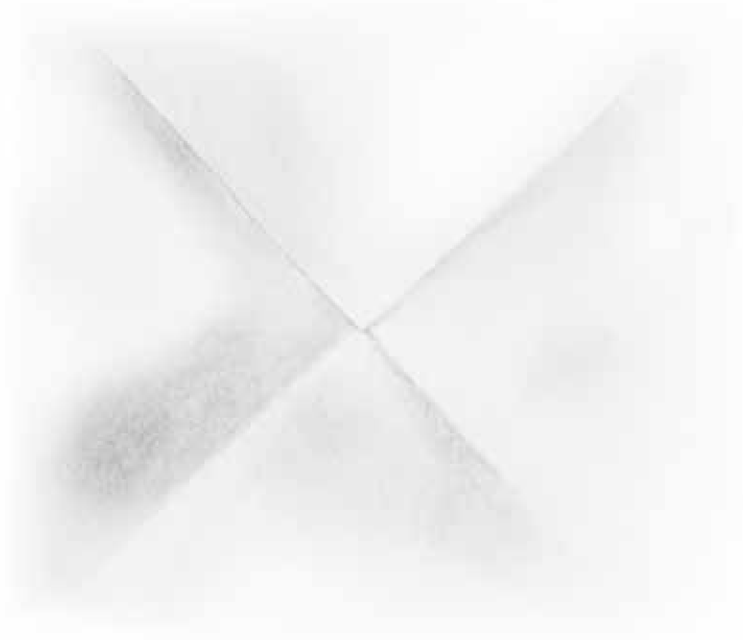
AURORA BOREALIS



The skin reads the texture, weight, density and temperature of the matter.

Juhani Pallasmaa

'Aurora Borealis' aims to design a hotel and observatory that helps Man rediscover his primitive instincts and create a bond with nature - a reestablishment of the connection between Man and the glories of His planet.
Set in one of the most extreme latitudes inhabited by man, this project seeks to create a place of solitude, where Man can disconnect from the daily routines - a refuge from normality - and experience true reverie in the lush endless forests of northern Finland surrounded by nature of its purest form and the most glorious phenomenon of all, the Aurora Borealis.

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Architectural supervisor	Claus Bonderup
Technical consultant	Dario Parigi
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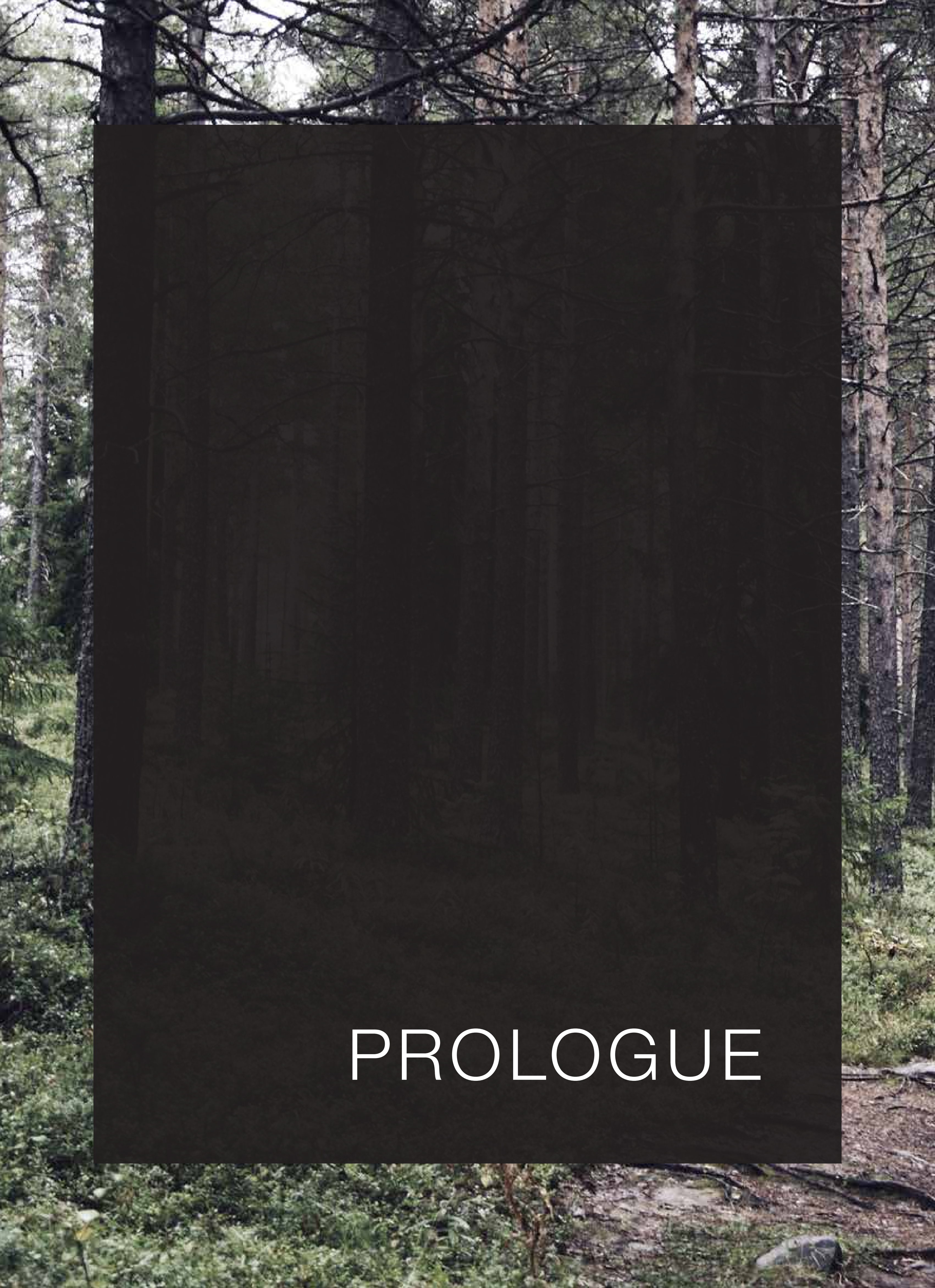
MIRNES TULIC



PROLOGUE

DESIGN BRIEF

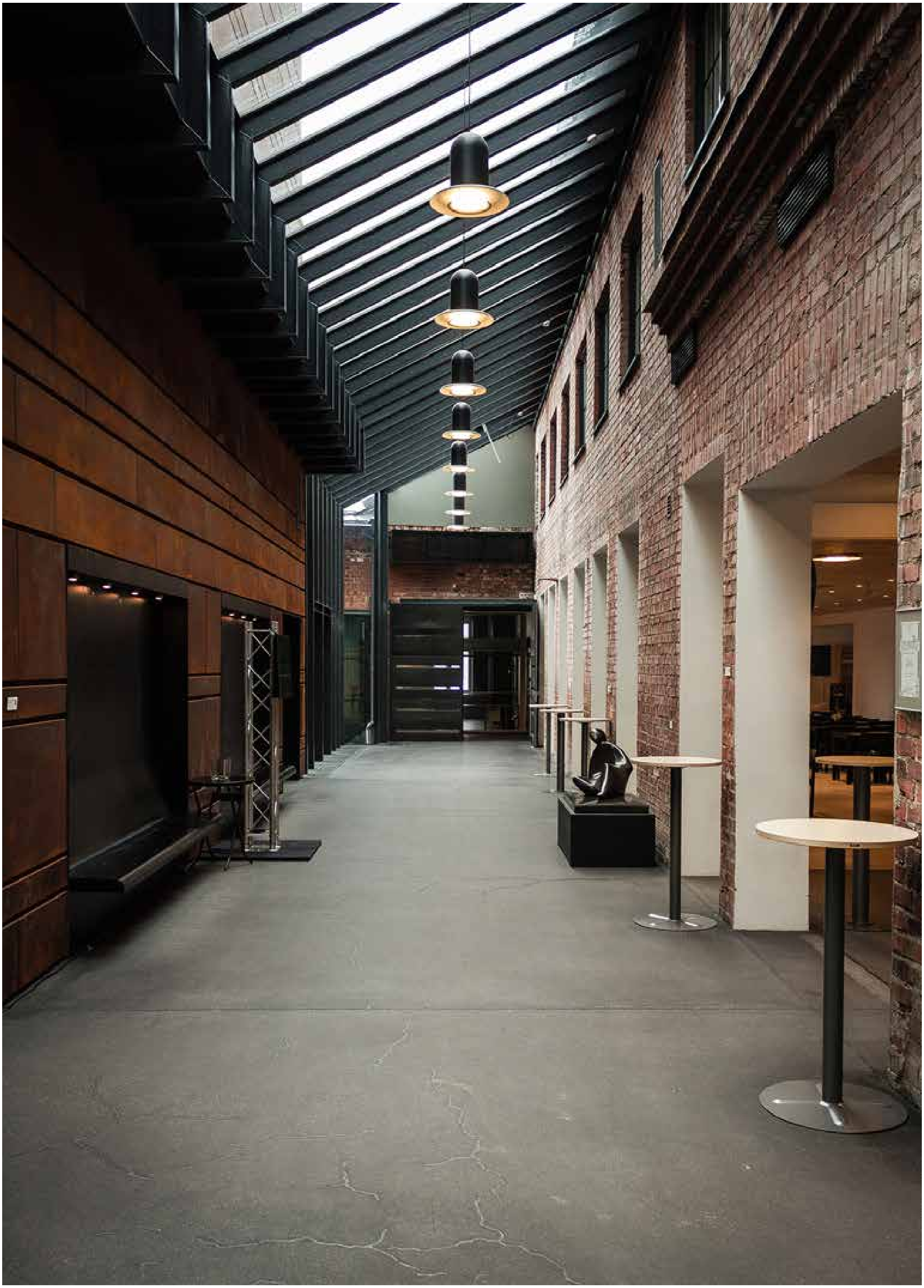
Man is inherently fascinated by mysteries of the universe. During our evolution we have scoured the earth with our tools of science to obtain answers for everything that attracted our attention: what makes a fire burn? What lies awake at the bottom of the ocean? Which mountain peaks the highest? Which cave plunges deepest?
For every answer, for every mystery solved another question forms itself - our planet gives us another mystery to solve.

The Northern Lights have been one of nature's greatest mysteries. Why does the sky light up with hues of green, yellow or purple in various regions? Why is this phenomenon happening seemingly at random at specific times of the year?
The explanations and theories of the phenomenon have changed over time, and even when we in our modern era have a perfectly reasonable scientific explanation, the phenomenon doesn't amaze us any less.

Northern Finland, near the Arctic Circle is becoming an increasingly popular tourist destination for the exploratory driven, curious travellers in search for the Northern Lights.

Based on a student competition from 2012, by ArchMedium, the objective of this project is to create a vacation retreat with focus on travellers visiting Rovaniemi to experience, not only the mystic wonders of aurora borealis, but also rediscover their primitive instincts – disconnect themselves from everyday routines of their ordinarily busy urban lifestyle and experience a life of relaxation, observation and learning – a place where they can bond with nature and re-establish the connection between Man and the glories of his planet. [ArchMedium]

The site for this project is situated east of Rovaniemi centre. Approximately 5,5 acres of lush forest will form the base for the design of a resort that incorporates living facilities, an observatory, a planetarium, a restaurant and a Finnish sauna.
The aim is to enhance the travellers experience by reimagining the typical generic hotel and creating a design that relates to the travellers expectation.



LEFT 'Sensuous use of material'
Korundi house of Culture, Rovaniemi, Juhani Pallasmaa

MOTIVATION

I've always been fascinated with craftsmanship, whether it be the beautiful curves a carpenter gives to a violin, or even the beautiful composition of a writers sentence - craftsmanship has in many ways been poetic to me. The notion of the tekton as being the carpenter/builder and the architekton as the master builder is thus what I find particularly of interest in architecture.

Through my early years I realized that specific spaces had a certain impact on me – even though I at the time was not able to express myself clearly of why and how - these spaces offered senses that altered my perception.
A sense of content in one space could be exchanged for insecurity or submissiveness in another. It was impossible for me to walk around without looking around trying to demystify the secrets of these spaces and why they affected me as they did.
It was at that time I distinguished between building and architecture – a very provoking notion indeed, but my reasoning was simple.
Some buildings, although functional and pretty looking, didn't engage me in the same ways as others. To put it in simple terms, for me a building becomes true architecture, when it impacts my perception of the world around me and not only satisfies me visually.

During my studies in architecture, I've had the opportunity to work on various projects, and with each project I would come a little step closer to defining myself as an architect.

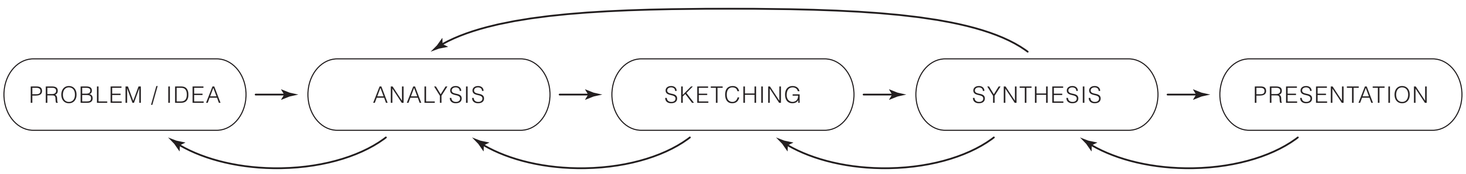
Being that this is the final chapter of my life as an architecture student the kind of project I wanted to do was one where my view on and understanding of architecture could be envisioned as clearly as possible. A project that deals with the significance of space – the particular attention to how external factors touches human.

I am ultimately motivated by and interested in learning how architecture, beyond the physicality of providing a building envelope also has the ability to choreograph life – how it can alter human interaction with external factors.

The present thesis is dealing with a project that suggests a primordial approach to tourist accommodation and gestures thereof.

BELOW IDP progress chart
BOTTOM Abstraction of topics

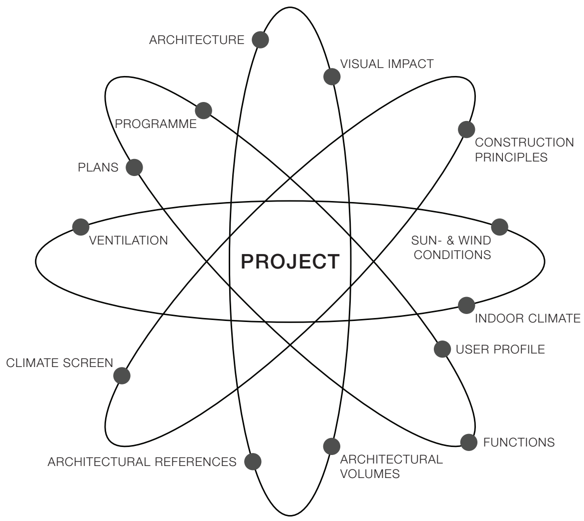
METHODOLOGY



ARCHITECTURAL QUALITY

With the educational approach of 'Problem Based Learning' (PBL) that Aalborg University imposes, the working method of this project takes its point of departure in the Integrated Design Process (IDP) as defined by Mary-Ann Knudstrup, with focus on the ability to integrate knowledge from engineering and architecture to solve complex problems during the design process.

In its simplified form, the design process is divided in five blocks that during the development will intertwine and interrelate: *problem, analysis, sketching, synthesis, presentation*.
The main goal of this working method is to ensure the design process yields competencies in design, functionality, aesthetics and technical solutions.
Through a critical, analytical and theoretical approach to the subject the intention is to reach a practical synthesis with inherited integrated values of the functional, technical and aesthetical aspects derived during the design process that are visually presented through a report, drawings, physical models and visualizations. [IDP]
The stringent method represents an approach based on delimitations, whereas this project seeks to exploit potentials in the process of continuingly sketching during the first couple of phases.



BUILDING THE DRAWING

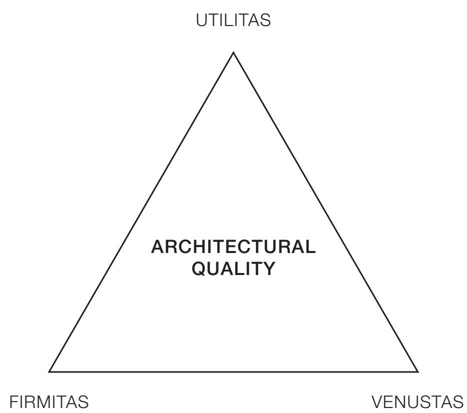
Although this projects methodology is based on IDP and the iterative process within should be aparent, IDP is presented fairly linear, which is why the sketching phase in this project is initiated along with the analysis phase.
This reordering of phases in IDP methodology is based on readings of Jonathan Hills article 'Building the drawing' in the 4th issue of 2005's AD magazine "Design Through Making".
He raises a theory that traditional architectural drawings are reduced to mere representational

tools, thus diminishing the articulate language of architecture and hence the development thereof. If however the drawing is comprehended as an analogue to the building and not merely a representation;

a dialogue can exist between what is designed and how it is designed, between design intention and working medium. Between thought, action and object – building the drawing rather than drawing the building.

[Hill: 2005]

The act of building the drawing starts at the same time as analysis – every new piece of information or knowledge obtained during analysis is thus implemented in the sketching and acts as a driver for building the drawing.



MIDDLE Vitruvius trinity

ARCHITECTURAL QUALITY

In order to be able to asses design proposals in the course of the process, the principles of Vitruvian trinity is applied in evaluation. Vitruvius' characterization of architectural quality is described through three key elements in design;

- *Firmitas* – durability and robustness.
- *Utilitas* – functionality relative to its user
- *Venustas* – aesthetical merits.

When these three elements are treated correspondingly a synthesis is achieved. Balancing the three elements throughout the process is of high importance in order to reach a substantial outcome and is consequently the basis for the ongoing assessment of the design proposals.

LEARNING GOALS

It has been of great importance to specify, from the beginning what learning goals this project should yield during the process.

As a student of architecture at Aalborg University I've been creating various projects – all with a particular focus on the integrated design process as a methodology. This project should demonstrate the ability to master this - hence the goal will be to provide sufficient documentation during this report of aesthetic, functional and technical aspects the process has addressed.

In previous projects my focus has been on two particular and essential topics of architectural design. During this process the main learning goals are a clear understanding of structure, and how it aids in the holistic understanding of the design. I have very little experience in buildings outside the Danish climate region, and no experience in extreme weather conditions, which is why considerations on sustainability mainly will be addressed in terms of passive strategies on a conceptual level.

During the previous semester I've been working in a professional studio environment and thus gained knowledge of aspects that haven't been addressed in previous academic projects – mostly with a focus on a highly structured design process. It is a learning goal for me to continue this professional approach and ensuring that the project reaches as far as possible during the timeframe by structuring the process correctly.

RIGHT Natural path on site
BELOW Fell stone exposed through vegetation

LIMITATIONS

The project focus is tectonic architecture, and although considerations on sustainability will be a part of the process, it will not be a specific goal to reach a sustainable building. When dealing with sustainability, this project will focus mostly on passive strategies in a harsh climate.

The building site for this project is a very debated topic in the city, during the last 30 years there's been a discussion about the possibility to build on this particular site – the consensus is currently that the site be left as is. It is therefore acknowledged that the site might not be a realistic possibility but is still chosen because of its interesting character compared to the project brief.

Financial considerations will not be addressed during the process as this is of less importance since there is no client for this project and economic challenges are not a part of the learning goals. Furthermore there is no particular local plan for the site and the regional plan does not specify anything of importance – the project will therefore be limited to dealing with European standards, rules and regulations.

PROGRAMME

TOP LEFT Finnish sauna
TOP RIGHT Dog sledding
MIDDLE Santa Claus Village, Rovaniemi
BOTTOM LEFT Finnish winter darkness
BOTTOM RIGHT Hill overviewing Finnish Nature

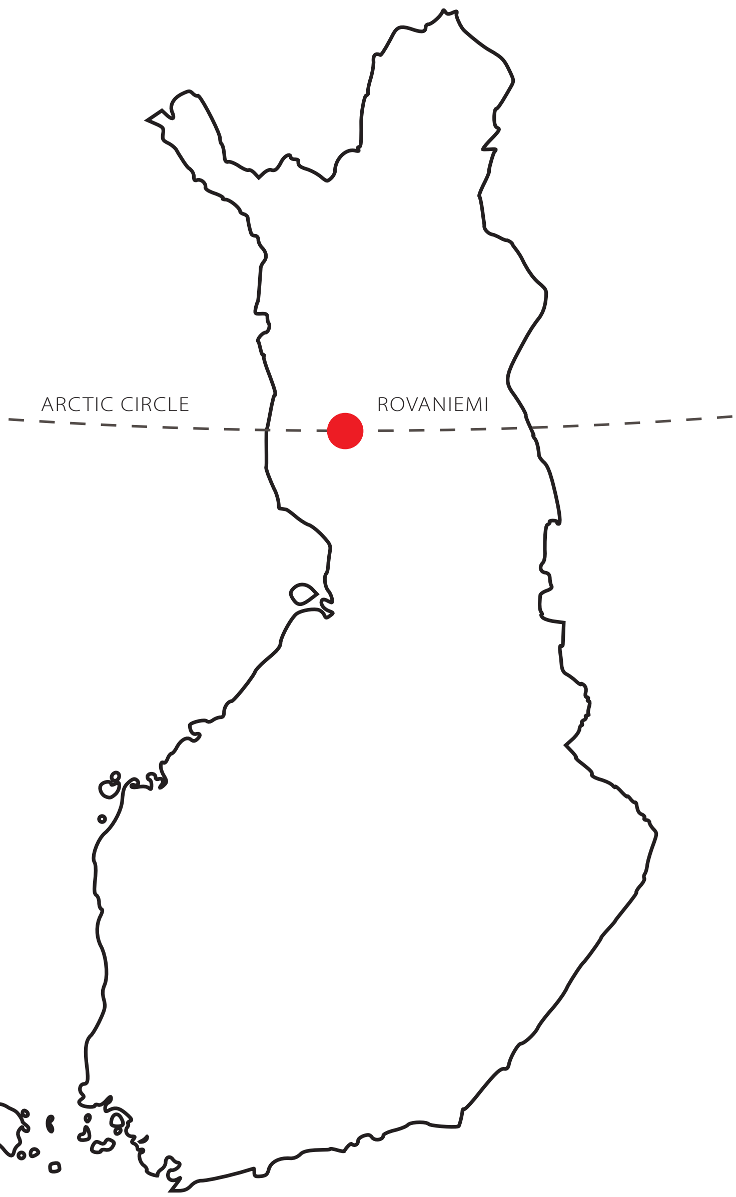
FINLAND

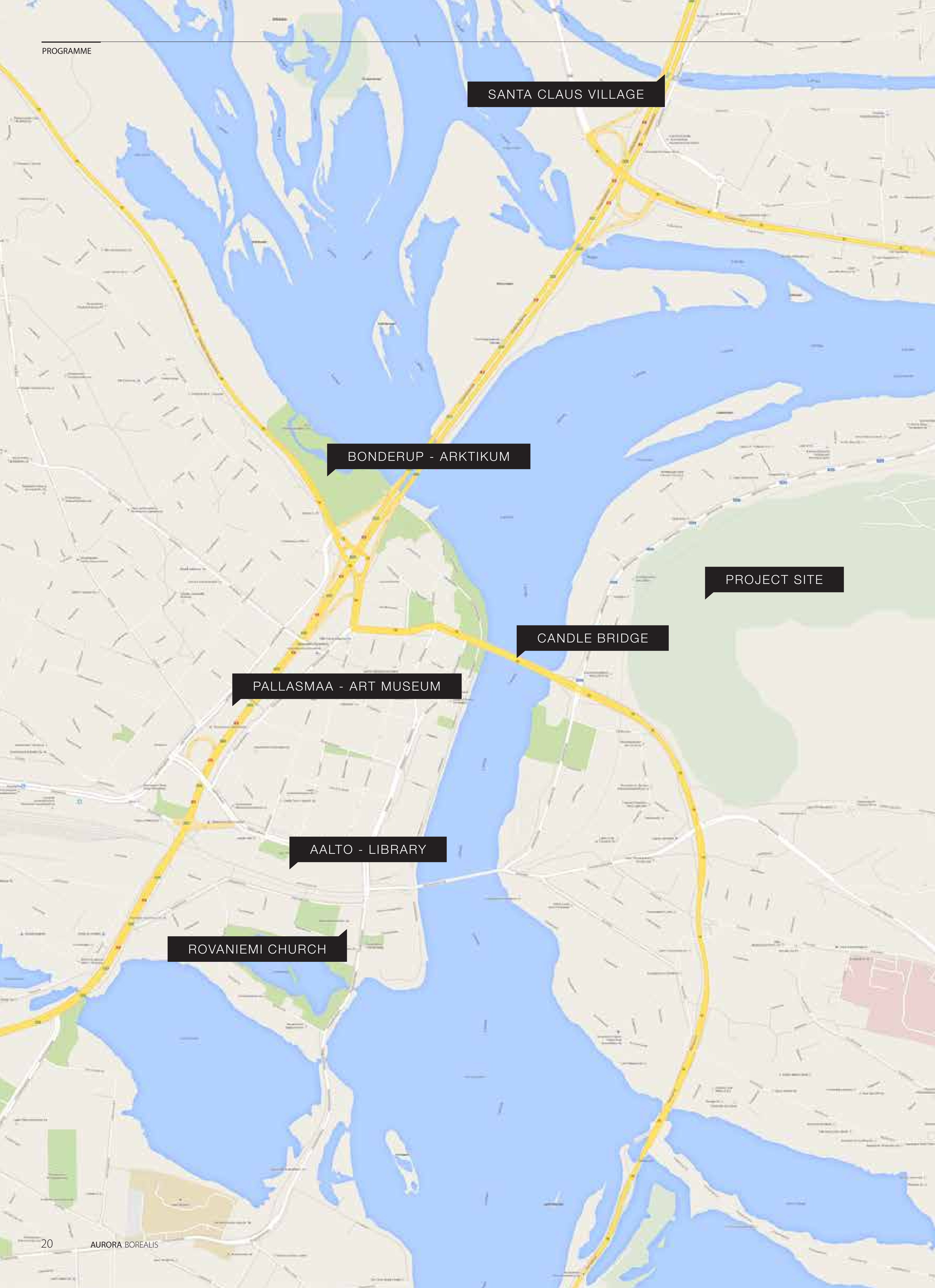
The Land of the Midnight Sun

The outermost eastern country of Scandinavia, situated in the Fennoscandian region, Finland is a EU country since 1995 and is bordered by Sweden to the west, Norway to the north, Russia to the east and Estonia to the south. The country is the eight largest in Europe with the 5.4 million inhabitants who are mostly concentrated around the southern regions.

During a period of eight centuries, Finland has been a part of Sweden, which is still evident by the occurrence of Swedish language. Later Finland became part of Russian Empire until the Russian revolution prompted the Finnish Declaration of Independence in 1917, even though the foreign influence is still apparent in Finnish culture and architecture.
During World War II Finland was active in three conflicts, making it a huge battleground - Lapland fought against Nazi Germany in the period of 1944-1945 - which left the populated areas destroyed.

Finland is a country full of contrasts – As you move from south to north the southern seafront and the urban rural life is exchanged for Lakeland with magnificent nature and landscapes, while further north the arctic Lapland follows up on this unique nature with both the Aurora Borealis and the Midnight sun as spectacular features of this land. [wiki]




SANTA CLAUS VILLAGE
BONDERUP - ARKTIKUM
PROJECT SITE
CANDLE BRIDGE
PALLASMAA - ART MUSEUM
AALTO - LIBRARY
ROVANIEMI CHURCH

LEFT Google Maps view of Rovaniemi

ROVANIEMI

The hometown of Santa Claus

POPULATION

61
THOUSAND

DENSITY

8
PER KM^2

TOURISM

480
THOUSAND
OVERNIGHTS / YEAR

AURORA BOREALIS

200
DAYS / YEAR

Situated on the border of the Arctic Circle, Rovaniemi is also known as the hometown of Santa Claus. The northern location and the surrounding Lappish wilderness makes the town a unique meeting place for nature and culture.

The city is situated between the hills of Ounasvarra and Korkalovaara at the confluence of rivers Kemijoki and Ounasjoki and as the fifth largest municipality in Finland the population density is just about 8 / km^2. During its existence, the town has adopted the role of the "gateway to Lapland" and is also the administrative capital of Finnish Lapland.

The Lappish areas have certain characters during the year, which is why Lapland is known as the land of eight seasons. The distinct character of Rovaniemi wilderness changes not only on the four regular seasons; spring, summer, autumn, winter, but also in the transition between these.The moonlit nights of August feel like summer, but with days growing shorter, the lighting gets melancholy shades of autumn. Snowdrifts, frozen rivers and sunlit sparkling crusted snow covering the landscapes define the transition between winter and spring. The experience of nature and wilderness around Rovaniemi depend highly on time of year and adds to the character of the area.

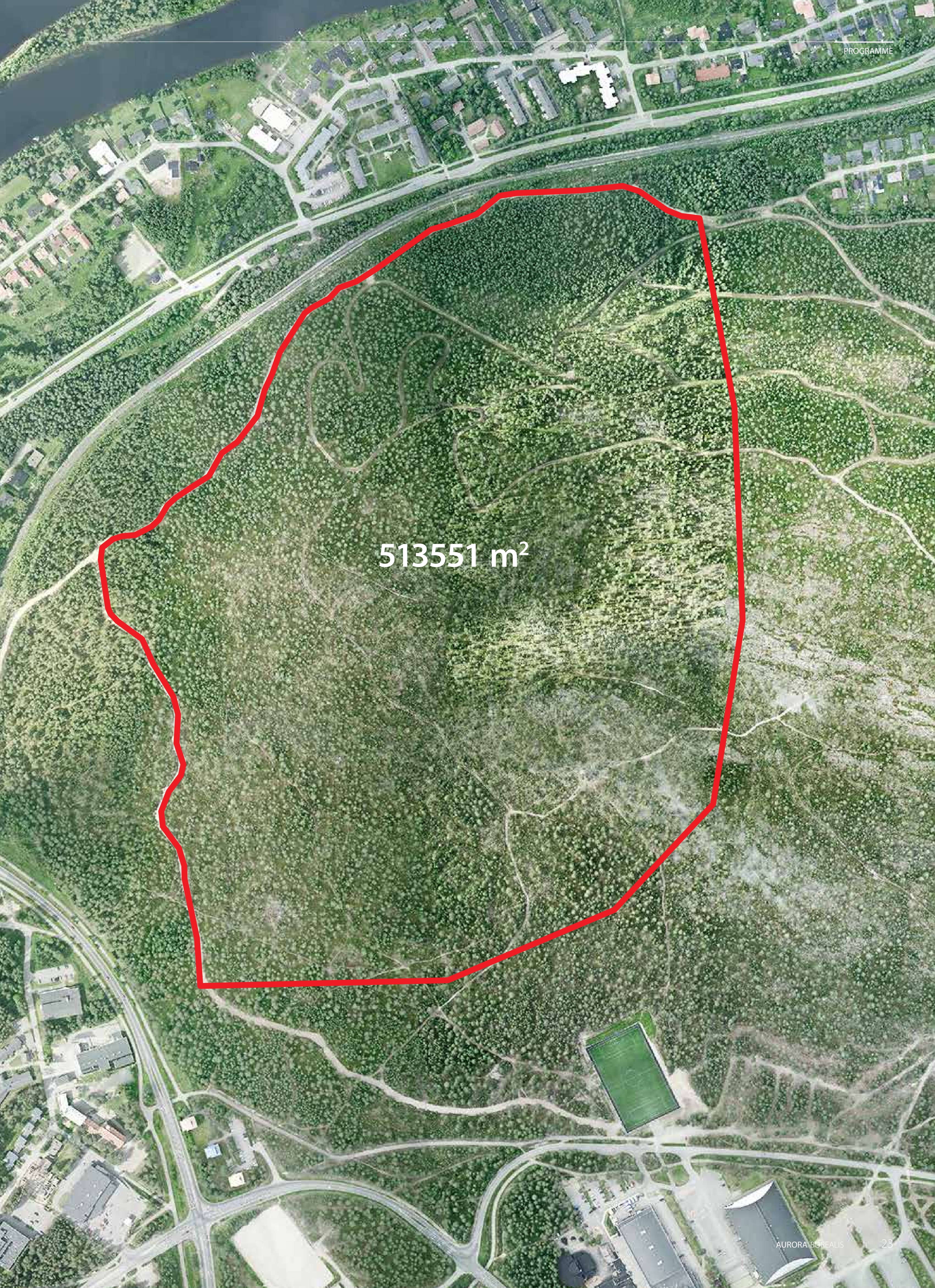
Since Second World War, and the destruction of the entire city by Nazi Germany, Rovaniemi has gained a significant interest by architects. Alvar Aalto was responsible for designing the reconstruction plan of Rovaniemi in 1944-1945. The reconstruction plan of Rovaniemi is concealing a puzzle picture of a reindeer: two branches of the central park are outlined as reindeer horns, two are defining reindeer's head and one it's back. That is why it is called "Reindeer Antler Plan". Alvar Aalto has also designed several buildings in the city; The Library Building, Lappia Hall, the Town Hall among others. Another interesting piece of Rovaniemi architecture; The Arktikum, was designed by the Danish architects Birch-Bonderup & Thorup-Waade. The crescent-shaped building was designed by Claus Bonderup and Janne Lehtipalo and it was completed in autumn 1992, with further expansion finished in 1997.

Plenty of local natural building materials have been used in the building: the floors are made from Perttaus granite – the hardest type available in Finland – and from lime-washed Lappish pine. The chairs are made from birch and reindeer hide. [visitrovaniemi]

Very little is left of the old traditional building methods in Rovaniemi, as the city has been completely rebuilt after WWII - Most buildings are masoned brick or concrete, while the remaining old buildings are entirely of wood.

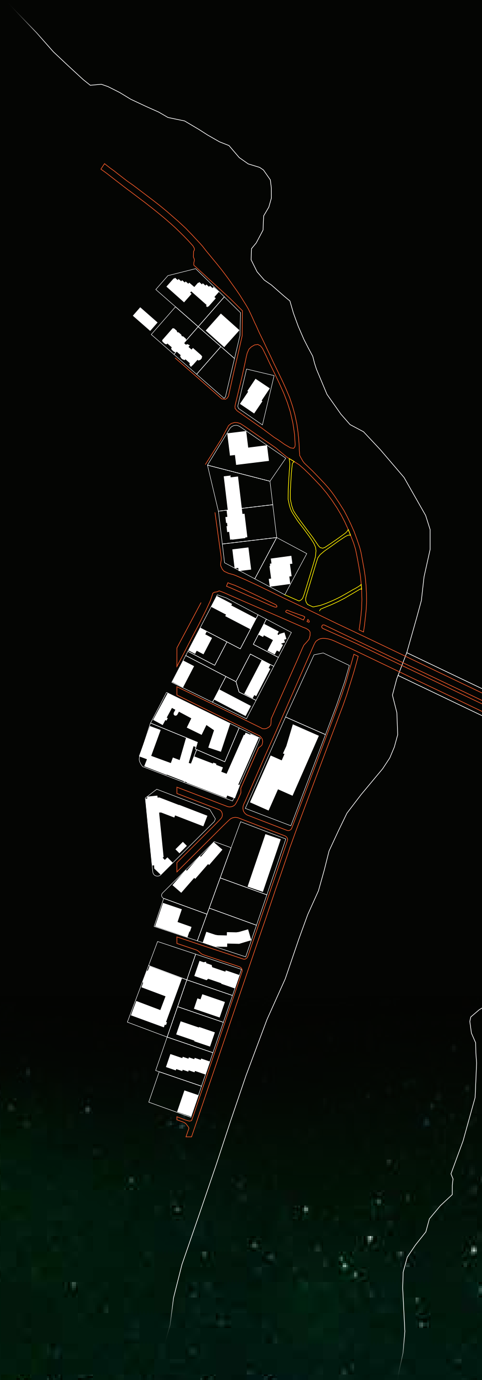
PROJECT SITE

The Ounasvarra hill, where the project site resides, is a massive landscape of untouched nature. The hill is a popular starting point for trekking through the Lappish forests – the tracks range from the Ounasvarra all the way to the Russian border.
At the top of the 180 meter (above sea level) hill, another popular attraction of the city; the ski resort, is situated, with several skiing tracks going to the bottom on the northern slope.
Besides the trekking tracks and the cross country skiing tracks, this site is pure Lappish wilderness, which is quite rare to have so close to a city center.
The dense forest consists mainly of pine trees and smaller parts of mountain pine, dwarf pine and spruce trees. Among the trees the earth ground has several types of bushes, brushes and grass, among other vegetation, while the hill also exposes the highly eroded, gently shaped Fell. [Lapland]
The site boundary spans 750 meters (west-east) from the slope start and almost to the top, while on the north south direction the span is almost 1 kilometer, resulting in approximately 51 acres.


513551 m²

MAPPINGS

Observations and identifications of current conditions and limitations around the site.



The site connects to city center via roads only across the Candle Bridge, making it an influential road for visitors as this would be the preferred main entrance. Another entrance is possible from the north, following the train tracks until the intersection just past the Candle Bridge.

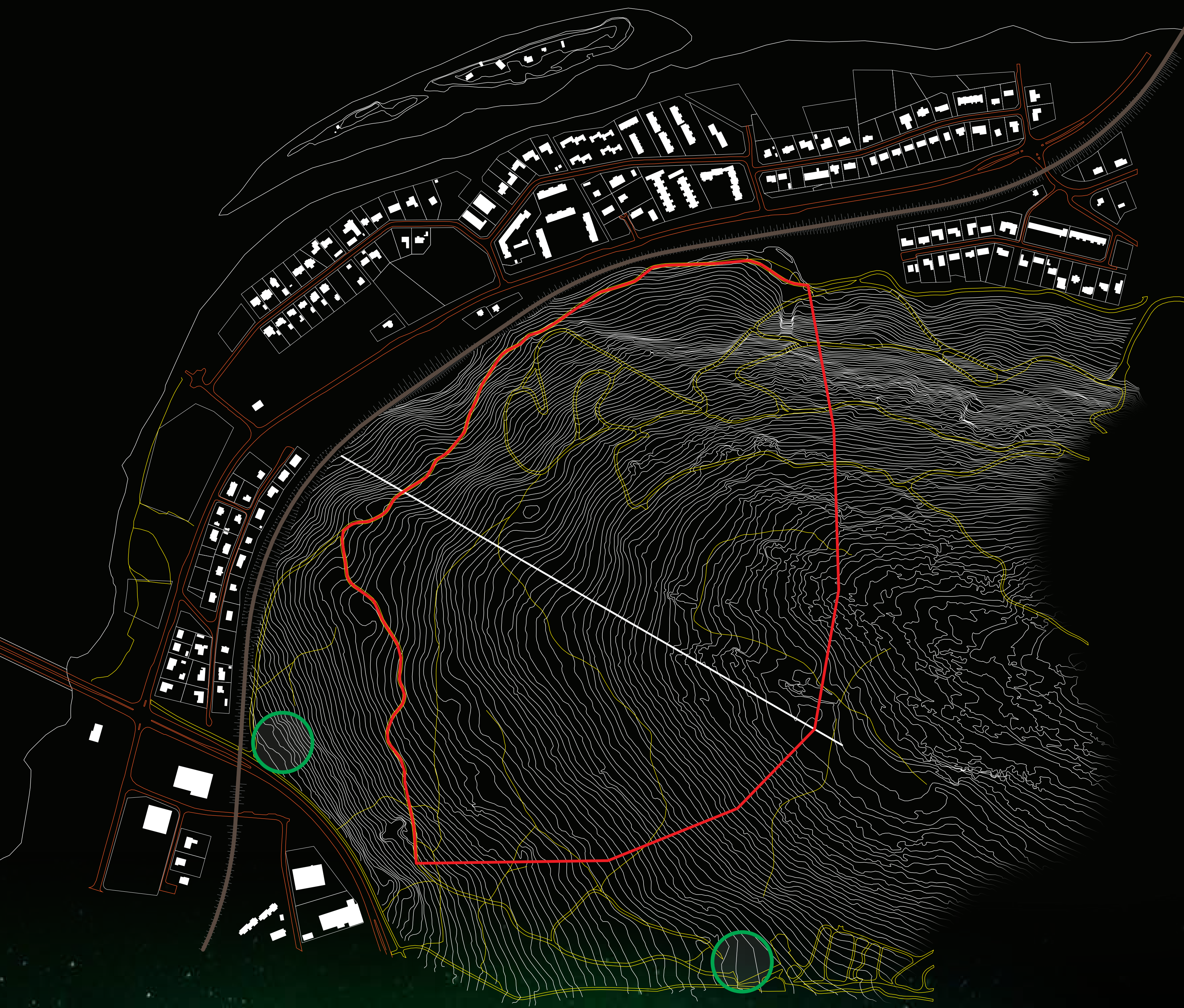
Two types of paths exist on site; trekking paths and cross country skiing paths. The trekking paths are very rough with unaltered terrain, created by trekkers, while the skiing paths are deliberately created for the ski resort. They are approximately 5 meters wide, covered with compact snow during skiing season and with gravel during summer.

A railroad cuts through at the border of the site, divding it from inhabited areas. The train departs from Rovaniemi Train Station and journeys north. No stops are registered near the site - visitors arriving with train, would have to arrange a shuttle taxi from the Train Station to reach the site.

The nearest neighbourhood is situated across the train tracks, towards the riverfront. the area is dominated by detached housing, while plans for a new hotel on the front row to the river is under planning. Below the site there's a sportsarena and other businesses of no industrial character.

Site Boundary; the high density of trees, and the long distances to inhabited areas makes the site surprisingly quiet - during mapping in spring, the only present noise was that of leafs waving with the wind.

There are two entries to the site. The first being at the intersection between train track and the road, which is only accessible by foot - this is also the entry path for trekkers. The second is further east, next to a tennis court belonging to the sports arena, another entry exists, which is accessible with automobile, making it the preferred access road for visitors arriving with car or shuttle taxi.



SITE 1:4000

SECTION A - A 1:2000

SPIRIT OF THE PLACE

Consulting the Genius Loci

To fully perceive the contextuality which this project is to join, a phenomenological approach is introduced to grasp the understanding of the site identity.

The principles of 'genius loci' or in other words the protective spirits of the place have been applied and reinvented throughout architectural history and have eventually reached the modern era, where it most notably has had deep impact in Nordic architecture in particular as a phenomenological approach to place-making.

Christian Norberg-Shulz is the leading theorist on matters of genius loci and in his book 'Genius Loci: Towards a Phenomenology of Architecture' he argues that identity of place in the modern realm - the 'spirit' which cannot be explained through analytical or scientific methods - is dissolving.

Embarking on an investigation of the spirit of the place starts first and foremost with relating the place to the human being and how these two interact, counteract and intertwine.

Norberg-Shulz presents three aspects of being that are necessary in order for the place to possess genius loci;

Remembrance – elements of remembrance justify the reasoning of the site, mostly characterized by distinct elements or symbols, natural or man-made. These determine which characteristics are used for describing the place.

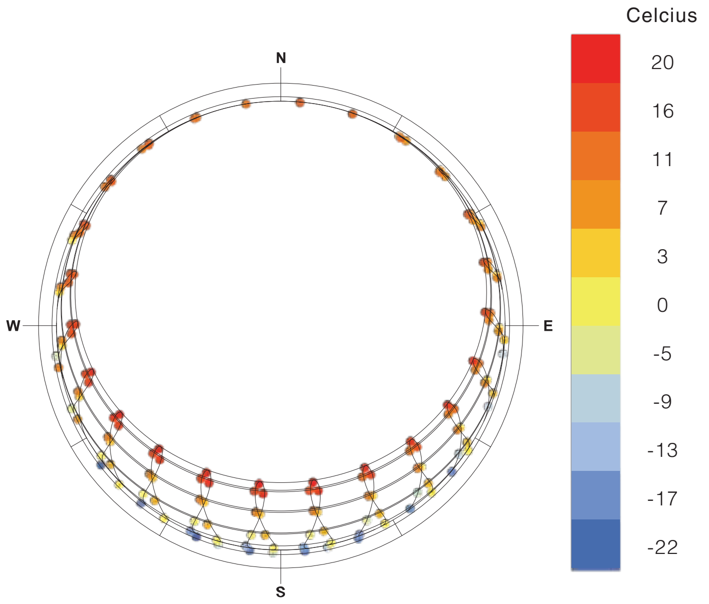
Orientation – this aspect refers to the objects of the place and their innate ability to create a sense of coherence. Distinct landmarks, the infrastructure and even the landscaping contours create a sense of orientation of place in relation to the greater entity.

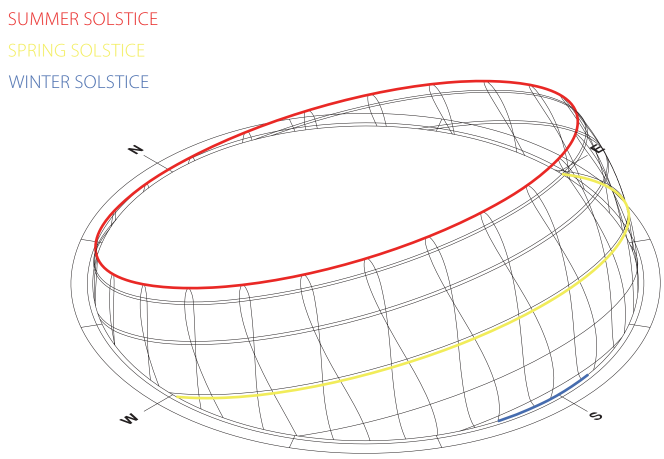
Identification – this aspect deals with the distinct atmosphere occurring from the specific shape and character of place, thus being a subject to remembrance. [Norberg-Shulz, 1991]

A place alienated from urbanity cut off by the rail road. A mass of fell oriented towards the sky. Trees rise like columns, leafs shelter like a roof. A place seemingly defying the man-made. The tall trees and the steep hill echoes of a time when nature ruled nature. No landscape contour is planned, no tree is placed by the human hand. The place is engaged for recreation, not for habitation. A natural environment. A mental retreat from city life. An exceptional refuge from normality. A charitable refuge from reality. Calm and peaceful – Mother Nature at her best.

CLIMATE CONDITIONS

Rovaniemi being on the border of the Arctic Circle, means the climate is very different from what we are used to in Denmark, it is very close to the extreme arctic conditions. making it one of the coldest environments inhabited by a larger population.

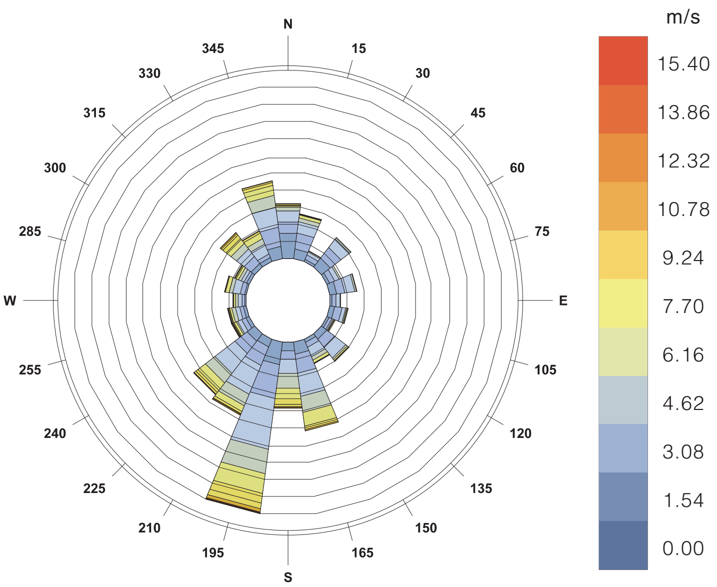


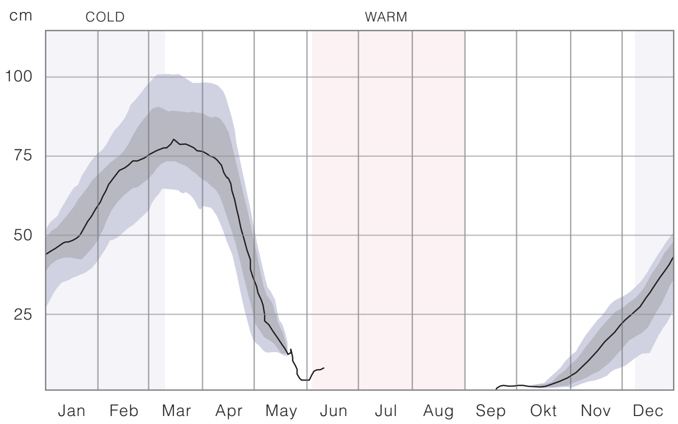


During winter time the temperature drops to -21,2 degree celcius on average with a recorded low of -45 degree celcius, while the summer time is more tempered with an average of 16,5 degree celcius.

With a winter spanning from November to March, on average January is the coolest month, while the warmest is July.

In continuation of the temperatures if we look at the sun position during a year, the sun maximum angle, during summer solstice reaches 45.6 degrees, because of the the latitude of Rovaniemi which is 65,500° N.
During winter solstice the sun is present for 2 hours, a condition close to that of polar nights.





Over the course of a year the the wind has a dominating direction from south and north, while wind speed varies from light air to moderate breeze, rarely exceeding 9 m/s.
From a monthly study it was registered that the highest average wind speed occurs in Febuary from south, while the lowest average wind speed occurs in August, from the north.

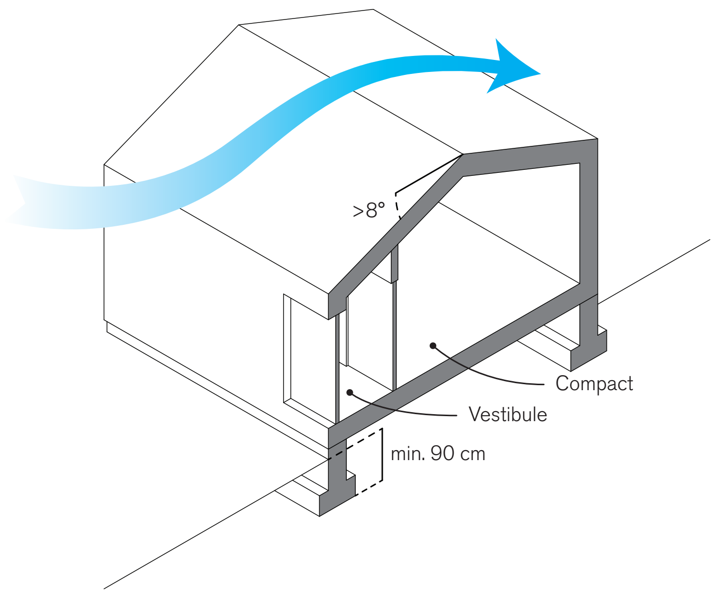
Through October to May the likelyhood of snow falling is highest in january, and the amount of snow falling is registered in the diagram above.
Snow depths are highest in March, where paradoxically the seasons are transitioning, which is evident in the graph as the average 75cm deep snow melts over the course of a month. [weatherspark]

BUILDING TRADITION

During a studytrip to Rovaniemi, part of the goal was to study design principles the local community used in this climate, to better understand how to deal with the conditions. The following is a summary of the most common principles, that will be considered during the design process.

Envelope

It is not evident that building envelopes are highly insulated, they follow the Scandinavian average and usually aim at energy class 2015. However there is a strong attention to thermal bridges in order to avoid both infiltration and moisture damage. It is common practice to have a two door entrance, minimizing direct infiltration. Furthermore in order to lower energy consumption, it is common that the buildings are compact.



Materials

During the Modern era of architectural history, about the same time that Rovaniemi was completely demolished, a clear transition from the traditional timber buildings to a use of concrete is evident. The city only has one timber building left from before the war, and only few buldings on the outskirts of the city are built completely in timber, while the city center sprawls with pre-fab concrete.

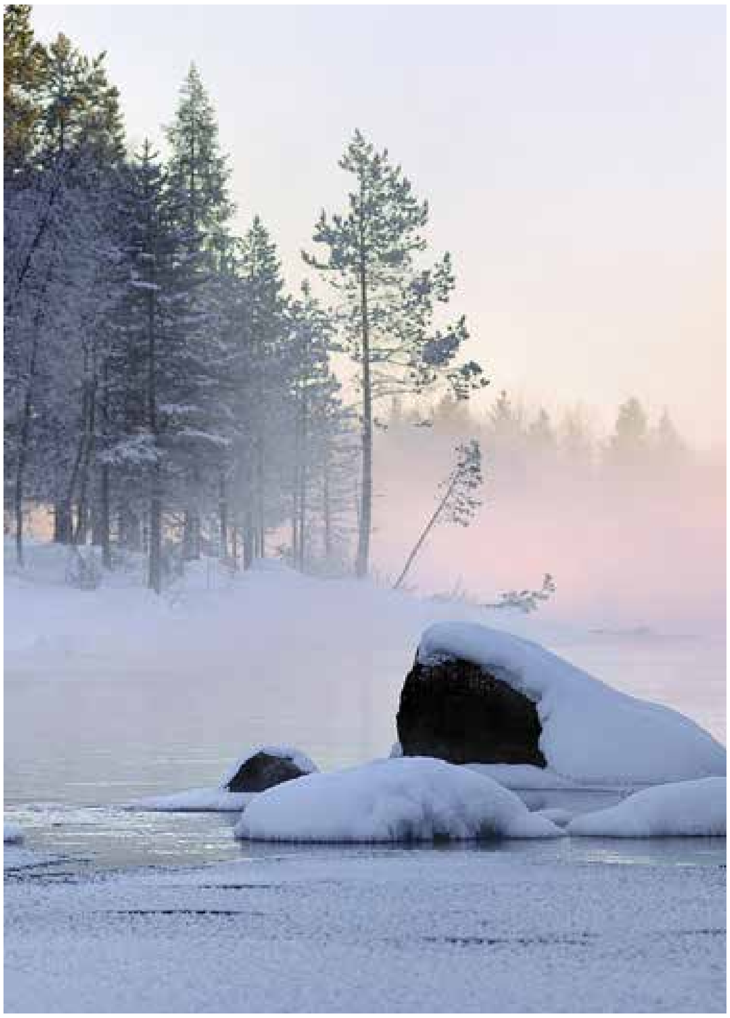
Foundation & Levels

From a first sight of the city center, it was registered that most housing blocks were raised one story and instead of housing the first floor accommodated parking garages. The initial reasoning for this being the massive snow fall was dismissed by a local architect that explained it mainly was reasoned by the local plan for buildings near the riverfront. The typical foundations are made as wall footings or drilled piers.

Roofs

Although the city center presents a clear image of flat roofed concrete blocks, the most common building tradition with regards to the roof is to slope it with a minimum of 8 degrees, to allow snow being blown away. Ideally the roofs are constructed in a manner to avoid the piling of snow.

LEFT Frosty Winter Morning
TOP RIGHT Midnight Sun over Rovaniemi
BOTTOM RIGHT Departure of Ice



EIGHT SEASONS

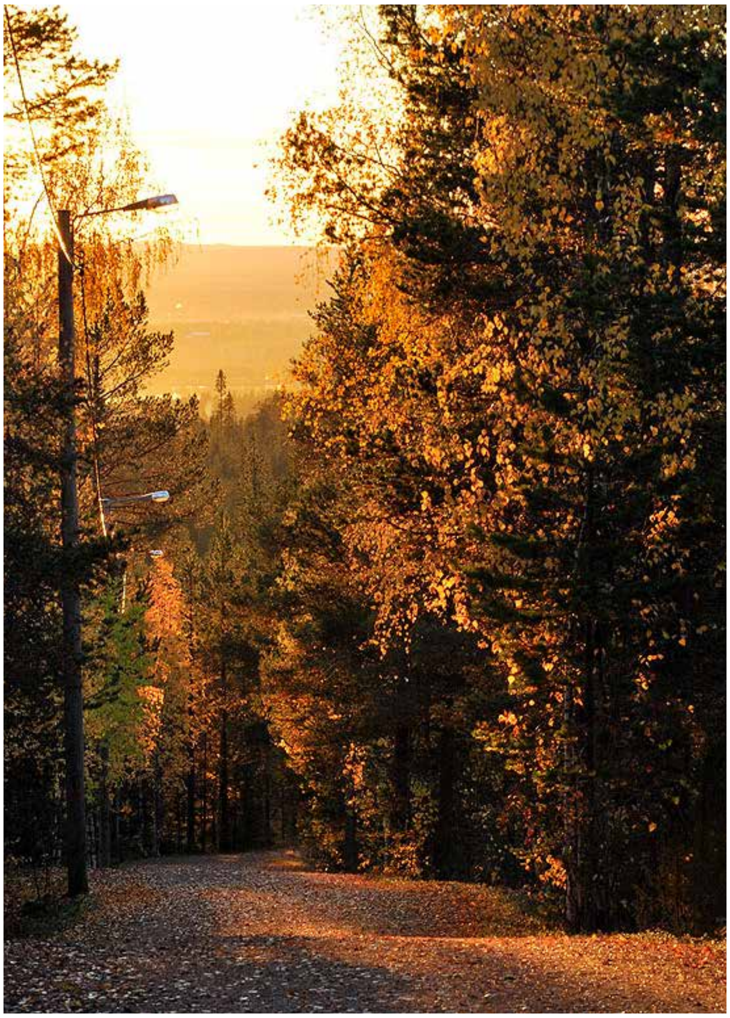
From a sensuous perspective to the climate conditions, the Lappish landscape has a dramatically distinct atmosphere dependent on the season. Besides describing the seasons in the regular four; spring, summer autumn and winter, the seasons in Lappish seasons can be further divided, as the transitions are particularly distinct in their own respective ways.

The common division of seasons in Lapland is; Christmas as the deep winter, frosty winter as the late winter, crusty snow as the spring, departure of ice as early summer, midnight sun as summer, harvest season as late summer, coloful autumn and lastly first snow as early winter.

The atmosphere of ice departing can be described by sunshine glistening on the silky crystal snow cover that gradually melts, making way for nature to gradually awaken and slowly display its grandeur.

Midnight sun presents the nightless days with the rough beauty of the fell and sparkling clear rivers. Coloful autumn paints everything with a melancholy hue of orange in preparation for the dark and bleak early winter with vegetation changing its appearance and at first snow slowly transitions into the deep winter, distinguished with a twilight period where the sun stays below the horizon. [eightseasons]

TOP LEFT Colorful Autumn
BOTTOM LEFT Midnight Sun Nature
RIGHT First snow



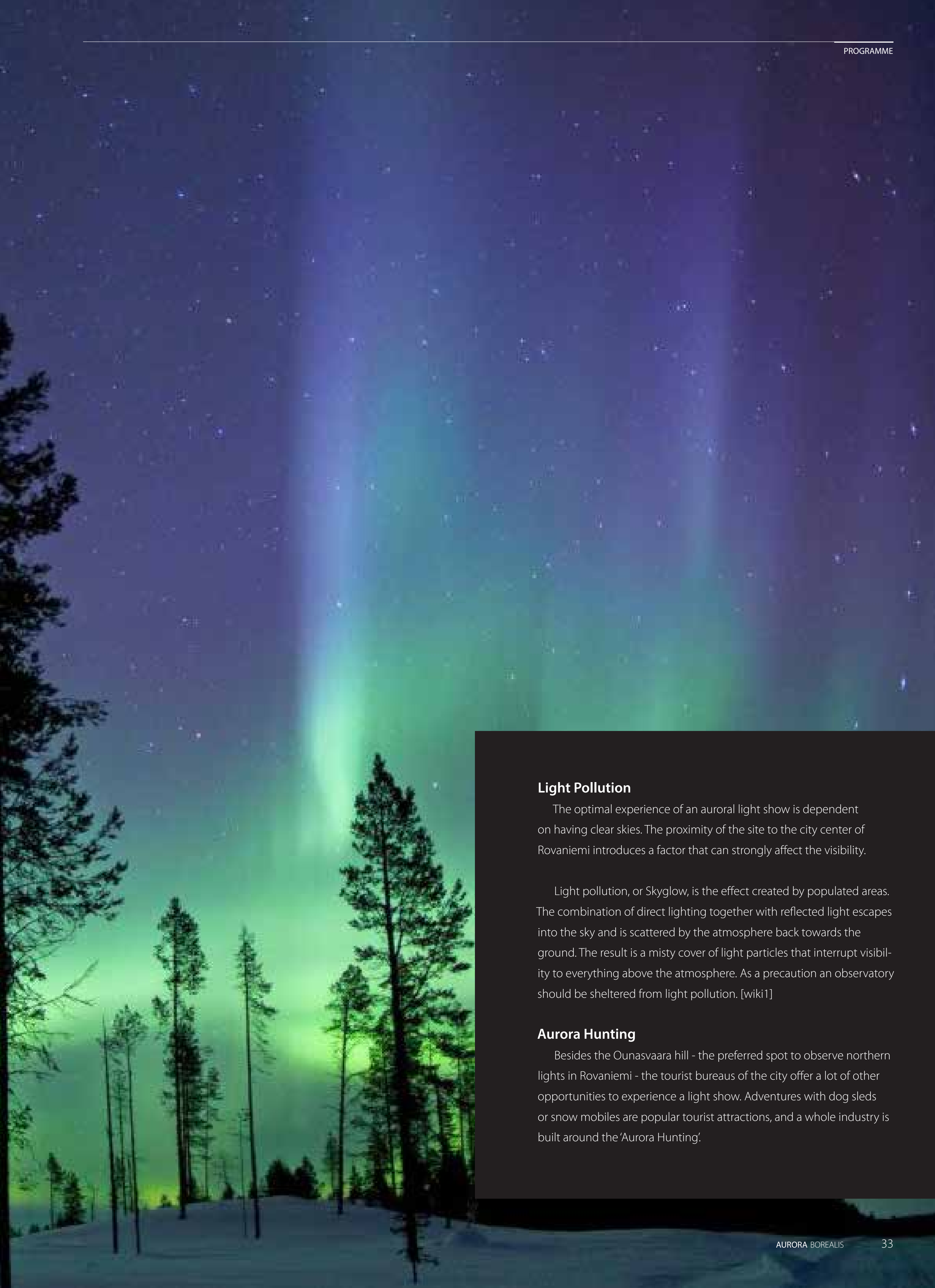
CAPTURING ELUSIVENESS

The natural phenomenon that lights up the skies has been a great mystery amazing us time and time again, perhaps it is the elusive character of it that intrigues?

The Finnish word for northern lights is revontulet, and originates from the ancient belief of a fire fox is sparking the sky with its tail, creating a light display – revontulet is directly translatable to 'fox fire'

However, science explains the bursts of light in a different manner. The sun thrusts particles towards the Earth that, when entering the earth's magnetic field, are directed into the atmosphere close to the magnetic poles the 'auroral zones'. When the particles reach the oxygen and nitrogen atoms of the atmosphere a chemical reaction ignites them and thus erupts a light of yellow-green and red-violet hues.

Although conditions for observing the aurora in Rovaniemi are ideal for about 200 nights a year the visibility of it is not certain. Forecasting an auroral light show is next to impossible, even when monitoring solar activity and solar winds, which are usually the main factors for predicting aurora. Even with a hard scientific explanation of the Northern lights the unpredictability of the phenomenon increases to the enduring fascination of it. [visitrovaniemi]



Light Pollution

The optimal experience of an auroral light show is dependent on having clear skies. The proximity of the site to the city center of Rovaniemi introduces a factor that can strongly affect the visibility.

Light pollution, or Skyglow, is the effect created by populated areas. The combination of direct lighting together with reflected light escapes into the sky and is scattered by the atmosphere back towards the ground. The result is a misty cover of light particles that interrupt visibility to everything above the atmosphere. As a precaution an observatory should be sheltered from light pollution. [wiki1]

Aurora Hunting

Besides the Ounasvaara hill - the preferred spot to observe northern lights in Rovaniemi - the tourist bureaus of the city offer a lot of other opportunities to experience a light show. Adventures with dog sleds or snow mobiles are popular tourist attractions, and a whole industry is built around the 'Aurora Hunting'.

TECTONIC APPROACH

Although being a very delicate and complicated term, in the ordinary sense tectonic architecture, as described by Kenneth Frampton, deals with materials used through a clear sense of structural order enhancing the visual result of space – it is the poetics of construction. Full tectonic potential has the capacity to articulate both poetic and cognitive aspect of its substance creating a narrative of its own making:

> "Good architecture is always tectonic in the sense that it tells the story of its own making and how it stands up and how its details are related to the larger entity."

[Pallasmaa, 2012]

Juhani Pallasmaa suggests with this quote that there is a connection between our intuition and the tectonic in architecture, much like theories of Louis Kahn and Steen Eiler Rasmussen; the creation of architecture is related to the architects own experience of the world surrounding him. However intermittent this perception is, recognizing it is the first step towards the ability of envisioning the architect's role in the act of building.

> "The geometrical and mathematical construction of the architectural detail is in no sense a technical question.
> The matter should be regarded as falling within the philosophical problem of the foundation of architecture or geometry, and ultimately within the theories of perception"

[Frascari, 1984]

As Frascari here suggests, construction of architecture falls in the theories of perception, thus leading to an idea of intuition being the main guide during the design process. It is obvious that a lack of practical knowledge of a craftsman delimits one's ability, hence the ultimate goal for an architect / architecture student dealing with tectonics, is to aid the intuition in terms of structure and construction through a learning of understanding architecture in its gestures, often expressed with sensibly constructed details.

> "When a structural concept has found its implementation through construction the visual result will affect it through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building yet cannot be described in terms of construction and structure alone. For these qualities which are expressive of a relation of form to force, the term tectonic should be reserved"

[Frampton, 1995]

This project seeks to practice the theories on tectonics as identified here, focusing on the expression of structure rationalized through the knowledge of material properties and the inherently intrinsic qualities thereof.

TIMBER DESIGN

Being the son of a carpenter, with personal experience of working with wood in buildings, I've grown a strong affection for timber as a construction material and its versatile qualities.

Wood has always been an influential part of building design. It has many purposes, both in terms of construction and in aesthetical appearance.

Due to its properties, as an organic material, there are several technical qualities in wood; it is an exceptional insulator, it becomes harder when exposed to heat making it well suited for indoor structures, it is environmentally friendly as it is a carbon neutral construction material, and with over 5000 different woods, each with their own qualities in terms of insulation, acoustics and appearance, the possibilities of use are endless. The quality that I find most interesting is the versatility in terms of aesthetics – wood has a mesmerizing beauty where different hues of color combined with its textures gives it a delightful expression.

Through the recent century, engineered wood has had an immense role in developing new applications, as seen on some of the inspiration. Engineered wood is a derivative of the traditional lumber that is manufactured by binding it with adhesives in certain ways to give it design properties that traditional lumber can't match. The most common engineered wood in construction is glue laminated timber, which is using smaller pieces of wood bound together giving it the possibility to both span long distances and even curve in certain ways, while still maintaining the strength the exceeds traditional lumber classifications.

I believe wood is very powerful in portraying the tectonic approach I've set out, and it is the intention for this project to work with a wooden construction, putting an emphasis on the expression of structure and the qualities wood possess in terms of atmosphere.

ANOTHER TYPE OF HOTEL

Based on the phenomenological analysis, where it is suggested that this site is a refuge from normality this particular trail of thought is further investigated with focus on how people vacation.

With regards to vacationing, travelers usually have different parameters influencing their decision both in terms of accommodation and destination. The general consensus is however, that most travelers look for an escape from everyday life, a place where they can relax and a location where they can enrich their lives with new experiences.

The paper on Psychology of travel gives an insight to a shift in tourism attitude. The development from style and conspicuous consumption to valuing substance and quality has intensified during the recent recession, and now luxury in travel is about the ability of realizing one's own passion. [STAR, 2003]

In correlation to this, in an article posing the question 'what is the future holiday home?' professor, designer and architect Claus Bonderup presents a romantic definition of a return to the simple ways of living. [Børsen, 2012]

It has to be beautiful and uninsulated. You have to feel the weather. And then the romance have to recapture the days we take a break from everyday life. […] In the modern holiday home there should be no flatscreen TV or a conversation kitchen. […] After decades of abundance we have to return to simplicity'

Claus Bonderup

What is suggested in the article, is a sort of return the the primitive ways of living. A holiday home where you can have solitude.

I've experienced the site as a sort of refuge, and that is a highly valuable asset to have as this site can offer a retreat not in the usual understanding of a hotel, as the original competition suggests, where you check in to have a place to overnight while you go out to experience the destination, but a getaway from reality, where you stay close to the elements of nature. A place for reverie, a place to think, a place to be your wholly self without all the modern amenities you are used to in your daily home.

Usergroup

This type of hotel should be for travelers that have a need for relaxation through self-realization. The traveler that wants to get in touch with his own mind, body and soul without distractions. The traveler that seeks a place for introspection and reverie in a primitive environment close to nature.

JUVET LANDSCAPE HOTEL

To further clarify and in part classify what kind of hotel this should be, a case study of the Juvet Landscape Hotel seems appropriate.

Designed by the Norwegian Jensen & Skodvin Architect Office, this hotel is split into 6 cabins that are all placed at specific points in the Norwegian landscape to accommodate a specific view. When forming the cabins the architects had to work around the trees, as they were not to be removed, resulting in six different shapes. On each cabin, one façade is purely constructed of glass, framing an image of the landscape and bringing it inside. The distinction between inside and outside disappears while a dialogue between human and nature appears.

The Cabins are minimalistic – to sleep, you have to crawl up in a bed fitted between to walls, the bathroom only has a toilet and when the door is closed you can barely stand inside, while the main room is left fairly empty, only sitting furniture that points towards the view.

You will find no television here, nor will you have WiFi access to distract you from what is most important – this is a serene place for relaxation - it is only about the human and the nature.

ARCHITECTURE OF SOLITUDE

As a recapitulation of the Programme, I want to touch on the subject that will be the main focus of this project as a place to vacation.

During the studytrip to Rovaniemi, I acquired data from the municipality on tourism in the city, and as presented in the introduction to Rovaniemi, the city has an average of 480 thousand overnights a year. These travelers usually check in at the city centre hotels and hostels, much like I myself did, and from there they seek out the interest they have of Lapland, mainly through organized tourist events, that are carried out in the Lappish wilderness.

Through the mappings and especially analysis of spirit of the place it was realized that this site is particularly interesting because it is a calm and peaceful Lappish forest, so close to but still very cut off from the city. That is in particular interesting because a traveler that stays here would both be able to experience the Lappish eight seasons along with the aurora at first hand, right outside his room, while on the other hand, if so inclined, the traveler has the proximity to the city center that offers a variety of other tourist attractions.

While thinking of the spirit of the place, I've acknowledged that the site is not meant for a hotel complex, as the original competition suggests, but rather smaller cabins, where the travelers are in touch with the surroundings, not merely looking at them from a hotel room. The kind of holiday home where the traveler can experience solitude, much like what the Juvet Landscape hotel offers a traveler. Mark H. Dixon, Environmental Philosopher from Ohio Northern University, writes in his paper 'Architecture of Solitude':

> As a spiritual or meditative practice solitude implies more than mere silence or being alone. [..] Solitude is also more than being in some remote or inaccessible place. Even though geographical isolation might be conducive to solitude, with rare exceptions human beings have seldom sought solitude in complete seclusion in the wilderness The places where human beings have sought solitude have in the end been human places, human-built places. It should come as no surprise then that through architecture human beings have sought to build solitude, to construct, through stone and glass and wooden structures, places that are conductive to and encourage solitude.

[Dixon, M.H.,]

This statement together with the idea of the future holiday home presented by Claus Bonderup encompasses my general notion of what this place can offer as a vacation retreat.

ROOM PROGRAM

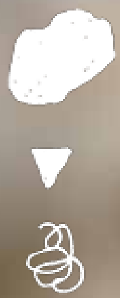
The room program presented here is the aim for the project, and is derived from the competition brief with alterations based on the project programme and project goal. The original competition brief suggests hotel rooms for 2-4 persons, while this room program is based on cabins instead. everything else from the competition room program is kept.

Function	*Properties*				
	Amount	*Size*	*Level of intimacy*	*Quality of light*	*Description*
Observatory	*1*	*~ 530 m²*	+ +		
Entrance / Reception	*1*	*~ 15 m²*	+ + +	*Combination of natural and artificial light*	*An entrance that presents the purpose of the observatory.*
Administration	*1*	*~ 10 m²*	+ +	*Artificial Light*	*Office of administration.*
Exhibition space	*1*	*~ 100 m²*	+	*Mainly natural light*	*Exhibiting Aurora facts, the space should intrigue, and invite into planetarium.*
Planetarium	*1*	*~ 60 m²*	+ + +	*Artificial Light from projector*	*Circular Room with complete focus on the projections*
Observatory	*1*	*~ 100 m²*	+ + + +	*Natural light*	*Outdoor space directed towards the northern hemisphere, this space should frame the nature surroundings and have a focus on the sky.*
Restaurant	*1*	*~ 140 m²*	+ + + +	*Combination of natural and artificial light*	*Small intimate seating arrangements with a view to the outside. (toilets & kitchen included in size)*
Sauna					
Dressing Room	*2*	*~ 10 m²*	+ + +	*Artificial light*	*A dressing room (male/female seperated), with toilets nearby - this should signify the start of the finnish spa ritual.*
Stove Room	*2*	*~ 10 m²*	+ + + + +	*Combination of natural and artificial light*	*The stove room in a finnish spa is the space where people talk, interact and discuss. The room should facilitate this.*
Washing Room	*2*	*~ 10 m²*	+ + +	*Artificial light*	*A washing room should be inbetween the stove room and the veranda.*
Social Area	*1*	*~ 30 m²*	+ +	*Mainly natural light*	*An area where both genders can socialize and relax. A small pool for cool down would be appropriate.*
Veranda	*1*	*~ 15 m²*	+ +	*Natural light*	*Outdoor area accomodating the need to cool down from sauna.*
2-4 Person Cabins	*~ 20*	*~ 83 m²*	+ + + + + +		
Entrance	*1*	*~ 5 m²*	+ +	*Artificial light when necesscary*	*It should signify a transition to a sheltered environment.*
Livingroom	*1*	*~ 20 m²*	+ + + + +	*Mainly natural light and light from fireplace*	*A room with a fireplace and openings focused at the outdoor nature.*
Bedroom	*1*	*~ 8 m²*	+ + + + + +	*Mainly natural light and light from fireplace*	*An intimate space for sleeping with an outlook to the surroundings*
Bathroom	*1*	*~ 5 m²*	+ + +	*Artificial light*	*Simple toilet facility.*
Sauna	*1*	*~ 5 m²*	+ + + + + +	*Combination of natural and artificial light*	*The cabins sauna should be smaller and more intimate, preferably with a view to the outside*
Washing Room	*1*	*~ 4 m²*	+ + +	*Natural light*	*In combination with sauna, a room to cool down*
Terrace	*1*	*~ 10 m²*	+ +	*Natural light*	*Mainly for the sauna ritual, but also for general use.*

VISION

Not a collection of hotel rooms

But a small distinct society

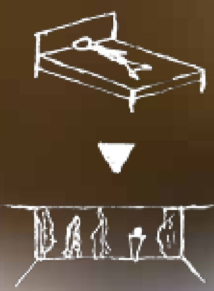


Not a massive malplaced volume

But dwellings embedded in nature

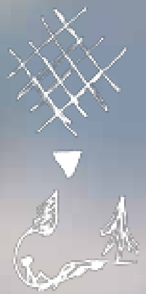
Not a place to call home

But a refuge from normality



Not just another place to sleep

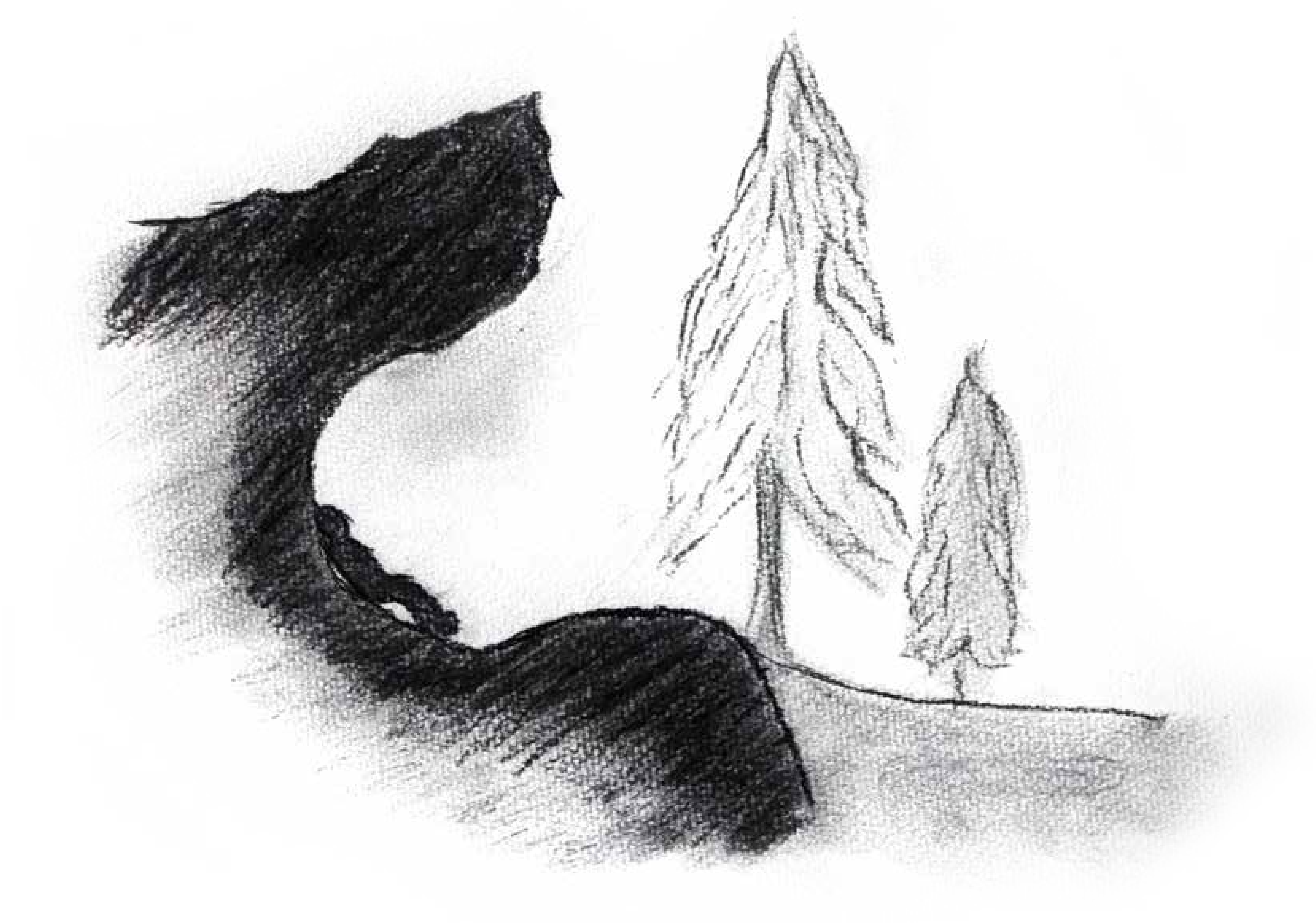
But a place for reverie, a place to think



Not a place of distraction

But a place of solitude

SKETCHING



Solitude **noun \'sä-lé-,tüd, -,tyüd**

the quality or state of being alone or remote from society

PRIMITIVE PRINCIPLES

The sketching phase took a point of departure from the notion of creating the cabins as primitive shelters – a cave like setting. The vision for this project suggests a distraction free space for reverie. The cave has the abilities to provide such a space, which is why an investigation in primordial needs was carried out. During this phase the main goal was to investigate the design principles that create an atmosphere of refuge, reverie and solitude.

In the architectural interpretation of a cave, it can be summarized as a shelter that provides all basic functions in one single space, hence one principle that will be carried out during sketching is the focus on assembling as much functionality in one space as possible, henceforth called the main room.

Furthermore, having a view to the outside is also common in such a shelter, it provides a sense of place and a sense of security, being sheltered from the elements while having the basic quality of daylight that is essential to human well-being.

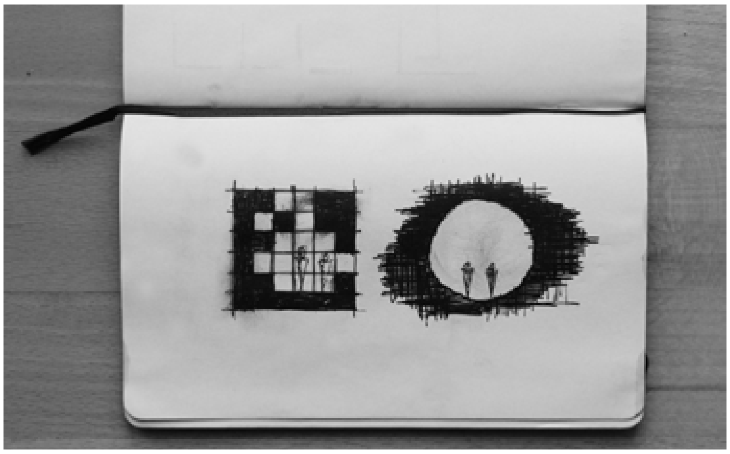
An open fire has the unique ability to pleasure the human, more than merely on a physical level of warming, as Juhani Pallasmaa describes it:

'Why do we all sense profound pleasure, when sitting by an open fire, if not because fire has offered our predecessors safety, pleasure and a heightened sense of togetherness for some 700 thousand years?'

Juhani Pallasmaa

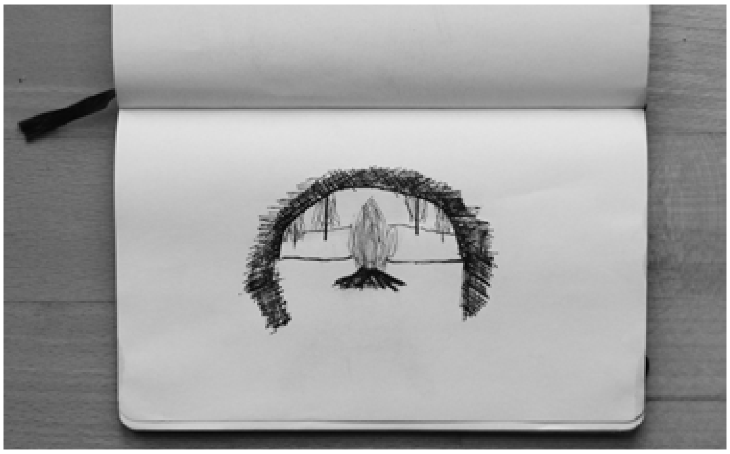
Architecture is a deep defence against the terror of time, it can speed up, slow down, even hault or reverse experiential time.
Speed is the most important product of contemporary culture - it is evident, if one considers why humans get stressed - everything has to be done fast.
The cave and the primordal notions attached to it presents a space where experiential time is slowed down to a scale that humans can grasp.

It is with this idea that the architectural context should provide a 'slow experiential time', through its unique structure and meaning, for man to percieve and understand his own existential situation.

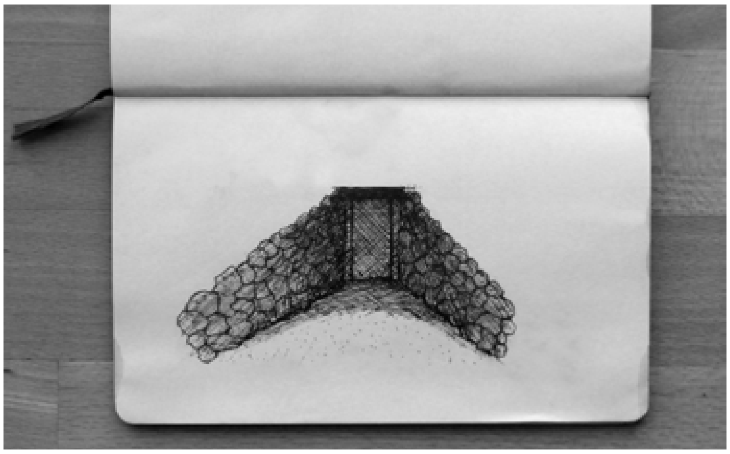


#01 - Comparison of man-made Final wooden house - a place of solitude and the primordial envelope of a cave. Mass produced by space and space produced by time.

#02 - A cave that opens up to its surroundings. The darkness diminishes the ocularcentric perception and enhances man's other senses.



#03 - Projecting a specific frame and horizon by an open fire - secluded, man can reverie one's existential situation.



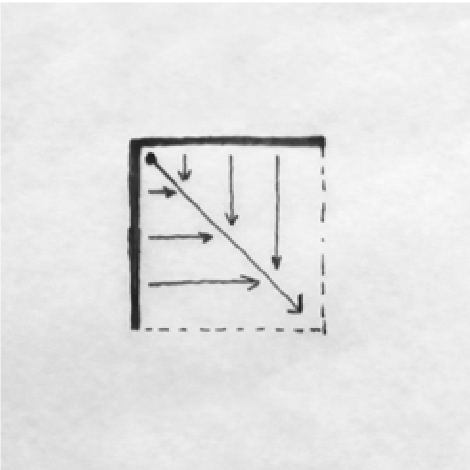
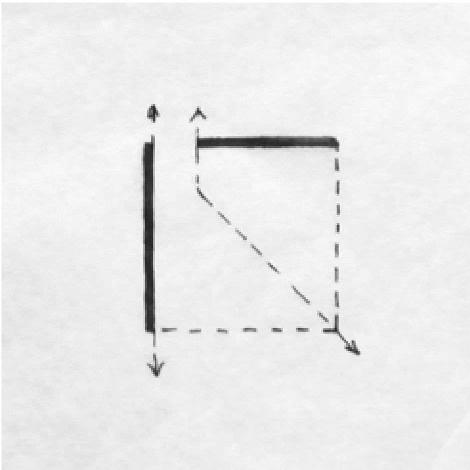
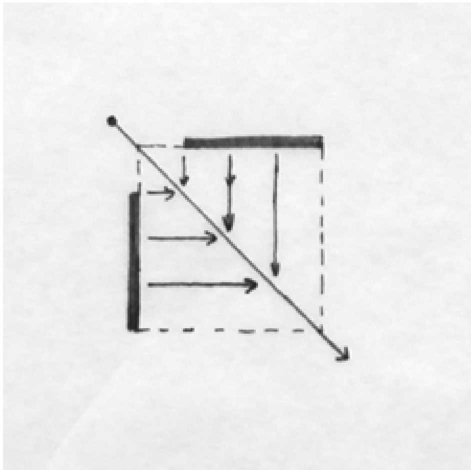
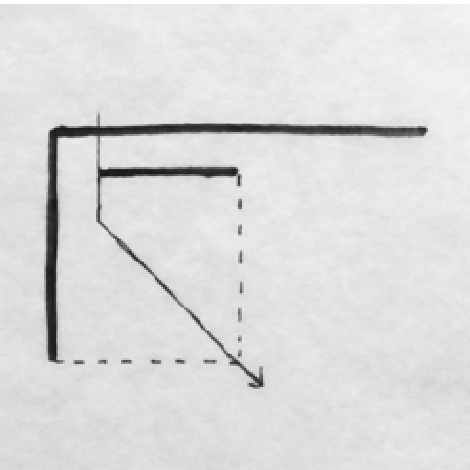
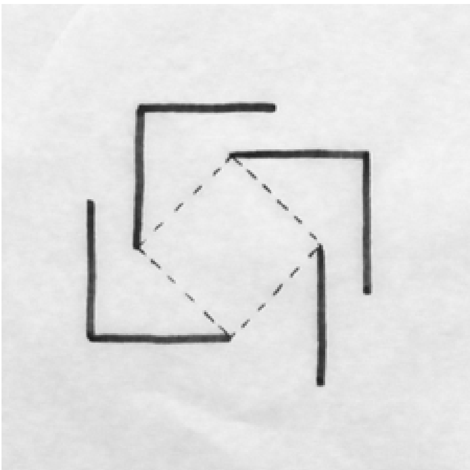
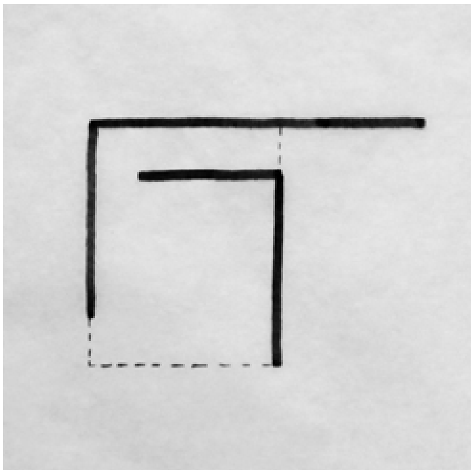
#04 - An entrance that takes you through darkness, not a sense of homeliness, but a comforting transition to safety.

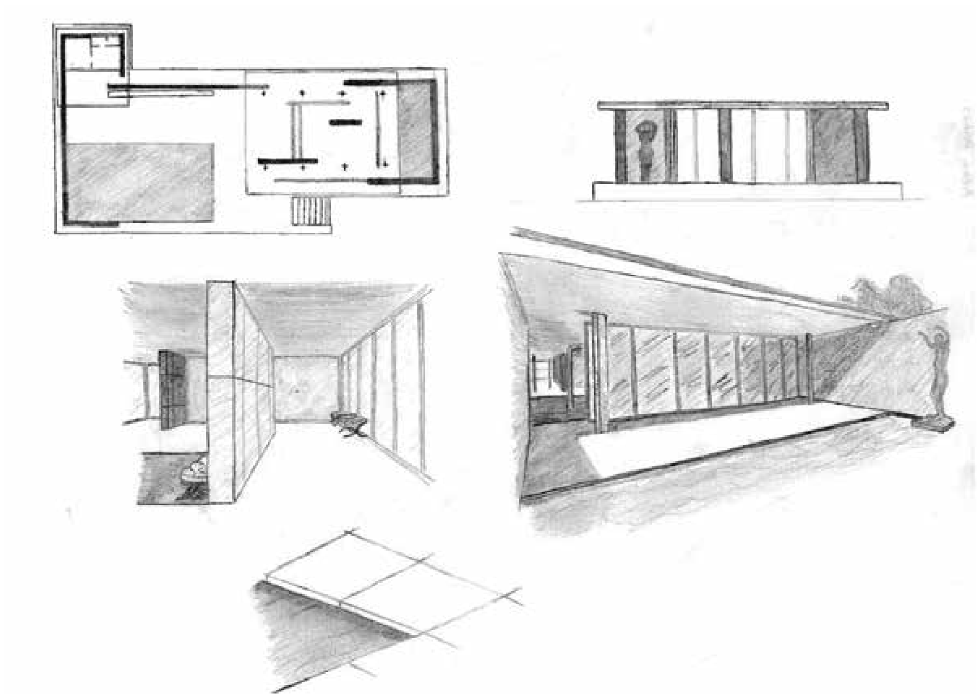
DEFINING SPACE

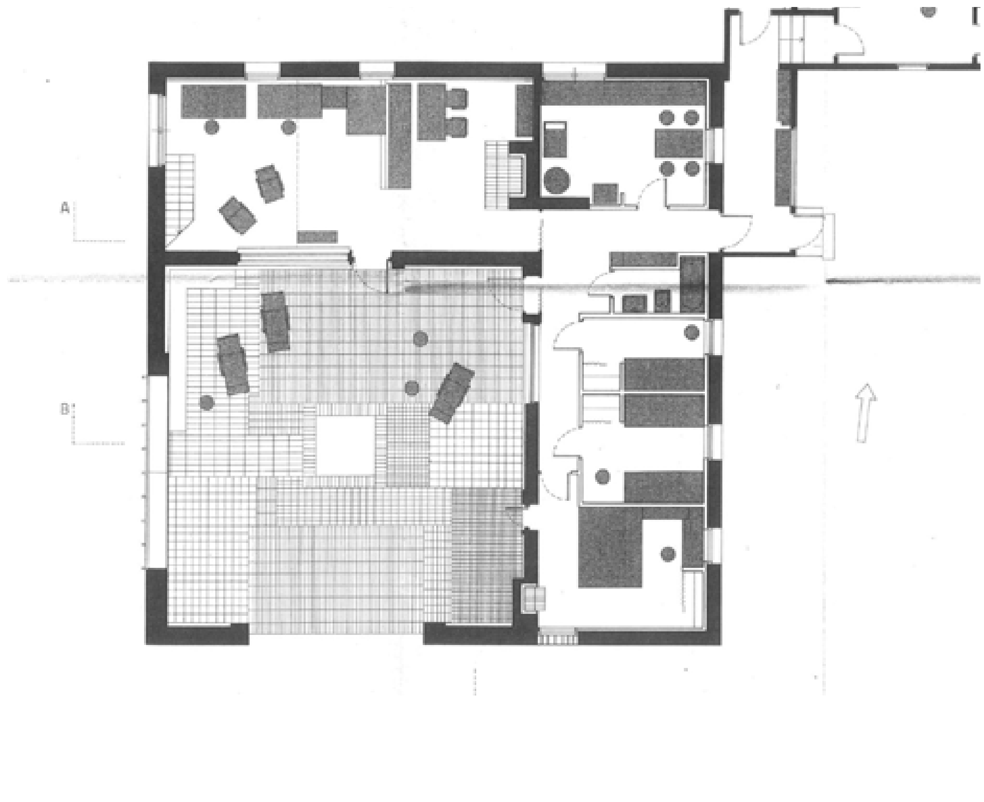
Upon entering the cabin, to enhance the feeling of the cave as enclosure, the presentation of the main room was of importance. The development of a simple system of planes that define the envelope was set out from the L-shape.

In its most simple way, the L-shape creates a natural attention towards the diagonal, while on the opposing edges the focus is on the outside. If this shape is opened, the direct diagonal focus shifts, and the planes appear as separate entities. Opening up on both sides the diagonal focus is reobtained.

The L-shape has endless possibilities in terms of spatial configuration, and is chosen as the main tool for defining the envelope of the cabin.





While doing this exercise, inspiration from architects like Mies van der Rohe and Alvar Aalto came to mind, as they have significant work with such plan compositions.

The barcelona pavilion envelopes the building with the use of L-shapes while basic planes inside define spaces.
On the other hand, Alvar Aalto uses the L-shape, in the experiemental house as building shape to provide a sheltered exterior courtyard.

The study of these designs and more from same architects was used as a continuous inspiration reference while sketching the plan ideation in order to enhance the *utilitas* of architectural quality.

PLAN IDEATION

Through the abstraction of the L-shape and its possibilities, the plan ideation started. The goal of this phase was to identify how the functionalities could be combined within the envelope.

The sketches presented here work with the main room as a center point. All iterations have emphasis on the presentation of the main room from the entry door and the view outwards from here. There is no specific bedroom, as this is combined with the central space.

By working with one single opening on the diagonal of the entrance, the main room focuses, and extends itself out into the surroundings - the main room has two specific views, in each of the directions. one out to the nature on the western side, with the intention of framing the eight seasons, and the other to the northern hemisphere framing the aurora.

The outcome of this phase was a preliminary plan solution (figure 4.6), with the main room in center, a doublebed to one side and a fireplace and small tea kitchen to the other, while the entrance, bathroom, sauna and washing room are surrounding it in an L-shape.

This will be detailed further in regards to informing the design based on proportions, materialty, daylight and structure.

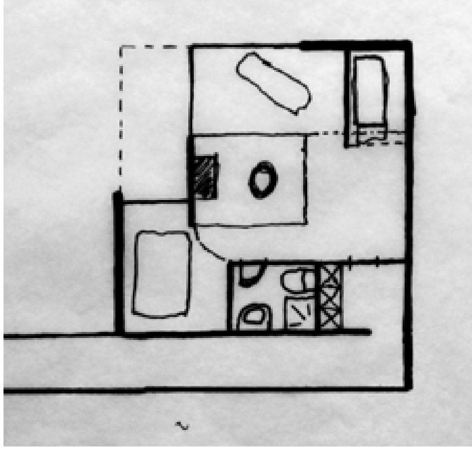


FIGURE 4.1

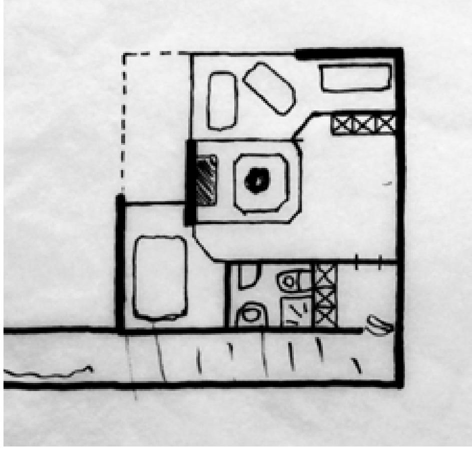


FIGURE 4.2

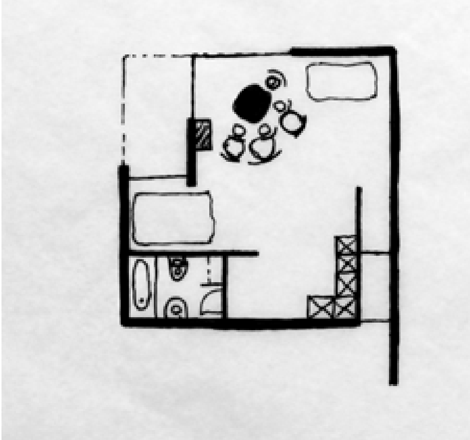


FIGURE 4.3

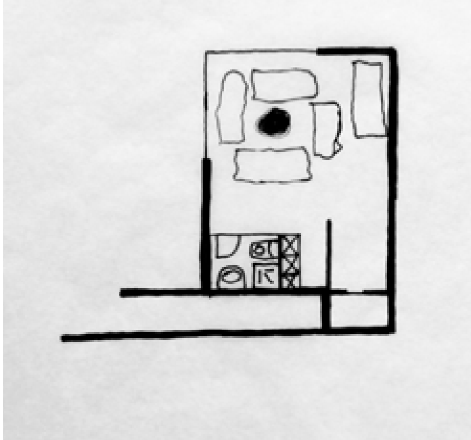


FIGURE 4.4

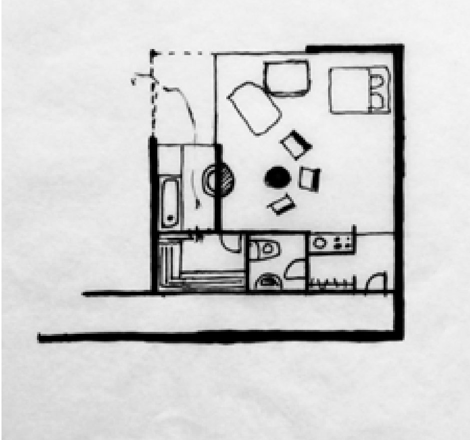


FIGURE 4.5

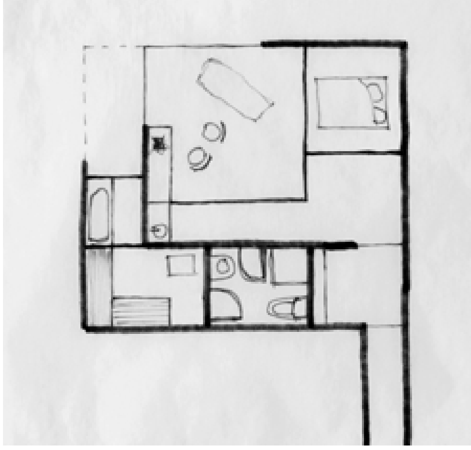


FIGURE 4.6

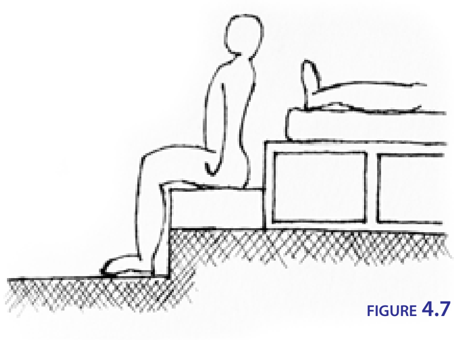


FIGURE 4.7

Articulating space

As mentioned previous, the main room is a combination of multiple functions. A double bed is placed in one corner, while on the opposite corner a little tea kitchen provides the basic necessities for water and food preparation. In between these the square space is meant as the living area, and in continuation of the tea kitchen, the open fire is extended into this space. To better distinguish these spaces as separate entities of the whole, instead of splitting them up with wall sections the use of level offsets elevates the areas and thus articulates them as separate zones, while still maintaining spatial and visual continuity.

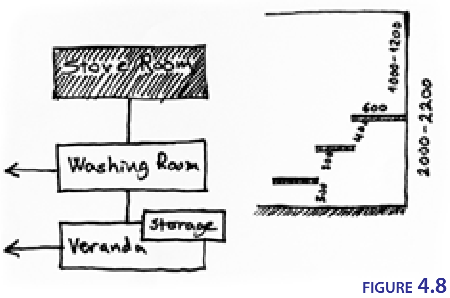


FIGURE 4.8

Finnish Sauna

As the cabins are to have private saunas, the finnish sauna tradition was studied, to provide the correct setting. This tradition is repetitious, in one sauna treatment, the user warms up the body in the stove room, and cools it down again in the washing room. This process is carried out a several times, each time the warming is intensified and in the end the user might have to cool down in the outdoors. The basic composition of these rooms are shown in figure 4.8 and have been addressed during the development of the plan.

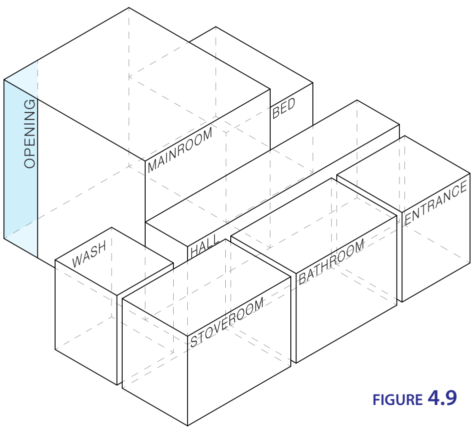


FIGURE 4.9

Room Heights

With a basic idea of the floorplan and room composition, the next step was to inform the design with volume studies in order to determine room heights.

A room height can significantly alter the experience of the room - narrow spaces with a low ceiling can feel claustrophobic, while small square spaces with a low ceiling can feel intimate. There is a fundamental dependency between width, depth and height of space in terms of perception. For the determination of room heights, it was necessary to combine functionality of space with the overall intention of its experience.

The bed area should be intimate, while the main room should have a large volume to express openness and enhance the connection between indoor and outdoor.

Through a series of CAD models, several approaches to the room height were tested out, and attention turned to the known methods of proportioning in architecture. Through the Italian Renaissance, Andrea Palladio proposed several ideal plan shapes and along with it, methods to calculate height; *the arithmetic, the geometric* and *the harmonic.*

Although these proportioning methods are used very little in the modern era, they do have qualities as they form part of the mathematics of the human body, thus an architecture that puts the human body in center and relates to it, unlike the standardized room heights of modern architecture.

Another system that was tested out was that of Le Corbusier, the Modulor system, which is much more centered on the human body while still addressing mathematics of the golden section and Fibonacci series.. The Modulor system was applied in the level offsets of the main room.

The harmonic means of proportioning, which are derived from the arithmetic and geometric, were chosen as a guide for room heights, as they addressed the experience criteria best – figure 4.9 shows the volumes in correlation to each other.

With inspiration from the sketch on page 43, the wish was to create the roof on the cabin as part of the terrain. the next phase was to find a structure that can support this, and enhance the cave concept.

STRUCTURE

Based on the cave reference, the room heights and the desire to give the main room an openness and strong connection to the outdoors, the structural concept of the roof has to enhance the diagonal focus through the cabin. It is also desired to use the roof structure as a unifying element, between the different rooms, articulating its tectonic qualities throughout the whole cabin.

With the climate condition studies, it was clarified that there is a lot of snow falling during a year, while the concept of the cabin is to build it into the terrain and cover it up with a green roof, the combined loads of these are expected to be huge – the roof structure will have to be very stable and sturdy.

During this phase the goal was to investigate different structural solutions for their capabilities and qualities in terms of architectural expression and tectonic influence.

The leaf structure (figure 4.10) consists of three primary beams one through each axis and a diagonal beam. Between these the secondary beams run parallel along each axis. The bending moments are directed linearly through each axis towards the primary beams. The focal direction is mainly along the diagonal beam. The structure needs support on each end of the diagonal beam to provide rigidity. The sense of forces flowing through the structure is apparent and in terms of tectonic qualities, the beams articulate this in a clear manner.

The one-way frame (figure 4.11) consists of parallel beams spanning along one axis, and resting on two primary beams in the opposite axis. The bending moments are directed linearly through both primary and secondary beams. The parallel beams are determining the direction of focus linearly along their axis, and in terms of tectonic quality the structure appears calm and easily readable.

The two-way frame (figure 4.12) is an evolution of the one-way frame. The frame consists of a lattice of beams resting on supports along the edge. Bending moments in this structure are distributed in two directions making it very rigid. The visual effect is consistent through all the spaces defined beneath and the structure can appear, depending on subdivisions and element dimensions, open and light.

The reciprocal frame (figure 4.13) was also considered as an alternative. The reciprocal frame has the quality of rigidity and the inherent interlocking, while working with short elements. The overall surface such a structure creates is dependent of the joints between the elements as they define the overall curvature.

While studying these solutions, the idea of the hyperbolic paraboloid surface appeared as it is fundamentally a two-way frame creating an organic surface.

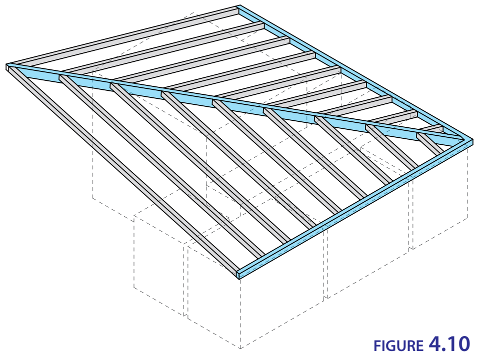


FIGURE 4.10

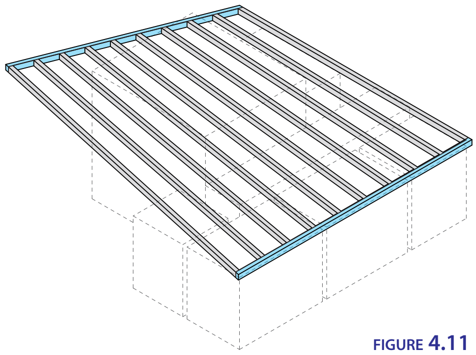


FIGURE 4.11

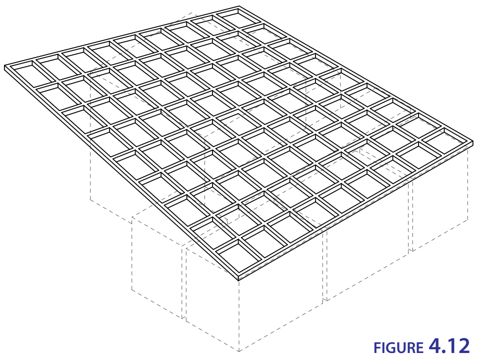
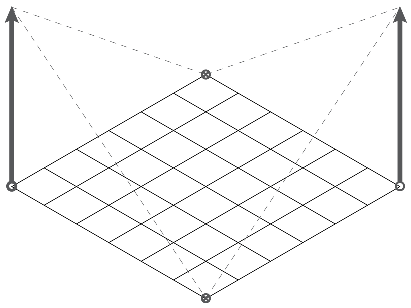
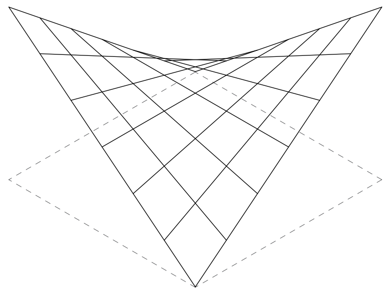


FIGURE 4.12

FIGURE 4.13





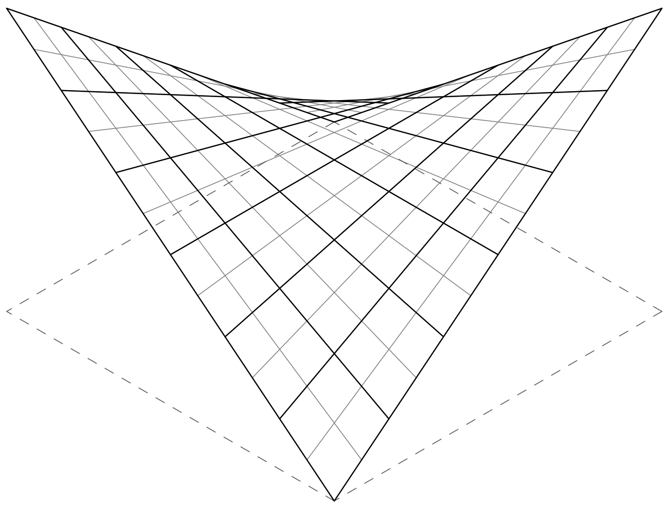
Hyperbolic Paraboloid

In mathematic terms it can be described as a double ruled saddle surface. The endpoints of such a surface determine its curvature and if split into quadrants all elements are linear – this is very suitable when working with wood. In one diagonal the surface usually has an upward curvature, while on the other diagonal a downward – the linear elements create a double curved surface.

When the endpoints are configured properly, a roof surface like this would have the potential to open up towards the outdoors while also addressing the room heights.

It is chosen as the basis for the roof, which in the detailing chapter will be dimensioned and addressed further.

Below is an example of a roof structure with the hyperbolic paraboloid as principle - the roof is constructed of multiple surfaces connected.



SITEPLAN IDEATION

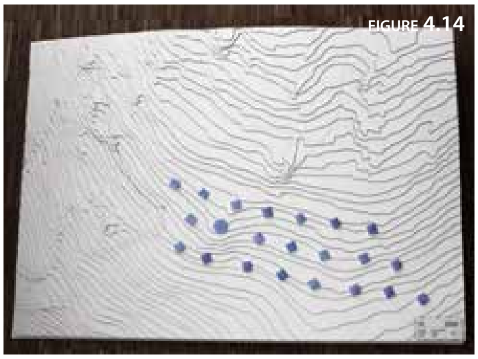


FIGURE 4.14

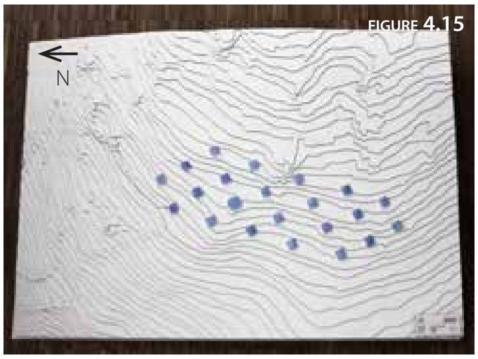


FIGURE 4.15


FIGURE 4.16

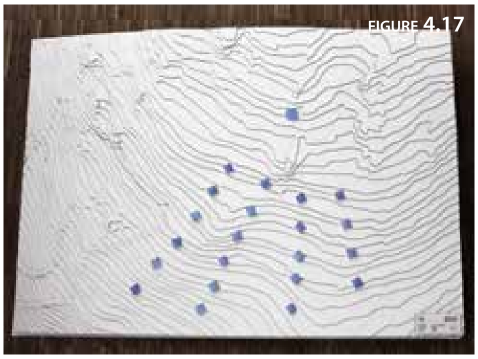


FIGURE 4.17

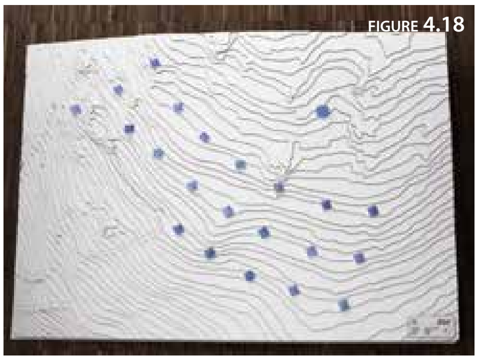


FIGURE 4.18

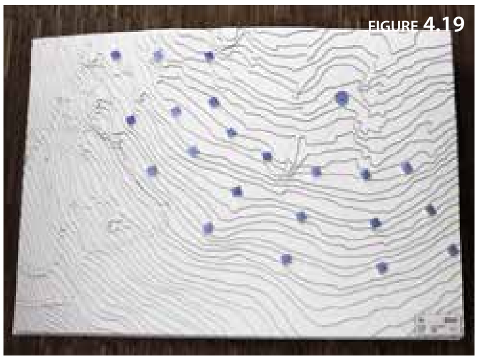


FIGURE 4.19

While sketching the cabins, considerations on their placement was influential for the successful integration of them in the terrain. A scaled site model was developed to get a better sense of the height differences on site and how they might affect the site plan. During this phase the goal was to create an organized hierarchal order that makes sense in terms of arrival, flow and privacy.

In a forest where nature growth has its own chaotic character, it was interesting to work within a confined grid and bring a sense of order in the overall plan as a contrast to natural growth. This was done by working with three types of grids (figure 4.14 - 4.19); the rectangular, the radial and the oval.

The inspiration for this comes from Bernard Tschumi's Parc de la Villette (figure 4.21). This park in Paris has multiple layers of paths, objects and terrain textures that combined have an incredible seemingly uncontrolled diversity.
By placing a layer of red pavilions in a rectangular grid, with straight paths in between these, Bernard manages to create a clarity and hierarchy in the complex site plan, resulting in a calm and ordered organization that has a guiding effect on the large site.

In terms of flow, the main idea is to have the main building, or observatory, centrally placed as


FIGURE 4.20

this is the point of arrival and here you check in before proceeding to the cabins. Given the nature of the context, accessibility for disabled is next to impossible to accommodate, as it requires large alterations in the terrain which would impact the character of the site drastically and was during development deemed as a lower priority. The paths (figure 3.x) created in the project are to have to the same character as the sites existing paths; narrow graveled, made naturally by the stomping of people walking through.

In terms of placement of the cabins, the important parameter was distances between. The cabins are meant as places of solitude and privacy is an essential key. As seen on the different site plan iterations, distances in between the cabins were investigated with a pragmatic approach, comparing the distances with photos taken on site during the study trip to get a clearer sense of what is appropriate, as the scaled site model is difficult to relate to given the large scale of the site.

The cabin orientation was also a factor during this phase, as they only have one large opening, the views from this had to enable the visibility of the beautiful nature (figure 4.20) down the Ounasvarra hill towards the riverfront and the northern hemisphere so every cabin becomes an observatory of the northern lights.

The final site plan solution (figure 4.22) is based on a centrally placed observatory and the oval grid was chosen as it follows the contours of the site best. Three oval curves radiate from the centre point and on the first, the distances between the cabins are approximately 50 meters, providing a large space around the cabin to accommodate the privacy needs. The paths (figure 4.23) leading to the cabins also radiate from the center and, with inspiration from Parc de la Villette, have a clear and straight direction through the forest.


FIGURE 4.21

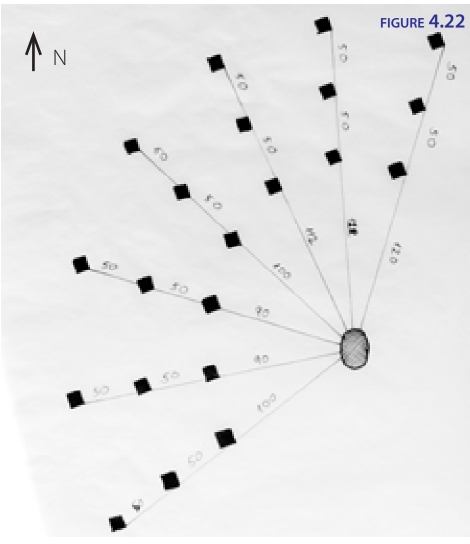


FIGURE 4.22

FIGURE 4.23

LEFT Collage of sketches made during the design process of the observatory

OBSERVATORY

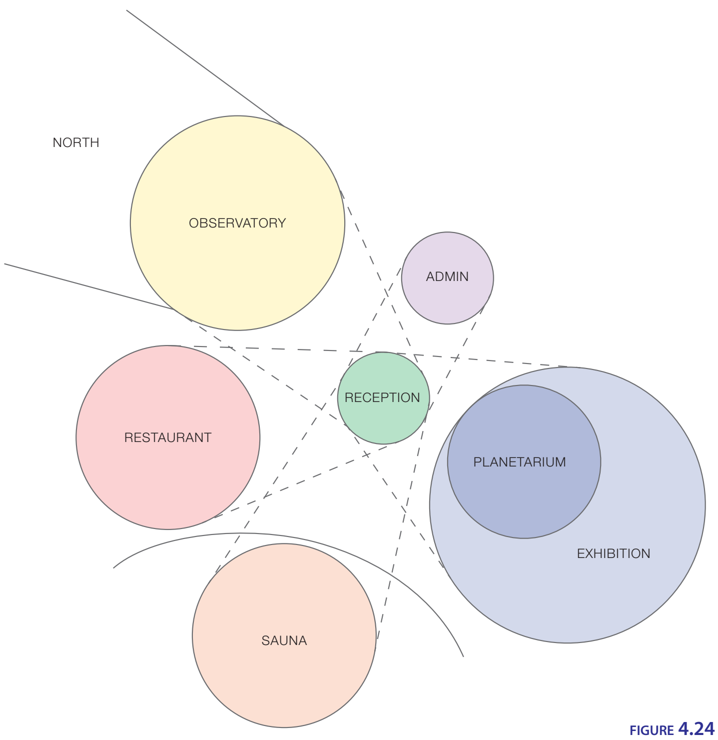


FIGURE 4.24

Sketching of the main building, the observatory, was initiated when the site plan was developed. The central placement of this building in the ellipse grid was an initial inspiration to the overall form, and the first sketches where focused on working with the envelope as an ellipse.
In relation to the cabins, this building is of slightly larger scale, and the concept of integrating it in the terrain did not make sense, however it was necessary to develop this building in the same manner with regards to the spirit of the place.

During the sketching phase, three specific proposals were developed, each with a distinct character, which was derived from the internal organization of functions.

Organization

The building consists of several functions, some of which have very little in common. It was therefore necessary to specify clearly how these would be organized and relate to each other inside the building (figure 4.24).

All of the functions would need a close proximity to the entrance / reception area as this is the starting point of distribution, furthermore the entrance should lead clearly through to the paths for the cabins.
From the room program description, the planetarium and exhibition are closely related, as the exhibition should intrigue and invite the visitor inside the planetarium.
The sauna, although being public, is not a function that fits well in with the other and would have to be visually separated from the rest.
During the programme an investigation in conditions for observing the aurora was made, where light pollution from the city center was considered a challenge. The direction of the observatory is reserved on the northern hemisphere, as the best chances for a light show is in that direction over the horizon, all the more focusing it to north would negate the view over the city center and the light polluted sky.

Properties of spaces

For the design of the observatory, some demands are set up in the room program, these will be explained here.

The planetarium is in the competition demands specific, as it has to be circular and have a diameter of 8 meters. Furthermore the ceiling has to be a dome structure in order to project on 360 degrees. To accommodate this the planetarium will be built as a circular wall with an entry door, and upon it, a geodesic dome as shown in figure 4.25.

The restaurant should appear transparent as visibility to the nature outside is a quality of its setting. The seating should accommodate 2-6 persons, and ideally provide an intimate atmosphere around the tables.

The exhibition space requires wall area. Windows on the walls are not required as the flexibility to rearrange exhibitions is diminished. In regards to light, the space will mainly need controlled artificial light, and if possible natural light.

The Sauna should be gender separated, hence the same setting (figure 4.26) will apply to both. The progression between dressing room, stove room, washing room and outdoor space needs to be fluent.

The observatory deck is intended as an outdoor area where visitors can sit and observe. The view is of high importance, as it not only has to have a clear focus on the sky above but also frame the surrounding scenery.

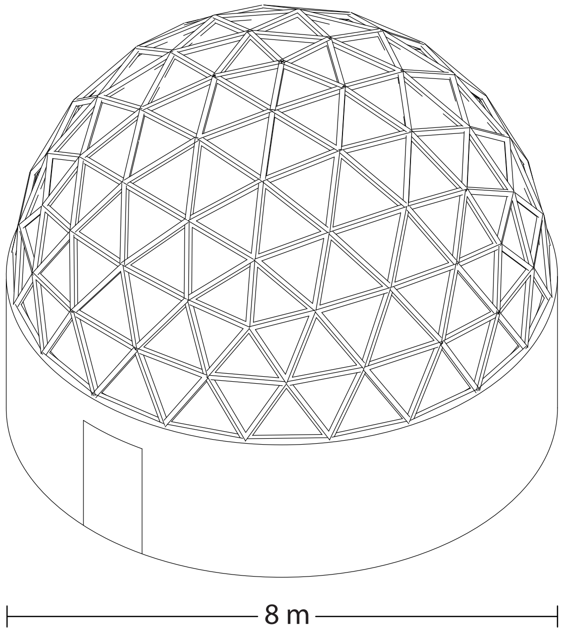


FIGURE 4.25

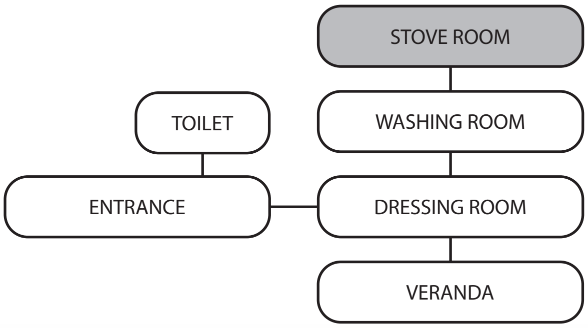


FIGURE 4.26

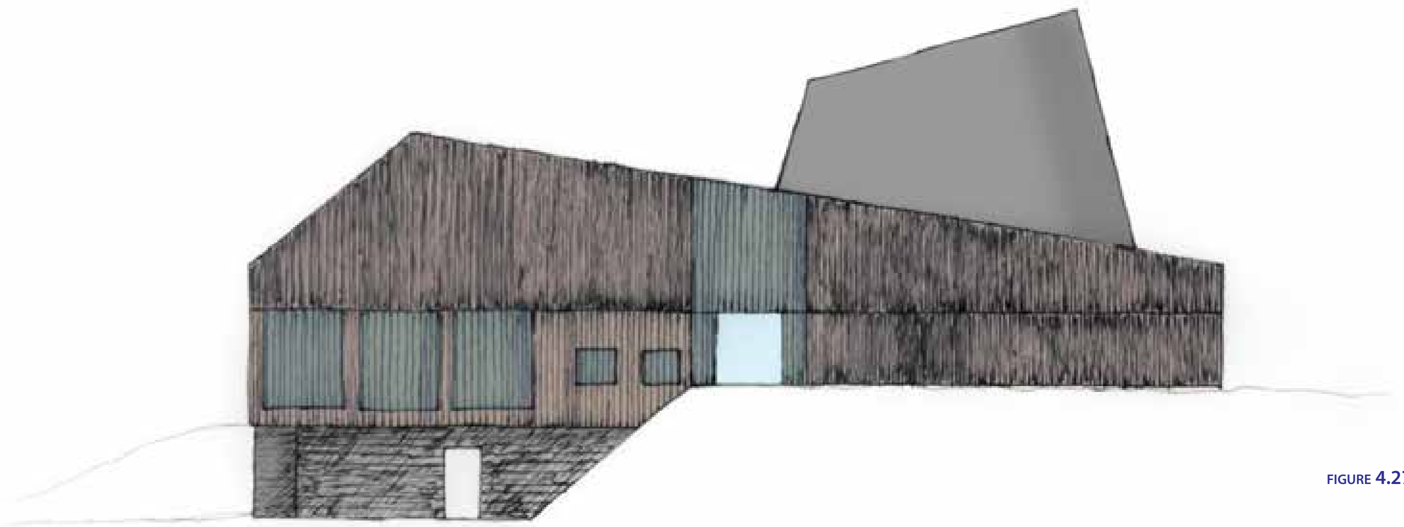


FIGURE 4.27

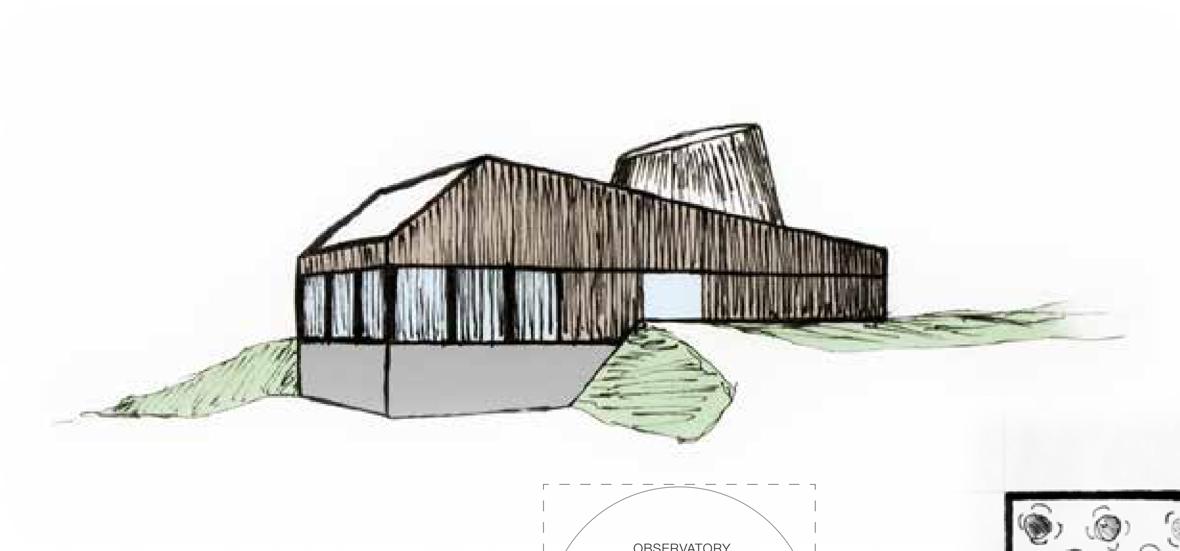


FIGURE 4.28

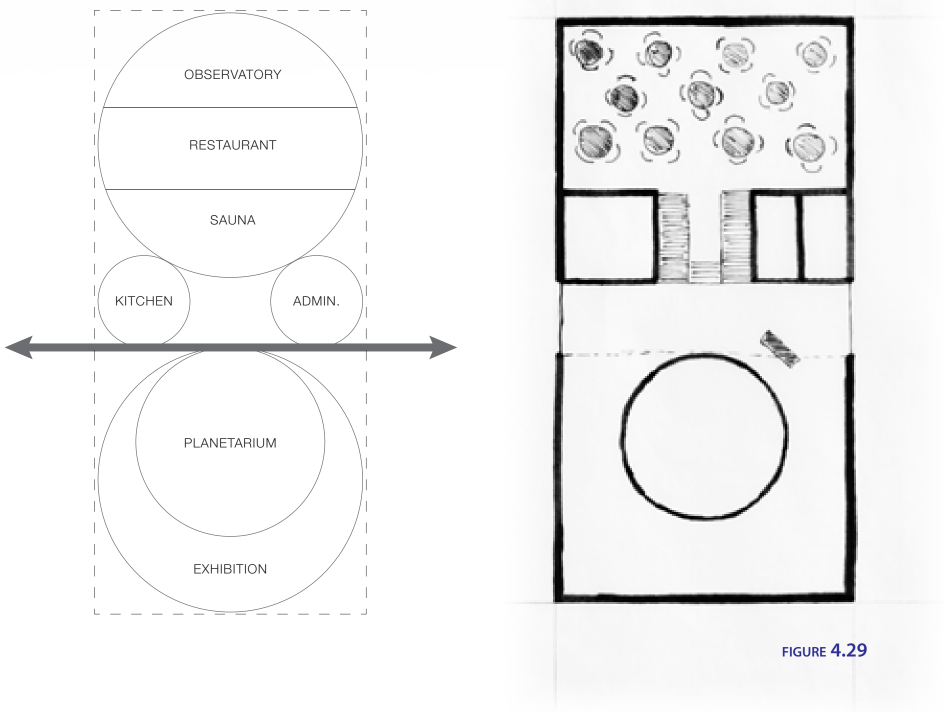


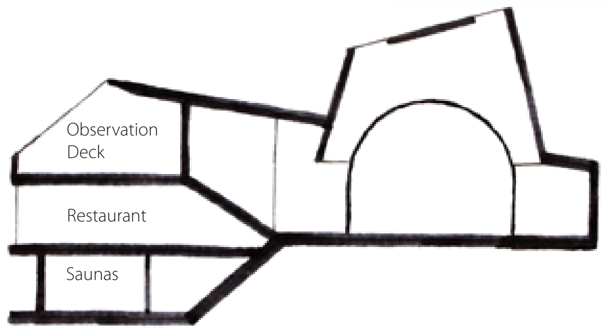
FIGURE 4.29

Composition

During sketching, different approaches to the layout of functions were investigated, with the outcome of mainly three shapes; the ellipse, the tower, the rectangule, as seen on the collage of sketches pg. 54.

The chosen method of organization was to seperate the functions in two sections with the entrance and reception cutting through for easy accessability. The planetarium and exhibition in one section and the observatory, restaurant and sauna in the other, split in three levels.

As the building serves different purposes, it was necessary to show this, through the composition. The development of the section lead to two elements contrasting each other, also seen on the elevation figure 4.27.
The long rectangular shape, rising towards north, with a truncated cone resting upon the circular planetarium, suggesting that this building is more than a hotel reception and restaurant.
The cone was added to the composition to provide daylight during day but also reflect the aurora as an effect for the exhibition space.



Structure

The construction of the observatory is based on a column beam principle, with the outer walls as loadbearing planes (figure 4.30). This will not be detailed or dimensioned further.

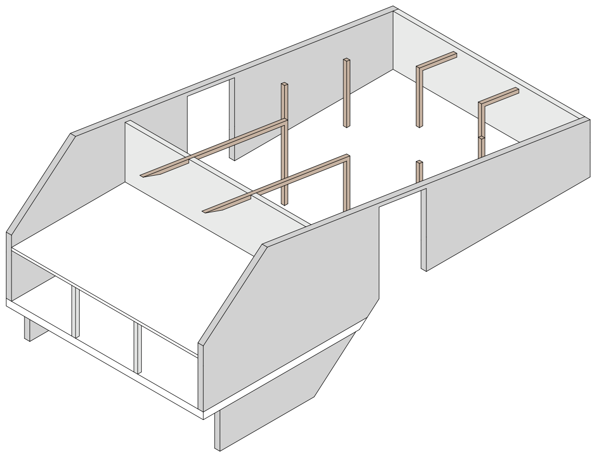
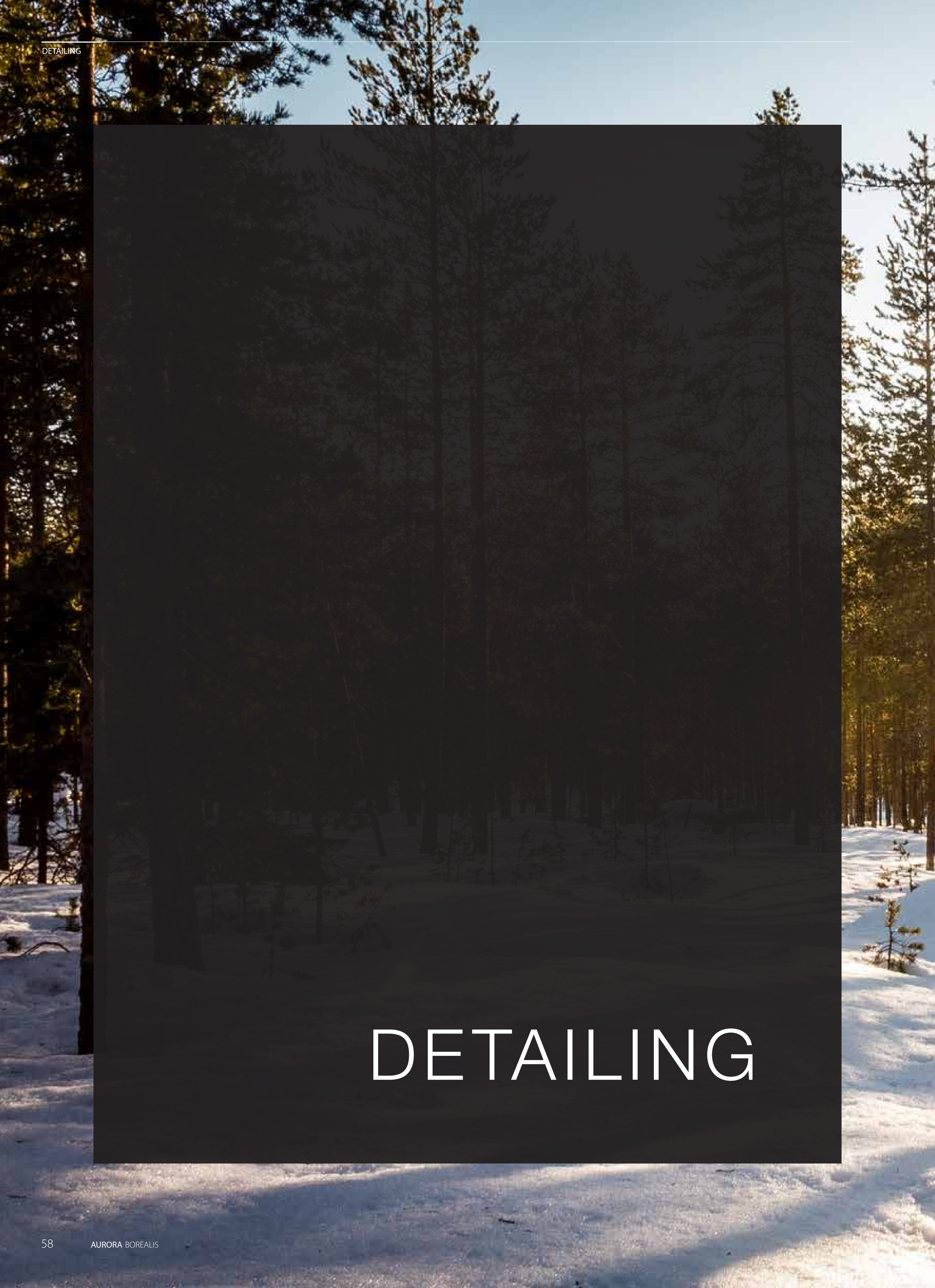


FIGURE 4.30



DETAILING

DAYLIGHT

This chapter deals with the design of the openings in the cabin, and a confirmation of the daylight situation in the main building. The analysis is performed with VELUX Daylight Visualizer and the approach is described below.

As this project is carried out in a high latitude, and as presented in climate conditions, daylight is limited, and pretty much non-existent during winter times. Although being a very necessary part of both physical and psychological comfort, this project has sought inspiration in writings of Juhani Pallasmaa, in regards to the experience of architecture.

He argues that western tradition in modern architecture has an immense ocularcentric preference. While the renaissance system dealt with the cosmic body, correlating vision to fire and light, hearing correlating to air, smell to vapor, taste to water, and touch to earth, the perspectival representation has made vision, the center point of the perceptual world. Sight and hearing overrules the three other senses:

Vision and hearing are now the privileged sociable senses, whereas the other three are considered as archaic sensory remnants with a merely private function, and they are usually suppressed by the code of culture.

[Pallasmaa, 2012-1]

The experience of architecture is multi-sensory, he explains: "architecture involves several realms of sensory experience which interact and fuse each other."

With this in mind, the design of the openings have not been performed with the intention to bring as much daylight in as possible, but to create a balance between where the sense of sight is necessary and where it can be reduced to enhance the other senses, such as touch or smell.

Following the Integrated Design Process methodology, the analysis is iterative and several calculations have been performed in an evolutionary manner until the desired outcome appeared.

To produce realistic results, it was important that the surroundings around the cabin were represented – the model is surrounded by tall trees with distances as close as 3,5 meters from cabin to tree trunk as seen on figure 4.x

Following is four of the eight iterations that explain the process of designing the openings in the cabin and lastly one analysis of the observatory. The four iterations are dealing with the main room, while the others dealt with openings inside the cabin, testing for possibility of daylight in both entrance and bathroom.

Usually daylight calculations are performed as worst case scenarios, which in this context would be winter equinox, but since there is no daylight at that time the analysis is performed during spring equinox.

From a quantitative perspective the daylight levels in all iterations are reasonable, however from a phenomenological perspective the space will have to be visualized to form an opinion. Iteration 4 is chosen as the best in terms of different daylight situations for the different zones.

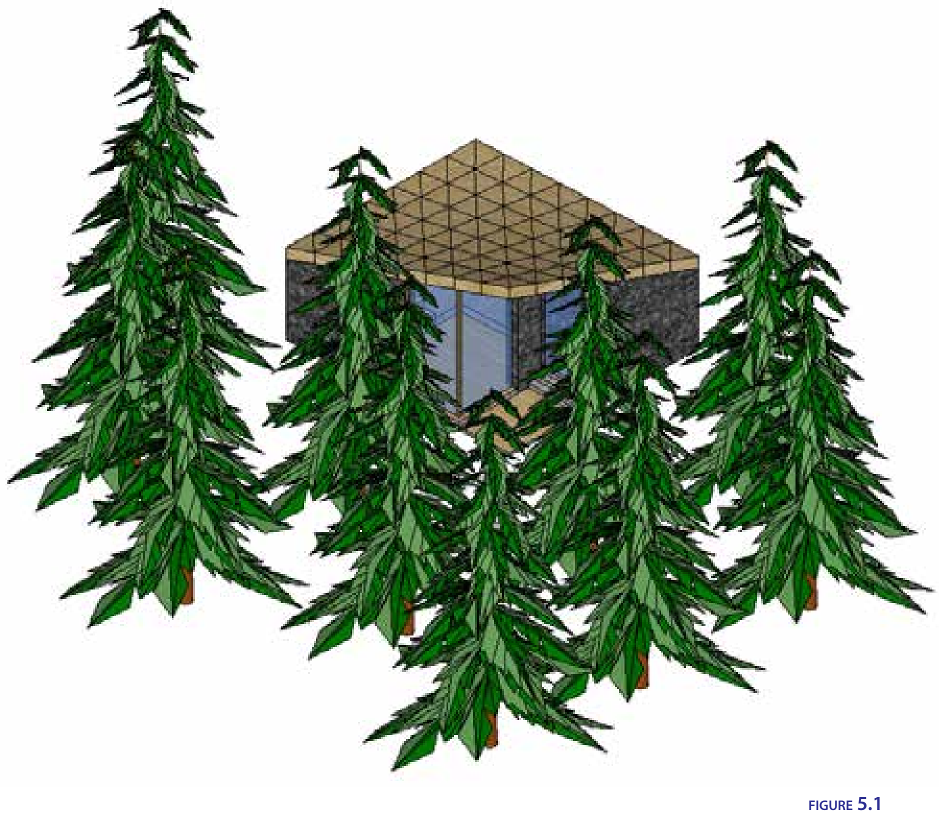


FIGURE 5.1

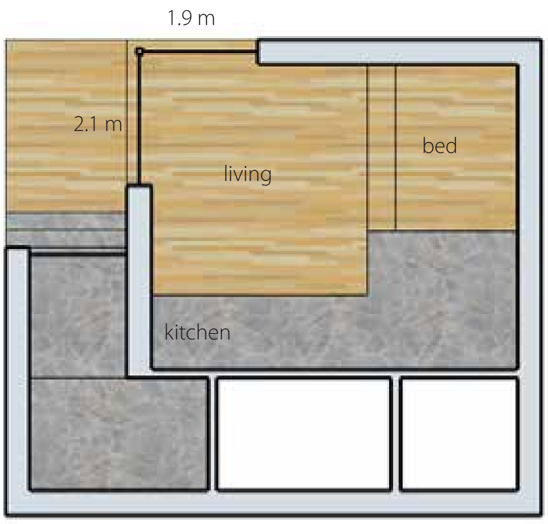
Iteration #1

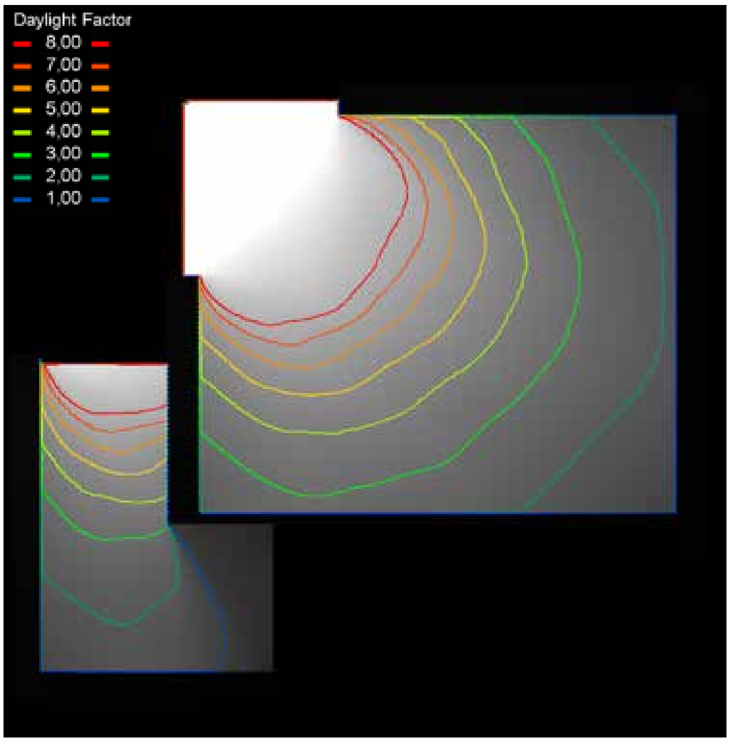
The first iteration seeks test out the initial dimensions the main opening. The two panes have the lengths of 1.9 meters and 2.1 meters and run from floor to ceiling. The result shows a fairly equal fall in daylight throughout the room.

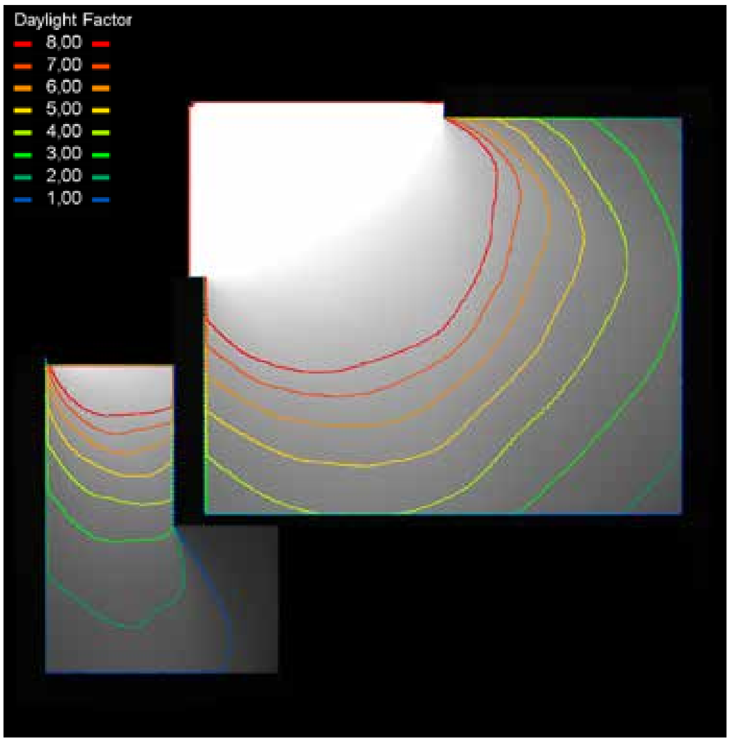
Although the living room is well lit, another iteration is performed for comparison.

Iteration #2

To provide a larger frame for views, the next iteration tries to open the northern side up making that pane 3.1 meters, and still running from floor to ceiling. The result is significantly different, as daylight penetrates further inside the main room. The whole living area is now lit fully, which is desirable, as this zone mainly focuses its attention to the outdoors the larger opening weakens the boundary between in- and outside.







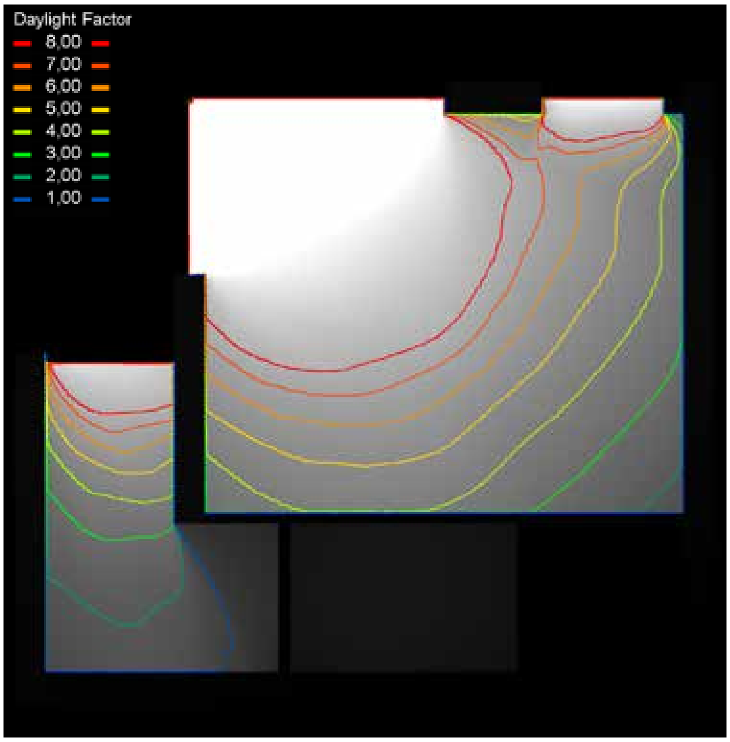
Iteration #3

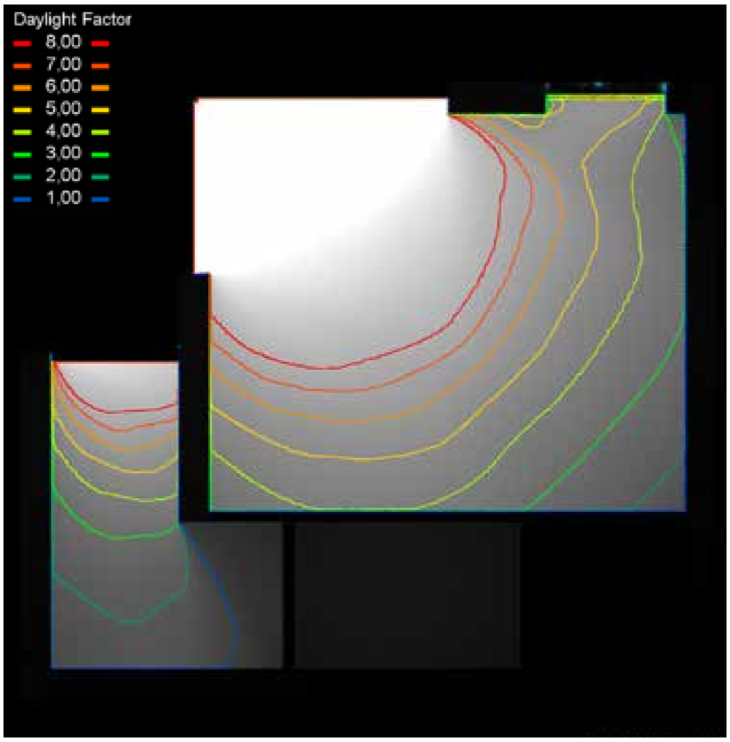
With an idea of bringing more daylight into the bedroom area, for a pleasant waking, the third iteration is implementing a window beside the bed, 1.5 meters wide and 0.8 meters tall.

The result is a lot more daylight in this area, which is not desired, as this zone is considered intimate, and the sight is not necessarily the most important here.

Iteration #4

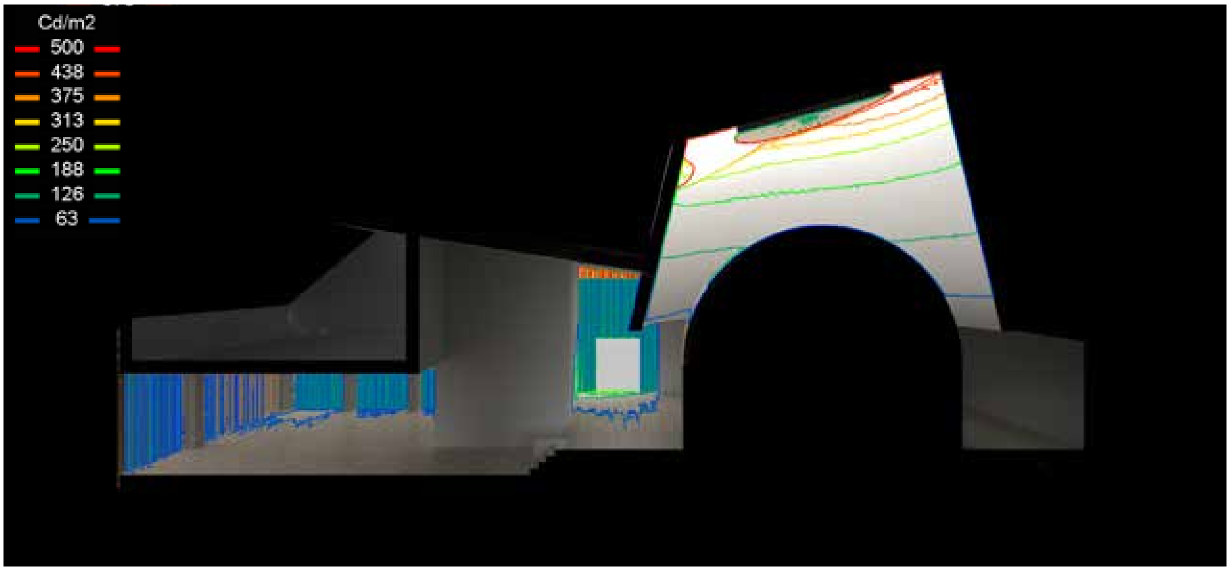
In order to reduce the effect of iteration 3, this iteration has a shading on the bedroom window. The shading is horizontal and has openings of 8 centimeters. The result is as expected a lowering of the daylight factor. The living area respects the privilege of the sight sense. The kitchen area, with the lower level of daylight can enhance the sense of smell and taste while the bedroom can enhance touch and hearing.

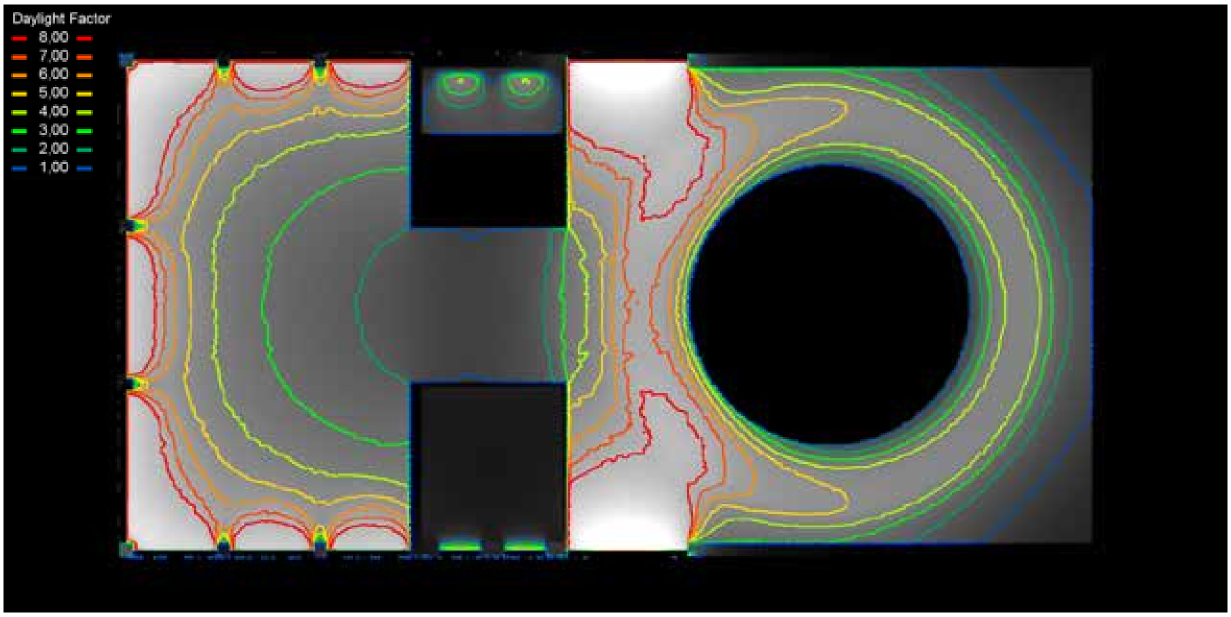


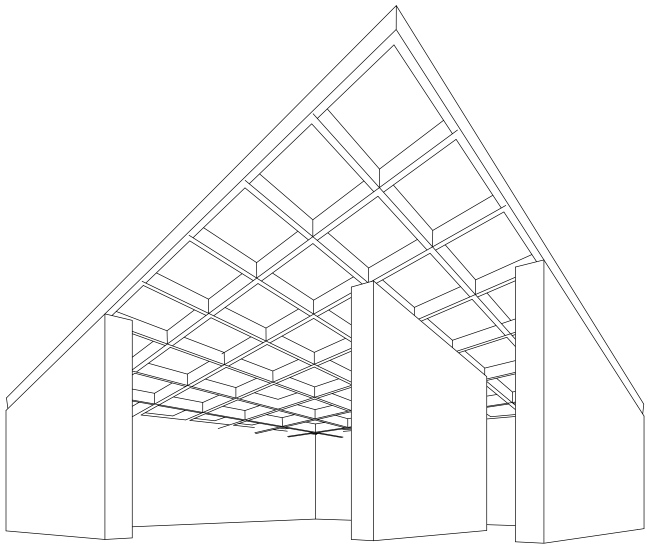


Observatory

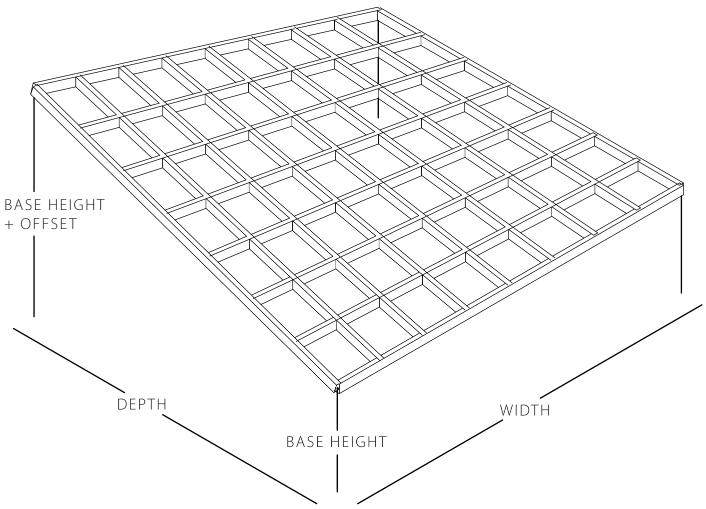
In this analysis it was important to verify that the restaurant, hall and exhibition space recieved evenly distributed daylight. The truncated cone skylight enhances daylight conditions all around its immediate area.







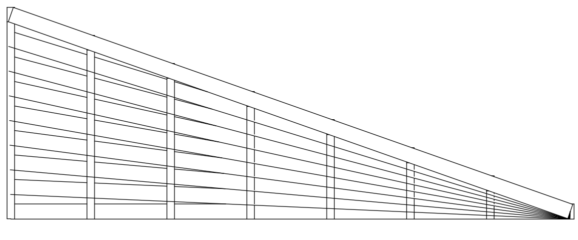
STRUCTURE



In the sketching chapter, the structural principle of the cabin roof was explained in terms of capabilities, while this section will focus on the detailing and dimensioning.

Through the use of parametric tools along with computational finite element analysis, the tectonic goal of the project is to dimension and optimize the hyperbolic paraboloid roof structure. The structure will have one endpoint raised as seen on the illustrations, while the base height is set to 2.4 meters the offset is 2.5 meters, thus the outer height of the cabin becomes 4.9 meters.

Initially the structure was created in the parametric environment of the grasshopper plugin for Rhinoceros and parameters such as width and depth of the structure, height of each end-point to control the curvature and amount of beams in each direction were set up to perform simple studies on how the structure reacts to loads. The prerequisite for a realistic analysis is dependent on obtaining knowledge of the kind of forces working on the structure to properly dimension in accordance.



Calculating Actions

From the climate conditions chapter two natural load types are introduced, the snow load and wind load.

Following the guidelines of Eurocode 1 [DS-EN 1991-1-3, 2007] the equation for determining the characteristic snow load is given as:

$$s = \mu_i \; C_e \; C_t \; s_k$$

Where:

s	snow load on roof [kN/m^2]
μ_i	snow load shape coefficient
C_e	exposure coefficient
C_t	thermal coefficient
s_k	characteristic value of snow load on the ground [kN/m^2]

The Finnish National Annex 4 for *Eurocode 1 [SFS-EN 1991-1-3, 2003]* specifies a characteristic snow load on the ground of **2.75 kN/m²** in the Rovaniemi area.

The form factor is defined by what type of shape the structure resembles. This is considered a monopitch roof with an angle between 0 and 30 degree, the corresponding form factor coefficient from *table 5.2* is **0,8**.

Given the circumstances that the structure is embedded in the terrain, and is surrounded by trees, the exposure coefficient will be considered as 'sheltered' with a value of **1,0** from *table 5.1 [SFS-EN 1991-1-3, 2003]*.

In cases, like this, where the roof does not have a high thermal transmittance the thermal coefficient is considered **1,0**.

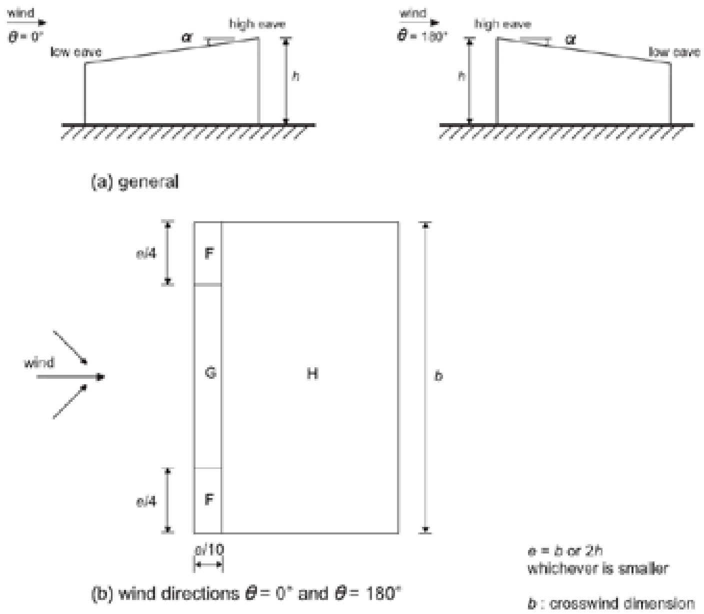
Given the abovementioned values, the characteristic snow load is calculated:

$$s = 0{,}8 * 1{,}0 * 1{,}0 * 2.75 \text{ kN/m}^2 = \mathbf{2.64 \text{ kN/m}^2}$$

The wind load acting on the structure will be considered from two directions, as the north and south winds are most common according to the climatic conditions study. As the calculations of wind actions is extensive it will be covered in Appendix A and only key numbers will be addressed here.

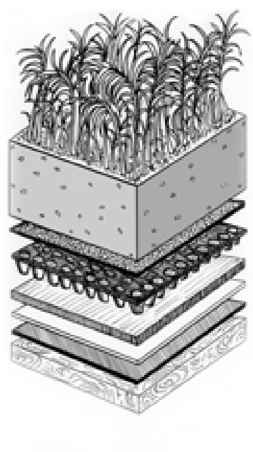
Basis Wind Velocity	24 m/s
Mean Wind Velocity	14.33 m/s
Turbulence Intensity	0.36
Peak Velocity Pressure	0.4525 kN/m²

Wind acts on surfaces, which is why factors need to be applied on the peak velocity pressure for the different situations. As mentioned previously, the roof structure can be considered a monopitch roof, with a cantilevered section. The roof surface is divided in smaller sections according to *[DS-EN 1991-1-4, 2007] figure 7.7* and the zones are calculated both for 0 degrees and 180 degrees according to *table 7.3a*.



Zone F (0 degree)	-1.131 kN/m2	Zone F (180 degree)	-0.407 kN/m2
Zone G (0 degree)	-0.588 kN/m2	Zone G (180 degree)	-0.362 kN/m2
Zone H (0 degree)	-0.407 kN/m2	Zone H (180 degree)	-0.272 kN/m2

Permanent loads



When dealing with the dead load, the computer will factor in the selfweight of the structure as it during development will change. The addition of a green roof is however investigated and depending on the type of green roof the weight is between 80 kg/m^2 to 135 kg/m^2. [SIG]

The chosen type 'Intensive', accomodates moderate sizes of vegetation, but not trees, and the weight of it is **110 kg/m2**.

Load Combinations

The calculated characteristic loads are applicable to analysis when the relevant load combination is found, where permanent and variable loads affect the construction simultaneously. This is done according to Eurocode 0 [DS/EN 1990, 2007] which provides the normative specifications for load combinations.

The structure will be analyzed for failure and excessive deformation of the structural members (STR) in Ultimate Limit State with permanent and temporary design situations, the analysis will not take into account the accidental design situation (equation 6.10b):

$$E_d = \gamma_G G_k + \gamma_{Q1} Q_{k,1} + \gamma_{Q2} \psi_{0,2} Q_{k,2} + ...$$

This takes into account the permanent action (G_k) with its partial coefficient, the dominating variable load (Q_1) and its partial coefficient, and the rest of the variable actions (Q_2) with both partial coefficient and reduction factor.
The partial coefficients are safety factors intended to reduce the risk of failure, while the reduction factor is applied to non-dominating actions as the norm defines that all actions can't act on the structure simultaneously with maximum force.
The snow action is considered the dominating variable, while the permanent action is unfavorable for the structure and the factors are therefore given as follows:

Permanent action, p. coefficient	1,35
Snow action, p. coefficient	1,5
Wind action, reduction & p. coefficient	0,5 * 1,5 = 0,75

Figure 5.2 shows the supports of the structure - as it will only rest on the outer walls a cantilever is created, where deformation is expected to be worst.
Figure 5.3 shows where the permanent and snow actions will be applied. The computer model works with point loads.
Figure 5.4 show a situation where wind loads are working on the structure from south. actions in this situation work unfavorably - this will be the used for dimensioning purposes.
Figure 5.5 shows a situation where wind actions work on the structure from north. The action is applied on the underside and thus works in favor.

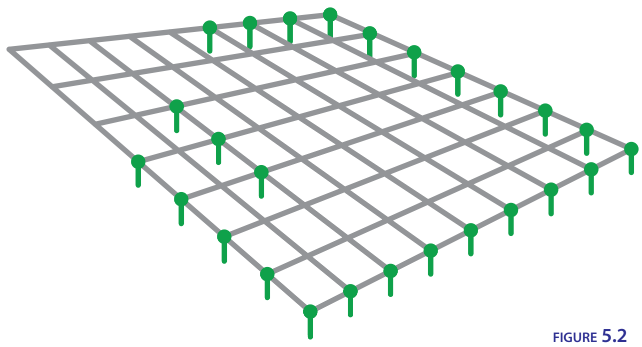


FIGURE 5.2

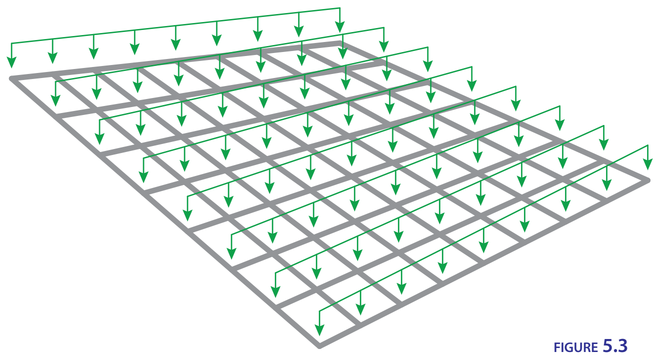


FIGURE 5.3

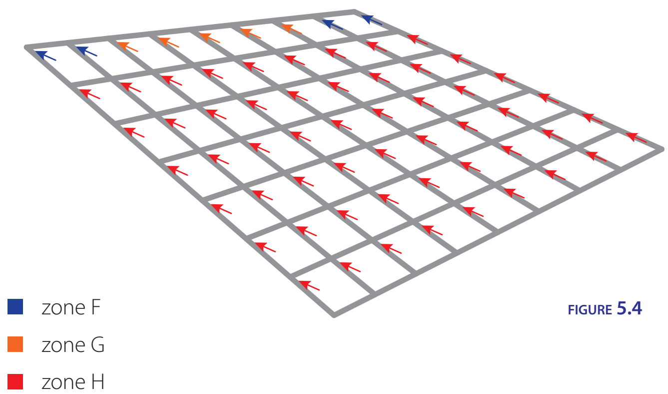


FIGURE 5.4

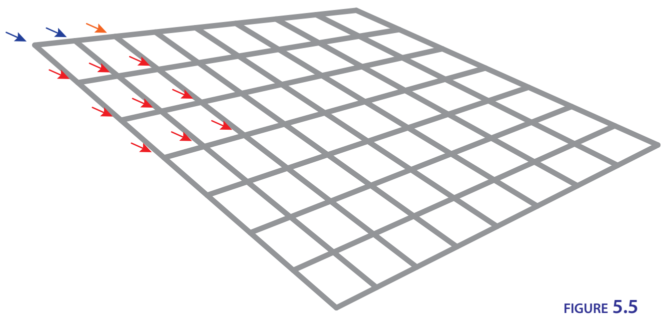


FIGURE 5.5

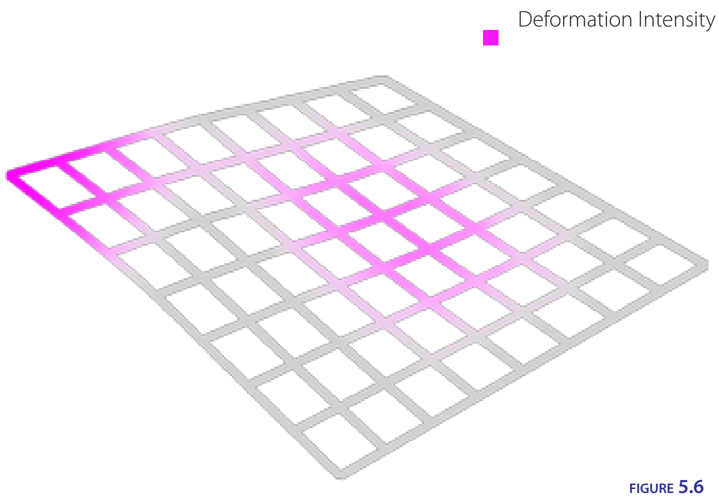


FIGURE 5.6

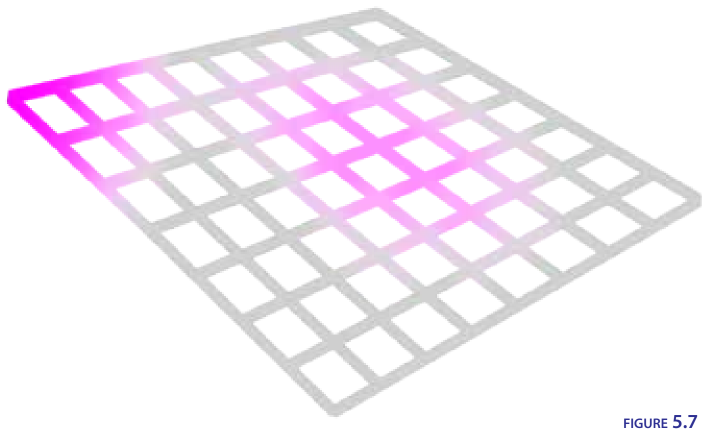


FIGURE 5.7

Actions on structure

With the correct actions applied on the parametric model, some early studies were made to figure out how the structure reacts and understand it better. During this phase of analysis, the main focus was to ensure deformation is satisfactory.

Very early on it was evident that the wooden profiles would have to be fairly large and in order to ensure that it will not be visually over excessive it was chosen to work with glue laminated beams (GL36h), which are engineered to be stronger than plain timber beams.
Karamba3D is used to show where the deformation is largest, and during the first iterations, it was clear that the cantilevered section has the most stress, but it also shows that the central part deforms significantly (figure 5.6).

With this knowledge in mind, the profiles were adjusted to find a satisfactory deformation, in this project given as 1/300th of the longest member.
In the iteration with beam profiles of (height x width) 10 x 10 centimetres, the displacement is 66 mm, while the maximum allowed displacement is calculated to 28 mm. Changing the profiles to 23 x 14 centimetres, the deformation reaches below 28 mm and is considered satisfactory.

Articulating Force Flow

With regards to the tectonic approach, the goal of this project was to investigate how the visual result of the structural concept affects it through expressive qualities.
From the first studies it was clear that the forces affect the structure differently in certain parts, such as the large deformation on the cantilever. This is basically the relation of form to force.
To enhance this expression and visually represent the forces through the beams, thus articulating force flow in a ever so subtly way, giving it a tectonic quality, the idea of creating specific profiles for each member was initiated.

The parametric model was adjusted and the beams were split into 4 subcategories, each with their own cross section (figure 5.8). This enables an optimization of the structure as the profile size directly correlates to the force upon it.
The advantages of this is not only the expressive qualities it provides and the clear readability of its own making, but also an exercise in minimizing material use.

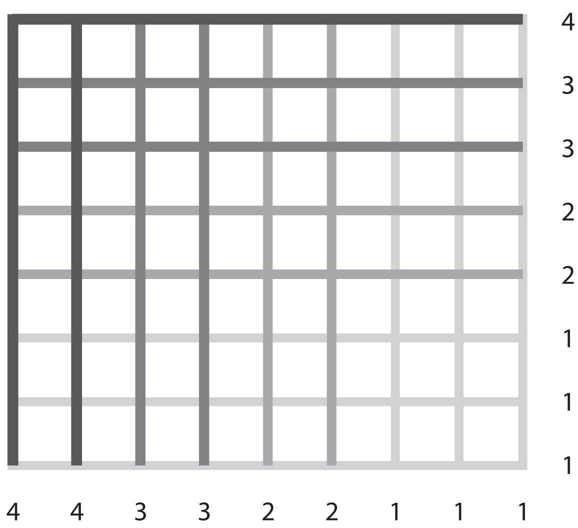


FIGURE 5.8

Given four profiles, each with two parameters to adjust, the model has endless possibilities, and adjusting it manually to find the satisfactory profile sizes is a tedious process. With the use of the built in evolutionary solver in Grasshopper3d, this process can be taken care of by the computer.

The evolutionary solver starts with a huge gene pool – input numbers for the parameters – and cross-references them in relation to the deformation result trying to minimize it and reach a satisfactory deformation. At certain points in this process, the best results will be separated and another pool of genes will be added to further enhance the result, hence the evolutionary process.
This means that the computer has the power to check millions of possible solutions in order to find the best result, and with the inherent computational power, it can be done in the matter of a few minutes.

The result for the four profiles is represented in figure 5.11 and the maximum deformation is in Karamba3d calculated to 15 mm, which is reasonably below the accepted 28 mm, it is however not as accurate as a finite element analysis performed in Robot Structural Analysis, which will also be used to check for failure of the timber members.

Verification

While Karamba3D is a simplified method of getting fast results, Robot Strutural Analysis is used for accurate results. The model is imported, and the load combination is set up according to 'Load Combinations' chapter. As this application has its own preset materials that are more accurate, the material properties of GL36h is applied.
The deformation result is 18 mm, which is slightly higher, mainly because of the change in material properties.

The structure is also tested for failure of members in Robot, here the service class, load classes and partial factor for material properties were set. All members were approved, and the list can be seen in Appendix B.

genes cross references best results

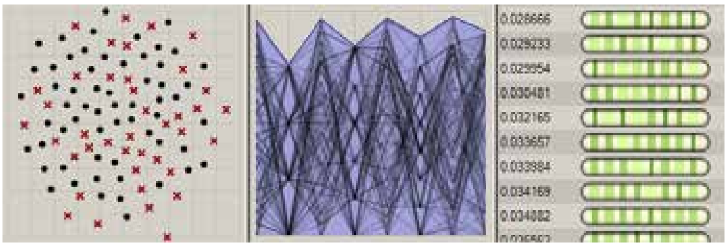


FIGURE 5.9

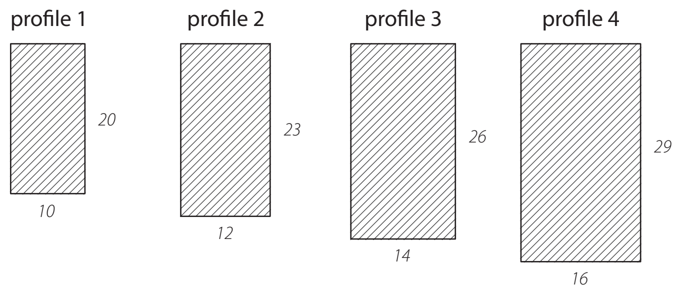


FIGURE 5.10

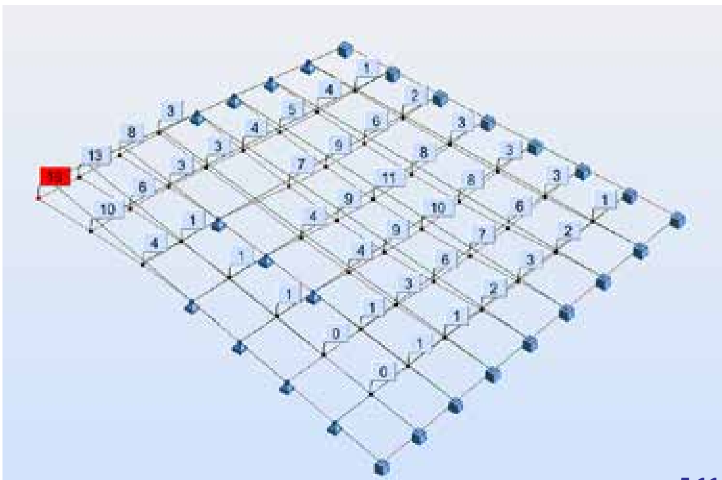


FIGURE 5.11

Joint

As a last step in the detailing of the structure, the joint possibilities were studied. The two-way grid has to intersect, and in order to keep the intersections plain the beams will have to be joined by cutting some of them up. There are different solutions to this, and most common joints introduce a secondary material, usually a metal bracket that connects the elements, as seen on figures 5.12 – 5.15.

The outset for the project has been focused on working with a timber only structure and in order to stay true to this, none of the bracket solutions are found appropriate.

The proposed joint for this structure was developed by splitting the beams (figure 5.16) in one direction and making a dovetail intersection (figure 5.17). The dovetail cuts through half the beam as any further cutting might weaken the tensile strength of the beams. The wood that is cut away from the long beams is replaced by the tail of the smaller members and the compressive reactions in the beams are unaltered.

In regards to architectural quality, this solution has dealt with balancing *firmitas* the robustness and *venustas* the aesthetical.

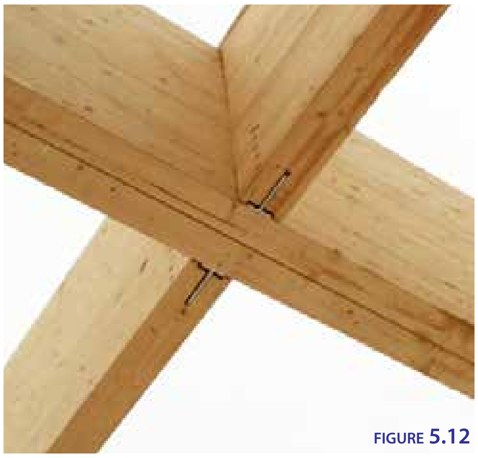


FIGURE 5.12


FIGURE 5.13


FIGURE 5.14


FIGURE 5.15

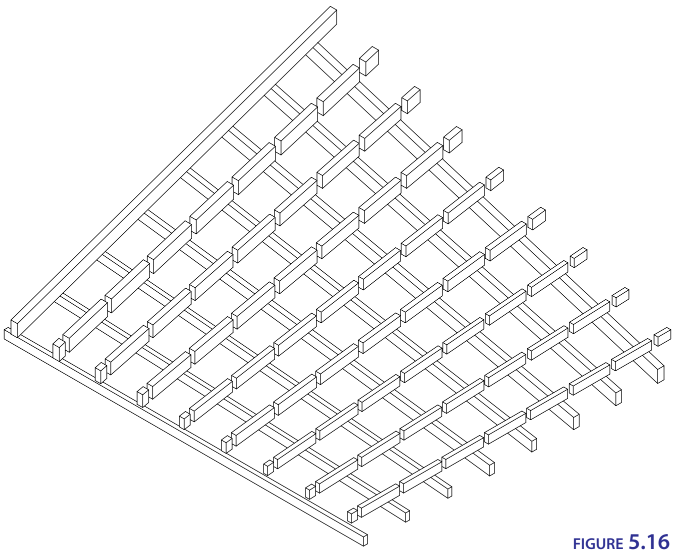


FIGURE 5.16

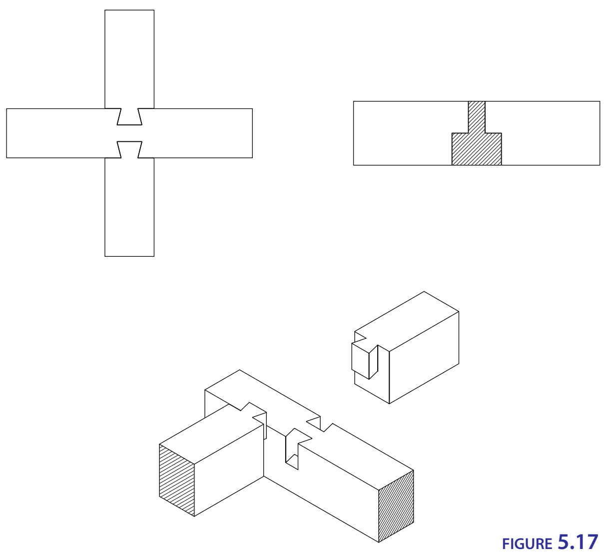
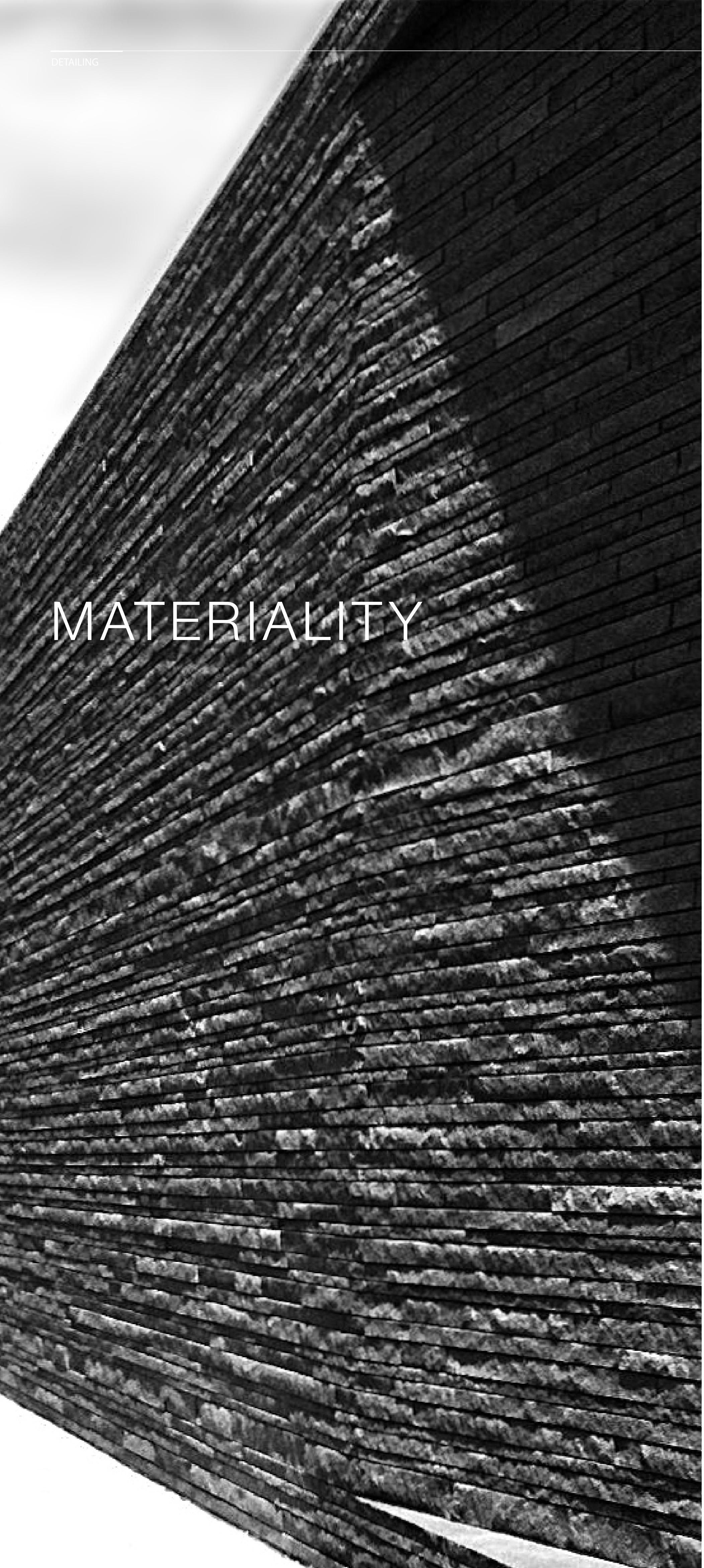


FIGURE 5.17



MATERIALITY

The very first page of this report presents a view on materialty that is often eluded in the development of modern architecture:

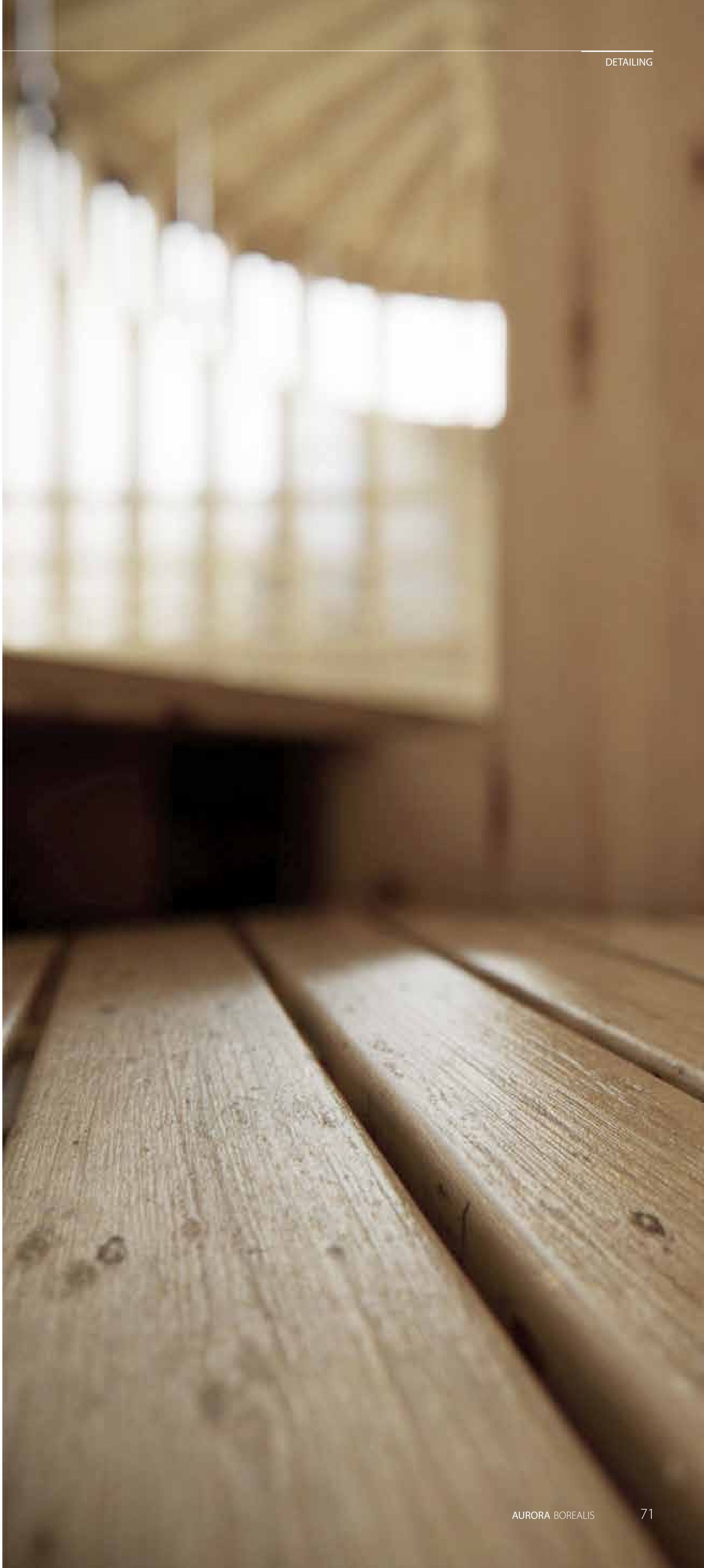
The skin reads the texture, weight, density and temperature of the matter.

[Pallasmaa, 2012-1]

As stated earlier, the experience of space is multi sensory, thus it is not only the eye that perceives the texture of the wall. The hand grasps its tactility in a far more sensory manner.

When dealing with materialty in architecture it is important to consider the way we percieve our surroundings, not only by the eye - certain materials or certain colors bring out certain emotions.
The goal in regards to materials was to balance the emotional associations from an interior perspective with the visual perception from the exterior.

From an exterior perspective the cabins are to be perceived raw. The outer walls will be formed rough cut from the very mountain the cabin is on, perceived as excavated mass, forming the 'cave'.
The granite stone from the fell has a strong tactility, dark and vivid with a patina that ages the 'cave' gracefully.
Through the interior, the granite walls continue, giving a feel of sturdyness and robustness.



The large gluelaminated timber beams with the yellowish hue, running through the space gives it a warm atmosphere - the roof floats above and opens to the exterior as a light reminder that you are in a safe place.
Wooden floors accenuate the living area, giving a soft touch to the bare feet.

The softness of the wood is contrasted with dark concrete around the fireplace and the floor of the hallway and kitchen area, which blends neatly with the granite, surrounding the main room and putting a strong emphasis on it.

The observatory is cladded with stained spruce wood panels, with an everchanging patina, that over time blends more and more in with the surrounding forrest.
The coned lightwell made of dark stucco lustro shines above the building resembling polished stone with sparkles of crystalised marbles that give the material a special reflection when the aurora lights it up.

TOP LEFT FRESH FUTON Figo lounge chair
TOP MIDDLE FRES FUTON Nido foldable chair
TOP RIGHT Flexible coffe table
BOTTOM LEFT Eco Chair as Chair
BOTTOM MIDDLE Eco Chair as bed
BOTTOM RIGHT Eco Chair folded as chair and table

INTERIOR

Due to the small size of the cabin, the main area is intended as a flexible space that accomodates the visitors basic needs to sit down, eat, and relax. The openings provide a view to the northern hemisphere, which enables the possibility to observe the aurora beside the warm fire.

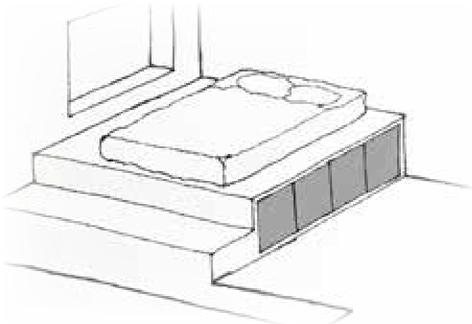
The detailing mainly focused on proposing interior furniture, showing how it can be arranged and used. Furthermore the detailing of storage area for the furniture is elaborated.

The futon is best known from traditional japanese interiors. It is easy to assemble/disassemble and with a modern take on it from FRESH FUTON it can be used as both an extra bed and a lounge chair.

Along with this, the FRESH FUTON Nigo, is another multiuse furniture that would fit well in the small space as it can be folded to a comfortable chair suited for a low table or unfolded to form a mattress.

An alternative take on these, is a design made at the Architecture & Design study by a team of Industrial Designer; the eco chair. Made of cardboard layers, the eco chair can be unfolded to form a chair, daybed or even a bed. It is easy to use, carry, stow away and is very robust in interiors.

Storing furniture that is not in use is possible by implementing a storage unit beneath the raised bed area, the unit will be able to hold two futons, a small table and four foldable chairs.

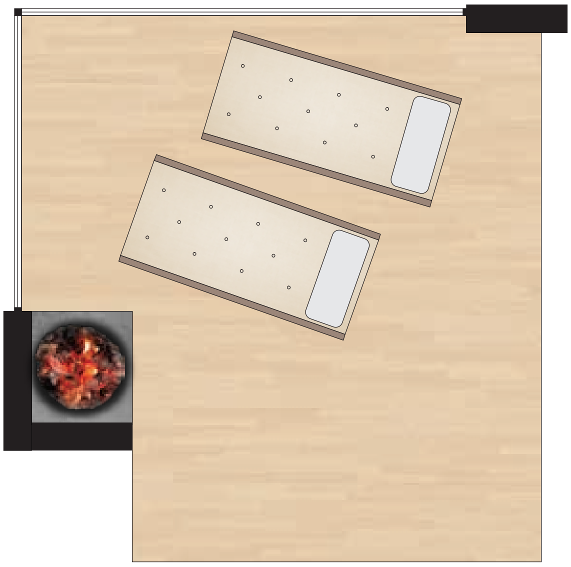


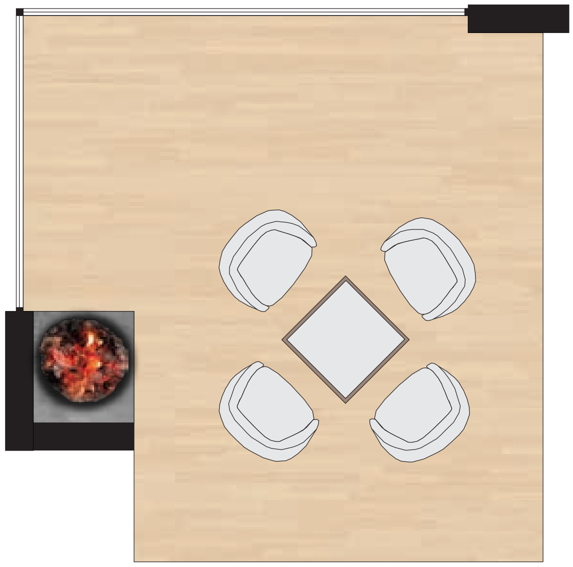
TOP LEFT Futons placed close to the fire and outdoors, sleep under the stars.

TOP RIGHT Intimate table setting for four.

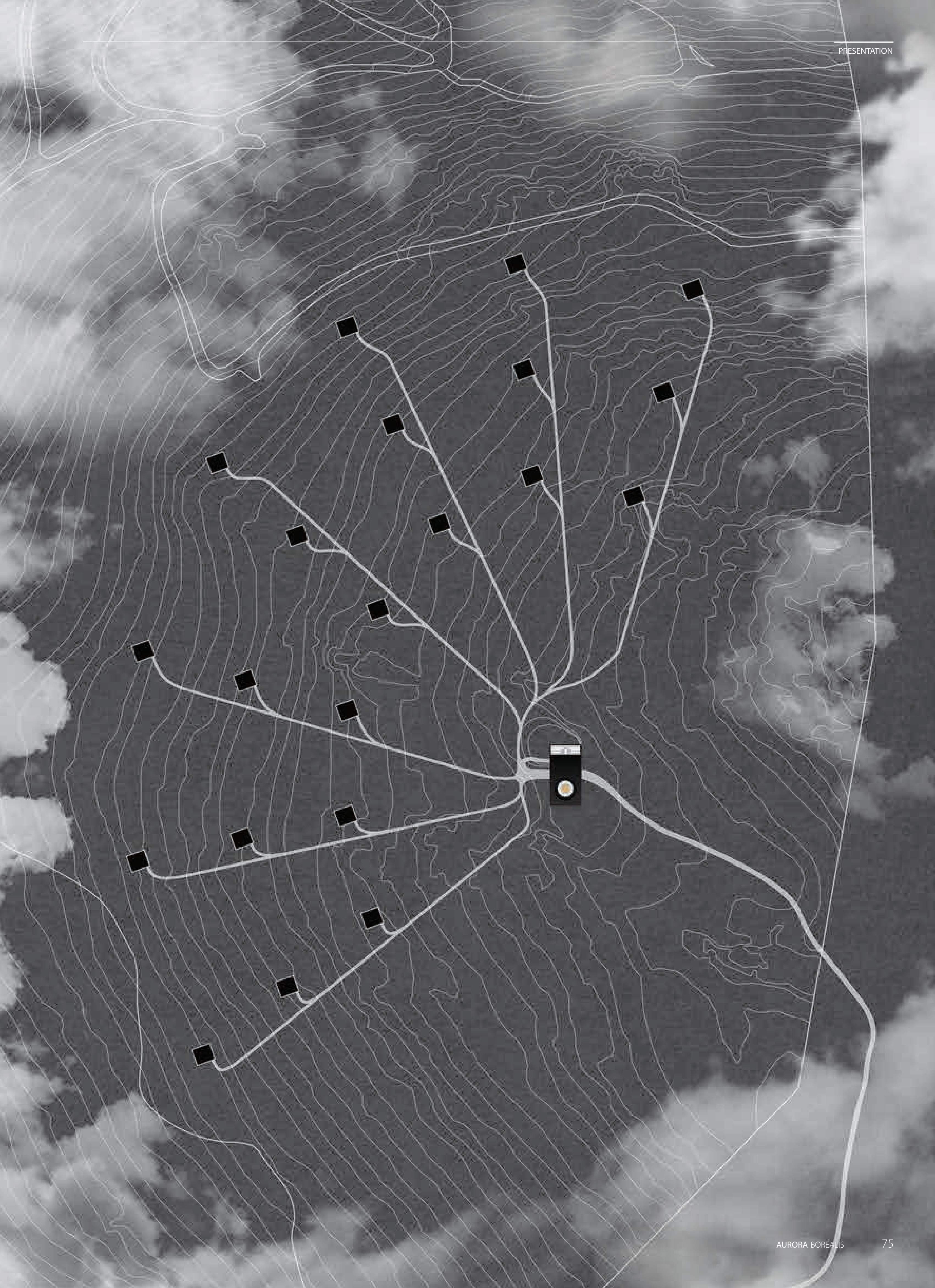
BOTTOM LEFT Chairs unfolded and lie as mattreses for relaxtion around the fire

BOTTOM RIGHT Working situation, surrounded by nature





PRESENTATION



ARRIVAL

FLOOR AREA

GROUND FLOOR

Entrance	25 m^2
Administration	8 m^2
Exhibition	134 m^2
Planetarium	56 m^2
Restaurant	121 m^2
Kitchen	19 m^2
Toilets	10 m^2

BASEMENT FLOOR

Hallway	15 m^2
Toilet	3 m^2
Technical Shaft	1,9 m^2
2x Dressing Room	9 m^2
2x Washing Room	8 m^2
2x Stove Room	9 m^2
Veranda / Social	29 m^2

TOP FLOOR

Observation Deck	109 m^2

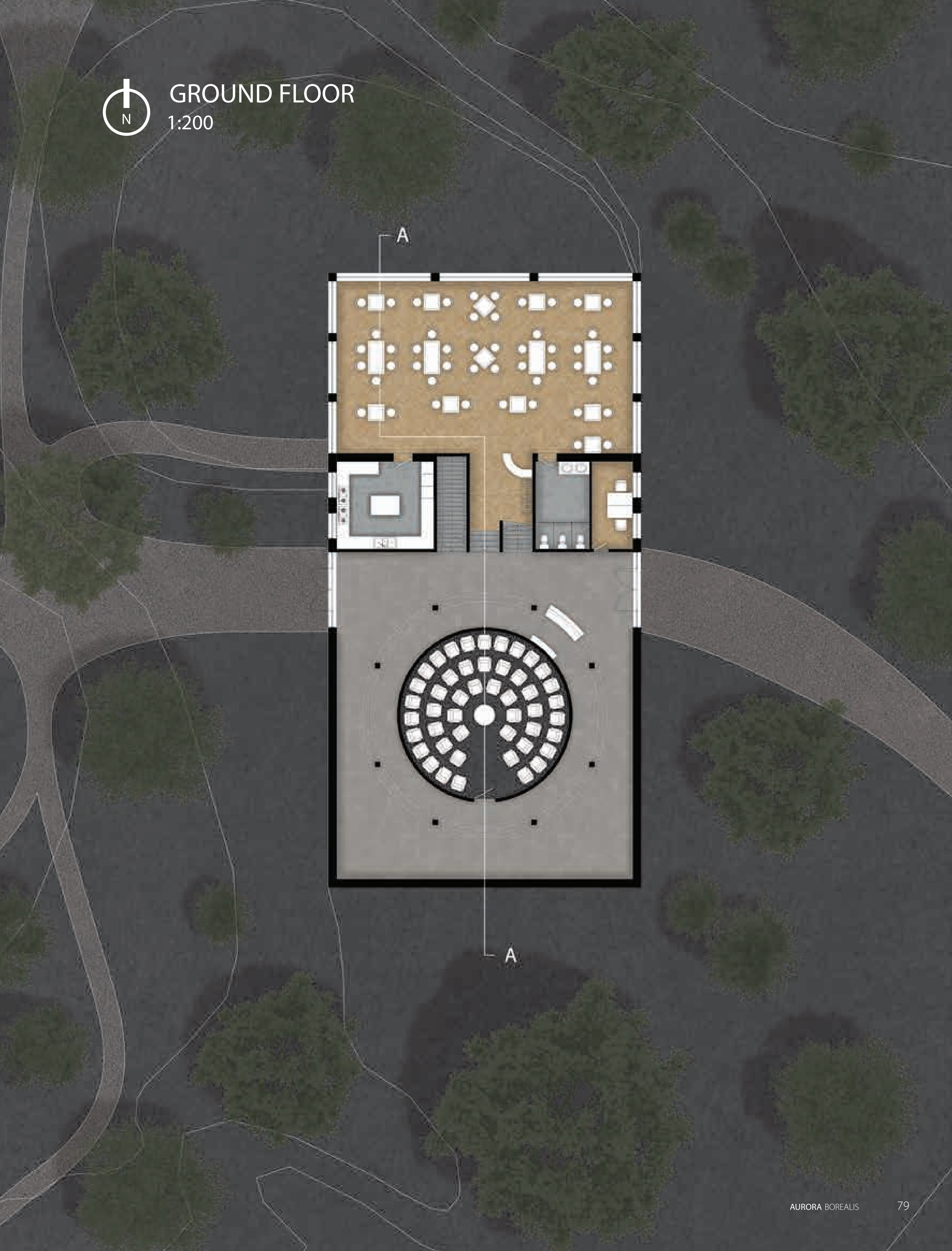
TOTAL AREA 474 m^2

CABINS x21

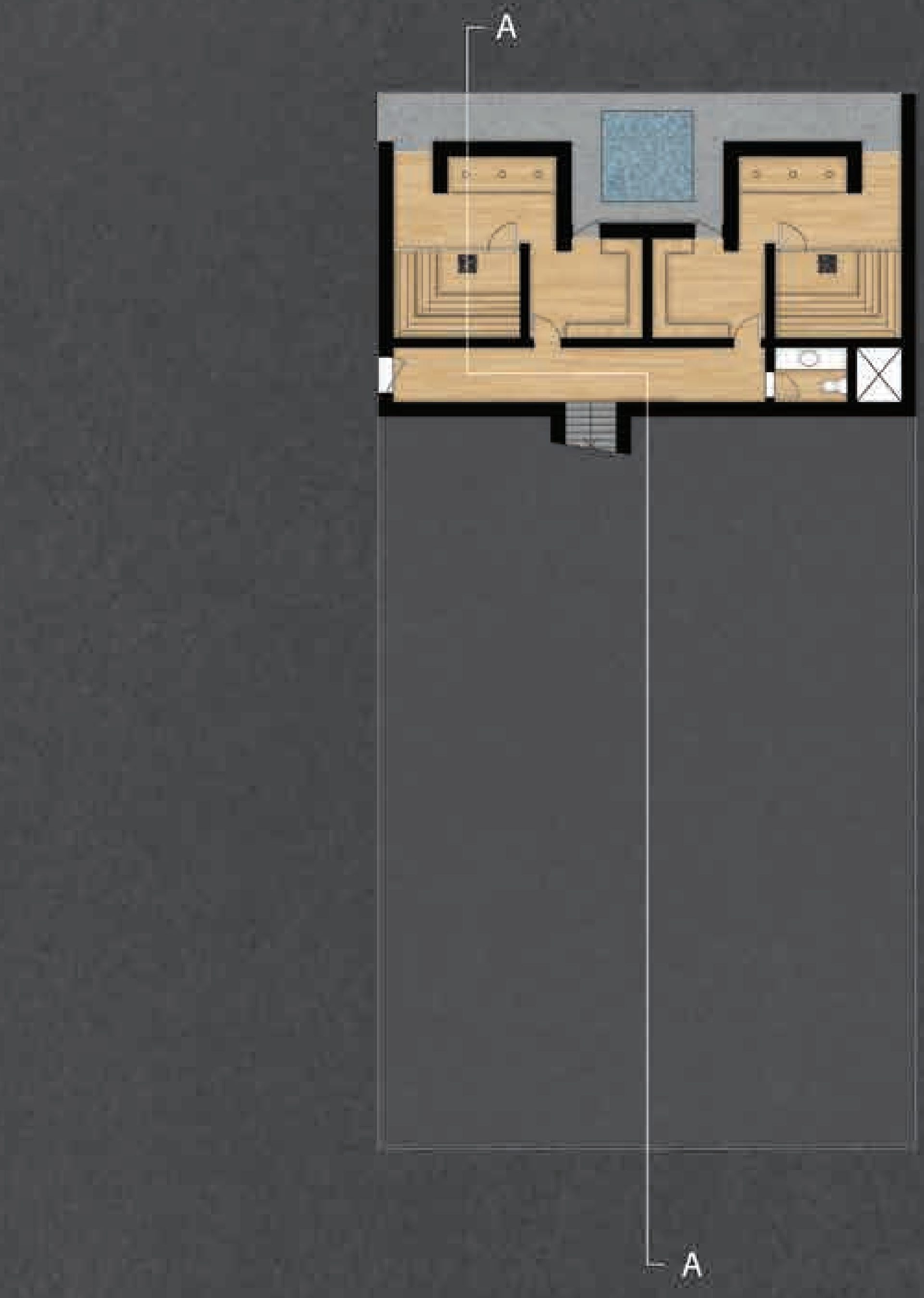
Entrance	3,5 m^2
Hallway	7,6 m^2
Tea Kitchen	2,1 m^2
Bed Area	6,8 m^2
Main Area	14,3 m^2
Toilet	19 m^2
Stove Room	5,6 m^2
Washing Room	2,6 m^2
Veranda	7,2 m^2

TOTAL AREA 1443 m^2

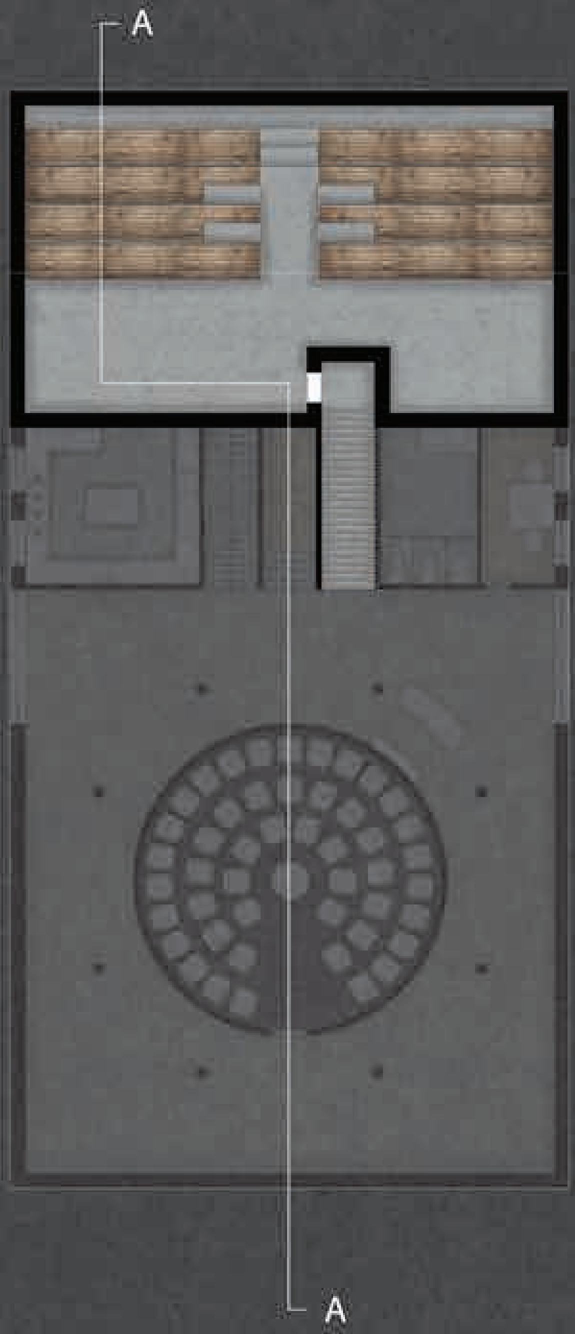
GROUND FLOOR
1:200



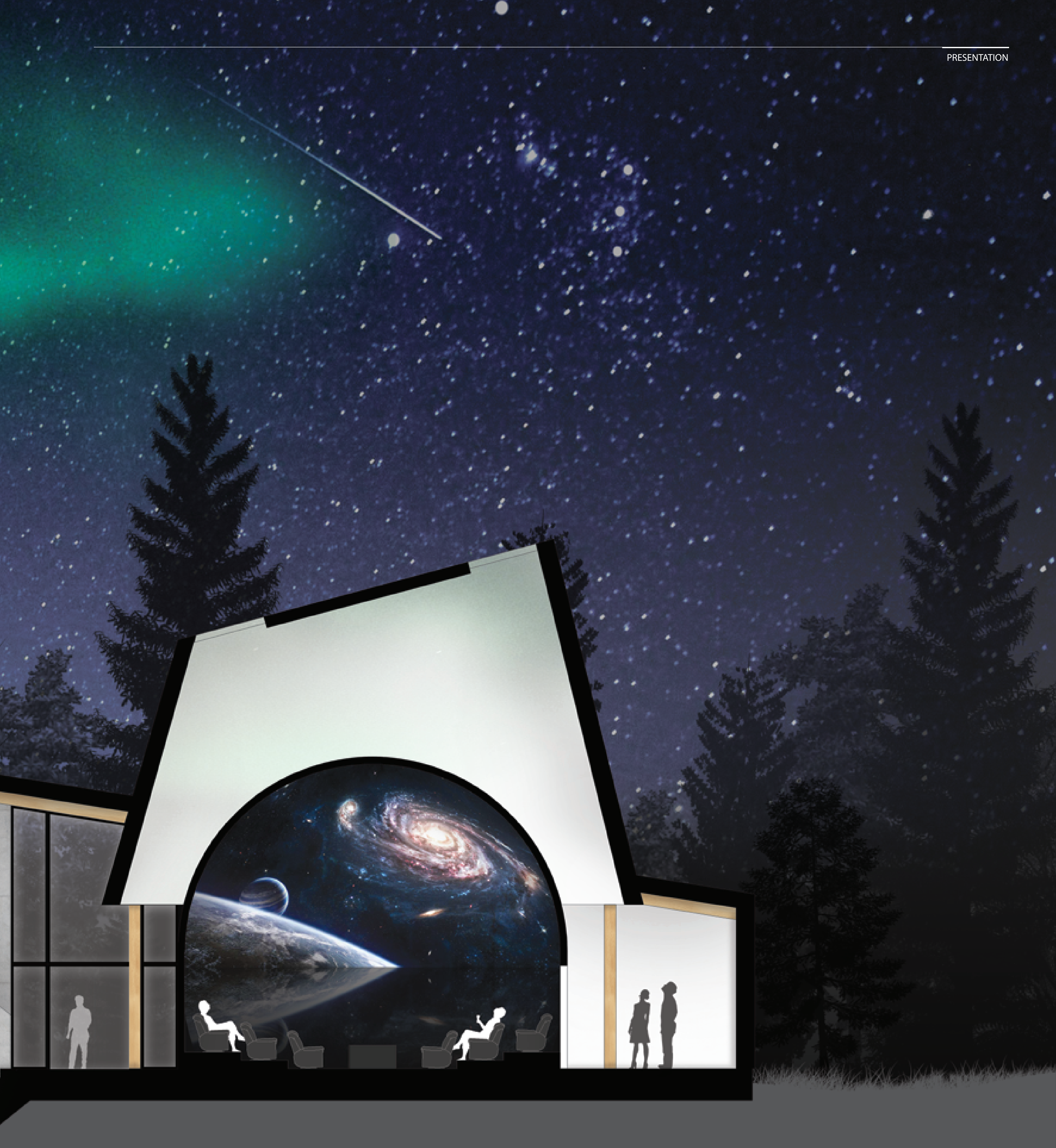
SAUNA
1:200



OBSERVATORY
1:200



SECTION A - A
1:100



AURORA OBSERVING

WEST
1:200

NORTH
1:200

EAST
1:200

SOUTH
1:200

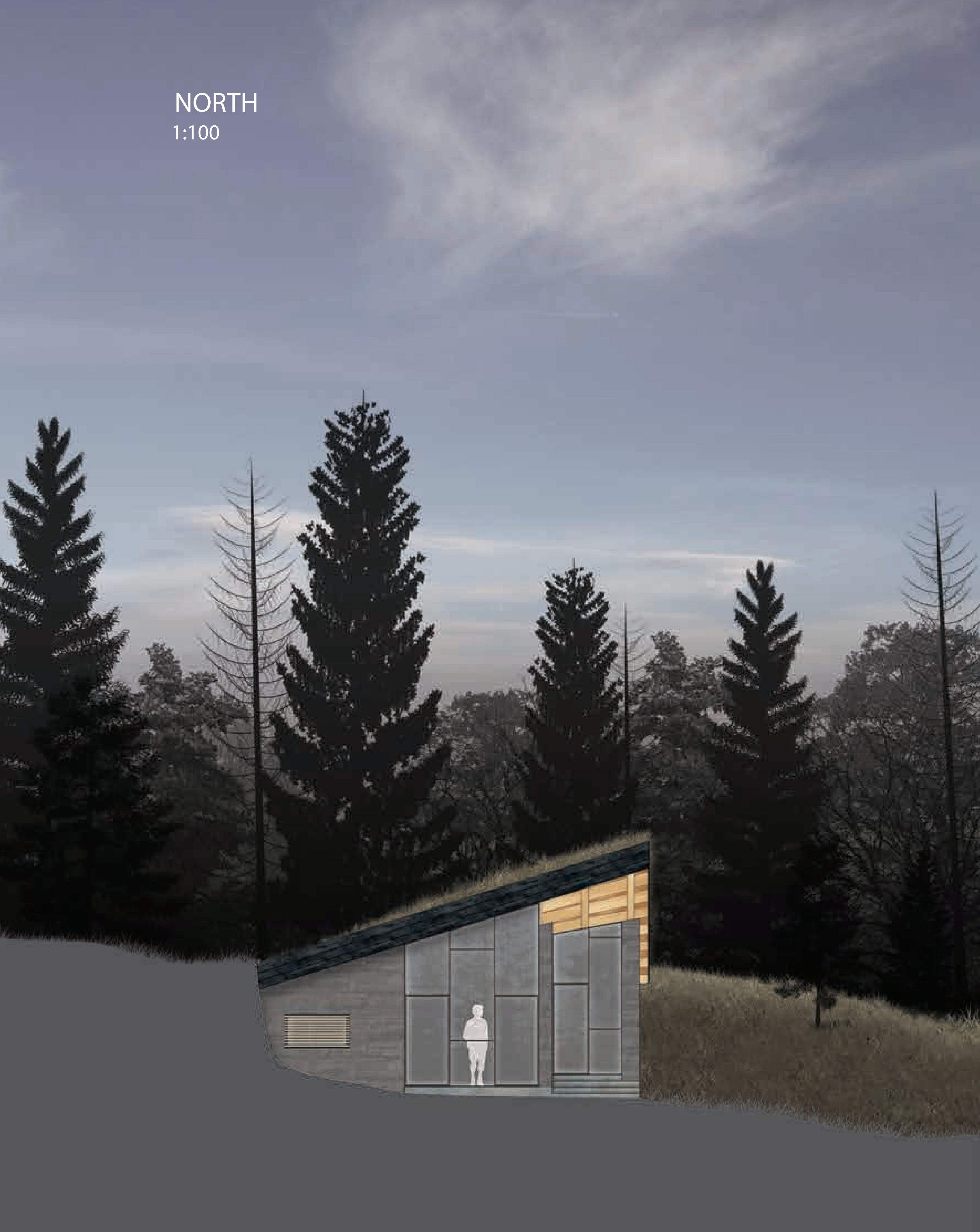
CABIN ENTRANCE

CABIN FLOORPLAN
1:100

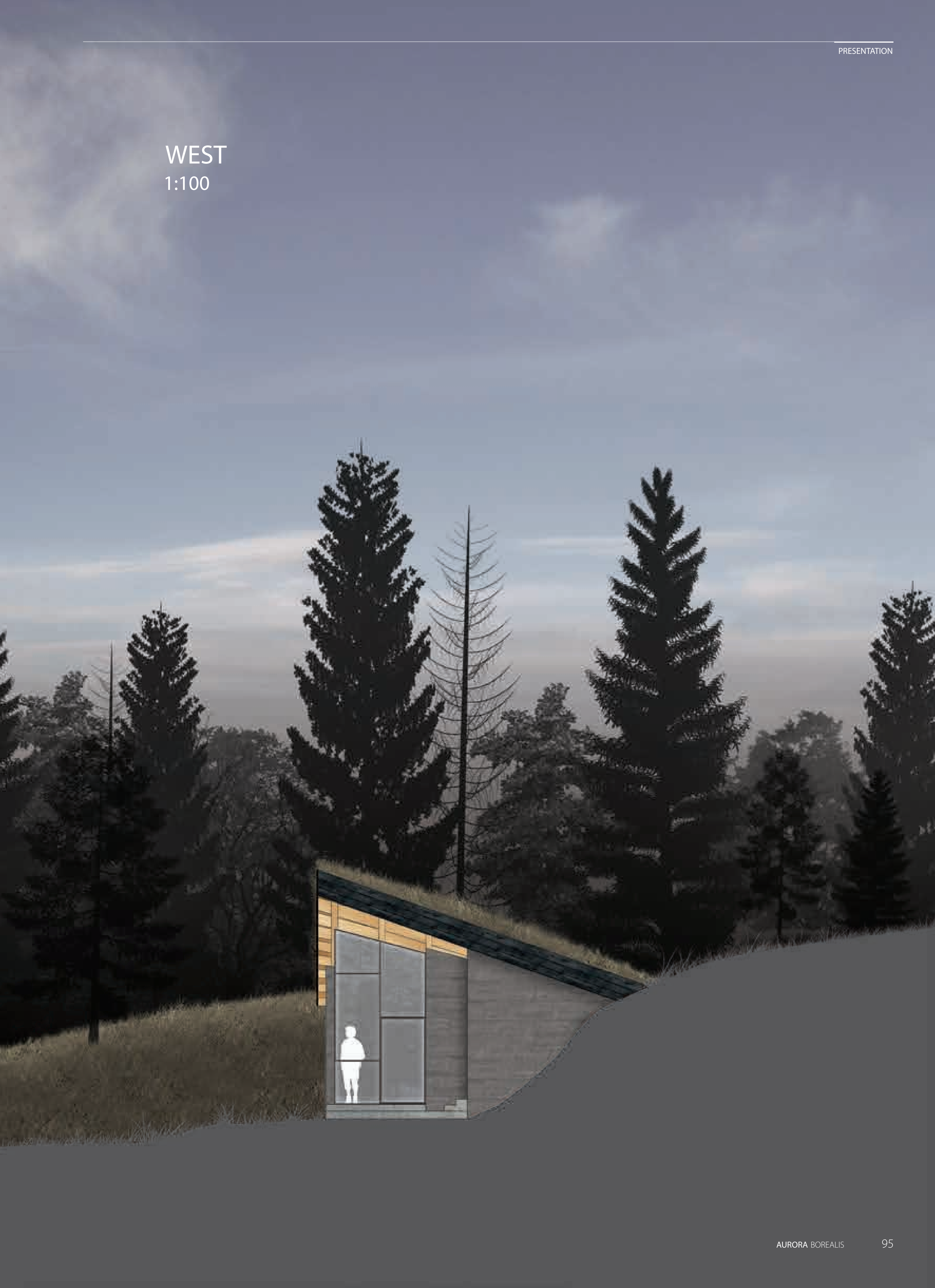

SECTION A - A
1:100

SECTION B - B
1:100

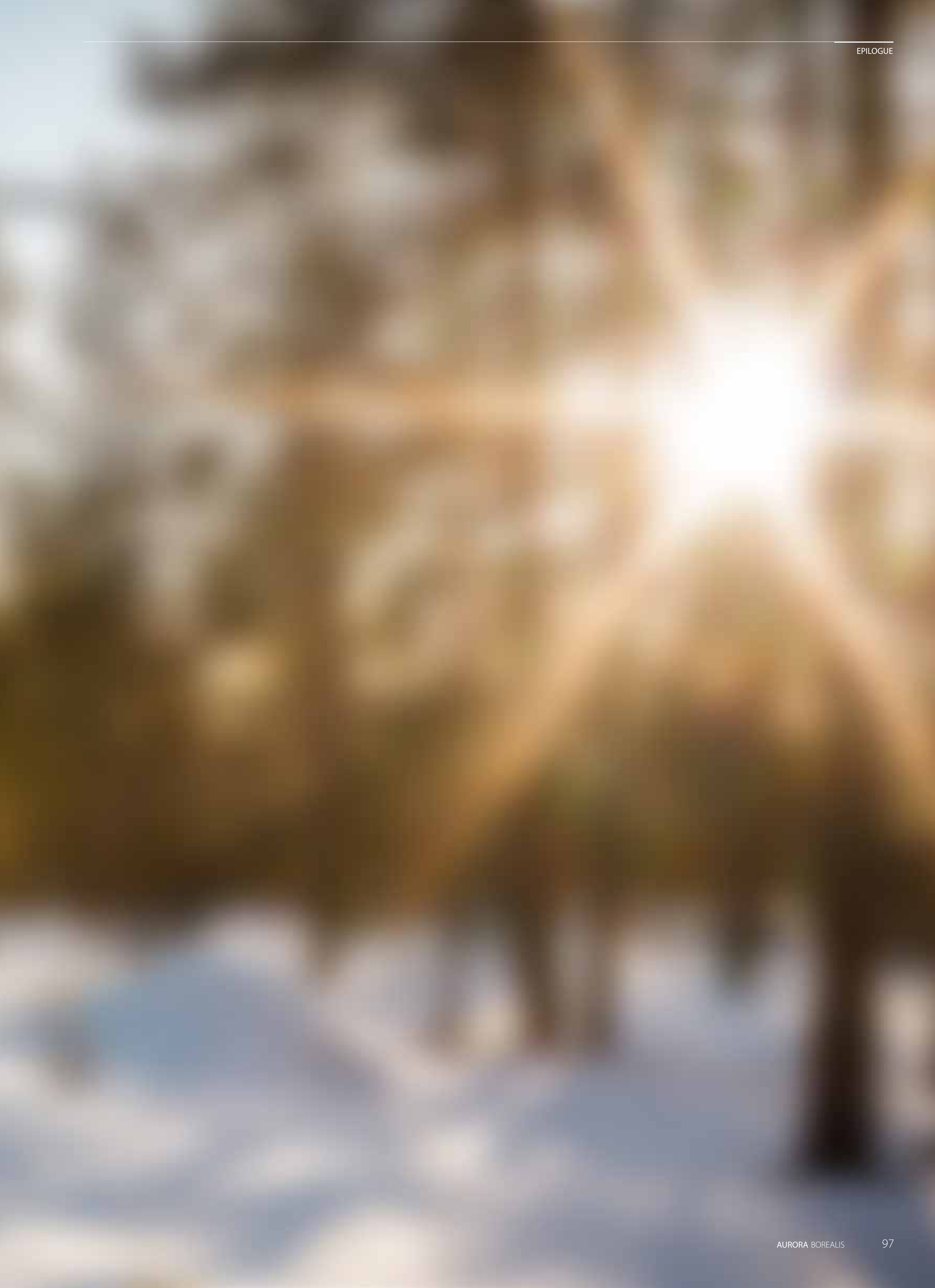
MAIN ROOM


NORTH
1:100

WEST
1:100



EPILOGUE



CONCLUSION

Placed in the Lappish forest, Ounasvarra, surrounded by untouched nature on all sides, the resort blends in with its surroundings like a natural part of it. Before arriving to the retreat, one is taken through the forest path, presenting the scenery in its most pure way. The transition from normality; one's ordinary urban life, begins here.

Arriving at the main building of the retreat, the first sight of it, from the diagonal approach, presents a dynamic body with a clear direction towards north. Following the narrow path straight to the front door, one arrives into a space that directly reflects the purpose of it. The centered round planetarium surrounded by aurora exhibitions is emphasized with the large cone floating above, providing the space with diffused hues of aurora light.

The central stairs invites one to the various possibilities this place offers; the theatrical seating on the top floor frames the perfect image of the spirit of this place. Nature at its best encircles the visitor, while the lights in the sky dance in front.

If one continues through the building, the path splits in even smaller and narrower ones. Small openings in the ground, almost unnoticeable in the large dense forest, form peaceful and secluded voids. Following the natural path, one arrives to the entrance through the dark passage leading underground ending in front of a small wooden door, signifying the privacy this place offers.

Inside one is presented with a whole new perspective of the place - a space that in its most simple manner offers refuge.

The ceiling lifts towards the central area and extends itself through the large opening creating a connection to the nature right outside. In the cold and unforgiving winters of Lapland, the fireplace right next to the opening provides a warm sense of security and comfort for one to relax, reverie and observe the beauties of the planet.

Following the vision of a secluded cabin in the wilderness as a place of solitude, with a methodology of 'building the drawing', this project presents a proposal that is in dialogue with the spirit of the place. Through the use of architectural theories on human perception the project has developed a space with the human body in center, while digital tools have aided in the intuitive understanding of technical aspects through the iterative design process. This combination has yielded in a synergetic relation between the scale of place and the scale of body.

DISCUSSION

In retrospective, this project had one unexpected topic that I did not foresee before the study trip, which is interesting to discuss because of its deep impact of the outcome.

Before arriving to Rovaniemi, and the site, I had only photos as reference for my project. During the trip, I approached the site several times, with a clear intention of 'getting lost' to fully perceive the context in a much more phenomenological manner than an empirical.
This approach lead to a better understanding of the genius loci, but it also carried a side effect. I was mesmerized by its character, it was the most tranquil place I've experienced during my entire adult life.

I am bringing this up as a subject because upon returning to the study my sketching literally stopped. Every proposal I had, when set in the context, did not make sense - it did not belong there. The process shifted from sketching to contemplating and through this a whole new concept arose. One that was inspired by the place itself.

This is of course important to address as it was a whole new approach for me. Most of the previous projects I've been involved in did not make considerations beyond the measurable aspects. The immeasurable qualities of the context and the perception of the existing conditions from an emotional perspective, have greatly impacted this project and myself as this was not a learning goal that I set out, but rather one that found me.

Another aspect that is worth discussing is that of the user. It is clear that the project did not have a focus on what kind of user group this was intended for. This is mainly due to the fact that I see the project as an experiment in architecture, built for the specific reason of solitude and observation.
During a lecture held by Juhani Pallasmaa in the UTZON(x) lecture series from Department of Architecture, Design and Media technology, where the subject neuroscience of architecture was addressed, Pallasmaa cited the French phenomenological philosopher Maurice Merleau-Ponty: *"What else could a poet or a painter express than his encounter with the world?"*

This is of particular interest, as it states that all creations, by any creative professional is reasoned through the personal view of and encounter with the world.
When contemplating on this with regards to vacation behavior, I found that there is a direct correlation between the kind of vacation retreat this project proposes and what I believe is necessary for vacationing in contemporary culture. I believe that the rate of experiential speed the world is moving in currently is constantly pushing the mental boundaries of human, hence I believe we need a place like this to slow down, to get in touch with ourselves again.

ILLUSTRATION CREDITS

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Image pg. 70	http://www.asla.org/2013awards/images/largescale/227_05.jpg
Image pg. 71	http://www.federicospoltore.com/45940/420001/home/caplutta-sogn-benedetg

LIST OF REFERENCES

[ArchMedium] http://en.archmedium.com/Concursos/OBA/Summary.php (Feb. 3rd 2014)

[IDP] Hansen, Hanne T. R. & Knudstrup., Mary-Ann, Mar 2005, The Integrated Design Process (IDP)

[Hill, 2005] Hill, J. Building the Drawing. Architectural Digest, Vol. 75 No. 4, 2005

[wiki] en.wikipedia.org/wiki/Finland (May 26th, 2014)

[wiki1] http://en.wikipedia.org/wiki/Light_pollution (May 26th, 2014)

[Lapland] http://www.pll.fi/in-english/about-lapland.php (May 26th, 2014)

[visitrovaniemi] http://www.visitrovaniemi.fi/ (May 26th, 2014)

[Norberg-Shulz, 1991] Norberg-Schulz, C. 1991. Genius Loci: Towards a Phenomenology of Architecture. Rizzoli

[Pallasmaa, 2012] Pallasmaa, Juhani, citation in lecture by Adrian Carter, September 6th 2012

[Pallasmaa, 2012-1] Pallasmaa, Juhani. 2012. The Eyes of the Skin. John Wiley & Sons

[Frascari, 1984] Frascari, Marco. Tell the tale detail. Princeton Architectural Press, 2008

[Frampton, 1995] Frampton, Kenneth. Studies in Tectonic culture, 1995

[weatherspark] http://weatherspark.com/averages/28687/Rovaniemi-Lappi-Finland (May 26th, 2014)

[eightseasons] http://www.lapland.fi/en/lapland/nature/eightseasons (May 26th, 2014)

[STAR, 2003] The Strategic Travel Action Resource, 2003, The Psychology of Travel – What is Luxury?

[Børsen, 2012] 'Tilbage til det enkle', Børsen, March 30th, 2012, Birthe Lauritsen

[Dixon, M.H.] Dixon, Mark H., "The Architecture of Solitude", Environment, Space, Place, Vol. 1/1, pg. 53-72, Spring, 2009

[SIG] http://www.singleply.co.uk/green-roofs/ (May 26th, 2014)

APPENDIX

APPENDIX A - WIND ACTIONS

In the following appendix, the calculations of wind actions are documented. The calculations are performed with instructions of Eurocode 1 [DS-EN 1991-1-4-2007].

The first step is to calculate the basis wind velocity, dealing with the national wind velocity multiplied with coefficients for direction and season.
As no information could be gathered from the Finnish National Annex, the basis wind velocity is based on the Danish standard of 24m/s while direction and season both are set to 1, resulting in a Basis Wind Velocity of 24m/s.

The Mean Wind Velocity is calculated:

$$v_m(z) = c_r(z)\ c_0(z)\ v_b$$

Where:

- $v_m(z)$ is the mean wind velocity (m/s)
- $c_r(z)$ is the roughness factor
- $c_0(z)$ is the orography factor
- z is height above terrain

Height above the terrain is 5 meters, thus the orography factor for this height can be set to 1, as this is the recommended value.
The equation for calculating the roughness factor is given as:

$$c_r = k_r \ln(z/z_0) \quad \text{for} \quad z_{min} < z < z_{max}$$

Where:

- k_r is the terrain factor
- z_0 is the roughness length

The roughness factor value can be found in [DS-EN 1991-1-4-2007], while the terrain factor is calculated by choosing category 3 (table 4.1, pg. 20), as this is a permanent forest environment.
The terrain factor is calulated to 0.2153 and the values can be set into the equation, giving a roughness factor of 0.597.

Lastly the mean wind velocity can be calculated

$$v_m(z) = c_r(z)\ c_0(z)\ v_b = 0.597 * 1 * 24 \text{ m/s} = 14.33$$

The Turbulence Intensity is calculated, with the use of a stadard deviation factor divided by the mean wind velocity:

$$I_v(z) = \sigma_v / v_m(z) \quad \text{for} \quad z_{min} < z < z_{max}$$

The standard deviation is calculated to 5,158, through the use of terrain factor, basic wind velocity and turbulence factor (1). This results in a turbulence factor of 0.36

Lastly the Peak Velocity Pressure will be calculated as this is the value that is used for calculations of forces on the different zones, as explained in 'Calculating Actions' section of the Structure chapter

$$q_p(z) = (1 + 7 * I_v(z)) * 0.5 * \rho * v_m(z)^2$$

Where:

- $q_p(z)$ is the Peak Wind Velocity
- ρ is the air density

With the air density set to 1,25 kg/m^3, the resulting peak wind velocity is

$$q_p(z) = (1 + 7 * 0.36) * 0.5 * 1.25 * 14.33^2 = \mathbf{0.4525\ kN / m^2}$$

APPENDIX B - TIMBER DESIGN

Member	Section	Material	Lay	Laz	Ratio	Case	Ratio(uy)	Case (uy)	Ratio(uz)	Case (uz)	Ca
1	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
2	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
3	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
4	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
5	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
6	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
7	OK Profile_01	GL36h	18.31	36.62	0.00	1 Dead_Load	0.00		0.00		-
8	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
9	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
10	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
11	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
12	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
13	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
14	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
15	OK Profile_01	GL36h	18.19	36.37	0.00	1 Dead_Load	0.00		0.00		-
16	OK Profile_01	GL36h	18.33	36.66	0.11	3 Snow_Load	0.00		0.02		-
17	OK Profile_01	GL36h	18.33	36.66	0.04	3 Snow_Load	0.00		0.01		-
18	OK Profile_01	GL36h	18.33	36.66	0.04	3 Snow_Load	0.00		0.01		-
19	OK Profile_01	GL36h	18.33	36.66	0.03	3 Snow_Load	0.00		0.01		-
20	OK Profile_01	GL36h	18.33	36.66	0.03	3 Snow_Load	0.00		0.01		-
21	OK Profile_01	GL36h	18.33	36.66	0.03	3 Snow_Load	0.00		0.00		-
22	OK Profile_01	GL36h	18.33	36.66	0.03	3 Snow_Load	0.00		0.00		-
23	OK Profile_01	GL36h	18.20	36.41	0.11	3 Snow_Load	0.00		0.02		-
24	OK Profile_01	GL36h	18.20	36.41	0.04	3 Snow_Load	0.00		0.01		-
25	OK Profile_01	GL36h	18.20	36.41	0.05	3 Snow_Load	0.00		0.01		-
26	OK Profile_01	GL36h	18.20	36.41	0.03	3 Snow_Load	0.00		0.01		-
27	OK Profile_01	GL36h	18.20	36.41	0.04	3 Snow_Load	0.00		0.00		-
28	OK Profile_01	GL36h	18.20	36.41	0.02	3 Snow_Load	0.00		0.00		-
29	OK Profile_01	GL36h	18.20	36.41	0.02	3 Snow_Load	0.00		0.01		-
30	OK Profile_01	GL36h	18.20	36.41	0.01	3 Snow_Load	0.00		0.00		-
31	OK Profile_01	GL36h	18.38	36.76	0.22	3 Snow_Load	0.00		0.04		-
32	OK Profile_01	GL36h	18.38	36.76	0.08	3 Snow_Load	0.00		0.01		-
33	OK Profile_01	GL36h	18.38	36.76	0.08	3 Snow_Load	0.01		0.02		-
34	OK Profile_01	GL36h	18.38	36.76	0.08	3 Snow_Load	0.01		0.02		-
35	OK Profile_01	GL36h	18.38	36.76	0.08	3 Snow_Load	0.01		0.02		-
36	OK Profile_01	GL36h	18.38	36.76	0.06	3 Snow_Load	0.01		0.01		-
37	OK Profile_01	GL36h	18.38	36.76	0.05	3 Snow_Load	0.00		0.01		-
38	OK Profile_01	GL36h	18.26	36.52	0.23	3 Snow_Load	0.00		0.05		-
39	OK Profile_01	GL36h	18.26	36.52	0.09	3 Snow_Load	0.00		0.01		-
40	OK Profile_01	GL36h	18.26	36.52	0.10	3 Snow_Load	0.01		0.03		-
41	OK Profile_01	GL36h	18.26	36.52	0.10	3 Snow_Load	0.01		0.03		-
42	OK Profile_01	GL36h	18.26	36.52	0.08	3 Snow_Load	0.00		0.01		-
43	OK Profile_01	GL36h	18.26	36.52	0.08	3 Snow_Load	0.00		0.02		-
44	OK Profile_01	GL36h	18.26	36.52	0.09	3 Snow_Load	0.01		0.02		-
45	OK Profile_01	GL36h	18.26	36.52	0.02	3 Snow_Load	0.00		0.00		-
46	OK Profile_02	GL36h	16.06	30.78	0.27	3 Snow_Load	0.00		0.05		-
47	OK Profile_02	GL36h	16.06	30.78	0.09	3 Snow_Load	0.00		0.01		-
48	OK Profile_02	GL36h	16.06	30.78	0.12	3 Snow_Load	0.01		0.03		-
49	OK Profile_02	GL36h	16.06	30.78	0.12	3 Snow_Load	0.01		0.03		-
50	OK Profile_02	GL36h	16.06	30.78	0.11	3 Snow_Load	0.01		0.02		-
51	OK Profile_02	GL36h	16.06	30.78	0.08	3 Snow_Load	0.01		0.02		-
52	OK Profile_02	GL36h	16.06	30.78	0.04	3 Snow_Load	0.00		0.01		-
53	OK Profile_02	GL36h	15.95	30.58	0.30	3 Snow_Load	0.00		0.06		-
54	OK Profile_02	GL36h	15.95	30.58	0.12	3 Snow_Load	0.00		0.01		-
55	OK Profile_02	GL36h	15.95	30.58	0.17	3 Snow_Load	0.01		0.04		-
56	OK Profile_02	GL36h	15.95	30.58	0.17	3 Snow_Load	0.01		0.04		-
57	OK Profile_02	GL36h	15.95	30.58	0.12	3 Snow_Load	0.01		0.02		-
58	OK Profile_02	GL36h	15.95	30.58	0.18	3 Snow_Load	0.01		0.03		-
59	OK Profile_02	GL36h	15.95	30.58	0.19	3 Snow_Load	0.01		0.04		-
60	OK Profile_02	GL36h	15.95	30.58	0.04	3 Snow_Load	0.00		0.01		-
61	OK Profile_02	GL36h	16.17	30.98	0.23	3 Snow_Load	0.00		0.05		-
62	OK Profile_02	GL36h	16.17	30.98	0.09	3 Snow_Load	0.00		0.01		-
63	OK Profile_02	GL36h	16.17	30.98	0.11	3 Snow_Load	0.00		0.02		-
64	OK Profile_02	GL36h	16.17	30.98	0.11	3 Snow_Load	0.01		0.02		-
65	OK Profile_02	GL36h	16.17	30.98	0.09	3 Snow_Load	0.01		0.02		-
66	OK Profile_02	GL36h	16.17	30.98	0.07	3 Snow_Load	0.01		0.02		-
67	OK Profile_02	GL36h	16.17	30.98	0.08	3 Snow_Load	0.00		0.01		-
68	OK Profile_02	GL36h	16.06	30.78	0.29	3 Snow_Load	0.00		0.06		-
69	OK Profile_02	GL36h	16.06	30.78	0.11	3 Snow_Load	0.00		0.01		-
70	OK Profile_02	GL36h	16.06	30.78	0.18	3 Snow_Load	0.01		0.04		-
71	OK Profile_02	GL36h	16.06	30.78	0.18	3 Snow_Load	0.01		0.05		-
72	OK Profile_02	GL36h	16.06	30.78	0.14	3 Snow_Load	0.01		0.02		-
73	OK Profile_02	GL36h	16.06	30.78	0.17	3 Snow_Load	0.01		0.03		-
74	OK Profile_02	GL36h	16.06	30.78	0.17	3 Snow_Load	0.01		0.03		-
75	OK Profile_02	GL36h	16.06	30.78	0.03	3 Snow_Load	0.00		0.01		-

75	OK	Profile_02	GL36h	16.06	30.78	0.03	3 Snow_Load	0.00		0.01		-
76	OK	Profile_03	GL36h	14.42	26.78	0.16	3 Snow_Load	0.00		0.03		-
77	OK	Profile_03	GL36h	14.42	26.78	0.08	3 Snow_Load	0.00		0.01		-
78	OK	Profile_03	GL36h	14.42	26.78	0.06	3 Snow_Load	0.00		0.01		-
79	OK	Profile_03	GL36h	14.42	26.78	0.05	3 Snow_Load	0.00		0.01		-
80	OK	Profile_03	GL36h	14.42	26.78	0.07	3 Snow_Load	0.00		0.00		-
81	OK	Profile_03	GL36h	14.42	26.78	0.10	3 Snow_Load	0.00		0.00		-
82	OK	Profile_03	GL36h	14.42	26.78	0.09	3 Snow_Load	0.00		0.00		-
83	OK	Profile_03	GL36h	14.33	26.61	0.26	3 Snow_Load	0.00		0.05		-
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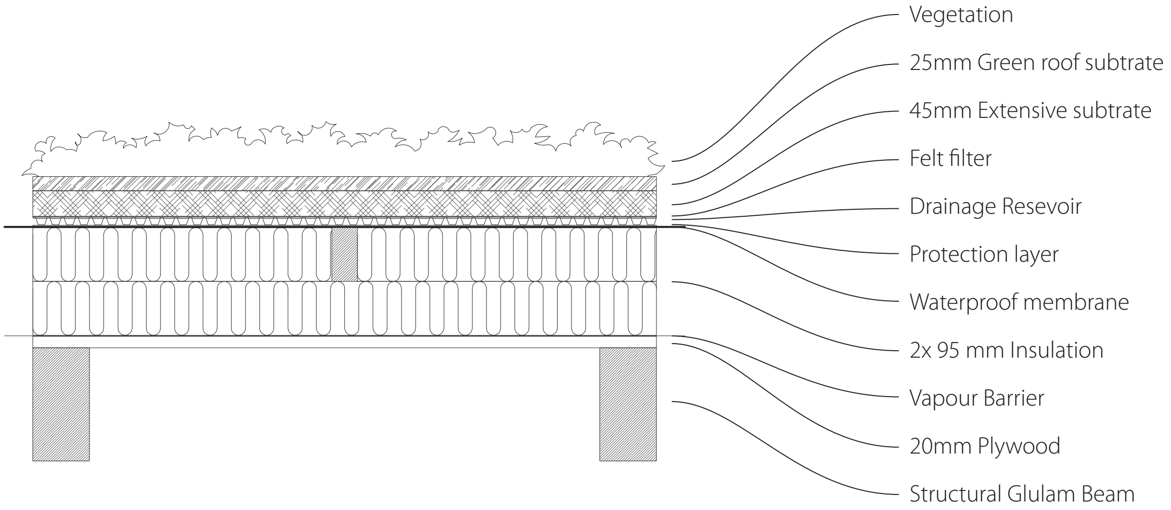
85	OK	Profile_03	GL36h	14.33	26.61	0.16	3 Snow_Load	0.00		0.03		-
86	OK	Profile_03	GL36h	14.33	26.61	0.15	3 Snow_Load	0.01		0.04		-
87	OK	Profile_03	GL36h	14.33	26.61	0.12	3 Snow_Load	0.01		0.02		-
88	OK	Profile_03	GL36h	14.33	26.61	0.28	3 Snow_Load	0.01		0.04		-
89	OK	Profile_03	GL36h	14.33	26.61	0.29	3 Snow_Load	0.01		0.04		-
90	OK	Profile_03	GL36h	14.33	26.61	0.04	3 Snow_Load	0.00		0.00		-
91	OK	Profile_03	GL36h	14.57	27.05	0.09	3 Snow_Load	0.00		0.01		-
92	OK	Profile_03	GL36h	14.57	27.05	0.05	3 Snow_Load	0.00		0.01		-
93	OK	Profile_03	GL36h	14.57	27.05	0.10	3 Snow_Load	0.00		0.00		-
94	OK	Profile_03	GL36h	14.57	27.05	0.10	3 Snow_Load	0.00		0.00		-
95	OK	Profile_03	GL36h	14.57	27.05	0.23	3 Snow_Load	0.00		0.02		-
96	OK	Profile_03	GL36h	14.57	27.05	0.22	3 Snow_Load	0.01		0.03		-
97	OK	Profile_03	GL36h	14.57	27.05	0.07	3 Snow_Load	0.00		0.00		-
98	OK	Profile_03	GL36h	14.47	26.88	0.15	3 Snow_Load	0.00		0.03		-
99	OK	Profile_03	GL36h	14.47	26.88	0.09	3 Snow_Load	0.00		0.01		-
100	OK	Profile_03	GL36h	14.47	26.88	0.08	3 Snow_Load	0.00		0.02		-
101	OK	Profile_03	GL36h	14.47	26.88	0.08	3 Snow_Load	0.00		0.01		-
102	OK	Profile_03	GL36h	14.47	26.88	0.12	3 Snow_Load	0.00		0.00		-
103	OK	Profile_03	GL36h	14.47	26.88	0.13	3 Snow_Load	0.01		0.02		-
104	OK	Profile_03	GL36h	14.47	26.88	0.14	3 Snow_Load	0.01		0.02		-
105	OK	Profile_03	GL36h	14.47	26.88	0.08	3 Snow_Load	0.00		0.01		-
106	OK	Profile_04	GL36h	13.21	23.95	0.05	3 Snow_Load	0.00		0.00		-
107	OK	Profile_04	GL36h	13.21	23.95	0.03	3 Snow_Load	0.00		0.01		-
108	OK	Profile_04	GL36h	13.21	23.95	0.05	3 Snow_Load	0.00		0.00		-
109	OK	Profile_04	GL36h	13.21	23.95	0.08	3 Snow_Load	0.00		0.01		-
110	OK	Profile_04	GL36h	13.21	23.95	0.15	3 Snow_Load	0.01		0.03		-
111	OK	Profile_04	GL36h	13.21	23.95	0.16	3 Snow_Load	0.01		0.03		-
112	OK	Profile_04	GL36h	13.21	23.95	0.08	3 Snow_Load	0.00		0.01		-
113	OK	Profile_04	GL36h	13.13	23.80	0.03	3 Snow_Load	0.00		0.00		-
114	OK	Profile_04	GL36h	13.13	23.80	0.06	3 Snow_Load	0.00		0.00		-
115	OK	Profile_04	GL36h	13.13	23.80	0.07	3 Snow_Load	0.00		0.00		-
116	OK	Profile_04	GL36h	13.13	23.80	0.20	3 Snow_Load	0.00		0.02		-
117	OK	Profile_04	GL36h	13.13	23.80	0.19	3 Snow_Load	0.01		0.03		-
118	OK	Profile_04	GL36h	13.13	23.80	0.12	3 Snow_Load	0.01		0.01		-
119	OK	Profile_04	GL36h	13.13	23.80	0.05	3 Snow_Load	0.00		0.00		-
120	OK	Profile_04	GL36h	13.13	23.80	0.05	3 Snow_Load	0.00		0.00		-
121	OK	Profile_04	GL36h	13.38	24.26	0.01	3 Snow_Load	0.00		0.00		-
122	OK	Profile_04	GL36h	13.38	24.26	0.02	3 Snow_Load	0.00		0.00		-
123	OK	Profile_04	GL36h	13.38	24.26	0.07	3 Snow_Load	0.00		0.01		-
124	OK	Profile_04	GL36h	13.38	24.26	0.22	3 Snow_Load	0.00		0.02		-
125	OK	Profile_04	GL36h	13.38	24.26	0.22	3 Snow_Load	0.01		0.04		-
126	OK	Profile_04	GL36h	13.38	24.26	0.12	3 Snow_Load	0.01		0.02		-
127	OK	Profile_04	GL36h	13.38	24.26	0.07	3 Snow_Load	0.00		0.01		-

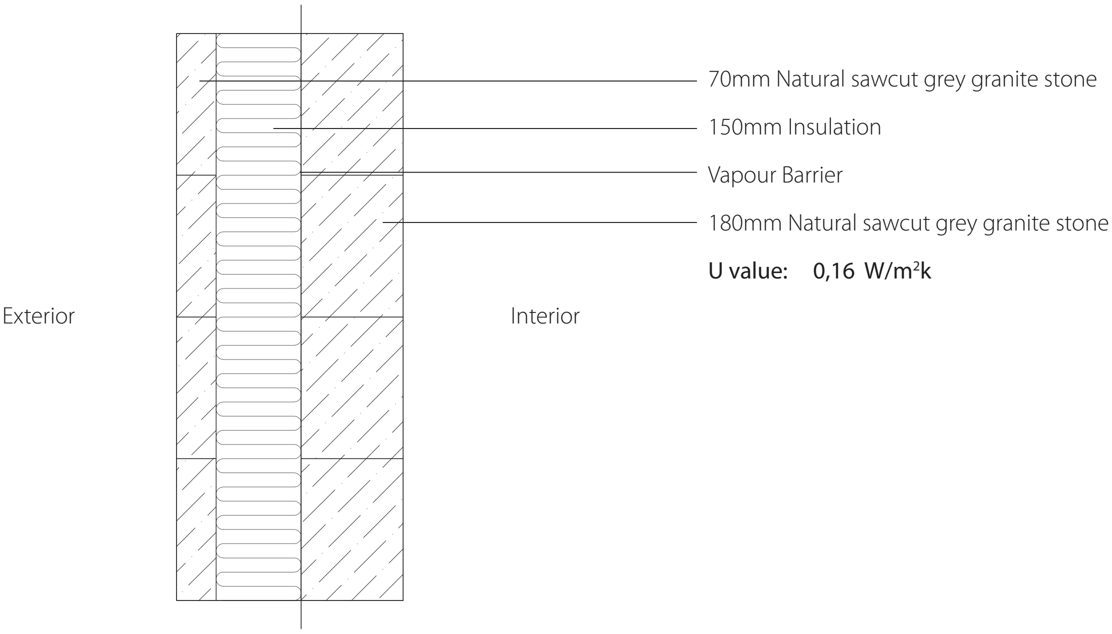
APPENDIX C - ENVELOPE

Cabin Roof



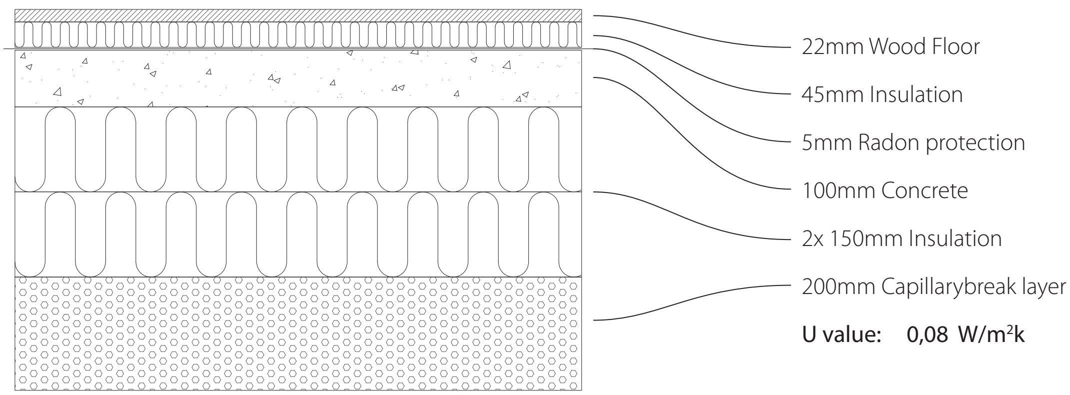
U value: 0,09 W/m²k

Cabin Walls



U value: 0,16 W/m²k

Cabin Ground Slab



U value: 0,08 W/m²k

MIRNES TULIC
MASTER THESIS
MSc.4, 2014