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## MASTER'S THESIS

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How can neighborhood quality be achieved through a focus on recreational areas for the entire community?

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**Master thesis 2021 - 30 credits**

Department of Safety, Economics and Planning at the University of Stavanger.

**How can Neighborhood Quality be Achieved through a focus on Recreational areas for the entire Community?**

Neighborhood development from a resident quality perspective.

Case study of a regulated area in Kristiansand, Norway. The thesis is conducted in collaboration with COWI Kristiansand.

Hilde Skadal & Siri Sait Eppeland

Master of Science in City and Regional Planning



Master thesis, spring 2021

Department of Safety, Economics and Planning at  
the University of Stavanger.

**Title:** How can Neighborhood Quality be Achieved  
through a focus on Recreational areas for the  
entire Community?

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# ABSTRACT

In this thesis the basis has been on the guidelines presented by Jan Gehl, Poortinga and a questionnaire for the municipality of Kristiansand. Based on these guidelines, recreational areas can have a positive effect on neighborhood quality if they are planned correctly. Jan Gehl presents a 12 quality criteria list with topics within protection, comfort and enjoyment, working as a “checklist” for a quality neighborhood. From Poortinga the most important features presented are the feeling of attachment and satisfaction, green areas and quiet spaces. As well as absence of graffiti, vandalism and litter. This is also evident from a questionnaire conducted in Kristiansand where the case study is located. The questionnaire maps out the population’s housing preferences and gives an impression of what direction Kristiansand municipality should develop into. Here the most important factors for choosing a resident were noise/pollution and the proximity to nature and sea.

From these criterias the recreational areas hold a big factor. The feeling of attachment will be present by the recreational areas bringing all people together, not just kids and their parents. To show how this can be done the case study presents a proposal with an overall concept for the area, as well as 11 different recreational areas. These areas all have unique elements, making sure there is something for everyone, as well as being universally designed and features to create an inclusive neighborhood. The proposal includes a number of recreational areas that are targeted for people of all ages. There are areas meant to be used by the adult residents where they have good possibilities for randomly meeting and getting in contact with other residents. By providing recreational areas with different qualities residents can find something fitting their preferences and meet others with the same passions. This can lead to more conversations between residents and the wish to form a stronger community.

# P R E F A C E

This master thesis is compiled for “Master of Science in City and Regional Planning” under the Department of Safety, Economics and Planning at the University of Stavanger. The thesis makes up the subject BYGMAS-1 and accounts for 30 credits

The subject for the thesis is neighborhood qualities relationship to recreational areas. The motivation behind the thesis came from working with the COWI office in Kristiansand on one of their housing projects and seeing how they implemented measures to ensure quality of living in their projects. One of the projects will be used as an example in the thesis to show how we think the potential can be better utilised. Our supervisor during the project has been Ana Llopis Alvarez from the University of Stavanger. Mariann Skei Fossheim and Arild Dahl, project managers from COWI Kristiansand has worked as external supervisors.

We would like to thank Ana Llopis Alvares, Mariann Skei Fossheim and Arild Dahl as well as Marita Helland, Sandra Sait Eppeland and Eivind Knutsen for reading and commenting.

Stavanger, June 2021

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**RESEARCH QUESTION  
& OBJECTIVE**

“ How can neighborhood quality be achieved through a focus on recreational areas for the entire community? ”

This paper will focus on how to create neighborhood quality. The main focus within this will be recreational areas and a sense of community. The basis for the literature review is two theories on neighborhood quality by Jan Gehl and Wouter Poortinga. Further it will go into a case study with an analysis focusing on guidelines and spatial qualities. The thesis will result in a proposal focusing on the qualities presented in the literature review.

The case study will be an ongoing project in Kristiansand, Norway. The project is part of Drangsvanns 23 regulated areas, Cb1 and Cb2. The project is being developed by the consultant company COWI with the guidance and provisions of Kristiansand municipality.

# **BACKGROUND**

CHAPTER 1



Statistisk sentralbyrå [SSB] predictions state that Norway will by 2060 pass the mark of 6 million people as seen in Figure 1.1. A rise from 5.4 million in 2020 (Statistisk sentralbyrå [SSB], 2020). Given that these predictions come true, the added population will put pressure on the existing housing market. To accommodate the population growth, new housing projects are necessary. When creating new housing projects it's important to create housing that not only accommodates the growth but also has aspects to ensure good living- and neighborhood quality.

The senior citizens are getting older and have a longer aspect of health on a level that makes them want to live in private housing at an older age. This creates a bigger demand for senior housing that the current situation can't accommodate. There are qualities missing in neighborhoods to make sure their needs and wants are taken care of. They also represent a part of the community that overall has a better financial situation than young people who might

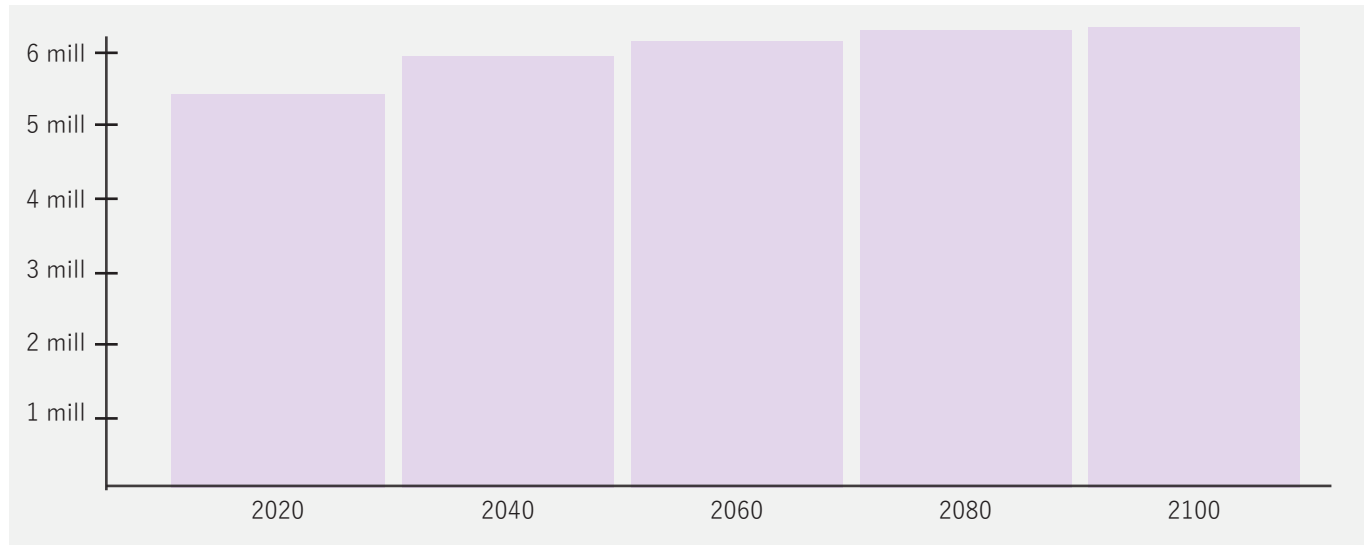


Figure 1.1: SSBs prediction of the population in Norway from 2020 -2100 (SSB, 2020).

struggle to finance their living situation in the establishment phase. This creates a need for neighborhoods to change if all people, in all stages of life, are going to have their needs accommodated (Akademikerne, 2020). Creating a neighborhood community is important and parks serve as the heart of peoples communities and should be a high priority for community planners. The importance of parks and recreation goes beyond the aesthetic benefits of green space. Residents and the local government all benefit from having a nearby park and play space. There are clear benefits when

looking at physical health, mental health, clearing the air, conserving wild areas and creating safe meeting places (Miracle, 2021). With this, the thesis will look at what gives a neighborhood quality, how recreational areas can contribute and what makes a community. The results will be a proposal for an existing neighborhood development in Kristiansand, Norway. The proposal does not include any economical aspects but is rather meant to show what is possible and what neighborhood planners should aspire to. The thesis is also limited by Norwegian laws and municipal guidelines. Further research is also presented at the end.



# **METHOD**

CHAPTER 2

## **2.0 METHOD**

- Validity and credibility
- Literature review
- Analysis
- Questionnaire
- Case study
- Proposal for the case study

The thesis consists of a mixed method. This chapter will give an understanding of the different methods used and to what extent. In addition, how the data has been gathered and analyzed. Figure 2.1 shows an overview of the methods which are used in this master thesis. The research question are mentioned below:

*How can neighborhood quality be achieved through a focus on recreational areas for the entire community?*

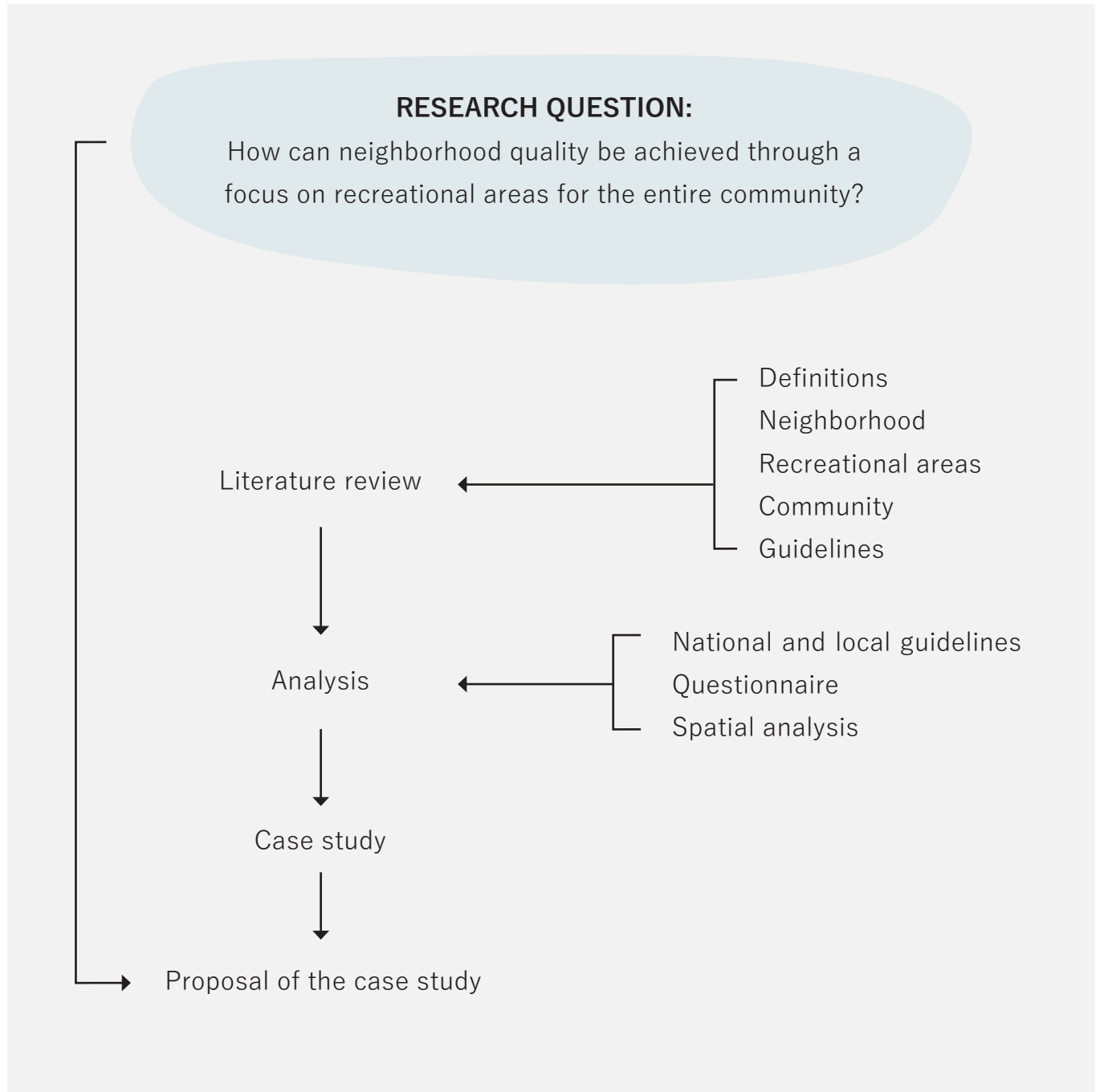


Figure 2.1: Overview of the methods used in this thesis (Self-produced).

## 2.1 Validity and credibility

The validity and credibility has been taken into consideration in the method. The thesis is based on a mix method, this will contribute to the credibility and create the foundation for professional breadth (Grønmo, 2016). It is mostly primary data used, but some secondary when deemed needed. There is a mix of both quantitative and qualitative methods and data, with mostly the latter. Having a mix of qualitative and quantitative methods will give a combination of flexibility and a coherent understanding of the field (Cresswell, 2014, p.215-240, cited in Kaiser 2015). These two methods on collecting information are shown in Figure 2.2 as illustrations.

**Quantitative method** gathers measurable data that can be calculated (Kaiser, 2015, n.p). In addition, numbers of average and variances can be defined from the data collection (Befring, 2015, p. 131-160). The method covers data gatherings such as **surveys** and **questionnaires** for the case study. The result can be assembled in a

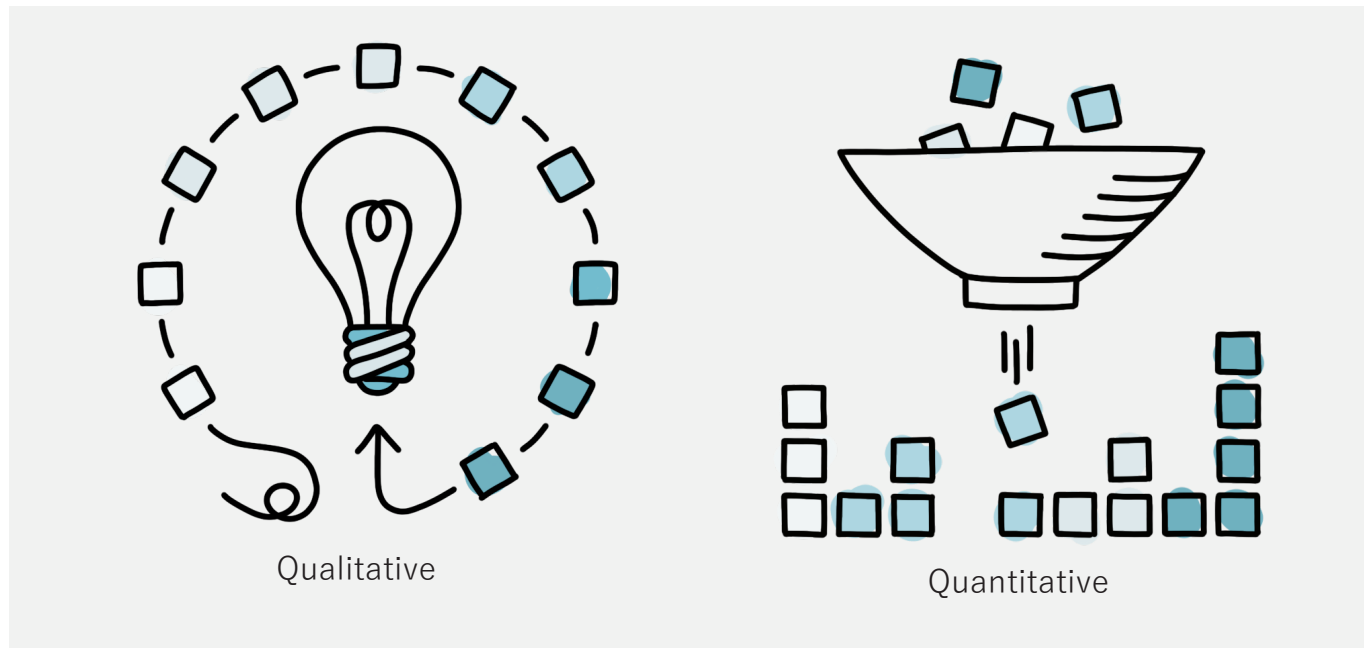


Figure 2.2: The difference between qualitative and quantitative methods. Self-produced based on (Optimal Workshop, 2021).

numerical form, and can be gathered further into illustrations such as graphs and tables.

To answer the research question it will be beneficial to use a **qualitative method**. This method will give data which is based on meanings, knowledge and problems in real life settings. Further it will give a coherent understanding of the results. It will be easier to make room for peculiar findings (Dalland, 2011, p.112). The qualitative methods used are **literature review**, **spatial analysis** and

the results in the **case study**. The result will be written text and can be analysed up against other qualitative findings and quantitative results.

## 2.2 Literature review

Analysing documents are often used for qualitative research (Thagaard, 2009, p.11). A literature review is used to strengthen our knowledge in the field and explore new information that can be useful. It will contribute to gathering critical information.

There have mostly been searches for norwegian articles, to make sure the data is valid in this climate, culture and political structure (Amsrud, 2018, p.18). Further, this master thesis has been looking at different fields, such as urban planning and architecture. A combination of these fields will give a consistent perspective on the development of urban planning and architectural aspects (Grønmo, 2016, p. 125).

### **2.3 Analysis**

Analysis of qualitative data will vary in how the data is understood. It will be important to be critical of the information presented and try to examine if it can be understood from other angles (Andersen, 2018, n.p).

The analysis for this master thesis looks at municipal guidelines, regulations for the planning areas and the regulations specific to the planning site. It also looks at a questionnaire. Lastly is a spatial analysis of today's situation plus a risk-and vulnerability analysis conducted by COWI Kristiansand is

implemented to show their findings.

### **2.4 Questionnaire**

Choosing questionnaires as a method will contribute to getting an overall understanding of the field instantly. This method will give quick access to the information we are looking for. (Børsting, 2021).

The questionnaire used in the thesis is conducted for Kristiansand municipality. The results were later gathered and published in a report. The questionnaire maps out the qualities the residents in Kristiansand appreciated and prioritised when buying a housing unit.

### **2.5 Case study**

The case study can be further explored after the foundation of the literature study and analysis has been gathered. This type of study should conclude with several "main variables" if the concepts are being used in other places (Widding, 2005, p.14-15).

The case study started with printing out

Cb1 and Cb2 out on A0 paper and the existing properties were outlined. Further, the proposal for properties were placed out in various combinations while looking at the guidelines for the area, results from the spatial analysis and the findings in the literature review. At the end of several changes the result is presented.

### **2.6 Proposal of case study**

It can be helpful to contribute with a proposal of the case study, if the project is scoped and has several guidelines. These limits are set when doing the literature review, analysis, case study, knowledge from the field and etc (Baxter & Jack, 2010).

The last method in the master thesis is the illustrations of the proposal. There were several maps and pictures developed to illustrate the ideas and possibilities for the area. These were made using digital programs, mainly Adobe Illustrator for 2D- and Lumion for 3D illustrations. The 3D illustrations from Lumion are meant as illustrations and may have smaller differences from the proposal.

# DEFINITIONS

## SINTEF/BYGGFORSK

“Selskapet for industriell og teknisk forskning ved Norges tekniske høgskole” (SINTEF) contribute for the development of housings and recreational areas. The institute cooperates with the biggest technical university in Norway which is called NTNU (SINTEF, 2021). SINTEF has gathered all their guidelines and research articles on their website “byggforskserien”. This site has guidelines on how to plan different subject areas, such as spatial planning, construction, uniformal design, water etc (Byggforskserien, 2021)

## TEK17

“Tekniske krav” (TEK17) has specific measures such as minimum requirements for buildings and outdoor areas. These must follow the requirements for getting legally approved in Norway. TEK17 references to Norwegian- and SINTEF standards (Direktoratet for byggkvalitet, 2017).

## LOVDATA

Lovdata contains of Norwegian laws, central and local guidelines etc. These are presented in detail on the website and always up to date (Lovdata, 2021).

# LITERATURE REVIEW

CHAPTER 3



### **3.0 LITERATURE REVIEW**

- 12 quality criterias

### **3.1 NEIGHBORHOOD**

- Neighborhood quality
- Densification
- Place identity
- Site analysis
- Terrain and vegetation
- Infrastructure
- Building structure
- Local climate
- **Guidelines**

### **3.2 RECREATIONAL AREAS**

- Play and meeting places
- Pollution
- Drain water
- Materials
- Activities and ages
- Location
- **Guidelines**

### **3.3 COMMUNITY**

- Social
- Voluntary work/maintenance
- **Guidelines**

This chapter is divided into three parts: neighborhood, recreation and community. The first part will delimit neighborhood qualities and densification to this thesis. As well as explain important factors for gathering a site analysis. The second part goes into outdoor recreational areas. Last part contains factors that make a neighborhood a community. There will be guidelines at the end of each chapter for further use in the proposal. Lastly the proposal will be compared to the 12 quality criterias as the main checklist for answering the research question.

## **12 quality criterias**

A well known architect and urban planner from Denmark named Jan Gehl has been researching urban cities in Denmark in decades and written the book “The new city life”. In the book he presents 12 quality criterias for urban cities (Gehl, J., Gemzøe, L., Kirknæs, S. & Søndergaard, B.S. 2006, p.107). Denmark has a similar northern climate as Norway, so these criterias will be relevant here as well and used throughout

this thesis. The criterias are mainly meant for areas close to the city center and/or in a 6 km distance, this could mean that the implementation to the neighborhood scope would lack or excess important qualities.

The criterias is illustrated in Figure 3.1 and is divided into three main categories; protection, comfort and enjoyment.

First category consists of feeling secure and having opportunities to relax without worrying about children playing near the road. In the evenings it will be important to feel safe with several light sources in the streets and the common areas. In addition, protection for weather, such as wind, rain, pollution etc.

Comfort is the second category and consists of 50% of the criterias. This contains how the buildings are placed with the present opportunities to walk without blockades, relax on benches and natural places to detain. Besides, creating that areas can be experienced as interesting elements to look

at, low sound level and places which are inviting for activities.

Enjoyment is the last category and contains aesthetic factors such as sunny places, warm areas, overall pleasing buildings and outdoor areas. Taking these factors into consideration will contribute to an attractive, high quality neighborhood (Jan Gehl, et al. 2006, p.107).

These characteristics will be used further in the master thesis for answering the research question.

## PROTECTION

### Protection against traffic & accidents

#### - feeling safe

- Protection for pedestrians and cyclists
- Eliminating fear of traffic
- Safe crossings

### Protection against crime & violence

#### - feeling secure

- Lively public realm
- Allow for passive surveillance
- Diversity of functions 24/7/365
- Well lighting in human scale

### Protection against unpleasant sensory experiences

- Wind/draft
- Rain/snow
- Cold/heat
- Pollution
- Dust, noise, glare

## COMFORT

### Opportunities to walk/cycle

- Room for walking
- Interesting facades
- No obstacles
- Good surfaces
- Accessibility for everyone

### Opportunities to stop & stay

- Attractive & functional edges
- Defined spots for staying
- Objects to lean against or stand next to
- Facades with good details that invite staying

### Opportunities to sit

- Defined zones for sitting
- Pleasant views, people watching
- Good mix of public and café seating
- Resting/waiting opportunities

### Opportunities to see

- Reasonable viewing distances
- Unhindered views
- Interesting views
- Easy orientation
- Lighting (when dark)

### Opportunities to talk & listen

- Low noise levels
- Public seating arrangements conducive to communicating, "talkscapes"

### Opportunities for play & exercise

- Allow for physical activity, exercise, play & street entertainment
- Temporary activities
- By day and night
- In summer and winter

## ENJOYMENT

### Dimensioned at human scale

- Dimensions of buildings & spaces in observance of the important human dimension in relation to senses, movements, size and behavior

### Opportunities to enjoy the positive aspects of climate

- Sun/shade
- Heat/coolness
- Shelter from wind/breeze

### Aesthetic qualities + positive sensory experience

- Good design and detailing
- Good materials
- Fine views/vistas
- Rich sensory experiences: trees, plants, water

Figure 3.1: The 12 qualities criteria presented in three different categories; protection, comfort and enjoyment. Self-produced based on (Gehl, 2021).

### 3.1 Neighborhood

This chapter will delimit the definition of neighborhood qualities and densification. In addition, how to plan a neighborhood that secures the place's identity and important factors in a site analysis.

#### 3.1.1 Neighborhood quality

To know what neighborhood quality is one needs to define what one includes as part of the neighborhood. In this thesis a neighborhood is divided into one social, one organizational structure and one material. Social is the interaction that happens within the areas mostly between residents, the material structure is defined with buildings, open spaces and transportation barriers and the organizational structure is defined by public institutions and organizations. From these criterias there can be defined a geographical area to the neighborhood with the house in the centre.

When defining what neighborhood quality entails, it is often combined with talking about living quality, so a distinction is

important. There is some debate about what the meaning of neighborhood quality and living quality, should entail. When using the term living quality most people view this as more in terms of qualities inside the house, or working at a place with a good working environment. Not as a term that includes their physical elements outside of their private space (Tjora, A., Henriksen, I. M., Fjærli, T. & Grønning, I. 2012, p. 16). In an article from 2016, Wouter Poortinga, a professor for environmental psychology, et al. state that a variation of studies show a link between neighborhood quality and the feeling of attachment and satisfaction. The article talks about a variety of studies and concludes that the quality is built on a range of physical environmental features that directly or indirectly predict place attachment. The most important features are the presence of green or quiet areas and absence of incivilities such as graffiti, vandalism or litter. People often attach to places that follow these guidelines with good reason; natural elements provide opportunities for mental restoration and recreation. With the absence

of incivilities, people feel safe and secure. Incivilities can also act as an indicator of a neighborhood that functions poorly and as a result triggers further disorder and criminal behavior. They also state that urban form features such as natural surveillability and physical and symbolic boundaries afford a feeling of safety and a space for social interactions (Wouter Poortinga et al., 2016). Gro Harlem Brundtland (previous prime minister of Norway) said in a speech in 1995 that having a "neighborhood quidnunc" is a sign that people in the neighborhood are caring about each other (Bergensavisen, 2009). SSB surveyed safety compared to neighborhoods. In areas outside cities people often felt safer than neighborhoods near the centre. This can indicate that people get to know more of their neighbors outside the cities and develop a community where people care for each other (Lima & Slagsvold, 2009). In this text the focus will be on the neighborhood as described and used as the "main term" throughout the paper. From this point of view the neighborhood quality is most important to

people are less resourceful who have few other options. For the more resourceful people the neighborhood quality will have less of an impact on their level of wellbeing, as they are more likely to seek out what they want or need outside of their immediate surroundings (Tjora et al, 2012, p. 16).

### **3.1.2 Densification**

The Norwegian government has presented densification as their preferred strategy where it is possible and can be done in a good way. (Miljøverndepartementet, 1996, p.3). The goal with this strategy is to go towards a sustainable solution. When using the areas within the city limits more efficiently the impact on the local and global environment will be limited due to the decrease in transportation needs, keeping the nature surrounding the city for recreational and biodiversity purposes and putting less pressure on repurposing agricultural areas for new building projects. They also present negative sides with densification as when the new areas are built with poor quality, inalienable natural values and recreational

spaces might be lost, reducing the quality of life and taking away what makes that place special and interesting. There is a lot of research around densification and the environmental benefits. When looking at reports on densification the main focus is how important and rewarding it can be rather than guidelines on how to do it and how to do it well. The topics also often show a bigger focus on technical measures like the use of public transportation, proximity to everyday needs and economic benefits. In a review by Pont, Perg, Haupt and Heyman they present that 41% of studies are transport related, 14% focusing on economics, 12% on social effect, 11% on human health and the rest is a mix of other topics. Studies on transportation and economics have positive correlations with higher density. On the other side of the scale ecology, social impact and health are mainly shown with negative correlations. Of the total reviewed research one third of the studies show a negative relation and 12% showed that density does not play a significant role. These results are under the UN habitat definition of densification with a

minimum of 150 inhabitants per hectare and are generic in studies in both North America, Asia and Europe (Pont, et al., 2020).

As this master thesis will focus on developing high quality neighborhoods focus on high density could be against the best interest of the neighborhood quality. Given the negative correlation with health and social effects. Therefore the density will rather be determined by regulations put in by the municipality, together with residents preferences.

### 3.1.3 Place identity

Place identity as a phenomenon has become more prominent on the agenda in site development processes in cities, towns, settlements and regions in recent years. “Cultural Heritage Act’s” definition of cultural heritage and cultural environments is presented in chapter 1, §2: “Cultural monuments mean all traces of human activity in our physical environment, including localities, beliefs or traditions. Cultural monuments is the area where cultural monuments are included as part of a larger whole or context” (Kulturminneloven, 1979, §.1-2). How places are perceived with qualities and characteristics gives a lot of attention to the place and is a part of creating a sense of “self-image” for the locals, and affects how attractive or interesting we view a place. There are four elements that are used to determine what defines an area’s place identity; “physical distinctiveness and spatial qualities”, “business and business structure”, “culture and history” and “local population and social life”. These classification can illustrate “place identity”

as a phenomenon and how it changes over time. (Foss/NIBR, 2010, p. 36-38). Cultural heritage can also influence what people view as the place’s identity.

### 3.1.4 Site analysis

“Site analysis is a systematization of knowledge to understand the history, situation and the future possibilities of a place”- Miljøverndepartementet (Miljøverndepartementet, 1993, p.3). The analysis builds on the knowledge of an area’s history and current situation. The purpose of doing a site analysis is to map out the area’s qualities and hopefully change the place for the better. Figure 3.2 shows how important it is to research the whole area. Most commonly the municipality will engage professionals in different disciplines and architects to complete the analysis and is the first step in the planning process. This analysis is a help for municipalities when they are in doubt of how the area should be develop, and to see if there are specific wishes by locals or planners that need to be considered to make sure the resources are

not wasted on unwanted elements. In some cases a site analysis can be mandatory if there are big renewals of municipal technical facilities. When renewing old towns it can also be relevant to make them as attractive as possible and reduce trade leaking out to surrounding areas (Byggforsk, 2020).

There are four main elements in a site analysis; historical development, nature and landscape, the organization of buildings and other singular elements. There can always be other elements added according to what the site entails, but these four should always be covered. The government created a guide on how to approach a site analysis in 1993 which is still being used today. This “guide” goes step by step on how to make decisions on who should do the analysis, the different topics that should be a part of it and how to use it (Miljøverndepartementet, 1993, 11).

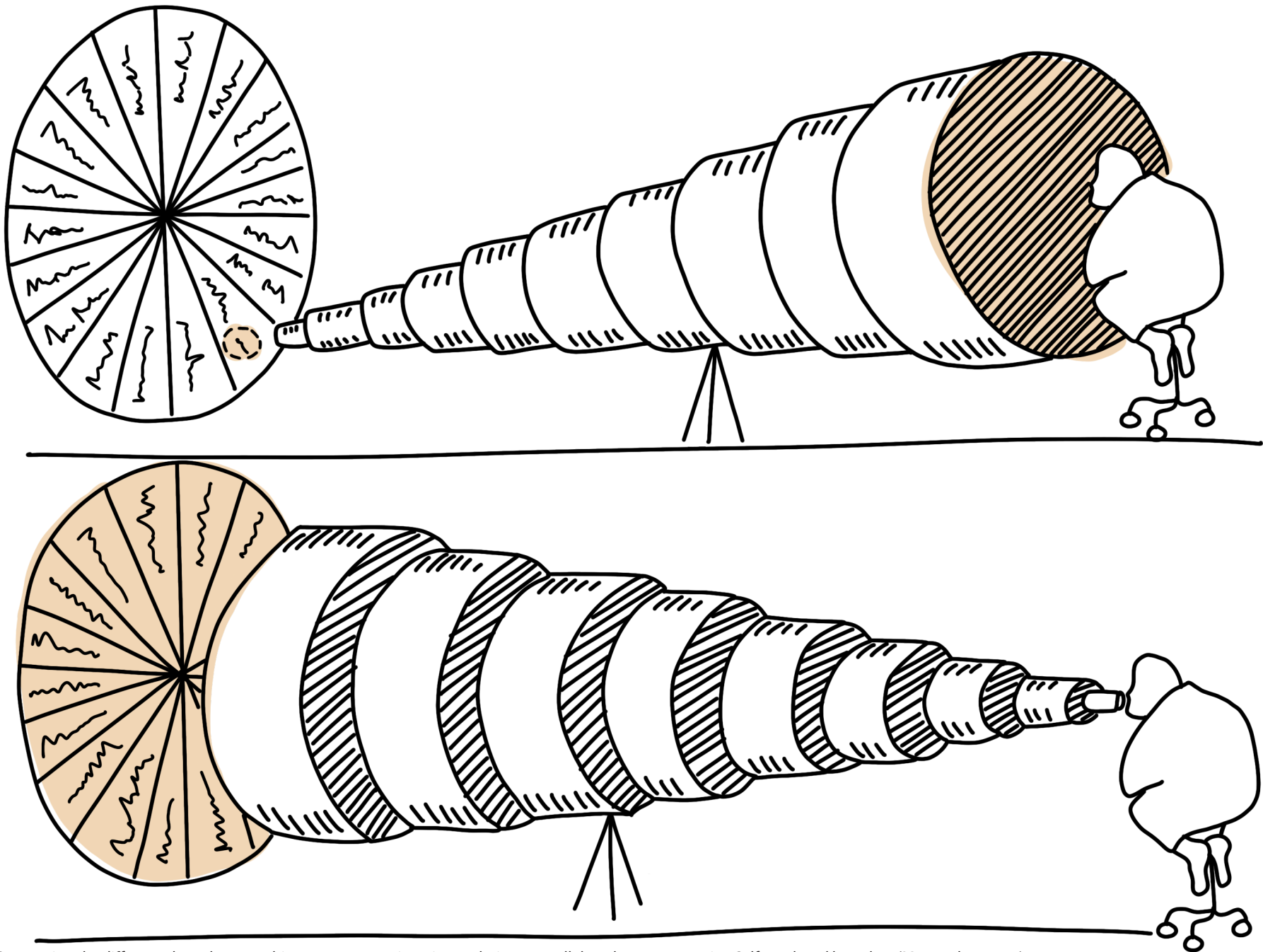


Figure 3.2: Contrasting the difference by only researching one category in a site analysis versus all the relevant categories. Self-produced based on (Masterplan, 2021).



### 3.1.5 Terrain and vegetation

In 1970 a new regulation in Norway for soil protection contributed to save important land use areas, gathered housings in smaller areas and created more suburban sprawls (Husbanken, 1987, p.58). Nature encroachment in new areas can contribute to new local climate changes such as stress situations, lower humidity or more wind. To avoid such problems, the terrain should be considered when planning (Dyring, 1986, p.22)

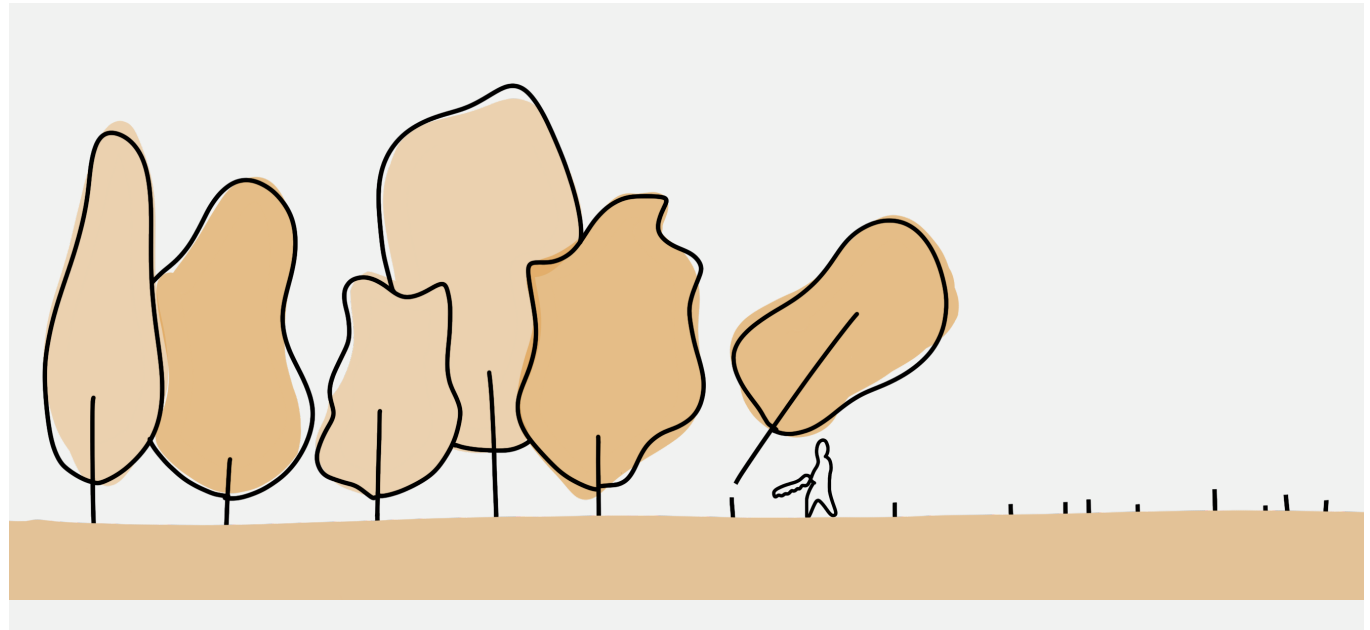


Figure 3.3: *The man is showing how easy it is to get rid of the vegetation and make the surroundings bare (Self-produced).*

“The Ministry of Climate and the Environment” encourages planners to make an overall plan with connections to green natural areas. Existing paths, playing areas and other recreational areas. This will contribute to making the spaces more accessible for people living nearby. The municipality has to preserve important areas to make sure they are being maintained and create a connection from these to other green parts. This will make a total plan for being aware of important land use areas (Miljødirektoratet, 2014, p.7). The planning

and building act has set green structure as a high priority along with categories such as infrastructure, transport and buildings. This will contribute to the plan for preserving the landscape while planning for roads and housings/buildings (Miljødirektoratet, 2014, p.3).

First step is to analyze the area and make an overview of the vegetation. Step two is to mark the important vegetation for different uses (Dyring, 1986, p.26). It takes only a few

weeks or days to get rid of vegetation and landscape, but it will take several decades to grow vegetation back to its original state. Worst case, it can take up to three to four generations (Dyring, 1986, p.12). Figure 3.3 shows how the vegetation easily disappears. If the terrain and landscape are taken into consideration, the local climate can be taken into account so the changes are minimal. Drain water can maintain its natural path. Different animal species and ecosystems can be preserved. Closeness to green areas



can contribute people to get more outside (Guttu, et al., , 1985, p.58).

The vegetation should be gathered to preserve a coherence (Bjørneboe, 2000, p.57). There are different methods to keep green areas in the neighborhood as seen in Figure 3.4. Firstly, keep the vegetation around the housings. Secondly, keep the vegetation between the buildings, or lastly have a combination of the two (Guttu, et al., 1985, p.64). By keeping the terrain and vegetation, it will contribute to better the living environment due to a variation

in look and feel in different areas. It can make distance between buildings in a neighborhood and divide the areas in a natural way (Guttu, et al., 1985, s.61). Good outside areas near your neighborhood can also increase the living conditions (Dyring, 1986, p.11).

Different features in the neighborhood can contribute to giving the area character. It can be features such as a river, a hill or good recreational areas. Main features will help people navigate and influence how they experience the place. Planners

can contribute to making such features by including it in the plans (Guttu, et al., 1983, p.4). Green areas for walking and enjoyment should not be smaller than 30 meters. Small areas should not consist of only oblong recreational spaces (Miljødirektoratet, 2014, p.24). It will be beneficial to avoid grey areas, such as parking spots and big areas with asphalt (Guttu, 2008, p.9). By using vegetation such as trees, it will give a visual feeling between grey areas and housings (Statens vegvesen, 2019, p.19)

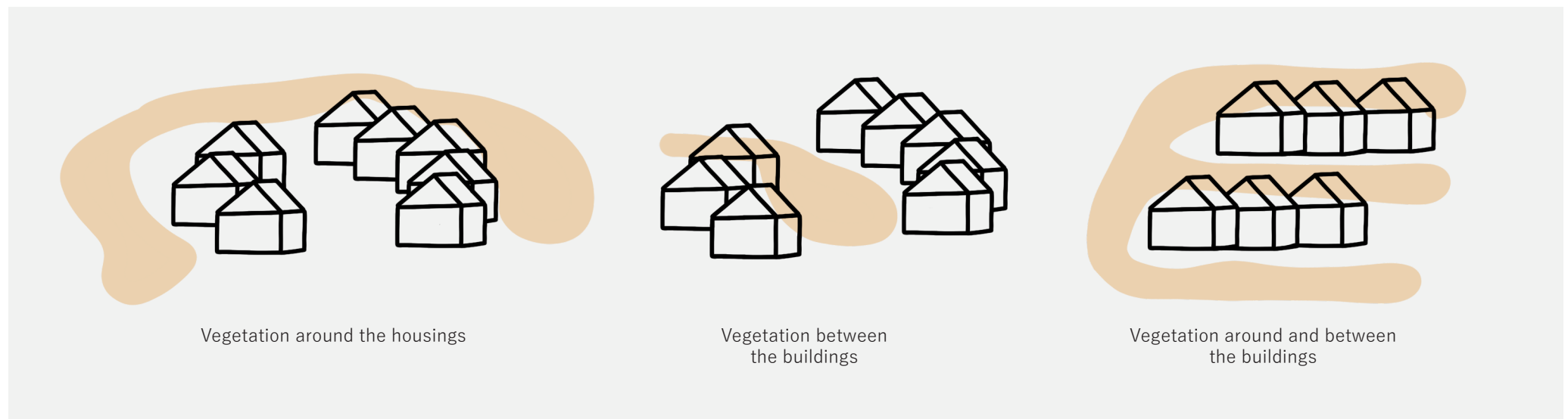


Figure 3.4: Three different ways to blend the vegetation and housings for a better living environment. Self-produced based on (Skjelbreid, Kvarme, 2019).

### 3.1.6 Infrastructure

This will give an overview of how to further develop the road network in a neighborhood and presents national guidelines provided by “The Norwegian Public Road Administration”

#### Car traffic

The Public Roads Administration has made a standard for the transport sector in Norway. “Håndbok 100” contains regulations for streets, main roads, solutions for soft passengers, public transport etc. The main

job for “Statens vegvesen” is to develop good solutions for the future which take pollution, nature, terrain and soft passengers into consideration (Statens vegvesen, 2020). The road hierarki can be divided into three categories as seen in Figure 3.5. The first consists of the main roads in Norway which gather the road network of region and local roads. Second category contains local roads which are divided into two categories; gathering roads and access roads. Gathering road is the road between the local road and

a house, the access roads merge a gathering road and a property. The third road system is for soft passengers (Statens vegvesen, 2019, p.29).

Planners should focus on developing safe road networks in neighborhoods. By focusing on the national regulations, it can inspire more people to use public transport rather than driving a car. Planners should develop roads adapted to suit soft passengers to make them want to use them (Statens vegvesen, 2018). The distance between public transport and the housing should be a maximum 10 minutes walking which is about 500-800 meters (Statens vegvesen, 2014a, p.11). New regulated areas should implement good infrastructure early in the planning process to contribute to less cutting and filling (Bjørneboe, 1983, p.21).

The roads must be developed for emergency vehicles such as fire trucks and ambulances as well as service vehicles such as garbage trucks, plow truck etc. The road must be developed with a width of 4,5 meters

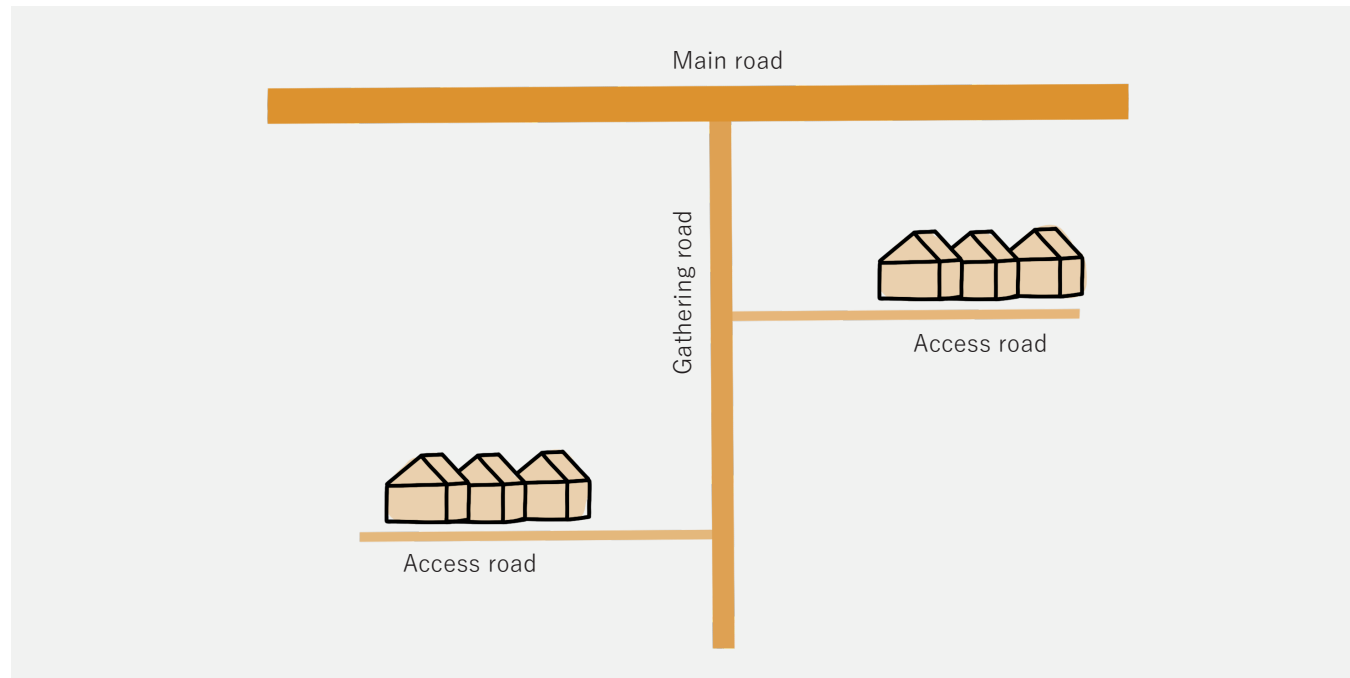


Figure 3.5: Road hierarki divided into main, gathering and access road. Self-produced based on (Skjelbreid, Kvarme, 2019)

(Statens vegvesen, 2019, p.19). In addition, universal design has to be considered when developing streets and roads structure (Statens vegvesen, 2019, p.10). The gathering roads in neighborhoods with soft passengers should have opportunities on each side to be at least 1,5 meters. If there is public transport such as bus, the road width should be minimum 6 meters (Statens vegvesen, 2019, p.25)

The street in neighborhoods should not be longer than 250 meters, but if loops are developed the length can be up to 600 meters (Statens vegvesen, 2019, p.25). Turning points should be added on the longest dead ends to make sure one does not have to back out to far. The Norwegian Public Road Administration provides in their guide for road and street design measurements for small trucks. This size is the most relevant for a residential area, for emergency vehicles, moving trucks and so on (Statens vegvesen, 2019, p.90-91). Street roads in neighborhoods has a set speed limit of 30-40 km/h. This measurement is set to protect

children playing in streets and minimize the noise pollution (Statens vegvesen, 2019, p.25)

There should be planned parking for recreational areas for people in the neighborhood (Guttu, 2008, p. 7). Regular parking outside should contain 2,5 meter times 5 meters (Statens vegvesen, 2019, p.85). Road crossing should be implemented where children are for making safer road crossings. Such crossings should only be placed where it is necessary, unless it can increase where road crossings are less used (Vegvesen, 2017, p. 8). For planning safer roads near schools, there should be traffic lights at roads with high traffic. Traffic lights should be implemented on roads with lower speed limits than 60 km/h (Vegvesen, 2014b, p. 17).

### **Paths**

Public spaces, sidewalks, and street crossings all influence the direction of crowd movement along with the surrounding

conditions that have an impact on people making decisions on which access path they select (Siewwuttanagul, Hayashida & Inohae, 2018). Existing paths should be kept and new paths added. It will give a coherent feel with paths that lead to attractive areas such as nature and parks (Miljødirektoratet, 2014, p.9). Quarter and local parks should have parking spaces with easy directions for soft passengers in a safe direction. Such places should have signs which show the direction of the attraction. There should be a coherent structure in the neighborhood for easy perceiving. In addition, such places should be placed lower in the terrain for preventing children from running out in the street without thinking (Guttu, 2008, p. 13). The paths should be planned as a circular path with safety and comfort in consideration. In addition, these areas should be designed where the quality is taken into consideration (Kristiansand kommune, 2015, p.10-11).

### 3.1.7 Building structure

When new neighborhoods are developed, they all have their zoning plans with regulations. There can be regulations such as placement, size, floors, height, color on housings, which type of fence, the design etc. By adding regulation in each zoning plan, it will contribute to getting a coherent neighborhood, and let the municipality secure a level of quality of what is built (Miljødepartementet, 1990, p.6).

The neighborhood can be categorized as three different structures. Building structure, road and infrastructure and green structure. To get a coherent neighborhood all three structures need to be planned out simultaneously. (Guttu, 2008, p.3).

The placement of buildings can greatly influence the quality of the property. By placing buildings along the terrain and making them oriented towards the sun and view, one contributes to keeping nature and being more economic for the developer. Further other factors such as

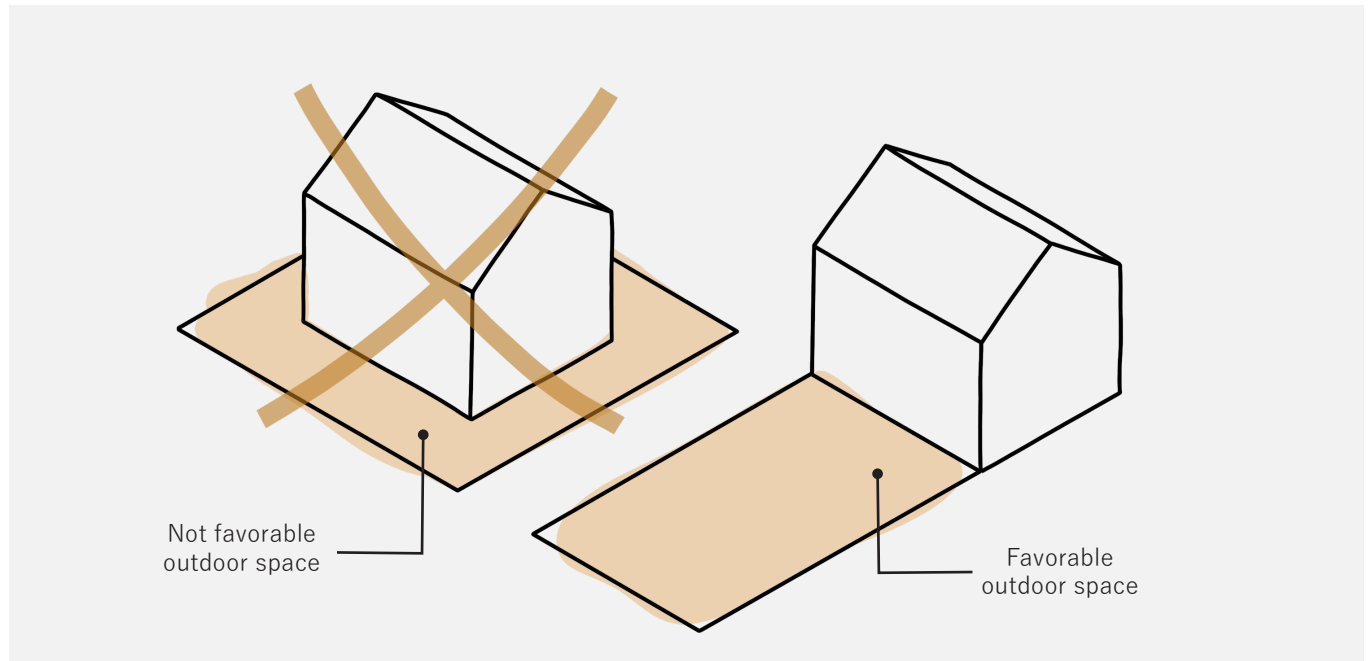


Figure 3.6: Contrasting how the property should be utilized . Self-produced based on (Byggforsk, 2018).

wind and cold pits should be considered when placing housings (Bjørneboe, 1983, p. 20). Encouraging developers to use a variety of housing types that fit different types of landscapes, will contribute to making both combined and various neighborhoods (Guttu, et al., 1983, p.13).

There are national guidelines on the distance between houses in the “Planning and Building Act”. In §29-4 the law says the distance from the house to the plot boundary

should be a minimum half of the house, or 4 meters. This is only if the detailed zoning plan does not state other measurements for the specific area (Plan og bygningsloven, 2008, § 29-4). The architecture of the housings should not be in contrast to the existing structures surrounding the neighborhood, but inspire the development to create a visually coherent area (Vegvesen, 2021). The property should consist of two different zones; private and semi-private.

The private zone is more peaceful with privacy and vegetation. The semi-private is more social with road, parking and entrance (Guttu, et al., 1983, p.8). Figure 3.6 shows how the placement of a housing can give benefits to the private. Planners should focus on the placement of each housing to utilize the property. Overall, there should be planned green areas between buildings and place the housings near the road to create a

bigger coherent green area rather than small pieces on each side of the house. (Byggforsk, 2016). Further, the neighborhood consists of two other zones; half public and public. As seen in Figure 3.7. The half public zone is often the space between buildings, for example gathering roads. Lastly, the public zone such as recreational areas (Bjørneboe, 1983, p. 26). Good conditions such as good sunny areas, comfy wind, good view and,

etc should be planned as private zones, for including everyone (Guttu, 2008, p. 9). Planners should avoid dominating parking spaces, extensive infrastructure, lack of private areas and for all outdoor areas to be small (Bjørneboe, 1983, p.11). Services such as kindergarten, school, recreational areas, groceries stores and should be in a radius of 500 meter within about 5-10 minutes walking distance. (Guttu, 2008, p. 5).

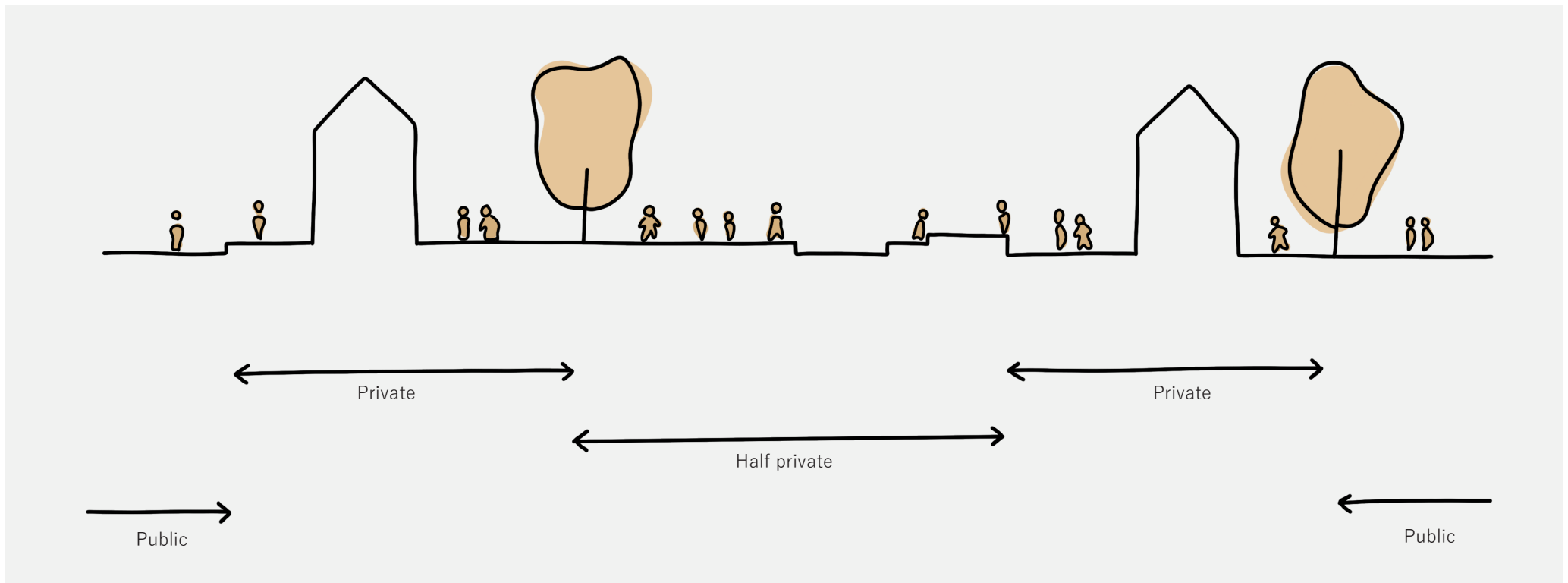


Figure 3.7: Public, private and half private outdoor areas in a neighborhood. Self-produced based on (Austbø, 2012).

### 3.1.8 Local climate

An area with a distance from 100 meters to about 20 km can be described as the local climate (Utaaker, 1991). Areas can consist of various landscapes, vegetation and the variations from summer to winter. This needs to be considered during the planning process (Børve, 1992, p. 20). The quality of the property and recreational areas will increase by taking the sun and wind into consideration. People will get more affiliation and enjoyment by having such areas (Aicher, 2018, s.19). Each property must be customized to ensure good sun, view and wind conditions (Guttu, 2008, p.19).

Local climate is not mentioned in the building and planning law in Norway, but overall it can be found in contact with different laws about nature. The impact assessment (IA) mentions indicators about local climate. The purpose of this assessment is to take the environment and community into consideration (Lovdata, 2017). A planning process should always include a risk- and vulnerability analysis (RAV). This will predict

how vulnerable and safe the development is, in addition to find insecure areas which should be considered before building (Vegdirektoratet, 2018, p. 207).

#### Sun

Figure 3.8 shows measurements for the average sun hours per month, per year. In the capital of Norway from October to March, Oslo has 7,5 sun hours on average per day. From May to September there is an average of 3 sun hours per day (Meteorologisk institutt, 2020). The northern climate has fewer sun hours than further south. It will be important to place the housings relative to the sun direction and the placement for

creating good outside areas (Byggforsk, 1996).

The placement of housings affect the recreational areas by the shadows through the seasons (Byggforsk, 1996). An architect and researcher at the Norwegian institute for urban and regional research, Jon Guttu has made a report on how to keep the sun qualities when developing new neighborhoods. The report is stating that  $\frac{1}{4}$  of the recreational areas should have 5 sun hours or more from spring to fall. He refers to a Swedish study where they were satisfied with this amount of sun hours (Guttu, 2008, p. 19).

People from young adults are more appreciative of private outdoor spaces than children. Private outside areas should be implemented for letting them enjoy the sun hours as long as possible. It will be important to know the sun conditions to utilize the advantages into good outdoor areas, and place them towards south or north/west (Guttu, 2008, p.19).

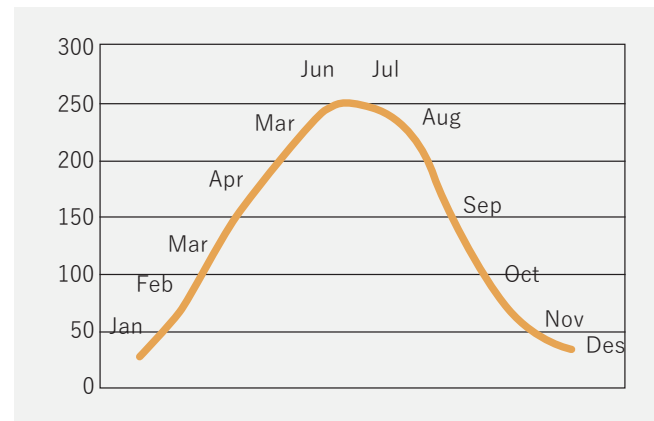


Figure 3.8: Measurements for the average sun hours per month per year in Oslo. Self-produced based on (Meteorologisk institutt, 2020).

In addition, use the landscape heights to contribute to more sun hours, for more housings and outside areas (Byggforsk, 1996).

## Wind

It will be beneficial to look at local wind roses for further information on how the wind direction works in different areas. The wind roses vary from location and different seasons, such as winter and summer (Byggforsk, 2005a).

There are differences between cold wind and warm wind. Cold wind will stagnate at low areas and warmer wind will move upwards. (Husbanken, 1987, p. 66). Figure 3.9 shows how the wind will gather in a landscape where there is a slope. This will contribute to cold wind staying for a longer period of time. To prevent this, housing should not be planned at the lowest areas (Byggforsk, 2016).

The cause of cold pits is inversion, a high pressure situation that often occurs in

winter. According to state meteorologist Vibeke Thyness inversion is because we get a large heat loss from the ground, at the same time as there is too little wind to mix the air from higher air layers. The cold and heavy air thus remains close to the ground. Such situations can last for days and weeks on end, and with ever-increasing cooling, temperatures can become very low. This can mean a difference in temperature of 10 degrees over small distances (YR, 2010).

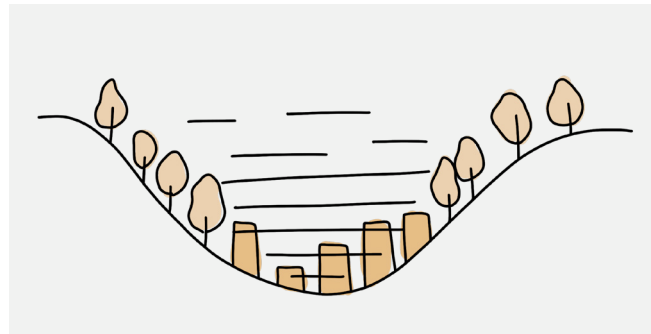


Figure 3.9: Cold wind remains close to the ground and it will be beneficial to build higher up in the terrain. Self-produced based on (Skjelbreid, Kvarme, 2019)

A combination of buildings and vegetation will contribute to making calmer recreational areas. It will contribute to keep the cold and windy days away, and simultaneously get turbulence with fresh air to keep good air

quality (Husbanken, 1987, p. 66).

Adding trees with leaves can reduce the wind with about 10-20% (Glaumann, 1988). Green areas can make enjoyable cooling areas with a good mix of shadow and sunny areas (Guttu, 2008, p. 15). If planners use the benefit of the wind and vegetation it can contribute to more enjoyable outside areas, even if it is slightly windy (Byggforsk, 2005b).

A single tree will let the wind through, but by adding lower vegetation such as bushes it can contribute to reducing the wind. In addition, blockades such as fences with different variations can contribute to reducing the wind (Asplan Viak, 2010, p. 29).

# GUIDELINES

from chapter; Neighborhood

## Terrain and vegetation

- Firstly, keep the vegetation around the housings. Secondly, keep the vegetation between the buildings, or lastly have a combination of the two (Guttu, et al., 1985, p.64).
- Green areas for walking and enjoyment should not be smaller than 30 meters. Small areas should not consist of only oblong areas (Miljødirektoratet, 2014, p.24)

## Infrastructure

- The distance between public transport and the housings should be maximum 10 minutes walking which is

about 500-800 meters (Statens vegvesen, 2014, p.11)

- Emergency vehicles need a width of 4,5 meter (Statens vegvesen, 2019, p.19)
- Soft passengers should have opportunities to walk on each side of the road, this path must be a minimum of 1,5 meters. (Statens vegvesen, 2019, p.25)
- If there is public transport such as bus, the road width should be minimum 6 meters (Statens vegvesen, 2019, p.25)
- Regular parking outside should contain 2,5 meter times 5 meters (Statens vegvesen, 2019, p.85).
- Street roads in neighborhoods has a set speed limit of 30-40 km/h (Statens vegvesen, 2019, p.25)
- Turning points on long dead



ends should follow “The Norwegian Public Road Administration” guidelines.

- The street end in neighborhoods should not be longer than 250 meters, but if loops is developed the length can be up till 600 meters (Statens vegvesen, 2019, p.25)

### **Buildings and structure**

- Have a variation of house shapes and sizes which can be used in different landscapes (Guttu, 1983, p.13)
- Have a combination of private, half private, half public and public zones (Bjørneboe, 1983, p. 26)

### **Local climate**

- $\frac{1}{4}$  of the recreational areas should have 5 sun hours or

more from spring to fall (Guttu, 2008, p. 19).

- Place building towards south, west or west/north for best view and sun conditions (Guttu, 2008, p. 19).
- Keep the lower areas for recreational areas due to the cold wind will stagnate (Husbanken, 1987, p. 66)
- Have a variation of placement of housing to reduce the wind speed (Husbanken, 1987, p. 66).
- Keep vegetation between buildings and recreational areas for reducing wind speed (Glaumann, 1998).

### 3.2 Recreational areas

People are busier than ever, and finding a balance of work, family, physical and mental health is important. According to an American Recreation Coalition Study in 2000, people who prioritise recreational activities are more likely to feel satisfied with their overall life situation. Of the people who said they participate in regular outdoor recreation 90% responded they were satisfied with their overall lives. If this is compared to those who reported not to recreate outdoors regularly only 60% of these reported to be satisfied with their lifestyle as seen in Figure 3.10. From these findings the importance of going outside and moving is a direct way to a healthier and happier life. Further taking part in recreational activities, especially outdoors, can greatly improve physical health. People who take part in park activities such as walking, hiking, or skiing, schedule fewer doctor visits, maintain lower body fat percentages, and have lower blood pressure and cholesterol levels. Recreation also has mental health benefits. Mental wellness is critical to overall physical health.

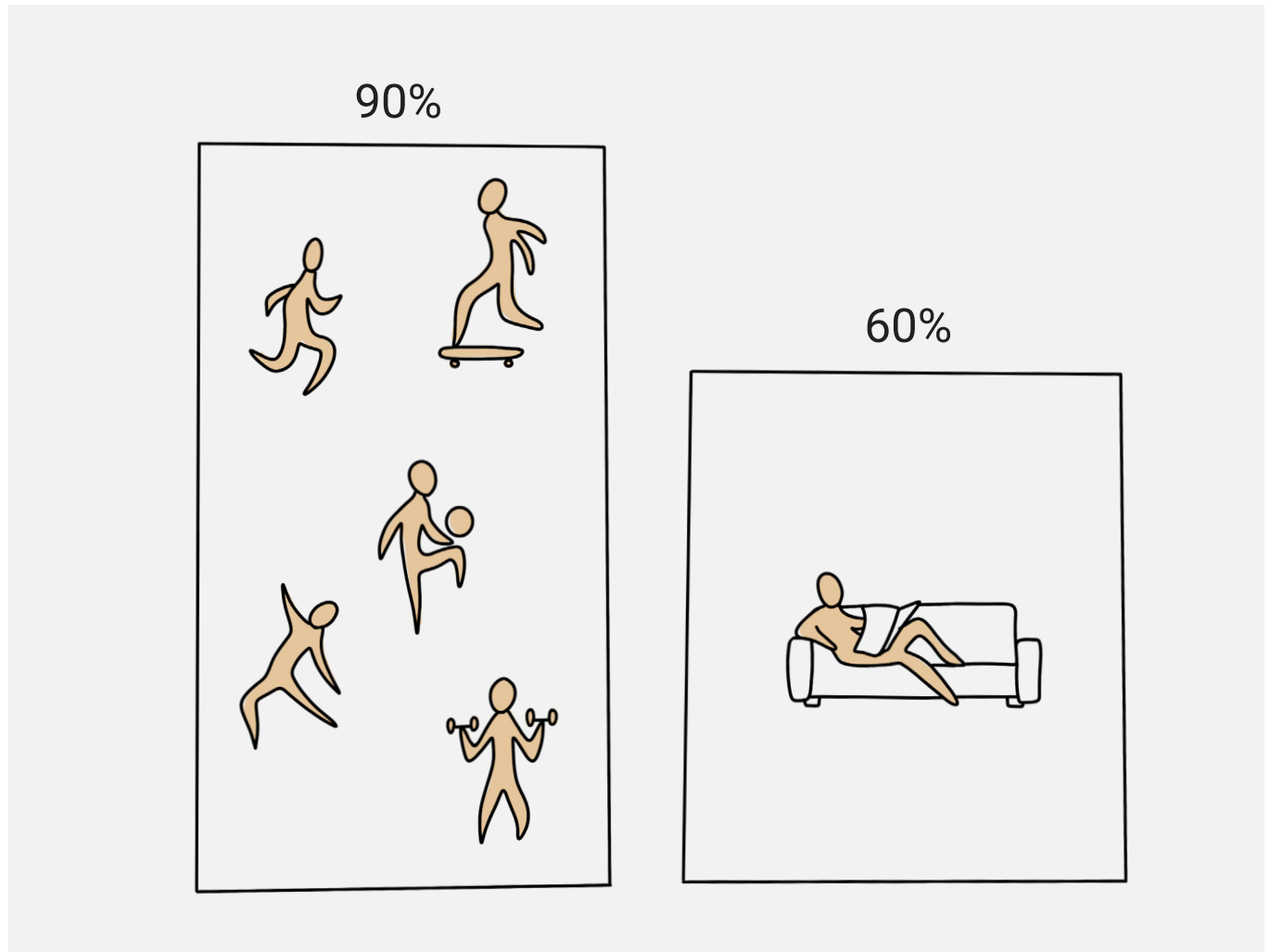


Figure 3.10: 90% responded they were satisfied with their overall lives who participated in regular outdoor recreation. Contrasting, 60% of the people who did not participate outdoors regularly was satisfied (Self-produced, 2021).

Participating in recreational activities helps manage stress and taking time to nurture oneself provides a sense of balance and self-esteem, which can directly reduce anxiety and depression (Metroparks, 2019)

### 3.2.1 Play and meeting places

Time spent outside has become more of a luxury for children or in some cases more of a chore than a staple. Screens are becoming a bigger part of children's day to day life, and activities are being more and more structured and scheduled (Selrenrich, 2015). Indoor activities is better than no activity but when kids start to play outside, that's when the positive effects of physical activity increases. Studies show that kids who spend more time outside have better test scores, less behavior problems, fewer signs of ADHD, better cognitive functions and improved self-discipline (Miracle, 2021). Recreational areas, especially quiet ones, let people meet each other randomly and give opportunities to talk to other people in the neighborhood as seen in Figure 3.11 (Guttu, 2008, p. 15). Such places should have opportunities for benches, vegetation, activity, acceptable noise level, detaining, view, comfy wind and sun. These areas must have potential for use in every season, summer and winter (Byggforsk, 2020). Functions for each age should be represented for including the

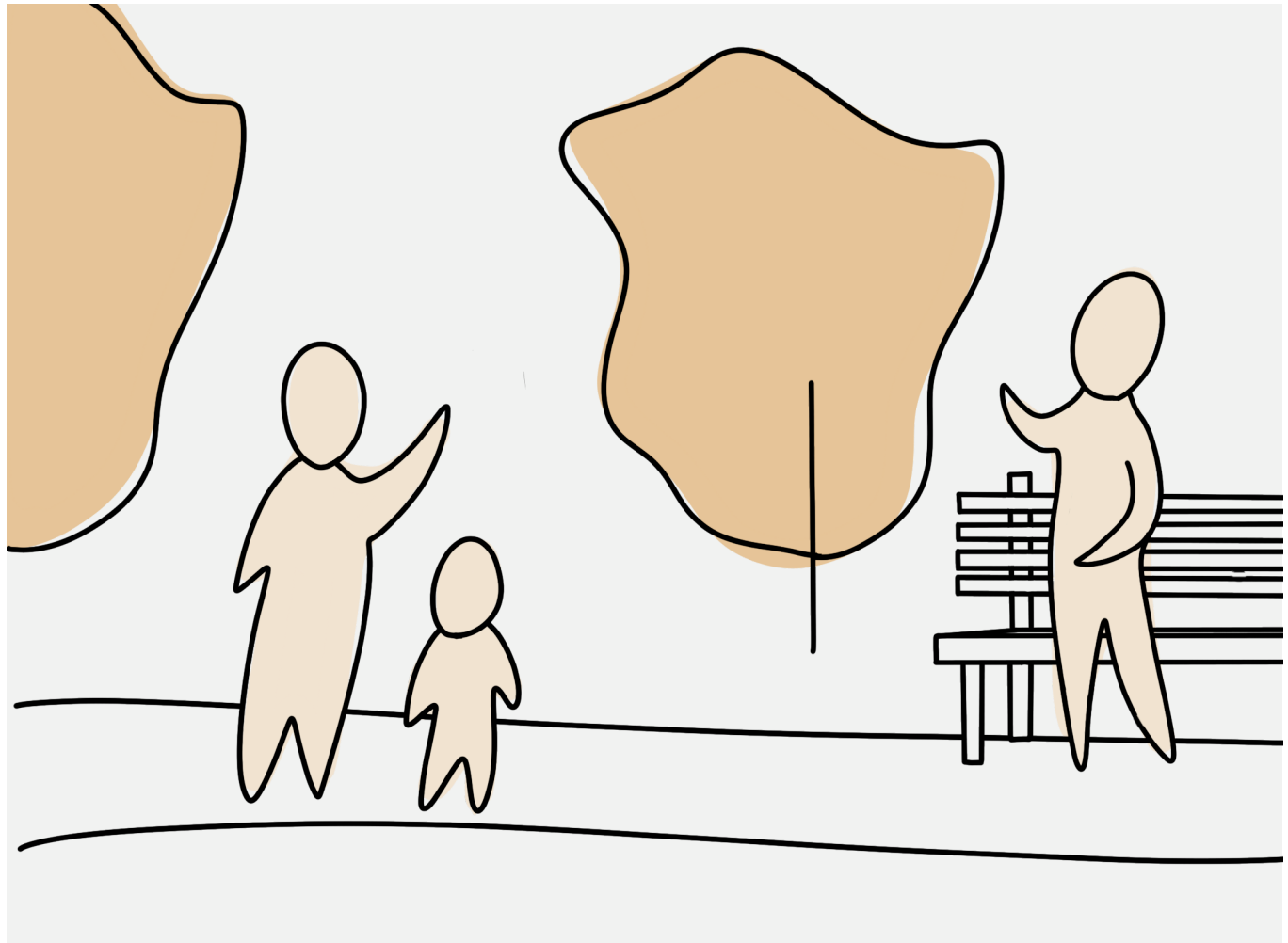


Figure 3.11: Recreational areas which let people meet randomly and give opportunities to talk to other people in the neighborhood. Such areas should have potential for use in every season. (Self-produced).

entire neighborhood and increase the quality (Guttu, 2008, p. 13).

### 3.2.2 Pollution

Light pollution is connected to a higher concentration of light at night and does not include light in day time. Modern technology is progressing with rapid speed, unfortunately it's now moving faster than our ability to adapt. The modern lifestyle has become painfully detrimental to our health in some areas. One of the new consequences is the pollution we now face caused by noise and light. Noise pollution can have serious consequences on our health and some of the conditions can be high blood pressure, headaches, exacerbated stress, fatigue, anxiety and depression, sleep disorder, irritability, hysteria and more. Light can also affect your circadian rhythm and impair the production of melatonin, which is the hormone that puts us to sleep as well as trigger our cortisol production which is a stress hormone that keeps us awake (Schaeffer, H. 2020). With these health factors in mind, an aware relationship to light and noise pollution is important in the planning process.

### Noise

Outside areas should be secluded from traffic by buildings to reduce the noise level. Quarterly structure provides outdoor areas with minimum noise pollution and cleaner air. Alternatives: when no buildings are separating recreational areas and roads, noise barriers can be implemented to help minimize the pollution. (Guttu, 2008). Green screens work as noise barriers where the vegetation is planted in the screen itself. These screens require quite a bit of maintenance to keep an acceptable look, so they should only be used when necessary. (Statens vegvesen, N200, 2018). Green noise screens can also include vegetation that does not grow in the screen itself, for instance climbing plants or vegetation planted along the screen. To use vegetation is also mostly relevant on the side not facing traffic or high up in the terrain. There are other benefits with using vegetation such as covering up the noise cancelling construction, shield from wind and snow, binds together the road and the surroundings, reduces pollution from particles, collects dust and

reduces graffiti (Statens vegvesen, V271, 2016). Lukas Martinelli has created a global noise pollution map, here one can find approximate noise levels for the entire world and guidelines for the average noise level for different sources. The average leisure area has a sound buffer of >65 dB within 35 meters, 55-64.9 within 55 meters and 45-54.9 within 75 meters distance (Martinelli, n.d.). Figure 3.12 shows the variation of noise intensity from low to very high which gives an indicator.

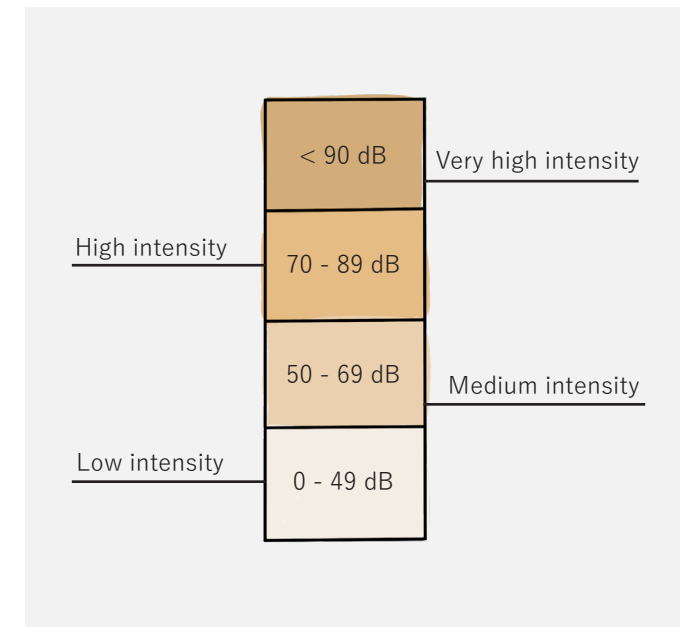


Figure 3.12: Variation of noise intensity divided from low to very high. Self-produced based on (Store norske leksikon, 2018)

## Lighting

Outdoor lighting serves a functional purpose of better view but also holds esthetic qualities. Lights should highlight objects of meaning to our surroundings to make it easier to move safely and perform tasks when needed. Light can also be used to make beautiful elements in our surroundings visible. The most extensive lighting tasks outdoors are street lights as seen in Figure 3.13. Signals reaching us from cities further south in Europe indicate that the coordination of all light in the city has great economic, aesthetic and well-being gains as a result. Public lights have to satisfy the societal demands for safety and aesthetics. Although the authorities' main responsibility is safe passage on roads and streets. Street lights are also one of the easiest ways to reduce robberies and assaults. Street lights along paths and seating should have a higher intensity than along street roads. The height is important to reduce the risk of flood lights (Guttu, 2008). Like with more and more traffic follows more and more street lights, something exceeding requirements

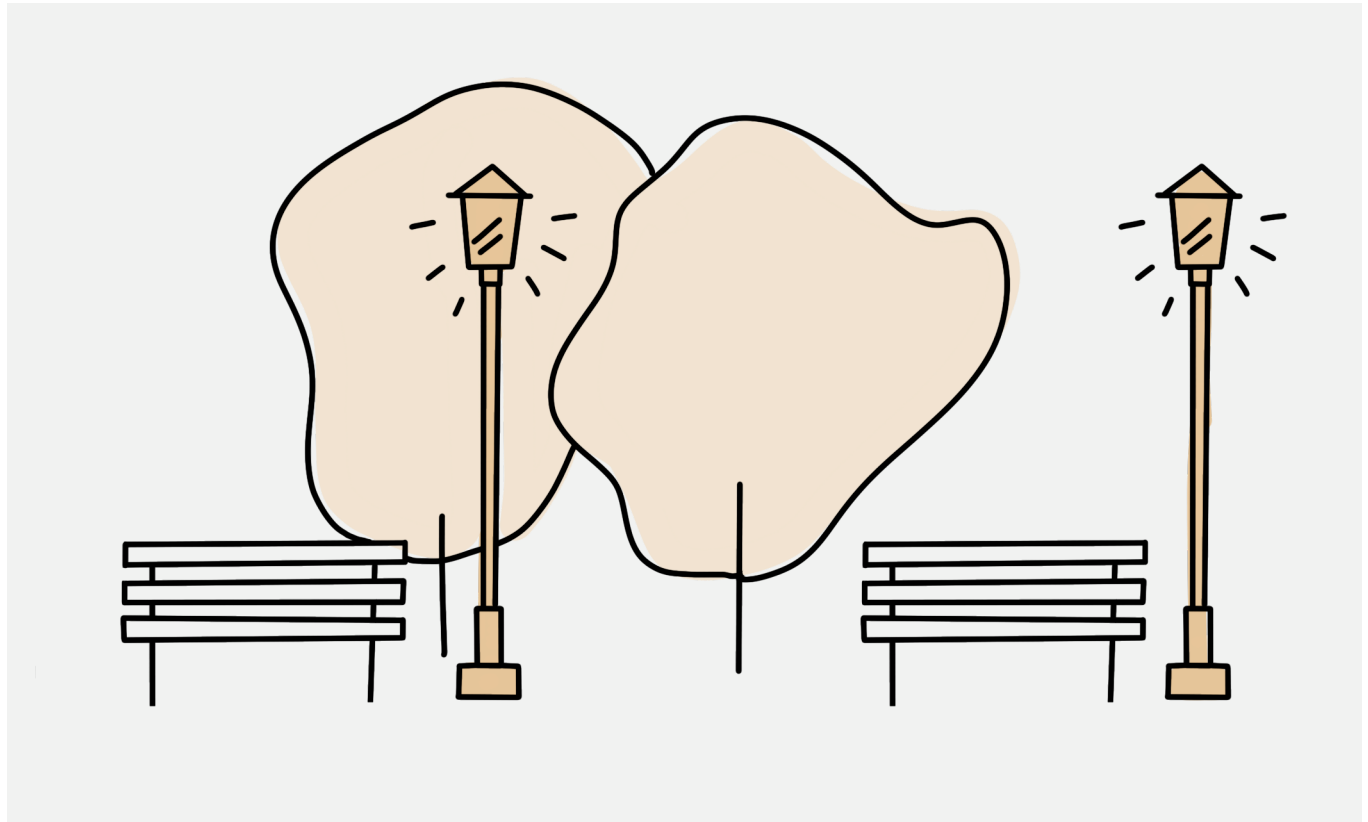


Figure 3.13: Lighting in recreational areas for satisfying the societal demand for safety and aesthetics (Self-produced).

to fulfill others. Outdoor light should have a natural quality. Conscious use of light and with today's technology to avoid stray light, glare and light pollution are also important goals. Lighting of trees and bushes in parks can create a beautiful view, but lighting in random corners and noches can create a focus on the less esthetic parts of the area (Schaeffer, 2020).

### 3.2.3 Drain water

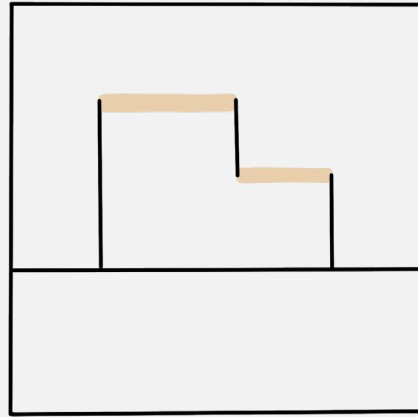
All water as a result of rain or ice or snow melting on the surface is considered drainwater.

The combination of density politics and powerful rain creates a challenge when the quick runoff can harm buildings, infrastructure, health and the environment. (Miljødirektoratet, 2020). Traditionally drain water in urban areas has been dealt with through the use of pipes under the ground, to lead the water out. This is not ideal as it takes the water out of its natural lifecycle and into pipes. The system often shows problems with capacity during floods. In dense places, drainwater must be considered and dealt with. Asplan Viak has a focus on more use of open solutions, creating spaces suited for flood prevention. This also created opportunities to create experiences in the neighborhoods, through play and keeps biodiversity that are dependent on open rivers as habitats. This can further lead to a better feeling of well-being for residents, higher safety against flood and reduced emission

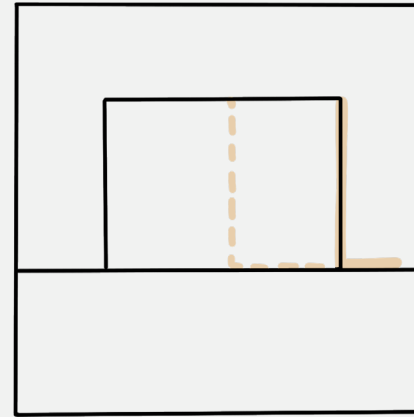
of pollution. In a research project by Asplan Viak and NMBU they present observations in connection to the treatment of rainwater, and present guidelines to improve this part of the planning. One of their main pieces of advice is to implement open drain water systems early in the planning process. This way you can use the water's natural "roads" in the new plan as well. They also say to look at a bigger area and how it connects, map out the blue-green relationship, share knowledge and that there are still not a lot of sufficiently good facilities in Norway. In future planning projects there should be a focus to keep drain water open or at least partly open (Asplan Viak, 2016, p.10-12).

"Norwegian water" has made a report on how to handle drain water in populated areas. The main concept is to make sure the lowest areas are being used as recreational areas. By doing this, it will prevent properties, housings and roads getting flooded. It will in addition give recreational areas more experience value on rainy days (Norsk vann, n.d., p.10.-11). In practice there are different

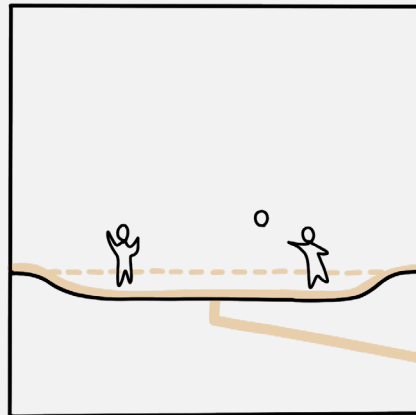
measures for how to create open solutions for drain water. Asplan Viak presents some in the guideline "Surface water as a resource"; As illustrated in Figure 3.14, green roofs will reduce and slow down the runoff process when the vegetation takes in and holds the water. With small amounts of water the vegetation can hold all the water, while with heavier rain it will reduce the pressure on pipes and the discharge area. Roof downspite the vegetation is a good solution because it leads the water directly into the ground, as a pose to under the ground in pipes. This way the vegetation takes up a lot of the water and the risk of big floods is reduced. Dry diversion magazines are areas where the terrain is brought down. This can be done in different scales depending on the rainwater in the area as the water will naturally gather in these fields. The vegetation will hold a lot of the water and when there is excessive rainwater this will go down pipes in the ground. Canals are built construction that can carry and lead the water (Asplan Viak, 2016 p.165-171)



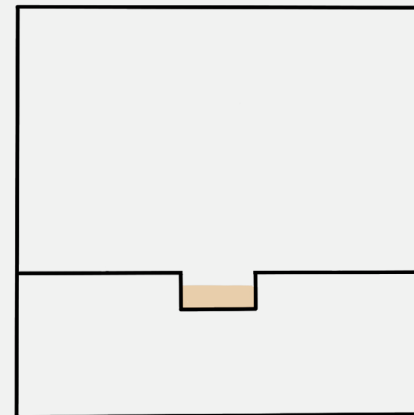
Green roofs



Roof downspite the vegetation



Dry diversion magazines



Canals

Figure 3.14: Different guidelines for drain water. Self-produced based on (Asplan Viak, 2016).

### 3.2.4 Materials

Today children have less and less contact with nature and room to move freely. It will be important to have a variation of play equipment for the different areas to fulfill the need for activity for the children as seen in Figure 3.16. In addition, the choice of substrate has to be adapted by the mean for the recreational area and the type of elements that are being implemented. A good option is to use durable alternatives of untreated wood or environmentally friendly impregnation (Svensson, Et al, 2019, p. 12)

One of the most common durable underlays in Norway is Platop rubber underlay. This rubber underlay is certified and has been tested with the highest safety requirements. These should be used when necessary to prevent injuries for children while using play equipment (Uniq, n.d)

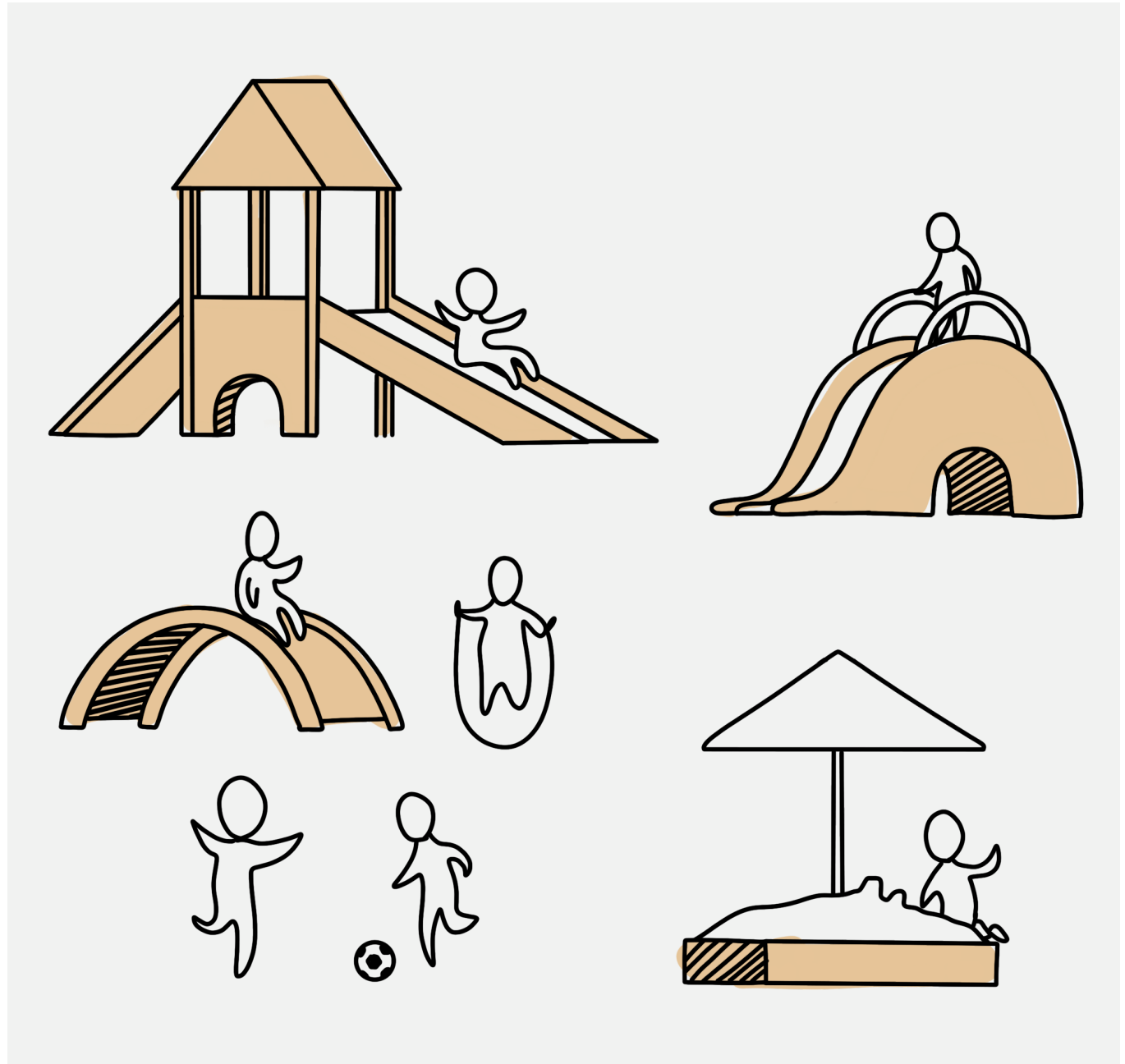


Figure 3.15: Different types of play equipment and activities which often are placed at recreational areas. Such equipment has a variation of materials and needs to be considered. Self-produced based on (Egorov, 2017)



### 3.2.5 Activities and ages

Good quality and inclusive solutions are essential when creating new residential areas. When the areas can be used by all ages and levels of function it contributes to creating better neighborhood quality. Recreational areas near housing should contain activities that stimulate children, youth, adults and elders to spend time and be active outside. Children traditionally play in play equipment, but can also benefit from natural areas, waters and other elements where they can be creative and use their body. Climbing provides good experiences and triggers their physical and motorical development. Children of all ages should have areas in their community that allure them to go out and stay active. Activities that can be used by children with grownups are also good assets. With every playground there should be seating for adults. Parents like to be able to watch as their children play, when they're not participating themselves. Youth also has to be a part of their community and given room to do what they like. Outdoor exercise equipment and

areas with ballplay can contribute to youth staying active longer. These appliances can also be used by adults and contribute to shared experiences. Physical activities are just as important for older people. The number of elders will rise in the years to come, and more elderly people will have to live home longer. By providing opportunities for them to stay active, their motor functions are retained longer. So outdoor areas must therefore be designed so that even elderly are tempted to use them. This also means paths with good accessibility, as well as stairs and uneven paths to help train balance. Training appliances and installations that stimulate strength training can have a positive effect on the activity level. Gardening is also a good way to contribute to elders to stay active (Universell utforming AS, 2017).

#### **Examples of activities that can be implemented in the plan:**

- Play equipment for different ages
- Trampoline
- Pond, streams, water installations
- Trees for climbing or just aesthetic quality
- Climbing wall
- Slackline or other balance training
- Benches, chairs, hammocks
- Campfire site
- Golf, volleyball, tennis, football, basketball or other sport courses.
- Skating/bicycle park
- Terrain formations that can be used for different activities
- Gardens, garden kitchen
- Ice Skating, tobogganing
- Pool
- Kayaking/canoeing
- Paddleboarding

### 3.2.6 Location

Accessibility is important for recreational areas to be beneficial for residents. Paths and signs are crucial for people to find and reach the areas. The Ministry of Culture and Church Affairs has created a guide on how to facilitate hiking trails and paths. The guide suggests wooden signs with milled out letters and painted writing as a durable, easy to read and affordable solution. These sorts of signs can be used on posts, trees and buildings. The signs can have different colors indicating different paths or different degrees of challenge. There can also be painted markings on trees to make it clear where the trachea leads (Kultur - og kirkedepartementet, 2008, p. 36-29).

Playgrounds for toddlers should be located a maximum of 50 meters from the residents entrance. The area should not be less than 50 square meters, as seen in Figure 3.17 and have benches for people to sit. Ball loop and other play areas for bigger children should be atleast one acre and a maximum of 150 meters from residents. The shape

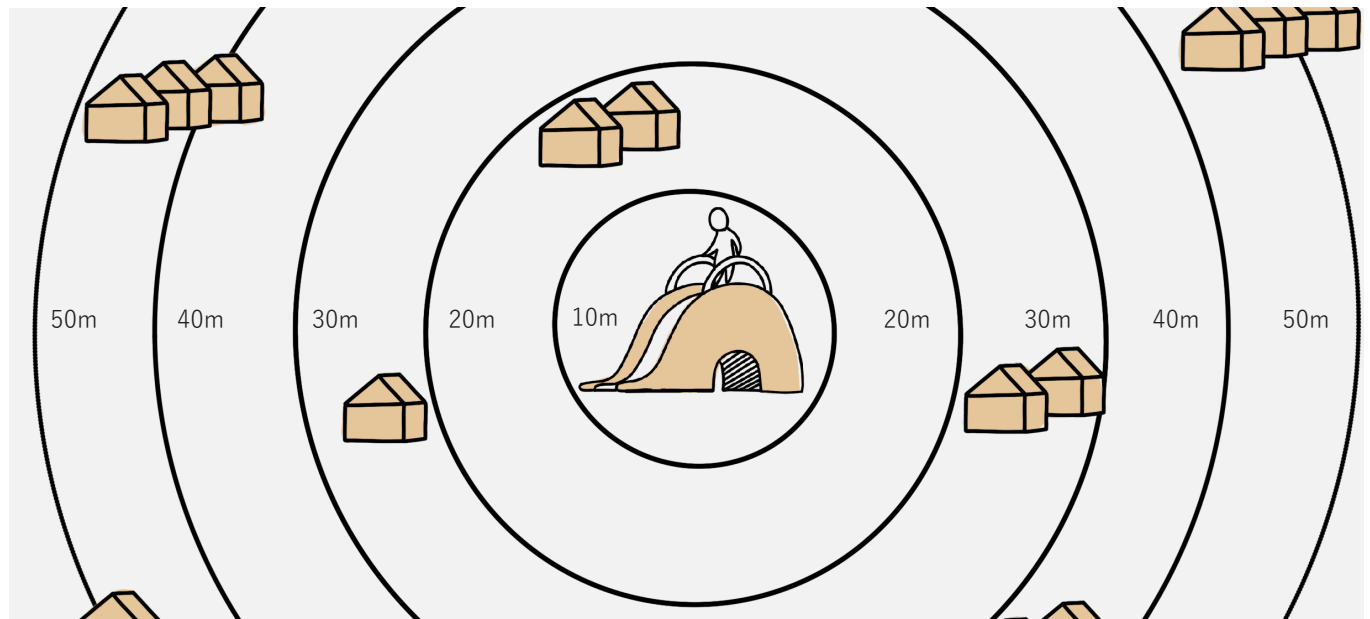


Figure 3.16: Location of a playground relative to the 50 meters guideline (Self-produced).

of the terrain and ground cover should challenge the kids and play equipment alone is not enough. Older children also often have a higher noise level when playing than younger children. Their playgrounds should be located further away from residents than the other areas, or be separated with fences and vegetation to keep the noise pollution at a minimum. Meeting places should be located in quiet and secluded areas with good sun conditions and preferably some vegetation. As a general rule the recreational areas connected to residents should form

a connection of traffic safe streets, paths, spaces and green structures. It's also important that everyday functions such as schools, kindergartens and after school activities can be reached without danger. This includes speed limits to an acceptable limit at 30 km/h in residential areas, given there are good sightlines and sufficient light. Children should be able to bike around without entering roads with high traffic, this can be achieved by placing sidewalks along resident homes (Guttu, 2008).

# GUIDELINES

from chapter; Recreational areas

## Play and recreational places

- There should be residential areas in different sizes and different levels of privacy (Guttu, 2008, p. 15)

## Pollution

- Recreational areas and private outdoor areas should be separated by buildings when possible to keep the noise level at a minimum.
- Noise barriers should be implemented where the noise level exceeds 55 dbA (Guttu, 2008).
- Green noise screens should be considered benefits with required maintenance
- Use vegetation and fences to

minimize noise pollution (Guttu, 2008).

- Street lights along paths and seating should have a higher intensity than along street roads.
- Lighting of trees and bushes in parks can create a beautiful view, but lighting in random corners and noches can create a focus on the less esthetic parts of the area.

## Drain water

- Make open solutions for drain water (Asplan Viak, 2016 p.165-171)
- The lowest areas should be prioritized for recreational areas for gathering drain water (Norsk vann, n.d., p.10.-11).

## Location

- Playground for toddlers should be no more than 50 meters from resident homes, or less than 50 square meters. (Guttu, 2008).
- Ball loop and other play areas for bigger children should be at least one acre and a maximum of 150 meters from residents (Guttu,2008).

### 3.3 Community

“A sense of wellbeing and a thriving community is key to a happy neighbourhood, according to housing researchers who looked at the relationship between the experience of the home and wellbeing” - University of Birmingham (University of Birmingham, 2018)

#### Social

Good outdoor spaces contribute to good living conditions. When creating outdoor spaces it is important to include a focus on people in all life stages as seen in Figure 3.18 and consult different disciplines as architects, user organizations, the municipality, landscape architects and entrepreneurs. When good quality spaces are created they can encourage social gatherings, stimulate activity, increase the level of wellbeing and give positive responses on physical and mental health. In today's planning this part often gets downprioritised by the developers focus on the buildings. Then to accommodate the municipality's demands they create a bench area and playground for

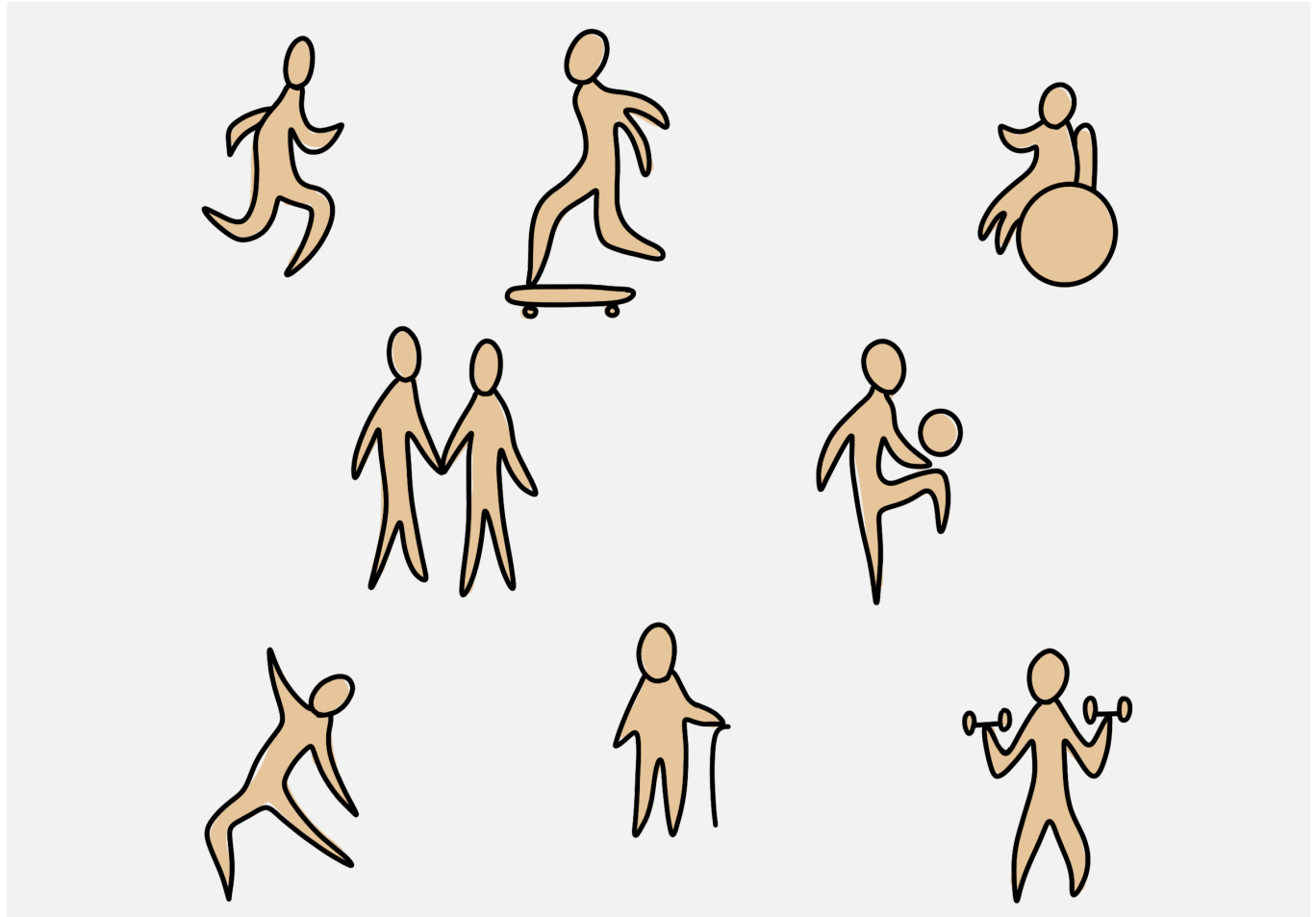


Figure 3.17: It is important for planning a community for people in all life stages (Self-produced).

children. This will be sufficient in getting it past the municipality's demands, but does not guarantee an outdoor space that works well with the residents. There are not a lot of outdoor areas that include all ages in activities, and it does not fulfill the need

for meeting places that inspire activity. The planning and building act indicates minimum requirements for buildings and outdoor spaces through TEK17. Chapter 8 deals with “Developed outdoor areas” and includes laws regarding placement,

functions, universal design, accessibility and so on. The regulation consists of provisions and guides. Through these provisions each municipality can make additional requirements to outdoor areas. It is adapted for varied use for all age groups, outdoor meeting spaces and seating and elements to stimulate all ages for physical activity in green and attractive surroundings. Existing nature is utilized, good sun conditions yet sheltered. The area is accessible and easy to move around for people who are in bad health or on wheels. It's also easy to navigate in the area and has a good connection to the surrounding ones. Important that people feel safe and secure, and the area stays well maintained. The residents also feel a sense of ownership to the outdoor shared spaces. For people to actually use the areas they have to be seen as attractive and have qualities that make people want to spend time there. People are also different, while some will prefer areas that indicate big gatherings, others like to be more alone and so more private places for people to be alone should also be implemented. Children

need areas that facilitate playing in different stages of childhood. Here one can use traditional play equipment but also nature, water and areas where they can be creative. As climbing trees, this gives the child a good experience and strengthens the physical health and motoric skills. Youth also need space for leisure activities, outdoor training equipment and the possibility for ball sports can create areas for them to meet up and connect through physical activity (Universell utforming AS, 2017).

### **Voluntary work/maintenance**

Operation and maintenance of paths will naturally depend on the purpose and structure, especially on the materials used and on the season. The scope and execution of the maintenance depends on several factors, and must be considered separately in each individual case. Routes with a permanent surface normally require less maintenance than gravel surfaces, if the construction is in accordance with regulations and thoroughly carried out (Kultur - kirke departementet, 2008).

## **GUIDELINE**

from chapter; Community

- Important to create spaces that accommodate social interactions as well as secluded areas for people to get a feeling of privacy

# ANALYSIS

CHAPTER 4

#### 4.1 NATIONAL AND LOCAL GUIDELINES

- Kristiansand municipality vision
- Benestad
- Planned roads
- Housing survey in Kristiansand municipality
- **Summary**

#### 4.2 SPATIAL ANALYSIS

- Historical/Building Structure
- Ownership
- Buildings
- Cultural heritage
- Infrastructure
- Waters in the areas
- Recreation- and outdoor life
- Local climate
- Green structures overall
- Biodiversity
- Terrain
- Precipitation field
- Natural disasters
- Target points and functions
- Traveltime and forms of transport
- Public transport
- Risk- and vulnerability assessment
- **Summary**

The analysis will first look at the national and local guidelines, as well as the planners vision and a questionnaire conducted of the residents in Kristiansand municipality. The second part is a spatial analysis of the regulated areas Cb1 and Cb2.

#### **4.1 National and local guidelines**

The analysis will be the base for a feasibility study of a regulated plan undergoing development by Drangsvann AS, together with COWI Kristiansand. The planning area is located in Kristiansand municipality in Agder county. The limitation for the proposal is defined by national regulations, regionale plans, municipal guidelines, a detailed zoning plan, provisions, laws and the spatial limitations.

##### **4.1.1 Kristiansand municipality vision**

Kristiansand has a population of 112 725 spread over a total area of 644 square kilometers. The city is located south in Norway in “Agder” county and is the sixth biggest municipality in Norway (SSB, 2021). The vision for Kristiansand is to develop

towards an inclusive, attractive and green innovation city. Kristiansand has set their prerequisites as their foundation for which conditions they are working with, such as economy, work area and innovation. The municipality needs to consider global trends for achieving their vision. For instance, climate change, urbanization and digitalization. Kristiansand has made four main categories which will contribute to achieving their vision. The first is to be an inclusive community with diversity, and to increase the population. The second is to have a diverse offer of leisure activities for people to use and develop their competence, as well as contributing to the development of a circular economy and facilitating social, technical and digital infrastructure. Third is to give the inhabitants opportunities to make environmental and climate friendly choices. The fourth and last is an urban plan focus. By utilization of areas near the city centre og near public transport to reduce the private transport. The municipality will build on these four categories to make the vision for Kristiansand to come true (Kristiansand

kommune, 2017).

Kristiansand has made a land-use part of the municipal master plan as seen in Figure 4.1. The city centre is placed almost in the middle of the municipal boundaries and most of the settlements are connected to this part. The development that is under regulation plans for the moment is focused along the coast. The biggest types of areas are forest and water. They also have standards for outdoor facilities, here they mention that all municipal recreational areas should have implementation of fruit trees (Kristiansand kommune, 2015, p.19).

#### **Lighting**

Kristiansand municipality made a report in 2014 called “Good and safe light where you walk and cycle” (“godt og trygt lys der du går og sykler”. 10 lux as the average horizontal illuminance along most sidewalks with external glare in the city, as well as in underpasses without cyclists. Elsewhere 5 lux is presumed to be sufficient in parks. The masts should have a height of 4-6 meters in



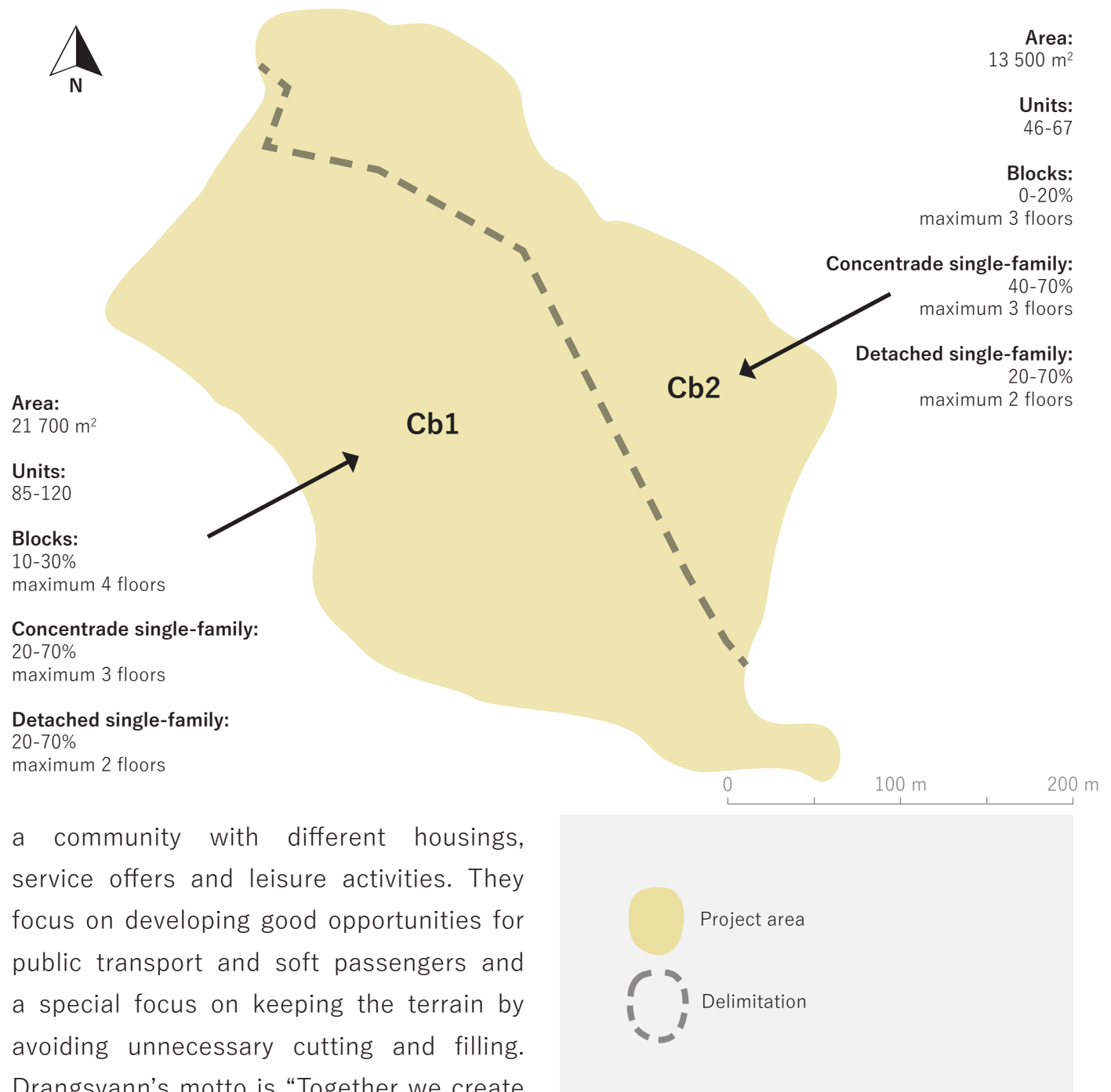


Figure 4.1: Land-use map. Self-produced based on (Kommunekart, 2021)

parcs and 6-8 along roads. The report gives further guides on distances, strength, light colour, glare and so on. This report should be used for providing lighting purposes (Kristiansand kommune, 2014).

#### 4.1.2 Benestad

Drangsvann AS has regulated a total area of 28 000 acres in Benestad, Kristiansand (Rambøll, 2014). The goal for the area is to build 2000 units which will house approximately 6000 people (Drangsvann, 2020). Benestad is further divided into 23 areas as seen in Figure 4.3. Bb1, Bb5, Cb3, Cb5 and Cb6 have gone through regulations and are finished or are being developed now (Kristiansand Kommune, 2019). The thesis will be focusing on Cb1 and Cb2 which is planned to be finished in 2022, stated by Mariann Skei Fossheim (personal communication, 04.06.2021). The red zones will consist of schools, kindergarten, multi-purpose hall, football field and possibilities for a nursing home. The yellow areas will be mainly housing (Kristiansand Kommune, 2019). Drangsvann AS wants to establish



a community with different housings, service offers and leisure activities. They focus on developing good opportunities for public transport and soft passengers and a special focus on keeping the terrain by avoiding unnecessary cutting and filling. Drangsvann's motto is "Together we create

Figure 4.2: Requirements for Cb1 and Cb2. Self-produced based on (Kommunekart, 2008)

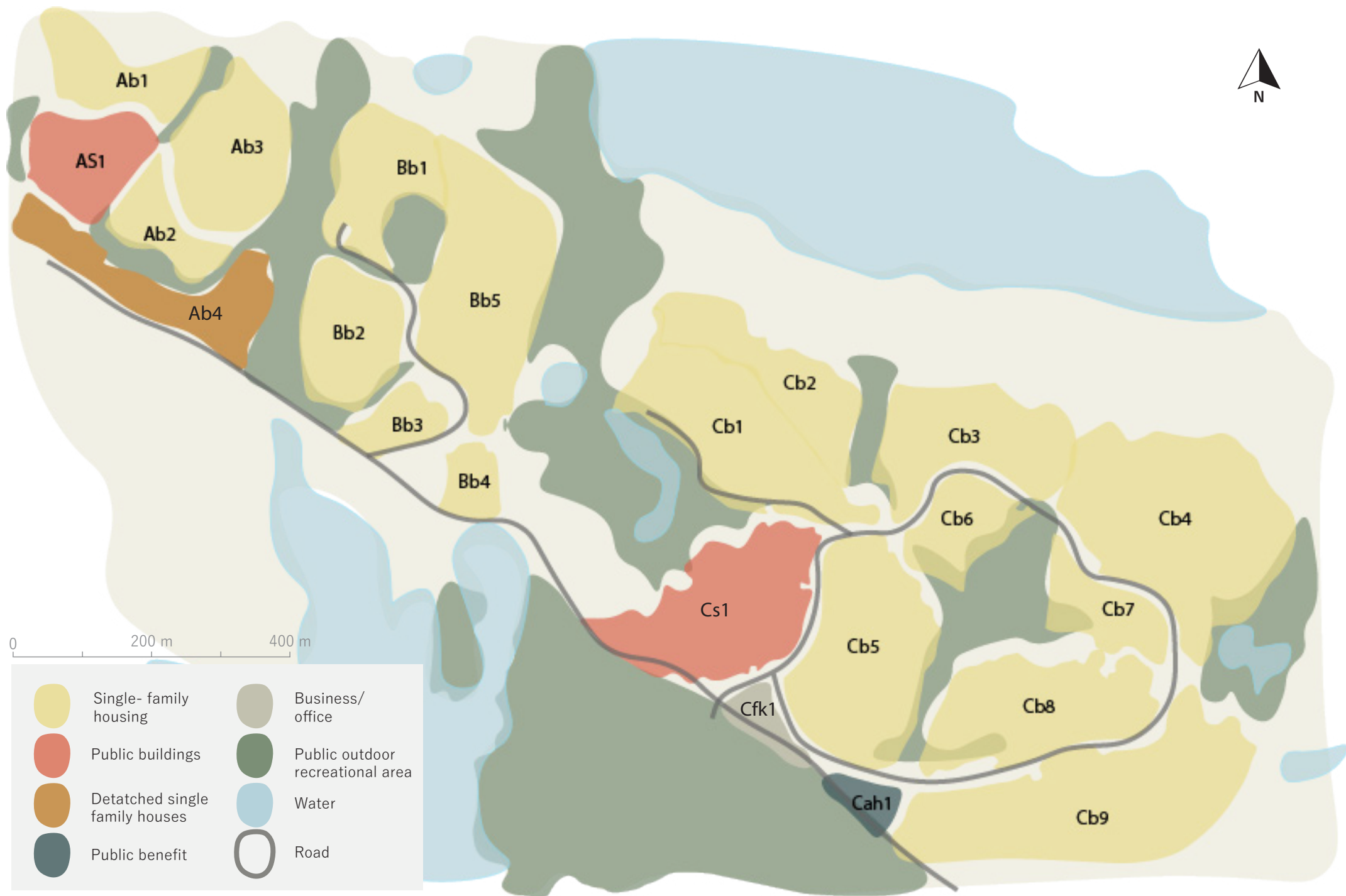


Figure 4.3: Zoning plan for Benestad divided into 22 areas. Self-produced based on (Kommunekart, 2008).

Norway's best district". On their website they also include a vision for the future residents "With nature right outside your door, it is easy to live "the good life". It should be good to live in Drangsvann, and it should be good for nature to welcome new residents. We look forward to seeing you at Drangsvann". (Drangsvann, 2021).

The zoning plan for Benestad last edited on the 18th of May 2020 included provisions placed on Cb1 and Cb2. The project consists of an area of approximately 94 acres, and is located about 7 km east from Kristiansand city center, 1,5 km from the closest town "Rona". Today the area consists of housing south in the Cb1 area, but other than this it's mainly covered by forest.

For Cb1 the plan is concentrated single-family housing, block housing and detached single-family housing; the specific requirements are presented in figure 4.2. In this field, a minimum of 85 and a maximum of 120 housing units are allowed and a BRA of up to 21,700 m<sup>2</sup>. Towards the free area

in the west, detached single-family housing will be built.

For the Cb2 field the plan is to concentrate single-family housing, block housing and detached single-family housing; further requirements are shown in figure 4.2. In the field, a minimum of 46 and a maximum of 67 housing units are permitted. BRA is up to 13,500 m<sup>2</sup>.

A joint detailed zoning plan for Cb1 and Cb2 was submitted by COWI on February 08, 2021. This planning initiative discusses the premises for the further planning work following §1 of the Regulations on the processing of private proposals for detailed regulation pursuant from the "Planning and Building Act". The planning initiative shall, to the extent necessary, discuss the premises for the further planning work, and account for:

1. The purpose of the plan
2. The planning area and if the plan will have effect outside of the planning area
3. Planned buildings, facilities and other

measures

4. Development volume and building heights
  5. Functional and environmental quality
  6. The measure's effect on, and adaptation to, landscape and surroundings
  7. The relationship to the municipal plan, any current zoning plans and guidelines, and ongoing planning work
- And so on.

In the plan they propose to change the outline of the planning area to include the space between the planned development and Drangsvann. They also present plans for the main road going through the area which will be presented under infrastructure in the spatial analysis (COWI, 2021).

- Cb1 and Cb2 are regulated for housing and will house, anywhere from 131 to 187 units.

### 4.1.3 Planned road

From the regulated areas Bb1, Bb5, Cb3, Cb5, and Cb6 there are plans for a road through the south part of the Cb1 and Cb2 area. We have been informed by COWI where they are looking at building the road. The southern main road was from the beginning placed outside of the area by COWI. Further in the process. COWI had to find new solutions for where the road could be placed due to feedback from the neighbors. In the beginning, the road was placed near Langetjønn and by moving the road further up in the terrain, it gives possibilities to build properties near Langetjønn and keep a nice view without cars driving through. This road gets connected to an already existing gravel road. Further, this existing road goes between parts of the housing and leads to the pier, volleyball, hammock, and grill area. This road will be moved to the outside of Cb1 and Cb2 for making possibilities for gathering housings south of the area. Both of the solutions will preserve the southeast area along Langetjønn (Kilde, muntlig). The first proposal in Figure 4.4 shows a 331 meter

long road being moved to the northern part of Cb1 and crossing down to the southeast corner, while the second proposal shows a 323 meter long road going to the south part of Cb1.

- All roads need to be linked to the planned main road presented by COWI



Figure 4.4: Planned roads for Cb1 and Cb2. Self-produced based on (COWI Kristiansand, 2020).

#### 4.1.4 Housing survey in Kristiansand municipality

A population survey from 2018 on housing situations and housing preferences in Kristiansand municipality. The report sums up the results from the “Housing survey in Kristiansand municipality” (“Boligundersøkelse i Kristiansand kommune”). Kantar TNS has executed the project for the municipality as a continuation of the report “What type of housing... and where?” (“Hva slags bolig ... og hvor?”). The report is meant to help create the next municipal master plan and housing policy for Kristiansand. The focus for the survey was to map out the population’s housing preferences, and give an impression of what direction Kristiansand municipality should develop into. The survey targeted people over 18 living in Kristiansand and was conducted as a web survey. A selection of 21 000 people received an invitation to the survey by text with some information about the survey and that everyone who submitted would be in the draw for a giftcard of 1000 nok. In total 2462 answered the survey giving

a response of 11%.

Sole proprietorship through co-ownership is the dominating owning and renting form today. Approximately 70% inform that they own a proprietorship house today while 15% of the population rent. 40% say they live in a detached house and 30% live in apartments. The average time living in the same unit is 11 years, while the average in their area of Kristiansand is 16 years. 50% say they feel connected to the geographical area they live in while 30% say they feel connected to the neighborhood’s social relationships.

The most important factors when choosing where to move was “type of housing” and “local environment” with 70% listing these as the most important ones. Health was the least important factor with 30% listing it as important. Public transportation, cafes and gyms are the services with the most use by the population with 40% saying they use these often. Dentist/doctors appointments are naturally used with less frequency and registered as the least used in this survey.

Of the services provided in housing types with communal services the most used one is a janitor and the least used is the landlord. When asked about preferred housing type 80% said freehold housing is what they would prefer. In the financial part as seen in Figure 4.5 of the survey 20% stated they are willing to spend between 2-3 million, 30% say they are willing to spend 3-5 million, while 10% are willing to spend more than 5 million. Few people say that they want to move out of the municipality.

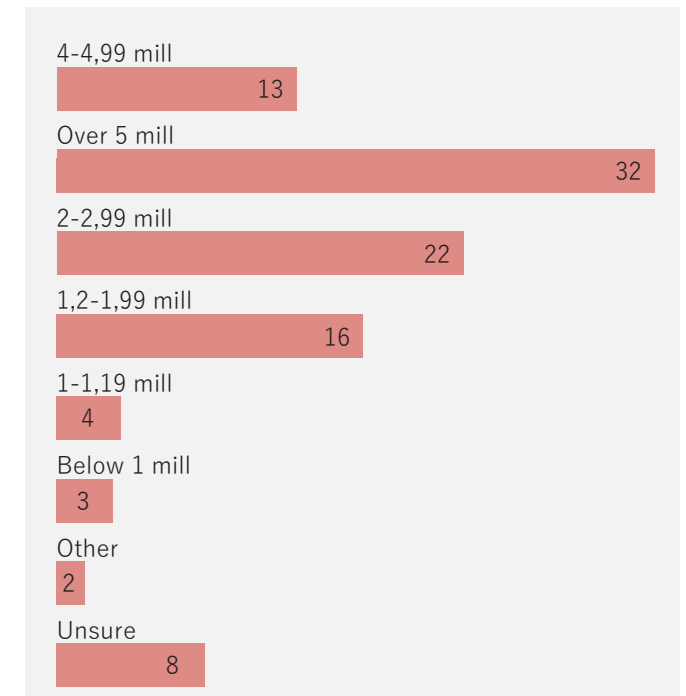


Figure 4.5: The value difference on how much the participants wanted to spend on their new housing. Self-produced based on (KANTAR TNS, 2018).



The population can tolerate a decent traveling distance as seen in Figure 4.6. 21% state they are willing to travel further than 10 kilometer travel distance to work and 16% say they can accept a distance of three to five kilometers to work.



Figure 4.6: The travel distance the participants are willing to move to work. Self-produced based on (KANTAR TNS, 2018)

On the other hand they don't want to travel far to get to the grocery store. 44% state that

they would accept 1 to 3 kilometers, 30% would want under 1 kilometer and only 2% would be okay with more than 10 kilometers as seen in Figure 4.7.

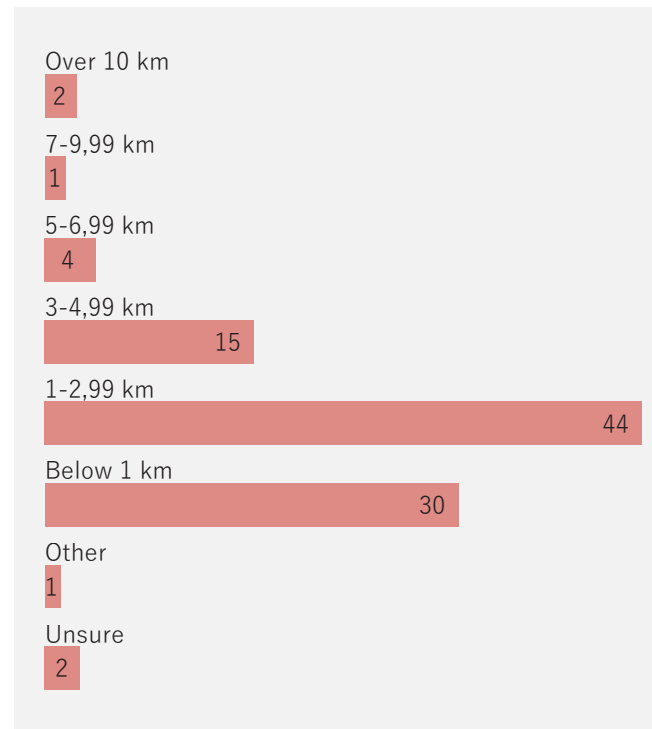


Figure 4.7: The travel distance the participants are willing to move to a grocery store. Self-produced based on (KANTAR TNS, 2018).

When choosing a resident many factors are contributing to a degree. The survey has mapped out which factors the residents value when looking at houses. The factors presented in the survey was:

- Sub-area/part of the city
- Price Level
- Size of the housing unit
- Area without noise/pollution
- Proximity to nature and sea
- Proximity to shops and other services
- Proximity to public transportation
- Safe route to school/traffic safety
- Proximity to work/kindergarten/school
- Proximity to leisure and cultural activities
- Area with people in the same age group
- Proximity to family and friends

From these the most important elements were noise/pollution, proximity to nature/sea and the price level for the people living in Kristiansand with 80% stating that these factors are important as seen in Figure 4.8. The least important is proximity to services and to live in an area with people in the same age group with 40% stating that it's important. 30% stated that they would be willing to make the environmental choice of give up car use if they had services and public transportation within proximity. Here the younger population is the once who are

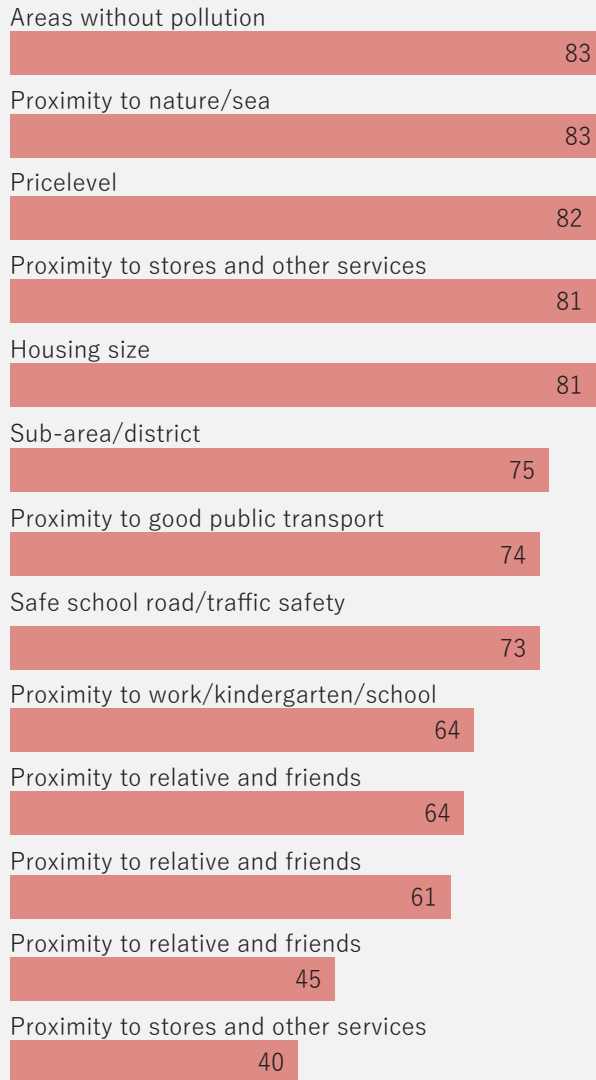


Figure 4.8: Different factors map the residents value when looking at houses. Self-produced based on (KANTAR TNS, 2018).

the most willing with 50% saying yes. The ones with a lower pay than 600.000 nok

consider price level as a bigger factor than those above, while those with over 800.000 view the housing type as more important. The survey also collected information on how they now live and mapped out some of their habits (Hindenes, Å (2018).

- 80% prefer freehold housing
- 80% think the most important elements were noise/pollution, proximity to nature/sea and the price level
- 40% think the distance to services and to live in an area with people in the same age group is important

Residents were asked what services they used the most from public transportation, training center, cafe, playground, kindergarten, doctor/dentist or other public services. The most used category is public transportation with 35% stating they use this every 14th day or more often, followed by training centers with 33% and cafes with 27% every 14th day or more often. This high use of public transportation needs to be considered and a bus stop within the area should be implemented (Figure 4.9).

## SUMMARY

from chapter; National and local guidelines

### Benestad

- Cb1 and Cb2. Both fields are regulated for housing and will house anywhere from 131 to 187 units.

### Planned road

- All roads need to be linked to the planned main road presented by COWI

### Housing survey in Kristiansand municipality

- 80% prefer freehold housing
- 80% think the most important elements were noise/pollution, proximity to nature/sea and the price level
- 40% think the distance to services and to live in an area with people in the same age group is important



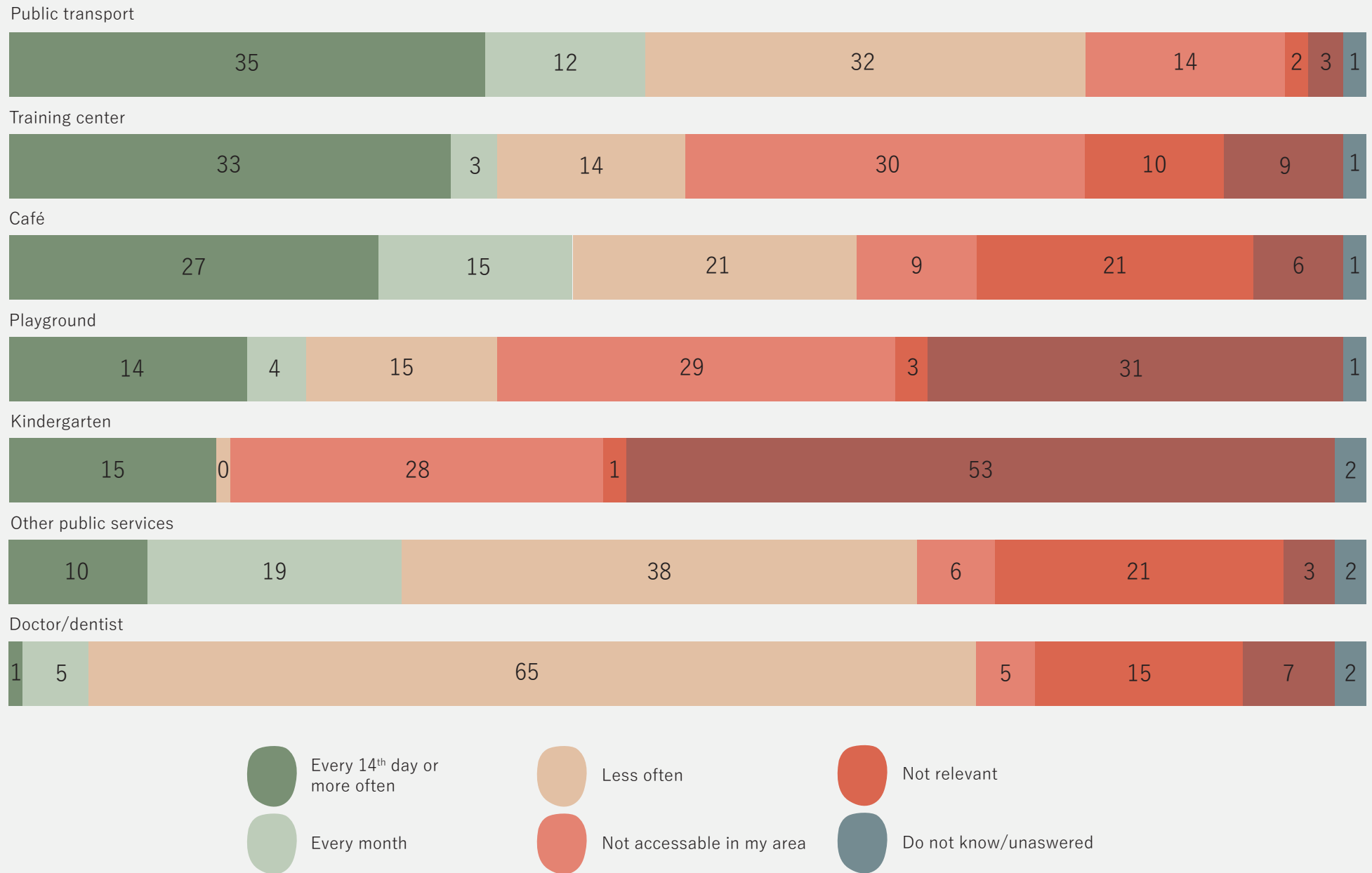


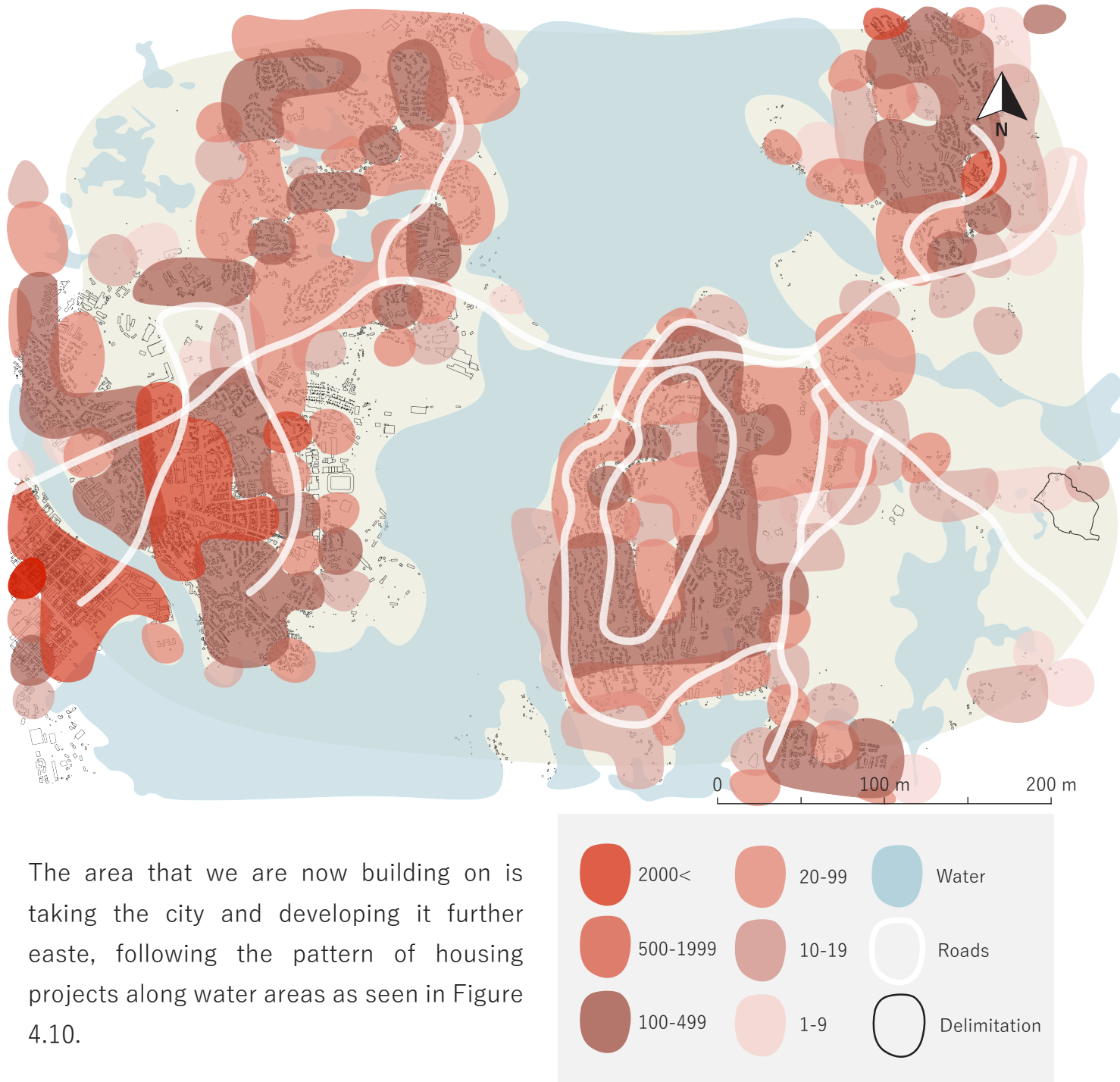
Figure 4.9: The participants were answering how often they were using these different services. Self-produced based on (KANTAR TNS, 2018).

## 4.2 Spatial Analysis

The analysis is conducted with different scales depending on the distance required to get sufficient information. The widest scale shows the area in connection to Kristiansand sentrum. The second shows the area in connection to the elements in close proximity and the most detailed scale shows just the planning zone. The more detailed analysis is only the regulated areas Cb1 and Cb2.

### 4.2.1 Historical and building structure

The building pattern for Kristiansand is located in and around the city center. As the city's population has gone up one can see it becoming bigger and bigger to accommodate the growth. From 1955 and 1978 there were a lot of developments and "Søm" went from a wooded area to suburban areas with infrastructure and several smaller neighborhoods. From 1978 and until now the development has not been as drastic, but more focused on filling in the space between neighborhoods (Norge i bilder, 2021).



The area that we are now building on is taking the city and developing it further east, following the pattern of housing projects along water areas as seen in Figure 4.10.

Figure 4.10: Building structure in Kristiansand. Self-produced based on (Norge i bilder, 2021).

When looking at the population and how it is spread out, one can see a cluster of units in the city center, and less density further away. South and east of the planning area is an untouched landscape, to the west 1-9 people are living per square kilometer, while to the north there is between 10-19 per square kilometer.

#### 4.2.2 Ownership

In the study area 10 properties as seen in Figure 4.11 will be fully or partly influenced by the development, matrikkel 69/1, 69/2, 69/7, 69/9, 69/10 and 69/12 (Gule sider, 2020). Properties within the planning area are primarily contributed to Drangsvann AS who proposed the building opportunities. The properties with matrikkel 69/2, 69/9, are 69/10 are today privately owned.

- Some of the properties have existing buildings and will be given special consideration for further development.



Figure 4.11: Ownership in the area. Self-produced based on (Gulesider, 2021).

### 4.2.3 Buildings

Today there are five (40, 48, 80, 82, 88) properties in our area and two (110, 112) properties north of the area as seen in Figure 4.15. Property number 40 is getting removed when developing cb1 and cb2. These properties that are staying are from the 1960's and have gable roofs with a variation of white and red buildings. Nearby housings in Drangsvann have facades as seen in Figure 4.12- 4.14.

- The properties that are being removed need to be implemented in the plan and the ones that stay need to be taken into consideration during the process.
- Blend in new housings Cb1 and Cb2 with the housings existing nearby

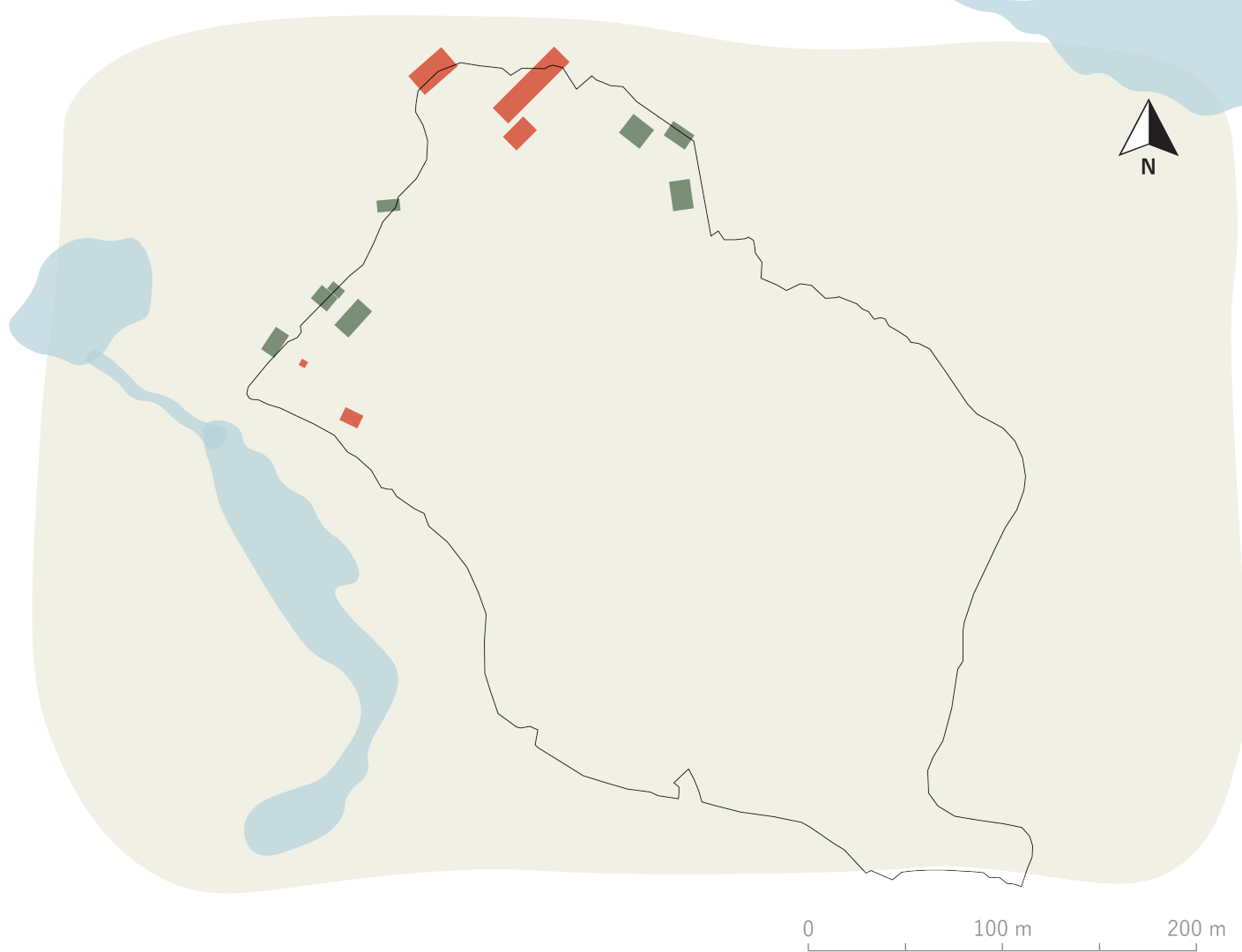


Figure 4.12: Single-house (Block Watne, 2021)

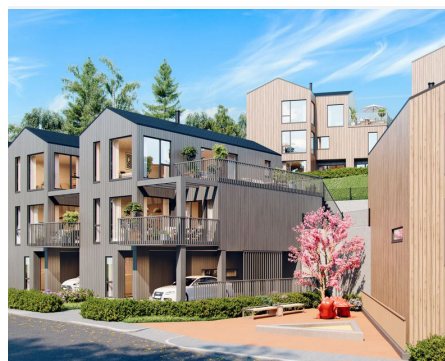


Figure 4.13: Townhouse (Drangsvann, 2021).



Figure 4.14: Four-unit home (Drangsvann, 2019).

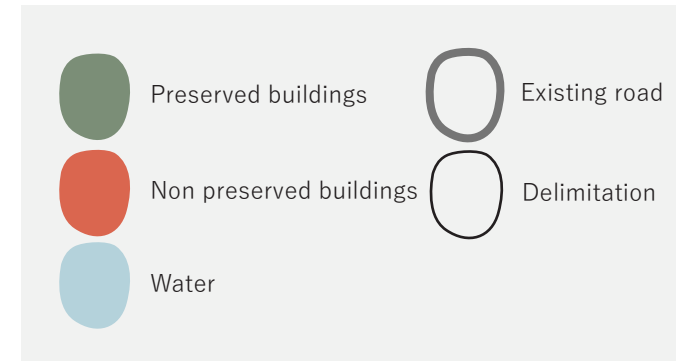


Figure 4.15: Buildings in the area. Self-produces based on (Georange, 2021a).

#### 4.2.4 Cultural heritage

Today's generation is committed to managing cultural monuments with respect for those who have lived before us, and with consideration for those who come after (Regjeringen, 2005, s.5). "Cultural Heritage Act's" definition of cultural heritage and cultural environments is presented in chapter 1, §2: "Cultural monuments mean all traces of human activity in our physical environment, including localities, beliefs or traditions. By cultural monuments is the area where cultural monuments are included as part of a larger whole or context" (Kulturminneloven, 1979, § 1-2)

There are three ruins or removed buildings. Due to their status, these should not be a problem during development. There are three buildings under SEFRAK on one of the plots to be preserved as seen in Figure 4.16. All three are within the property and should not be affected by the development (Riksantikvaren, 2020).

There are no cultural monuments within



the regulatory area. There are some in the immediate vicinity who should be considered for any consideration during further development of the area.

Traces of settlement from the Stone Age around built-up areas north of the

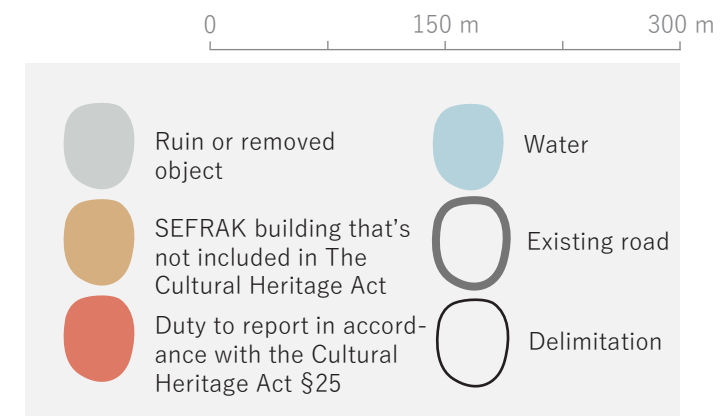
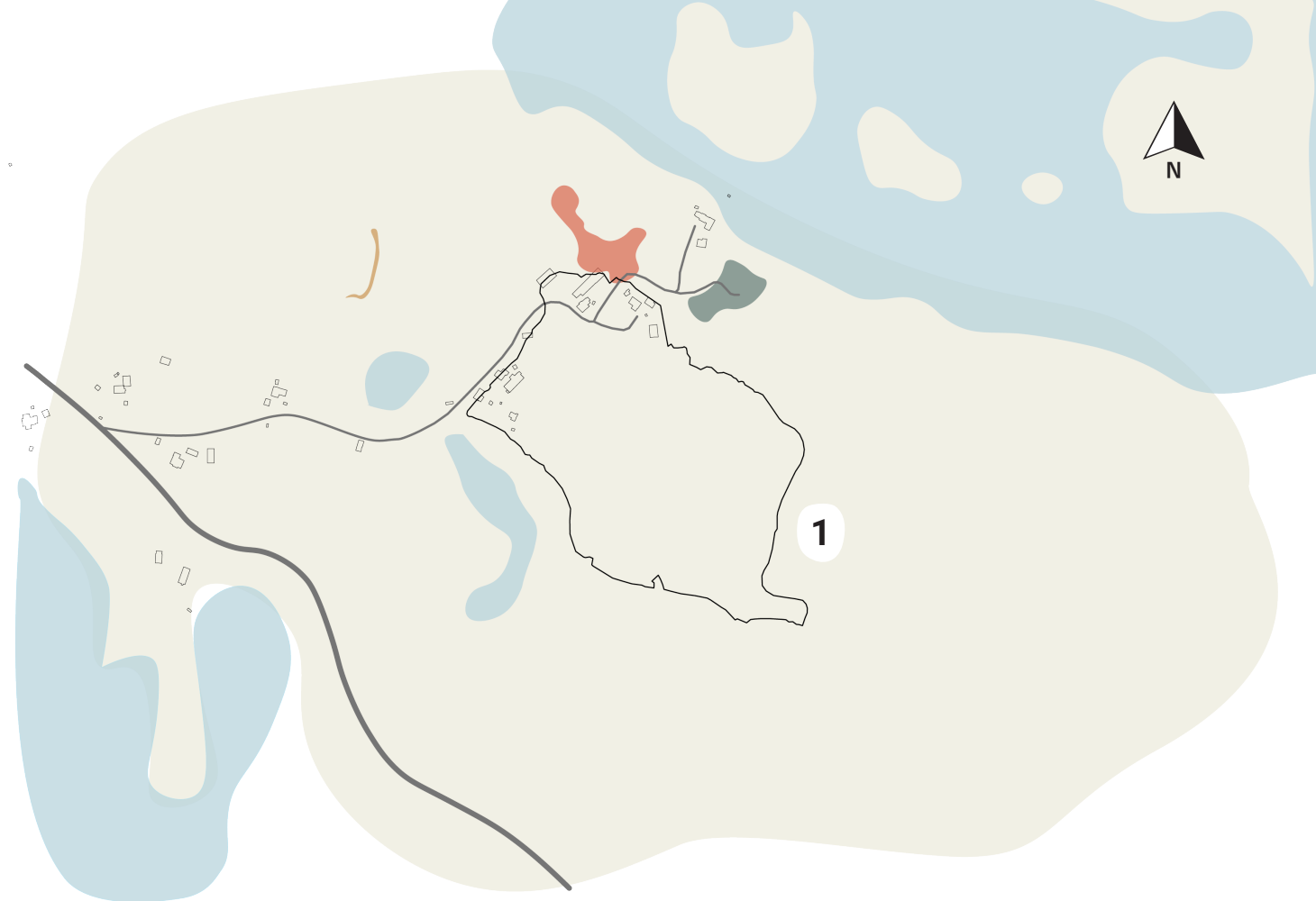


Figure 4.16: Ruins, SEFRAK etc in the area. Self-produced based on (Riksantikvaren, 2020).

demarcated area. During a field trip, 1 Nøstvedtøks of diabase, 1 beef fragment of diabase, 1 possible ax fragment, 8 flint tubers, 2 flint tubers with splitting scars, 3 flint chips, 1 grinding plate of quartzite, 1 rock crystal chip, and 3 chalk pipe fragments were found. Today's conservation status is automatically protected (Riksantikvaren, n.d.a). The findings are outside the actual zoning plan as seen in Figure 4.17, but the proximity means that there are probably also traces within the area.

- Should there be findings during development, the development should be stopped until an archaeologist has made the necessary examinations

Skanse is a fortification about 30 m long and 0.5 m high somewhat east of the planning area. Further northeast there are several small ramparts with a total length of 30-40 m. The cultural monuments are not protected and the distance from the regulated area indicates that they will not be affected (Riksantikvaren, n.d.b). On



Engelholmen there is a grave monument which according to Geir Tveide Drange consists of three burial mounds from the Bronze Age. Today's conservation status is "Automatically protected cultural monument" (Riksantikvaren, n.d.c).

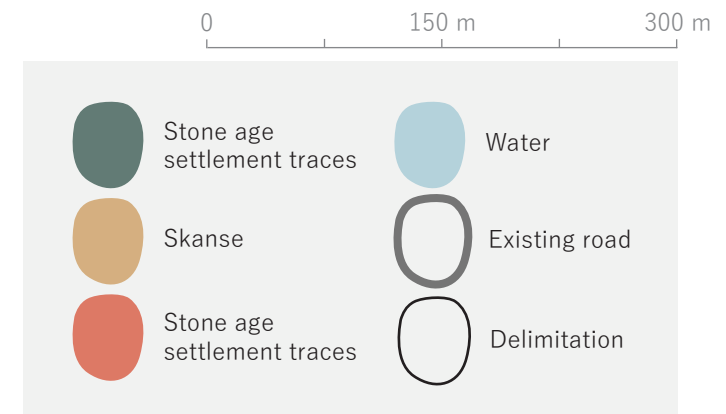


Figure 4.17: Cultural monuments in the area. Self-produced based on (Kulturminnesøk, 2021).



- The location of the cultural monument is an island north of the area that is not under regulation and will not be affected.

As part of the work on the zoning plan for Benestad in 2007, archaeological registration of the entire Benestad was carried out. The proposal is adapted to the conclusions in the analysis. In this study, it is recommended that the developers take into account that stone fences and clearing piles in open/open-air areas shall be preserved, and that stone fences and clearing piles in building areas shall be preserved as far as possible. These types of stone fences are also within the Cb1/Cb2 areas as seen in Figure 4.18.

- There is one that is in a good enough state that it should be preserved on the east side of the area.



Figure 4.18: Stone fence along the delimitation east of Cb1 and Cb2 (Eppeland, 2020).

#### 4.2.5 Infrastructure

Since there is limited existing development in the area, the infrastructure is also limited.

- When implementing infrastructure the guidelines from “the Norwegian Public Roads Administration” will be followed.

#### Existing roads

The planned area has access from the southern highway 401, as seen in Figure 4.19. There is a path for both pedestrians and bicycles towards cb1 and cb2, but the road further in is without sidewalks.

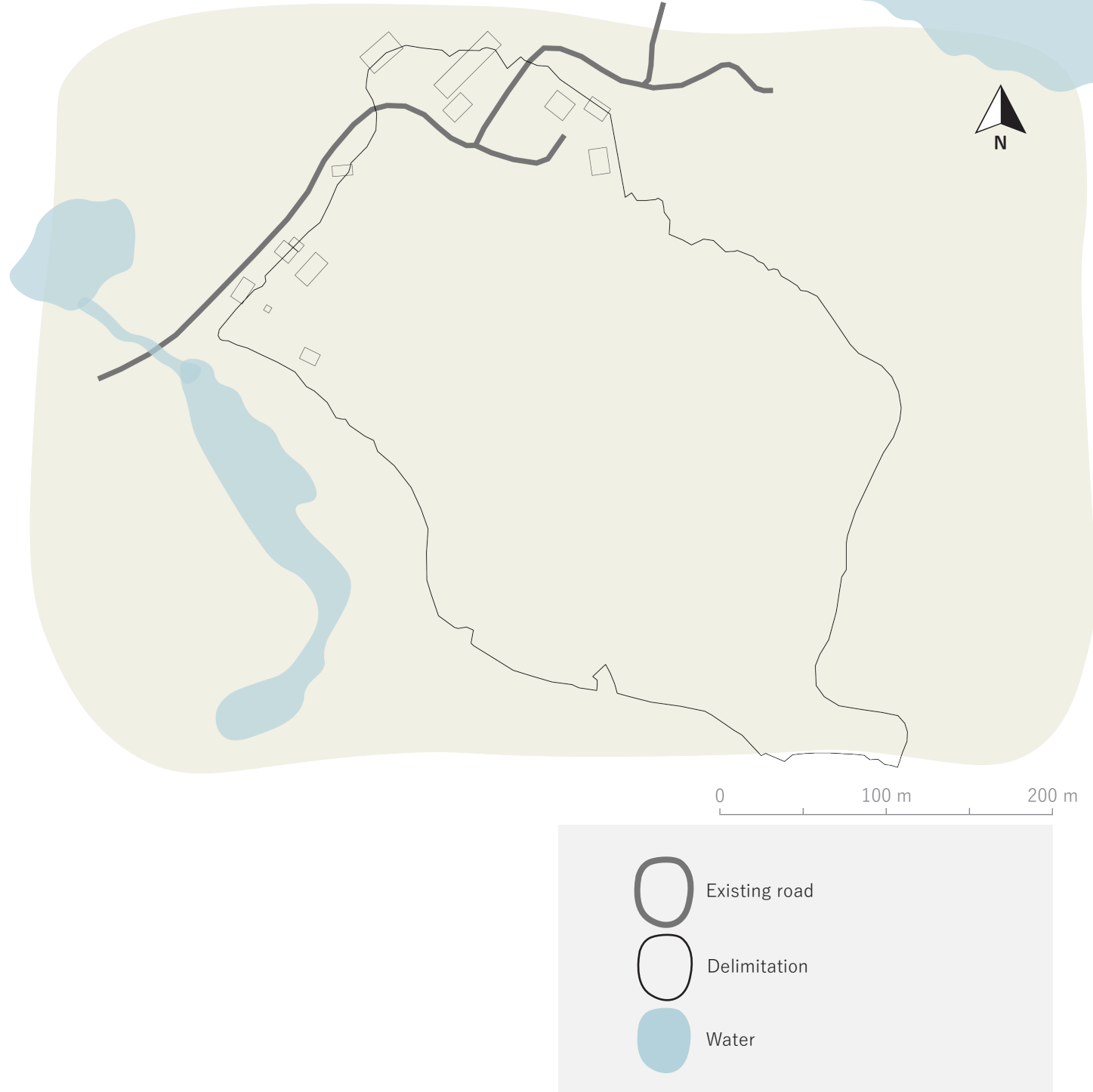


Figure 4.19: Existing roads in the area. Self-produced based on (Vegkart, 2021).



## Noise pollution from the road

Today there is no noise pollution in proximity to the delimited area in Sommerro. The road 401 has an annual average daily traffic (AADT) of 2950 vehicles, with a share of heavy vehicles of 6% (figures from 2018) (Statens vegvesen, n.d). This equals noise on the road and right next to it a Lden of 65 dB and a wider buffer of Lden from 55-65 dB, as shown in figure 4.20. The speed limit on Høvågveien is currently 60 km/h. There are plans for a new road closer to the area.

- A new analysis of noise pollution should be conducted with the new road structures.

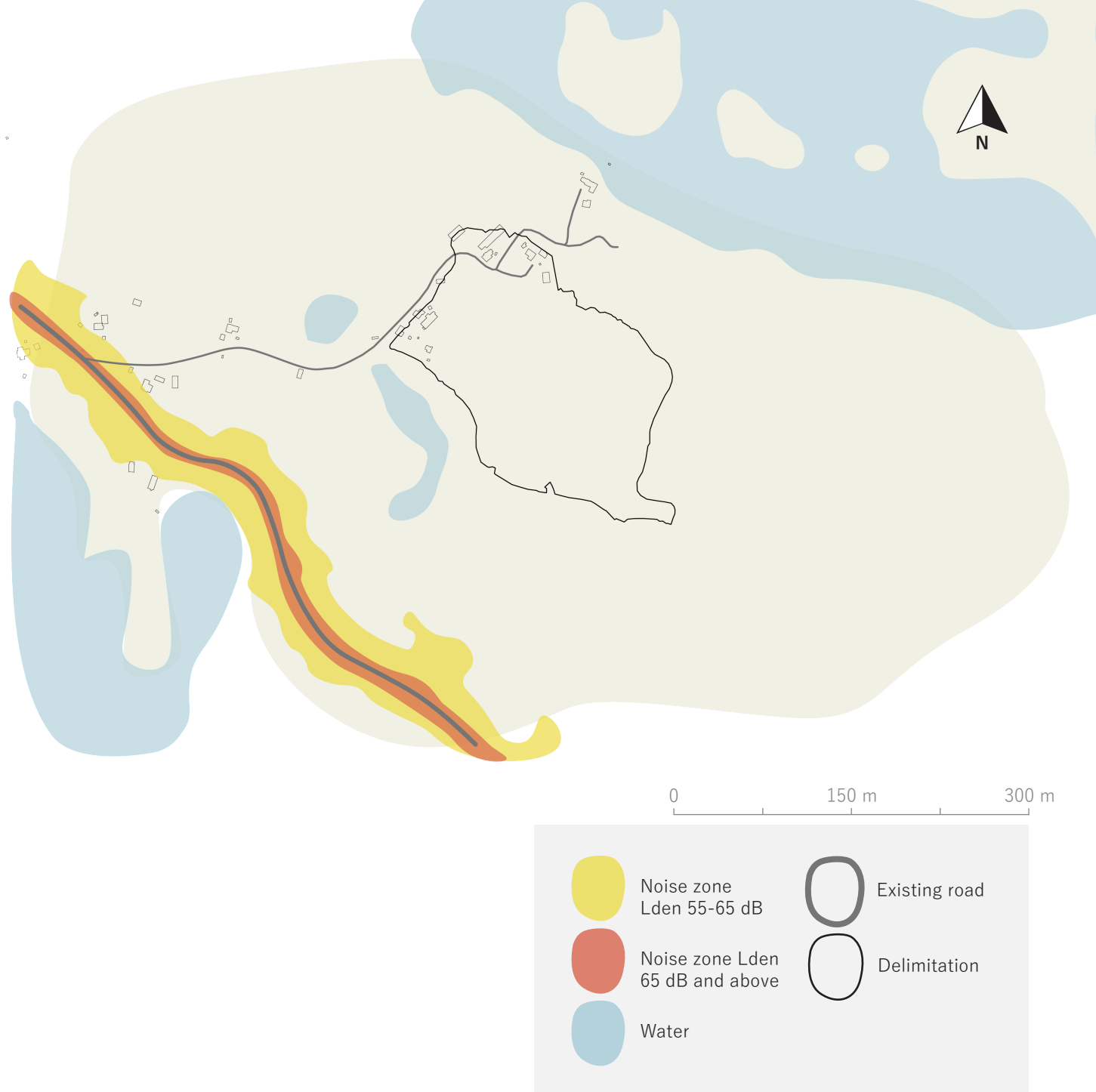


Figure 4.20: Noise pollution from highway 401. Self-produced based on (Georange, 2021b).

#### 4.2.6 Waters in the area

Cb1 and Cb2 are in close proximity to Langetjønn, Rundetjønn, Drangsvann og Sukkevann as seen in Figure 4.21. Langetjønn is located south of the area and is about 260 meters. Rundetjønn is located on the west side and has a diameter of almost 60 meters. Drangsvann is located north of the areas Cb1 and Cb2, and consists of seawater from Rona extending about 2,7 km. Sukkevann is far south of the area and is about 1,7 km long.

- Potential for floods coming from these areas into the planning area should be analysed



Figure 4.21: Waters in the area. Self-produced based on (Geonorge, 2021c).

#### 4.2.7 Recreation- and outdoor life

The planning area is located between Drangsvann in the north, and Sukkevann in the south. The terrain is varied making residential development a challenge. The developer has a goal of upgrading the current hiking network around Drangsvann with associated pier facilities, bathing areas, activity-creating areas, and social meeting places as seen in Figure 4.22-4.25.

There is no registration of children's use of areas in subfields Cb1 and Cb2. There is dense forests throughout the area not suitable for playing. On the other hand, there is a jetty, barbecue area, volleyball net, and hammocks located in the north outside of Cb2. Here there are good opportunities for children's use.

The facility in the immediate area is the Sukkevann sports facility "Randesund sports club" with more than 2300 members, 1,8 km away. Here you can find football and tennis courts. In addition, there are good hiking tracks and an 18-hole frisbee golf course

right next to the clubhouse. It is a short distance to Sukkevann and Drangsvann for outdoor activities and recreational use (Randesund idrettslag, 2018). Next to Sukkevann, there is also a 6,8 km light trail, suitable for walks in the summer and skiing in the winter months (Ut, n.d.).

- With the limited recreational opportunities, there should be a focus on implementing more for both existing and future residents. Since the Randesund sports club is so close the amenities should differ from what is already here.



Figure 4.22: Hammocks (Eppeland, 2021).



Figure 4.23: Drangsvann logo at the benches (Eppeland, 2021).



Figure 4.24: Volleyball (Eppeland, 2021).



Figure 4.25: Grilling area (Eppeland, 2021).

## 4.2.8 Local climate

Giving your skin access to a healthy dose of the sun's rays will likely give you tangible benefits immediately. Increase vitamin D, improve mood, contribute to quality sleep, stronger bones and lower blood pressure are all health benefits from spending time in the sun (Tricitymed, n.d).

### Sun

The average sun hours in winter are almost 5 and in the summertime 14 hours. The shadows will be appearing on the east side of the hills in the evenings. To provide sun conditions, terrasse and private gardens should have a south/west location to make the most of the sun it gets. Figure 4.26 illustrates the sun hours each season.

- To take advantage of the sun conditions, the terrasse should be built at hills towards the south and west. One should avoid building houses on the east side of the peaks

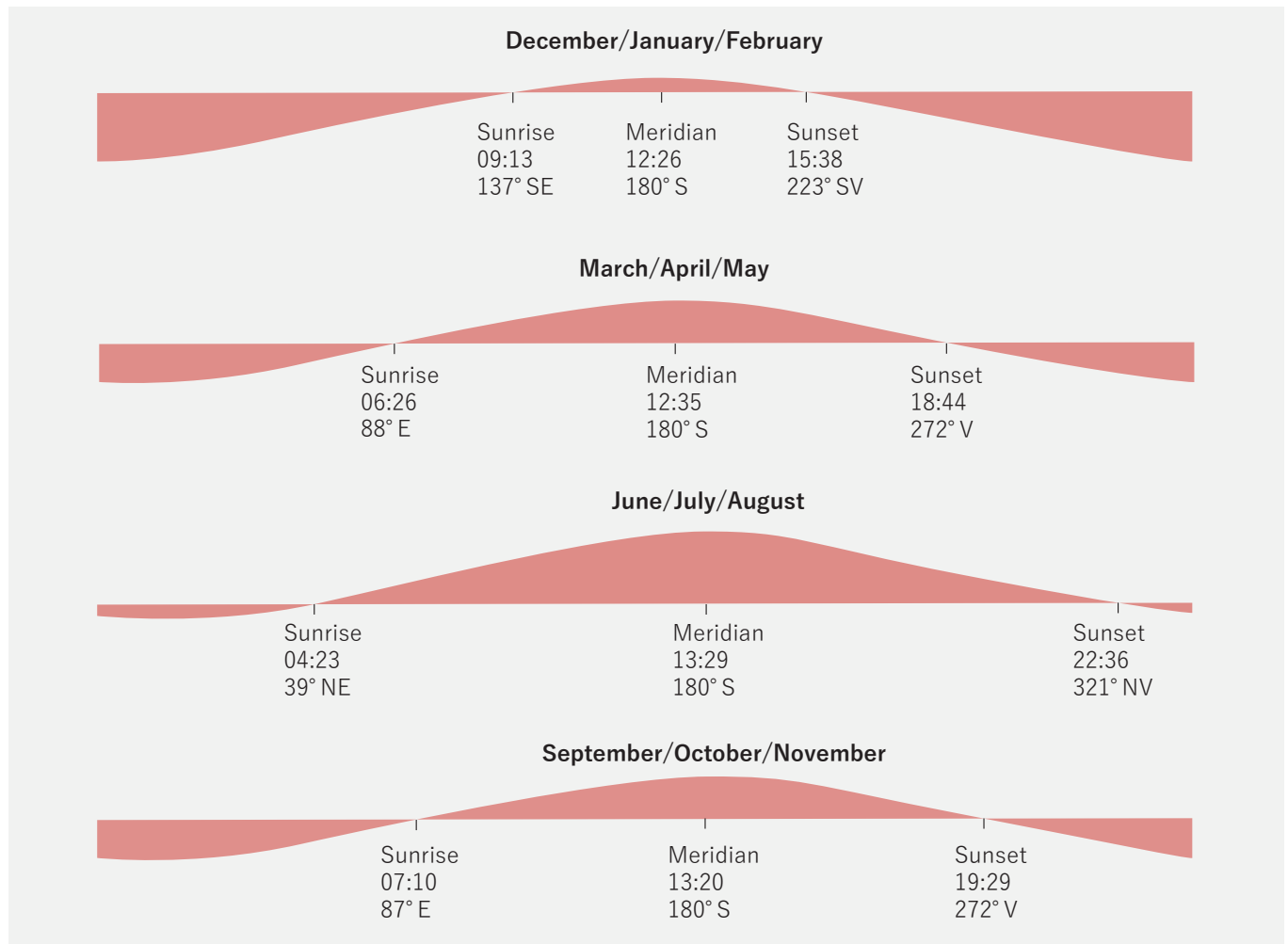


Figure 4.26: Sun hours for the four seasons in Kristiansand. Self-produced based on (Time and date, 2021).

### Wind

The wind and temperature are measured in Kjevik in Kristiansand, this is a distance of 5,5 kilometers from Cb1 and Cb2. The temperature at the lowest has been -18,1

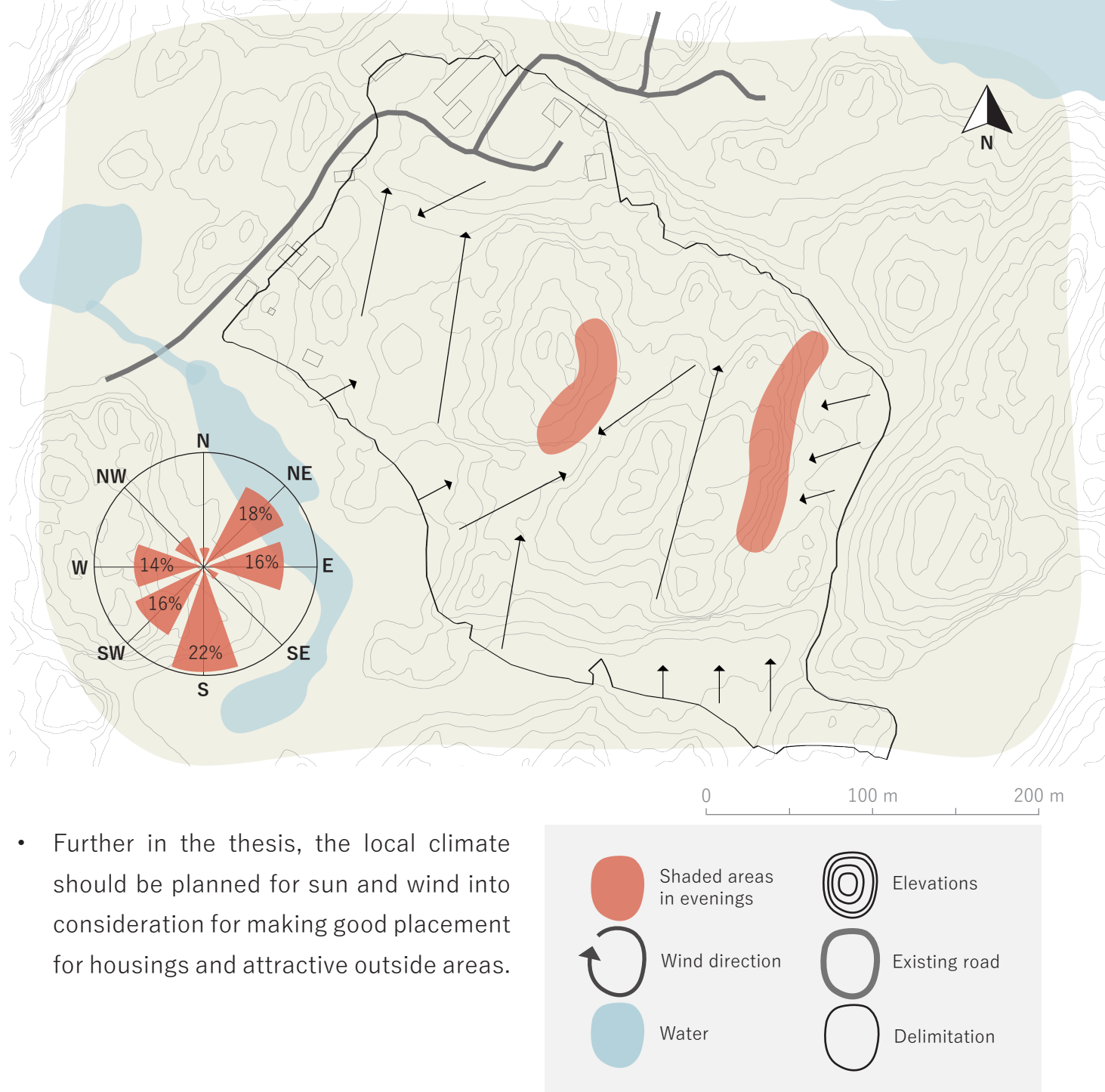
degrees and the highest 26,3 degrees. This is a variation of 44,4 degrees throughout the year. The difference in the weather, 34% are sunny days and almost 50% of days are cloudy and overcast. During the year



there has been almost 17% precipitation in Kristiansand and this needs to be considered when planning (World Weather, 2021).

- With a climate with such variables in temperature and wind, the recreational areas need to be usable and adaptable for the different weather conditions and seasons.

Overall, the wind speed is an average 3-4 meters per second throughout the year. The average wind direction in Kristiansand is mainly from the south with 22%. The wind also occurs from north-east, east, southwest, and west with an average of 64% gathered together. By looking at the terrain, the oblong hills are mainly placed from south to north. This means 22% of the time, the wind will blow through the terrain. But on the other hand, the oblong hills will reduce the wind when it appears from east or south with 64% of the occurrences. Figure 4.27 shows how the wind direction will affect the area Cb1 and Cb2 (World Weather, 2021).



- Further in the thesis, the local climate should be planned for sun and wind into consideration for making good placement for housings and attractive outside areas.

Figure 4.27: Wind direction in Kristiansand. Self-produced based on (World weather, 2021).

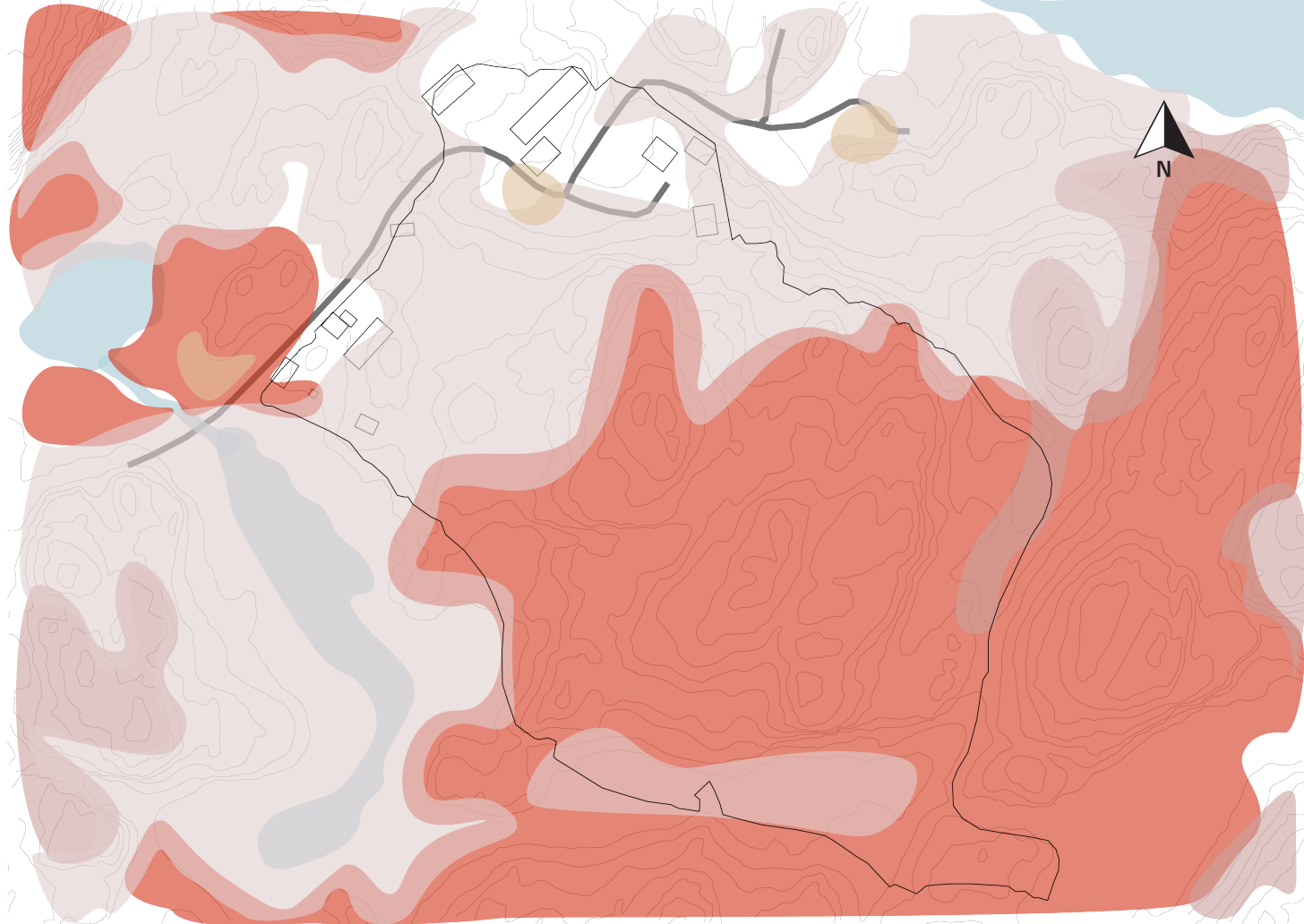
#### 4.2.9 Green/natural structures overall

The green and natural structures should be considered before development so considerations can be made to keep conservation, get an overview of existing conditions and see if any measures need to be implemented before building.

#### Vegetation

The planning area has a nice view of Drangsvann in the north, previous development in the west, Sukkevann in the south, and natural areas in the east. There are no important habitats or nature reserves within the area, as seen in Figure 4.28.

- It is still good to note the forest and the agricultural areas that are located nearby, during the development concerning construction machinery and so on. (Miljødirektoratet, 2019)
- The area mostly consists of deciduous forest in the west, coniferous in the east, and a small patch of mixed forest on the far east side.



The area mostly consists of deciduous forest in the west, coniferous in the east, and a small patch of mixed forest on the far east side.

The forest farmers are varied in the area, with “very good” conditions in the west

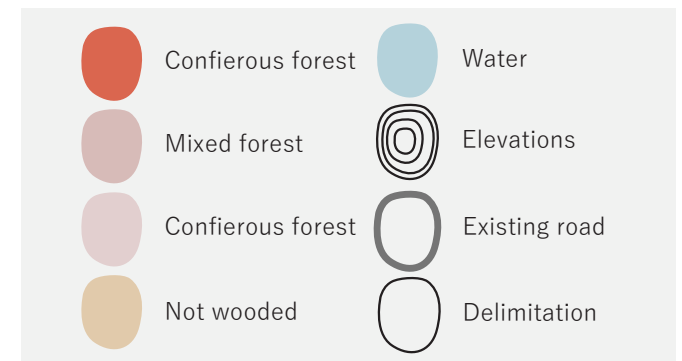


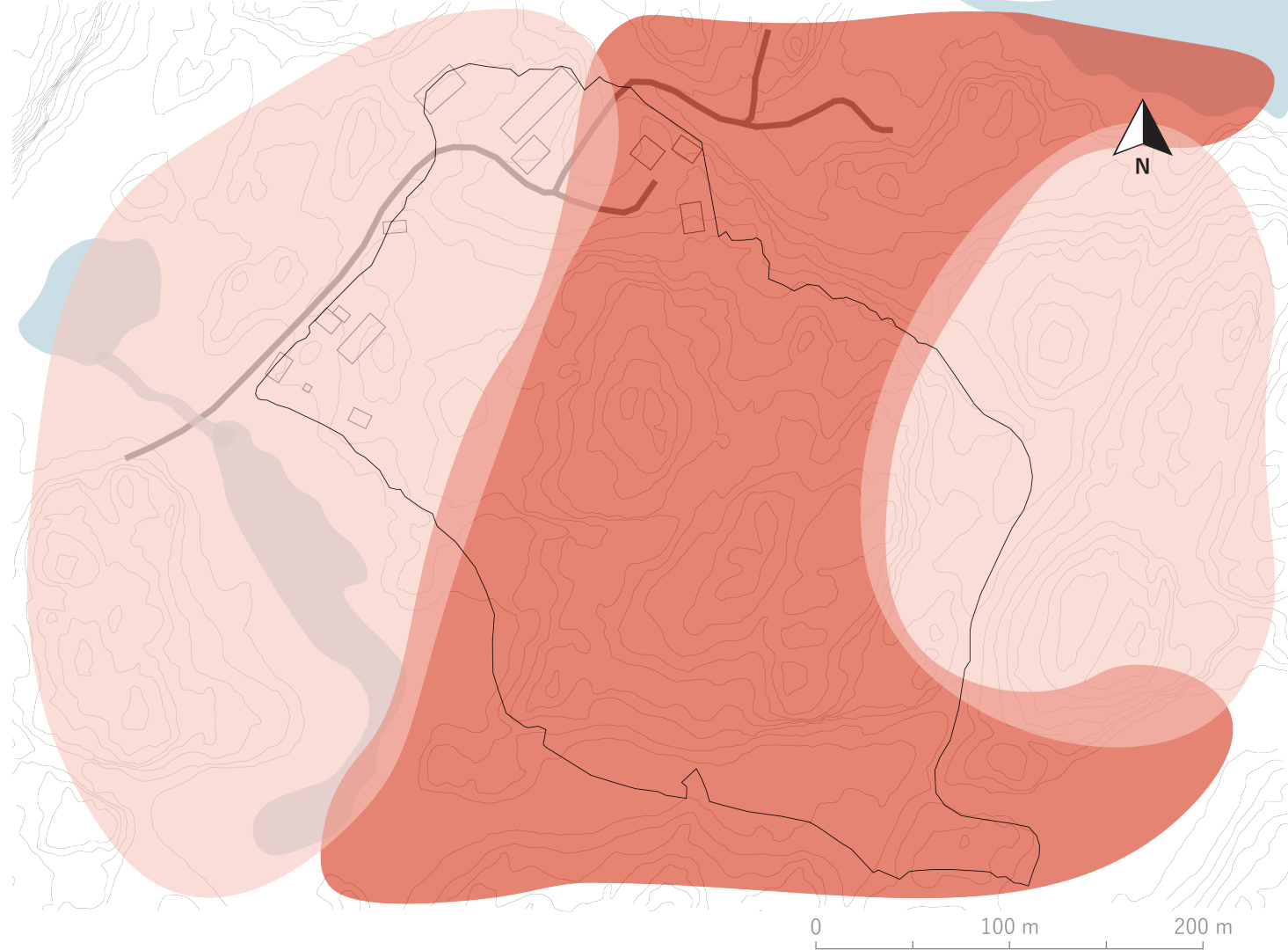
Figure 4.28: Vegetation in Cb1 and Cb2. Self-produced based on (NIBIO, 2021).

close to the existing houses, and at the very south part. The majority of the area is “medium” with some patches of “low” and “unproductive wood areas”.

- The forest farmers are varied in the area, with “very good” conditions in the west close to the existing houses, and at the very south part. The majority of the area is “medium” with some patches of “low” and “unproductive wood areas”. (NIBIO, n.d.)

### Radon

Radon is an invisible and odorless radioactive gas, which is formed continuously in the earth’s crust. Outdoors the radon concentration is normally low, and health hazards only arise when the gas seeps in and becomes concentrated in our indoor environment. (Norwegian Radiation and Nuclear Safety Authority, 2021). Figure 4.29 shows high- and moderate low risk for the area.



- There is a high risk of radon in the area and measures should be put in place.

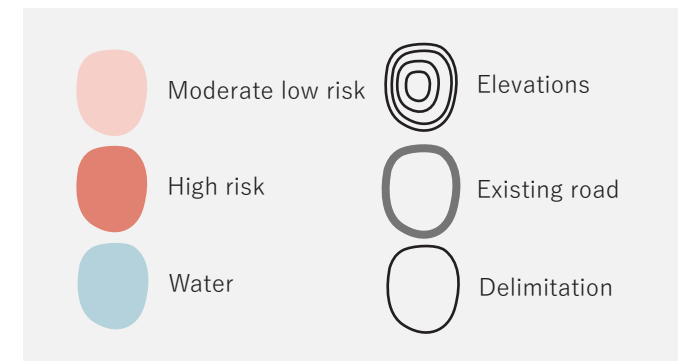


Figure 4.29: Radon in the area. Self-produced based on (Georange, 2021)

## Ground condition

The ground within the planning area consists of a “thin humus cover”.

There are two types of bedrock in the area as seen in Figure 4.30. The biggest part in the south is a combination of “diorite to granitic gneiss, migmatite” while the west part consists of “mylonite and phyllonite”.

- An inspection should be made here, to examine the risk of sulphide-bearing rocks.

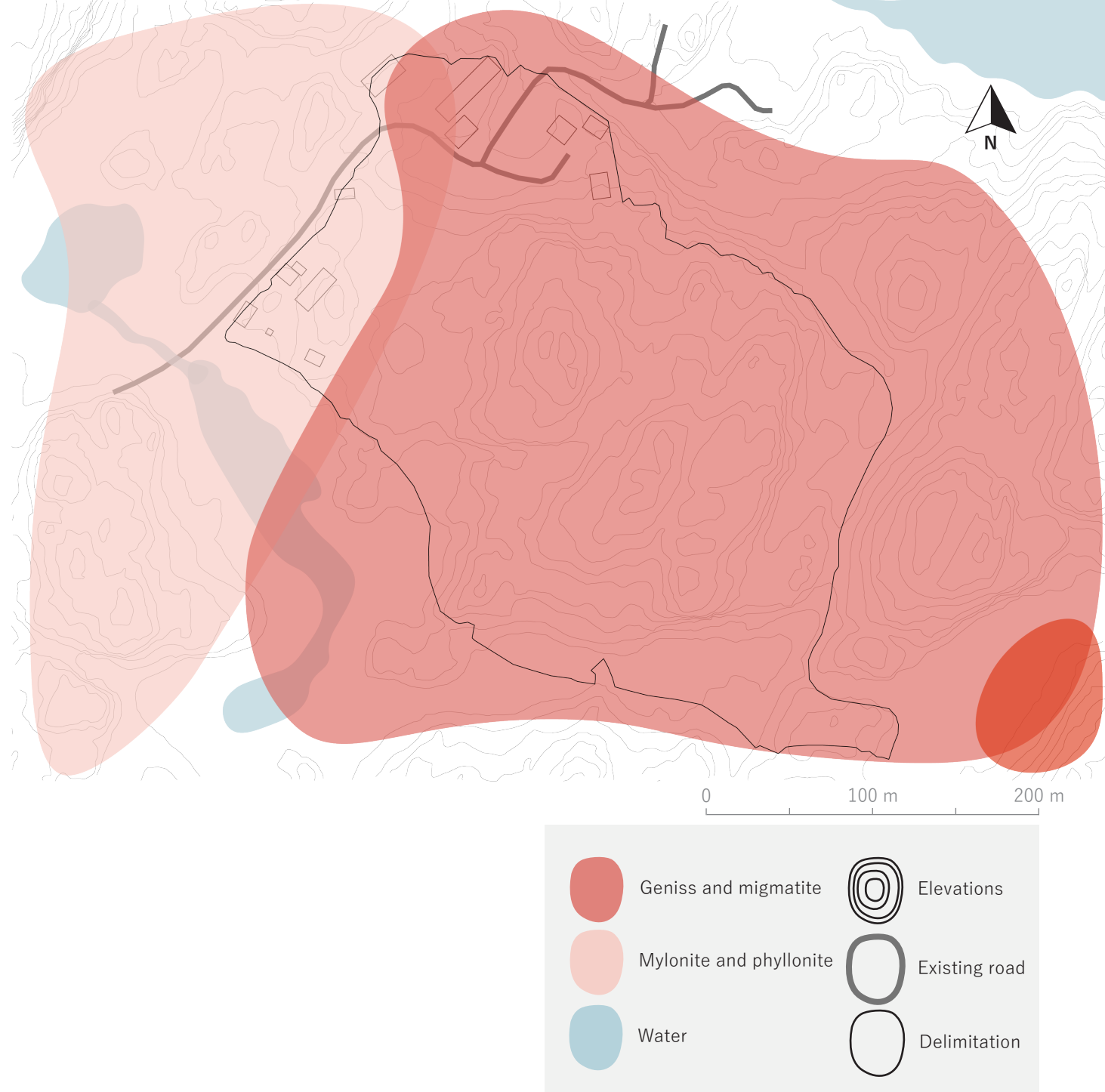
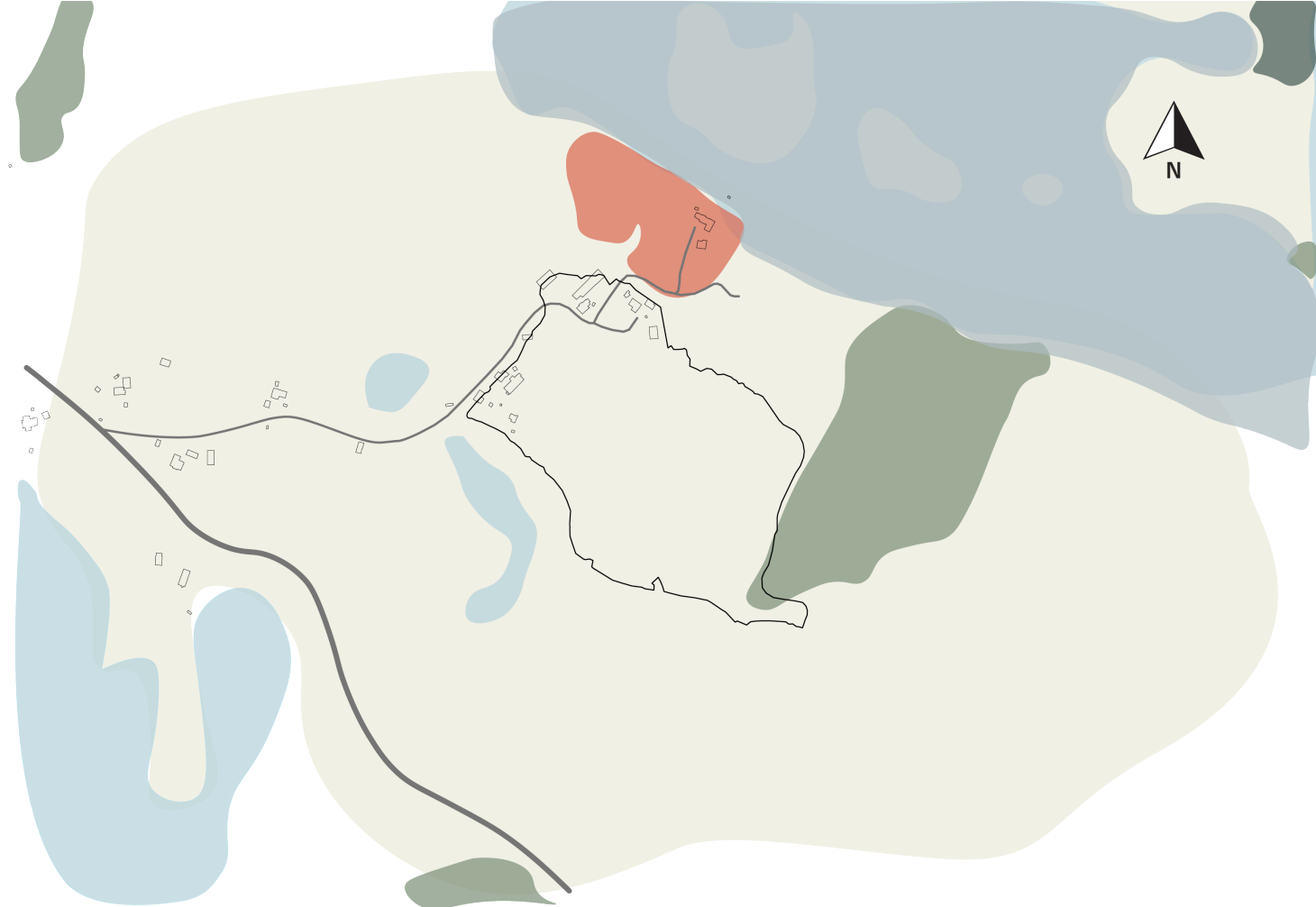


Figure 4.30: Ground condition in the area. Self-produced based on (Georange, 2021).



## Conservation

There is no registration of special types of nature within the planning area as seen in Figure 4.31. North of the area NIN (DN-håndbok 13) has mapped out an area of small biotopes consisting of low-grass oak forest which is a threatened vegetation type. This place has been measured to be less rich, the trees are old and in a location with a lot of shadows. The location is assessed as locally important or as a C-value and will not affect development within the planning area. (Miljødirektoratet, 2009a) East of the area there is a forest field with old coniferous forest with pine, the area is valued as only locally important, this is because there is no connection from this field to others. The trees were registered in 2009 as old and the amount of deadwood would/will increase in the coming years. (Miljødirektoratet, 2009b). The brackish water in the north is valued as an important type of nature. Here Strandenga is overgrown with roof pipes, mad weed, beach pipes, pollen wax, and some *Carex paleacea*. This is also an important area for whooper swans with up to 60-70 registered



sightings in the fall as well as other species.

- There is no preservation required to take care of the conservation areas as they are outside of the delimitation. However should the delimitation move, it is important to make sure it stays with a good distance from the whooper swans in Drangsvann.

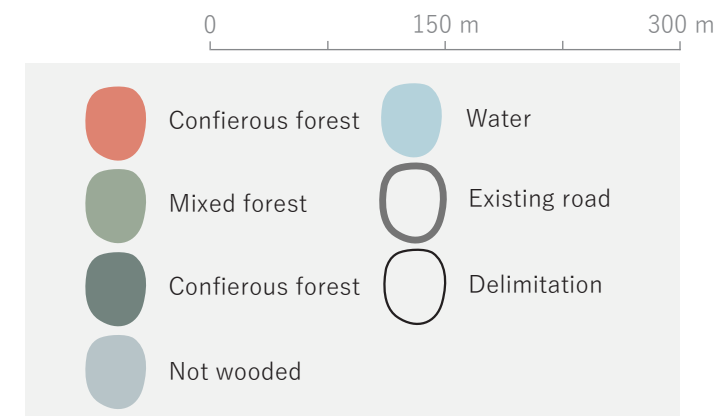


Figure 4.31: Different conservations in the area. Self-produced based on (Miljødirektoratet, 2009a and 2009b).

#### 4.2.10 Biodiversity

Artsdatabanken has 69 registered observations of species in the area. 63 of these are birds that most likely have a much bigger habitat and are not dependent on the area. Other than that there are two tracheophytes and two different types of mushrooms. Both mushrooms and the tracheophyte are regular (Artsdatabanken, 2020).

#### Endangered species

There are registrations of endangered species in and around the area as seen in Figure 4.32. Large populations of toads have also been observed. This is a special feature of the area that should be preserved and increases the chance that there are also other amphibians here.

- The biodiversity should be looked further into to implement necessary measures



Figure 4.32: Endangered species. Self-produced based on (Artsdatabanken, 2020).

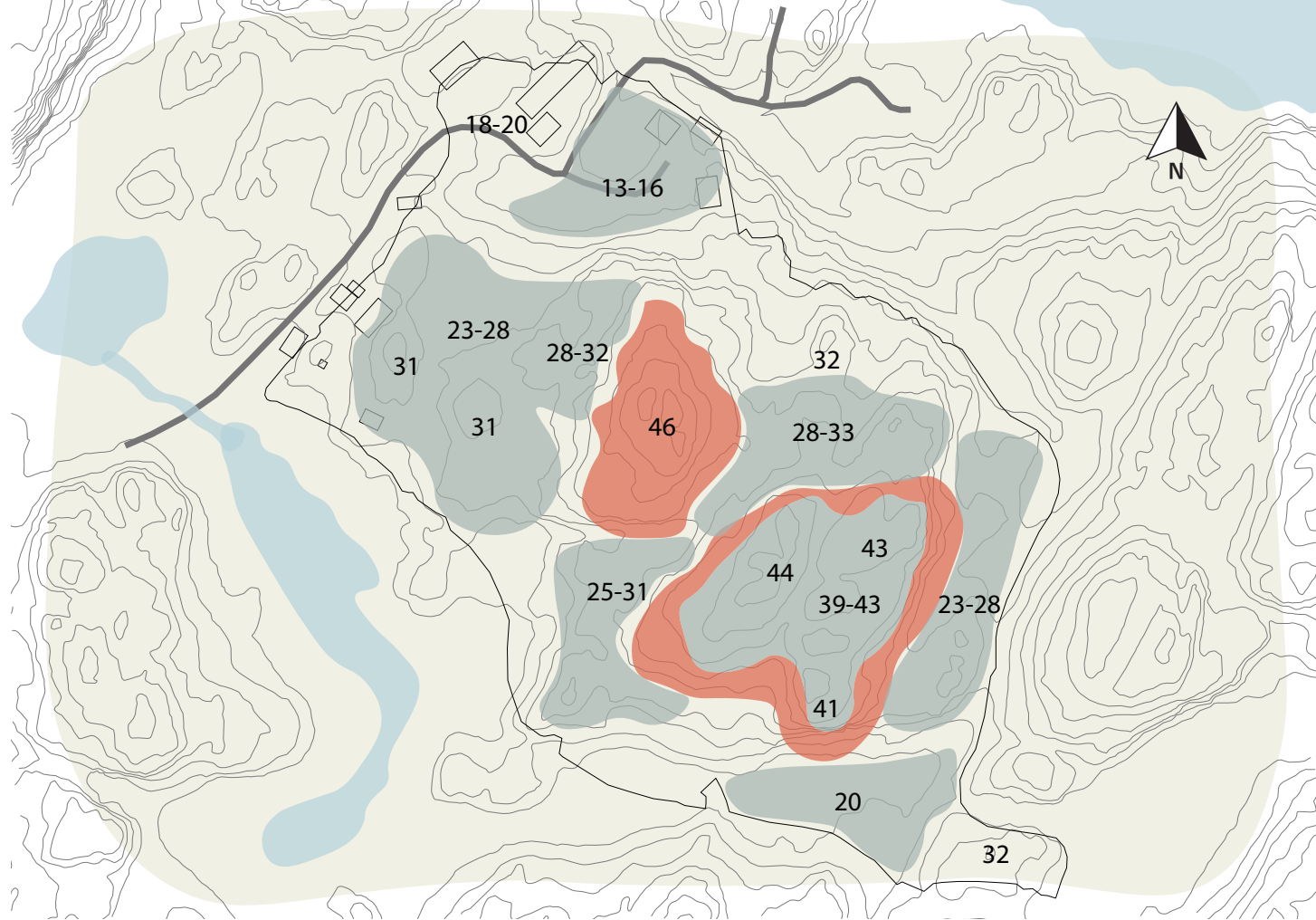
#### 4.2.11 Terrain

Cb1 and Cb2 are located from 8 meters to 47 meters above sea level. It has two main peaks and there are plenty of small peaks near the area as seen in Figure 4.33. The first big hill is 47 meters above sea level and the second is located 44 meters above sea level. There are several steep places. For instance, in the south, between the two main peaks, east for the eastern hills and north for the western hills.

- Peaks and low terrain areas should be preserved from development because of the measures needed to make it possible to build.

There are three flat areas in Cb1 and Cb2. The first is located between the existing houses. The second is located between the main peaks, as a flat area that goes from north to southwest. The third area is located in the south.

- After an inspection of the area, several peaks should be preserved. A small



peak toward the existing buildings and a little peak on the western “main” peak. Preserving them will help to create a variation in the neighborhood and reduce wind.

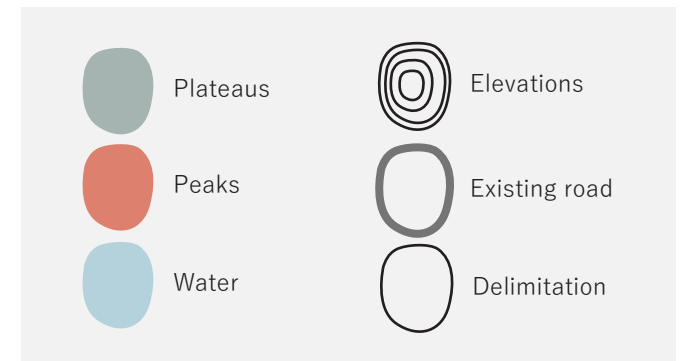


Figure 4.33: Plateaus and peaks in the area. Self-produced based on (NORDIC, 2020)

#### 4.2.12 Precipitation field

The water will naturally pour down on each side of the peaks. The water pouring down will gather between the two main peaks as seen in Figure 4.34. Rest of the water will pour against Langetjønn, the existing housings, and towards Drangsvann.

- It will give benefits by placing houses higher in the terrain. It will be important to define the lowest point to preserve these areas from housing development. In addition, it will be important to update the precipitation map if the landscape is changing due to cutting and filling. By considering this, it can give benefits to the neighborhood by utilizing the participation fields for aesthetics, open-drain water systems, and for recreational purposes.



Figure 4.34: Terrain analysis of the elevations in the area (Self-produced)

#### 4.2.13 Flood

The flood caution zone presented by NVE does not enter the planning area as seen in Figure 4.35. However the Norwegian Environment Agency presents predictions of a rise in precipitation in the coming years due to climate change. This will lead to an increase in rain flood and surface water problems. From 1900 until today rainfall has increased by 18%. If greenhouse gas emissions continue as now, the increase will go up by a new 18% by 2100. 57% of Norway's municipalities state that they don't have the capacity to handle this degree of surface water. This trend indicates additional measures for floods should be implemented in the plan. Methods using pipes and underground pools are less used in recent years, for the benefit of more natural possibilities such as opening up streams (Miljødirektoratet, 2021).

- Natural streams should be opened up for natural surface water management.

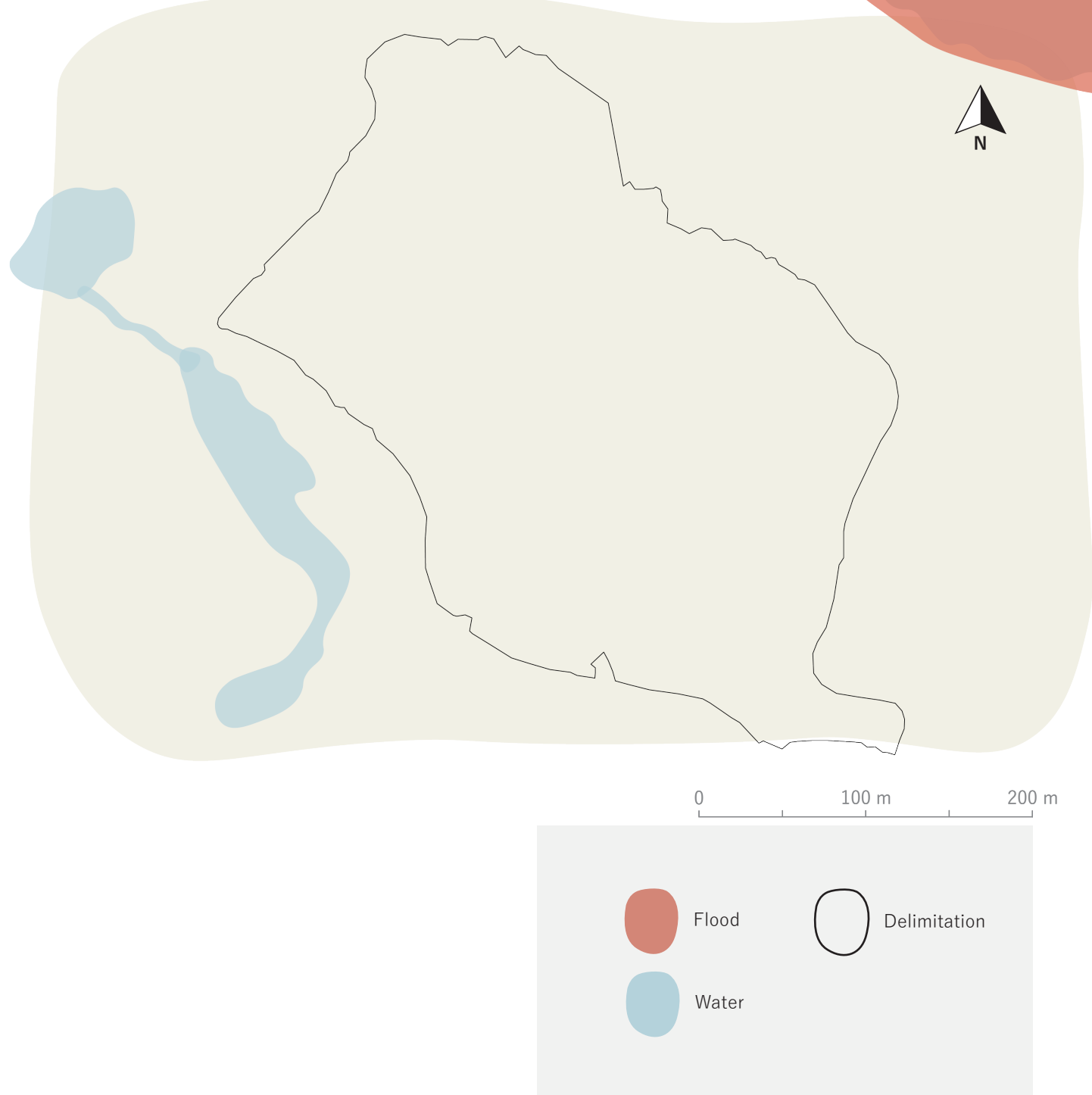


Figure 4.35: Flood in the area. Self-produced based on (Norges vassdrags- og energidirektorat, 2021)

#### 4.2.14 Target points and functions

Internally in the planning area, there are no service functions or public functions. But it is a short distance from the planning area to Rona, which has city functions and is a public transport hub. Rona is located approx 1.7 km northwest of the planning area as seen in Figure 4.36. Here there are good public transport services, with frequent bus departures to Kristiansand center. At Rona, there is also a grocery store, pharmacy, fitness center, dental clinic, hairdresser, etc (Google maps, 2021).

There are currently about six different kindergartens within a walking distance of around 2-2.5 km. Strømme school is about 2.0 km and Haumyrheia junior high school is about 3.3 km from the planning area (Google maps, 2021).



Figure 4.36: Target points and functions in the area. Self-produced based on (Google Maps, 2021).



#### 4.2.15 Traveltime and forms of transport

It is about 9 kilometers from Cb1 and Cb2 to Kristiansand city center. According to Google maps, the travel time will be about 13 minutes by car, 36 minutes by bicycle, and 1 hour and 50 minutes by walking as seen in Figure 4.37. The distance is too far to walk every day so a bicycle or car will be the best solution for everyday transport. There should be public transport close to the area to contribute to less traffic into the city center (Google maps, 2021).

- Public transportation options should be created to make it easier to travel to Rona and the center of Kristiansand.



Figure 4.37: Difference in travel time from Cb1 and Cb2 to Kristiansand city center. Self-produced based on (Google Maps, 2021)

#### 4.2.16 Public transport

There is currently a bus stop about 500 meters from the area in Sommerro, as seen in Figure 4.38, on the national road 401 with two different bus departures; 58 Ytre Randesund and 139 Høvåg - Lillesand. The Ytre Randesund bus leaves every hour in the middle of the day, but after 15:00 the bus leaves every other hour, and the last bus leaves at 21:37. The Høvåg bus has fewer departures with approximately 1.5 hours between each departure; this route stops running at 19:42 on a weekday.

- A bus connection must be implemented for Benestad to have good public transport.

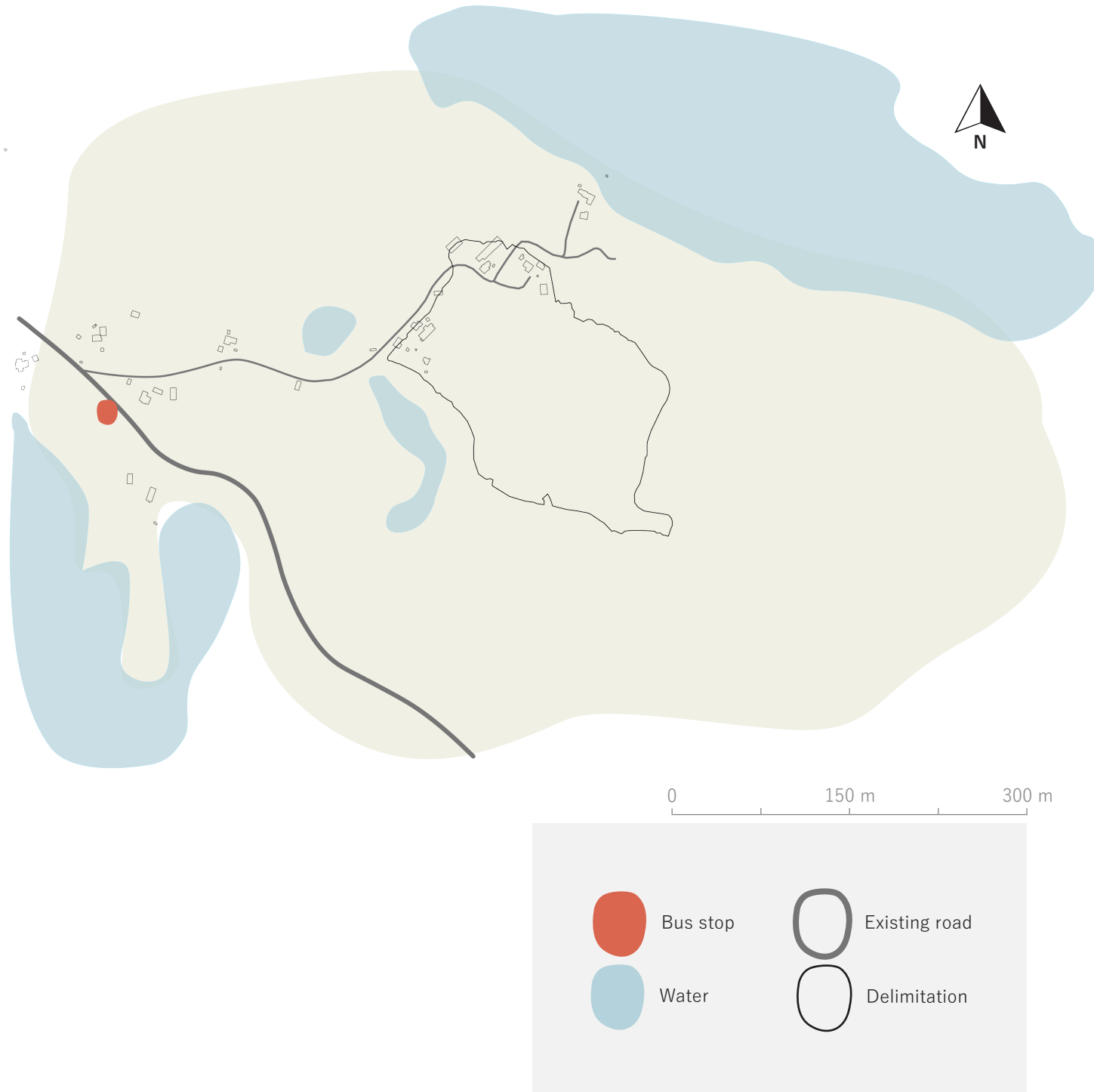


Figure 4.38: Bus stop near the area. Self-produced based on (Google Maps, 2021).



#### 4.2.17 Risk- and vulnerability assessment

COWI Kristiansand is in the process of conducting a risk- and vulnerability assessment for Cb1 and Cb2 (Personal communication, Arild Dahl, 10.05.2021) . The probability of the incidents occurring divided into four categories as seen in Figure 4.39, with the degree of probability ranging from “low probability” to “very probable”. The range of consequences is divided into 5 categories from “safe” to “catastrophic”. The topics where COWI found further examination or specific measures being implemented as necessary, they have presented the topics and their findings so far as seen in Table 4.1-4.4. We have made our own analysis of most of the topics mentioned, since the evaluation is not complete and we can not use their temporary conclusions as “facts”. The analysis is presented in Appendix 1.



Figure 4.39: Risk- and vulnerability assessment (Self-produced).

#### 4.2.18.1 Nature and environmental conditions

Quick clay	From the findings so far they view the ground conditions as in a risk of containing quick clay because of the “thin humus cover” and because part of the area is below marine boundaries.
Rockslide and rockfall	Considered to be relevant for further examination needs to be conducted as Norwegian Water Resources and Energy Directorate has yet to map out the trigger areas for rockslide or rockfall. Because of the terrain of the area this should be conducted.
Ice and snow slope	Considered relevant for further examination as the trigger area is located north, south-east and north-west on the planning area. The terrain formations and the plans to transform the terrain also make this relevant.
Flood	The Norwegian Water Resource and Energy Directorate shows the proximity to Drangsvann that makes part of the area under the area of caution for floods. Same goes for areas close to Rundetjønn south-east within the planning area. Even if there are no historical flood maps for the area this is still considered relevant because of the proximity to Drangsvann and Rundetjønn.
Radon	The area of caution for radon exposure mapped out by “Norwegian Water Resources and Energy Directorate” is moderate to low for most of the area but smaller areas in east, south and west show high risk of radon exposure.
Unsafe ice	With Langetjønn and Drangsvann so close the possibility of unsecure ice is considered relevant.
Special terrain formation that pose danger (cliff)	The terrain consists of hilly terrain making this relevant.
Areas close to rivers or sea with needs of security measures	The proximity to Drangsvann and Langetjønn makes this relevant.
Danger of polluting run-off from an exploded area (applies to sulphide-containing rock)	The area limits between an area with migmatite gneiss and an area with amphibolite. The migmatite can contain sulphide minerals both finely divided in the rock or attached to quartz-feldspar bands. The amphibolite may also contain sulphide minerals, but the probability of this is low.
Ice drift	Proximity to Drangsvann even if there is no registration of this today.
Noise	Noise Pollution has been mapped out and this is considered relevant for further inspections.

Table 4.1: Nature and environmental conditions. Self-produced based on (COWI Kristiansand, 2021).

#### 4.2.18.2 Drinking Water and biological resources

Drinking water sources, precipitation field	The area is close to precipitation fields and surface water that ends up in Drangsvann.
Agricultural areas	A small area with good soil quality is registered north of the planning area. There has not been registered arable land within or in immediate proximity to the area.
Building plans close to biological species	Registrations of “nemoral deciduous forest” with elm and linden with important values west of the planning area. The location is medium big. Or-ash forest is a threatened vegetation type, but this part is affected by felling. The occurrence of ash has also been registered centrally in the planning area. This is registered as vulnerable (VU) in the Norwegian Red List of Species. 3 occurrences of soft brown spikes (fungi) have been registered in the south of the planning area. This is a vulnerable species (VU) in the Norwegian Red List of Species. An apple tree has also been registered within the planning area. This is registered as an alien species. Very high and high risk in the blacklist.

Table 4.2: Drinking Water and biological resources. Self-produced based on (COWI Kristiansand, 2021).

#### 4.2.18.3 Infrastructure

Incidents in the road	The area is not particularly vulnerable to incidents on nearby roads. But this is still considered relevant.
Will drainage of the area lead to flooding in the areas below?	Considered relevant.
Danger connected to use of infrastructure by soft passengers and motorised transport	
School/kindergarten	Primary school and kindergarten are within a reach of 3 km meters from the planning area. As of today, sidewalks and highways have been prepared along Fv 401.
Local facilities	Sports facilities are located about 300 meters south-west of the planned area. As of today, no crossing point of the county road has been established.
Shops etc.	The nearest existing bus stop is south of the planning area along Høvågveien by Sommerro. Pedestrian and bicycle paths / sidewalks will be built to the bus stop and they will be upgraded.
Bus stops	The nearest existing bus stop is south of the planning area along Høvågveien by Sommerro. Pedestrian and bicycle paths / sidewalks will be built to the bus stop and they will be upgraded.
Fire preparedness Does the area have insufficient fire water supply (quantity and pressure)	The regulatory provisions set order requirements for documentation of sufficient extinguishing water capacity of a minimum of 50 l / sec.

Table 4.3: Infrastructure. Self-produced based on (COWI Kristiansand, 2021).

#### 4.2.18.4 Other conditions

Will forest fire / heather fire in the area be a danger to homes / houses	Surrounding areas around the planning area are characterized by coniferous forest / deciduous forest. Forest fires / heather fires in the area are therefore considered to be a risk
Protected cultural monument	A cultural monument has been registered within the planning area.

Table 4.4: Other conditions. Self-produced based on (COWI Kristiansand, 2021).

# SUMMARY

from chapter; Spatial analysis

The findings of the spatial analysis that needs to be implemented or taken into consideration are listed below. Findings that did not result in guidelines for the development is not included in the list:

## Ownership

- Some of the properties have existing buildings and will be given special consideration for further development

## Buildings

- The properties that are being removed need to be implemented in the plan and the ones that stay need to be taken into consideration during the process
- Blend in new housings Cb1 and Cb2 with the housings existing nearby

## Cultural heritage

- Should there be findings during development, the development should be stopped until an archaeologist has made the necessary examinations

- The location of the cultural monument is an island north of the area that is not under regulation and will not be affected
- There is one that is in a good enough state that it should be preserved on the east side of the area

## Infrastructure

- When implementing infrastructure the guidelines from “the Norwegian Public Roads Administration” will be followed.
- A new analysis of noise pollution should be conducted with the new road structures.

## Waters in the area

- Potential for floods coming from these areas into the

planning area should be analysed

### **Recreation- and outdoor life**

- With the limited recreational opportunities, there should be a focus on implementing more for both existing and future residents. Since the Randesund sports club is so close the amenities should differ from what is already here

### **Local climate**

- To take advantage of the sun conditions, the terrasse should be built at hills towards the south and west. One should avoid building houses on the east side of the peaks.
- With a climate with such variables in temperature and

wind, the recreational areas need to be usable and adaptable for the different weather conditions and seasons.

- Further in the thesis, the local climate should be planned for sun and wind into consideration for making good placement for housings and attractive outside areas.

### **Vegetation**

- It is still good to note the forest and the agricultural areas that are located nearby, during the development concerning construction machinery and so on. (Miljødirektoratet, 2019).
- The area mostly consists of deciduous forest in the west, coniferous in the east, and a small patch of mixed forest on the far east side.

with a good distance from the whooper swans in Drangsvann.

### **Terrain**

- Peaks and low terrain areas should be preserved from development because of the measures needed to make it possible to build.
- After an inspection of the area, several peaks should be preserved. A small peak toward the existing buildings and a little peak on the western “main” peak. Preserving them will help to create a variation in the neighborhood and reduce wind.

### **Precipitation field**

- It will give benefits by placing houses higher in the terrain. It will be important to define

the lowest point to preserve these areas from housing development. In addition, it will be important to update the precipitation map if the landscape is changing due to cutting and filling. By considering this, it can give benefits to the neighborhood by utilizing the participation fields for aesthetics, open-drain water systems, and for recreational purposes.

### **Flood**

- Natural streams should be opened up for natural surface water management.

### **Traveltime and forms of transport**

- Public transportation options should be created to make it

### **Radon**

- There is a high risk of radon in the area and measures should be put in place.

### **Ground condition**

- An inspection should be made here, to examine the risk of sulphide-bearing rocks.

### **Conservation**

- There is no preservation required to take care of the conservation areas as they are outside of the

### **Biodiversity**

- The biodiversity should be looked further into to implement necessary measures delimitation. However should the delimitation move, it is important to make sure it stays

easier to travel to Rona and the center of Kristiansand.

### **Public transport**

- A bus connection must be implemented for Benestad to have good public transport.

The background features several overlapping, wavy, organic shapes in various shades of green, ranging from light to dark. These shapes create a layered, mountain-like effect across the page.

# **PROPOSAL & ARGUMENTATION**

CHAPTER 5



## **5.0 PROPOSAL & ARGUMENTATION**

- Infrastructure
- Properties and housing
- Balcony and parking
- Recreational areas and paths
- Concept
- Outside areas from 1-11
- Spatial conditions
- 12 quality criterias

This chapter will go into detail about our proposal for Drangsvann Cb1 and Cb2. The proposal is based on the presented previously theory and analysis. The proposal will explain details from the placement of the structure, to the total concept for the area. In addition, explain the spatial conditions through the orange area. Lastly, the result will be examined through the 12 quality criteria by Jan Gehl.

The delimitation of planning areas Cb1 and Cb2 as seen in Figure 5.1 has been modified to have the roads and the connecting housing in the most suitable place. This meant expanding some of the south and west parts, making the total go from 94 acres to 114 acres. The areas being included are areas that are already under regulation plans, but have not been developed yet. So the changes will not influence their plans. COWI Kristiansand also made similar changes. To protect the conservation in Drangsvann the delimitation has been limited in this direction following the guideline from chapter; analysis - conservation.

## 5.1 Infrastructure

There is one main road planned by COWI early in the process, and five street roads implemented by us to access properties as seen in Figure 5.2. The main road (M1) is 378 meters with possibilities for soft passengers on one side with a total width of 7.5 m. The access roads (A1, A2, A3, A4 and A5) dimensions are 6 meter wide with the possibility for soft passengers on one side. This means all roads are wide enough for emergency vehicles. There has been a focus on placing the roads away from the recreational areas. This is to create safe outdoor areas for kids. The speed limit is set to be 30-40 km/h on the street roads and 50-60 km/h on the main road. The dimensions of the road is based on the guidelines presented by The Norwegian Public Road Administration in chapter; literature - infrastructure.

We started to place the street roads in flat areas and followed the terrain to get a soft incline throughout the area. It was important to make decisions on the road structure early



Figure 5.1: Old versus new delimitation (Self-produced).

in the process to protect nature qualities and avoid extensive cutting and filling. Turning points and street ends are following The Norwegian Public Road guidelines in the chapter; infrastructure. All roads were created using the program InfraWorks to make sure the inclines were not too steep. The A5 road is built on an already existing gravel road that leads to the pier. The road is 310 meters and gathers in the north to give the existing houses a private space by not placing roads right next to the existing

houses. The M1 street road is placed south in the area. This is the longest street road and connects to the four access roads. This is also the only road leading in and out of the area connecting it to the rest of Benestad. The A1 southern street road is placed along the main road to make it possible to build properties on both sides. The access road has been following the elevation to keep the terrain. The length of this street road is 218 meters. It starts from the west to the southern part of M1. As this road will have a lower speed limit than the main road, it will be undesirable for “through road”. The A2 starts at the same western point of the M1 but goes up north of the area and comes back down to the M1 closer to the middle. This will also be undesirable as a “through road” as it is longer and has a lower speed limit. The A3 starts at the middle of M1 and goes north, this road further divides into shorter access roads to reach properties. The A4 is a combination of further development of a gravel road and new infrastructure to access the new properties.

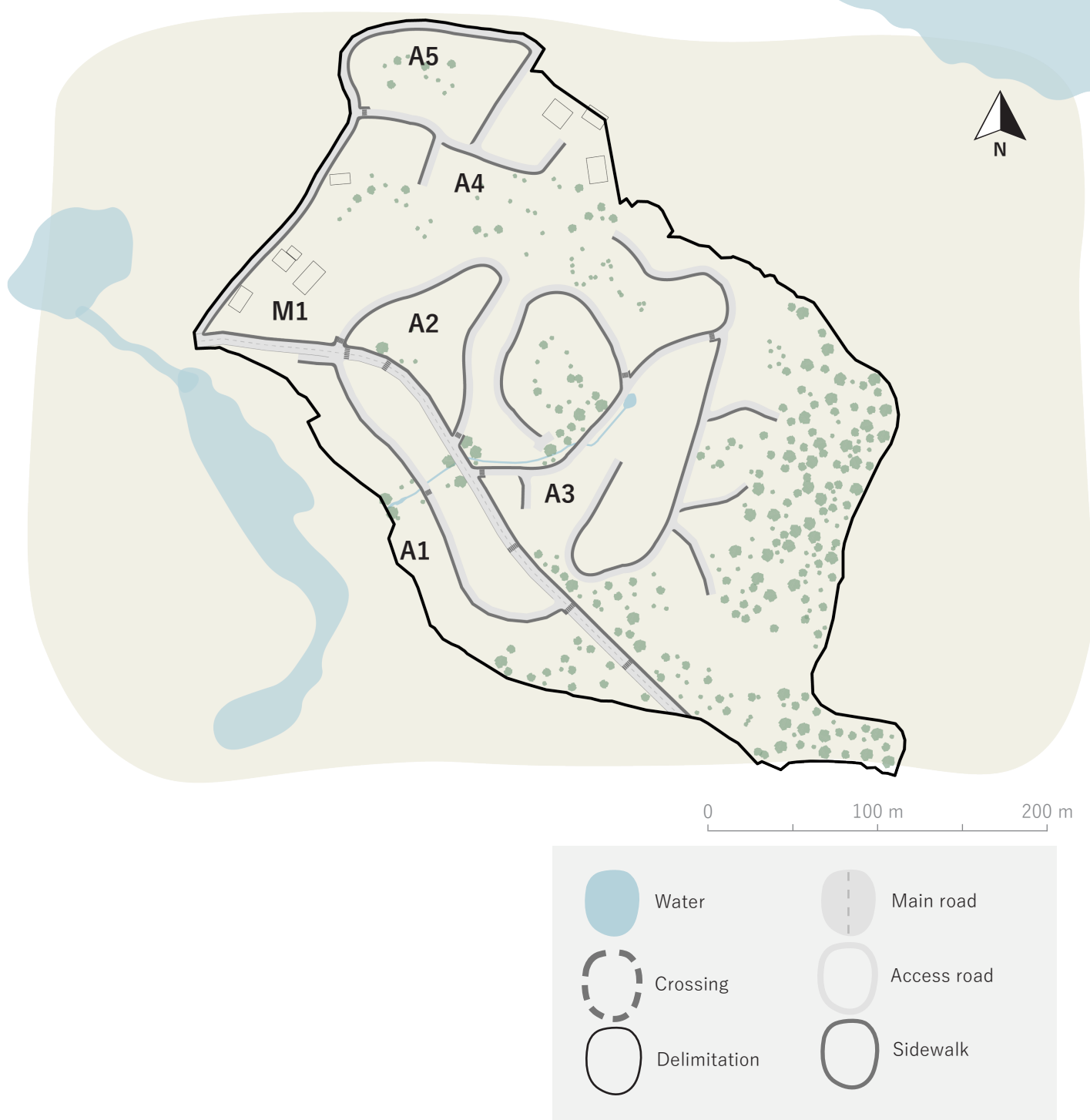


Figure 5.2: Road structure (Self-produced).

## 5.2 Properties and housings

The existing buildings that stay within the area have been taken into consideration, and the development will make a coherent neighborhood that includes these houses. The proposal will also benefit the existing residents with recreational areas, more life to the neighborhood, as well as better infrastructure. The proposal includes a total of 143 properties with sizes from 121 to 942 as seen in Figure 5.3. The properties are spread out in Cb1 and Cb2 following the guidelines put on the area by the municipality. Each property will have different qualities with advantages and disadvantages. For example, the properties in the north will get less sun, but a nice view towards Drangsvann. These dimensions are presented as a guideline by Gutti in the chapter; litteratur - local climate. The properties on the hills will get opportunities for more sun and view, but also more wind. In the south, the properties will get a nice view of Langetjønn, but some of them will be located along the main road and be affected by the noise pollution. Properties east will get nature as

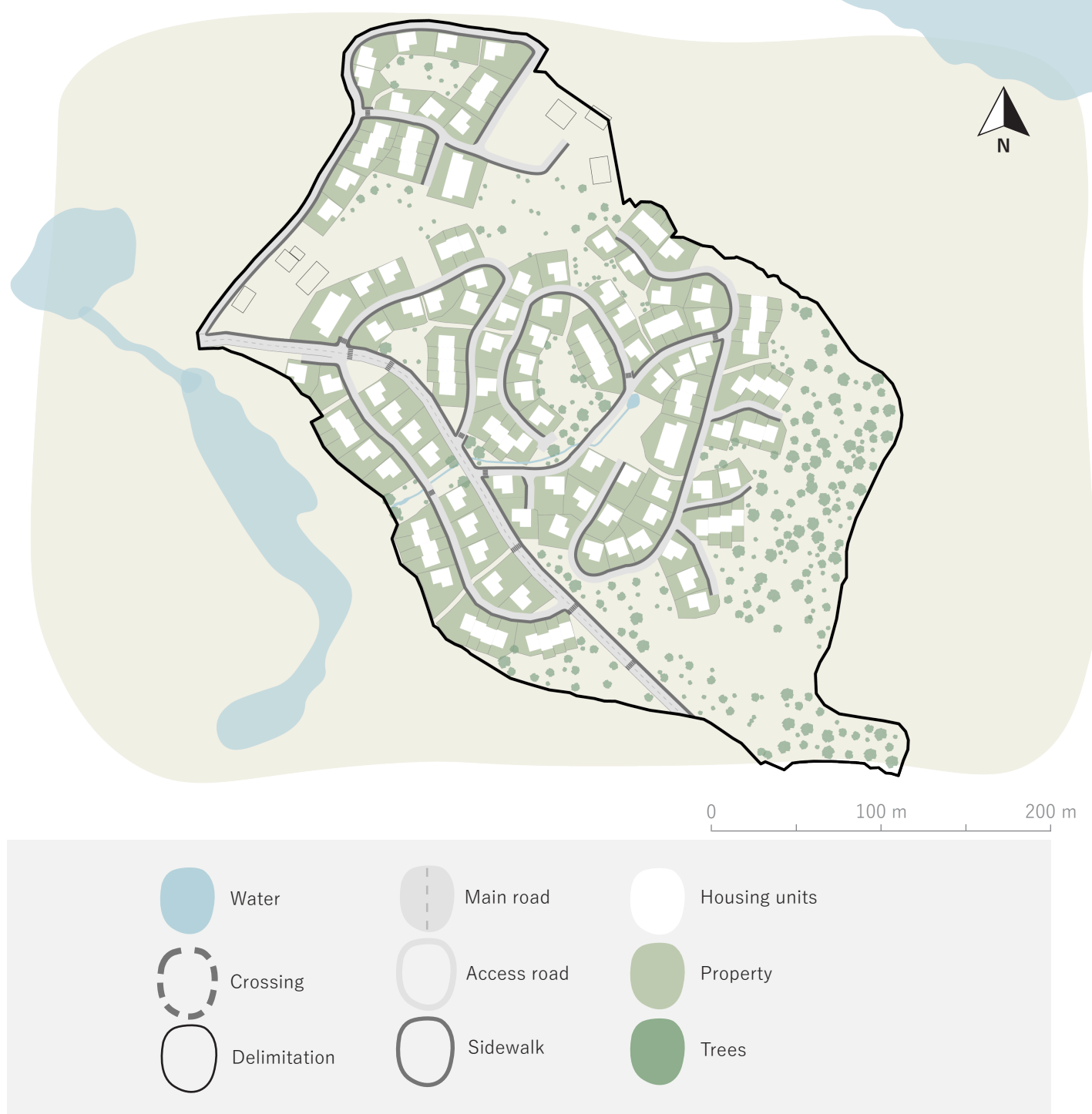


Figure 5.3: Properties and housings (Self-produced).

a view and forest areas close by, but less sun. The housings are customized for each property ensuring as good sun conditions as possible, outdoor area, and possibilities for private space as presented in the chapter; buildings by Bjørneboe. By doing this, the houses can appear “messy” from above, but it will give character by providing a more varied look. A variation of house shapes and size are presented as a guideline by Guttu in the chapter; literature - buildings. The variation in the qualities of the property will fit different people’s wants and needs. Overall, the properties are not placed in the lowest areas to avoid rainwater gathering near the houses and the potential for cold pits forming in private homes and gardens, presented as a guideline by Husbanken in the chapter; literature - local climate.

To have a variation of people in different income groups and life situations, the area consists of varied unit sizes and levels of private outdoor space. The variation in housing is single houses, townhouses, and four-person homes. The levels will be two

floors in the single homes, three floors in townhouses and 4 apartments divided by three floors in the four-person homes. In the beginning, there were regulations to build about 10-30% blocks in the area. COWI has been talking to the municipality and they have agreed to remove this regulation due to the market’s lack of interest in blocks in Drangsvann, so no blocks have been implemented. Where the houses are in steep terrain, the houses should be built into the hillside to follow the natural elevations.

The regulations for Cb1 and Cb2 stated between 131 to 187 units, and the result is a total of 152 units in our proposal. There are a total of 72 single houses with an L shape. This shape is chosen to provide shelter from the wind at all properties. In addition, it will contribute to a feeling of privacy by having outdoor space with walls on two sides. There are a total of 68 townhouses in rows from 3 to 5 depending on the surrounding conditions. Several of the townhouses have been placed a little further in or out to make the outdoor spaces more private. There are

3 four-unit homes, they are spread out in the area and all units have a private terrace and semi-private outdoor space, here some of the units can be used as sheltered housing as the regulation from the municipality expressed as a desire.

### 5.3 Balcony and parking

The balconies are placed towards the sun in the south/west, towards a good view, or in a direction creating privacy between houses as shown in Figure 5.4. They will also be placed on the second floor on the townhouses to utilize the ground floor for more garden space. The balconies are approximately 16 square meters. The parking spots are about 5x3 meters making it possible to park one car outside each property as presented as a guideline by The Norwegian Public Road in the chapter infrastructure. There are parking spots near the two biggest recreational areas. This will provide parking for people from outside the neighborhood as well as serve as guest parking for residents.



Figure 5.4: Balcony and parking (Self-produced).

## 5.4 Recreational areas and paths

Figure 5.5 shows 11 recreational areas. The areas vary from 8794 to 634 square meters and are placed in different terrain. There are paths between the recreational areas which will make it easier for soft passengers to move from each area without crossing the main road. All paths will be slate stone to make sure they are universally designed and mirrors the visual profile of the existing stone fence. In addition, each area has possibilities for sun, wind, and vegetation. It has been focusing on keeping trees between the properties for keeping a natural feel of privacy, a guideline presented in the chapter; terrain and vegetation by “Husbanken”. The lowest areas have been prioritized as outside areas due to drain water. Here there can also be placed vegetation that will soak up a lot of the water better than private gardens and housing foundations. This is presented as a guideline in the chapter; literature - drainwater by “Norwegian water”. The outside areas will be inclusive to every age group to stay and play. Further the concept will be outlined and each recreational area presented in detail.

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Figure 5.5: Recreational areas and paths (Self-produced).



## 5.5 Concept

Building on Drangsvann's vision of being an active area with a proximity to nature we have used this as the basis for our vision of making it an "outdoorsy" neighborhood. The area is close to water on either side, has a good variation in topography and a lot of existing vegetation making it ideal for an "outdoorsy" neighborhood feel. The recreational areas all have different qualities, fitting to the possibilities provided by the natural environment, proximity to houses and municipal guidelines. Each outside area has its color to make contrasting areas. This will contribute to the area having a better sense of identity and it will be easier to navigate using the colors. The Norwegian Tourist Association is known by most Norwegians (DNT) as seen in Figure 5.6, and people connect this with hiking, outdoor life, and being active as seen in Figure 5.6 and 5.7. One of their main characteristics is signs on their paths to a variety of sites with direction and distance to the location as seen in Figure 5.9. In each outside area, there will be signs which point in the direction of the

colors. Each area will be a mixture of wood and other materials in the color assigned to the place. The materials and limitations on colors will contribute to the outside area being aesthetically pleasing. By making the outdoor areas more aesthetic, it can contribute for people of every age to use the areas more often and further making it easier to get in touch with other neighbors who also use the areas. Outdoor areas which are placed next to housings will have vegetation between private and shared space to give a natural distance, give a better sense of privacy for the residents and help prevent noise pollution. In addition, each area will have possibilities to sit, relax and have interesting views.



Figure 5.6: Red marking (Den norske turistforening, 2015).



Figure 5.7: Kayak (Sætre, 2021).



Figure 5.8: Hammock in the forest (Sætre, 2020).



Figure 5.9: Signs along the path (Fjeld, 2001).



## 5.6 Recreational area 1-11

The recreational areas are divided into 11 colors as seen in Figure 5.10, which is again divided into three categories, semi-private, shared, and municipal areas. The municipal areas are named spectrum, green and red. These are meant to be used by people living in Cb1/Cb2 in addition to people living in other parts of Benestad or going to the school or kindergarten in Cs1. The shared areas are named blue, pink, purple, and beige. These areas are meant for all residents in Cb1/Cb2 while the areas named black, white, yellow, and orange are meant for the people surrounding those areas. Every housing has access to a minimum of one of the recreational areas with a maximum distance of 50 meters. This measurement is presented in the chapter; location by Guttu. All areas will have a mix of two types of benches with the exception of the white area. These benches are a “single stand alone” bench and a picnic table. These will all be in wood and have the “Drangsvann” logo as shown in the analysis in chapter: recreation- and outdoor life.



Figure 5.10: 11 different recreationa areas (Self-produced).

### 5.6.1 Spectrum

Spectrum is a municipal area. This will be the main outdoor area and consist of a mix of elements from all the other recreational spaces and help tie them together as seen in Figure 5.11. The area is a total of 6 558 square meters and located between the existing buildings and some of the new ones. The area is relatively flat but with some elevation on the right side. There are good sun conditions and a view towards Drangsvann at the north end. Spectrum will have a variation of the ten colors and zones for different ages and noise levels. There is also parking connected to this area for guests. The west side of the area has boulder walls, nets to relax in, and seating. Further north there are balance bars, hammocks, obstacle courses, and more relaxation areas. Further south there is “soft terrain” children can play on and a sandbox. On the east side, there is an outdoor gym, slides, woodhouse, boulder walls, and benches. There will also be implemented fruit trees as mentioned in the municipal guidelines. Figures 5.12-5.14 illustrate the different activities as described.



Figure 5.11: Spectrum (Self-produced).





Figure 5.12: Balance bars (Self-produced).

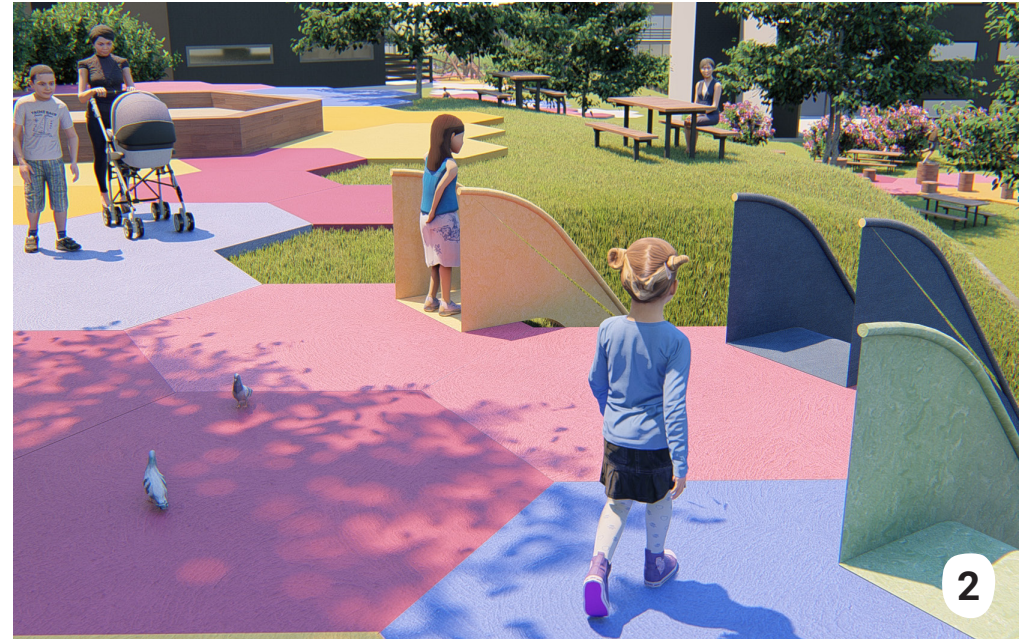


Figure 5.13: Slides (Self-produced).



Figure 5.14: Outdoor gym (Self-produced).



## 5.6.2 Orange

The orange area is a semi-private area. This area is placed between houses and will consist of orange rubber underlay under relaxation spots in the net, climbing frame and balance boards as seen in Figure 5.15. Benches are also placed in the grass areas for people to sit and relax as well as parents wanting to keep an eye on their kids. This area has a size of 983 square meters and has two paths that lead outside of the area. The activities have less noise than some of the others. The proximity to "Spectrum" makes it easy to go there for other types of play. The houses surrounding the area will reduce wind and provide a buffer from traffic making it safe to let children play outside with less supervision. Figure 5.16 and 5.17 illustrate the different activities as described. There is a hill west of the area which can contribute to shadows at certain times of the day but the sun should in general be good.

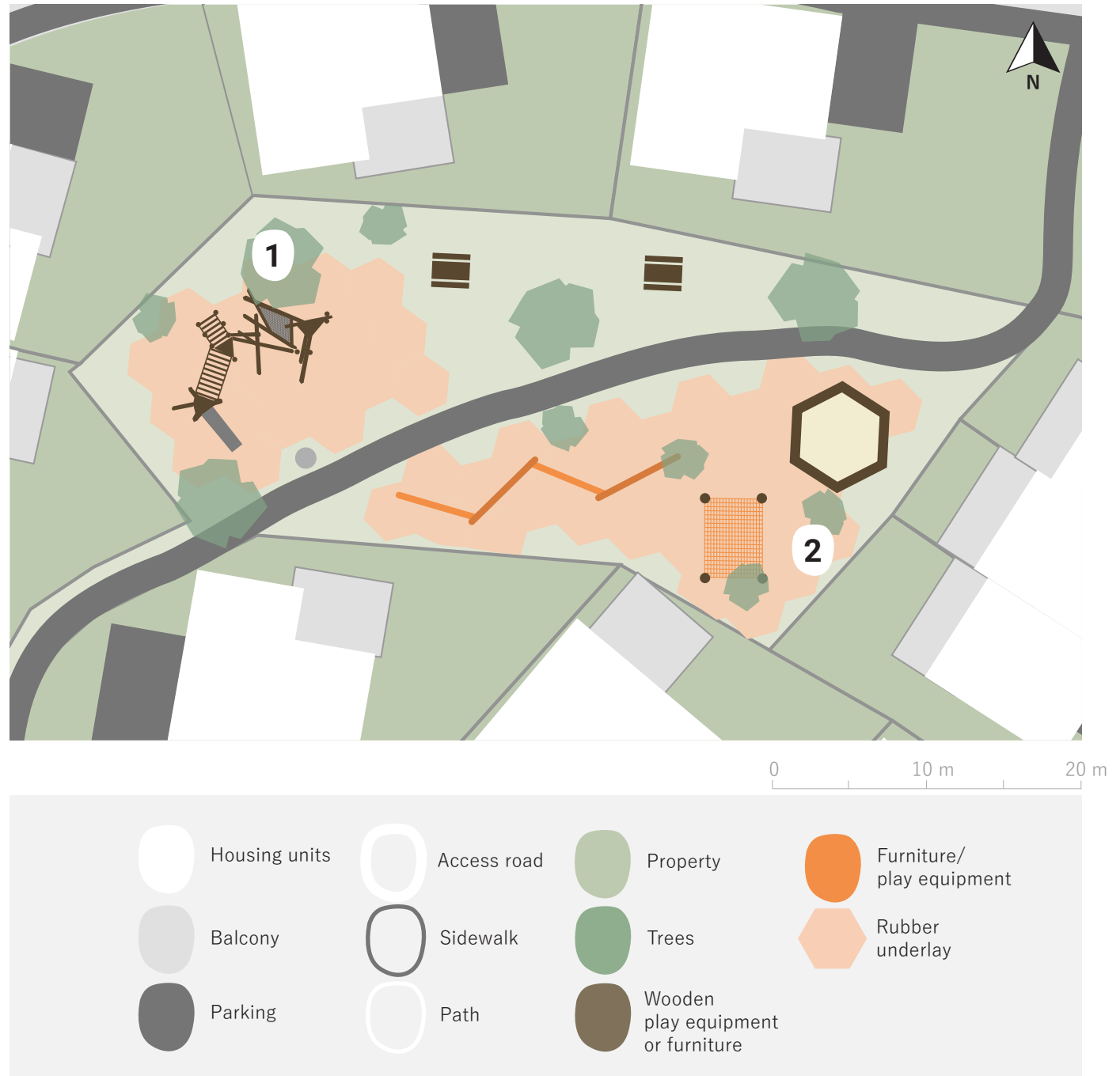


Figure 5.15: Orange area (Self-produced).



Figure 5.16: Play equipment (Self-produced).



Figure 5.17: Net and sandbox (Self-produced).

### 5.6.3 White

The white area is a semi-private area. It is close to the spectrum and will therefore consist of a more calm and esthetic area for adults and elders. The area is 813 square meters and is 8 meters at the thinnest. The white area will have aesthetic furniture and a variation of vegetation to create a calm and comfortable atmosphere as shown in Figure 5.18. The materials will be a mix of stone coating on the ground and wood flower beds and benches. This zone will have low noise levels and will offer people a space to be able to meet, sit and share a quiet moment. Figure 5.19 and 5.20 illustrate a comfortable atmosphere as described. The wind will be limited and the view will be nice.



Figure 5.18: White area (Self-produced).





Figure 5.19: Aesthetic furniture (Self-produced).

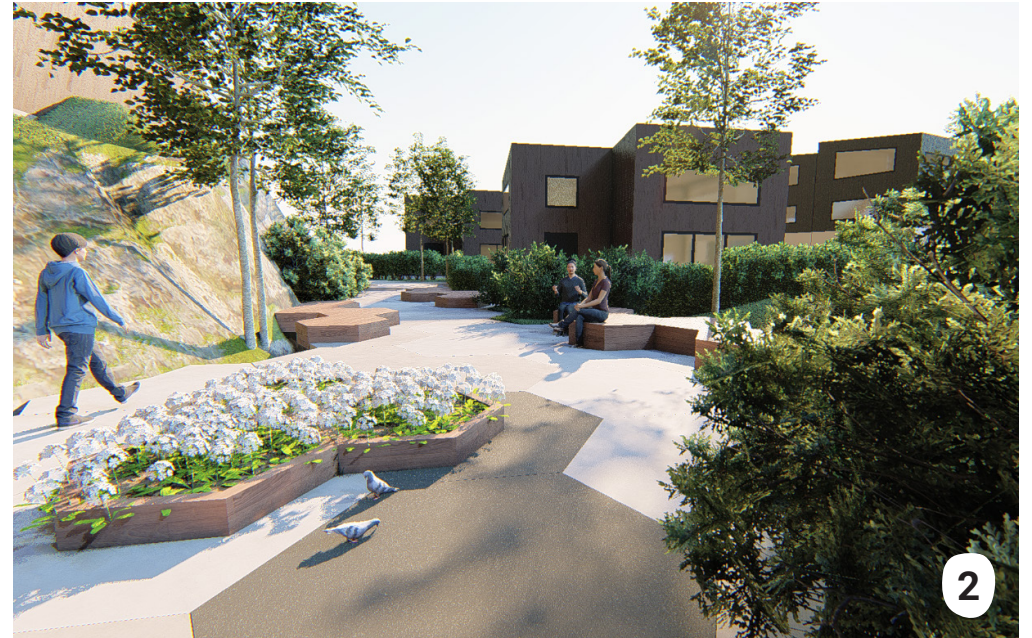


Figure 5.20: Pleasant environment (Self-produced).

### 5.6.4 Beige

The beige area is a shared area. It is located between houses and near the main road as seen in Figure 5.21. To reduce the noise level it will be important to add a noise wall along the road. The area is 608 square meters. The use of the area will consist of a greenhouse and cultivation. It will have benches spread out of the area to let people enjoy the weather and plants. The materials will consist of grass and gravel to keep a natural feel and prevent traffic. The beige outdoor area is in addition located close to the spectrum so there will not be a focus on playgrounds here. This area is for people with an interest in horticulture to have a space to unfold their hobby and share it with other residents. The plant boxes will be placed facing south-west to get good sun conditions. Figure 5.22 and 5.21 illustrate the different interests as described. The trees in the area will be fruit trees to pick up the municipal wish of more fruit trees in the municipality.



Figure 5.21: Beige area (Self-produced).





Figure 5.22: Greenhouse (Self-produced)



Figure 5.23: Plant boxes (Self-produced).

### 5.6.5 Blue

The blue area is a shared area. This is placed on the lowest area in Cb1/Cb2; this is also where the precipitation field of rainwater will gather from the main peaks ending in Langetjønn as seen in Figure 5.24. This follows the guideline from chapter; analysis - flood, of further developing natural streams. The area is in total 654 square meters and has a road dividing it into two parts. This street road will only have a 30 km/h speed limit and it will be a road crossing opportunity. The blue represents a water zone and will have opportunities to play with drain water at different levels. In the north part, it will be possible to gather water in a chute, a sandbox and benches. The south side will have elements in different heights for play, rocks to cross the water and benches. The water level will vary making the area a more interesting attraction and teach children about nature. The materials will be wood on the chute and stone in the elements for height play. Figure 5.25 and 5.26 illustrate the different activities as described. The area also has a good view down to Langetjønn.



Figure 5.24: Blue area (Self-produced).





Figure 5.25: Different heights (Self-produced).



Figure 5.26: Benches near the drain water (Self-produced).

### 5.6.6 Yellow

The yellow area is a semi-private area and the plan is shown in Figure 5.27. This will be at the highest area in this neighborhood and is in total square meters. To utilize the highest space, it will be an opportunity to get higher in the terrain by climbing in the climbing frame giving a good view of the entire neighborhood. It will also have a sandbox, playhouse and small play windmills to teach children about wind. The materials in the ground will be rubber underlay under the climbing frame and grass surround. There are also benches placed throughout the area. These types of activities will have an acceptable noise level and let people enjoy the view. Figure 5.28 and 5.29 illustrate the different activities as described.

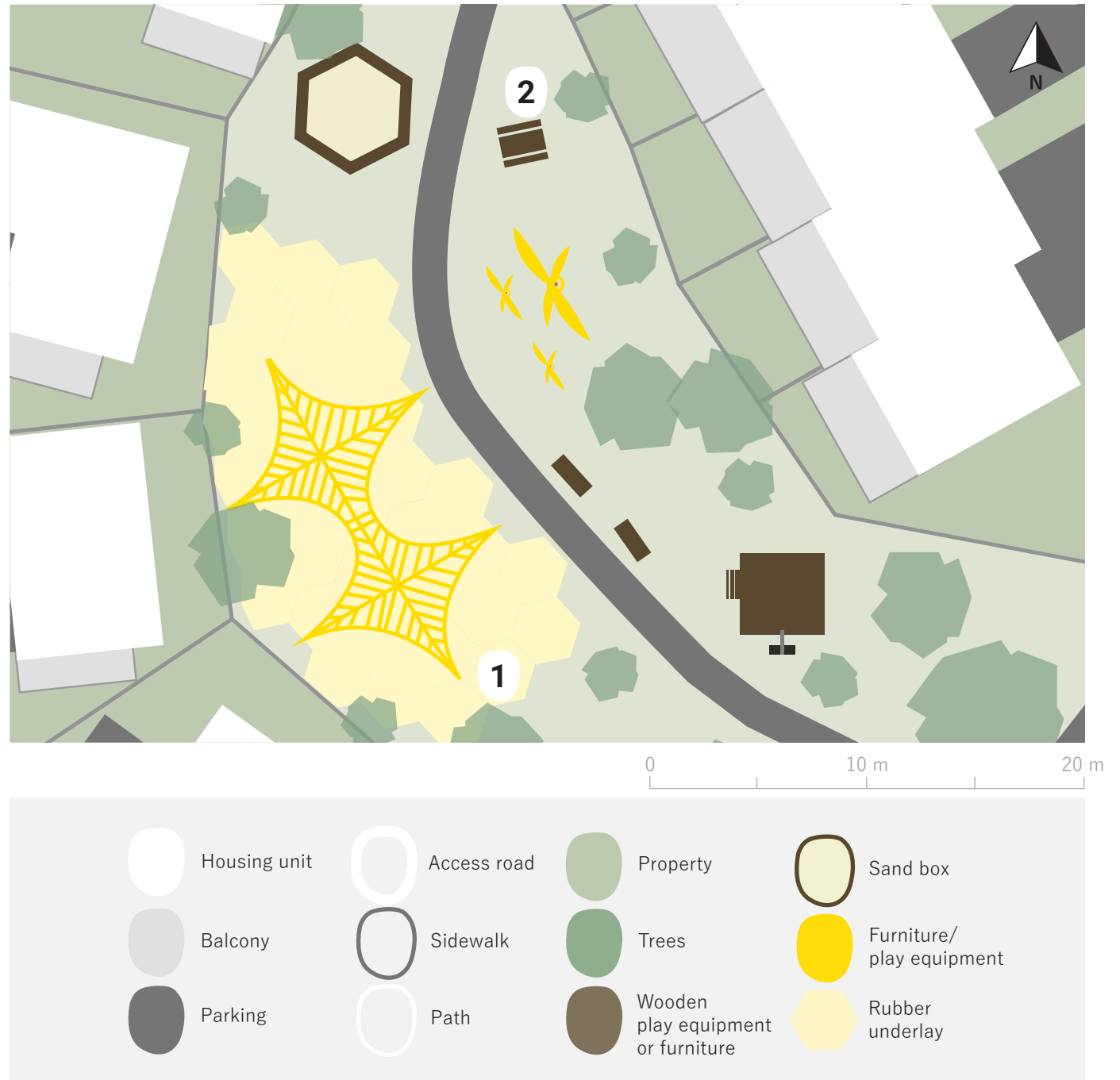


Figure 5.27: Yellow area (Self-produced).





Figure 5.28: Climbing frame (Self-produced).



Figure 5.29: Bench between housings (Self-produced).

### 5.6.7 Pink

The pink area is a shared area. This area is placed along a street road and will be an outdoor area where cars drive close by contributing to a higher noise level as seen in Figure 5.30. There are additional hills on each side giving the area shadows in the morning and evening time. The area is a total of 955 square meters and will be a spot where the drain water gathers in an open solution before it leads into the blue area. This guideline is presented in the chapter; literature - drain water by Asplan Viak. The focus is on possibilities for bicycles and skaters. The different hexagon base plates will be placed in different angles to make it interesting for skating and cycling. In addition, there will be japan cherry trees to go along with the pink theme and give a connection to the municipal wish of adding more fruit trees. The material will be stone coating. There are also benches on the north side and along the road, around the trees adding the element of a buffer from the road and the skate/cycle area as well as for rest and viewers. Figure 5.31 and 5.32 illustrate the different activities as described.

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Figure 5.30: Pink area (Self-produced).





Figure 5.31: Entrance to the pink area (Self-produced).



Figure 5.32: Opportunities for bicycles and skaters (Self-produced).

### 5.6.8 Purple

The purple area is a shared area and the plan is shown in Figure 5.33. This area is placed with a view toward Drangsvann and is in total 730 square meters. The theme will be focusing on a relaxing existence. It will be a big opportunity to do yoga/meditation on the “scene”, grilling with a view, or relaxing in hammocks. The noise level will be low due to no elements intended for low noise level activities. The “scene” is also versatile and can be used at different events such as small concerts and gatherings resulting in higher use. The materials will be wood in the scene and grilling spot. Figure 5.34 and 5.35 illustrate the different activities as described.

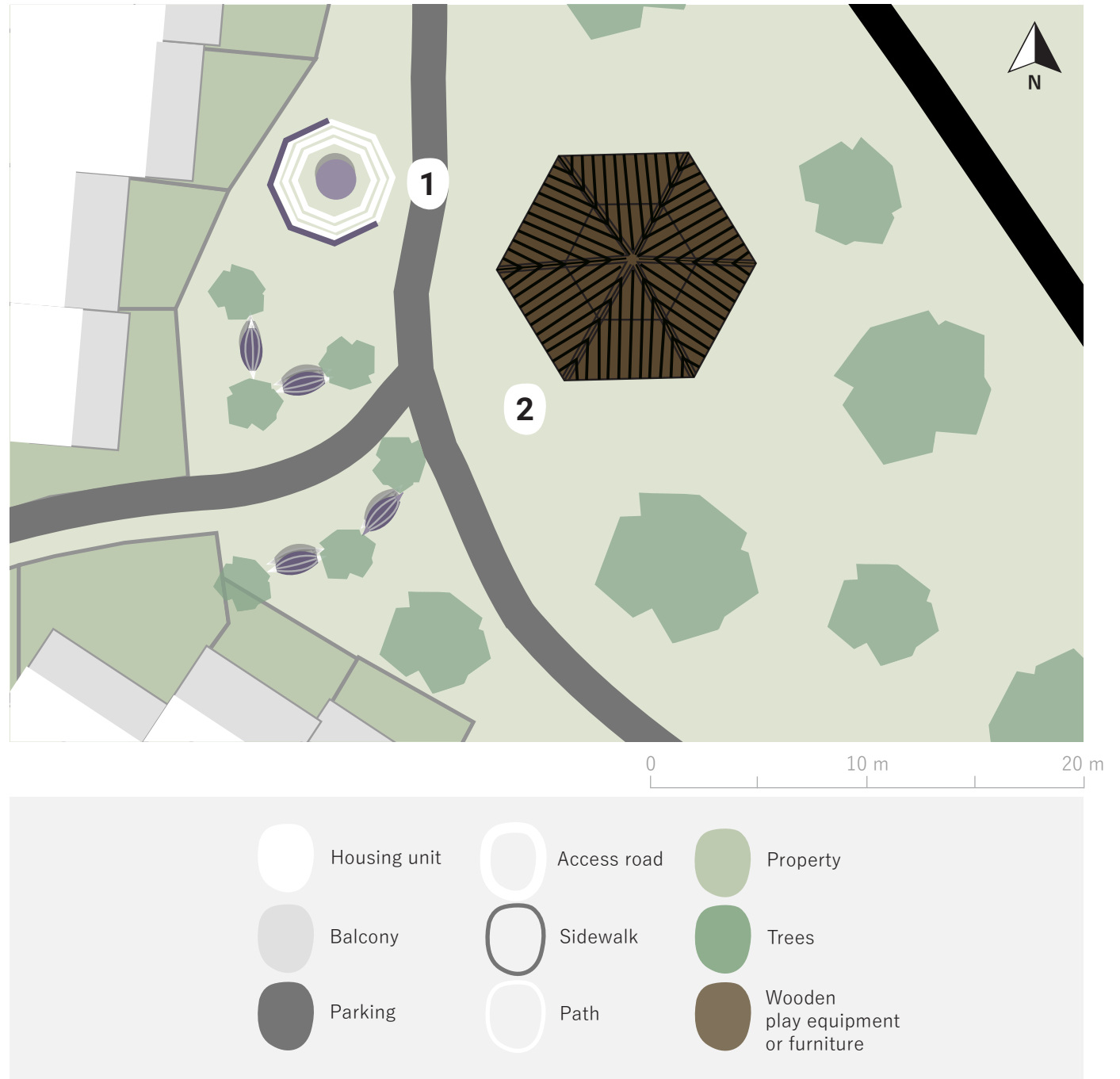


Figure 5.33: Purple area (Self-produced).





Figure 5.34: Yoga (Self-produced).

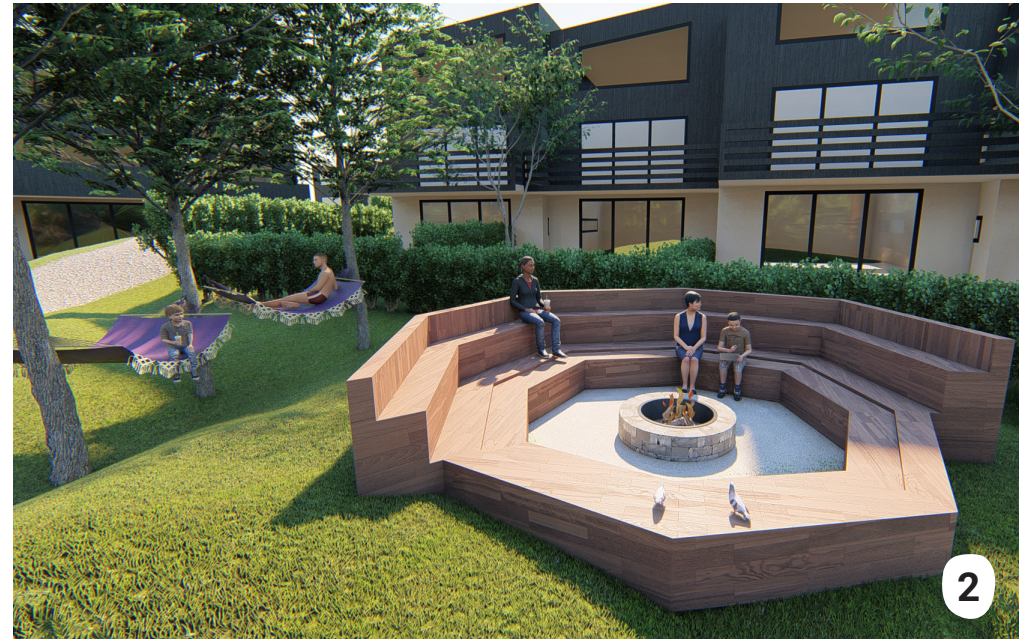


Figure 5.35: Opportunities for grilling (Self-produced).

### 5.6.9 Black

The black is a semi-private area and the plan is shown in Figure 5.36. It is placed between buildings and is 634 square meters. This area will have a balance board, climbing frame and sandbox for children and possibilities to relax and eat lunch outside. Figure 5.37 and 5.38 illustrate the different activities as described. These spots will not contribute to much noise and it will be possible to enjoy the weather on beaches. The materials will be wood on the play elements and rubber underlay where needed.



Figure 5.36: Black area (Self-produced).



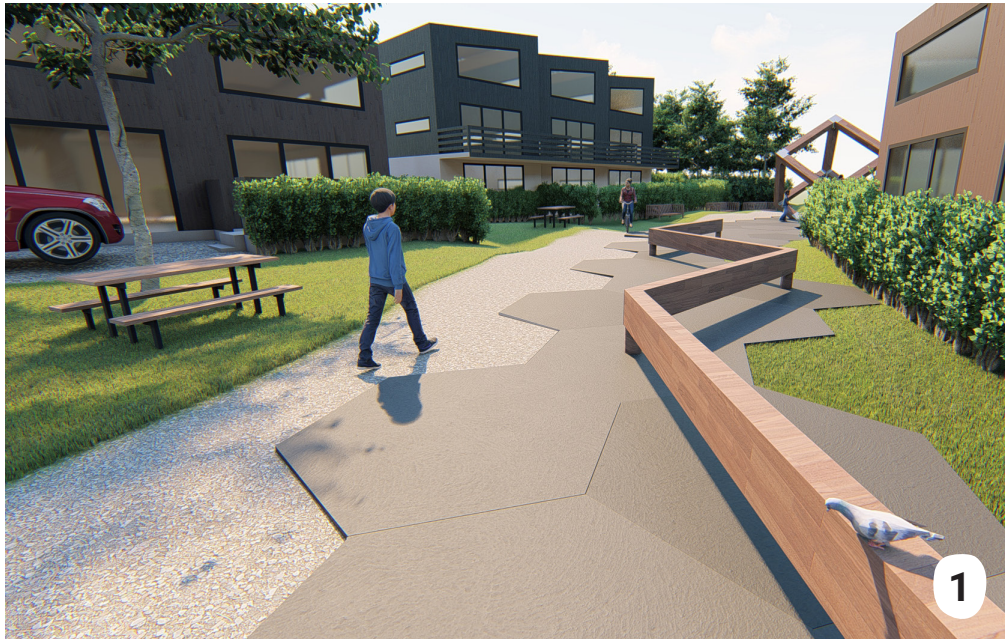


Figure 5.37: Balance bar (Self-produced).

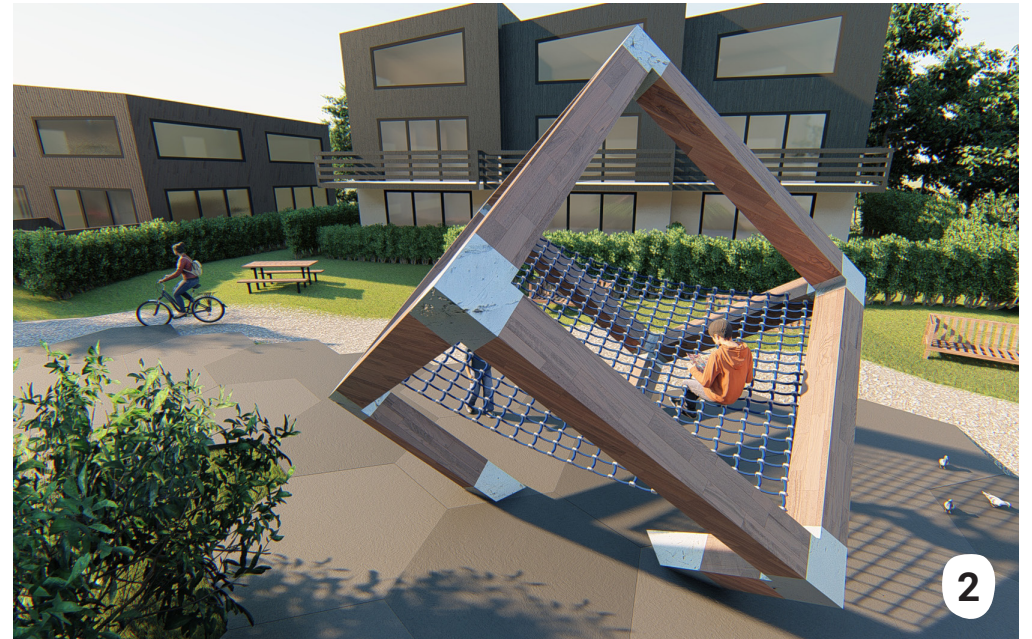


Figure 5.38: Relaxing spot (Self-produced).

### 5.6.10 Green

The green area is a municipal area. This area is one of the biggest recreational areas and is in total 5208 square meters as shown in Figure 5.39. The green area is located east of one of the biggest hills in the area which will contribute to a shadow placed in the evening. This area will focus on keeping the existing trees throughout. The North of the area will consist of a lean-to, the middle of the area will consist of treehouses and the south of the area will have an opportunity to relax in the sun with a campfire site. Overall, there will be cones for play in the area with different functions. Figures 5.40-5.42 illustrate the different activities as described. This place will also accommodate the kindergarten/school which is planned to be built in the south of the area. The materials will consist of wood elements and rope nets. Additional fruit trees will be added.



Figure 5.39: Green area (Self-produced).





Figure 5.40: Opportunities for sleeping outside (Self-produced).



Figure 5.41: Campfire site (Self-produced).



Figure 5.42: Treehouse (Self-produced).



### 5.6.11 Red

The red area is a municipal area. It is a total of 8794 square meter and is located south of the area, as shown in Figure 5.43. There will be opportunities for climbing, football, an outdoor gym and a playspot for children. This spot is located a maximum of 150 meter from the resident, a guideline presented in the chapter about location by Guttu. The red zone is placed near kindergarten and school in Cs1 and will therefore be used by many people. The M1 road divides the area, and a road crossing will ensure a safe crossing with a traffic light. There will be parking with vegetation to “hide” the cars and make the parking more aesthetically pleasing. Additional fruit trees will be added. Figures 5.44-5.46 illustrate the different activities as described.



Figure 5.43: Red area (Self-produced).





Figure 5.44: Playground area (Self-produced).



Figure 5.45: Climbing (Self-produced).



Figure 5.46: Football (Self-produced).



## 5.7 Spatial changes/spatial conditions

When the development is put in place some of the elements such as sun conditions, noise levels and lightning will change. In order to make sure the guidelines in these areas are being followed they will be evaluated with the measured in place. Since the proposal is not developed an evaluation will be based on approximate measurements to give an idea of the actual conditions. In the illustration the “Orange” area will be used in all three categories.

### 5.8.1 Sun conditions

The proposal of buildings will influence the sun conditions on the recreational areas and the private outdoor areas. To make sure we fulfill Jon Guttu guidelines for sun qualities in the chapter; literature - local climate of more than  $\frac{1}{4}$  of the area having good sun conditions for at least 5 hours from spring to fall the recreational areas with an approximate building height of 7.5 on 3 storey building, and 5m on 2 storey building.

The Figure 4.47 and 5.48 shows the “Orange” areas sun conditions three different times of the year as well as five times a day. January shows relatively low sun hours. Only in the middle of the day does the outside area get sun. The sun is also low, making the buildings block a lot of it, this is also expected and common in these areas that time of year. April/October is better with good conditions from 10:00am to 06:00 pm, following the guidelines. July shows the best sun conditions with most of the area being sun exposed from 10:00am to 08.00pm and probably later as well.

The other areas have also been examined and the results are presented in Appendix 2.

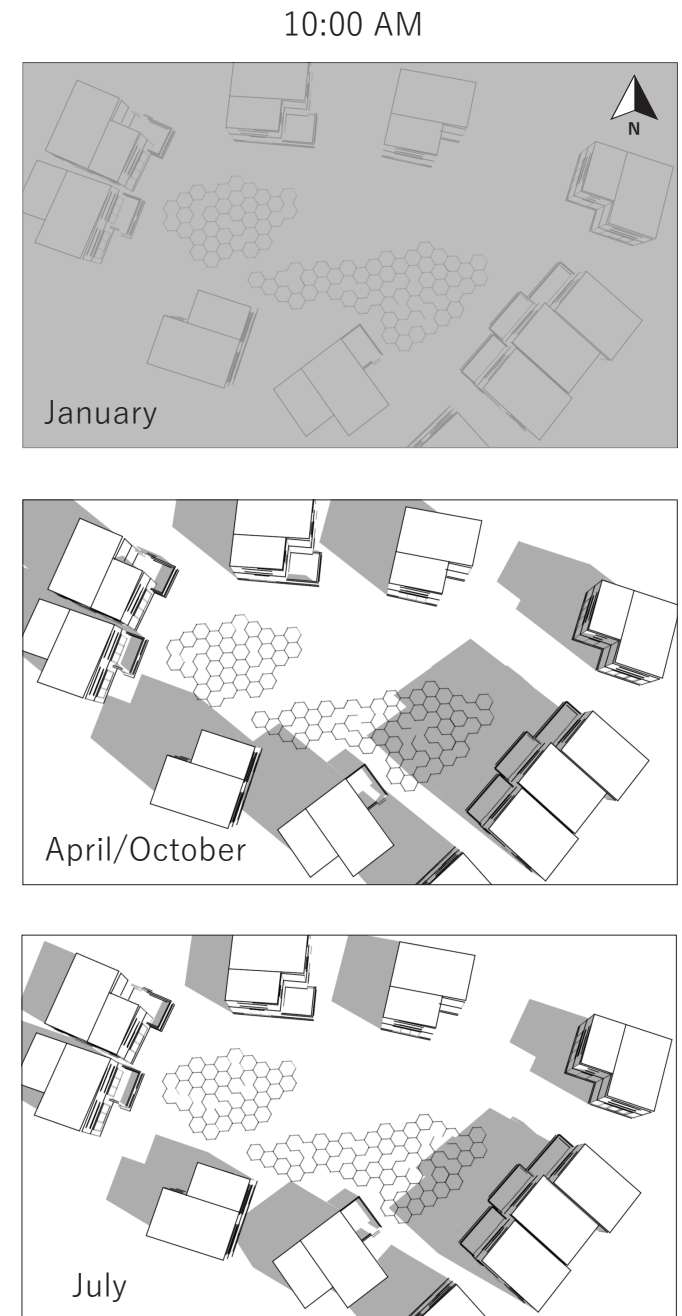


Figure 5.47: Sun conditions for the orange area at 10:00 am every four seasons. Calculated through Sketchup with the sun and shadow tool (Self-produced).



Figure 5.48: Sun conditions for the orange area at 03:00, 06:00 and 08:00 pm at every four seasons. Calculated through Sketchup with the sun and shadow tool (Self-produced).

## 5.8.2 Noise

The noise level from the orange area is shown in Figure 5.49. The values are from numbers presented by Lukas Martinelli and only a guide. Here, elements such as vegetation and noise lowered by buildings are not included in the illustration. The values do not take into account what sort of leisure activity there is. To try and minimise the noise from the road as much as possible, the recreational area is placed between the buildings and vegetation has been preserved as presented as a guideline by Jon Guttu in the chapter; literature - Noise.



Figure 5.49: Noise condition at orange area (Self-produced).

### 5.8.3 Lighting

The lightning proposal follows the norm in Kristiansand municipality, and the light fixtures will be the same as surrounding areas. The proposed lighting map in figure 5.5 shows two different types of light fixtures. The once along the road is 10 lux with a mast height of 6 meters. The once along the path and within the recreational area is 5 lux and has a mast height of 4 meters. Here the lighting is also placed away from housing and with vegetation making sure the light doesn't become a haccard for the surrounding residents. This followest the guideline from the chapter chapter; analysis - lighting.



Figure 5.50: Lighting opportunities at orange area (Self-produced).

## 5.8 12 qualities

The proposal will be viewed by the demands from the 12 quality criteria list. If the conditions are good the topic will be given a green color code, if the quality is sufficient it will be given a yellow color code and if the topic is not at a sufficient level it will get a red color code. This way the overall quality of the neighborhood can be evaluated.

### PROTECTION

#### Protection against traffic & accidents - feeling safe

- Protection for pedestrians and cyclists
- Eliminating fear of traffic
- Safe crossings

#### From traffic and accidents

The recreational areas are divided by housing in most of the areas to make it safe for children to play without worrying about motorised traffic. In the areas where roads

go parallel to the recreational areas there has been implemented a buffer and where traffic goes through the area road crossing and low speed limits help the security.

#### Protection against crime & violence - feeling secure

- Lively public realm
- Allow for passive surveillance
- Diversity of functions  
24/7/365
- Well lighting in human scale

#### Crime and violence

The area is a residential area approximately 8.5 kilometers from Kristiansand sentrum indicating a relatively low possibility of crime. With recreational areas spread out across the entire area there will be people close by at most times. Lighting along roads and paths and in addition to the recreational areas also contribute to the areas feeling secure.

#### Protection against unpleasant sensory experiences

- Wind/draft
- Rain/snow
- Cold/heat
- Pollution
- Dust, noise, glare

#### Uncomfortable sensory influences

Wind will vary from space to space. In some of the areas the wind can get quite strong due to the high topography but buildings and vegetation will help reduce the wind. Rain and snow will influence the recreational areas, they can still be used, but less people will want to use them. Cold temperatures are also hard to influence, but no buildings are placed in areas with potential for cold pits. Noise will on average be low due to no high traffic roads. Some of the residential areas might cause noise but vegetation will reduce some of it. These guidelines is presented in the chapter; local climate by Husbanken, Glaumann og Westerberg.



## COMFORT

### Opportunities to walk/cycle

- Room for walking
- Interesting facades
- No obstacles
- Good surfaces
- Accessibility for everyone

### Possibilities for walking

There are plenty of sidewalks and paths across the area creating comfortable possibilities for walking. All the paths are slate stone and the sidewalks pavement making sure it's universally designed. The signs, the different color themed recreational areas, housing facades and the view to waters in directions will also provide interesting views throughout.

### Opportunities to stop & stay

- Attractive & functional edges
- Defined spots for staying
- Objects to lean against or stand next to
- Facades with good details that invite staying

### Possibilities for standing and stay

The proposal includes a lot of places to stay in with so many recreational areas that have different qualities encouraging people to stay in different parts. The texture in the slate stone will make it easy to feel where the path is located and edges down from the sidewalks creates good edge effects. Lightpoints, trees and built-in physical elements will provide good support points.

### Opportunities to sit

- Defined zones for sitting
- Pleasant views, people watching
- Good mix of public and café seating
- Resting/waiting opportunities

### Possibilities for sitting

All the recreational areas include possibilities for sitting and since there are recreational areas throughout the entire area there will also be a bench or a picnic table close by. They also have a good view of the waters on either side or to the people playing or

doing activities close by. The benches vary on whether or not they have a back or not and if there is a table attached or not.

### Opportunities to see

- Reasonable viewing distances
- Unhindered views
- Interesting views
- Easy orientation
- Lighting (when dark)

### Possibilities to see

The view will be very different depending on where in the area you stand. There is overall quite a bit of buildings and vegetation that can shield some of the view, but these elements can also contribute to an interesting view within the area. Lighting along roads and recreational areas will make sure it's not too dark at night.

### Opportunities to talk & listen

- Low noise levels
- Public seating arrangements conducive to communicating, "talkscapes"

### Possible to talk and listen

There are several areas that provide space with low noise levels for talking and listening such as the white, purple and beige area. Other areas will in full use have a higher noise level, but should still be acceptable for conversations. All the recreational areas also include possibilities to sit down.

### Opportunities for play & exercise

- Allow for physical activity, exercise, play & street entertainment
- Temporary activities
- By day and night
- In summer and winter

### Possibilities to unfold and activities

There are tons of invitations for doing activities. Most of the areas consist of some form of play equipment for children and some areas have activities more targeted at adults. Due to the light in and around the recreational areas they can be used in the evening as well. In the winter time the climbing frames, three houses and some of the play equipment will be able to be used as well as turning Langetjønn into a skating rink.

## ENJOYMENT

### Dimensioned at human scale

- Dimensions of buildings & spaces in observance of the important human dimension in relation to senses, movements, size and behavior

### Scale

The buildings are no higher than three floors in the area. The green, spectrum, pink, red

and purple are all open areas with good lines of sight. They feel open and clear. Black, beige, yellow, blue, orange and white are more defined by buildings, here they make the space feel safe and secure and provide a feeling of space. The recreational areas vary in different sizes and levels which are presented as a guideline in the chapter; play and meeting places by Guttu.

### Opportunities to enjoy the positive aspects of climate

- Sun/shade
- Heat/coolness
- Shelter from wind/breeze

### Possibilities to enjoy good weather

The recreational areas vary in how much sun or shadow they have along the day. The variation in placement in the topography also provides differences in warm and cold spots with more or less wind depending on height and how much vegetation or buildings shelter from the wind.



## Aesthetic qualities

### + positiv sensory experience

- Good design and detailing
- Good materials
- Fine views/vistas
- Rich sensory experiences: trees, plants, water

### Aesthetic qualities/ positive sensory experience

The diversity in design of the different recreational areas will create a different feeling and aesthetic value to each place. The topography creates nice views from several of the areas and the preserved vegetation will also help with aesthetic quality. The water on either side and the precipitation field going through also add aesthetic and recreational qualities.

Overall, the proposals of Cb1 and Cb2 have 10 of 12 of the criterias which are set as good. Protection against unpleasant sensory experiences and opportunities to see are set as sufficient. The opportunity to see is set lower because it's hard to know how good the lines of sight will be from different positions before the development is complete. The protection against unpleasant sensory experiences is also evaluated lower as weather will impact the areas no matter what. With this in mind the results seem to be achieving the requirements for a high quality neighborhood.



# **DISCUSSION**

CHAPTER 6

How can neighborhood quality be achieved through a focus on recreational areas for the entire community?

### **1) Are there challenges with the chosen mixed method?**

What defines a neighborhood with quality is subjective yet in some ways measurable. In order to find out what most view as neighborhood quality, and how to achieve this, a mix method, including both quantitative and qualitative data seemed to be the best way. The qualitative data from Jan Gehl and Poortinga gave a good pointer to what areas to focus on. Further the questionnaire gave more specific data for the area in question, and more specific guides provided from possible/probable residents. The questionnaire can however be flawed in the way that it presented a list of qualities that one should range from most important to least important and gave no way for the participants to voice qualities they would appreciate outside of these. The subjective interpretation of how the questions and qualities are formulated, can

lead to the result not being perceived in the same way as the participant intended. On the other hand, a systematic survey like this can provide good indications of what people value. The method of set values also allows for a great number of people to contribute, making the results more reliable. The analysis and the literature review outlines factors that affect the planning site and gives recommendations for the development direction. However when using literature provided by others, it can be hard to know their intention for the publication, what they are basing their statements on and if it is relevant for this place, time and scope. The spatial analysis can be a challenge to keep objective. Most of the topics give information about what exists in and around the planning site. Then these findings are evaluated by us to decide whether further examinations are required, or if it should not affect the development. Which is where the challenge of objectivity comes in. The case study is a valuable method as it gives an example of how the guidelines and measures from the literature review and analysis can be

implemented. Here, the challenge may be related to how relevant this proposal can be used in other settings. The proposal is submitted with guidelines specific to this development project, and the provisions here will always vary slightly from this to other projects. The spatial qualities and opportunities that provide the basis for the proposal will always be different. Especially with regard to climate, political guidelines and access to specific information about the wishes of the local population as here. This can make it challenging to use the same solutions in other areas.

### **2) Which aspects make a high quality neighborhood?**

Poortingas, Jan Gehl and the questionnaire all include a lot of the same variables for a high quality neighborhood. By using a combination of the three the most important aspects have been outlined, as well as they all present variables that are unique to each of them. Making the thesis consider more aspects than if only choosing to focus on only one point of view. Challenges with using all

three is that the questionnaire has a small scope since these are opinions from only people living in Kristiansand municipality. This might mean that the results are hard to translate to other projects as the result can be specific to this area. The measures from Jan Gehl also have limitations from being meant for cities in Denmark, the climate from Denmark to Kristiansand is not that different, so this should not be a problem. But the planning site is not within the city limits and the qualities residents seek can be quite different from a city life to a more rural living situation. Even if the qualities are meant for cities most of them are general and can be used in any residential area. The ones that are not as relevant is when talking about protection against crime and violence as this is a problem much more relevant in cities than rural areas. In comfort and opportunities to sit cafe seating is also not relevant in the thesis, but opportunities to sit in general is.

### **3) Can one plan acquaintance through recreational areas?**

Forming acquaintances is a natural social process that is hard to force and plan. In the early stages of life most social bonds are formed through close family, school and leisure activities. Here people bond over shared family ties, experiences and interests and just by spending the amount of time together as kids spend at school for instance, we all will become acquainted with someone. Later in life these “natural” connections can be harder to come across. People get more “set in their ways” and their leisure activities are switched out by work next to studies, taking care of children or focusing on a career path. Now forming natural bonds with the people around change and we do not have the same “drive” to know people on a personal level. Here the recreational areas can help people connect if the areas are attractive enough that people want to prioritize spending their time here. This makes recreational areas targeted at different stages of life and at people with different interests is very important. As an

example, creating a space that is meant for nothing else than for people to sit, relax, talk, read or just enjoy the surroundings you can gather people planning to spend time alone running into others with the same idea. This can also be done with creating spaces facilitated for more concrete recreational activities such as a skating park, where (most likely) teens and young adults can meet, learn from each other and bond over their common interest. The more varied the possibilities in a neighborhood is, the more likely it is that people will discover a passion they can perform right outside their door and learn that their neighbor, who they thought they had nothing in common with, has some of the same passions. By having these opportunities in your neighborhood, the threshold for following through is lowered by not having to travel far distances for everyday activities.

#### 4) Can paths and recreational areas be used to help people move around and navigate?

With development of areas that have a lot of natural paths acquired over years, this can be a quality connected to space identity and a good sensory experience as one gets so close to nature. A less developed path can help elders train their balance and mobility. However these paths are not suited for everyone in a neighborhood. Moving on these types of paths in a wheelchair, with a stroller or for someone who is visually impaired can be next to impossible. With more developed paths with a hard even cover this will give these groups more freedom to move around in their neighboring areas. Although these paths might not hold the same sensory quality as the less developed ones and will not help elders work on balance. These types of paths create a neighborhood that takes everyone into consideration and a more diverse mix of people can live here. To be able to navigate in a neighborhood is important for adults as well as children. Most adults can navigate quite easily in

most scenarios as signs, a good overview and knowledge of how neighborhoods are formed provides the information they need. For children this can be harder as they don't learn to read properly before 2<sup>nd</sup>-3<sup>rd</sup> grade. As well as remembering the name of streets and areas can be challenging. Here using signs and recreational areas with connection to different colours and signs pointing to the different colors can help them navigate and make it easier for them to tell their parents where they are going or where they are. As - I'm going to the yellow playground or calling and saying everything here is orange. The signs will also help when knowing where they live as parents can use the colors and show that we live close to the purple area. The colors can also help people who are senile who don't remember where they should go. To make sure the color blind are also stand a change the names should also be carved out in the signs. Planning these areas is one thing, but making them a reality can be a challenge as the required means to make it happen are high. This leads us to a topic that should be further researched;

What is the population's sense of quality in their neighborhood worth?



# CONCLUSION

CHAPTER 7



How can neighborhood quality be achieved through a focus on recreational areas for the entire community?

In this thesis the basis has been on the guidelines presented by Jan Gehl, Poortinga and the questionnaire for the municipality. Based on these guidelines, recreational areas can affect the neighborhood quality if they are done with care and planned correctly. By providing leisure opportunities targeted at all age groups and for different preferences, the recreational areas can help contribute to the quality. Giving the area a clear concept will help people feel a sense of attachment to their neighborhood. The recreational areas hold an opportunity to give each neighborhood its own basis for attachment. Poortinga presents green structure as one of the most important factors for the feeling of attachment. By preserving green structures in recreational areas and between the properties, this can have a big impact on the attachment, and so the level of quality. In Jan Gehl 12 quality criterias several goes directly on recreational areas and qualities that are

important within them. These are qualities as opportunity; for play and exercise, talk and listen, to see, to sit, stop and stay. Using his guidelines when planning recreational areas, the quality of the neighborhood will increase. A different aspect is also to take the people who are most likely to live in these areas into account. For this thesis an area in Benestad, Kristiansand has been used. The area is a part of Drangsvanns development,

and has a focus on the regulated areas Cb1 and Cb2. The municipality conducted a questionnaire in 2018 mapping out housing conditions and housing preferences among residents within the municipality. The data gives good information on what specific qualities the residents in this community appreciate. From the questionnaire the most prominent wishes was a noise and pollution free area, as well as accessibility

“ How can neighborhood quality be achieved through a focus on recreational areas for the entire community? ”

to nature and the sea. The regulated area is located close to Drangsvann and consists mostly of forest, making it the ideal place to fulfill these preferences. In order to create recreational areas suitable for all ages and different preferences the proposal includes as many as 11 recreational areas with different qualities and they range from 8794 to 634 square meters. The idea behind this is to accommodate as many groups and activities as possible, increasing the chance for everyone to find something they enjoy. The area has a general concept based on colours. This is shown in every area being designed with a specific color as well as spectrum which binds them together. This concept will give the area a space identity, while preserving physical qualities as the stone wall and using this further in paths it combines the old and new identity. The colors are also shown in signs and markings along the paths and sidewalks all through the area. The recreational areas range from traditional playground with play equipment meant for children, to areas more aimed at specific activities such as the purple

area with a platform for yoga/meditation, beige area with a greenhouse and plant boxes, white focusing on seating and a calm sensory quality, red with climbing/bouldering and a ballcourt, green area with treehouses and a focus to connect to nature, blue with a focus on waterplay and drainwater and pink with a skating/cycling park. By providing such a range in leisure activities and sensory qualities everyone can find something providing them with joy, this helps the neighborhood become a community. There is one big aspect that is not included in the thesis and this is economics. In order to present an area as close to the "goal" as possible this was an aspect we wanted not to influence the proposal. From this perspective the proposal is not the most realistic and creating areas as these would come at a great price. However the concept and ideas can still be translated into a smaller scale. Using colors and paths to create a more inclusive and coherent neighborhood can be done without all the areas being as highly developed, as well as using the more unique areas could

be done in a bigger scale as if this was done to several of the regulated areas in Benestad and the recreational areas and paths had a more overall plan for all of them, more areas as these could be implemented. Even by providing opportunities for recreation and putting in place the physical elements for an inclusive neighborhood, this will not be guaranteed. People also need to have a wish to get to know who they live among and want to get out and use the opportunities present, but by providing the opportunity at least one can choose to.

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Figure 5.9: Marius Dalseg Sætre. (2020). Hammock in the forest. [Picture] Retrieved from <https://telemark.dnt.no/artikler/nyheter/21582-slik-overnatter-du-i-hengekye/>

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# APPENDIX



## Vedlegg 3: ROS-analyse

### Risiko- og sårbarhetsundersøkelse: Reguleringsplan for delfelt Cb1 og 2, A201106

Utført av COWI AS. Dato: 30.03.21, revidert:



#### 1. Generelt

Eventuelle hendelser som planen forutsetter skal skje er ikke inkludert i ROS-analysen. Dette er hendelser som innebærer en villet konsekvens, og således ikke en uønsket hendelse.

#### 2. Vurderingskriterier

Vurderingskriterier for sannsynlighet for at en hendelse skal inntreffe er vektet i fire kategorier, med grad av sannsynlighet fra "Lite sannsynlig" til "Meget sannsynlig".

Betegnelser for konsekvens er vurdert i fem kategorier, med vurdering fra "Ufarlig" til "Katastrofal".

#### 3. Vurderingskriterier for sannsynlighet

Vurderingskriterier for sannsynlighet er gitt i tabell 3.1.

**Tabell 3.1: Vurderingskriterier for sannsynlighet for at en hendelse skal inntreffe**

Betegnelse	Frekvens	Vekt
Lite sannsynlig	Mindre enn en gang i løpet av 50 år	1
Mindre sannsynlig	Mellom en gang i løpet av 10 år og en gang i løpet av 50 år	2
Sannsynlig	Mellom en gang i løpet av ett år og en gang i løpet av 10 år	3
Meget sannsynlig	Mer enn en gang i løpet av ett år	4

#### 4. Konsekvens

Vurderingskriterier for konsekvensgrad er gitt i tabell 4.1

Betegnelse	Personer	Miljø	Materielle verdier/økonomiske tap	Vekt
Ufarlig	Ingen personskade	Ingen skade	Ingen skade på materiell. Driftsstans / reparasjoner < 1 uke.	1
En viss fare	Få og små personskader	Mindre skader, lokale skader	Mindre lokal skade på materiell og ikke umiddelbart behov for reparasjoner, eventuelt mulig utbedring på kort tid. Driftsstans / reparasjoner < 3 uker.	2
Kritisk	Alvorlige personskader	Omfattende skader, regionale konsekvenser med restitusjonstid < 1 år.	Betydelig materielle skader Driftsstans / reparasjoner > 3 uker.	3
Farlig	Alvorlige skader/en død.	Alvorlige skader, regionale konsekvenser med restitusjonstid > 1 år	Alvorlige skader på materiell. Driftsstans / reparasjoner > 3 mnd.	4
Katastrofalt	En eller flere døde.	Svært alvorlige og langvarige skader, uopprettelig miljøskade	Fullstendig materielle skader Driftsstans / reparasjoner > 1 år.	5

## 5. Risikogradering

Risikogradering som er basert på sannsynlighet og konsekvens er illustrert i matrise i figur 5.1

Risikomatrix						
Sannsynlighet	Konsekvens					
	Ufarlig	En viss fare	Kritisk	Farlig	Katastrofalt	
Meget sannsynlig	4	8	12	16	20	
Sannsynlig	3	6	9	12	15	
Mindre sannsynlig	2	4	6	8	10	
Lite sannsynlig	1	2	3	4	5	

	Lav risiko
	Middels risiko
	Høy risiko

## 6. Undersøkelse

ROS sjekklisten nedenfor tar for seg de mest generelle punktene man kan møte på i et planarbeid.

1. NATUR- OG MILJØFORHOLD				
Forhold / Uønsket hendelse	Ja/Nei	Vurdering	Merknad	Kilde
1.2 Jord-/leire-/løsmassekred	Nei	NVE har ikke registrert områder med jord- og flomskredaktomhet på eller i nærhet til planområdet.	Vurderes ikke som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.3 Kvikkleire, utglidninger, ustødige, grunnforhold	Ja	Planområdet består av tynt humus-/torvdekke med berggrunn. Vanligvis er kvikkleire stort sett fraværende i denne grunntypen. Likevel ligger deler av planområdet under marin grense. Området kan derfor inneholde feire/kvikkleire.	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.4 Steinras, steinsprang	Ja	NVE har ikke kartlagt utløsningsområde eller utløpsområde for steinsprang i eller i nærhet til planområdet. På grunn av terrengformasjonene anses dette likevel som relevant.	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://atlas.nve.no">http://atlas.nve.no</a>
1.5 Is-/snøskred	Ja	Område som er registrert som utløpsområde samt område kategorisert som utløsningsområde er lokalisert nord, sør-øst og nord-vest på planområdet. På grunn av terrengformasjonene og planlagt bearbeiding av terreng anses dette som relevant.	Vurderes som relevant.	Norsk geologisk undersøkelse (NGU). <a href="http://atlas.nve.no">http://atlas.nve.no</a>
1.6 Kjente historiske skred, utbredelse	Nei	Det er ikke registrert skred i planområdet. Forøvrig vises det til punkt 1.5 ovenfor.	Vurderes ikke som relevant.	Norsk geologisk undersøkelse (NGU). <a href="http://www.ngu.no/no/hm/Kart-og-data/">http://www.ngu.no/no/hm/Kart-og-data/</a>
1.7 Flomfare	Ja	NVEs kartdatabaser viser at områder som grenser til Drangsvann er innenfor NVEs aktsomhetskart for flom. Det samme er området som grenser til Rundetjønn sør-øst innenfor planområdet.	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.8 Springflo	Ja/Nei	Området ligger såpass høyt over vannet at springflo ikke vurderes til å være relevant for planområdet.	Vurderes ikke som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>

1.9 Flomsonekart, historiske flomnivå	Ja	NVEs kartdatabaser viser at områder som grenser til Drangsvann er innenfor NVEs aktsomhetskart for flom. Det samme er området som grenser til Rundejønn sør-øst innenfor planområdet. Det er ikke historiske flomsonekart for området. Vurderes likevel som relevant på grunn av nærhet til Drangsvann og Rundejønn.	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.10 Sterkt vindutsatt, storm/orkan etc.	Nei	NVEs kartdatabase viser at området ikke er spesielt vindutsatt	Vurderes ikke som relevant.	Meteorologisk institutts vær- og klimadata (MET). <a href="http://eklima.met.no">http://eklima.met.no</a>
1.11 Mye nedbør	Nei	Ikke mer nedbør enn normalt.	Vurderes ikke som relevant.	Meteorologisk institutts vær- og klimadata (MET). <a href="http://eklima.met.no">http://eklima.met.no</a>
1.12 Store snømengder	Nei	Snømengder anses ikke som over normale.	Vurderes ikke som relevant.	Meteorologisk institutts vær- og klimadata (MET). <a href="http://eklima.met.no">http://eklima.met.no</a>
1.13 Radon	Ja	Radon aktsomhetsgraden i området er vurdert som moderat til lav stort sett over hele planområdet. Mindre områder i øst, sør og vest har høy radon aktsomhet.	Vurderes som relevant.	Norsk geologisk undersøkelse (NGU). <a href="http://www.ngu.no/no/hm/Kart-og-data/">http://www.ngu.no/no/hm/Kart-og-data/</a>
1.14 Er det regulert vannmagasiner i nærheten, med spesiell fare for usikker is?	Ja	Langejønn ligger innenfor planområdet. Planområdet grenser også til Drangsvann. Fare for usikker is vurderes derfor som relevant.	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.15 Finnes det naturlige terrengformasjoner som utgjør spesiell fare (stup)?	Ja	Området består av kupert terreng. På grunn av terrengformasjonene anses dette som relevant.	Vurderes som relevant.	Norsk geologisk undersøkelse (NGU). <a href="http://www.ngu.no/no/hm/Kart-og-data/">http://www.ngu.no/no/hm/Kart-og-data/</a>
1.16 Er det tatt hensyn til fremtidig havnivåstigning?	Ja	Området ligger over nivå for eventuell havnivåstigning (NVE, 2016)	Vurderes ikke som relevant.	
1.17 Dersom området har tilgang til elv eller sjø; er det behov for sikringstiltak?	Ja	Planområdet grenser til Drangsvann. Langejønn ligger også innenfor planområdet. Behov for sikringstiltak vurderes derfor som relevant	Vurderes som relevant.	Norges vassdrags- og energidirektorat. <a href="http://skredatlas.nve.no/ge/">http://skredatlas.nve.no/ge/</a>
1.18 Er det fare for forurensende avrenning fra et utsprengt område (gjelder sulfidholdig fjell)?	Ja	Planområdet grenser mellom et område med migmatittisk gneis og et område med amfibolitt. Migmatitten kan inneholde sulfidminerale både finfordelt i bergarten eller	Vurderes som relevant.	

		tilknyttet til kvarts-feltspat bånd. Amfibolittten, kan også inneholde sulfidmineraler, men sannsynligheten for dette er lav.	
1.19 Annet: a) Isgang	Ja	Planområdet grenser til Drangsvann. Det er ikke registrert isgangfare i Drangsvann. Vurderes likevel som relevant.	Vurderes som relevant
b) Støy	Ja	Det er utarbeidet støysonekart for området. Vurderes som relevant.	Vurderes som relevant.

2. DRIKKEVANN O.A. BIOLOGISKE RESSURSER				
Forhold / Uønsket hendelse	Jai/Nei	Vurdering	Merknad	Kilde
<b>2.1 Utbyggingsplaner (boliger, fritidsbebyggelse, næring/industri, infrastruktur etc.) i nærheten av:</b>				
> Drikkevannskilder, nedbørstfelt, grunnvann	Ja	Området grenser til nedbørstfelt og overflatevann som renner ned mot Drangsvann	Vurderes som relevant.	Norsk geologisk undersøkelse (NGU). http://www.ngu.no/no/hm/Kart-og-data/.
> Landbruksareal	Ja	Det er registrert et mindre område med god jordkvalitet nord for planområdet. (naturoglandskap.no/miljøstatus.no). Det er ikke registrert dyrkbar jord i eller i betydelig nærhet til planområdet.	Vurderes som relevant.	Norsk geologisk undersøkelse (NGU). http://www.ngu.no/no/hm/Kart-og-data/.
> Oppdrettsanlegg m.m	Nei	Det er ikke registrert oppdrettsanlegg i eller i nærheten av planområdet.	Vurderes ikke som relevant.	
> Utbyggingsplaner i nærheten av biologiske arter/ressurser	Ja	Det er registrert edellauvskog av Alm og Lind med viktig verdi (B-verdi) vest for planområdet. Lokaltiteten er middels stor. Or-askeskog er en truet vegetasjonstype, men den er hogstpåvirket. Det er også registrert forekomst av Ask sentralt på planområdet. Denne er registrert som sårbar (VU) i norsk rødliste for arter. Det er registrert 3 forekomster av mykbrunpigg (sopp)sør på planområdet. Dette er en sårbar art (VU) i Norsk rødliste for arter. Det er også registrert et epletre innenfor planområdet. Denne er registrert som en fremmed art. Svært høy og høy risiko i svartelista.	Vurderes som relevant.	www.artsdatabanken.no



### 3. INFRASTRUKTUR

Forhold / Uønsket hendelse	Ja/Nei	Vurdering	Merknad	Kilde
<b>3.1 Vil utilsiktede / ukontrollerte hendelser som kan inntreffe på nærliggende transportårer utgjøre en risiko for området?</b>				
> a) Hendelser på vei	Nei	Området er ikke spesielt sårbart for hendelser på nærliggende vei.	Vurderes som relevant.	Vegvesenet, kartbase. <a href="https://www.vegvesen.no/vegkart/vegkart/">https://www.vegvesen.no/vegkart/vegkart/</a>
> b) Hendelser på jernbane	Nei		Vurderes ikke som relevant.	
> c) Hendelser på sjø/vann	Nei		Vurderes ikke som relevant.	
> d) Hendelser i luften	Nei		Vurderes ikke som relevant.	
<b>3.2 Ulykkesbelastede veier</b>				
	Nei	Det er registrert 10 ulykker innenfor en radius på ca 500 meter fra planområdet. Ulykkene spenner seg fra tidsrommet 1979 – 2014 med to ulykker de siste ti år og lettere skadet som alvorligste personskadegrad. Gjelder FV 401	Ingen av de registrerte hendelsene er på vegnettet inn til planområdet.	Vegvesenet, kartbase. <a href="https://www.vegvesen.no/vegkart/vegkart/">https://www.vegvesen.no/vegkart/vegkart/</a>
<b>3.3 Vil drenering av området føre til oversvømmelse i nedenforliggende områder?</b>				
	Ja		Vurderes som relevant.	
<b>3.4 Vil utilsiktede/ukontrollerte hendelser i nærliggende virksomheter (industriforetak etc.) utgjøre en risiko for området?</b>				
> Utslipp av giftige gasser/væsker	Nei		Vurderes ikke som relevant.	
> Utslipp av eksplosjonsfarlige/brennbare gasser/væsker	Nei		Vurderes ikke som relevant.	
<b>3.5 Medfører bortfall av tilgang på følgende tjenester spesielle ulemper for området?</b>				
> Elektrisitet (kraftlinjer)	Nei	Bortfall av elektrisitet vil ikke få spesielle konsekvenser. Vurderes derfor som lite relevant.	Vurderes ikke som relevant.	
> Teletjenester	Nei	Bortfall av teletjenester vil ikke få spesielle konsekvenser. Vurderes derfor som lite relevant.	Vurderes ikke som relevant.	
> Vannforsyning	Nei	Bortfall av vannforsyning vil ikke få spesielle konsekvenser. Vurderes derfor som lite relevant.	Vurderes ikke som relevant.	
> Renovasjon/spillvann	Nei	Bortfall av renovasjon/spillvann vil ikke få spesielle konsekvenser. Vurderes derfor som lite relevant.	Vurderes ikke som relevant.	
<b>3.6 Dersom det går høyspentlinjer vedligjennom området?</b>				
> Påvirket området av magnetisk felt fra linjer	Nei	Det går en distribusjonsnettlinje (22 kW-luftlinje) sør vest for planområdet langs Fv401. Denne luftlinjen planlegges	Vurderes ikke som relevant.	

		avviklet, og all ny el. infrastruktur skal legges i bakken.		
> Er det spesiell klatrefare i forbindelse med linjer	Nei			
<b>3.7 Er det spesielle farer forbundet med bruk av transportnett for gående, syklende og kjørende innenfor området?</b>				
> Til skole/Barnehage	Ja	Barneskole og barnehage er innenfor en rekkevidde på 3 km meter fra planområdet. Det er per i dag opparbeidet fortau og gs-veg langs Fv 401.	Vurderes som relevant.	
> Til nærmiljøanlegg (idrett etc.)	Ja	Idrettsanlegg er lokalisert ca 300 meter sør-vest for planområdet. Det er per i dag ikke opparbeidet krysningspunkt av fylkesvegen.	Vurderes som relevant.	
> Til forretning etc.	Ja	Det er ikke opparbeidet sammenhengende fortau fra planområdet inn til forretningene på Rona.	Vurderes som relevant.	
> Til busstopp	Nei	Nærmeste eksisterende busstopp ligger sør for planområdet langs Høvågveien ved Sommerro. Det skal opparbeides gang- og sykkelveg/fortau til busstoppet og de skal oppgraderes.	Vurderes som relevant.	
<b>3.8 Brannberedskap</b>				
> Omfatter området spesielt farlige anlegg	Nei	Reguleringsformål: boligbebyggelse	Vurderes ikke som relevant.	
> Har området utilstrekkelig brannvannforsyning (mengde og trykk)	Ja	reguleringsbestemmelsene settes det rekkefølgekrav om dokumentasjon av tilstrekkelig slokkevannskapasitet på minimum 50 l/sek.	Vurderes som relevant.	
> Ligger området slik at brannvesenets krav til innsats tid tilfredsstilles?	Ja	Området ligger ca 7 km fra Kristiansandregionen brann og redning. Beregnet kjøretid fra brannstasjon til planområdet er ca. 6 minutter.	Vurderes ikke som relevant.	Vegvesenet, kartbase. <a href="https://www.vegvesen.no/vegkart/vegkart/">https://www.vegvesen.no/vegkart/vegkart/</a>

4. TIDLIGERE BRUK			
Forhold / Uønsket hendelse	Ja/Nei	Vurdering	Merknad
<b>4.1 Er området påvirket/forurenset fra tidligere virksomhet?</b>			
> Gruver: åpne sjakter, steintipper etc.	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Militære anlegg: fjellanlegg, piggrådsperringer etc.	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Industrivirksomhet, herunder avfallsdeponering	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Bensinstasjon/bilverksted/tankanlegg/ Mekanisk verksted/ skipsverft?	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Industri (for eksempel galvaniseringsverksted, impregneringsverksted, annen industri)?	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Gjentatte rivingsarbeider/rehabilitering av bygninger fra 1950-1980/byjord?	Nei	Området er ubebygd.	Vurderes ikke som relevant.
> Annet(angli)	Nei		Vurderes ikke som relevant.

5. STRATEGISKE/SÅRBARE OBJEKT SOM KAN VÆRE SÆRLIG UTASATT FOR SABOTASJE/TERROR, OG/ELLER ER SÅRBARE I SEG SELV OG DERFOR BØR HA EN GRUNDIG VURDERING			
Forhold / Uønsket hendelse	Ja/Nei	Vurdering	Merknad
5.1 Vannkraftverk/Kraftverk	Nei	Ikke registrert	Vurderes ikke som relevant.
5.2 Undervannsledninger	Nei	Ikke registrert	Vurderes ikke som relevant.
5.3 Bru/Demning	Nei	Ikke registrert	Vurderes ikke som relevant.
5.4 Sosiale arenaer/bygg	Nei	Ikke registrert	Vurderes ikke som relevant.

6. Andre forhold			
Forhold / Uønsket hendelse	Ja/Nei	Vurdering	Merknad
6.1 Vil skogbrann/lyngbrann i området være en fare for boliger/hus	Ja	Omkringliggende områder rundt planområdet er preget av barskog/lauvskog. Skogbrann/lyngbrann i området vurderes derfor å kunne utgjøre en risiko	Vurderes som relevant.
6.2 Annet(angli) Fredet kulturminne	Ja	Det er registrert et kulturminne innenfor planområdet.	Vurderes som relevant. <a href="http://www.kulturminnsok.no">www.kulturminnsok.no</a>

## 7. Resultater

Matrisen viser en sammenstilling av resultater fra risikoanalysen slik den er angitt i tabell 7.1 Rødt felt indikerer uakseptabel risiko. Det er funnet tre situasjoner/ hendelse i denne kategorien der tiltak må iverksettes for å redusere denne ned til gul eller grønn. Gult felt indikerer risiko som bør vurderes med hensyn til tiltak som reduserer risiko. Grønt felt indikerer akseptabel risiko.

Risikomatrise	Konsekvens					
	Sannsynlighet	Ufarlig	En viss fare	Kritisk	Farlig	Katastrofalt
<b>Meget sannsynlig</b>						
<b>Sannsynlig</b>			1.7 1.9 1.16 1.17 1.19a 1.19b 6.2			
<b>Mindre sannsynlig</b>			1.3 1.18 2.1a 2.1b	1.3 1.14 1.15 1.19 3.3 3.7 6.1	1.4 1.5	
<b>Lite sannsynlig</b>				3.6		

	Lav risiko
	Middels risiko
	Høy risiko

Resultatet av ROS-analysen har identifisert følgende hendelser:  
5 hendelser med lav risiko, 14 hendelser med middels risiko og 3 hendelser med høy risiko.

### 1.3

#### **Kvikkleire, utglidninger, ustødige grunnforhold (middels risiko)**

Østlige deler av området ligger under marin grense og kan derfor inneholde kvikkleire. Det er aktuelt å masseutskifte deler av områdene hvor det er dårlig grunn. Området skal bearbeides og det vil utføres grunnprøveboring på områder som skal bebygges og som har dårlige grunnforhold. Våren 2019 ble det utført grunnprøveboring på deler av området som planlegges for ny nærmiljøpark. Som følge av prøvetakingene resulterte dette funn av dårlige grunnforhold hvor det tidligere var planlagt ny 7er ballbane. Ballbanen ble derfor flyttet lenger sørøst, og det grunnen under ny fotballbane vil masseutskiftes Eksakt plassering av ulike tiltak vil under utarbeidelse av utomhusplan og tekniske planer vurderes i samråd med kommunen under for dette området.

### 1.4

#### **Risiko for steinras og steinsprang (høy risiko)**

På grunn av terrengformasjonene og planlagt bearbeiding av terreng anses dette som relevant. Det skal utarbeides tekniske planer som inkluderer ras- og fallsikring.



- 1.5 Risiko for is og snøskred (høy risiko)**  
På grunn av terrengformasjonene og planlagt bearbeiding av terreng anses dette som relevant. Det skal utarbeides tekniske planer som inkluderer ras- og fallsikring.
- 1.7-1.9 Flomfare (middels risiko) og Flomsonekart, historiske flomnivå (middels risiko)**  
Det er utarbeidet eget notatrapport vedrørende overvannshåndtering og mulighet for flomfare. På østlige deler av planområdet som ligger på lavliggende terreng med Rundeifjonn er det fare for flom. Flomhøyde er beregnet til å være kotehøyde k+18.4 m. Dette hensyntatt i planforslaget, ved at blant annet tilgrensende og nye tiltak på nærmiljøanlegget må etableres på høyere kotehøyde enn dette. Forprosjektert gang- og sykkelveg er også planlagt å etableres på sikker kotehøyde (over k+18.4m). I plankartet områdene hvor det er registrert fare for flom regulert med egen hensynssone (H320).
- 1.13 Radon (høy risiko)**  
Det er registrert varierende grad av aktsomhetsgrad for radon i grunnen i planområdet. Gjeldende teknisk forskrift ivaretar krav til tilfredsstillende sikring mot Radon.
- 1.14 Regulerede vannmagasiner i nærheten, med spesiell fare for usikter is (middels risiko)**  
Rundeifjonn ligger i planområdet. Det vises for øvrig til eget notat/rapport som er utarbeidet m.t.p flom, vannveier og aktuelle løsninger for dette. For øvrig vil Langeifjonn ikke gjerdes inne, da dette er et landskapselement i tilknytning til nærmiljøanlegget.
- 1.15 Naturlige terrengformasjoner som utgjør spesiell fare (middels risiko)**  
Tekniske planer som også omhandler tiltak mot ras og sikring av farlig terreng ivaretar risikoen for uønskede hendelser knyttet til farlig terreng.
- 1.16 - 1.17 Er det tatt hensyn til fremtidig havnivåstigning?  
Dersom området har tilgang til elv eller sjø; er det behov for sikringstiltak?**  
Drangsvann ligger i nærheten til planområdet. Det er ikke planlagt nye vannømfintlige tiltak i nærheten av strandsonen til Drangsvann.
- 1.18 Forurensning knyttet til sulfidholdig fjell (lav risiko)**  
Økt sulfidforekomst finnes ofte i grenseområder mellom de to forskjellige hovedbergartene innenfor området; migmatittisk gneis og amfibolitt. En undersøkelse gjort i hele Benestadområde viste at det nesten ikke fantes sulfidkilder i undersøkelsesområdet. Hverken på feltarbeid eller gjennom undersøkelser av steinprøver ble det funnet nevneverdige mengder av de vanlige sulfidkildene (magnetis, svovekis, pyritt m.fl.) Det anbefales at undersøkelsen følges opp med en befaring i de utviste sprengningsområdene etter at vegetasjonen er ryddet for å bekrefte resultatet av befaringen.
- 1.19a Isgang (middels risiko)**  
Vannføringen i Drangsvann er forholdsvis lav. Dette vises ved at vannet er svært oksygenfattig. Det er ingen ømfintlig bebyggelse eller annen infrastruktur som vil bygges i nærheten av Drangsvann. Viser til vedlagt plankart. Det er dermed ingen konstruksjoner som vil være utsatt for dette om det skulle forekomme (mindre sannsynlig).
- 1.19b Støy (middels risiko)**  
Det er utarbeidet støysonekart for samleveg i planområdet. Det vil være behov for støyreducerende tiltak for boenheter i felt Cb1 og 2. Dette ivaretas gjennom teknisk forskrift.
- 2.1a Utbyggingsplaner i nærheten av drikkevannskilder, nedbørsfelt, grunnvann (lav risiko)**  
Området grenser til nedbørsfelt til hav/ bekk fra Sukkevannet. Dette nedbørsfeltet drenerer til Sukkevannet. Overvann/tilrenning til Sukkevann vil holdes i stor grad igjen via Rundeifjonn.
- 2.1b Utbyggingsplaner i nærheten av landbruksareal (lav risiko)**  
Det er registrert et mindre område med god jordkvalitet øst for planområdet. (naturoglandskap.no/miljøstatus.no).Areal hvor det er registrert god jordkvalitet er ikke dyrket i dag. Området er også såpass lite at verdien av område som jordbruksareal vurderes som mindre viktig. Det er ikke registrert dyrkbar jord i eller i betydelig nærhet til planområdet.

- 2.1d) Utbyggingsplaner i nærheten av biologiske arter/ressurser (risiko – ikke vurdert)**  
Det er registrert område med rik edellauvskog vest for planområdet. Dette området vil bli regulert til grønnstruktur/friområde. Som avbøtende tiltak vil det bestrebes og å ivare ta vegetasjonen, men fjerning vil være aktuelt, og så ledes ikke en uønsket situasjon.  
Det er registrert 3 forekomster av mykbrunpigg (sopp)sør på planområdet. Dette er en sårbar art (VU) i Norsk rødliste for arter. Det er også registrert et epletre innenfor planområdet. Denne er registrert som en fremmed art. For at utbyggingen skal være mulig å gjennomføre, vil disse artene fjernes, og således er dette ikke en uønsket hendelse. Epletreet vil fjernes iht til krav.
- 3.3 Vil drenering av området føre til oversvømmelse i nedenforliggende områder (middels risiko)**  
Drenering av planområdet styres gjennom tekniske planer for overvannshåndtering. Det vises til eget notat/rapport for overvannshåndtering, flomveier og flomfasesoner.
- 3.6 Høyspent og magnetisk felt (lav risiko)**  
Det går en distribusjonsnettlinje (22 KV-luftlinje) sør vest for planområdet langs Fv.401 - Høvågveien. Denne luftlinjen planlegges avvirket, og all ny el. infrastruktur skal legges i bakken.
- 3.7 Farer forbundet med bruk av transportnett for gående, syklende og kjørende innenfor området til målpunkter i og utenfor planområdet (middels risiko)**  
Trafikksikkerhet er vurdert i de tre fasene infrastruktur for gående- og syklende skal etableres. Fase 1 er den eneste fasen hvor man planlegger kryssing i plan. Kryssingen planlegges over fylkesveg 401 Høvågveien sør for delfelt Bb2 og sør mot Torp og videre mot Strømme skole. I dag er trafikkmengden på omlag 2500 kjøretøy i døgnet og fartsgrensen er 60 km/t. I forbindelse med etableringen av gangfeltet og ny gang- og sykkelveg langs Høvågveien vil det være dialog med Statens vegvesen om utforming og eventuelle fartsdempende tiltak. På sikt skal det etableres planfri kryssing.  
Ellers internt på planområdet er det regulert inn langsgående fortau ved hovedadkomstvegen i boligfeltene, samt andre grøntkorridorer, gang- og sykkelveier og turveger som bidrar til at økt trafikksikkerhet på boligfeltene.
- 3.8 (b) Brannvannforsyning (lav risiko)**  
Det er satt følgende krav i bestemmelsene: For bebyggelse annet enn småhusbebyggelse kreves slukkevannekapasitet på minimum 50 l/s. Overnevnte krav til slukkevann må være tilfredsstillt før det kan gis byggetillatelse.
- 6.1 Fare for skogbrann/lyngbrann konsekvenser for bygninger (middels risiko)**  
Planområdet består av mye skog, men tomtene vil bearbeides og framtidig risiko for skogbrannfare vurderes som lav.
- 6.2 Fredet kulturminne (lav risiko)**  
Det er ikke registrert kulturminner i området.  
Ellers er det ikke planlagt nye tiltak som vil kreve automatisk fredete kulturminner må frigis. Ved utarbeidelse av utomhusplan for grøntområdene langs med Drangsvann kan de bli aktuelt med noen nye tiltak. Avklaring om disse kommer eventuelt i konflikt med kulturminnene må vurderes i en senere fase.



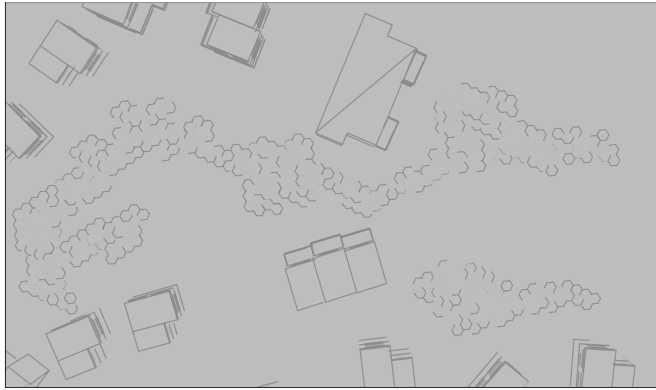


Figure 9.1: Spektrum in January 10:00

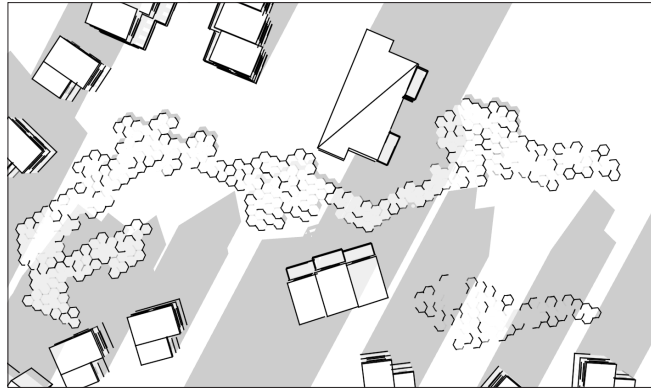


Figure 9.2: Spektrum in January 15:00

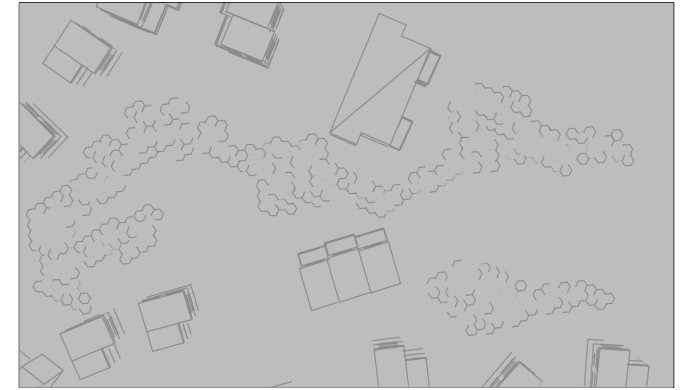


Figure 9.3: Spektrum in January 20:00

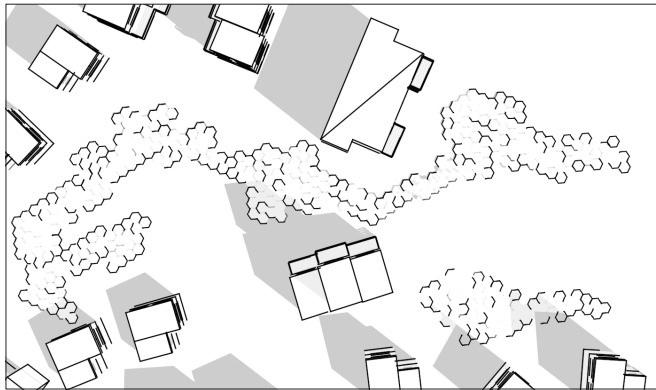


Figure 9.4: Spektrum in April/October 10:00

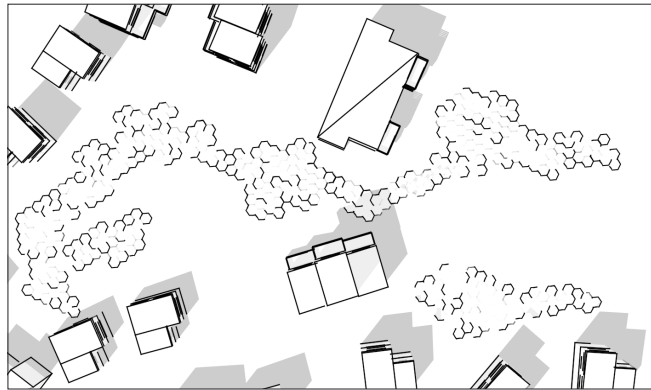


Figure 9.5: Spektrum in April/October 15:00

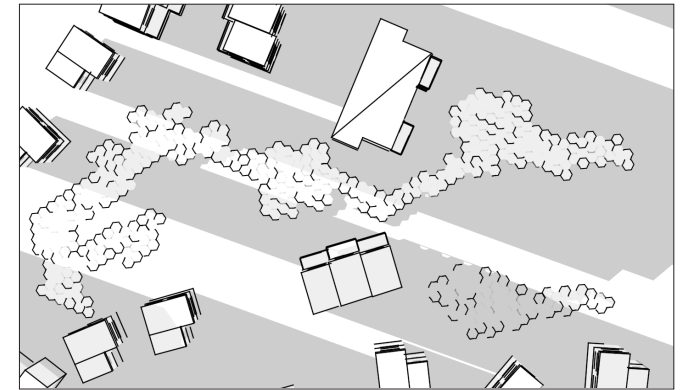


Figure 9.6: Spektrum in April/October 20:00

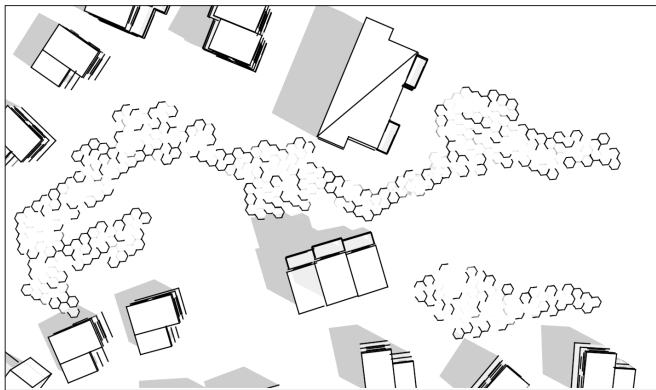


Figure 9.7: Spektrum in July 10:00

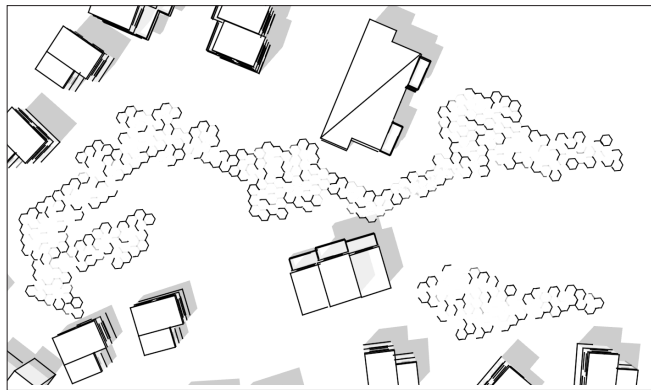


Figure 9.8: Spektrum in July 15:00



Figure 9.9: Spektrum area in July 20:00



Figure 9.10: White area in January 10:00

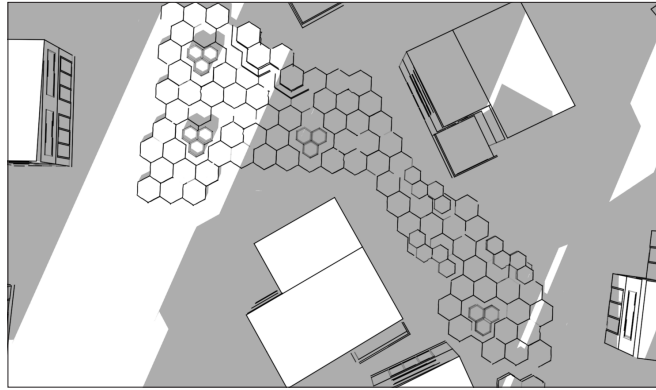


Figure 9.11: White area in January 15:00



Figure 9.12: White area in January 20:00

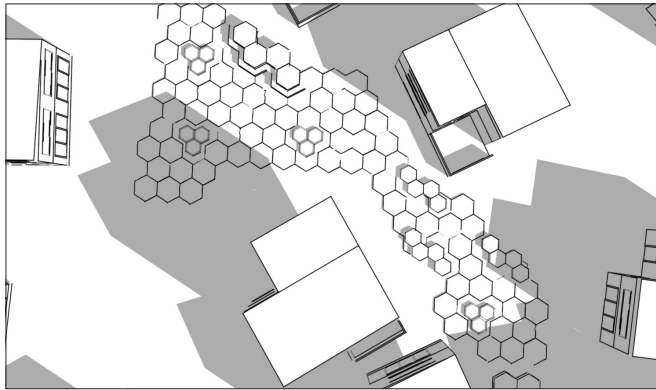


Figure 9.13: White area in April/October 10:00

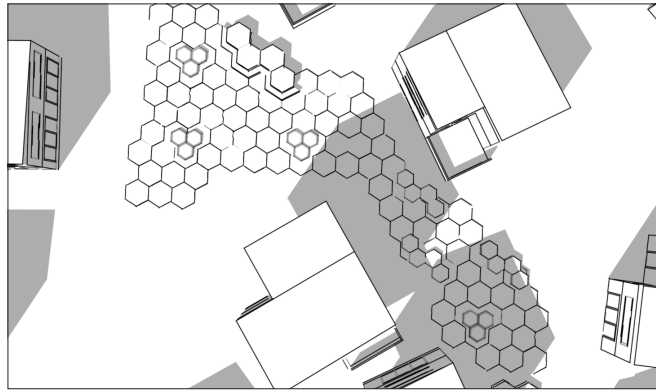


Figure 9.14: White area in April/October 15:00

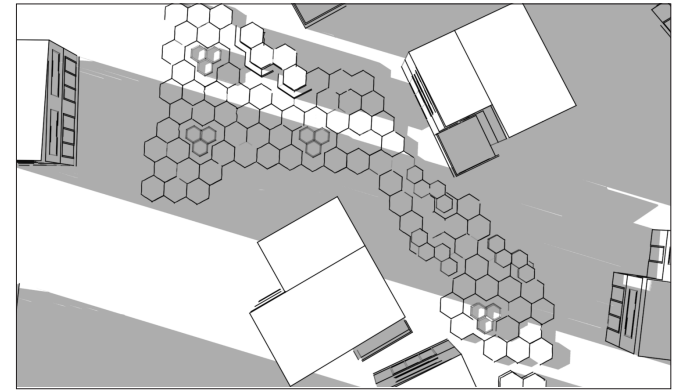


Figure 9.15: White area in April/October 20:00

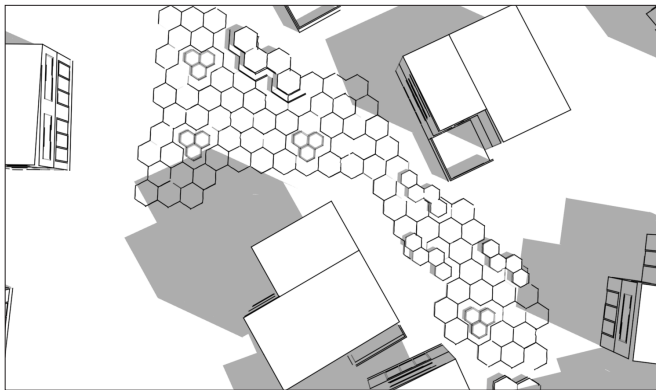


Figure 9.16: White area in July 10:00

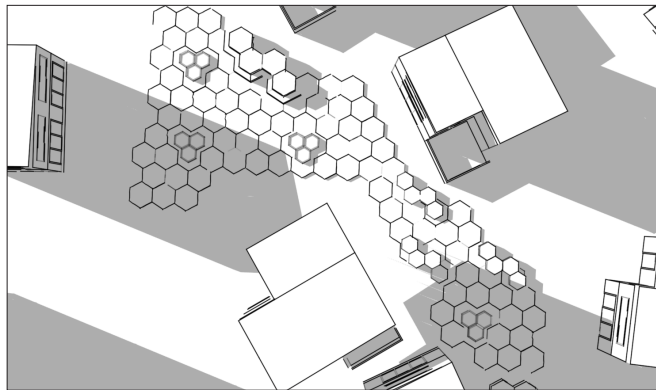


Figure 9.17: White area in July 15:00

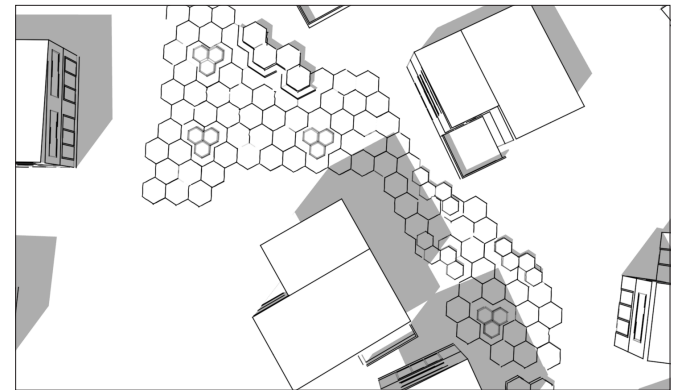


Figure 9.18: White area in July 20:00

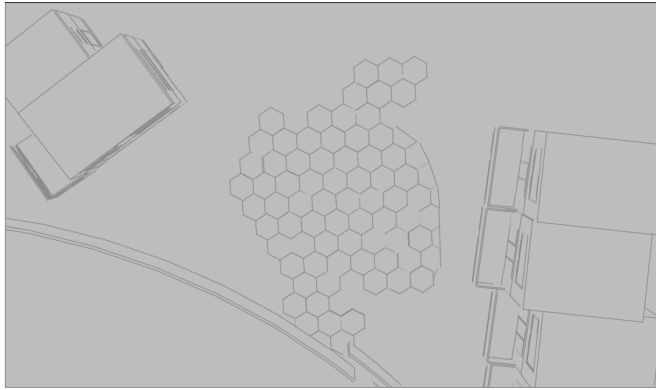


Figure 9.19: Beige area in January 10:00

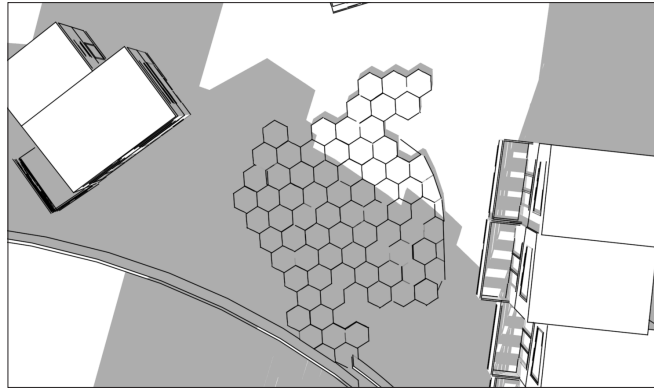


Figure 9.20: Beige area in January 15:00

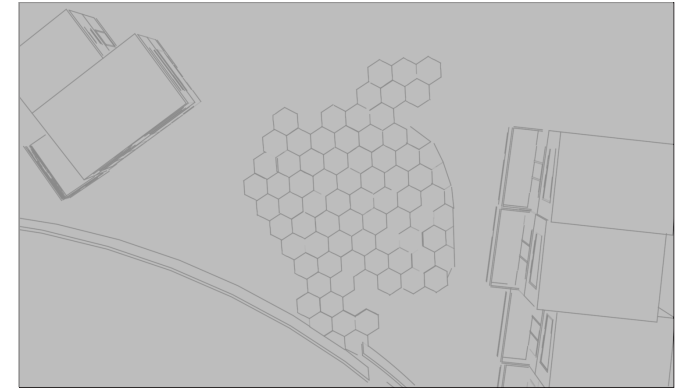


Figure 9.21: Beige area in January 20:00

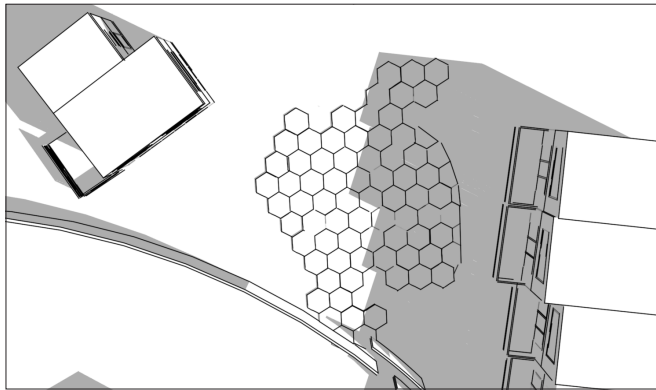


Figure 9.22: Beige area in April/October 10:00

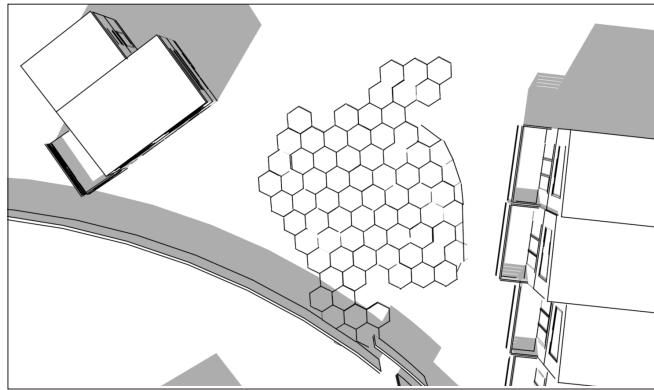


Figure 9.23: Beige area in April/October 15:00

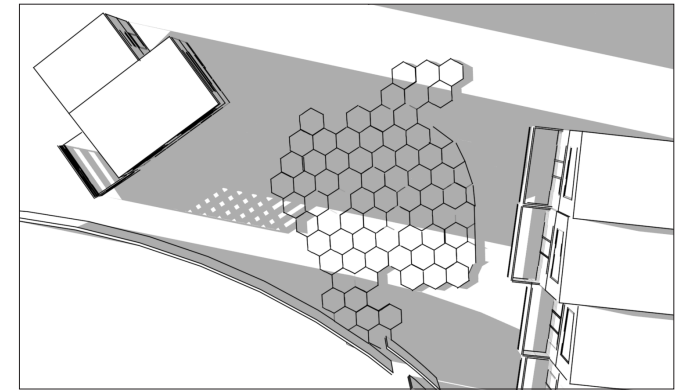


Figure 9.24: Beige area in April/October 20:00

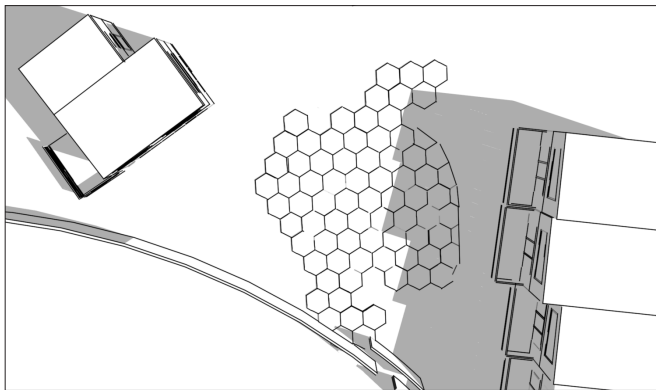


Figure 9.25: Beige area in July 10:00

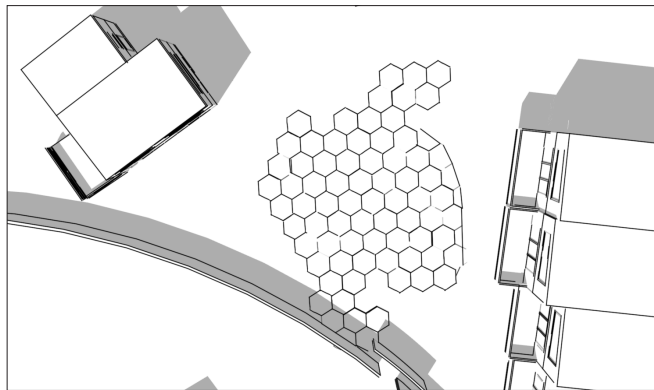


Figure 9.26: Beige area in July 15:00

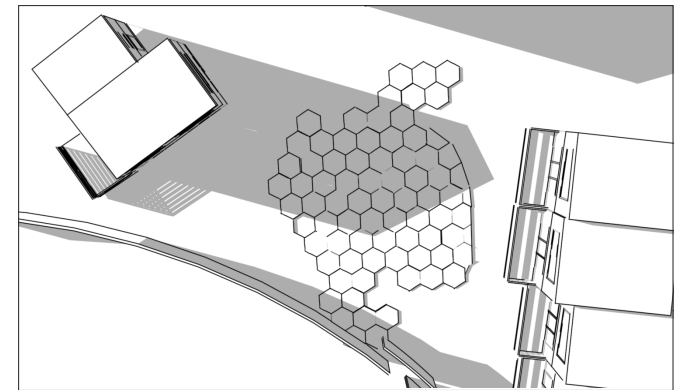


Figure 9.27: Beige area in July 20:00

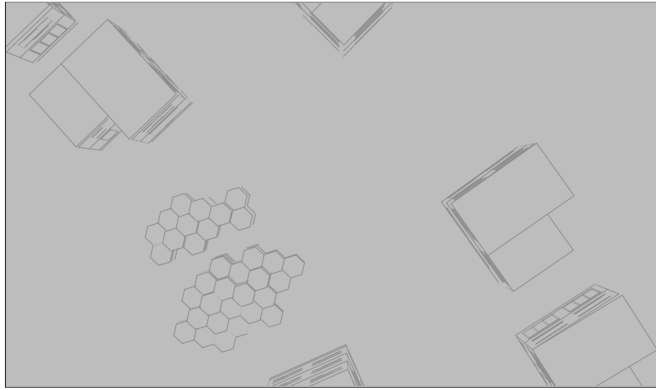


Figure 9.28: Blue area in January 10:00

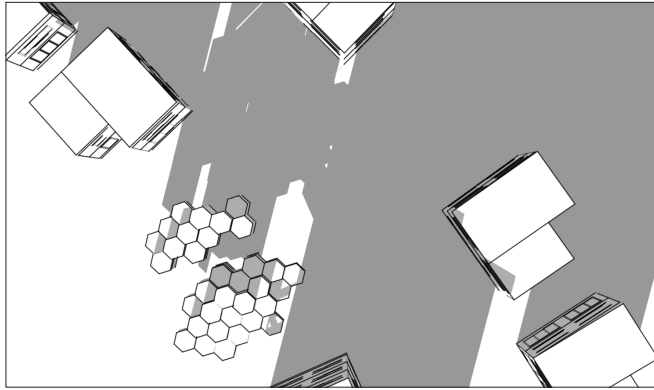


Figure 9.29: Blue area in January 15:00

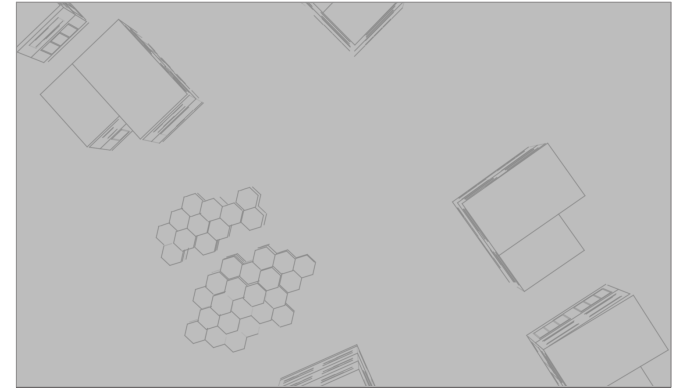


Figure 9.30: Blue area in January 20:00

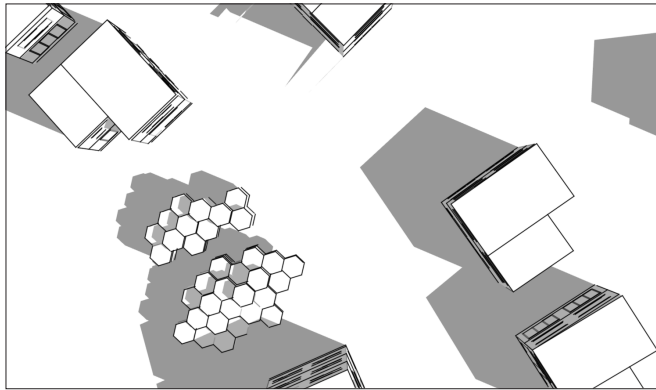


Figure 9.31: Blue area in April/October 10:00

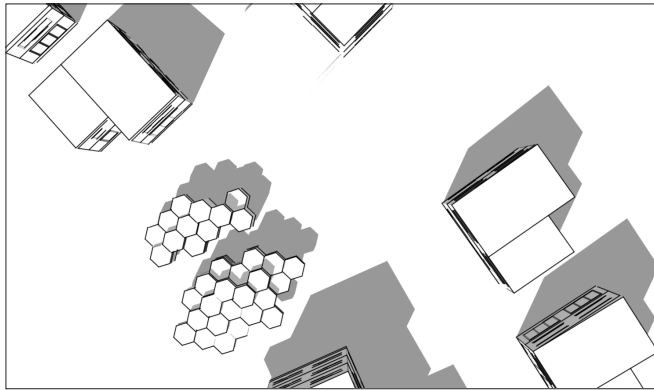


Figure 9.32: Blue area in April/October 15:00

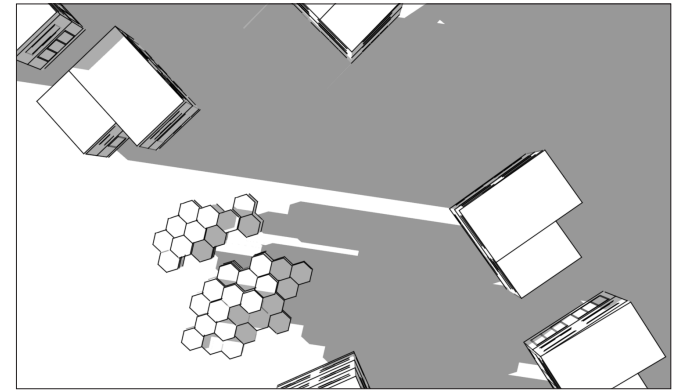


Figure 9.33: Blue area in April/October 20:00

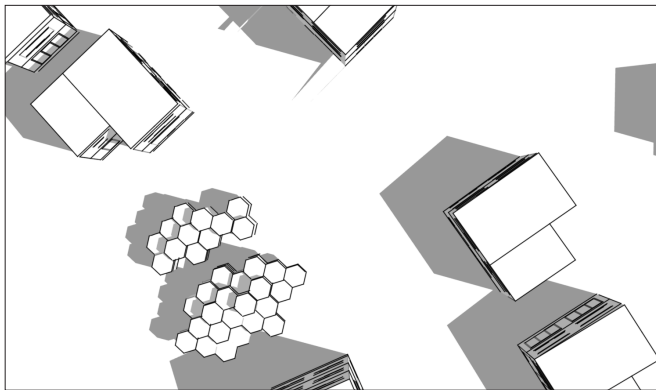


Figure 9.34: Blue area in July 10:00

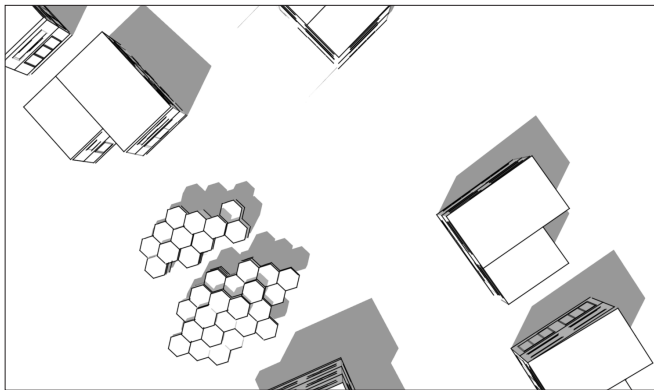


Figure 9.35: Blue area in July 15:00

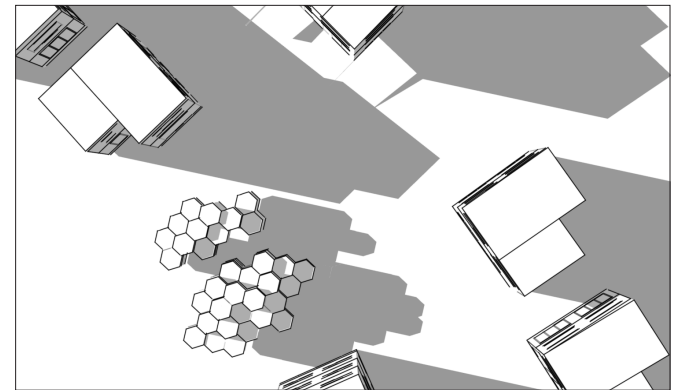


Figure 9.36: Blue area in July 20:00



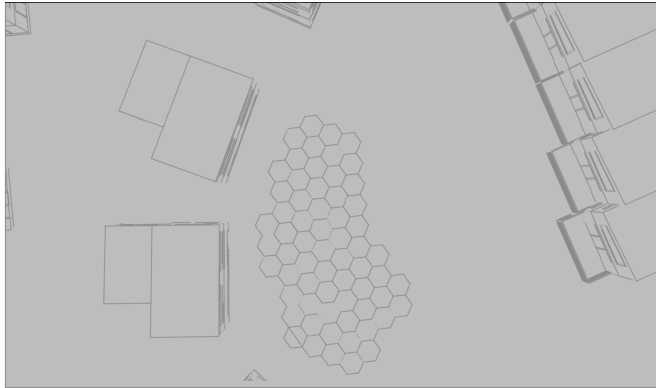


Figure 9.37: Yellow area in January 10:00

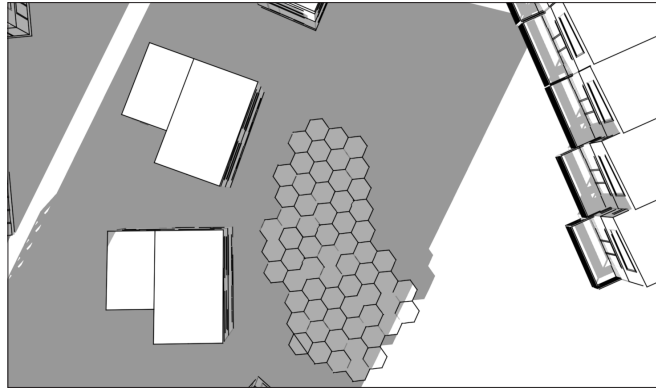


Figure 9.38: Yellow area in January 15:00

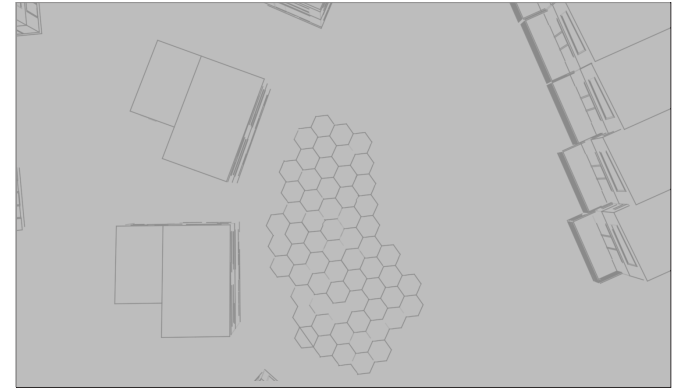


Figure 9.39: Yellow area in January 20:00

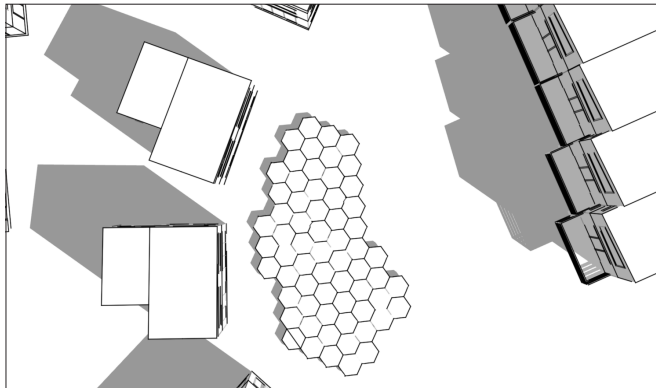


Figure 9.40: Yellow area in April/October 10:00

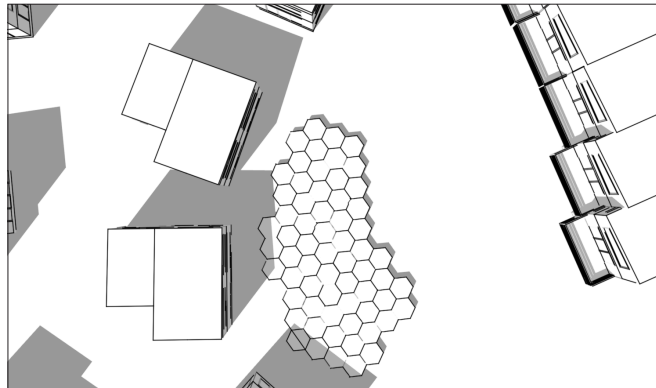


Figure 9.41: Yellow area in April/October 15:00

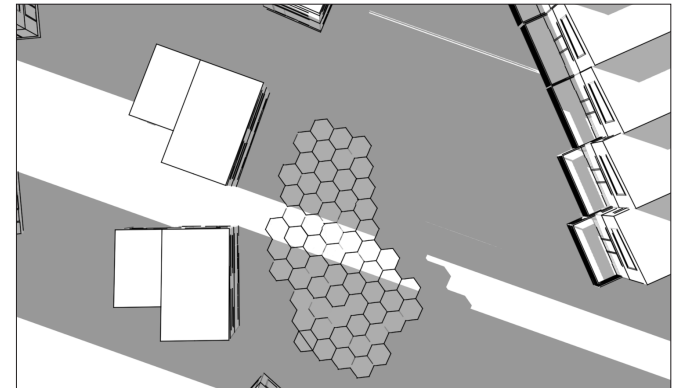


Figure 9.42: Yellow area in April/October 20:00

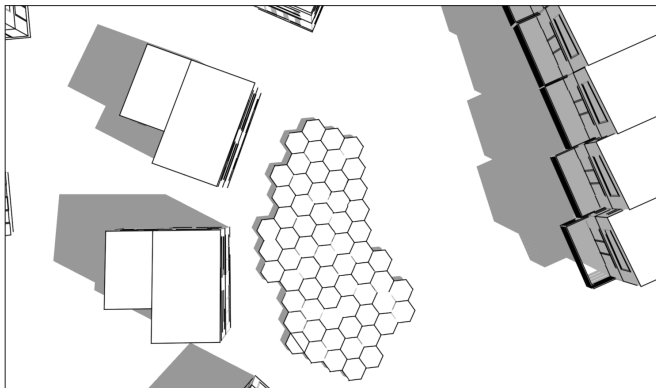


Figure 9.43: Yellow area in July 10:00

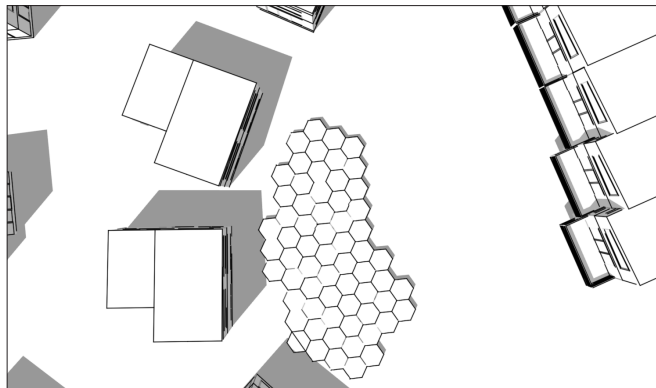


Figure 9.44: Yellow area in July 15:00

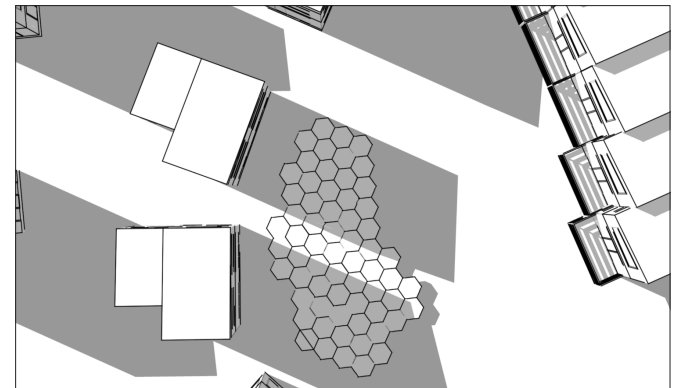


Figure 9.45: Yellow area in July 20:00

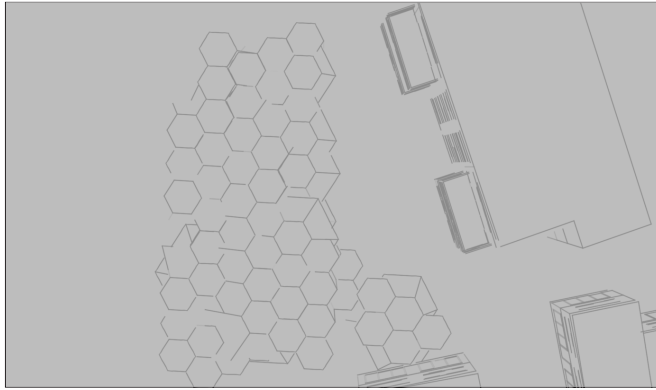


Figure 9.46: Pink area in January 10:00

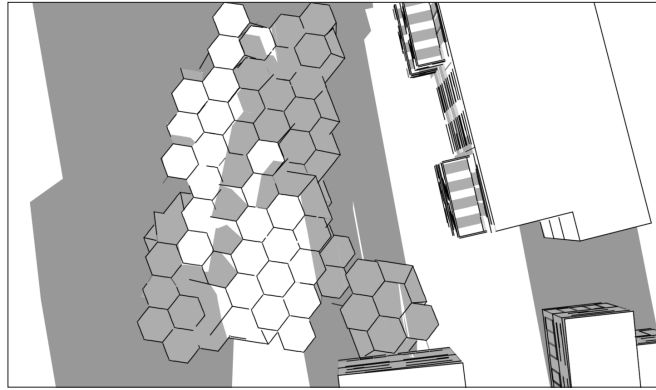


Figure 9.47: Pink area in January 15:00

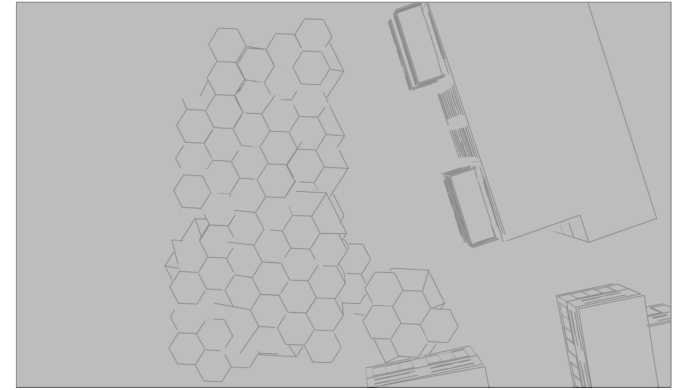


Figure 9.48: Pink area in January 20:00

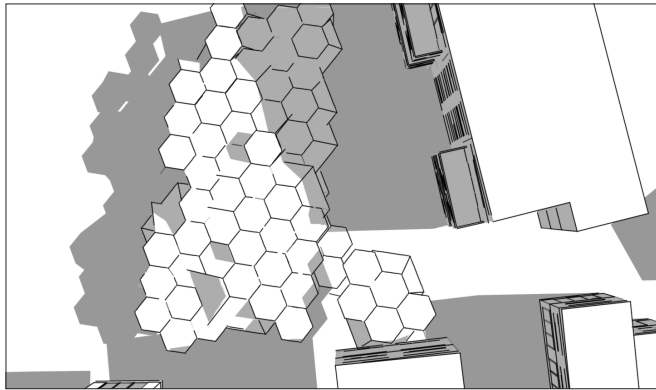


Figure 9.49: Pink area in April/October 10:00

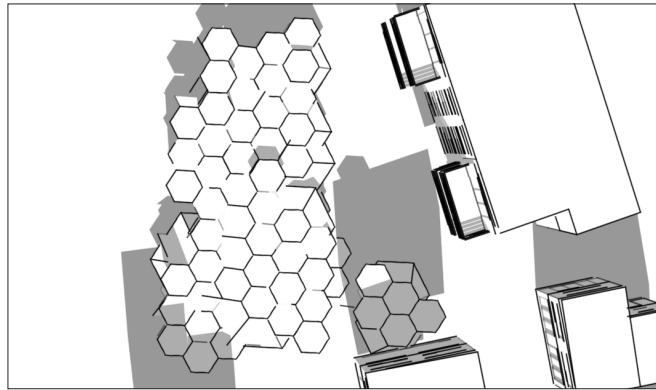


Figure 9.50: Pink area in April/October 15:00

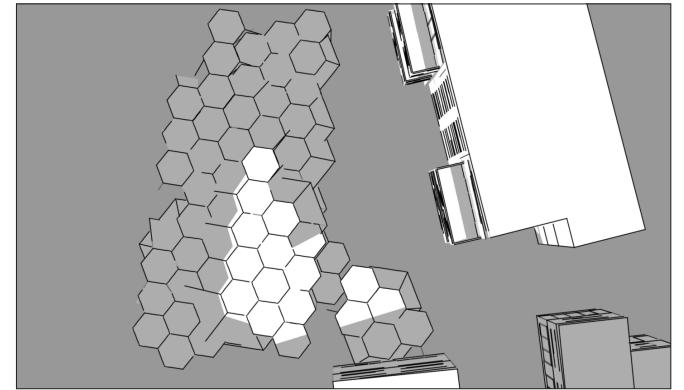


Figure 9.51: Pink area in April/October 20:00

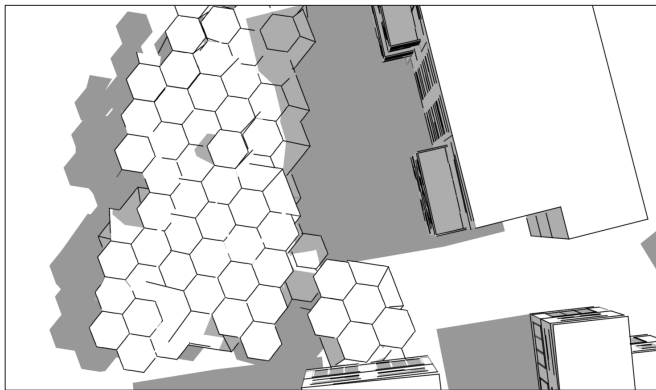


Figure 9.52: Pink area in July 10:00

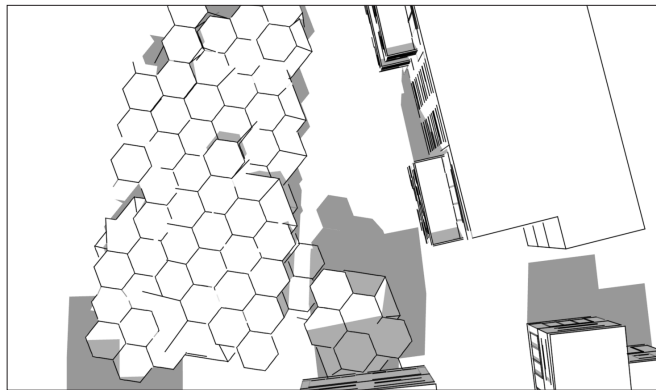


Figure 9.53: Pink area in July 15:00

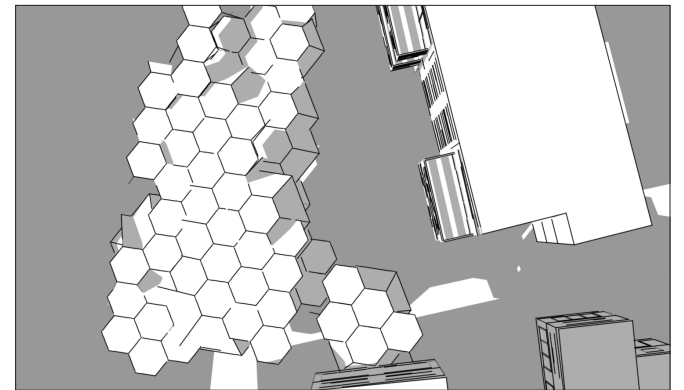


Figure 9.54: Pink area in July 20:00



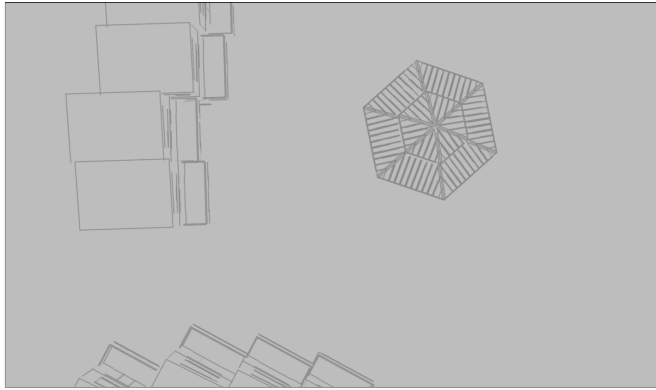


Figure 9.55: Purple area in January 10:00

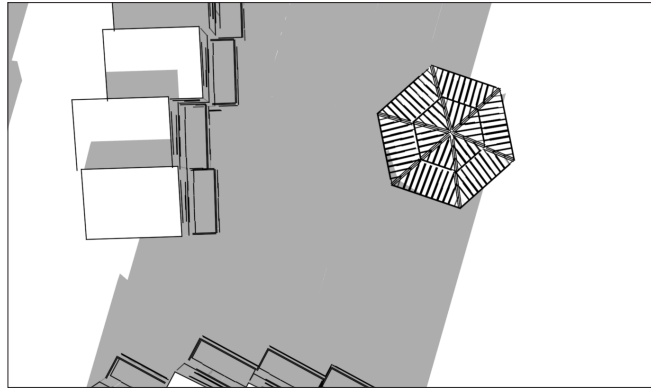


Figure 9.56: Purple area in January 15:00

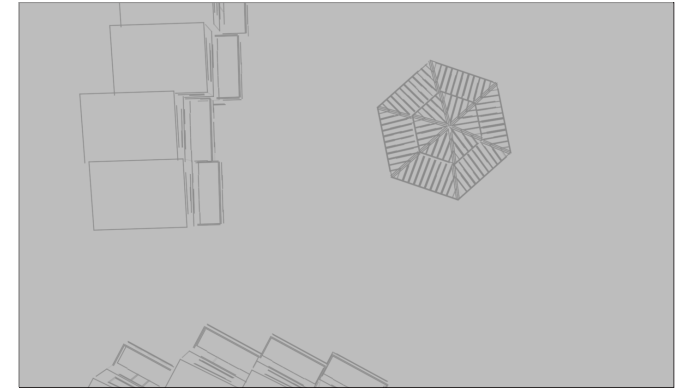


Figure 9.57: Purple area in January 20:00

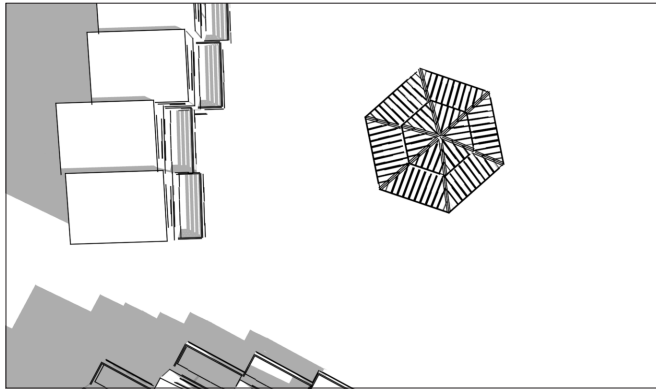


Figure 9.58: Purple area in April/October 10:00

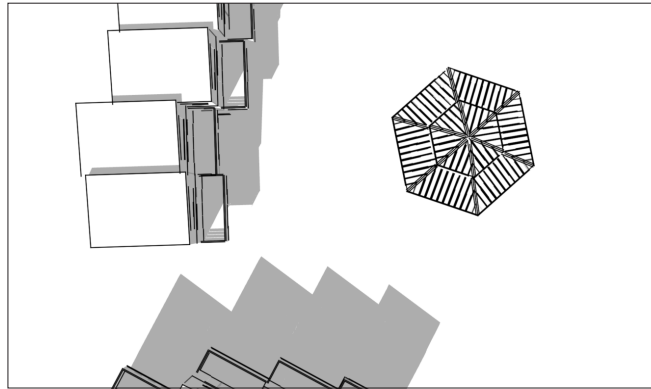


Figure 9.59: Purple area in April/October 15:00

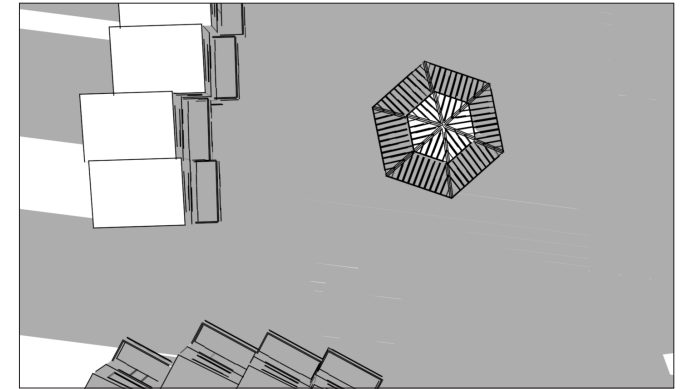


Figure 9.60: Purple area in April/October 20:00

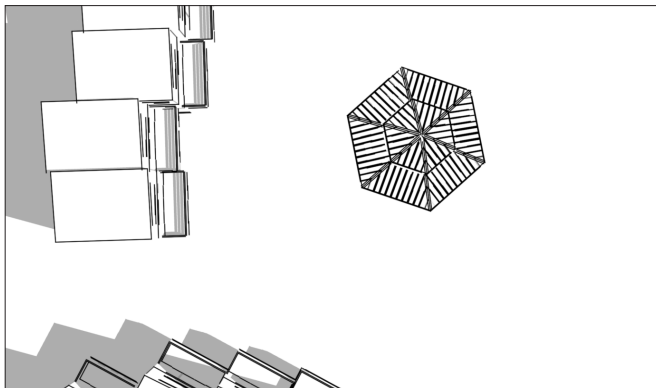


Figure 9.61: Purple area in July 10:00

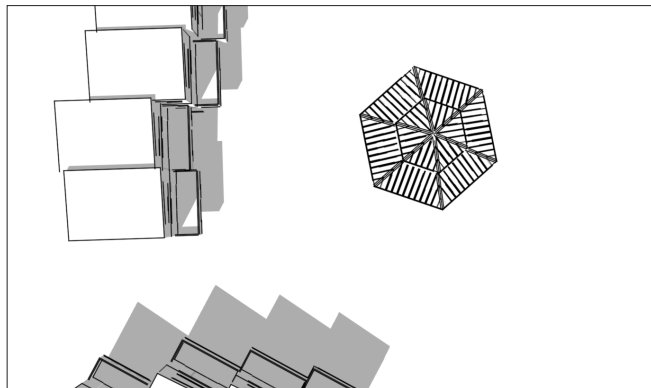


Figure 9.62: Purple area in July 15:00

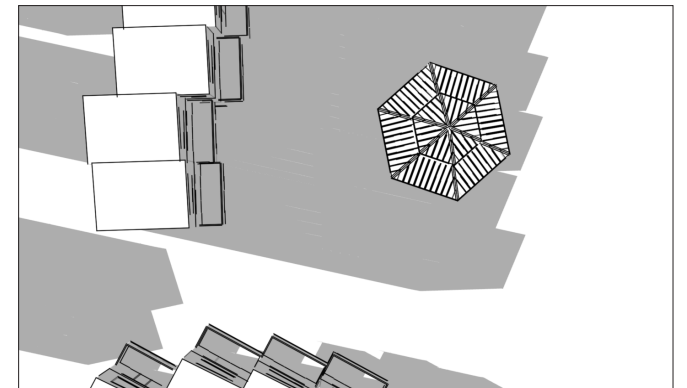


Figure 9.63: Purple area in July 20:00

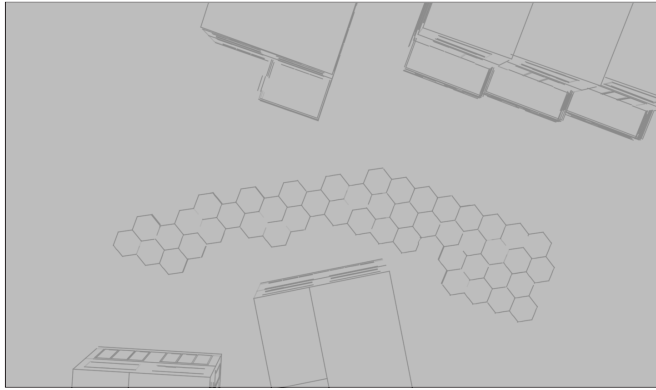


Figure 9.64: Black area in January 10:00

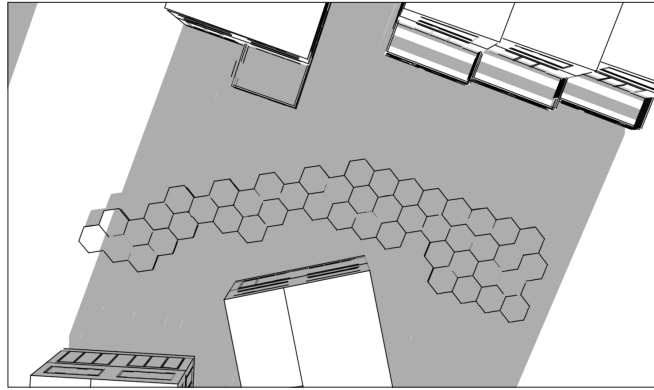


Figure 9.65: Black area in January 15:00

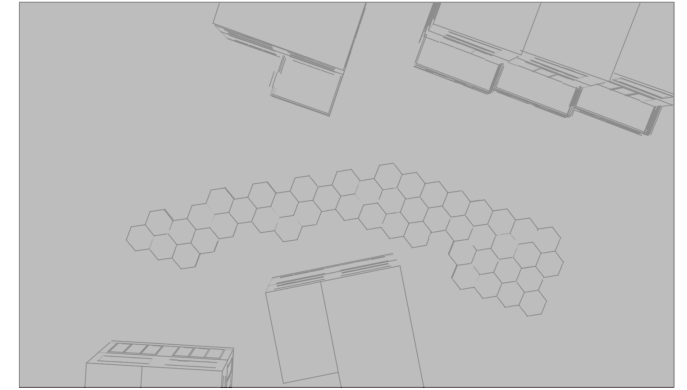


Figure 9.66: Black area in January 20:00

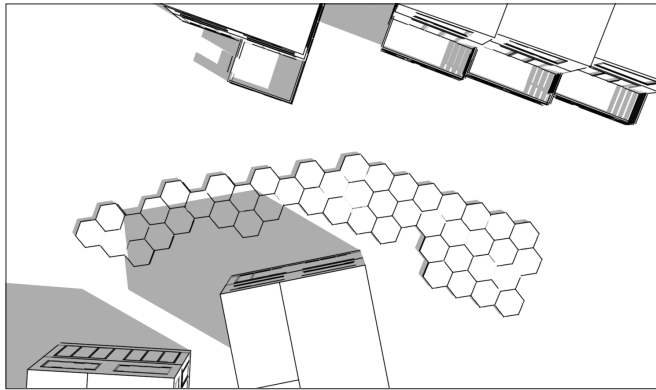


Figure 9.67: Black area in April/October 10:00

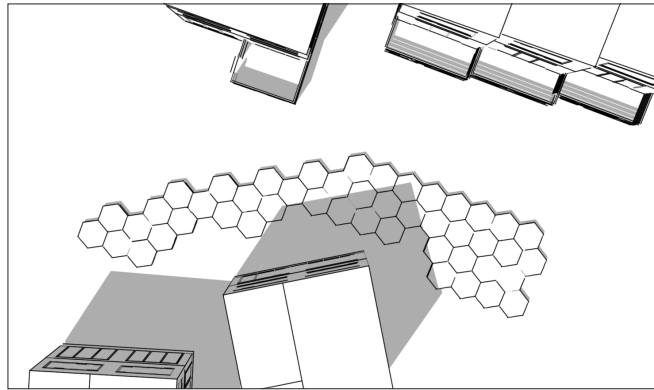


Figure 9.68: Black area in April/October 15:00

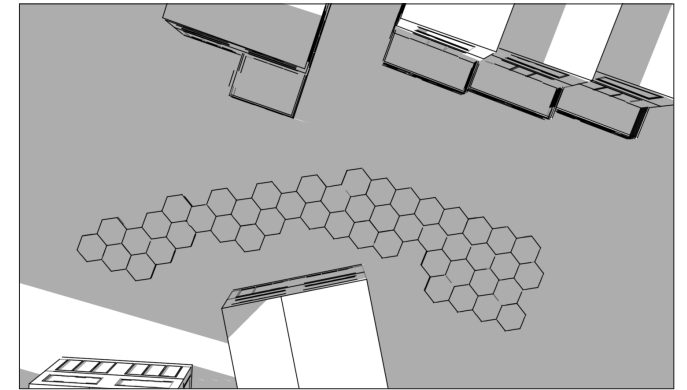


Figure 9.69: Black area in April/October 20:00

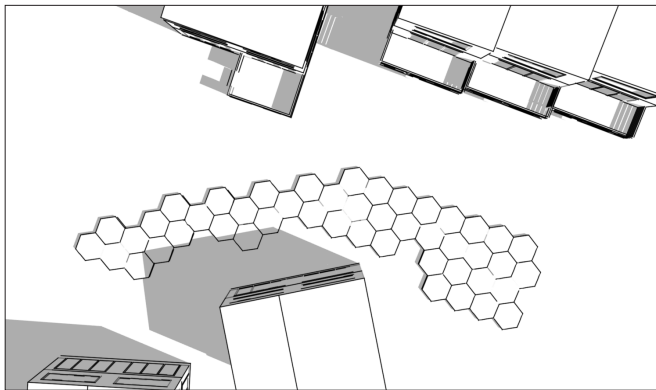


Figure 9.70: Black area in July 10:00

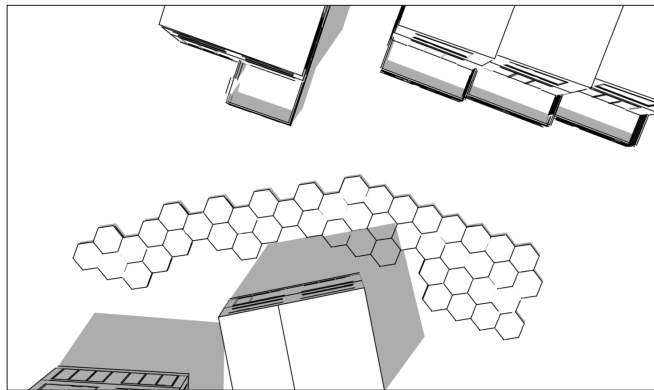


Figure 9.71: Black area in July 15:00

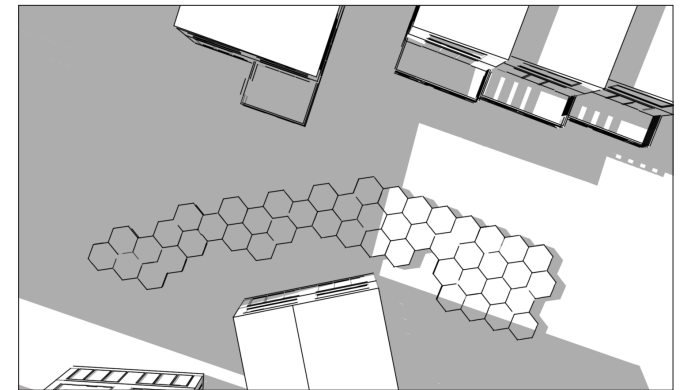


Figure 9.72: Black area in July 20:00

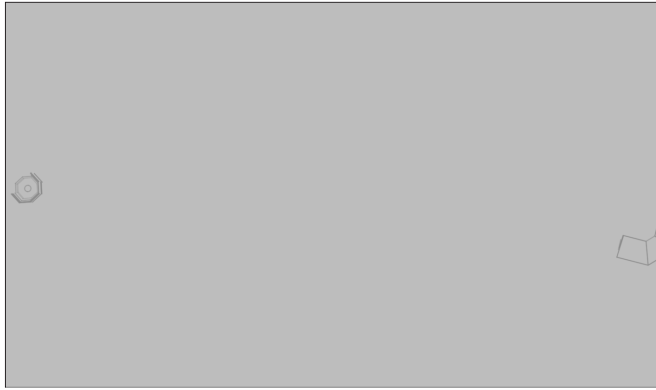


Figure 9.73: Green area in January 10:00

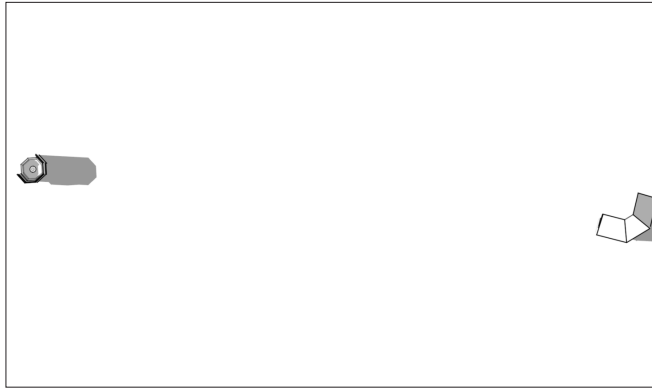


Figure 9.74: Green area in January 15:00



Figure 9.75: Green area in January 20:00



Figure 9.76: Green area in April/October 10:00



Figure 9.77: Green area in April/October 15:00



Figure 9.78: Green area in April/October 20:00

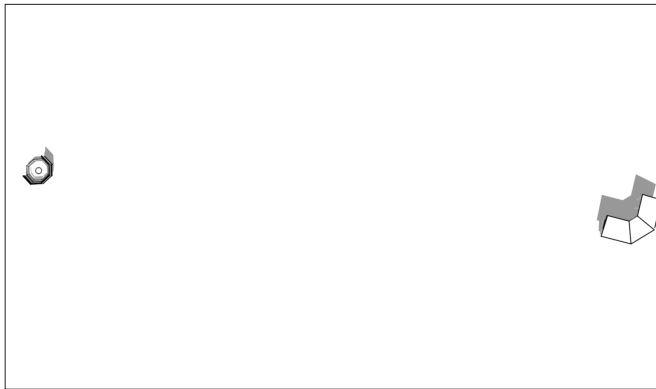


Figure 9.79: Green area in July 10:00

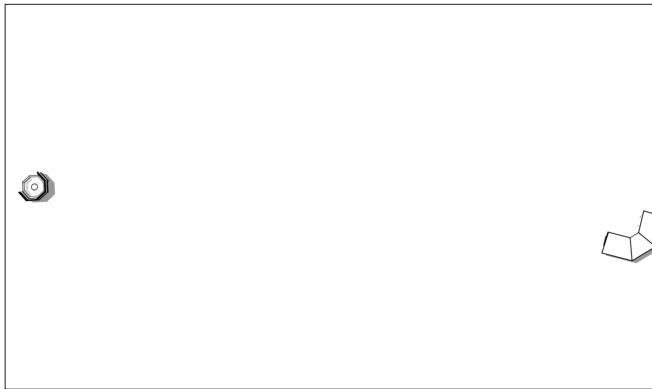


Figure 9.80: Green area in July 15:00



Figure 9.81: Green area in July 20:00

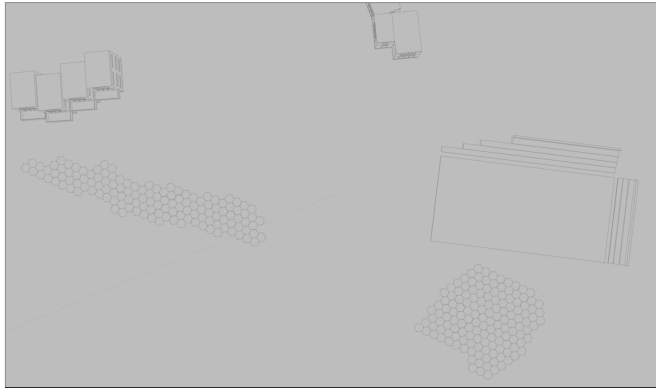


Figure 9.82: Red area in January 10:00

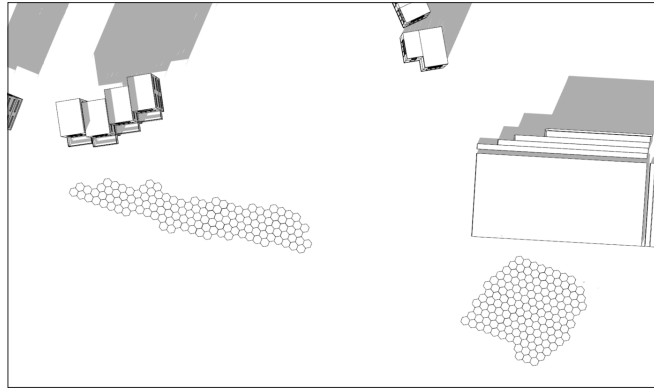


Figure 9.83: Red area in January 15:00

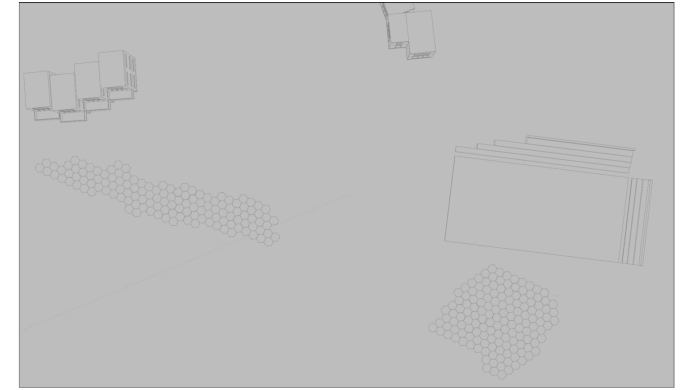


Figure 9.84: Red area in January 20:00

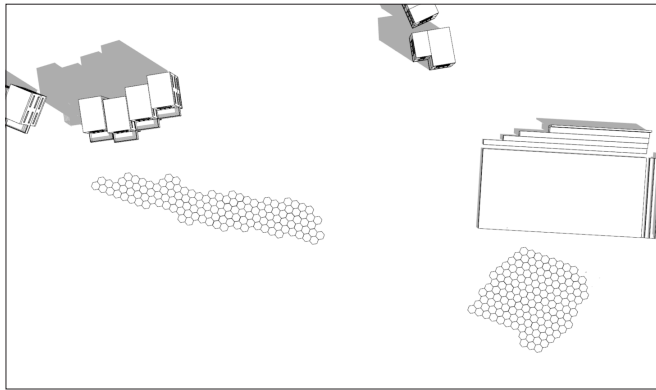


Figure 9.85: Red area in April/October 10:00

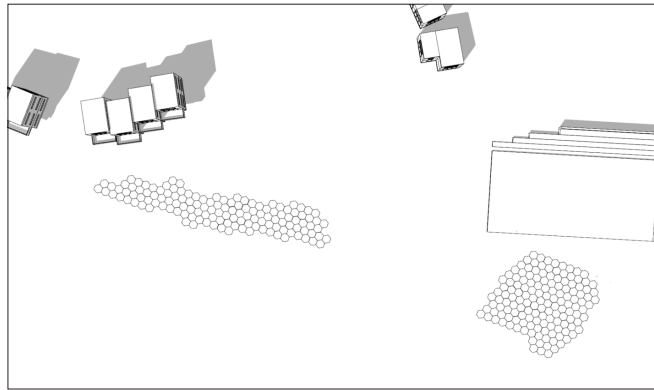


Figure 9.86: Red area in April/October 15:00

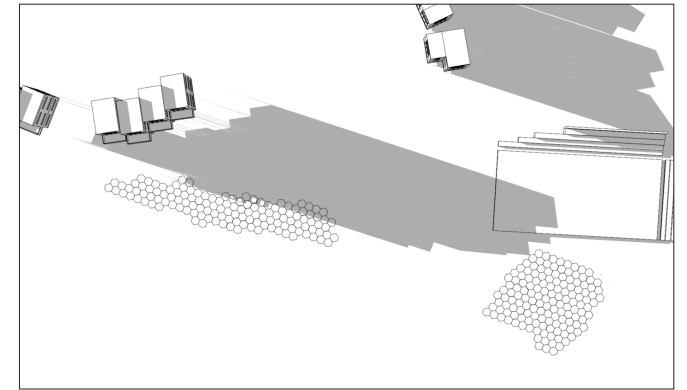


Figure 9.87: Red area in April/October 20:00

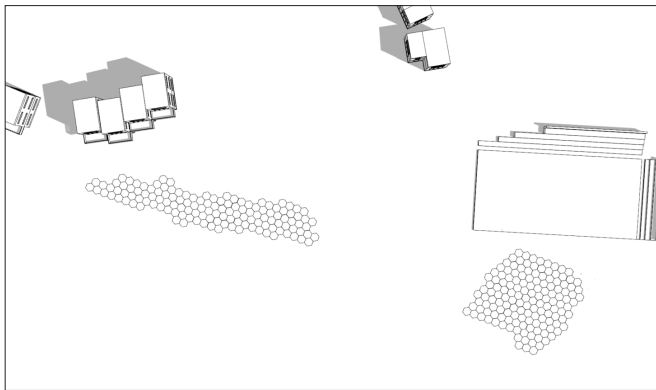


Figure 9.88: Red area in July 10:00

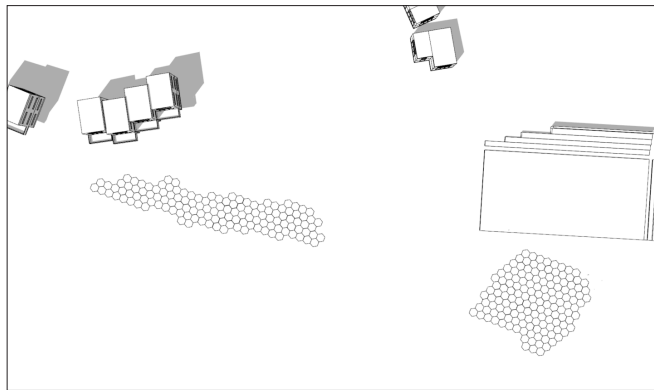


Figure 9.89: Red area in July 15:00

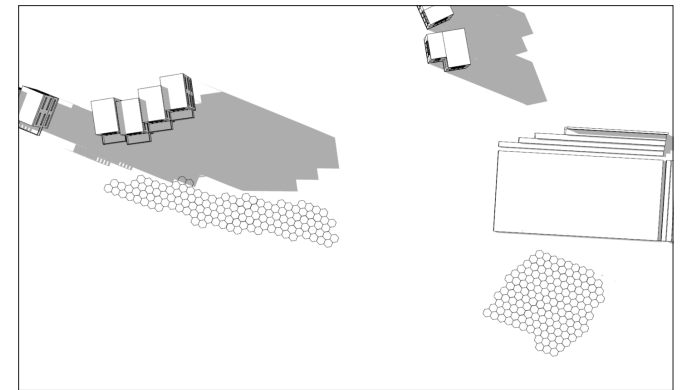


Figure 9.90: Red area in July 20:00