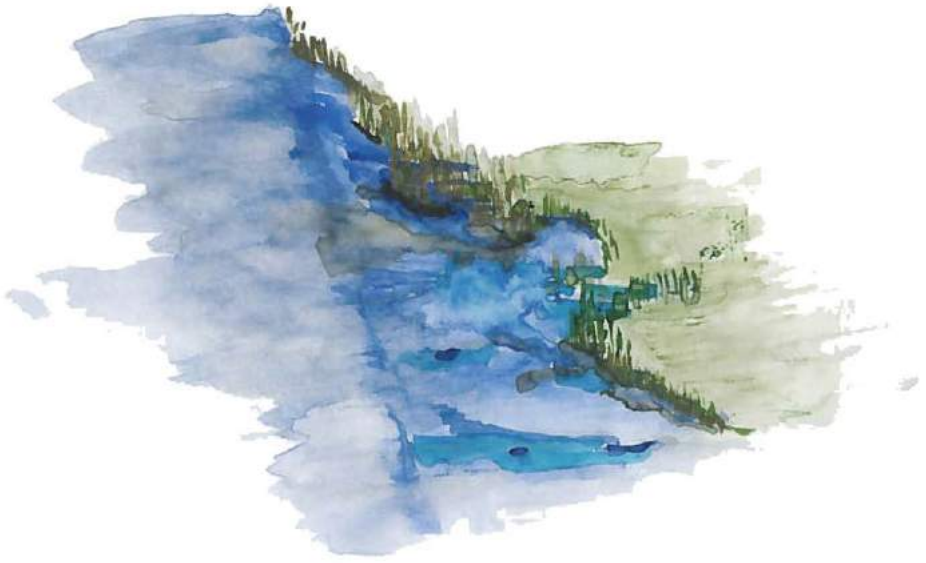
Nature Qualities

Ill. 3.8 - Watercolor

The Nature has a lot of qualities and potentials, the potentials of the site and the nature is investigated in the following analysis (potential analysis) .The quality of Nature is as hard to define as the definition of nature itself, but from looking at the chosen site for this thesis, some of the nature qualities are subtracted, for further investigation.

One of the qualities of nature is the changeability, over days, over weeks and on annual basis. The chosen site is heavily affected by the natural changeability. The change in color, structures and expression is a part of the nature's characteristic. But also the changing level in water is a big change in the perception of nature located on the site.

Another quality of nature, on and around the chosen site is the diversity in landscape types. The cause of the diversity is mainly based on the cultural history of the area and site, tracks from the previous uses and the present uses are visible and gives the site its character. The changing landscapes create different types of habitats for animal. natural quality are hard to measure, but biodiversity is measurable, because it is measured in quantities which is measurable. A high biodiversity is a quality for the design solution, but also a quality for the users of the area and the natural balance.



Ill. 3.9 - Watercolor of atmosphear

There was a defeating silence that afternoon. The only sound, which occurred on the site, was a small rippling from the stream (appendix 3). A fresh breeze blew air across the site. The air was refreshing but cold. The wide expanse did nothing to prevent the wind from raid in the area.

The ground underneath the feet was moistened by rainwater. Walking on the ground seems like walking on a sponge and the top layer was more water than soil, animal tracks and footprints were easy to identify. The high trees on the hillside dragged long shadows across the site. Scattered light was creating a pattern on the ground. A pattern, which changed according to position of the sun and light conditions.

The old buildings and the artificial trout ponds was the only leftover from the trout farming. The ponds were muddy and the water almost non-existing, only the sludge on the bottom of the ponds was left. A few sheep was grazing on the site, to maintain the natural growth of small trees, bushes, grass and weed. The landscape around the site showed sign of further uses, marl mining, farming and mining of clay. The building closest to the stream was transformed into a public shelter, were wood for a bonfire was stored and there was place for sleepovers.

The contours of the landscape were hidden in the heavy vegetation, especially on the hillsides and on the banks of the stream. The most visible edge in the landscape around the site was the road dividing the site from the little watermill on the other side of the road.

The site was located in a valley, with hillsides against north and south, which gave the site a direction. The site had a naturalistic identity, created by the surroundings and the conditions. When walking around in the area, the weather conditions was changing, from cloudy to sunshine and from windy to calm.

Ill. 3.10

Ill. 3.11

Ill. 3.12

Ill. 3.13

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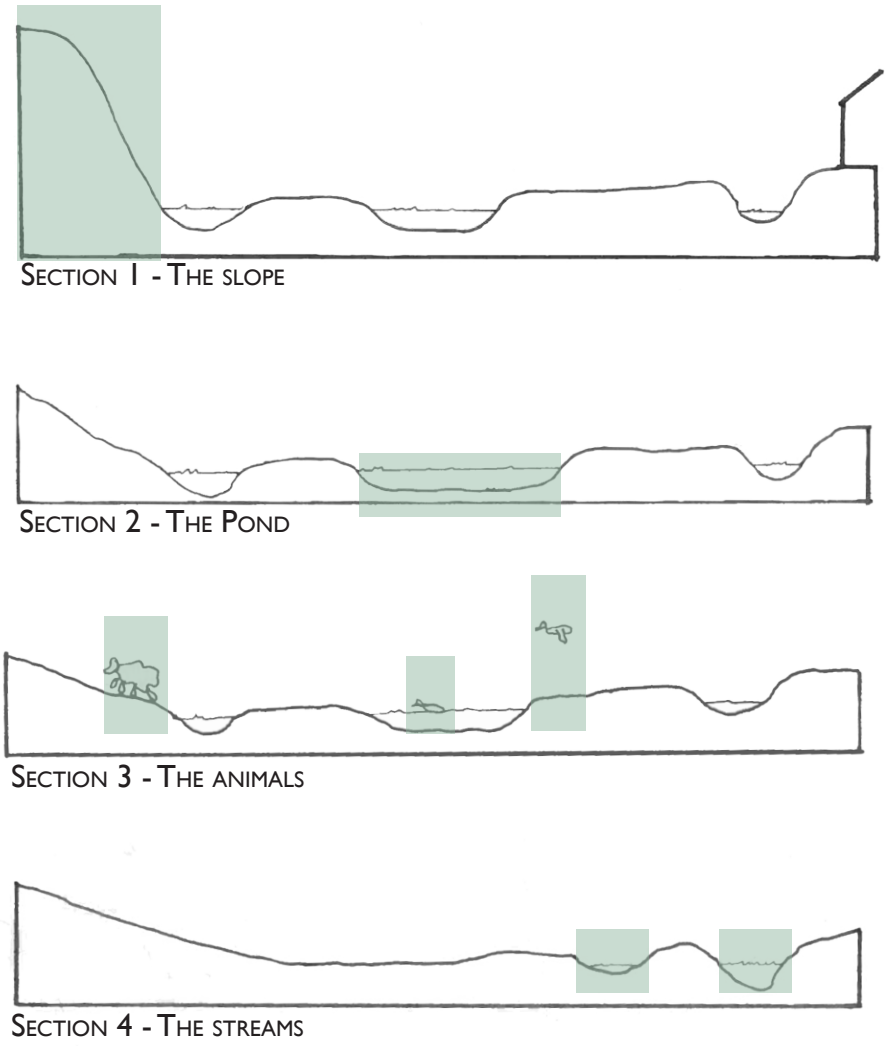
Ill. 3.19

POTENTIALS

Ill. 3.20 - Ortho Photo of Site



Ill. 3.21 - Potential sections

This analysis takes point of departure in an already described method, a method developed to read and understand complex urban situations.

We do not use is as the original methods describes. The situation that we are analysing is not a dense and complex urban situation, but a complex, open and naturalistic area. The original method has it strength in the complex structures with several overlapping structures, networks etc. The force lies in the isolation and division of specific potential, situations and elements. The sections above show the physical potential that we have been working with.

The intention of this analysis was different than the outcome of it. The intention was to create two different analyses of potentials; the first analysis should have focused on the physical potentials, trees, hills, ponds etc. and the second analysis should have focused on sensorial potentials as bird song, the taste of wild berries etc. but during the mapping of these potentials a relation became visible to us, between the physical potential and the sensorial potentials. The relation lies in the intersection between physical and sensorial. Sound of wind in the trees, only occurs if there are trees located at the site. That is the relation between the physical tree and the sensorial sound of wind in trees. This became an argument in only doing one analysis on the physical potentials.

This analysis and its outcome are consistent with the way that Stig Lennart Andersson argues for designing of urban environment. Stig Lennart Andersson argues that the adaptive environment has to be designed for situations and not for functions (Andersson, 2011). The outcome of this analysis is four small designs of situations, dependent on the four sections above.

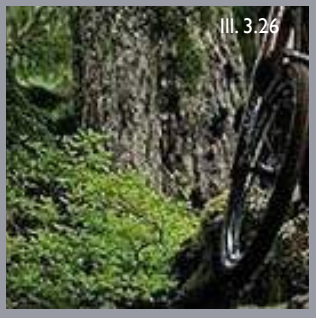
Section I - The slopes

Ill. 3.22 - Potential of the slope

Ill. 3.23 - Potential of the slope

Ill. 3.24

Ill. 3.25

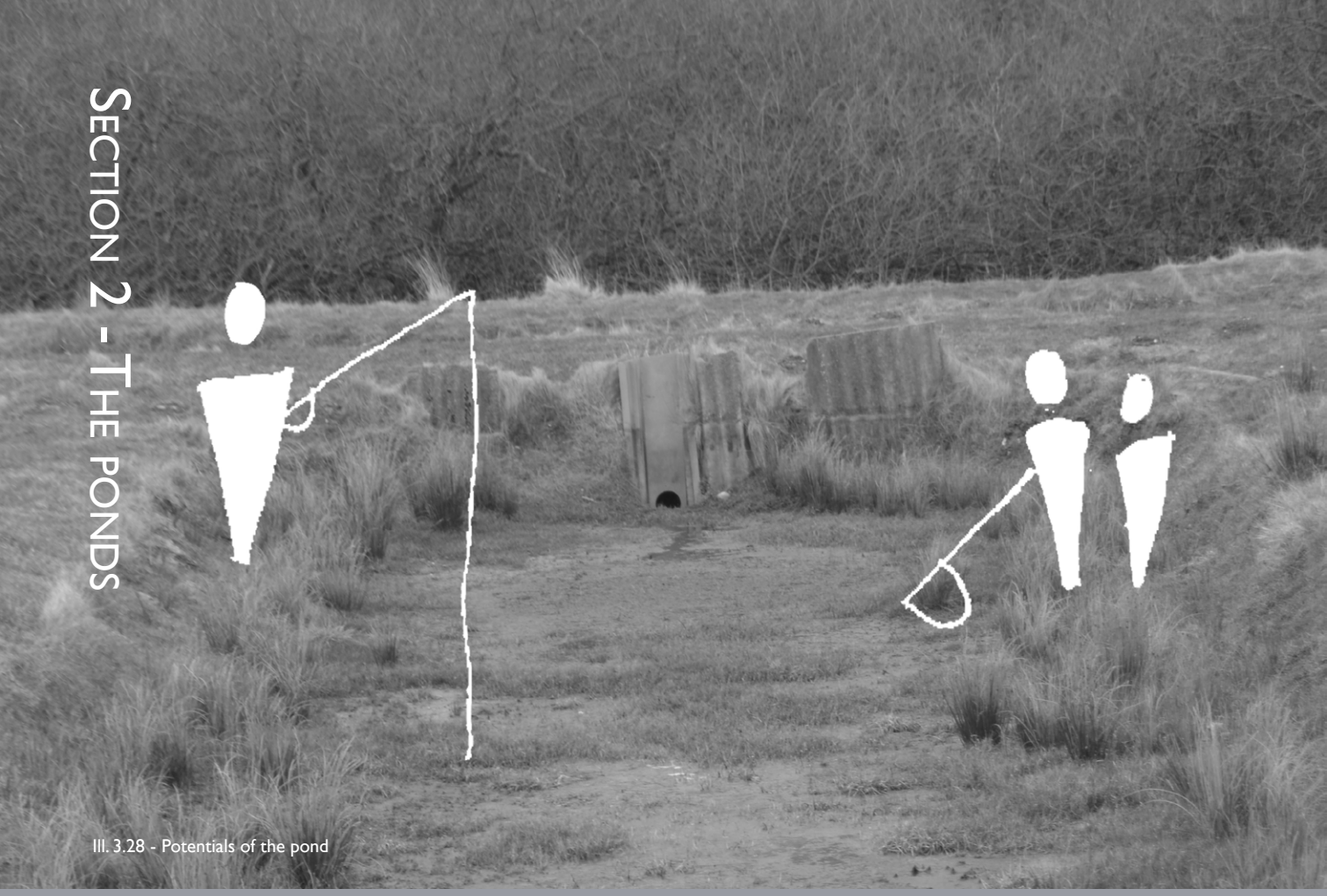


Ill. 3.26

Ill. 3.27

The site is located low in a valley. Trees densely occupy the slopes around the valley, and the perception of it is like being fenced. This design works with the movement up and down the slopes. Movement can take place at a high tempo, for example, a mountain bike or in a slower pace like walking. By facilitating several different tempos, the perception of nature and forest differs. At high pace the perception of the woods create a random rhythm of vertical trunks, but at slower tempos, small pockets are created in the in-between spaces, these small pockets facilitate then spaces where the silence can be enjoyedand other perceptual qualities occur.

Section 2 - The ponds



Ill. 3.28 - Potentials of the pond

Ill. 3.29

Ill. 3.30

Ill. 3.31

Ill. 3.32

The disused trout ponds will be rich on life of small fish and insects, by reinstating the disused ponds there will be an opportunity to capture small insects and fish. This can both be done in as leisure activity, or with a more scientific approach. By introducing people to animals and nature through interaction, hopefully an increasing interest form nature and animal will appear. Once the area from time to time is flooded, animals and plants will have the chance to spread to other areas of the site and other habitats. The ponds will be a habitat for the animals and plants living in still water.

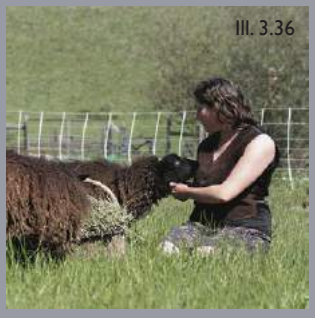
The activity of catching something appeals to many, new friendships and knowledge can be gained through activity near the ponds.

SECTION 3 - THE ANIMALS

Ill. 3.33 - Potentials of animals

Ill. 3.34 - Potentials of animals

Ill. 3.35



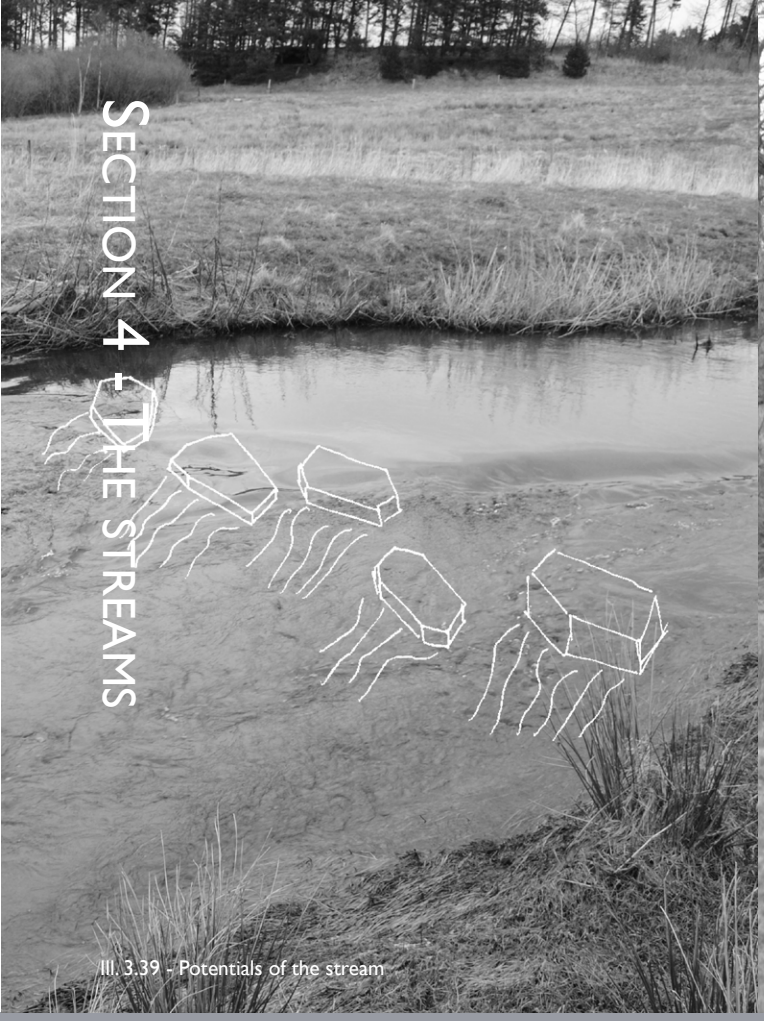
Ill. 3.36

Ill. 3.37

Ill. 3.38

Animals have a positive effect on us humans. The animals can be used for several different purposes. By implementing animals on the site for maintenance of plants and vegetation, but also an option to use animals in a more scientific or curative intent occurs. The animals on the site can both be naturally occurring or implemented by humans. Some animals are more misanthropic than others in that way we have to work with the relationship to animals in several ways, such as building an observation post to watch the birds or deer, which only shows from their hideouts if there is quiet around them.

SECTION 4 - THE STREAMS



Ill. 3.39 - Potentials of the stream

Ill. 3.40 - Potentials of the stream

Ill. 3.41

Ill. 3.42

Ill. 3.43

Ill. 3.44

Water as the element is full of options. Water has the ability to be an element which can be used in an active way and thus achieve health through exercise, but water can also have a relaxing effect on us as humans, rippling water are being used in healing and other forms of alternative treatment. More and more people are afflicted by stress, and therefore it is important throughout the project not only focus on health as exercise, but also see health as something you can boost by finding yourself and follow your needs.

Ill. 3.45

Problem formulation

"How does one communicate knowledge about water, nature, science and climate adaption through a physical design that appeals to the human senses and the changeability of nature?"

This chapter takes point of departure in three overall theories. The theory of nature represented by the Danish philosopher Hans Fink. The theory of perception, sensing of architecture and environment defined by Juhani Pallasmaa and Steen Eiler Rasmussen. The last theoretical position is urbanism. Landscape urbanism, expressed by James Corner and Charles Waldheim and Process urbanism expressed Stig Lennart Anderson. The respective theories will be understood through discussion and create a solid base for the next phases of the integrate design process.

Landscape Urbanism/Process Urbanism

"Landscape Urbanism describes a disciplinary realignment currently underway in which landscape replaces architecture as the basic building block of contemporary urbanism. For many, across a range of disciplines, landscape has become both the lens through which the contemporary city is represented and the medium through which it is constructed" (Waldheim, 2006 p.11).

James Corner argues that the landscape and the nature cannot be separated from the build and the cities, but the cities create a landscape itself, a "cityscape". A cityscape full of impressions and varieties do to the perception of the city. Small green pockets, larges squares, large building block and single-family houses with garden are elements, which is a part of defining the cityscape. All these elements together create a divers city.

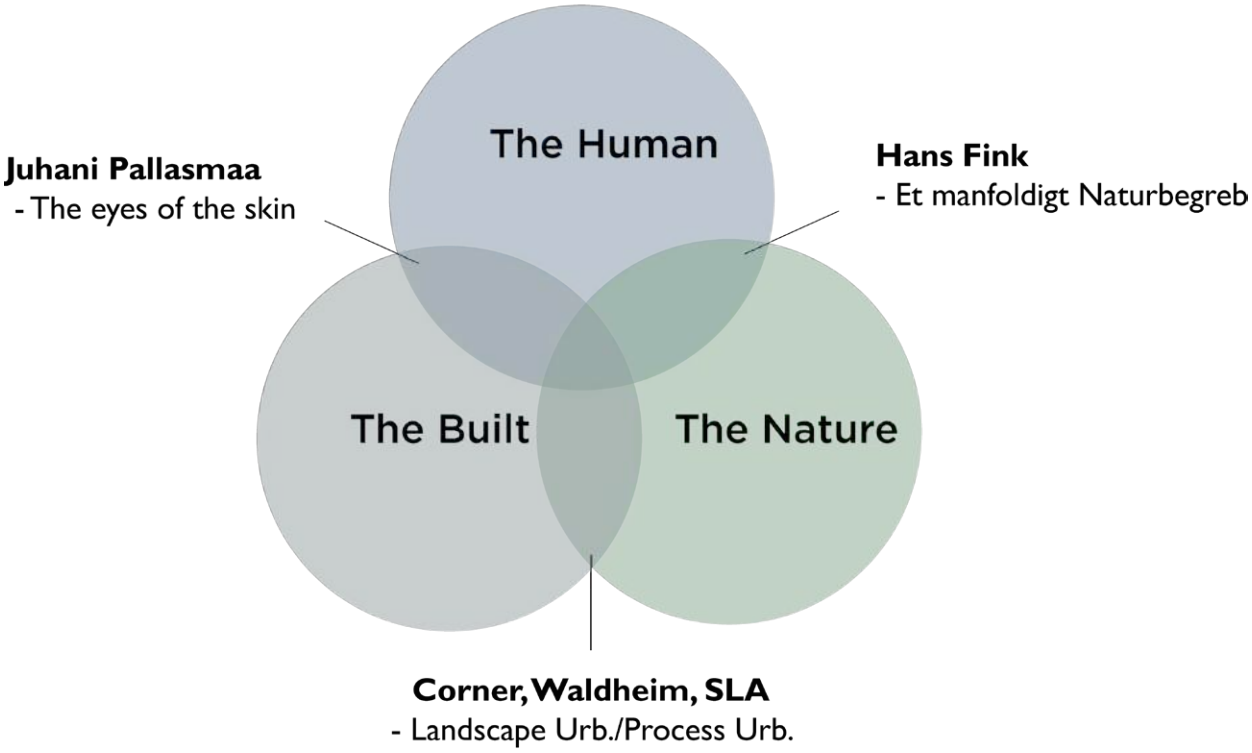
In landscape urbanism the City and the landscape blends and creates a dynamic and liveable city. A city, which changes because of the changing needs, according to the inhabitants. Landscape urbanism argues that the city is changeable and modifies by the inhabitants. The same happens to the world. We are living on a planet, which is changing constantly. The global warming is the result of a planet in change. We as humans have through generation changed our behaviour this has a knock-on effect on the environment we live in and the planet we live on. The constantly changing planet is also the foundation for us as evolved animals and humans.

Landscape urbanism lies in the intersection among urban planning, architecture, landscape design, biology, geography and science. It uses the landscape as framework for solving initial problems in the build environment such as rainwater management, infrastructure etc. Landscape urbanism works with an interdisciplinary approach. Otherwise the modernism, landscape urbanism works with merging and overlapping programs of the city and urban area. Landscape urbanism works whit layers, layers could be seen as a layer of infrastructure, of layer of water management, and a layer of sociological interaction, and thereby solve the current problem by focusing on the intersections and connections between the layers.

Landscape urbanism is seen as a response against the modernist city planning. The modernist city planning is known for its rigid structures and it segregation of facilities and uses (Waldheim, 2006). One of the most well known modernist city planning project, is the planning of "plan Voisin" made by the modernist architect and urban planner Le Corbusier. The modernist planned cities have been accused of not being cities for people, but cities that works as machines, machines for transport of people and a living machine.

"Landscape is not only a formal model for urbanism today, but perhaps more importantly, a model for process" (Stan Allen in Waldheim, 2006 p.39).

Not a single human inhabited city is stationary, development or demolishing is in process, but also the more natural processes is going on, the changing seasons, the changing weather conditions. The city we are living in as humans are dynamical, and are in a constant process or adaption. Adaption to climate changes, rising water level or the ubanisation (Anderson, 2011). The nature, the humans and the build are constantly in a process. A network of processes intersects and create relations between the three theoretical topics. When the nature changes, the humans' changes their behavi-



Ill. 3.46 - Theoretical field

our and thereby the build (the cities) will change over time and the same happens in the reverse direction. (Ill. 3.46)
The chosen project site is affected by natural processes from the changing level of water located at the site, but also the changing seasons and weather. The changing water condition will affect the design in several ways, perceptual, esthetical and technical.

Stig Lennart Anderson (SLA) is in the same conviction, as Corner, Waldheim and Allen. They all argue that there are a link between the nature/landscape and the city.

"Nature and city are not well-defined entities, nor opposites. They are different, but equivalent systems. This calls for adaptability and makes process urbanism a vague entity" (Anderson, 2011).

Process urbanism focus on situations instead of functions, situations can be changeable and functions cannot. It all turns around atmospheres. (Anderson, 2011). Several processes occur in our everyday life, and nothing is stationary. This will also happen to our design and is a factor that will be incorporated throgh design process and in the final design. The process urbanism approach aims against an adaptive city and an adaptive and changeable environment, which also is the aim during this thesis. A design capable of changing character, a character caused by the atmosphere and the perception of it. Atmospheres made by the surroundings, the users and the used design tools. The users of the space perceive the atmosphere trough their senses but also through there being

The landscape urbanism has been criticised in relation the their design method. The critic strikes against the lack of humanity. The landscape urbanism designs are made mostly for water management, reuse or infrastructural problems and not for social and humanistic reasons. This is why the landscape urbanism and process urbanism compliment each other very well. Process urbanism focuses a lot on the sociological aspect of a design, and the new situation going on in the new development or design.

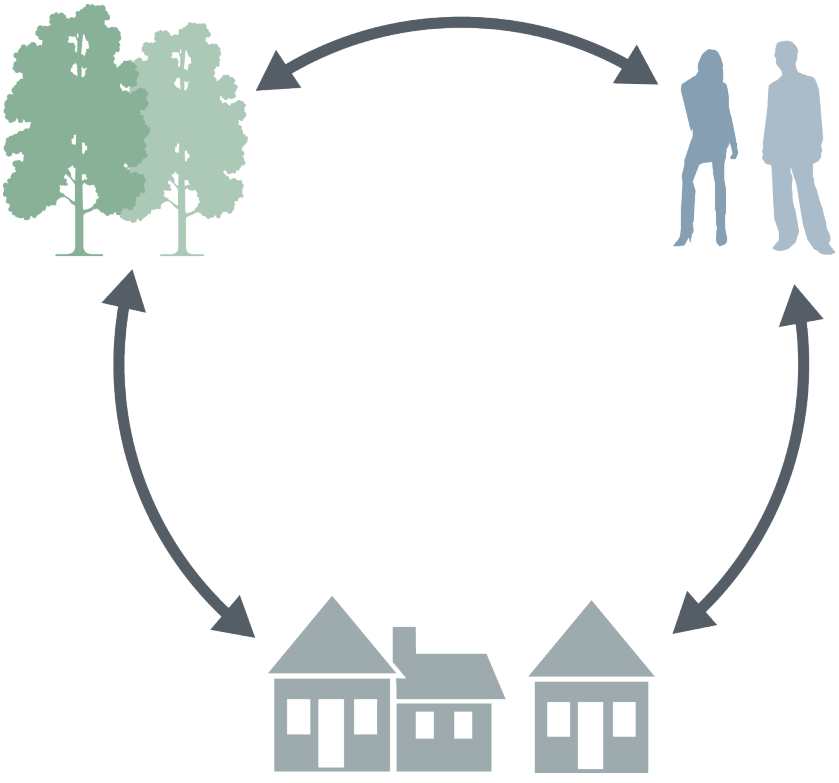
Senses and perception - Phenomenology

One of the focuses during this thesis is the relation among the build, humans and the nature. The humans relates to the surrounding through the senses and the perception of it.
Humans perceive the surroundings through the senses, but also trough a full bodily experience. The senses work in collaboration with the brain. The senses can be seen as the tools for perception and the brain as the main computer of understanding the information collected by the senses. Humans perceive constantly their surroundings and environment. The perception happens as a natural and unconscious process of understanding a space or a physical setting (Pallasmaa, 2005). Perception can happen through play or use, Steen Eiler Rasmussen argues that one only can get a full understanding of the building or design through interacting with it, use it, play with it, smell it, hear it, feel it, see it, PERCEIVE IT. Children are good at playing with buildings, they stomp hard on the floor and achieves an echo and a shaking sensation throughout the body, an example from Steen Eiler Rasmussens book is, children playingwith a ball against a curved wall and thereby the ball returns in an unpredictable lane back (Rasmussen, 1966).

" Perception is [therefore] not a sum of visual, tactile and audible givens: I perceive in a total way with my whole being: I grasp a unique structure of thing, a unique way of being, which speaks to all my senses at once" (Merleau-Ponty in Pallasmaa, 2005 p.20).

Vision is seen as the most important sense in perception of architecture and urban design. But to get a full impression of the architecture or urban design, all the senses must be a part of the perception. A disabled person with no vision has an improved sense of audio, and creates a kind of a vision from the sounds a "sound-scape".

"Vision is regarded as the most noble of the senses, and the loss of eyesight as the ultimate



Ill. 3.47 - The relation among humans, the nature and the build

physical loss" (Luis Bunel and Salvador Dali in Pallasmaa, 2005 p. 18).

The human brain functions as a hard drive, which stores previous occurrence and perceptions. The brain recalls the specific perception if the human relate the new situation to an old situation. So a person is able to feel just by looking at for example cold fresh water.
The theory of perception and sensing has affected this thesis during several phases, the design process, the analysis phase and the final design. Focusing on the sensing demands a perspective that grasps every parts of a design, from the small details to the general concept, in order to obtain a full understanding of the design and perception of space.

Perception, sensing and atmosphere, are important elements to focus on in architecture and design of learning environment. The final design in this thesis is a platform for education, learning and public awareness. Therefore a big effort is put on creating the right framework for this situation. Atmosphere can be obtained through materiality, perception of space, users etc. To gain knowledge according to education, the frame has to deliver the optimal space, both in order to give the possibilities, but also prevent from distraction.

Our opinion is that nature is able to apply to all our senses. The changing colour of leafs according to the seasons, Sound of wind in the treetop, the smell of flowers and the taste of edible berries and the feeling of soft grass underneath the feet. All these listed perceptions are elements that give the area a special character and creates a specific atmosphere.

Nature

Nature is a diverse expression and we as humans are interacting with the nature every day. The Danish philosopher Hans Fink frames the nature in seven categories or scopes. The seven categories frames the nature differently and reflects the way we are looking at nature. The frames works with the nature in a theoretical way. It scopes nature and define several way of looking at the nature. The seven categories are listed here:

The untouched nature, are defined as nature that has not been touched, used or changed by humans. Fink Argues that untouched nature dose not exist any more, the nature has always been affected by humans, physical structures or by invisible things as particles and CO2 derived from humans.
The wild nature, are defined as that non-maintained. The wild nature mange it self and the wild nature works in natural processes. Processes managed by the changing seasons, the wild animals and conditions.
The rural nature, are one of the most common types of nature here in Denmark. The cultivated land, cultivated for production of food and animal feed, defines the rural nature.
The green nature is found both in the countryside but also in the cities. Both flowers and herbs grown in flowerpots in the city and the old oak in the forest in defined as the green nature
The Physical nature, are affected by the evolution of science. This type of nature stretches from the smallest elementary particle to the largest star cloud.
The earthly nature, are affected by our faith and the way we see the world. The earthy nature is the opposite as the sublime and divines.
The last subcategory is **everything.** Everything can be seen as nature, bricks can for example be seen as nature because of it origin from clay, but also because of its ability to work under pressure force. It acts natural, it change and adapt to its natural environment (Fink, 2003).

The categories describe the frame of how we are looking at nature and the categories helps us finding the right term for the specific kind of nature we are looking at and working with. Hans Fink argues that the nature can be everything and at the same time be very specific.

The landscape and the nature at the site tell a story about production and use of natural resources. The Danish landscape has through generations been optimized for production of food and animal feed. It can be seen in the large flat fields and meadows, all over the country. More and more of the Danish Nature are turned intoproduction landscapes, landscape used for production and farming. The production landscape has the advantage of being efficient, optimized and useful for production. The use-scape is beautiful, in the spring and summer, but there is a distance between the humans and the use scape, the relation is only based on the sense of vision, and not a full bodily experience. There is no physical interaction between the production lndscape and the humans except from the framer harvesting the fields.

The different scopes of nature are in the political debate, hosted by several groups of interests. The rural nature is hosted by the farmers and some political parties, who focus on production and low costs, they see rural nature as the best way to utilize the nature and get the most out of it. The wild nature scope is hosted by nature conservationists, who intent to let the nature do as the natural processes predict. The wild nature and the rural nature have clashes do to maintenance. The rural nature is maintained by the farmers, opposite to the wild nature, which is maintained by the natural processes of nature. Nature conservationists are frightened by the thought that the rural nature over time will dominate the Danish landscape and create an odd balance in the nature.
The physical nature could be seen as the "super-nature", if the natural balances are ruined by the humans, the "super-nature" are going to strike back a in shape of a natural disaster. The global warming is for an example a natural disaster made by a disorder in the natural balance.

Even that the seven categories of nature are very different, are they all a part of the subject nature. The hills, the buildings, the trees, are all part of the nature, a changeable and diverse nature. This has a correlation to landscape urbanism, which sees nature and the city as a coherent, diverse, changeable and adaptive element.

Ill. 3.48

Sub-conclusion

There are a lot of relations between the three topics, creating a complex network of intersections. We have during the theoretical investigation found out that one can see the three theoretical topics individually, but also as a whole. The diagram (Ill. 3.46) shows the relation between the topics, and how they affect each other.

The Danish landscape is dominated by use-scapes, which has been optimized for production but not for perception of it. The purpose of this thesis is to conquer back some of the production landscape and create nature and landscape that applies to the human senses and at the same time combine aesthetic qualities with technical aspects. The dominating scope of nature, the rural nature, is going to destroy the foundation of nature. To prevent this from happen, the nature processes and networks have to be treated with care.
By working with a landscape and process urbanistic approach the natural cycle will be restored, and human activities do not end in a naturalist disaster that wipes out humanity.

This thesis combines several of the nature categories in a mix, to understand the nature as a dynamical and non-static element. The nature are changeable and in a constant and dynamical process. Processes, which changes the perception and expression of nature.

Biodivesity


Ill. 3.49

Light conditions


Ill. 3.50

Scales

Green roofs

Biodiversity is defined by the report "Global biodiversity strategy" from 1992 as a variation in species and ecosystems. The biodiversity is threatened in the whole world, due to human activities. Urbanisation, water management of cities, the inclination in the population of the world and mining/harvesting of natural resources, is just some of the human activities, which has an affect on the biodiversity (Naturstyrelsen.dk, 2016). The Danish nature is dominated by "the rural Nature" and production landscapes. The optimization of these areas has been a part of the decreasing biodiversity. The old streams, which were a part of the drainage system in relation to agricultural fields, have also been optimized as a part of the whole optimization for farming. The optimization has straightened out and increased the size of the streams. This has resulted in a decline of habitats and quality for animals and fish in the drainage streams. The optimization of the Danish landscape, the translation from "wild nature" to "rural nature" has put several species of animals in danger of becoming extinct (Vincentz, Hahn-Petersen and Kloster Bro, 2016).

The design in this thesis is aiming against an increasing biodiversity. The biodiversity of the site depends on the quality and quantity of the nature, habitats breeding spaces and breeding corridors. A higher biodiversity is equal to a larger natural value both in an ecological and biological perspective but also in an educational perspective. The report "Biodivesitet i byer" define five architectural tools which can help to increase the biodiversity (Vincentz, Hahn-Petersen and Kloster Bro, 2016).

Light conditions – is an important factor in relation to biodiversity. Almost all plants demands light to grow and bloom. For an area with high biodiversity three light conditions are demanded, light, partly shadow and full shadow.

Scales – a large area is more capable of a higher biodiversity, than a small area, because continuity is an important factor in

Ill. 3.51

Ill. 3.52

Terrain

Ill. 3.53

Meandering of streams

Ill. 3.51

an increasing biodiversity. Also the scale in vegetation is important, from the smallest grass to the highest tree.

Green Roofs – Creates new habitats for both animals and plants. Green roofs are able to absorb the percipitation and thereby create varies types of humidity in the base of the roof. A green roof with inclination preforms automatically several habitats because of the shape; the highest part of the roof will dry up quicker than the bottom.

Terrain – is able to create diversity in habitats and diversity in habitats is equal to diversity in species. The terrain has the ability to create small habitats within a large habitat. These small habitats could be different according to the height, and thereby humidity in the soil.

Meandering of streams – creates more diversity in habitats for fishes and animals living in and around the stream. It also creates breeding places for fishes, water mammals and other animals. The changing light condition in a meandered stream, creates places for different ecosystems, and thereby a higher biodiversity.

A short conclusion on this is that if a higher biodiversity is wanted, there has to be differences in the nature types and thereby also in the habitats. Many of the animals live in the intersection between nature types, on the edge of the forest, on the banks of the stream and in the dry areas with occasional flooding. Differences and continuity is everything if a higher biodiversity is the wanted outcome.

All these thoughts have been a part of the design phase of this project. To examine the design proposal the five architectural tools defined by the report "Biodiversitet I byer" have been used.

Water


Ill. 3.54


Ill. 3.55

Water is fatal for life on earth and any living organism demands water for survival. 70 percentage of the world is covered by water (Denstoredanske.dk, 2016). In some parts of the world the increasing level of water is a major treat, for humans and animals, the increasing water level demolish their habitat or destroy their food. While other part of the world is in heavy need of water, water for drinking, both for animals and humans.

Water is a highly changeable element, at very low temperatures hard, cold and prismatic and at high temperatures almost invisible. External impact such as frost and heat change the phase of water as a reaction. All these phases are natural to water, and help defining water as a changeable element. Another example is that water is able to increase the natural and economical value of a design but also the opposite way around. A view to water will increase the natural and economical value, but moist in the foundation will decrease the economical value. Several summerhouse owners on Denmark's west coast, has recently felt the power of water, several summerhouses was flushed into the water and the water has eaten several meter of their private plot.

The perception of water can be very divers, water is able to act calm and have a relaxing and rehabilitating effect on humans, but water has also the ability to be perceived as demonising and aggressive. The perception of water mirrors the external impact on the water. If it's a windy day, the water surface is broken and aggressive as the wind is too.

The chosen site for this thesis is occasional flooded, as a result of saving the inner city of Holstebro from flooding. A further description can be found in the water management analysis. The increasing level of water is then a part of a dynamical process, a process, which affects the expression of the build and landscape. The increasing and decreasing level of water is not the only process affecting the site. The site is located in an area with a high value of nature.

Ill. 3.56

Ill. 3.57

The nature is in a constant process, during the seasons.
During the thesis two water phenomenons has been in focus through the design process. The water phenomenons were dragged into the project, both to be a driver in the design process, but also as an element, which can help in the communication of the general water management strategy of Holstebro.

The water mirroring effect was dragged into the project in relation to the communication of the overall water management strategy, but also because of its ability to represent the picture of an element. If the water is enclosing an element, it can be difficult to distinguish between element and representation of it. This is a way of designing with the nature and water, and not against it, has been used during this thesis.

If elements for example, water drops hits a water surface, water rings will appear. This is a way of working, which has been used in the shaping of the landscape. Every of the ring has a program, the programs of the water rings are explained later on in the report. The water rings is part of the representation of the four Production landscape gradens, which is introduced into the site as a part of the educational environment.

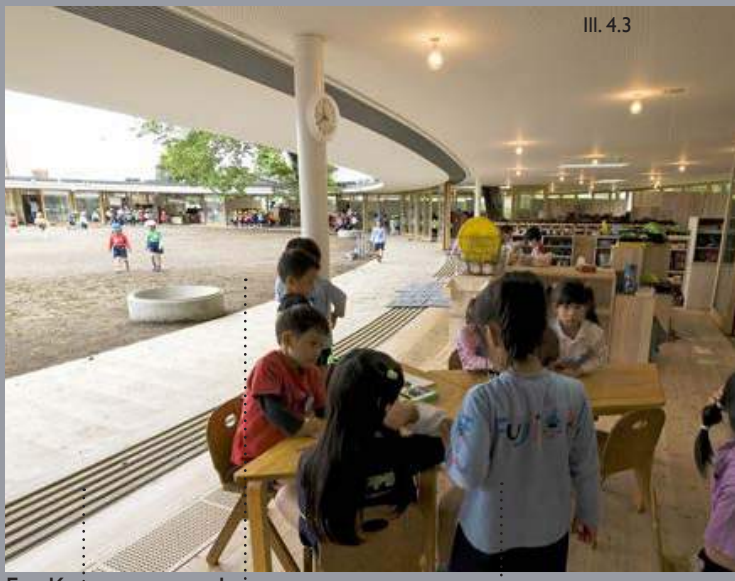
PRESENTATION

"The strength of a good design lies in ourselves and in our ability to perceive the world with both emotion and reason. A good architectural design is sensuous. A good architectural design is intelligent" (Zumthor, Oberli-Turner and Schelbert, 2006, p. 57).

Inspiration

Ill. 4.2

Fuji Kindergarden - Japan



Ill. 4.3

Fuji Kindergarden - Japan

Activated roof

Site specific

Flexible facades

inspiring environment

Free facades

Relation between inside and outside

Open learning environment

Ill. 4.4

Rolex Learning center - Sweitzerland

Ill. 4.5

Rolex Learning center - Sweitzerland

Flexible facades

Free facades

Open learning environment

Activation of sloped floor

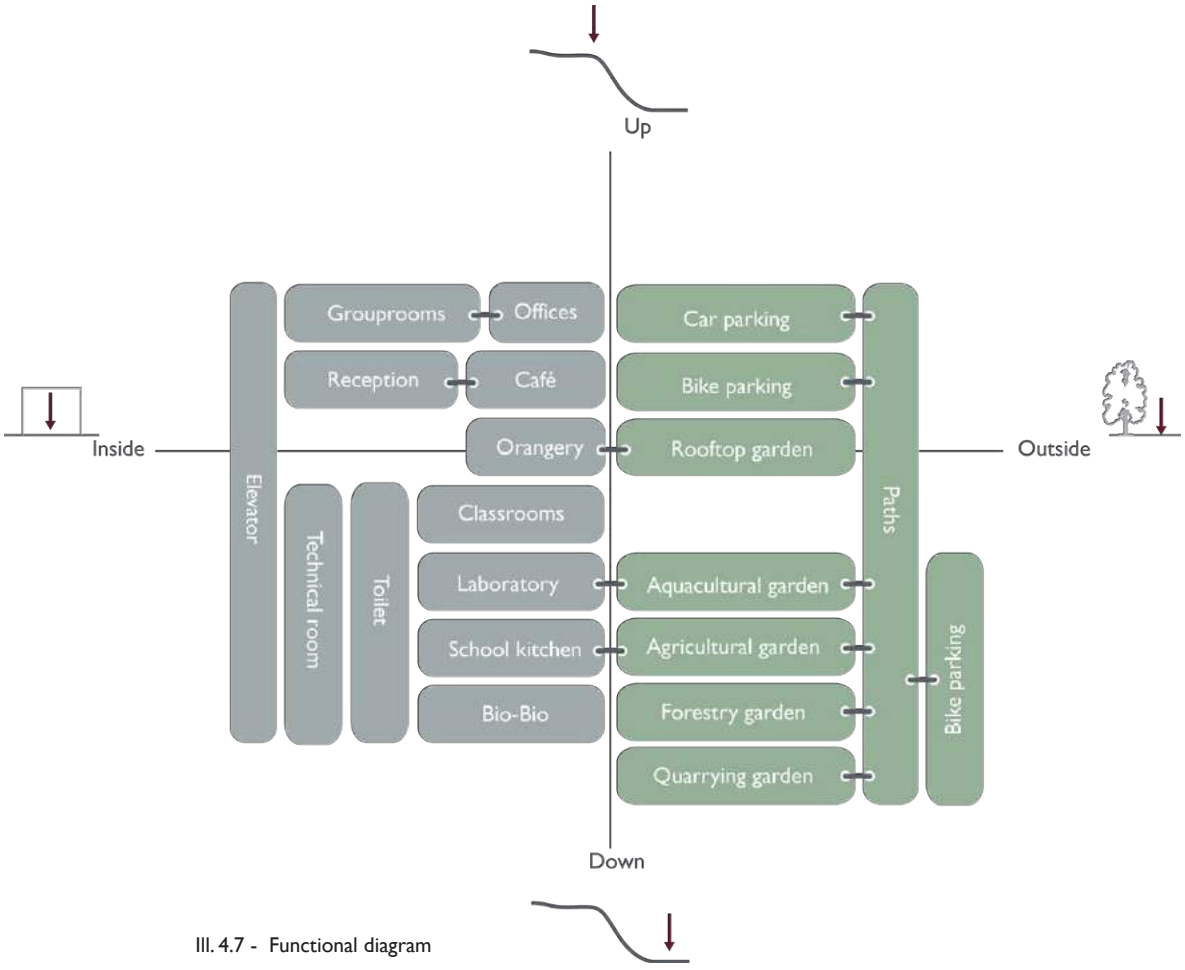
inspiring environment

Flexible rooms

FUNCTION	AREA, m^2	CAPACITY, PERS	ATMOSPHERE	REQUIREMENT
Laboratory	95	25/30	CLINICAL	
School Kitchen	95	25/30	PRODUCTIVE	
Library	145		OPEN	
"BIO-BIO" Auditorium	125	25/30	DIM/ENCLOSING	
Classrooms	600	3 x 30	LIGHT	6 m^3 PER. PERSON
Orangery	100		WARM	
Cafe'/Reception	350		OPEN	
Group rooms	275	55	LIGHT	
Offices	35	4		12 m^3 PER. PERSON
Toilets				
Tecnicalroom				
Elevator			MOVIE THEATER	

Car parking		10-15 CARS		PARKING NORM. HOLSTEBRO
Bike parking		90-100 BIKES		PARKING NORM. HOLSTEBRO
Rooftop garden			WIDE	
Agricultural garden			PRODUCTIVE	
Aquacultural garden			WET	
Forestry garden			ENCLOSING	
Quarrying garden			DIVERS	

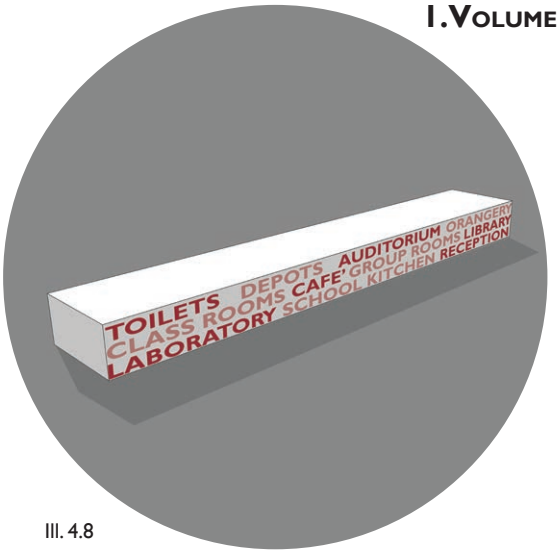
Ill. 4.6 - Building and Landscape program



Ill. 4.7 - Functional diagram

The building and landscape program is made on the basis of the vision for "Tvis Mølle Nature Laboratory" made by the municipality of Holstebro. The first diagram (ill. 4.6) creates the foundation for the overall design. Requirements from the Building Regulations and the program related visions made by the municipality, has had a major influence on this diagram. By working focused with the vision and requirements, the foundation of a well functioning design is created.

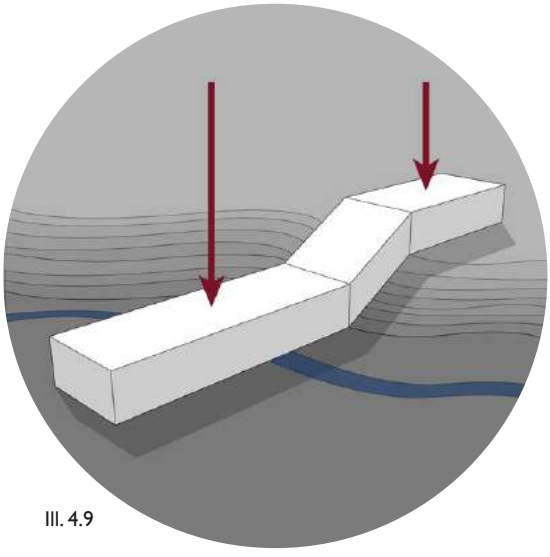
The second diagram, (Ill. 4.7) is representing the different programs and the relation among them. The diagram is focused around a coordinate system, which on the x-axis explains the location of the specific program in relation to inside or outside and on the y-axis explains the relation to the topography, uphill or downhill. This diagram is based on the previous diagram, and transforms it into a site related diagram. By working with at site related diagram the diagram has turned into the first phase of the design process.



Ill. 4.8

1. Volume defined by the building program

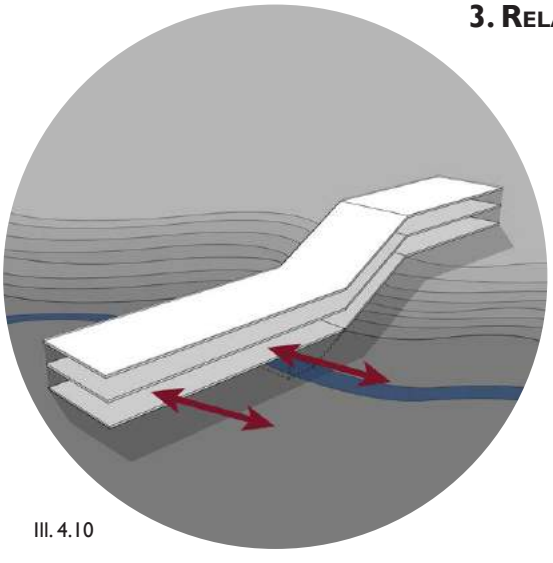
The final program is made as a interplay between us and the vision for "Tvis Mølle Natur Laboratorium" made by the municipality of Holstebro.



Ill. 4.9

2. Volume adapted to the terrain

By adapting the building to the terrain, the design secures accessibility and a relation to the specific site.

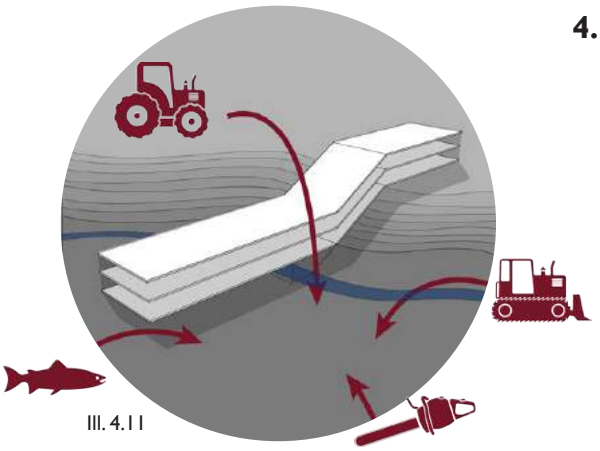


Ill. 4.10

3. Relation between inside and outside

The relation between inside and outside, plays a major role in the function of the building. The laboratory is placed nearby the aquacultural garden and the school kitchen is placed nearby the agricultural garden to secure a functional relation between them.

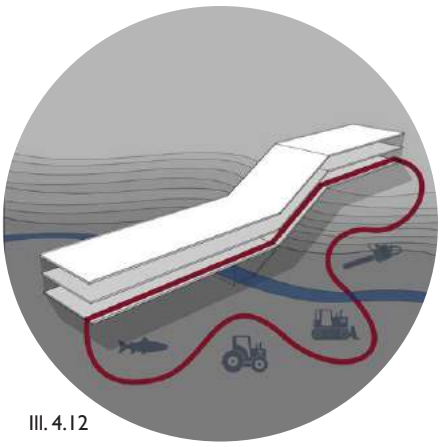
The next four steps in the concept are representing the four topics from the vision for the nature laboratory.



Ill. 4.11

4.Layer of cultural history applied

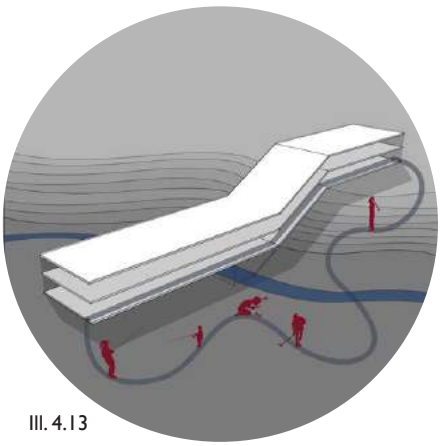
The layer of cultural history drags in the nearby production landscapes, to create diversity in the park. Diversity in relation to habitats, perceptions and programs.



Ill. 4.12

5.Layer of health applied

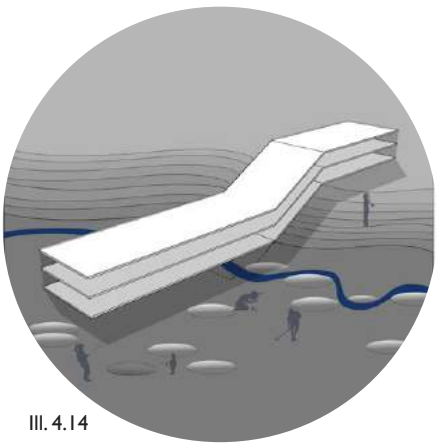
A continuously path created by the layer of heath, connects the four types of landscape in the park. The path affords several kinds of exercise, but the path is also attached to areas were mental health is in focus.



Ill. 4.13

6. Layer of sciences applied

The layer of science can be seen at the programming layer. The four types of production landscapes, affords several kind of scientific experiences. The aquacultural garden affords fishing and collecting of insects, and the three other types of landscapes has equal affordances.



Ill. 4.14

7. Layer of water applied

The layer of water takes point of departure in two arguments, the argument of creating an increasing biodiversity according to a meandering of the stream and a form tool achieved by investigating water phenomenons.

Relation between inside and outside

The open and flexible facades, creates portals into the gardens. The relation between inside and outside is created according to functionality and aesthetic qualities.

Ill. 4.15 - Relation between inside and outside

Site Plan

The site is located in an area, where the rise and fall in water level is creating a dynamical process, a process that gives the site a character. The change in water level is caused by the water management strategy, which protects the inner city from flooding. The following page visualizes the change in water level with and without water.

Ill. 4.16 - Flooded siteplan (+15.0)

Ill. 4.17 - Site plan 1:1000

Ill. 4.18 -Platform

Ill. 4.19 - Bike rack

Ill. 4.20 - Materiality change

Ill. 4.21 - Cut through

Ill. 4.22 - Path

Ill. 4.23 - Pond

The Landscape

The stream run slowly through the landscape and creates a calm atmosphere around it. The Ducks enjoy the fresh water too and the rich opportunities for food. The slope in the background preforms a natural setting for the activities happening in the gardens.

Ill. 4.24 - The Landscape

The Landscape

It is a stormy and rain full day in in the middle part of Jutland. It has rained in a couple of days, and the water level has increased. But even though it is a cold and rainy day, a lot of opportunities for experiences are offered in and around Holstebro Nature LAB.

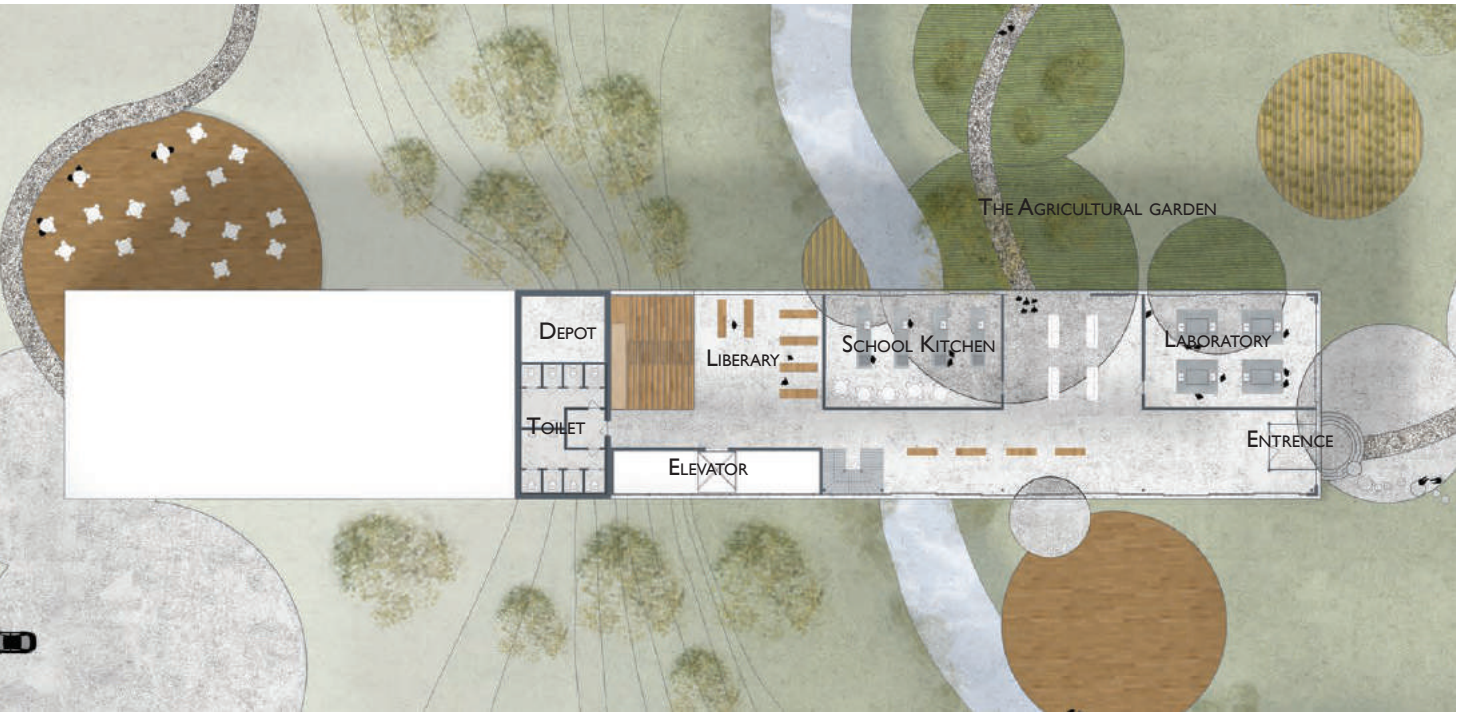
Ill. 4.25 - The Flooded Landscape

BUILDING SECTION

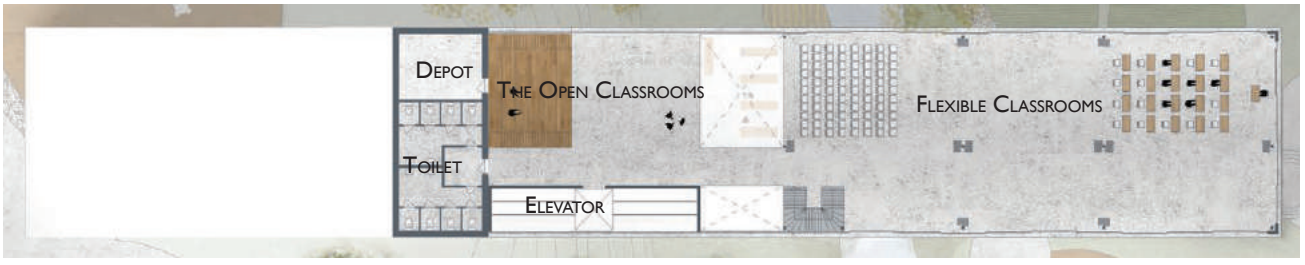
Ill. 4.26 - Section A-A !:500

Floor Plans

Ill. 4.27 - Level -1 1:500

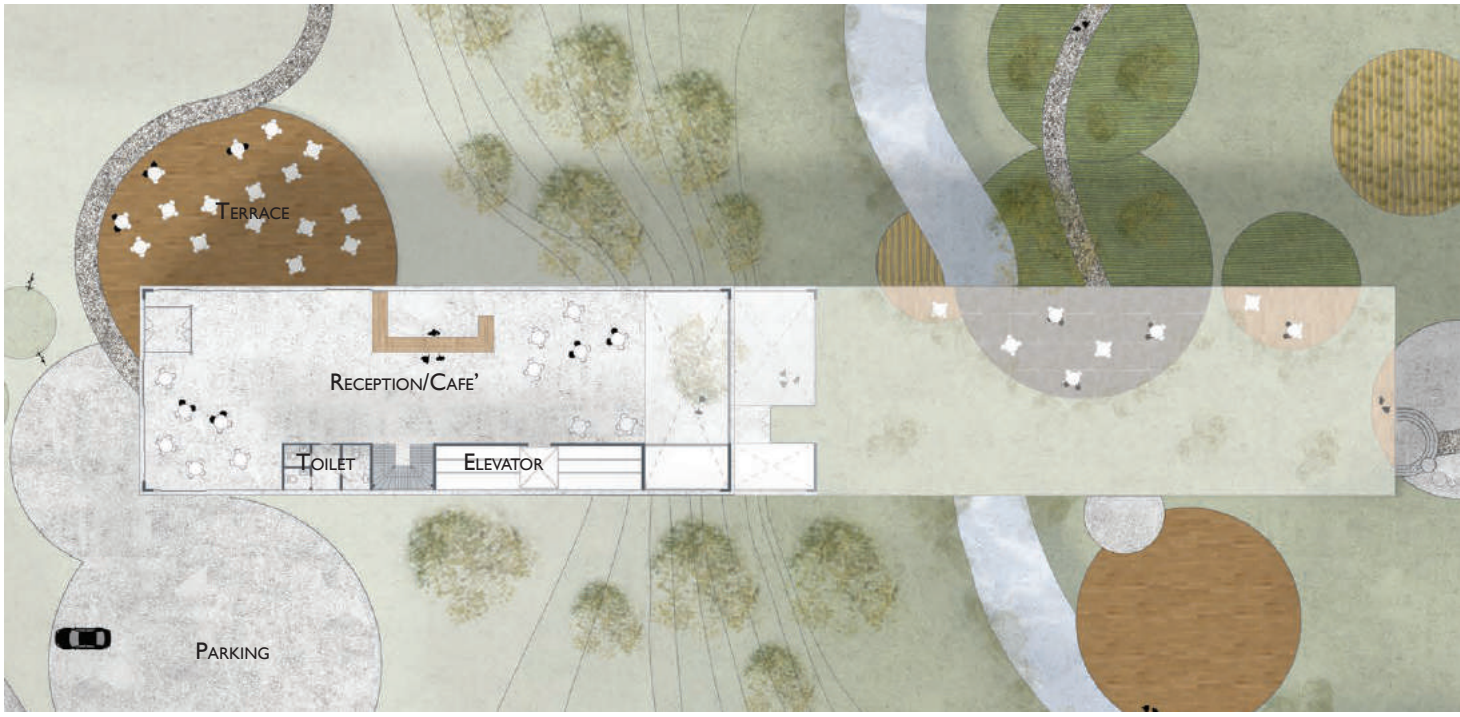


Ill. 4.28 - Level 0 1:500



Ill. 4.29 - Level +1 1:500

Ill. 4.30 - Level +2 1:500

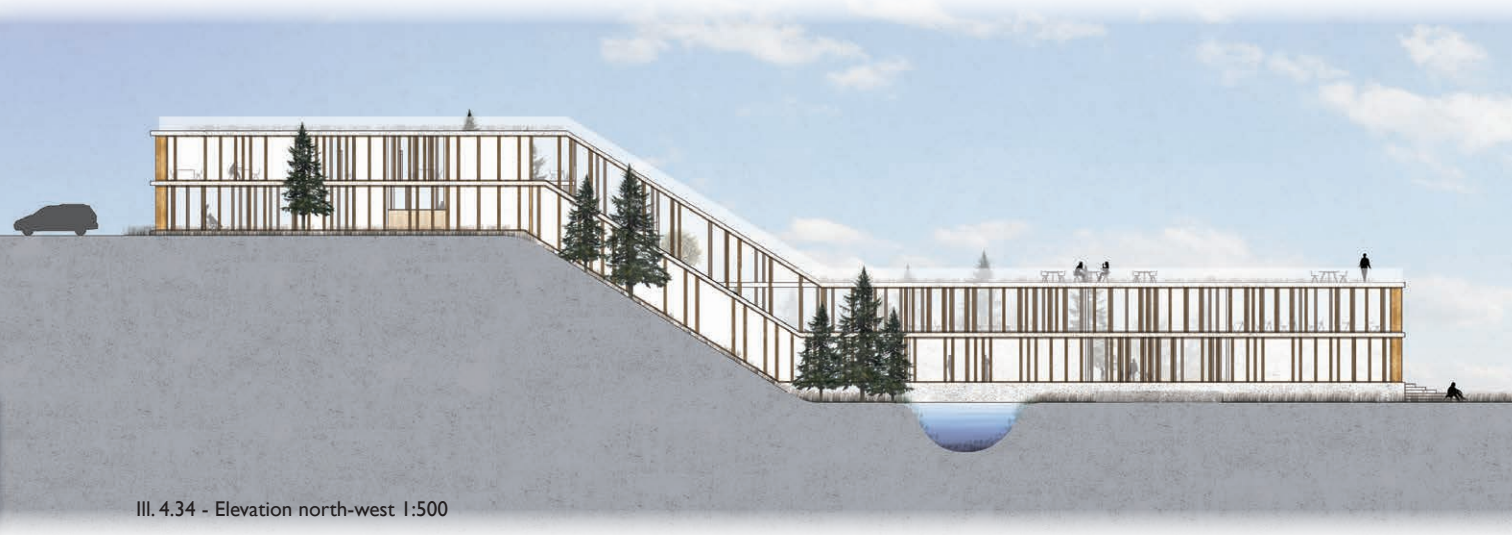


Ill. 4.31 - Level +3 1:500

Ill. 4.32 - Level +4 1:500

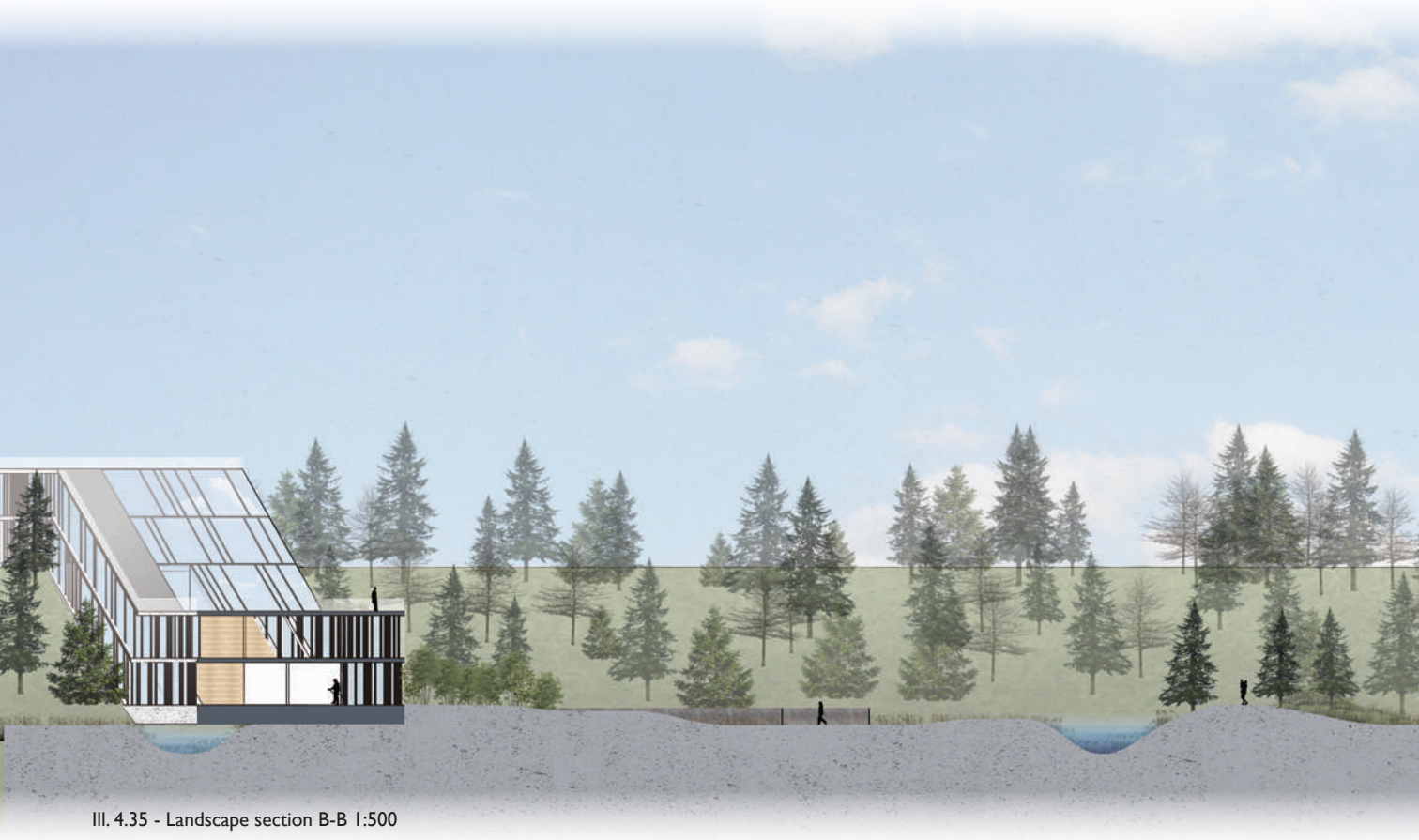
Elevations

Ill. 4.33 - Elevation south-east 1:500



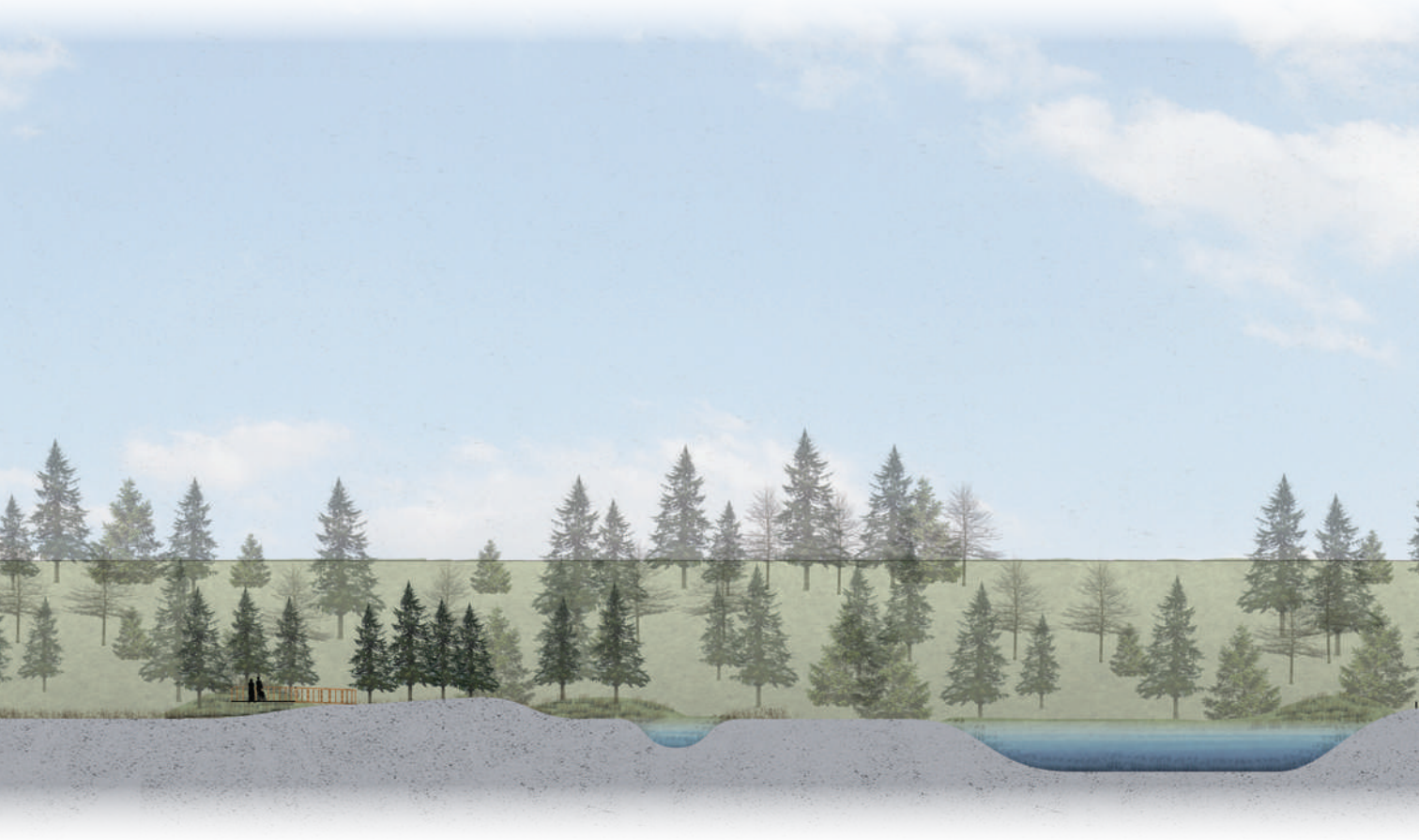
Ill. 4.34 - Elevation north-west 1:500

Landscape section

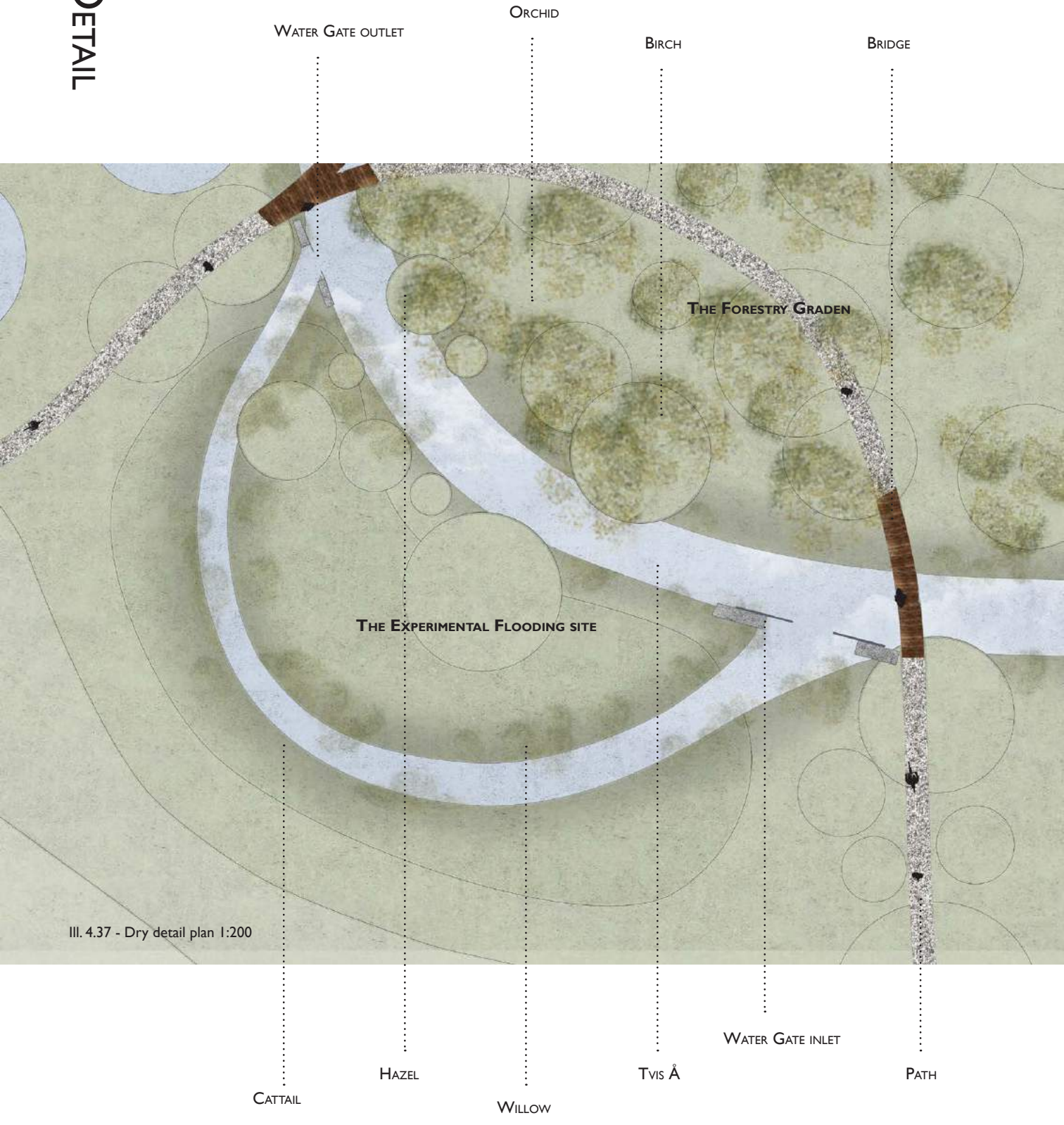


Ill. 4.35 - Landscape section B-B 1:500

Ill. 4.36 - Landscape section flooded 1:500



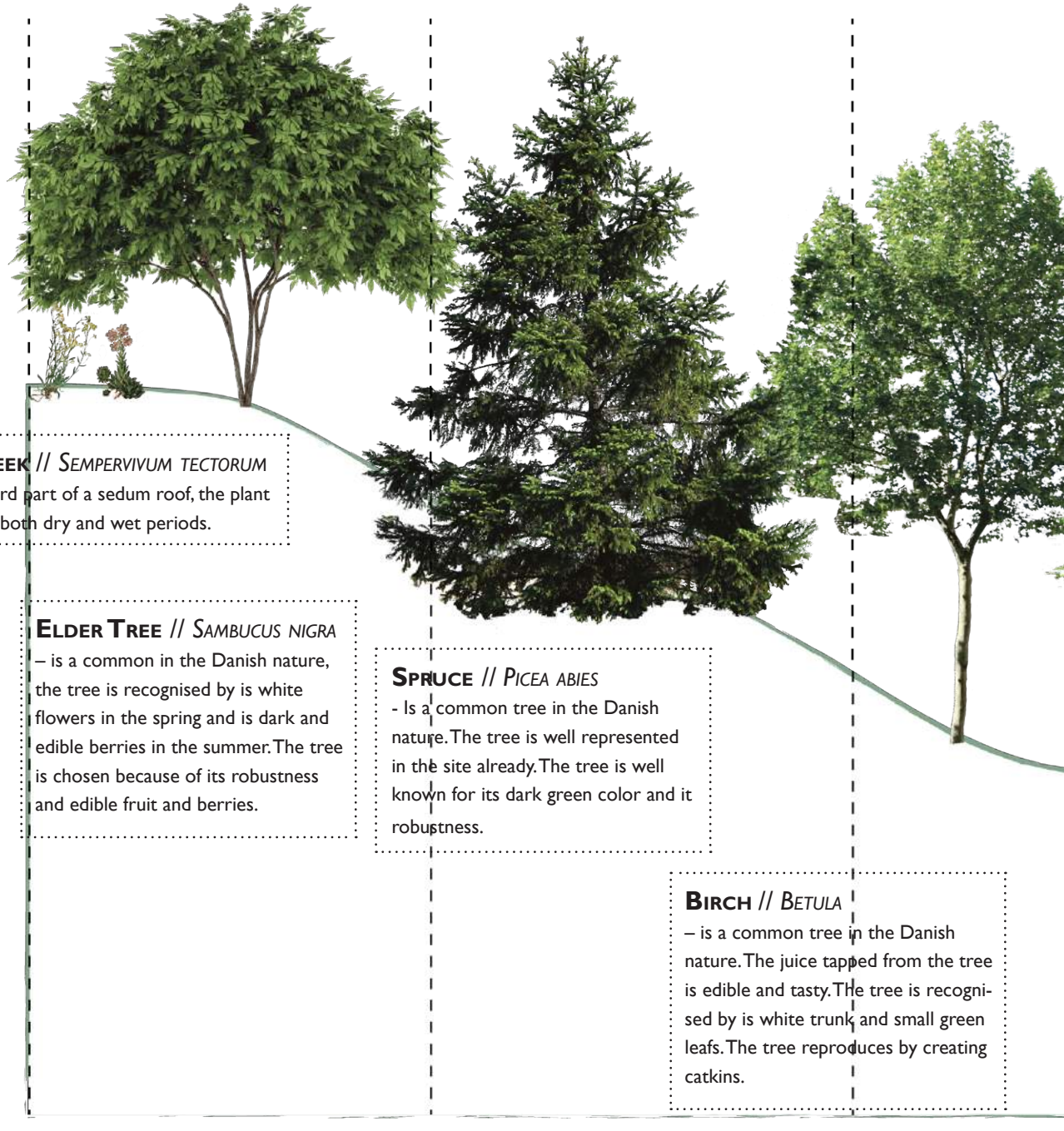
Plan Detail



Ill. 4.37 - Dry detail plan 1:200

Ill. 4.38 - Flooded detail plan 1:200

HIGHLAND **THICKET** **DRY MEADOW**



HOUSELEEK // *SEMPERVIVUM TECTORUM*
- is a standard part of a sedum roof, the plant can survive both dry and wet periods.

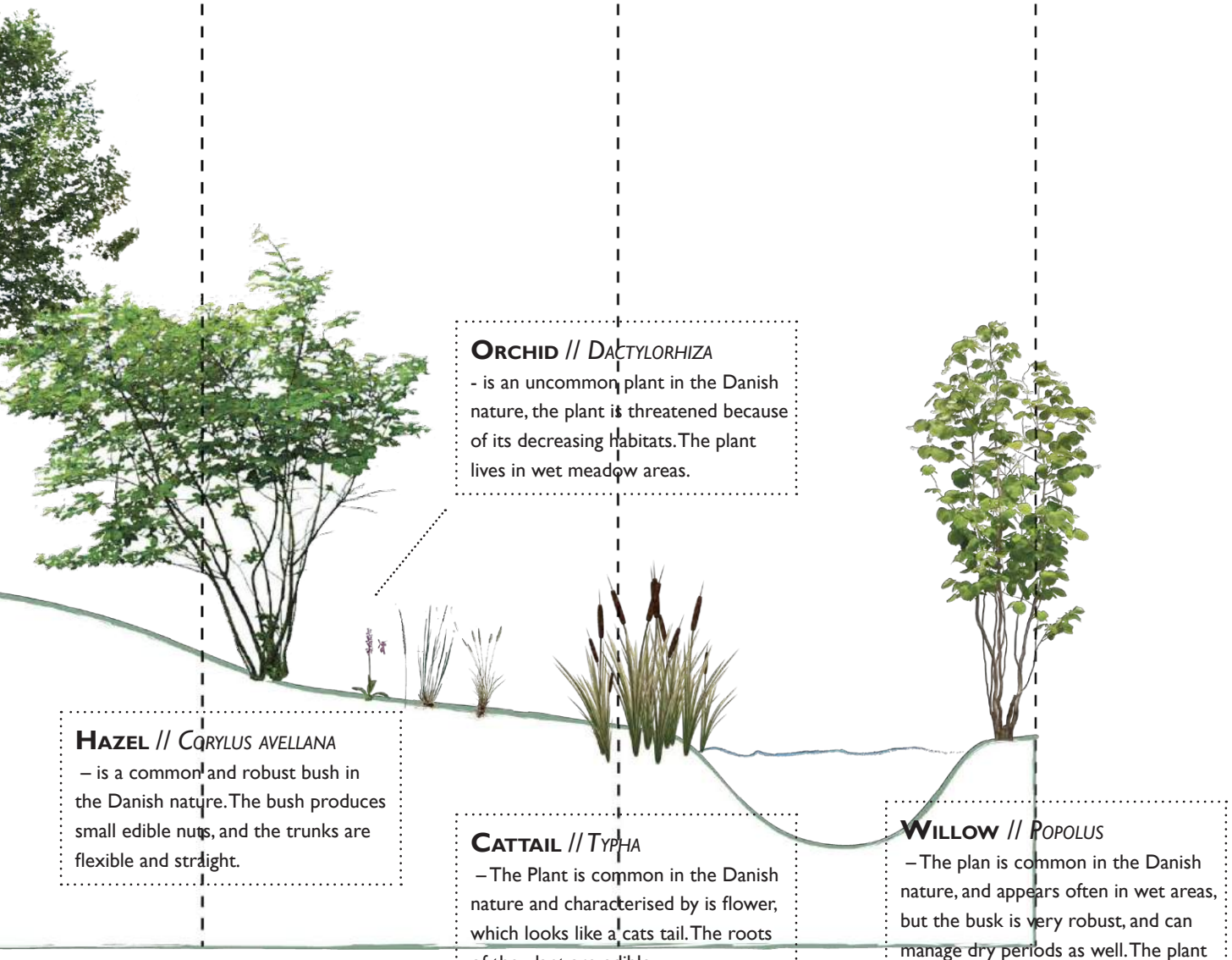
ELDER TREE // *SAMBUCUS NIGRA*
– is a common in the Danish nature, the tree is recognised by is white flowers in the spring and is dark and edible berries in the summer. The tree is chosen because of its robustness and edible fruit and berries.

SPRUCE // *PICEA ABIES*
- Is a common tree in the Danish nature. The tree is well represented in the site already. The tree is well known for its dark green color and it robustness.

BIRCH // *BETULA*
– is a common tree in the Danish nature. The juice tapped from the tree is edible and tasty. The tree is recognised by is white trunk and small green leafs. The tree reproduces by creating catkins.

Ill. 4.39 - Vegetation diagram

Wet Meadow **Wetland**



Orchid // *Dactylorhiza*
- is an uncommon plant in the Danish nature, the plant is threatened because of its decreasing habitats. The plant lives in wet meadow areas.

Hazel // *Corylus avellana*
– is a common and robust bush in the Danish nature. The bush produces small edible nuts, and the trunks are flexible and straight.

Cattail // *Typha*
– The Plant is common in the Danish nature and characterised by is flower, which looks like a cats tail. The roots of the plant are edible.

Willow // *Popolus*
– The plan is common in the Danish nature, and appears often in wet areas, but the busk is very robust, and can manage dry periods as well. The plant has ability to cleansing water for not wanted substances.

Materiality

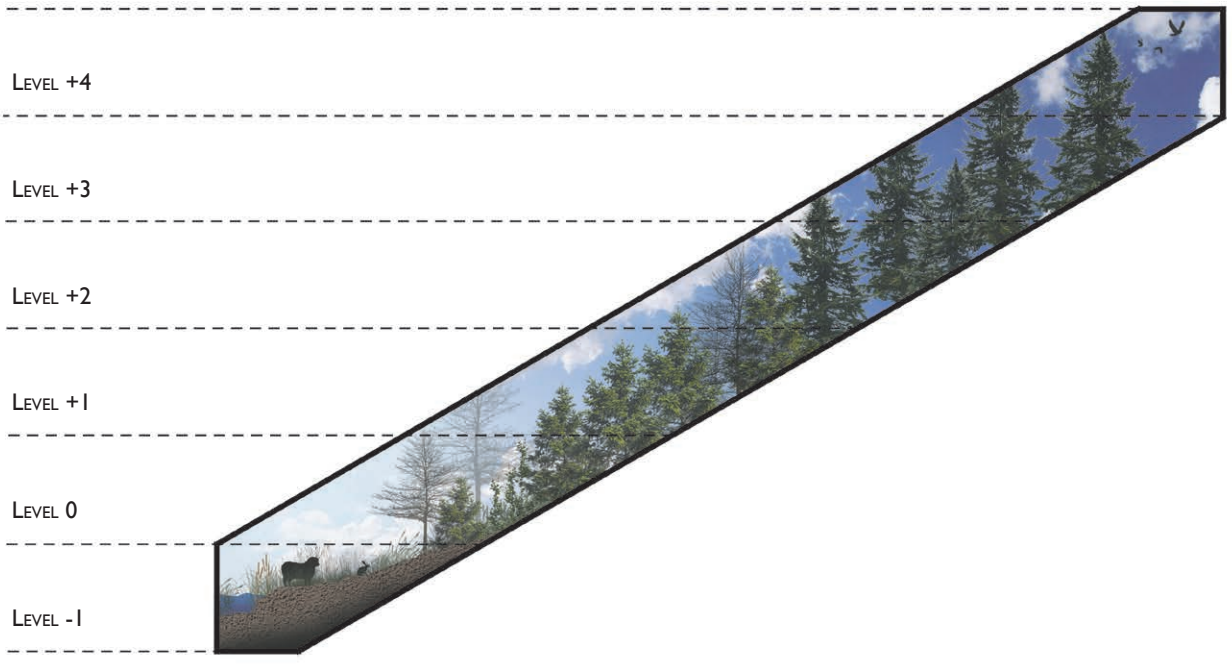
Materials and materiality is an essential factor in terms of atmosphere. The materials chosen for this design will over time undergo changes in expression and achieve patina, do to the changing water levels and seasonal changes. Besides having an aesthetic quality, the selected materials are resistant to abrasion and tough use. The colors of the materials are very consistent and interact well with the assorted colors and expressions made by nature.

Ill. 4.40 - Sedum roof

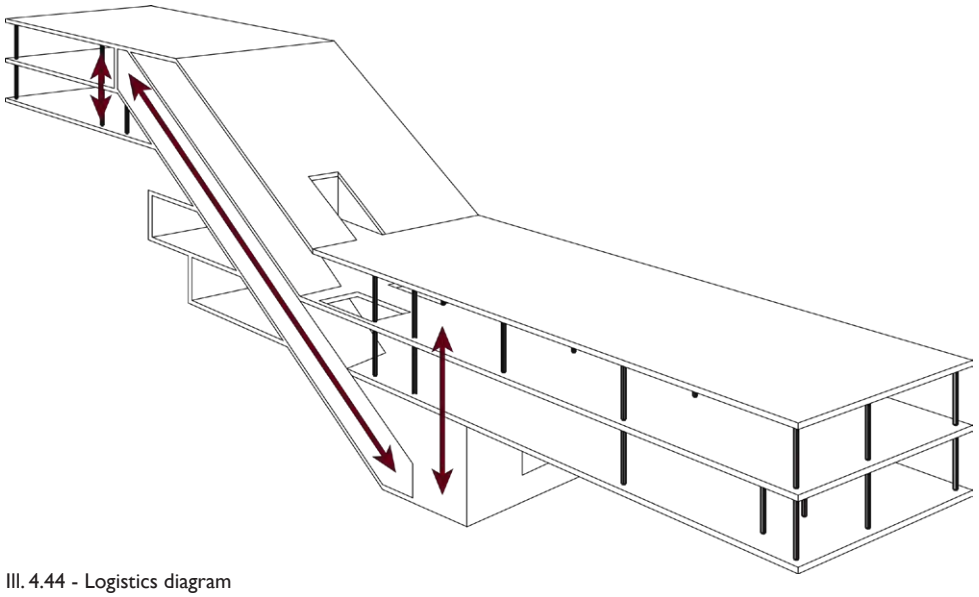
Ill. 4.41 - Concrete

Ill. 4.42 - Glass

Ill. 4.43 - Cherry wood



Ill. 4.45 - The Elevator Experience



Ill. 4.44 - Logistics diagram

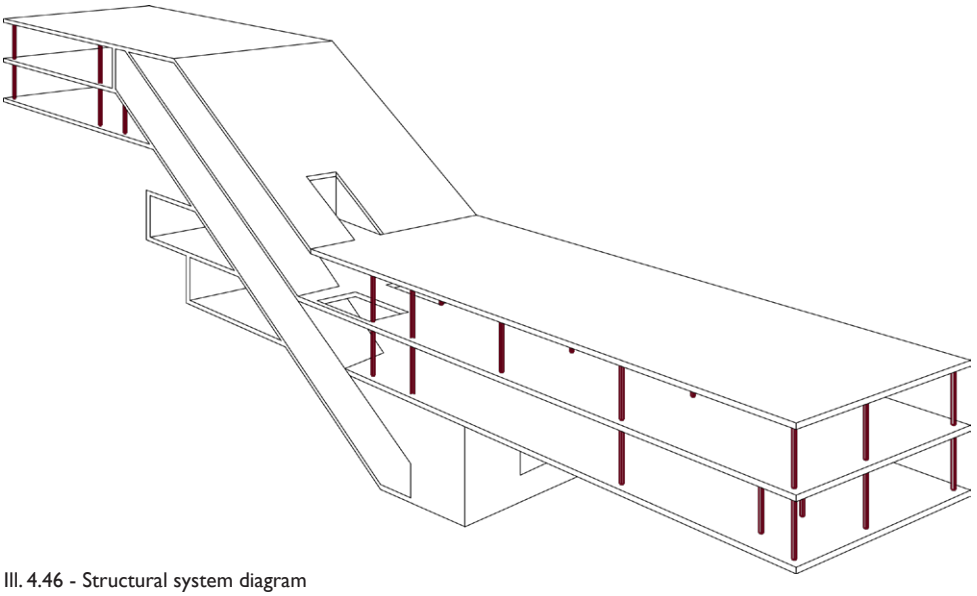
The logistical solution is planed from two perspectives, a functional and solution-oriented perspective, and an aesthetical and experienced based perspective. The logistical solution of building and urban design is a large task. If the logistics don't functions the whole building don't function.

The logistical solution in this design is more than a travel from A to B. The logistical solution of the building offers an experience during the travel from A to B. The solution is based on an elevator, which in a continuously stroke facilitates the whole building and at the same times gives the users a natural experience. An experience of different nature types, starting at level -1 by experience the stream and the wetland and ending at level +4, which frames the sky and the endless view towards the city of Holstebro. Two stairs one in the lower part of the building and one in the high part of the building facilitate also the building. The stairs works as fire escapes and emergency openings are present on every floor.

The Building is designed with two entrances, so even if the park is flooded, the entrance in the high part of the building will be available and accessible. The entrance in the high part of the building and the elevator is a part of making the building accessible to everyone.

The programs in the building is planed form a functional point of perspective in relation to logistic. The goods receiving parts (the café and the reception) is located in the high part of the building, so the receiving of goods can happen as quick and a smooth as possible.

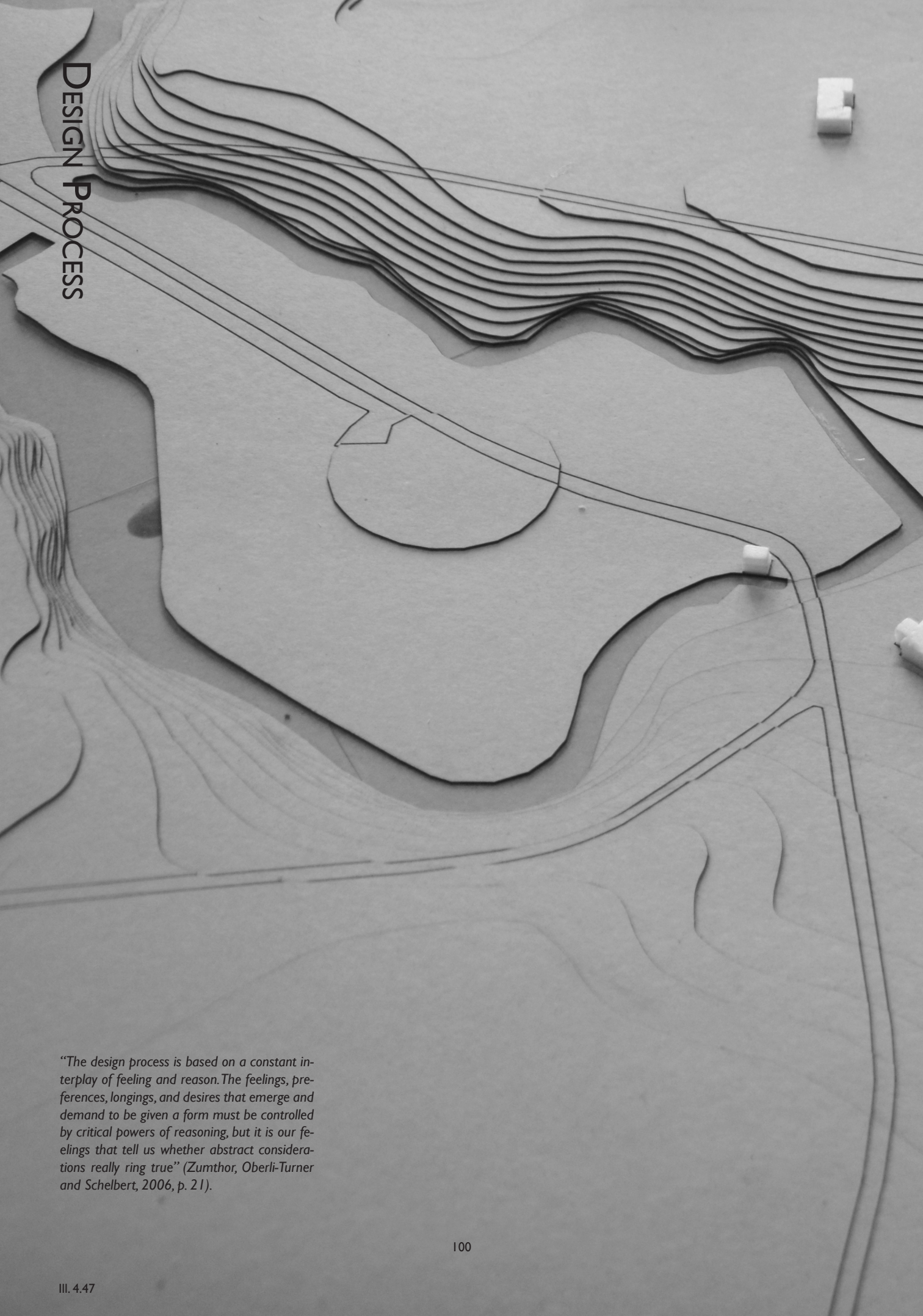
Structual system



Ill. 4.46 - Structural system diagram

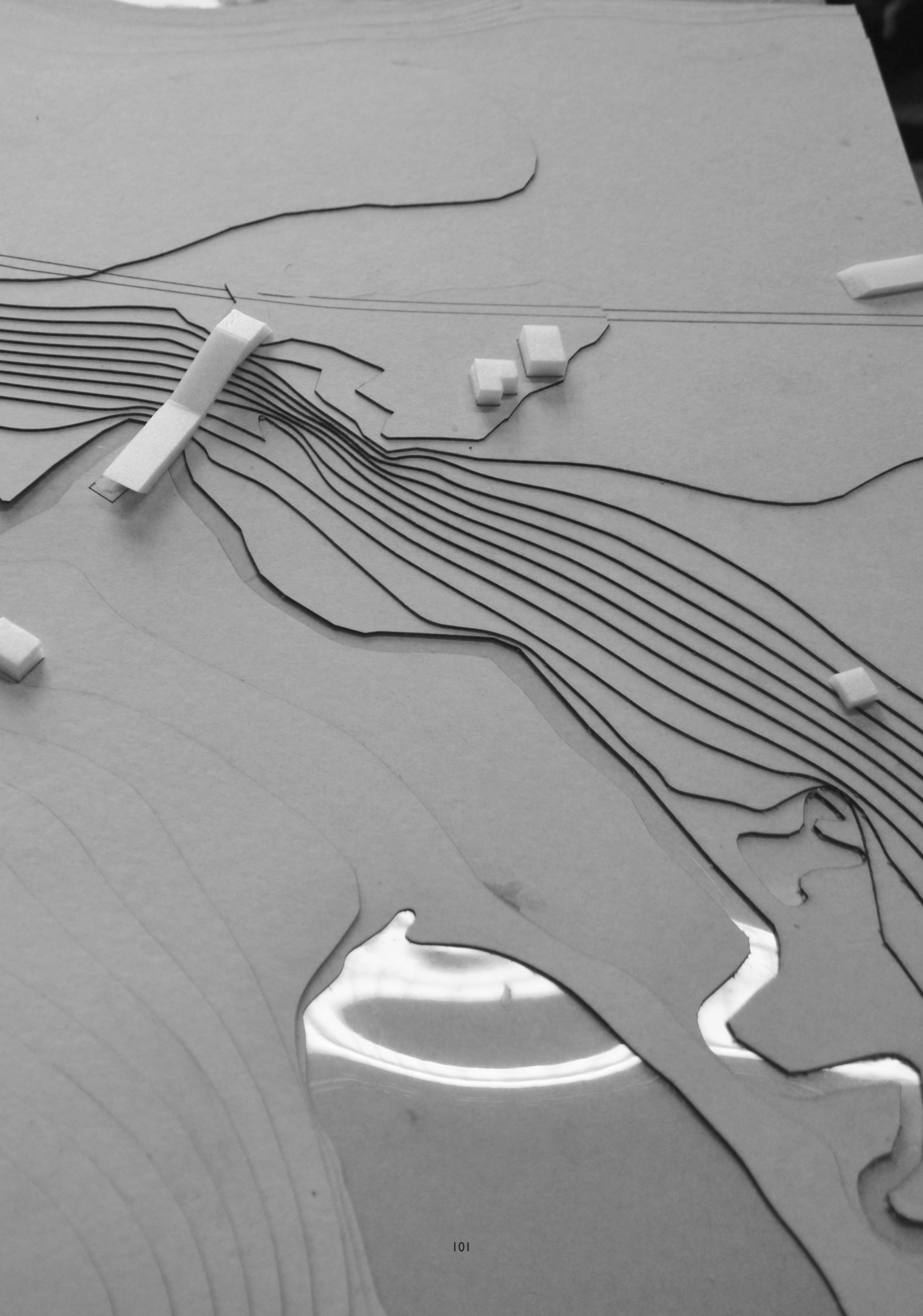
The structural system chosen for the building is based on columns and a solid core from top to bottom. The columns provide the building with the needed strengths in relation to the vertical loads from snow, use and the weight of the building. The solid core provides the building with the needed strength in relation to horizontal loads from wind and the geometrical shape of the building.

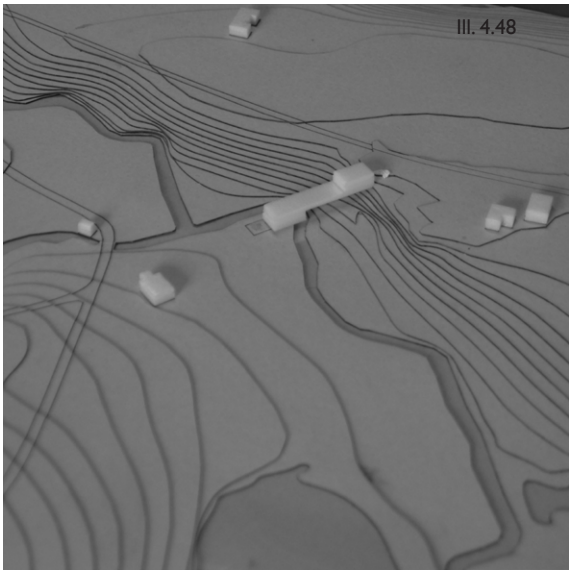
The chosen structural system provides us as designers with the possibility to freely choose the expression of the facade. A flexible facade was wanted in this building, to establish a physical and visible relation between the inside and the outside of the building. The chosen system provides the building with flexible facades, but predict continues columns through the levels. Therefor a relation occurs between level 0 and level +1, and again level +3 and level +4. The columns predict to some extend the placement of the flexible inner walls at level +1 and thereby predicts the sizes of the rooms. If the chosen system had been a system with load-bearing outer walls, a complete flexible plan could have been a reality.

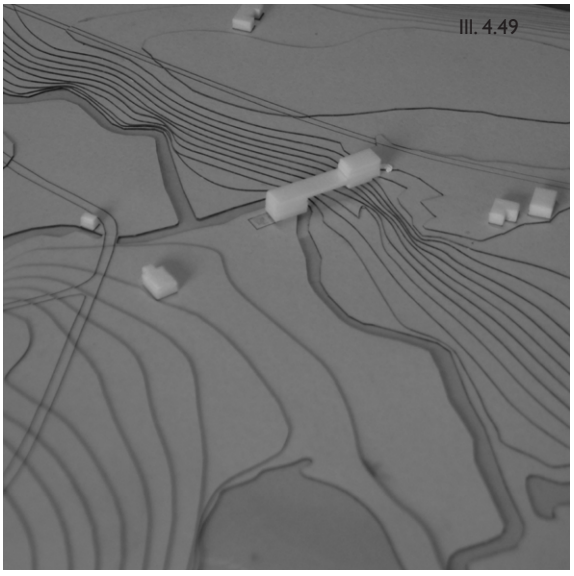


"The design process is based on a constant interplay of feeling and reason. The feelings, preferences, longings, and desires that emerge and demand to be given a form must be controlled by critical powers of reasoning, but it is our feelings that tell us whether abstract considerations really ring true" (Zumthor, Oberli-Turner and Schelbert, 2006, p. 21).

Ill. 4.47




Ill. 4.48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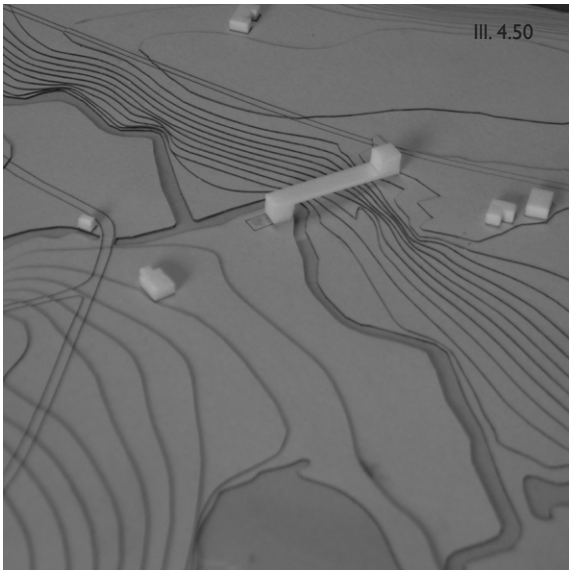
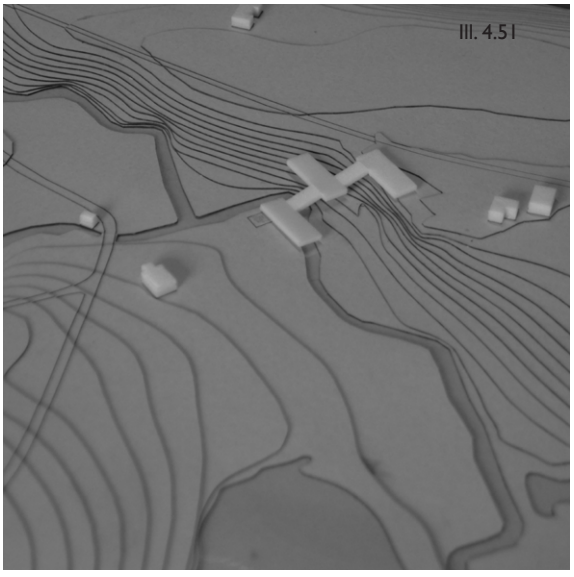
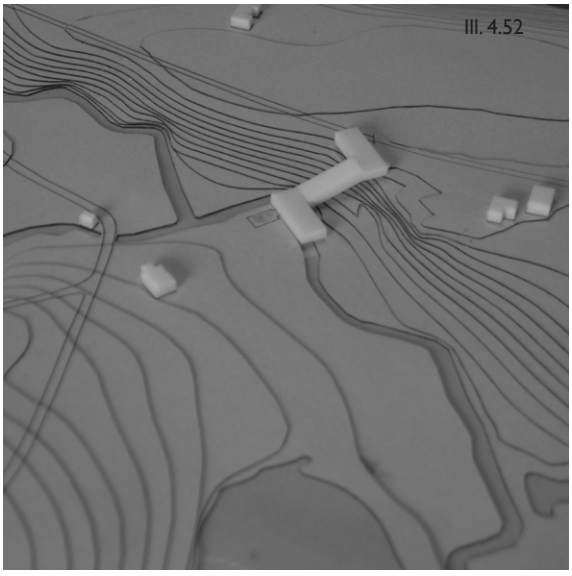

Ill. 4.50


Ill. 4.51

Parallel to this part of the process of finding the right geometrical shape of the building, a process focusing on the inner plan of the design was going on. This process focused on a shape, which fitted into the landscape but at the same time created a contrast.



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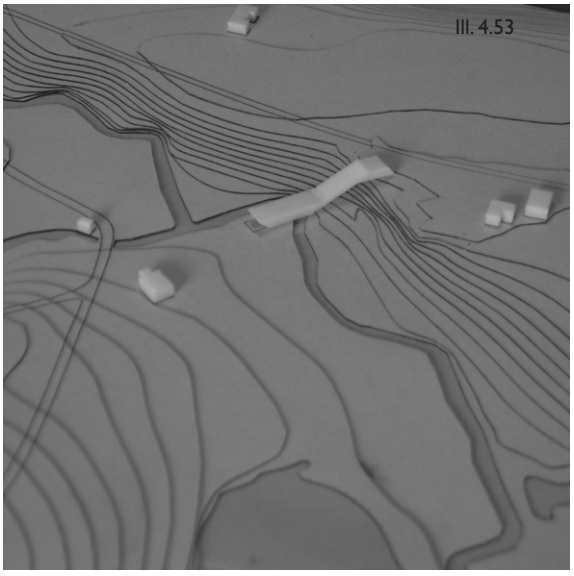

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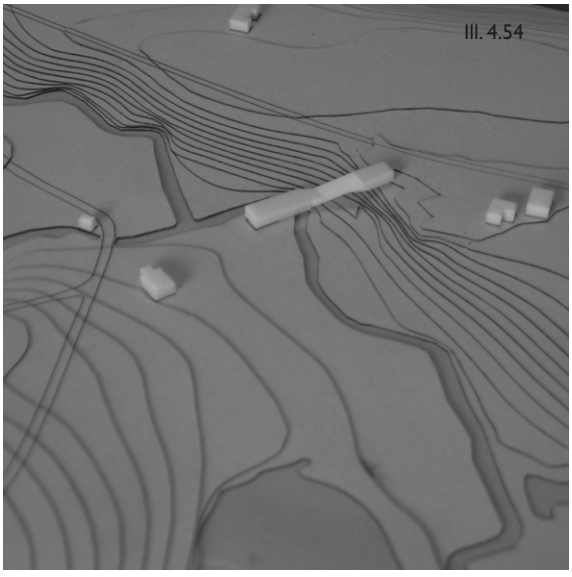

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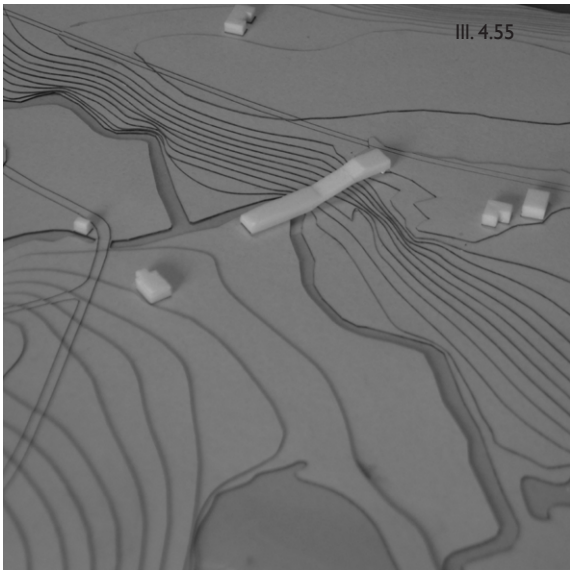

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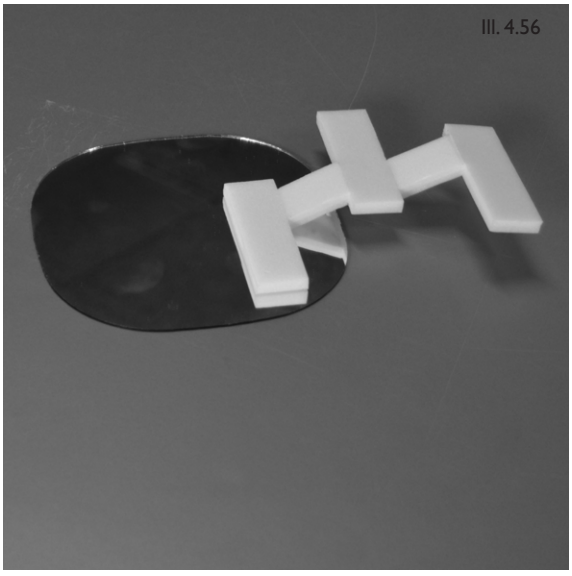
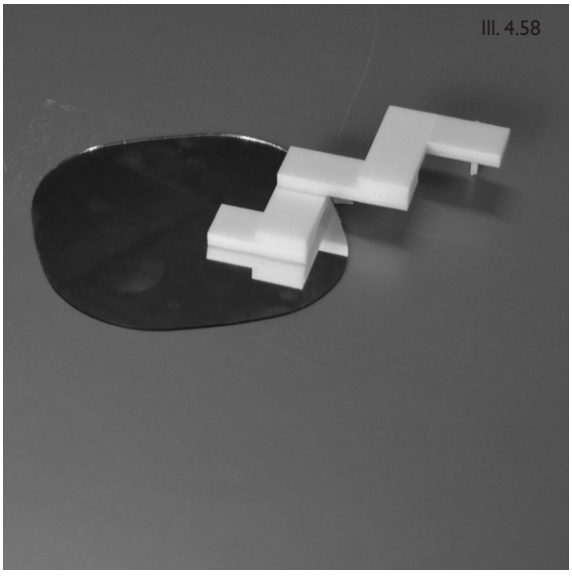
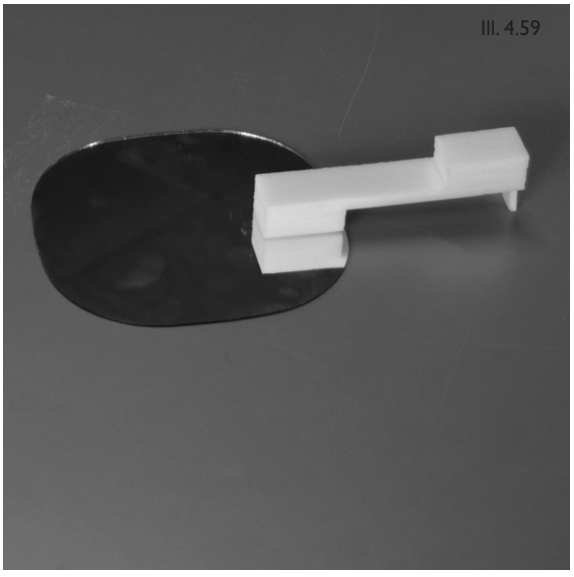
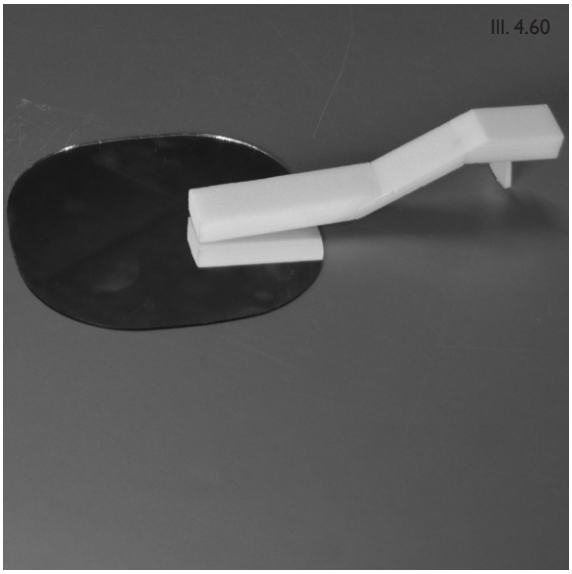

Ill. 4.56


Ill. 4.57


Ill. 4.58

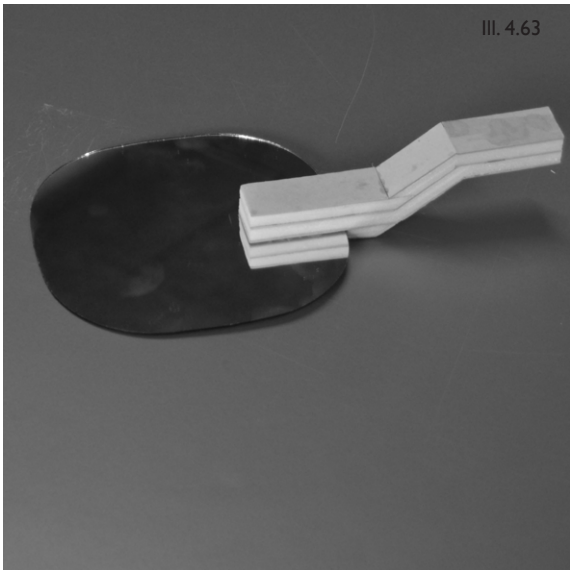

Ill. 4.59

To use the increased water level as a potential, a mirror is used to symbolize the effect from water. This part of the design process focus on the intersection between the water and the building.


Ill. 4.60


Ill. 4.61


Ill. 4.62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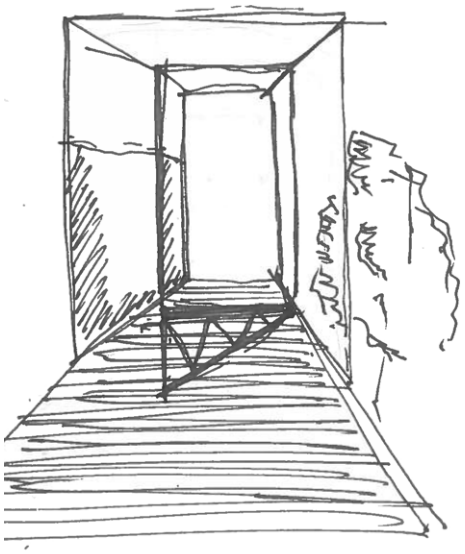

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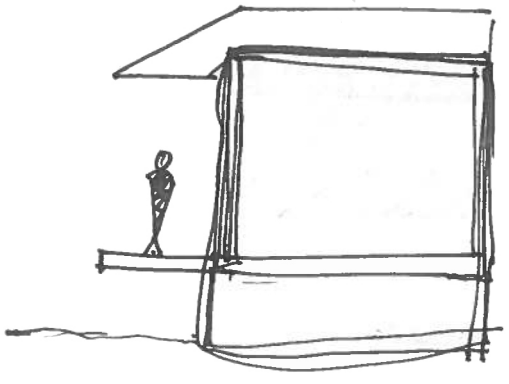

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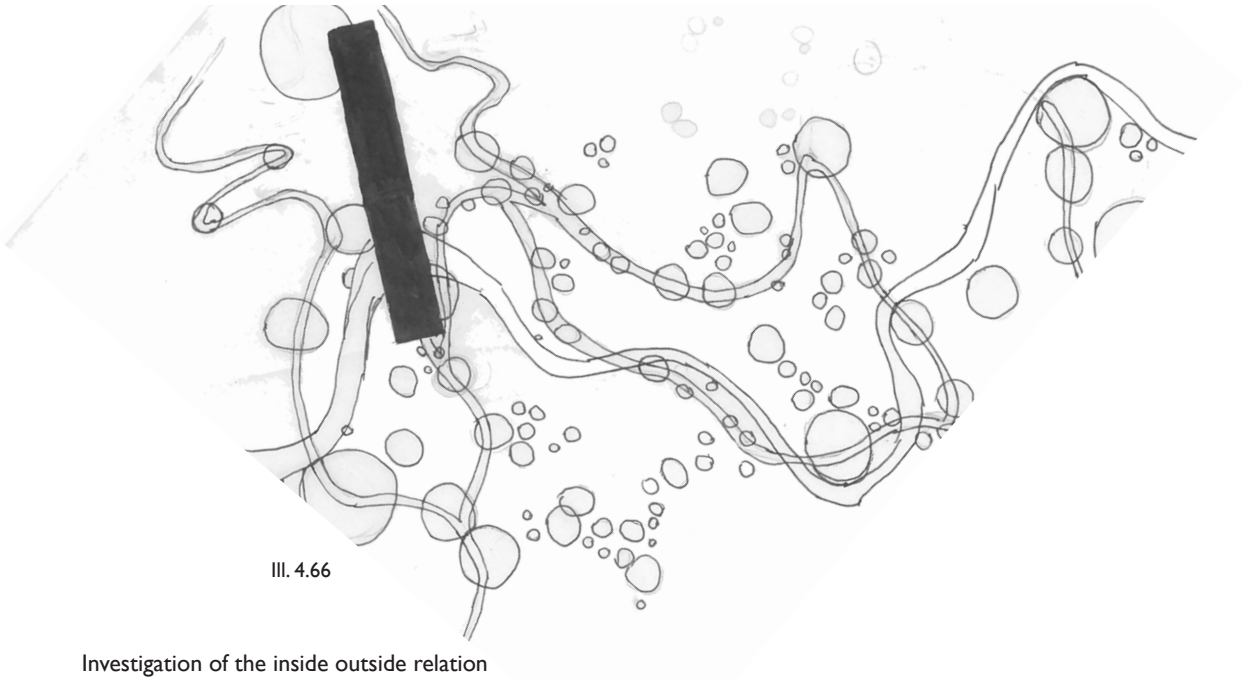
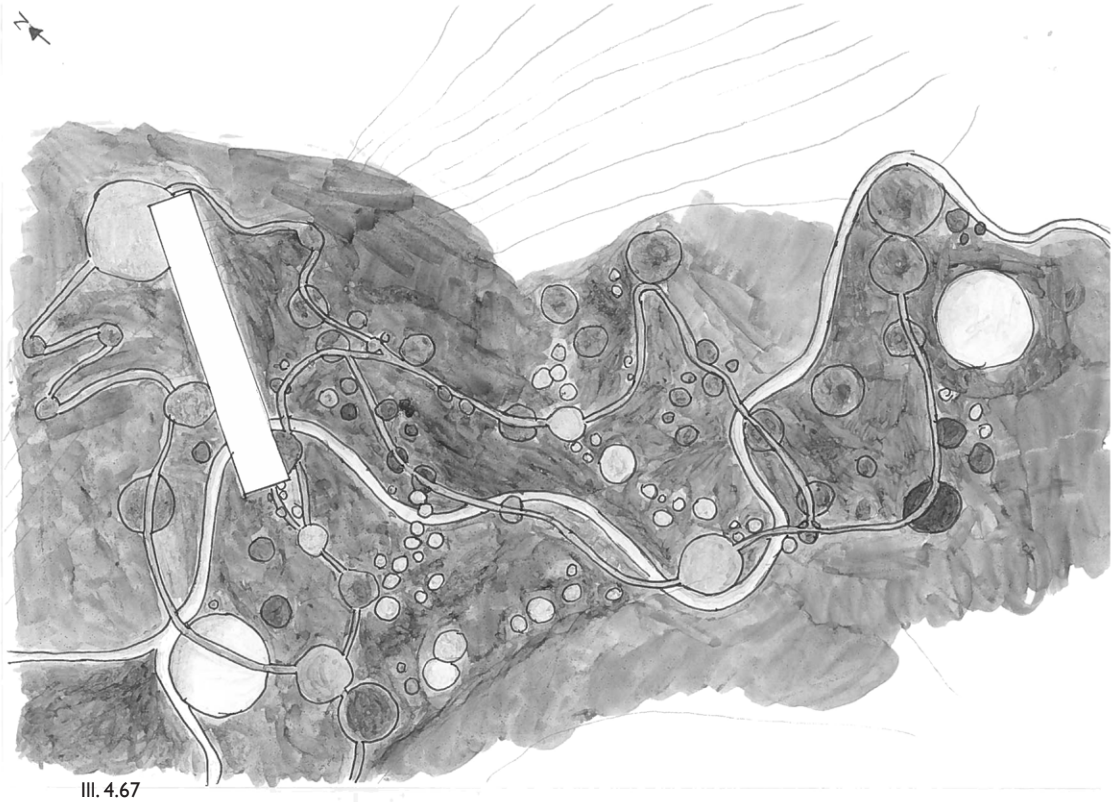
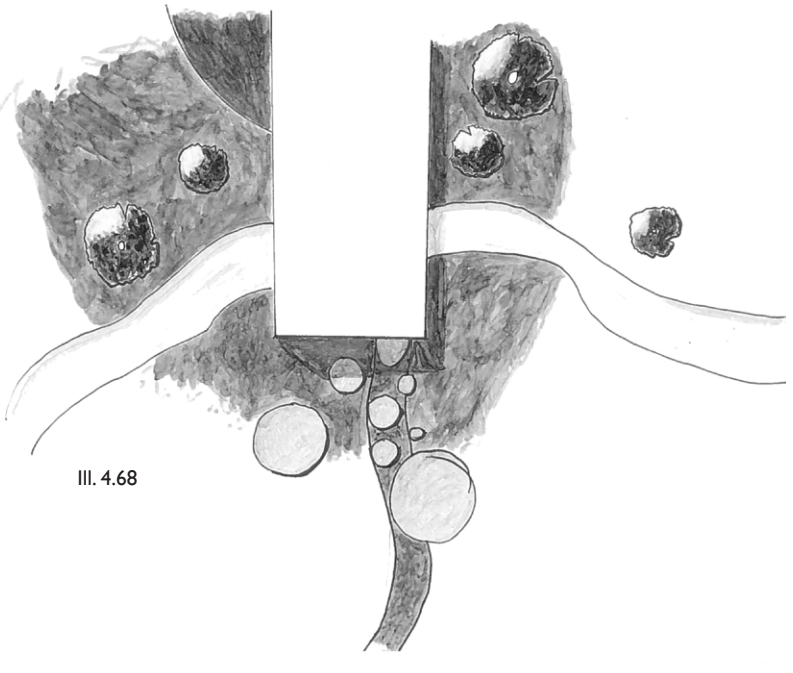


Ill. 4.66

Investigation of the inside outside relation



Ill. 4.67



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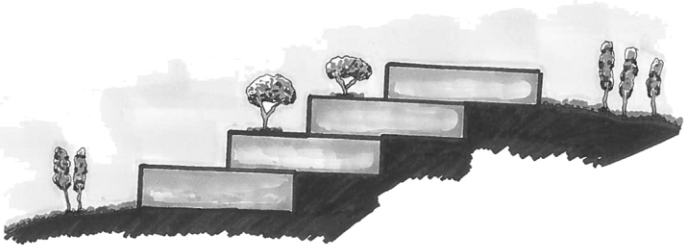

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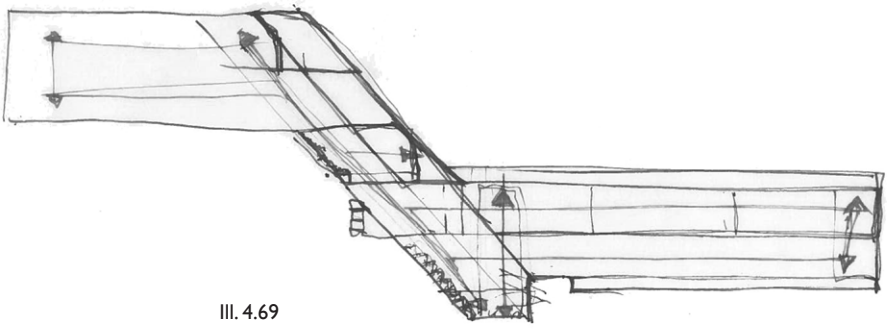

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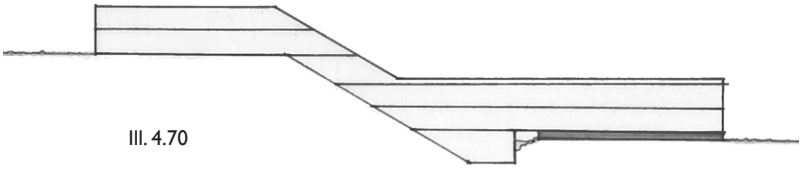

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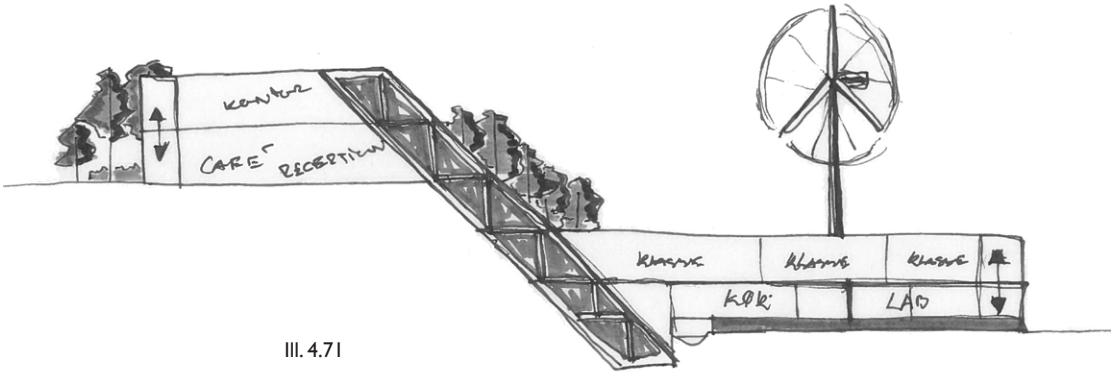
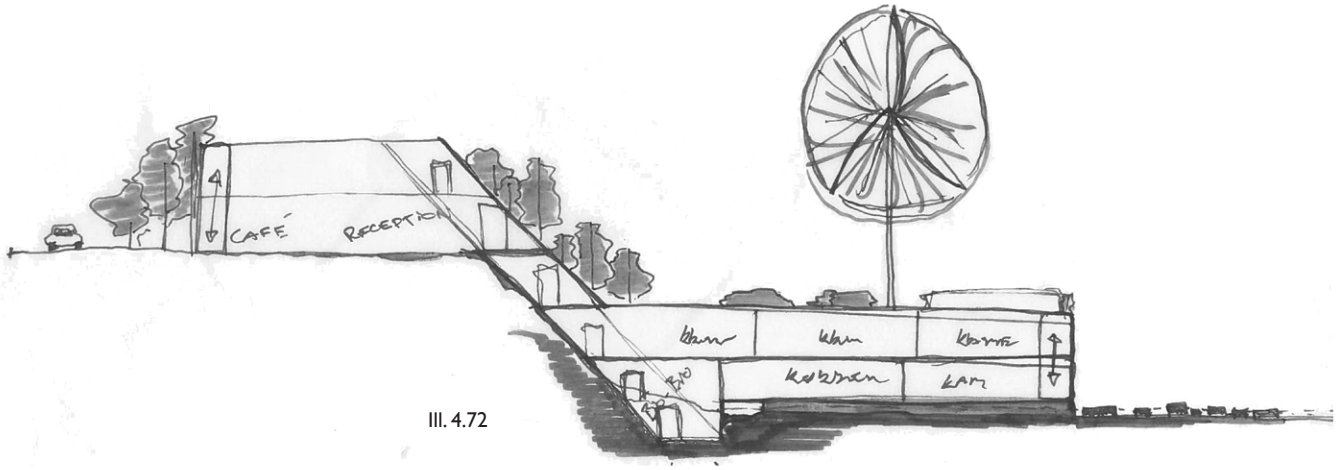


Ill. 4.71

The section has been a useful method for designing during this project. the section has the ability to show the relations between the topography of the site in relation to the applied design solution.



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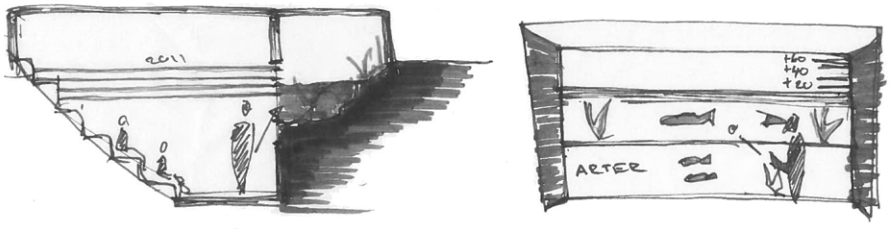

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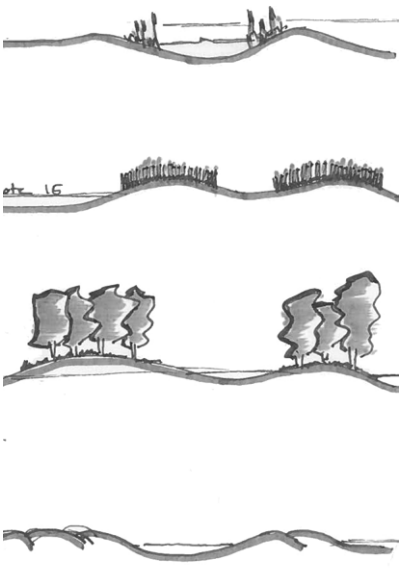


Ill. 4.74

EVALUATION

Ill. 4.75

Ill. 4.75 - Watercolor

We have as students achieved the learning objectives of this thesis by, among other things to work focused and determined with the integrated design process as the main method. The method has underway been complemented by several co-methods in relation to the form-finding, analysis etc. The program target is obtained by working, with an inside out approach, in this manner an understanding of how the building will function and how the building will be used in the future are gained.

The design aim of this thesis was to create a framework for education and public awareness. By designing a nature laboratory in close relation with its surrounding garden the objectives of this project are fulfilled. The building and the gardens create together a symbiosis, where learning and communication is in focus. The close relationship between the built, nature and humans has been a goal throughout the project. The relationships between the three aspects are expressed in the project through various design solutions where the perception of the built and nature is highlighted. The design has been a dynamical and flexible solution, which facilitates the changing uses and users.

The project works with the human aspect in relation to the needs of different groups of people, both on a weekly and annual basis. This is implemented by working with various programs according to the users and the usage time. This way of designing favouring the public space both inside and outside the building.

The project has resulted in a product that attach in close relation with its surroundings, but still as a respectful intervention. The buildings main characteristic is a strict outer that differs from the organic surroundings, but still mimes the slope its located on.
The garden surrounding the nature laboratory, drags in the production landscapes, both current and historical, to fulfil the visions of creating a nature laboratory with focus on water, health, science and cultural history. The garden get the ability to facilitate educational users, recreational users and businesses do to the overlapping programs.

Architecture and urban design will only function if the form, function, users and atmosphere interact in a larger whole. This is reached by focusing on creation of a place for humans, a flexible and divers place, which adapts to the changing condition both in relation to outer conditions and inner conditions.

Reflection

A suggestion for the future learning platform

The Danish school system for primary school has over the last years changed. The new school system imposes the students, pupils and children longer days, and more physical activity during the days. Therefor the environment has to change as well. The learning environment has to facilitate the users during their day both with educational facilities and facilities for socialisation and fun.

Topic days and weeks are implemented in the school system, to create cross-disciplinary collaborations within the school. Holstebro Nature Lab has the ability to offer the schools in Holstebro a place were educational values and natural values can be enjoyed at the same time. Holstebro Nature Lab is a place where fun and education can walk hand in hand.

The integrated design process

The integrated design process has been a major part in this thesis, the phases and the iterative element of the overall process. Several elements in the project have changed its appearance, do to functional demands or do to personal taste, which also is a major factor in the form finding development.

The integrated design process takes point of departure in the vision for a nature laboratory made by the municipality of Holstebro. Already in this phase our project have had the first iteration, as the general idea was to develop a general strategy, related to the water management problems of Holstebro. The development of a water management plan had already begun, and therefore the focus changed from develop a water management plan to work with one of the points of impact in the new water management plan drafted by Holstebro municipality.

Based in the integrated design process, the project quickly gets a character of reality when all thoughts about form, theory, analysis, etc. are put into perspective in relation to function and realism.

The big focal point in this project has been the relation between nature, the humans and the built. This is visible both in the theory were the three topics are discussed in relation to each other but also in relation to is self. The focal point is also visible in the design proposal, where the physical relations between outside and inside are expressed in open and flexible facade solutions where it is possible to diffuse between outside and inside.

It is always a challenge to work with the integrated design process. Problematics arise in the gab between forms and functions, built ability and esthetical visions, and this thesis is not an exception.

"Form Follows Function" or "Function Follows Form"

The circular shape has been the dominating grip in the form finding process. The original idea for the circles came from the shape of raindrops meeting a water surface. By working with the circles as the dominant element of the plan, it is possible to give the circles a communicative value. Communicative values are important in relations to the building's use as a learning platform for the city.

Several functions are applied into the circles doing the process of relating form and function. This has been a discussion throughout the project, keeping the concept of the circle or applies new forms by relation the new form to the function of it.

The project shows signs of being designed from two different perspectives, from the inside out and the outside in. This can be seen in the space where the internal functions and the overall shape in relation use the external values in the inside design. This is visible in the "bio-bio"/auditorium, the laboratory and the school kitchen, where natural values are dragged in to facilitate the use of the room.

Final design but not fully evolved

The project has turned out to be focused on the dynamical aspects of the nature and the changing conditions according to water. Therefore an argument is put up, that the finale design has found its shape, but the design will evolve in relation to the global changes but also in relation to the nearby changes in vegetation, biota, climate and use. The design will evolve over time until the nature and the surroundings have found the optimal solution for itself. The nature has the ability to transform into the most optimal and optimized solution for itself. The theory "survival of the fittest" is an argument that supports this discussion, the plants and animals that are most adaptable and strongest survive.

Sources

Books:

Binet, H., Bunschoten, R. and Hoshino, T. (2001). *Urban Flotsam*. Rotterdam: 010 Publishers.

Botin, L. (2005). *Pandoras boks*. Aalborg: Institut for Arkitektur & Design, Aalborg Universitet.

Cosgrove, D. (1999). *Mappings*. London: Reaktion Books.

Pallasmaa, J. (2005). *The eyes of the skin.* Chichester: Wiley-Academy.

Pallasmaa, J. (2010). *The thinking hand.* Chichester, U.K.: Wiley.

Rasmussen, S. (1966). *Om at opleve arkitektur*. København: G. E. C. Gad.

Waldheim, C. (2006). *The landscape urbanism reader.* New York: Princeton Architectural Press.

Zumthor, P. (2006). *Atmospheres.* Basel: Birkhäuser.

Zumthor, P., Oberli-Turner, M. and Schelbert, C. (2006). *Thinking architecture.* Basel: Birkhäuser.

PDF's and Publications:

Fink, H. (2003). *Et mangfoldigt naturbegreb.* 1st ed. [ebook] Copenhagen: GAD. Available at: http://www.byplanlab.dk/sites/default/files2/Et_mangfoldigt_naturbegreb_Fink.pdf (Accessed 16 Feb. 2016).

Theilgaard, L. (2016). *Klimatilpasning Holstebro PP.*

Risikostyringsplan for Vanddistrikt Jylland og Fyn. (2016). 1st ed. [ebook] København: Kystdirektoratet and Naturstyrrelsen. Available at: http://naturstyrelsen.dk/75737 -(Accessed 28 Mar. 2016).

Vestforsyningen, (2015). *Kort om Storå klimasikring.* [online] Holstebro: Vestforsyningen, pp.6-7. Available at: http://www.vestforsyning.dk/media/5866/Notat_Storaa_dec2015.pdf (Accessed 29 Feb. 2016).

Vincentz, R., Hahn-Petersen, P. and Kloster Bro, L. (2016). *Biodiversitet i byer.* 1st ed. Naturstyrelsen. – (Accessed 7 May. 2016).

Podcasts:

BYLYD, (2016). 1: *Naturen i byen.* BYLYD Podcast.

Websites:

Anderson, S. (2011). *Process Urbanism | The City as Artificial Ecosystem.* [online video] Processurbanism.com. Available at: http://www.processurbanism.com/index.html (Accessed 15 Feb. 2016).

Denstoredanske.dk. (2016). *vand | Gyldendal - Den Store Danske.* [online] Available at: http://denstoredanske.dk/It,_teknik_og_naturvidenskab/Kemi/Uorganisk_stofkemi/vand (Accessed 11 May 2016).

Holstebro.dk, (2016). *Indbyggertal i Holstebro Kommune.* [online] Available at: http://www.holstebro.dk/Indbyggertal-2018.aspx (Accessed 4 Feb. 2016).

Jochumsen, S. (2011). *Byens landskab - Dansk Arkitektur Center.* [online] Dac.dk. Available at: http://www.dac.dk/34865.aspx (Accessed 29 Mar. 2016).

Naturstyrelsen.dk. (2016). *Biodiversitet.* [online] Available at: http://naturstyrelsen.dk/naturbeskyttelse/biodiversitet/ (Accessed 9 May 2016).

Naturstyrelsen.dk, (n.d.). *Beskyttelse af § 3-naturtyper.* [online] Available at: http://naturstyrelsen.dk/naturbeskyttelse/national-naturbeskyttelse/beskyttede-naturtyper-3/beskyttelse-af-3-naturtyper/ (Accessed 22 Feb. 2016).

E-mail:

Theilgaard, L. (2016). *Fakta om Vandkraftsøen.* (email).

Illustartions

III. 1.1 – III. 1.3: Own Illustration

III. 2.1 – III. 2.5: Own Illustration

III. 2.6: http://www.holstebro.dk/Default.aspx

III.2.7 – III. 2.11: Own Illustration

III. 3.1 – III. 3.23: Own illustration

III. 3.24: http://divisare.com/projects/166050-lazzarini-pickering-architetti-clive-nichols-villa-all-argentario

III. 3.25: http://www.lifeoutdoors.ro

III. 3.26: https://dk.pinterest.com/pin/208080445260563781/

III. 3.27: http://www.pinkbike.com/news/2013-Shimano-Saint-Media-Camp.html

III. 3.28: Own Illustration

III. 3.29: http://seesouthwestwa.com/20th-annual-kids-fishing-derby-will-be-june-8/

III. 3.30: http://www.fs.usda.gov/detail/hoosier/learning/kids/?cid=fsbdev3_017515

III. 3.31: http://ocmomblog.com/free-kids-fishing-derby/

III. 3.32: http://www.davisenterprise.com/local-news/bohart-museum-open-house-features-aquatic-insects/

III. 3.33 – III.3.34: Own illustration

III. 3.35: http://www.waldeneffect.org/blog/Maintainer_livestock:_Chickens__44___sheep__44___and_cows/

III. 3.36: http://www.fibershed.com/event/ouessant-sheep/

III. 3.37: http://www.heltborgfoto.dk/fugle_pip.htm

III. 3.38: http://www.kristeligt-dagblad.dk/danmark/dum-som-en-gås

III. 3.39 – III. 3.40: Own illustration

III. 3.41: http://www.dn.dk/Default.aspx?ID=22325

III. 3.42: https://www.yogaoutlet.com/guides/an-introduction-to-yoga-sequences

III. 3.43: http://www.altomcamping.dk/Sverige/pa-kanotur-i-sverige.html

III. 3.44: http://visitskane.com/da/artikel/besog-kristianstads-vandrige-og-naturum

III. 3.45 – III. 3.48: Own Illustration

III. 3.49: http://www.foldbynorring.dk/author/frederik

III. 3.50: http://naturstyrelsen.dk/naturoplevelser/naturguider/noerreskoven/sevaerdigheder/

III. 3.51: http://happymodern.ru/razrushenie-6-mifov-o-zelenyx-kryshax/

III. 3.52: http://vandrefuglen.blogspot.dk/2013_08_01_archive.html

III. 3.53: http://vandlobsgruppen.dk/Vandlobsgruppen.dk/Velkommen.html

III. 3.54: https://dk.pinterest.com/johnhowardpin/olafur-eliasson/

III. 3.55: https://dk.pinterest.com/dpgud0523/

III. 3.56: https://dk.pinterest.com/akochrista/

III. 3.57: http://latinamericangrid.org/elgg/nsfpire/weblog/845.html

III. 4.1: Own Illustration

III. 4.2: http://www.e-architect.co.uk/japan/fuji-kindergarten

III. 4.3: http://www.e-architect.co.uk/japan/fuji-kindergarten

III. 4.4: http://www.architravel.com/architravel/building/rolex-learning-center/

III. 4.5: http://www.architravel.com/architravel/building/rolex-learning-center/

III. 4.6 – 4.39: Own Illustration

III. 4.40: http://inhabitat.com/hill-house-by-bjarke-ingels-is-a-house-under-a-garden/

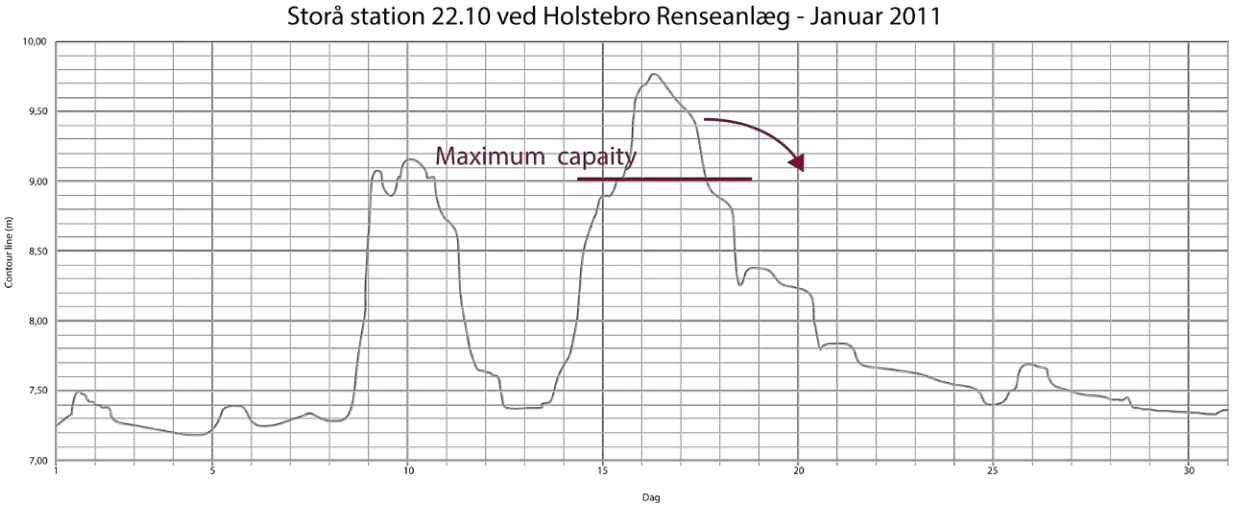
III. 4.41: http://www.kaneva.com/asset/assetDetailsLandingPage.aspx?assetId=5813228&communityId=0

III. 4.42: http://www.picsfair.com/raindrops-falling-on-window.html

III. 4.43: http://www.amtico.com/commercial/error

III. 4.44 – III. 4.76: Own illustration

Appendix



The red line on the diagram above shows the current water capacity of Storåen. For saving the inner city from flooding, a delay must be applied to the huge amount of water running through the stream and inner city. The solution is a dam between Vandkraftsøen and the inner city. The dam are then able to adjust the amount of water and thereby the height of water in Storåen.

#2 Soundscape of site

The audio recording is recorded on the CD

#3 Flooding collage