



LOW - IMPACT LIVING

*reducing the footprint of built environment
through small home design*

Master's Thesis by Gabija Zakarauskaite



CHALMERS

*Low - Impact Living
reducing the footprint of built environment through
small home design*

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INTRO

STUDENT BACKGROUND

1992 *Born in Vilnius, Lithuania*
2009 *Started architecture prep-course at VGTU*
2011 *Finished school and moved to Brighton, England*
2014 *Finished BA degree in Architecture and started working at ECE*
2015 *Started working at Conran*
2017 *Moved to Gothenburg and started MPDSD at Chalmers*

Relevant experience:



*Final Bachelor thesis
focused on rejuvenation
& well-being*



*3 year work experience in
residential sector*



*Master Programme in Design for Sustainable
Development:*

*/ Social Inclusion
/ Project Management
/ Sustainable Design
/ Sustainable Building Competition*

ABSTRACT

In the face of the current environmental crisis, there is an urgent need for alternative housing solutions. The discussion on sustainable design, renewable energy and recycled materials has been successfully developing a new field of architecture. However, the idea of reducing building size is not as desirable as techno-centric approaches, because that requires making significant changes to our way of living. Low-impact living is the antidote to a conventional consumerist lifestyle, proposing that living simpler could not only bring financial and environmental benefits but also improve our psychological well-being.

This project is aiming at people who are looking for a new home and are willing to reduce their footprint. The main research question then becomes: how can we encourage residents to voluntarily reduce their consumption and choose smaller homes?

The project is set in Frölunda, where the municipality allocated land for 70 dwellings. Even though the municipality allowed for taller apartment blocks, the proposal satisfies the demand with single-family houses creating a high-density, low-rise neighbourhood. The proposal consists of 74 individual homes, arranged in semi-detached layout. The four types correspond to both varying family sizes and terrain complexity.

The purpose of this thesis is to both raise the awareness towards the environment, followed by addressing the need to provide alternative ways of living that reduce our ecological footprint. This project also demonstrates how unconventional housing can fit into a conventional city planning framework. In order to achieve a well-rounded proposal, research in sustainable design is applied alongside architectural aesthetic, attention to detail and spatial quality. The thesis contributes to the field of architecture by participating in the discourse of the low-impact movement and illustrates its philosophy with tangible design solutions.

ABOUT

WHY?

The environmental crisis is urgently asking to reduce our footprint. Building industry contributes to almost a third of global CO2 emissions according to Huebner and Shipworth (2016) study. It is our as architects responsibility to get involved in searching for solutions that would lower our impact on the planet.

HOW?

There are many existing architectural strategies of how to create more sustainable buildings. As Pickerill (2016) discusses, most of those strategies focus on techno-centric approaches, that rely on technology to solve climate issues rather than change human behaviour. This thesis investigates less discussed approach - reducing building size in order to lower our environmental impact.

WHAT?

The proposal an alternative solution for those who are looking for an individual family home and are willing to lower their impact of living. The project is a low-rise, high-density neighbourhood that offers small homes, inspired by the small and productive house philosophy (Vale, 2009), while maintaining character, identity and quality of a villa.

ABOUT

PURPOSE

This thesis proposes individual homes on this particular site in response to the municipality's request for low-rise housing in the area of Frölunda. Even though, it would seem that multi-family block would satisfy the reduction of building footprint better, the purpose of working with individual homes is to offer more diverse housing alternatives. This aims at people who do not wish to live in an apartment, but look for an individual house, also people who want to keep in close contact with the nature but remain near to the urban context.

THEORY

Inspired by Hagbert's statement, that there is a need for solutions that explore new ways of residing, this thesis participates in a discussion on what we, as consumers can do to reduce our impact. This project is based on the theory of voluntary simplicity (Elgin 2010), suggesting that we could enjoy a better life if we turned away from materialistic possessions and focused on other values in life. Consuming less not only brings environmental benefits, but can also improve our psychological health, as constant chase for new goods and insatiable greed for more things, is never satisfied and can be mentally damaging. In response, this project tries to shift the values towards connection to nature, relationship to family and sense of belonging to the community in hope to bring a feeling of content.

SITE

ABOUT THE SITE

The important elements of selected site in Frolunda:

- + *Close to the city centre*
- + *Close to nature*
- + *Designated for residential development*
- + *Potential for low rise development*

Municipality requirements:

- + *Preliminary number of dwellings: about 70 homes*
- + *Type of housing: apartment buildings and row houses*
- + *Tenure: flats, property management, ownership*
- + *Materials: timber*

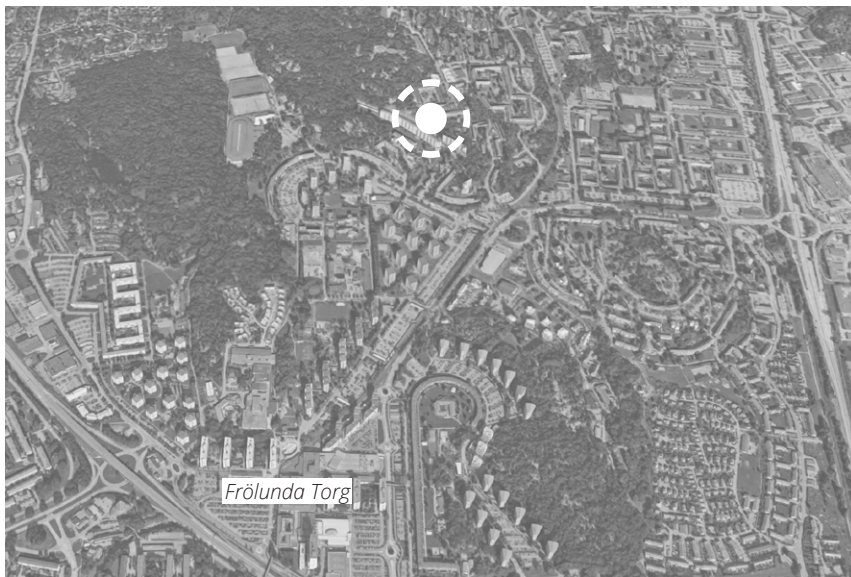
Site information:

<https://goteborg.se/wps/portal/start/byggande--lantmaterioch-planarbete/kommunens-planarbete/plan--och-byggprojekt>

LOCATION



Location in relation to Gothenburg centre



Location in relation to Frölunda Torg

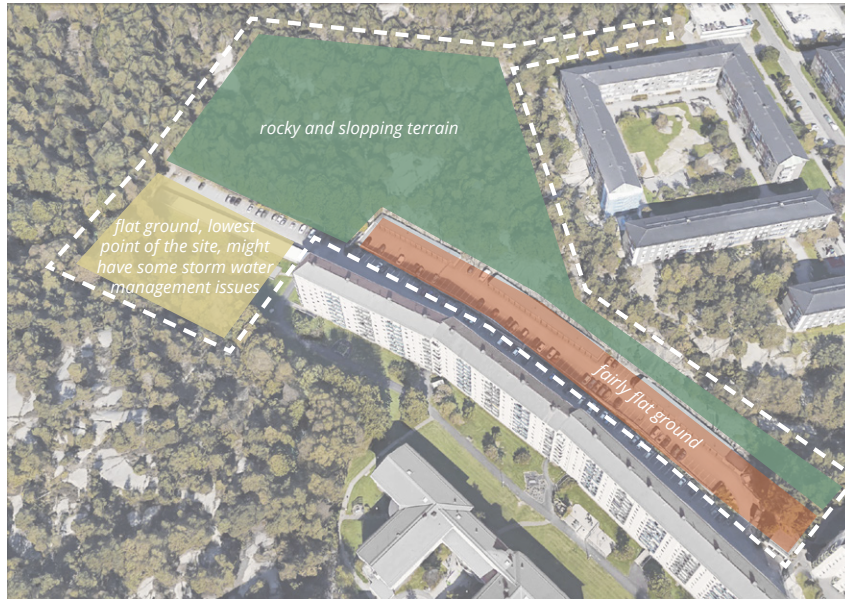
SITE ANALYSIS

During the site visits and also looking at terrain maps, three main site zones were established. These zones are based on landscape complexity, access and character. The further design proposal is heavily dependant on this arrangement.

Indicated green zone is the most slopped part with a challenging 20 meter drop, it is untouched by human activity and mainly covered by vegetation. The orange zone has been flattened out to allow for car parking and has a steep rocky edge to the north boundary. The yellow part is naturally flat, grassy area, seemingly to be used for recreation of local residents.

The narrow top right part of the site boundary extends with an intention to connect to Tenorgatan which will create main access point to the slopping part of the site. To the south, access is maintained via Basungatan. One of the challenges is a close proximity to the existing 8 storey residential block to the south, which will clearly cast shadow during the darker seasons. On the other hand, the slope is facing south which creates a brilliant opportunity for terraced development. The lower green area is containing hiking routes and paths which adds a lot of value to the neighbourhood.

SITE ANALYSIS



Zones



Challenges & opportunities

SITE VISIT

1



Site access seems to be one of the problems

2



Complicated terrain takes up a big part of the site

3



Car park boundary

4



Steep rocky edge

5



Existing garages

6



Plain and monotonous façades of the neighbouring buildings

7



View along Basungatan

8



Hiking route

9



Bowls play area

10



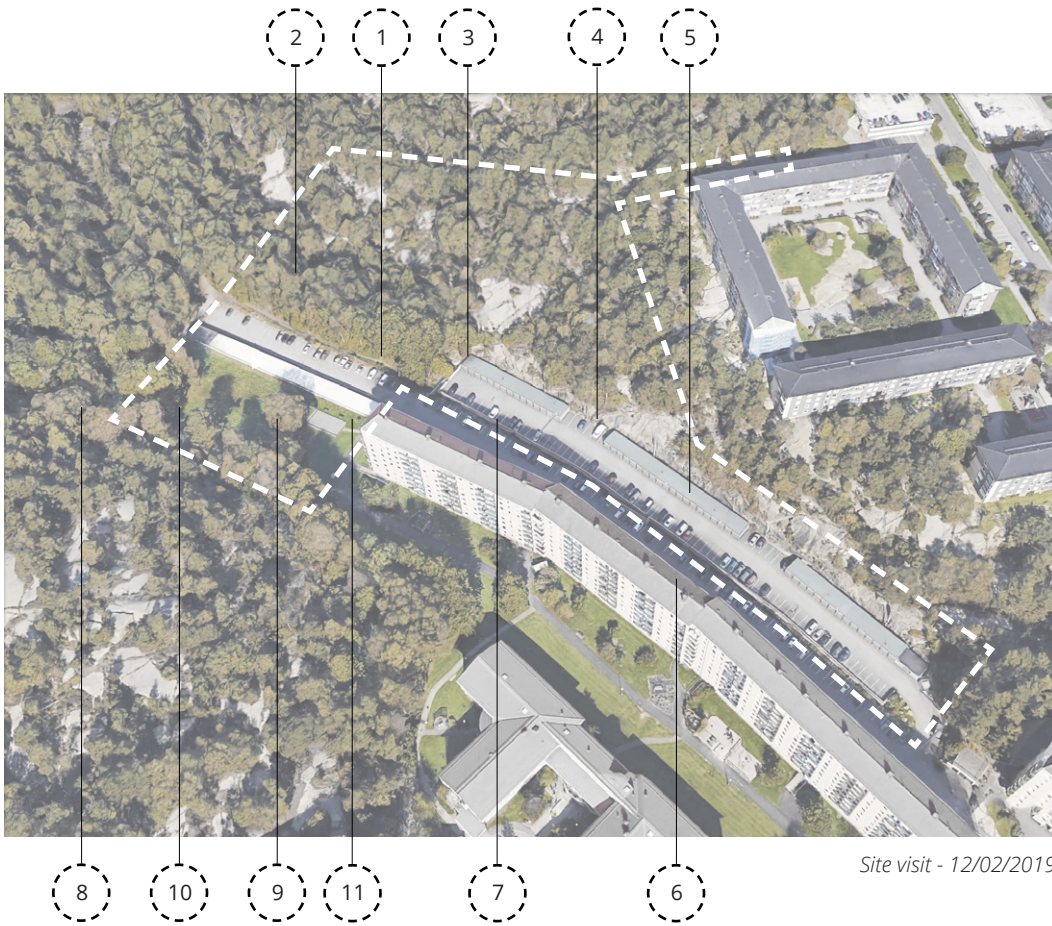
Storm-water treatment seems to be one of the challenges

11



Shared outdoor area, with seating and a fireplace

SITE VISIT



REFERENCES

REFERENCES

In parallel to the site analysis and early design development, learning from existing reference projects has been vital to this thesis. Amongst numerous references and useful examples, three key projects have been selected and analysed in more depth. Each of the examples are located in Gotheburg which allowed me to visit all of them which was very inspiring and useful and influential in further decision making.

Along the three site visits I have also analysed and learned from house catalogues such as A-Hus, Myresjöhus and The House company. I also had an opportunity to visit local Husknuten to better understand Swedish pre-fabricated house qualities as well as to speak to the staff members to find out what potential home owners are interested in when looking to buy a house.

REFERENCES



Study visit - 06/03/2019

Pauli Backe Terrasserat Småhusområde by Gunnar Werner (White Arkitekter)

Completed: 1978

Units: 47

- First area of this kind built in Gothenburg
- 4 Types of houses, variations from 3 to 7 bedroom
- Each house has a terrace or balcony with views
- Original idea of using neighbours roof as terrace could not be implemented
- Level differences between roads - 7 meters (total ~ 20 meters)
- Bohus brickwork (color relate to surrounding rock)
- White joinery

Information source:

Arkitektur magazine (1979, September)

REFERENCES



Study visit - 12/02/2019
Äppelträdgården Estate (White Arkitekter)

Completed: 2011
Units: 75

- Client: KB Skolmössan (FO Peterson & Söner Byggnads AB and White Arkitekter)
- Environmental certification: Miljöbyggnad Silver
- Awards: Bostadspriset 2011

Information source:
<https://whitearkitekter.com/project/appeltradgarden-estate/>

REFERENCES

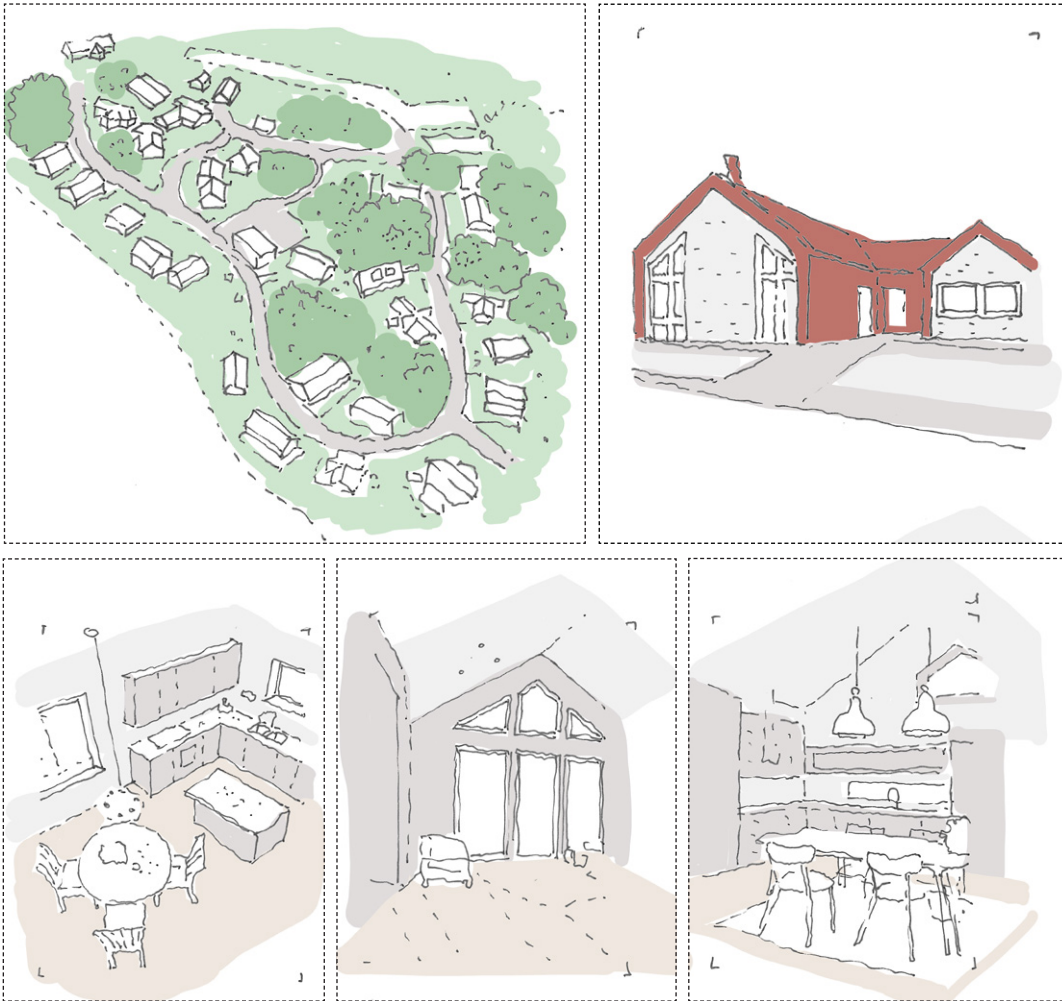


Study visit - 12/02/2019
SLOTTSBERGET (KUB Arkitekter)

Year of construction: 2010-2016
Client: Riksbyggen Göteborg
Size: 140 apartments

Information source:
<http://kub-arkitekter.se/slottsberget-vastra-frolunda/>

REFERENCES



Study visit - 07/04/2019
Husknuten - catalogue house exhibition

During the visit at Husknuten, I had an opportunity to visit more than ten catalogue houses and speak to the sales people about what qualities are important. It was really useful to walk around the houses, look at the floor layouts and experience the space.

REFERENCES

Villa - Vinga (A - Hus)
- most sold villa

Perhaps awkward having to cross living room in order to get to bedroom



Maybe utility space could be closer to kitchen / entrance

Husfakta.
Hustyp 1-plan
Antal rum 5 rum och kök
Antal sovrum 4
Boyta 140 kvm
Byggarea 157 kvm
Bygghöjd 3,2 m
Nockhöjd 5,1 m

Large windows



Double-height space



Generous terrace

Villa - Sjötorp (A - Hus)

Not so functional space



Husfakta.
Hustyp 1,5-plan
Antal rum 5 rum och kök
Antal sovrum 4
Boyta 118 kvm
Byggarea 133 kvm
Bygghöjd 3,2 m
Nockhöjd 5,5 m

Not so many openings might result in a dark living room

Villa - Solbacka (A - Hus)

Very big living space



Husfakta.
Hustyp 1,5-plan
Antal rum 6 rum och kök
Antal sovrum 4
Boyta 156 kvm
Byggarea 91 kvm
Överplan 65 kvm
Bygghöjd 3,6 m (kupa 6,0 m)
Nockhöjd 7,8 m

A lot of bedrooms

Villa - Aspudden (A - Hus)



Husfakta.
Hustyp 1,5-plan
Antal rum 5 rum och kök
Antal sovrum 4
Boyta 117 kvm
Byggarea 133 kvm
Bygghöjd 3,2 m
Nockhöjd 5,4 m

Not a very functional room

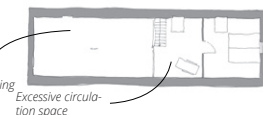
Barn House (The House Company)

Well used under-stair space



Husfakta.
Hustyp 1,5-plan
Antal rum 5
Antal sovrum 3
Boyta 139 kvm
Byggarea 158 kvm

Double - height space is an exciting feature



Excessive circulation space



Accent (Myresjöhus)

Excessive circulation space



Husfakta.
Hustyp 1,5-plan
Antal rum 6
Antal sovrum 5
Boyta 165 kvm
Byggarea 112 kvm



House catalogue analysis

In order to better understand the design principles of catalogue houses, I have investigated a selection of floor plans. The goal of this exercise wasn't to criticise or improve the designs, but more to learn from it and look for opportunities where the space could be rearranged to reduce the size of the home while still maintaining the signature qualities of the villa. The comments made were also influenced by the findings at RIBA study "Case for Space" (Roberts-Hughes, 2011).

Information source:
<https://www.a-hus.se>
<https://www.hus.se>

REFERENCES

Reflection on catalogue-houses:

After visiting the catalogue-houses and investigating the plans in more detail, a number of observations were made. Overall, the Swedish catalogue-houses are already pretty well sized, however some reductions could be made.

First of all, there are cases where circulation spaces are unnecessarily large and could be made smaller while still maintaining the functionality. Secondly, some houses have a secondary living space for children, which can become quite a luxury and perhaps could be compromised and rearranged. And finally, the areas of living, dining and kitchen could be brought closer together in order to reduce space even further.

The qualities that I learned to be important were tall living space, which would fill the room with light and bring the family together. Also it seemed to be important, how the living space connects to the garden and the terrace. The last feature that also took on board, is the distinct character of the gable roofs and that is something that could keep the feeling of a traditional villa and connect it to more updated architectural elements.

A challenging aspect of catalogue houses is that they are not designed to meet a particular site conditions individually. This has proved to be a difficult task in my proposal as well, however I experimented with different solutions to help houses adapt to terrain more, which can be seen in further pages regrading "Garden Situations".

PROPOSAL

PROPOSAL

The proposal consists of 74 individual homes laid out in semi-detached arrangement. 74 houses divide into 4 main house typologies that are adapt on terrain and orientation situations. Types 1A, 1B, 2 and 3 are located on the sloping part of the site, while the smallest type 4 lines along the rocky edge to the west of the plot.

The neighbourhood is mainly accessed from the Tenorgatan and branches out into two cul-de-sac type of streets. The two streets are then inter-connected by stepped paths to allow short-cuts to the hiking routes and recreation areas. Type 4 houses are sharing the existing access from the Basungatan.

The proposed layout is a result of efforts to adapt to the nature of the terrain, minimizing the need to blast the rocks and instead maintain as much of the hill character as possible.

SITE LAYOUT

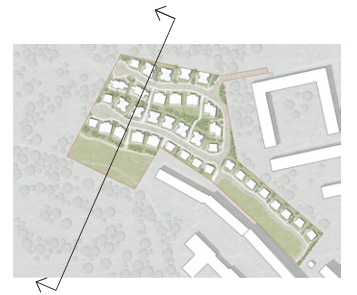


Proposed site layout

scale 1:5000



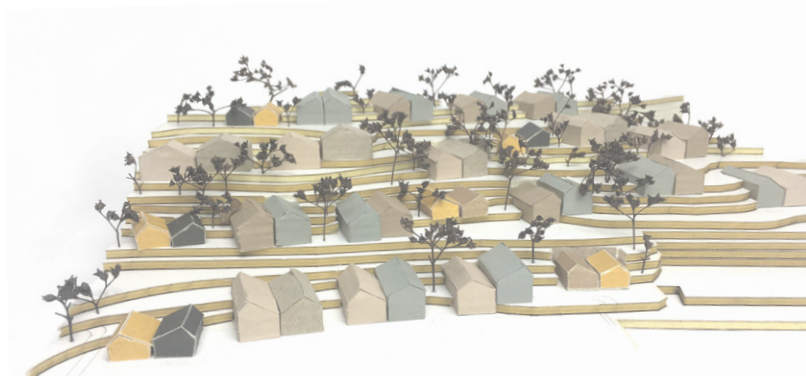
SECTION - I



SECTION - II

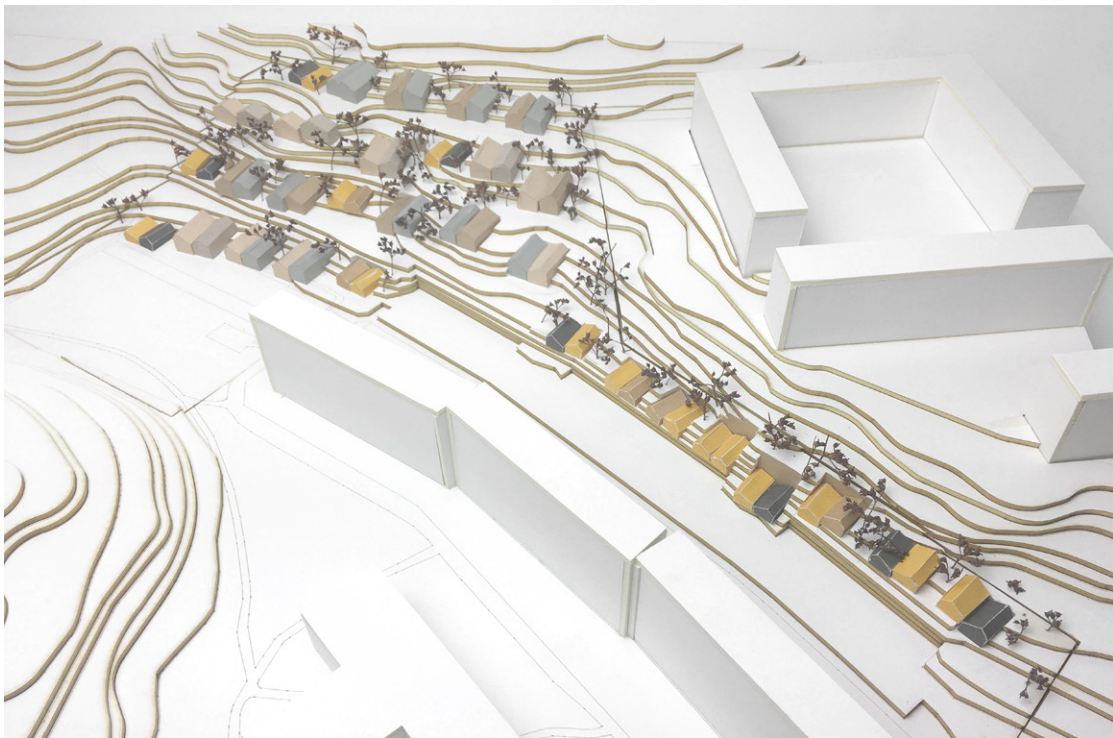


SITE MODEL



Due to the terrain complexity, the houses sit in varying positions which gives the neighbourhood a playful character. Also the height difference at each terrace allows to overlook the neighbour, so even though the proposal is high in density of dwellings, each home can enjoy plenty of sunlight and unobstructed views.

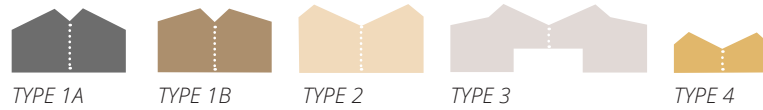
SITE MODEL



Physical model

Model scale 1:500

HOUSE TYPES



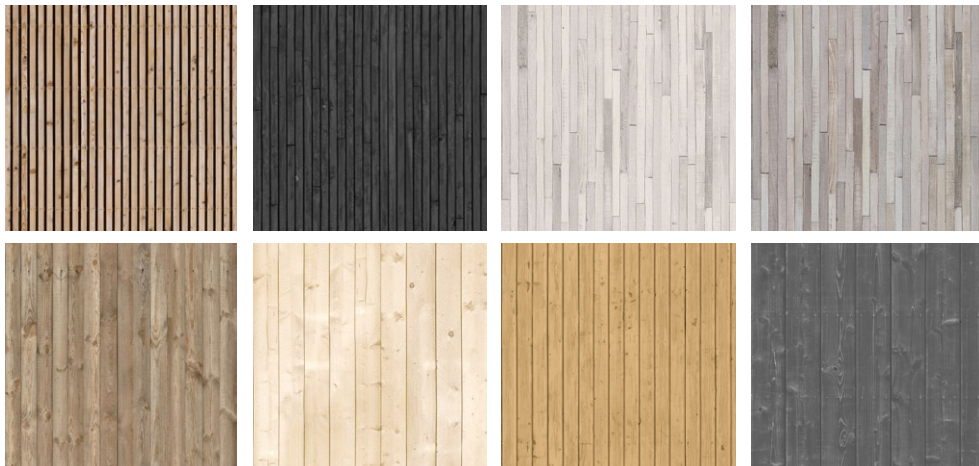
Four main typologies are all sharing some common features in order to create feeling of consistency throughout the neighbourhood. One of that features is similar proportion gable roofs that gives the houses a recognisable identity.

HOUSE TYPES



Typology distribution across the site

MATERIALS



Second distinct feature of the proposal is vertical timber cladding. Timber as a dominant material has been one of the initial requirements from the municipality. The reason behind such a wide range of different types of timber is to allow the use of recycled cladding materials. Having a variation of material makes it simpler to source cladding timber and also gives a more dynamic character to the whole neighbourhood.

MATERIALS



Facade material combinations

GARDENS

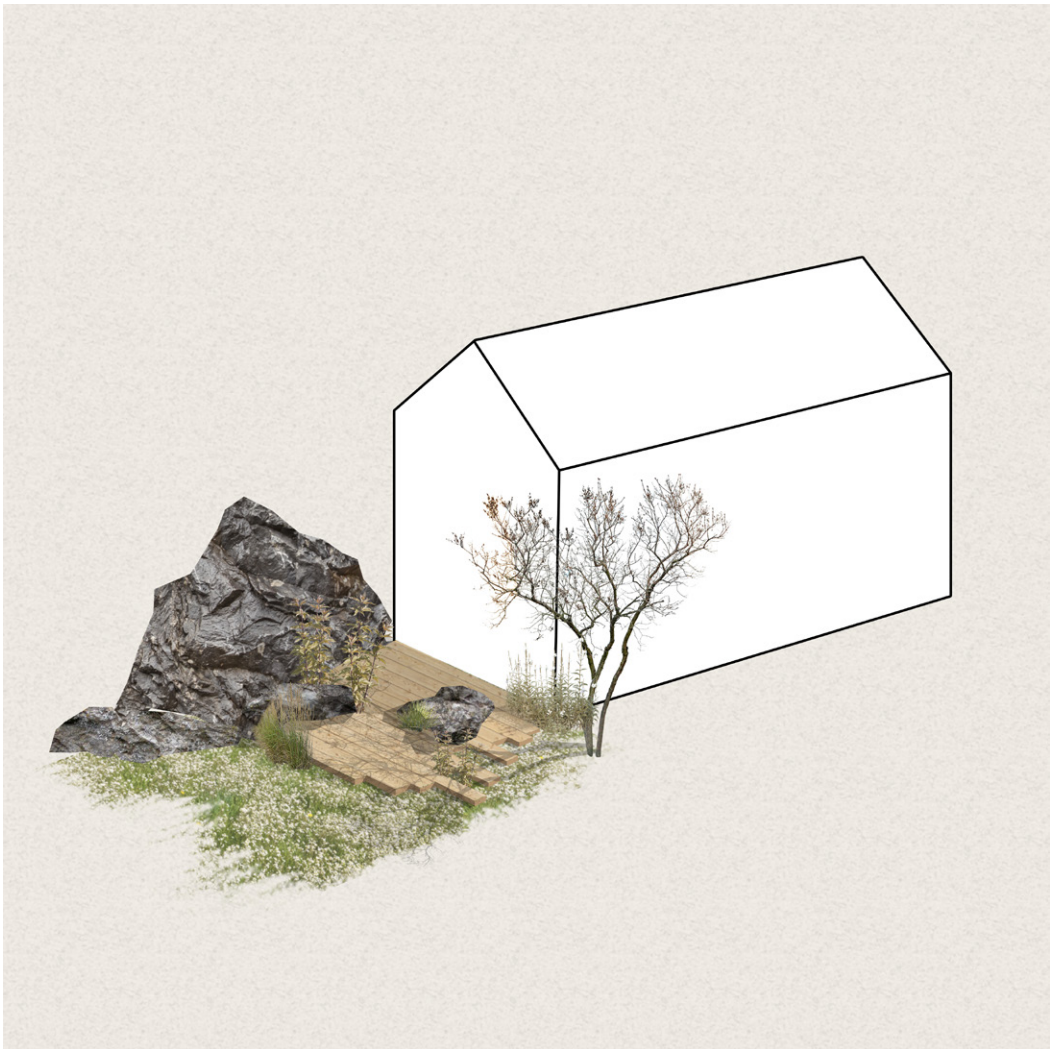
Third feature quality of the neighbourhood could be described as garden situations. Each house type due to its particular adaptation to the terrain has different garden category. Each garden category has a different character and qualities.

First garden type is a open terrace. Its distinct feature is timber decking that extends into the nature without a restrictive border.

Second situation is a secluded patio garden. This type situates against the rocky edge that can be shaped into stepped flower beds.

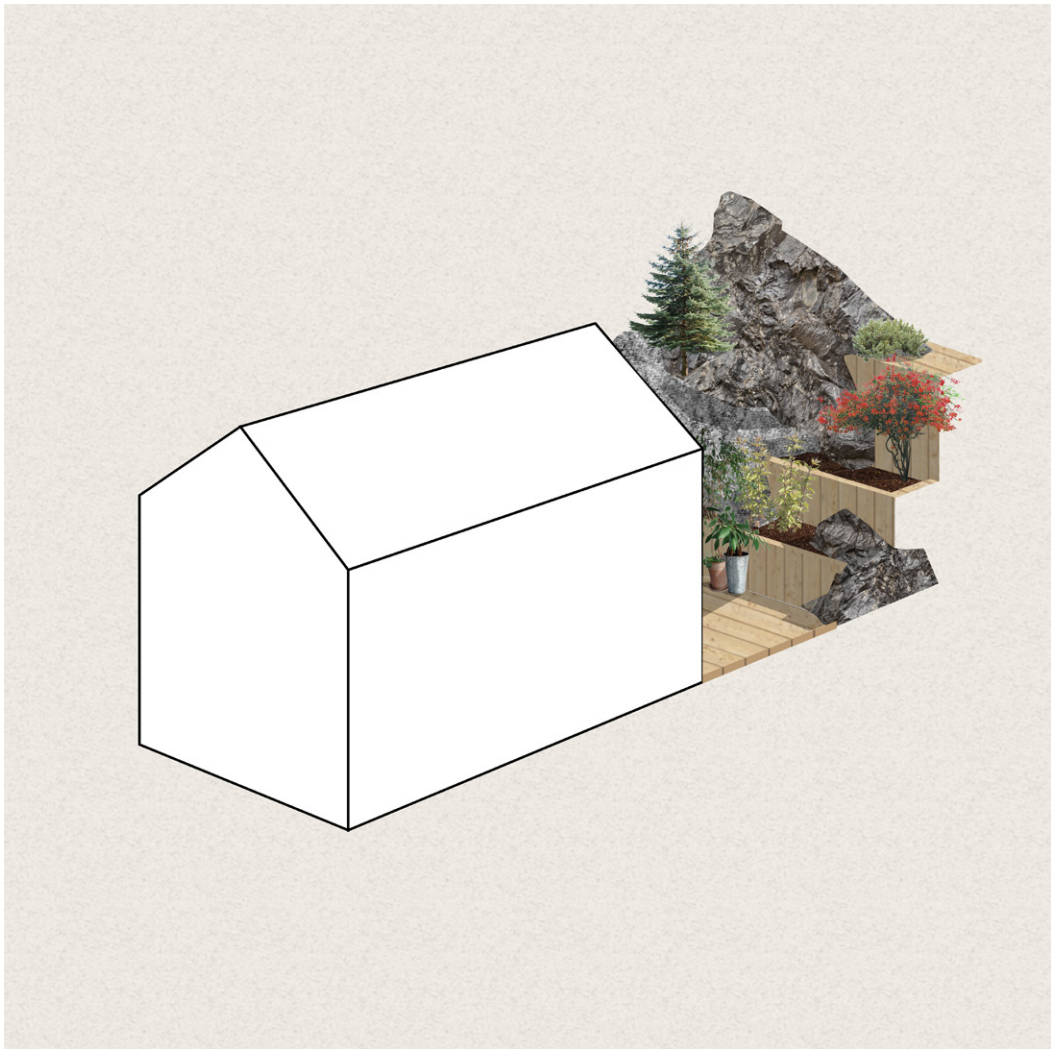
The third category is multi-leveled terrace. Utilising the natural rock, the garden splits onto different levels, allowing playful landscape arrangements.

GARDENS



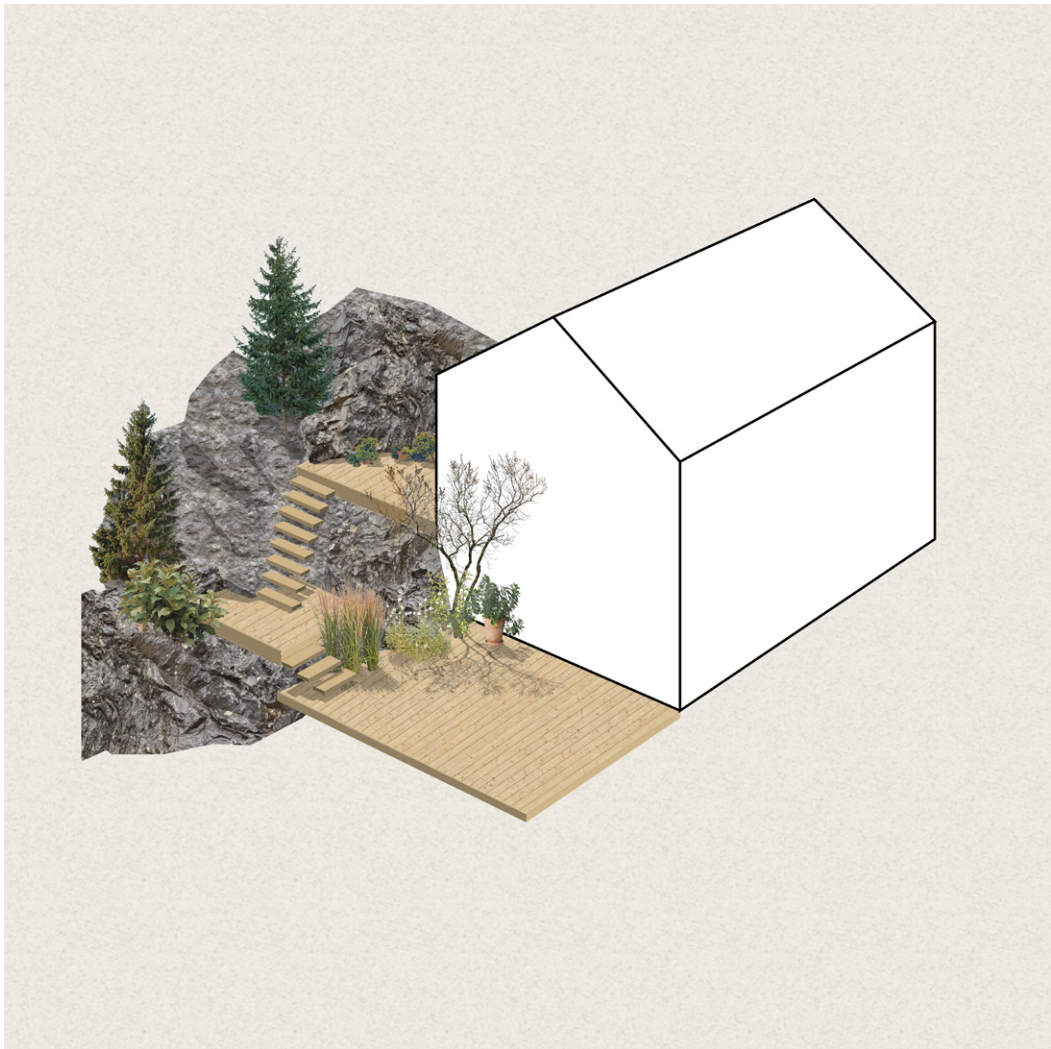
Garden situation I - open terrace

GARDENS



Garden situation II - secluded patio garden

GARDENS



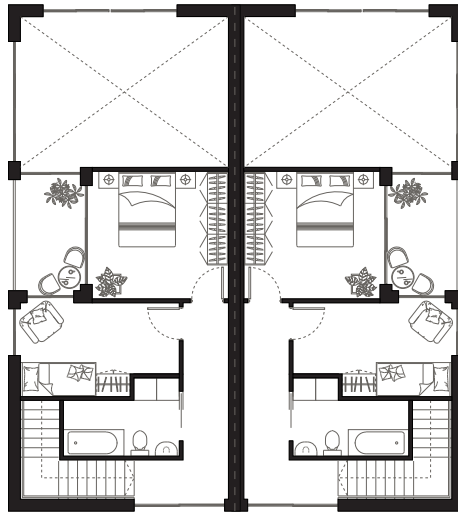
Garden situation III - multi - level terrace

ELEVATIONS / TYPE 1A

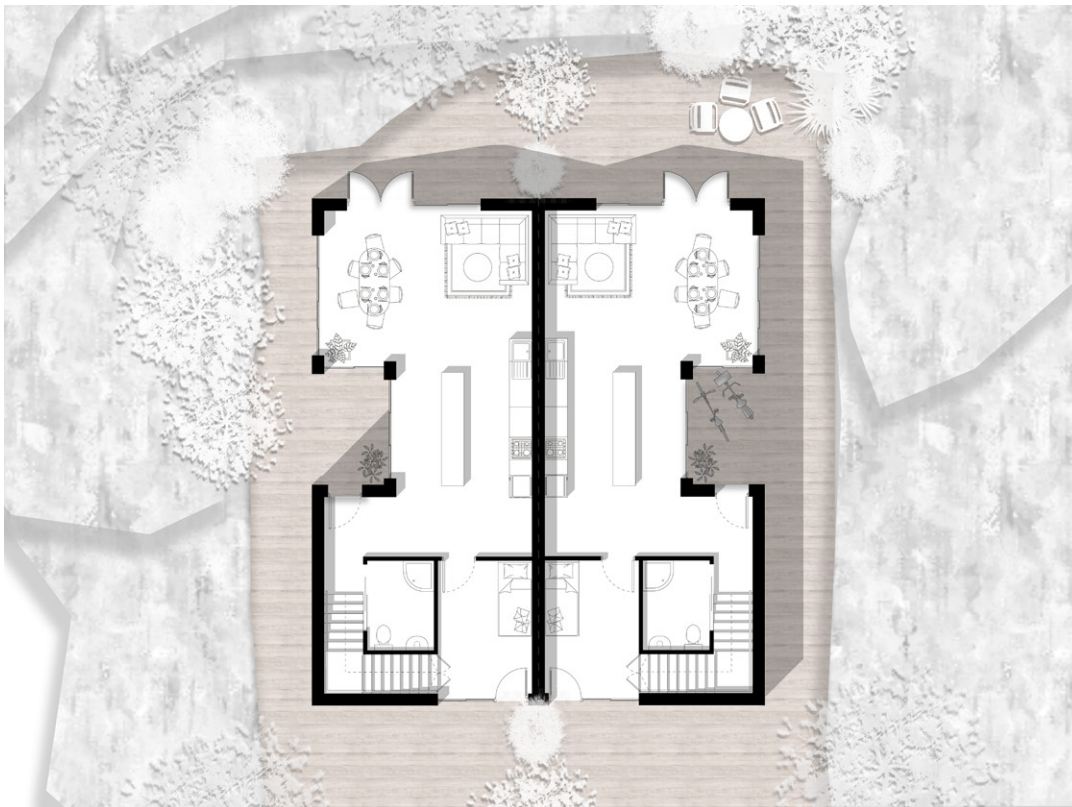


Front elevation - Type 1A

PLANS / TYPE IA



Upper floor- Type IA - 40m²



Lower floor- Type IA - 63m²

Total GIA: 103m²

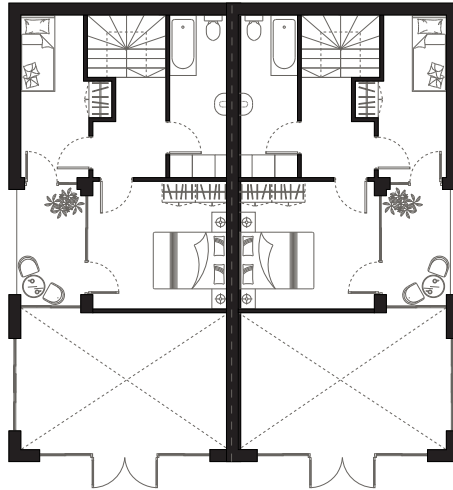
Scale 1:200

ELEVATIONS / TYPE 1B



Front elevation - Type 1B

PLANS / TYPE IB



Upper floor- Type IB - 36m²



Lower floor- Type IB - 55m²

Total GIA: 91m²

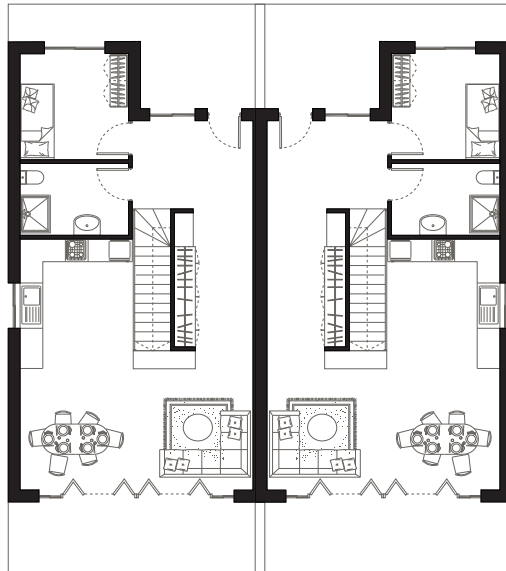
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ELEVATIONS / TYPE II

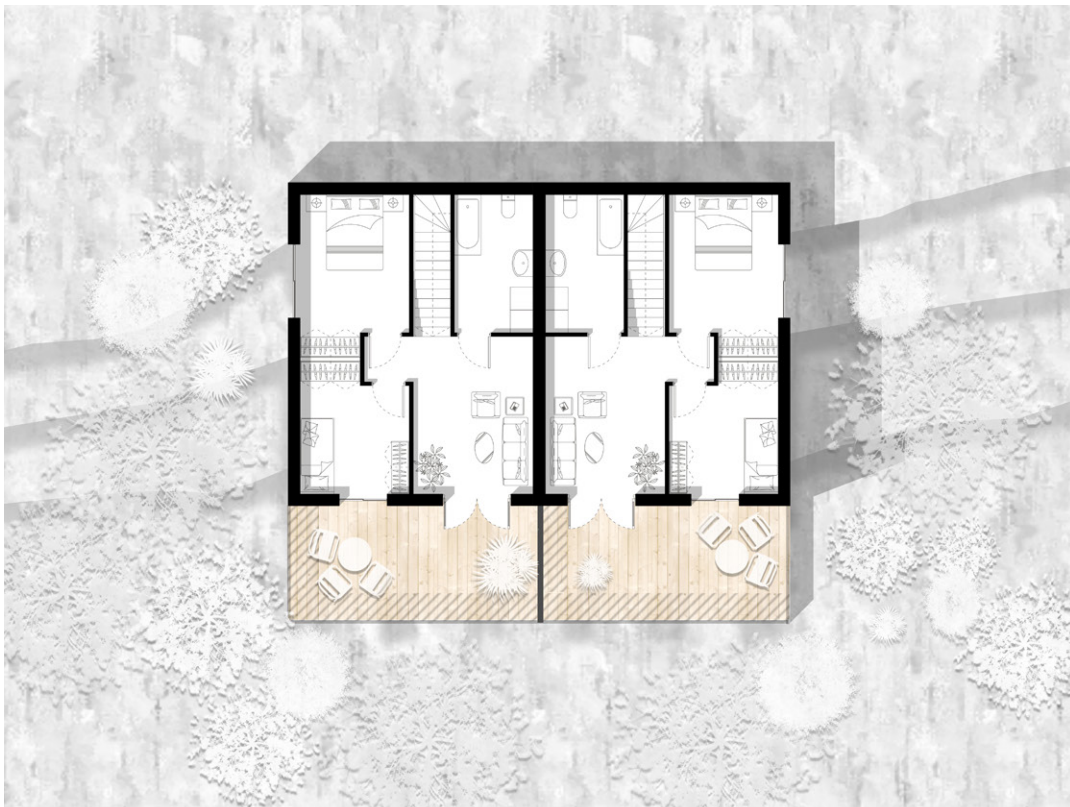


Front elevation - Type II

PLANS / TYPE II



Upper floor- Type II - 65m²



Lower floor- Type II - 48m²

Total GIA: 113m²

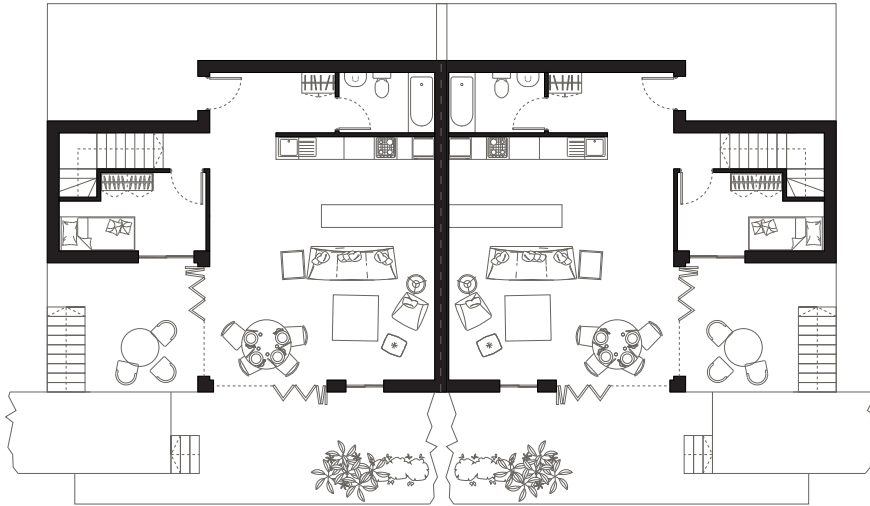
Scale 1:200

ELEVATIONS / TYPE III



Front elevation - Type III

PLANS / TYPE III



Upper floor- Type III - 41m²



Lower floor- Type III - 60m²

Total GIA: 101m²

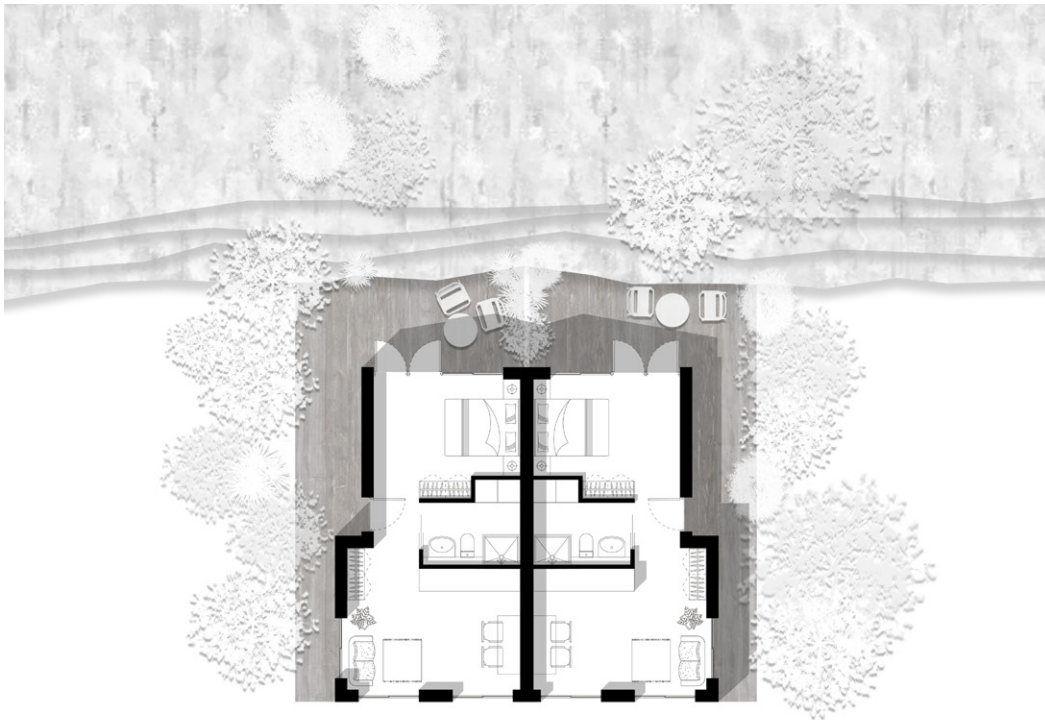
Scale 1:200

ELEVATIONS / TYPE IV



Front elevation - Type IV

PLANS / TYPE IV



Floor layout - Type IV

Total GIA: 34m²

Scale 1:200

ILLUSTRATIONS



View from the kitchen towards living space

ILLUSTRATIONS



Exterior view towards the entrance

CONCLUSION

This project has started with an intention to bring awareness to the environment and how the way we live affects it. My goal was to look beyond the technology approaches and instead, search for solutions that would inspire to change and lower our living impact. Reducing the building footprint, has led me to exploring what other qualities are there to keep, apart from the number of square meters that the value of a home is usually measured with. As a result, the qualities that I focused on were closeness to nature, identity of the neighbourhood and spacial character of the living spaces. I hope that this thesis contributes to the field of architecture by expanding the discussion on sustainable design and low-impact living through illustrating its philosophy with tangible design solutions.



Physical model, scale 1:50

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2019, spring