

Mulissat

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2019

Living the Arctic

Degree project of Master of science of Architecture in the field of
Sustainable Urban Design

Ilulissat, Living the Arctic

30 ECTS Master thesis degree project,
Master of science in Architecture, in the field of Sustainable Urban Design

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Mai 2019

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Cemetery near the Ilulissat Icefjord



Abstract

Nowhere in the world is there more proof of climate change than in Greenland, Ilulissat is no exception. With climate change and visible climatic shifts things are rapidly changing and already affecting the life of the people who live there. Those dramatic changes are not only affecting the Arctic but the whole global community. In this project it was though important to think locally to be able to focus on their needs and to act on how this Arctic community can be supported with sustainable and climate sensitive architectural solutions. My question was therefore: "How can we create a social, economic and environmental sustainability with climate sensitive architecture and urban design and without losing the cultural identity?"

Traditional practices are already at risk in Ilulissat, those practices are subsid-ing and a livelihood of many people is disappearing. New challenges are being introduced to all the people of the Arctic, their environment, nature, wildlife and their culture. It is unavoidable to say that a birth of a new generations in Greenland is a fact if nothing changes soon.

Population in Greenland and in Ilulissat as in other towns in the country is declining mostly do to emigration but then at the same time there is a hous-

ing demand in Ilulissat that for example comes from emigration from smaller settlements where traditional practices are or where their life.

The Arctic is circumcised with extreme landscape and harsh climate conditions and the people who live under these conditions need an environment that fits their life and their physical needs. My project focuses on strengthening this Arctic community and new generations of people so it can more easily adapt to future challenges. It focuses on creating an urban density to avoid unnecessary future urban sprawl and on a climate and cultural sensitive urban planning that can both support social, economical and environment sustainability and at the same time create a vibrant and visually stimulating environment.

Other important tasks of my proposal was to strengthen the core of the town to create an even economically stronger society and to follow up on my vision of this project. A vision for a resilient quality environment and sustainable future for new generations. Where traditions and cultural values don't get lost in future changes.

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The Ilulissat Icefjord



1.0 Background



1.1 Climate change

Arctic settlement like Greenland is circumscribed by climate and with the affect of climate change things are rapidly changing. Greenland is among the regions on Earth that are most affected by climate change and is undergoing a dramatic change. According to recent scientific studies the Arctic is heating up faster than any other region on the planet and the sea ice cover is diminishing. Recent studies suggest that Greenland is losing more ice than it is gaining. In the long term there is a danger that the 2.85 million km³ ice sheet is in danger of melting if the temperature continues to increase. Global warming is reshaping the world's largest island. The shrinking of the ice and the melting of Greenland's ice sheet and other Arctic ice caps will contribute more and more to the rise in global sea levels. If the temperature continues to rise, according to recent scientific studies the world's oceans will have raised 2.5 meters in the year 2100.

Climate change is introducing new challenges to the people of the Arctic and puts pressure on the natural environment, people, nature, culture, wildlife and the whole global community. Greenlandic traditional cultural practises and their cultural identity is already at risk, hunting on dog sleds is getting dangerous and is decreas-

ing because of reduced extent of sea, shorter freezing season and because of unpredictable weather changes and erratic weather conditions where the people can not anymore read the sky before hunting. Climate change is forcing the people of the Arctic to change the basis of their lifestyle and the indigenous people's culture and adapt to even more extensive changes in the future. But climate change is as well posing new opportunities to the Arctic.

Diminishing of the ice cover will increase access to the Arctic, it will lengthen the openings of seaways too and from Greenland and it can as well open new seaways between Asia and America. With easier access to Greenland there is increase in economy activity, development, human presence and environmental challenges in the region itself. And with global interest in biological and mineral resources, Greenland has become a gate to new global opportunities. Global opportunities that can as well affect the ingenious way of life, the culture and their language. The climate change will have and already has major implications for the whole world's environment and climate and requires immediate global action.



Source: Mads Pihl. 2103. After the dog sled. Sidetracked. <https://www.sidetracked.com/after-the-dog-sled/>

1.2 Traditional way of life

Greenland's cultural identity is a mix of globalism and tradition and their society is unlike any others. It is a combination of Inuit culture, Norse settlements, Danish colonisation, westernization and geographical challenges. Bigger towns can have a vibrant life, with cinemas, sports facilities and leisure activities, while life in the remote areas is more traditional. (Greenland statistics, 2018). Hunting has been a traditional way of life in Greenland for generations and provides an important supplement to the households economy, for many it is their livelihood. One of the major hunting tradition in Greenland is the hunt-

ing of seal, where 50 percent of the skin is tanned in Greenland and usually traded and the meat consumed. The tradition of hunting seals is a matter of pride for Greenlanders, not only to hunt for the table but as well for keeping these traditional values throughout to the next generations. As I have written here before, these traditions are at risk do to climate change.

2.0 Greenland



Greenland geographical location
Based on Fuller's map. Source: Fuller's projection map

2.1 Location and population

On top of the world, between the Arctic Ocean and the North Atlantic ocean, northeast of Canada and northwest of Iceland, lies the largest island in the world, 2,166,086 km², surrounded by sea and ice. Geographical location of Greenland is on the North American continent, but however it is a part of Europe. Greenland is a self-governing region within the Kingdom of Denmark. The country has its own national flag and Greenlandic is the official language, close to 90% of the population is born in Greenland. About 80% of the island is covered with ice and most of the landscape is pristine tundra. Population in Greenland is about 56,000 (Greenland in figures, 2018)

Due to declining birth rates and emigration, primarily to Denmark, the population is slowly but steadily declining. A prognosis has predicted that the number of inhabitants in Greenland will

be only 54 000 in 2040. Mostly everyone live in towns and small settlements along the coastline. Greenland is divided into five municipalities, Avannaata, Kujalleq, Qeqertalik, Qeqqata and Sermersooq. The Northeastern part of Greenland is not a part of any municipality, but is the site of the world's largest National Park. The capital of Greenland, Nuuk is a part of the Sermersooq Municipality and has a population of about 16.000, making it the world's smallest capital cities in the world by population. About 50.000 of the Greenland population live in the five largest towns, Nuuk, Sisimiut, Ilulissat, Aasiaat and Qaqortoq. Greenland has the lowest population density in the world or about 0.03 km² per person, counting only the ice-free area. (Greenland in figures, 2018)

2.3 Climate

Located high up, in the northern Polar region, the climate in Greenland has cold and long winters and mild and short summers but with local variations. Climatically we can as well divide Greenland into two very separate regions: the coastal region, much of which is ice free, and the inland ice sheet. Along the north-central coasts of Greenland, the climate is arctic, sometimes called arctic tundra climate, where the temperatures of the warmest months are around freezing. South-central coasts have low arctic climate but in the deep fjords of South Greenland the climate is subarctic, where the temperature can reach above freezing, but still below 10°C.

Greenland can be a windy island, where the winds descend from the perennial ice cap and then reach the fjords and the sea. Those winds are called Katabatic, they blow when the air is very cold and can be quite dangerous for human beings. Greenland's arctic nature and climate has a really strong presence, the nature is truly unique and along with extreme climate condition, the lives of those living there are really shaped by these harsh conditions.

2.4 Demographic

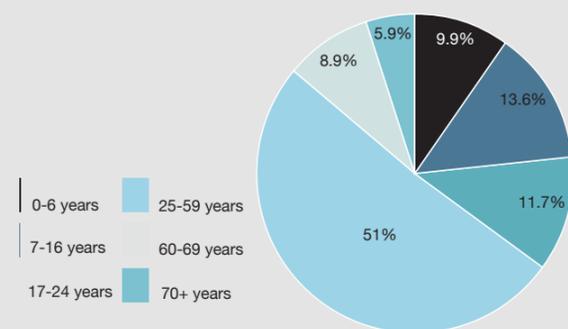
From 1998 to 2014 the overall population in Greenland remained between 56 and 57,000 people. For the past couple of years the population has been declining and today 55,992 lives in Greenland. Of these, nearly 6000 are born outside Greenland. There are around 800 births every year, and around 500 deaths. With this number there should be an population increase of 300 people per year. Either way the population in Greenland is decreasing, because of migration.

as the average net emigration can be estimated to 300.

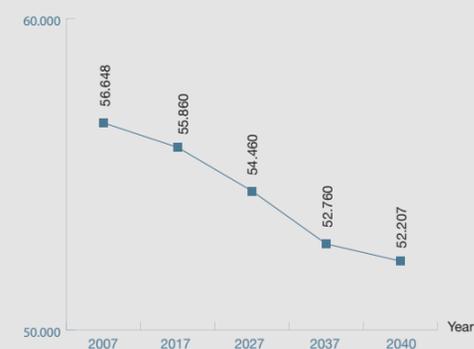
The total population in Greenland will decline over the next decades. It is expected that by 2040 there will be about 3.000 fewer people that live in Greenland if no unexpected changes will be in fertility, mortality or immigration.

Every year more people migrate than immigrate. It can be said that most of the entire population growth over the past 10 years has moved to Denmark,

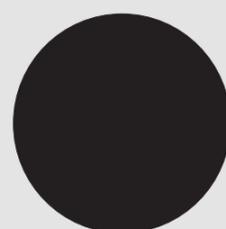
Population by age



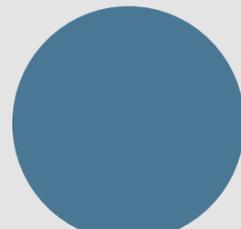
Estimated Population



Migration



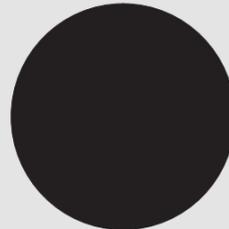
Immigration
2.248



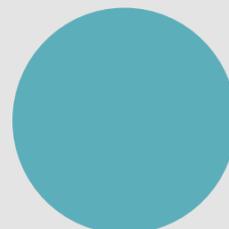
Emigration
2.580

Net migration 2017
-332

Density comparative

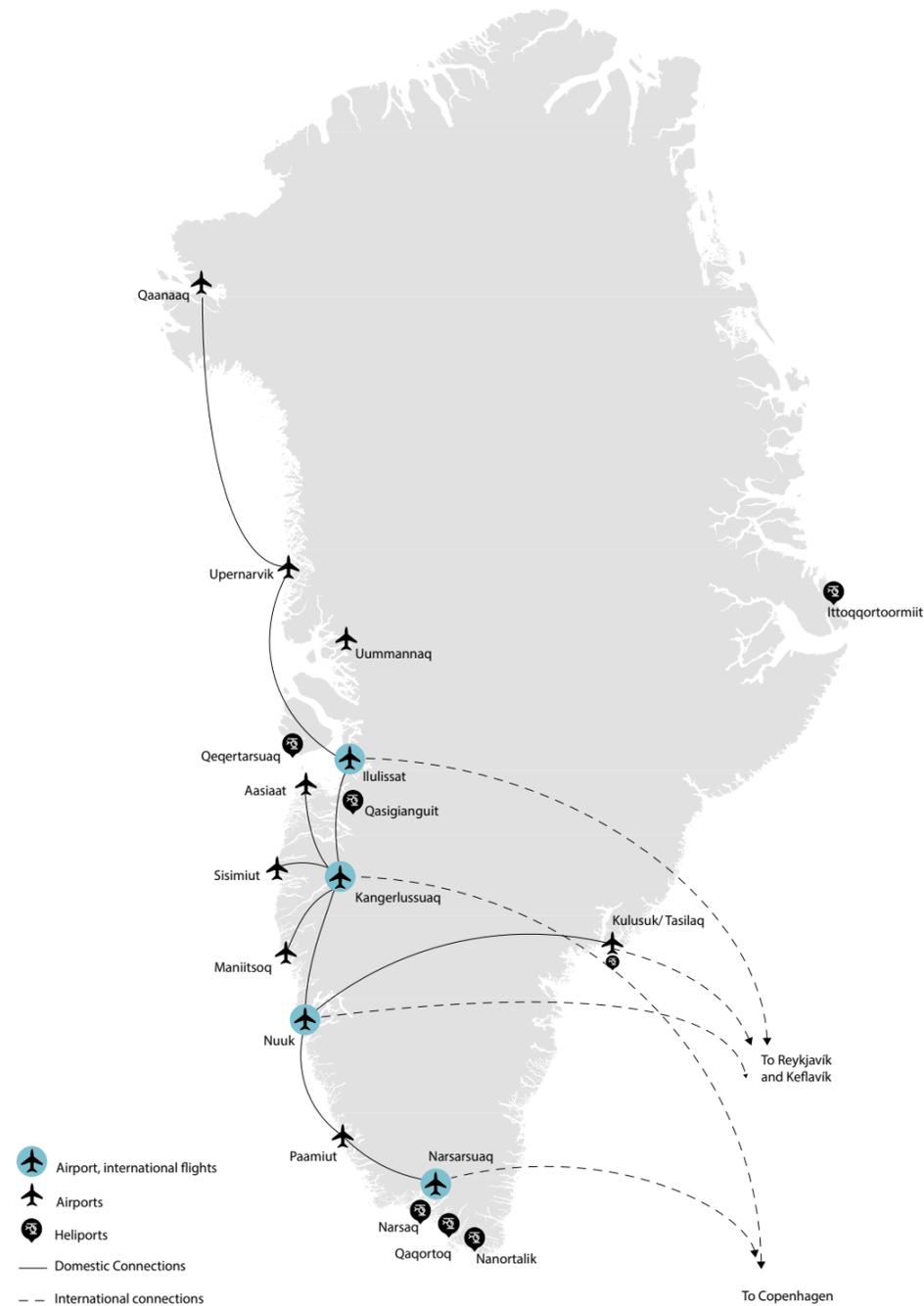


People per km²
Greenland 0.03



People per km²
Denmark 130

2.5 Transport



Due to climate and geography transportation is different in Greenland from the other countries. Greenland has generally no roads that connects towns and settlements so flight and shipping is extremely important and the most usual way of transporting goods and passengers between places. Most towns in Greenland have paved roads but smaller towns usually have gravel or dirt roads only.

FLIGHT CONNECTIONS

Air Greenland maintains international flight routes to Denmark and Iceland as well as domestic flights and helicopter routes between settlements and towns in Greenland. Several airports in Greenland do not have road connection to local settlements, so a helicopter is often needed for transportation between airports and settlements. Airports that are reachable by road are Kangerlussuaq Airport, Kulusuk Airport, Narsarsuaq Airport, Nerlerit Inaat Airport and Qaarsut Airport. Air Iceland Connect maintains flights from Reykjavik, bound for Nuuk, Ilulissat, Narsarsuaq, Kulusuk and Nerlerit Inaar/Ittoqqortoormiit.

There are currently 47 heliports and 14 airports in Greenland. The first airport, and the only airport that has a international standardize runway is in Kangerlussuaq, build by the United States defence 1941 as an army airbase in the Cold-War. Later Narsarsuaq airport was built 1942 and Kulusuk airport in 1956 for the same use, the airports were then given to Greenland. As these airports were air bases they

were not built for civilians so location was not near any local settlements except for Kulusuk. But either way they are still used today and have an important international and domestic transport role.

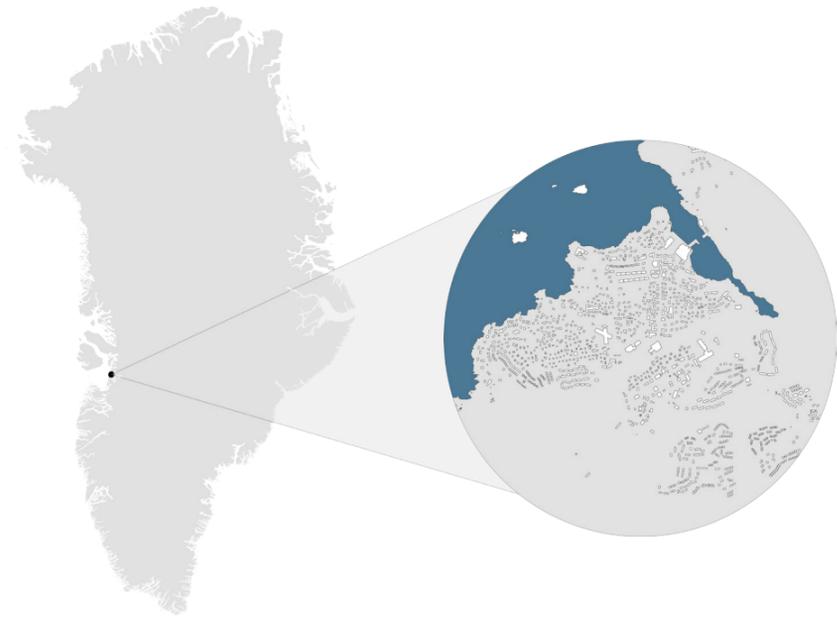
Air Greenland was founded 1960 and in the beginning managed flights between these air bases, and helicopter flights from the bases to settlements. Along with these flights from the bases several other small airports, with short runways were built, first Nuuk Airport in 1979 and Ilulissat Airport in 1983. Both of these airports runways will be extended in the future that will make these settlements an important international hubs in more accessed Greenland.

SHIPPING ROUTES

Arctic Umiaq Line provides passenger and freight service by sea, the service is limited to the West Coast most of the year. Several other passenger routes also exist. (Greenland in figures, 2018) Other shipping routes, to the northern and eastern parts of Greenland are impeded by the High Arctic sea ice, so those area have only ship arrivals from spring to fall. No international passenger ship routes are to Greenland but however Greenland is a popular destination for cruise ships from America, Canada and Europe and the popularity is growing every year.



3.0 Ilulissat analysis



3.1 Location

Located between Disko Bay and the mouth of the 60 km long icefjord, about 250 km north of the Arctic Circle, on the west coast of Greenland, Ilulissat is the largest town in the Avannaata municipality and the third largest town in Greenland. It is located 560 km north of the largest town in Greenland, the capital Nuuk. The population in Ilulissat is 4,556 (Statbank Greenland, 2018.) and is often noted, approximately the same number of sled dogs. The town is located on

the northern shore of the UNESCO'S World Heritage Site, Ilulissat Icefjord, which is the most productive glacier in the northern hemisphere. The name of the town, Ilulissat means icebergs and refers to the large icebergs that come from the Icefjord and linger in the freezing waters in Disko Bay. The unique and ubiquitous icebergs are a characteristic feature of the town of Ilulissat.



3.2 History

Ilulissat's former name is Jakobshavn, and was originally and officially established as a trading station in 1741 but its history goes back 4000 years when the Sermermiut Valley became populated by the Saqqaq people. The remains from this old settlement can still be seen at the mouth of the Ilulissat Icefjord.

From 1741-1900 the colony grew slowly and by 1900 the town had several districts, with trading houses, located on the southern side of the inner port area. The trading area includes the warehouse, housing, shops, day nursery and the municipal administration. Previously, three settlements, Pitoqqik, Illumiut and Kingigtoq belonged to Ilulissat but are today considered suburbs in Ilulissat. All the former settlements are situated along the Disko Bay, between Ilulissat and the Icefjord. Because of a short distance between

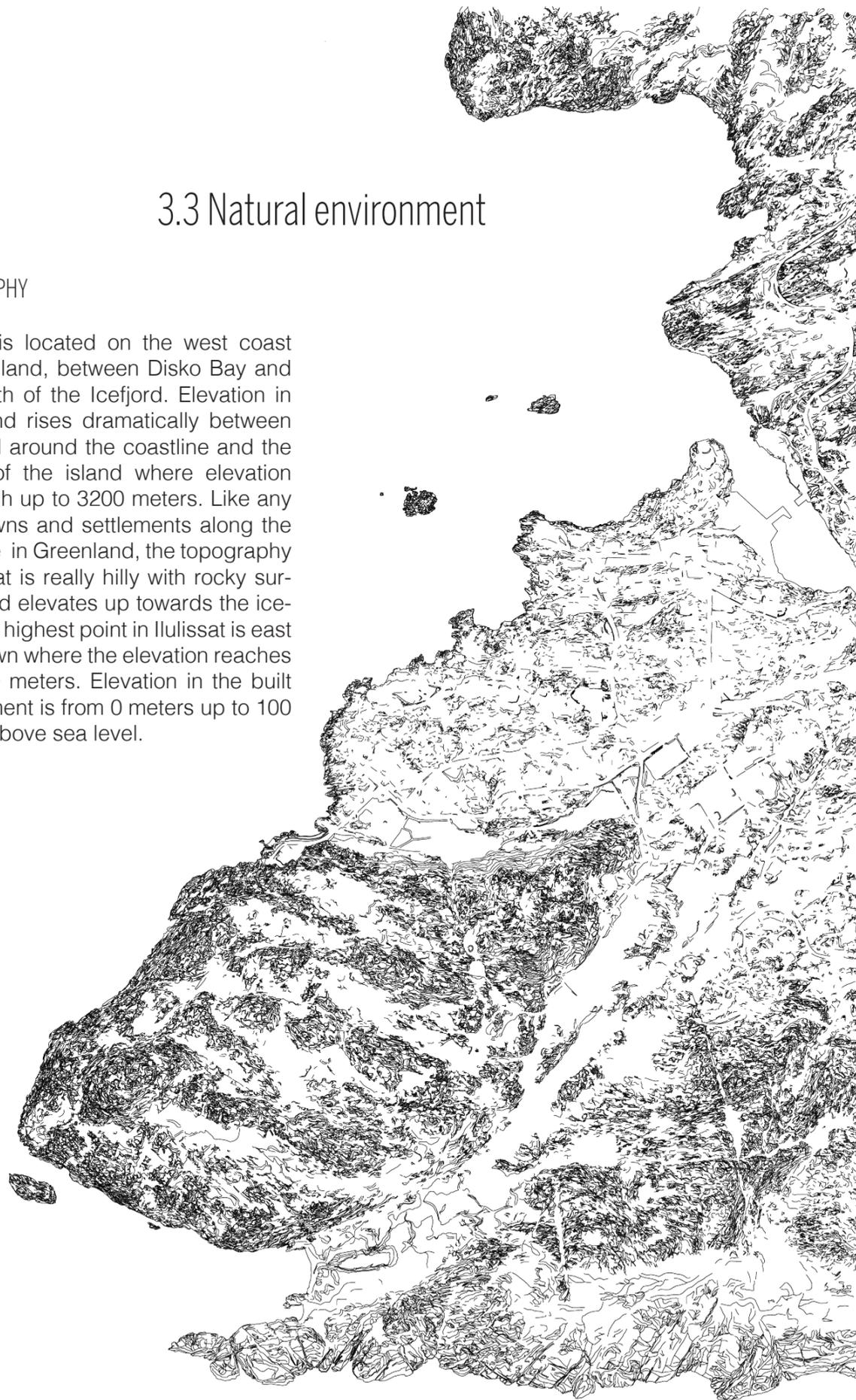
Ilulissat and Pitoqqik, the two settlements grew together, and already before 1920 Illumiut was considered a suburb to Ilulissat. Since housing standards in Illumiut were poor and outdated, standard houses were built in this area in the 1950s and 1960s to replace housing in the area towards the old part of Pitoqqik.

Over time the town has grown considerably in all directions. In the recent decades, the town of Ilulissat has expanded further from the harbour area towards the Icefjord but lately the urban expansion has been towards the north, towards the airport.

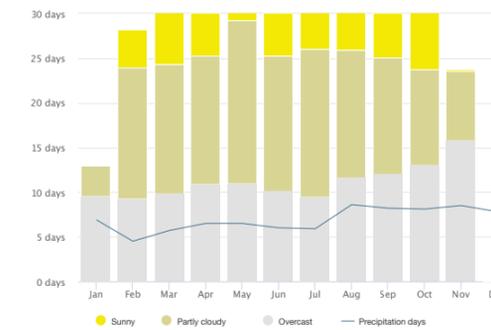
3.3 Natural environment

TOPOGRAPHY

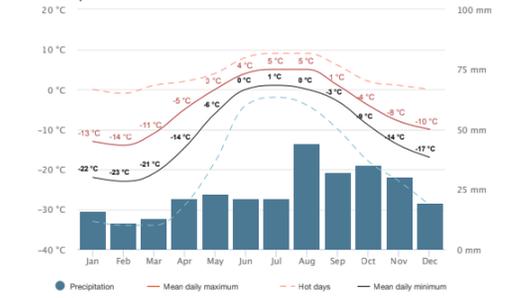
Ilulissat is located on the west coast of Greenland, between Disko Bay and the mouth of the Icefjord. Elevation in Greenland rises dramatically between sea level around the coastline and the interior of the island where elevation can reach up to 3200 meters. Like any other towns and settlements along the coastline in Greenland, the topography in Ilulissat is really hilly with rocky surfaces and elevates up towards the ice-cap. The highest point in Ilulissat is east of the town where the elevation reaches plus 200 meters. Elevation in the built environment is from 0 meters up to 100 meters above sea level.



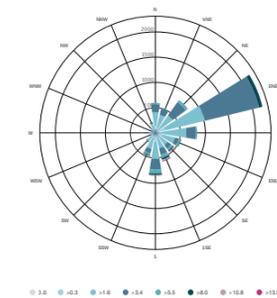
Sun



Temperature



Wind



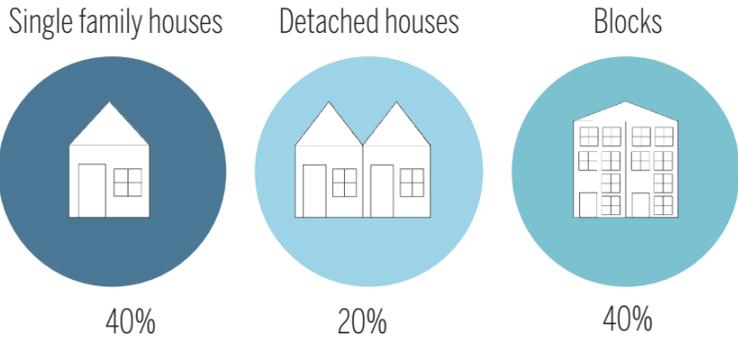
CLIMATE

The climate in Ilulissat is a typical arctic climate or a polar tundra climate (ET) according to Koppen climate classification system. The polar tundra climate means that the temperatures are very low all year round but are having at least one month whose average temperature is above 0°C. In a tundra climate, trees can not grow. The average annual temperature in Ilulissat is -4.4 °C, the warmest month is July, where the temperature is average 6.7°C and the coolest month is February, where the temperature is -16.1°C. According to wind rose from Ilulissat, the wind is blowing from South-West (SW) to North-East (NE).

Summer in Ilulissat lasts from June through August and is characterised by long and bright days. From approximately May 21 to July 23 the sun in Ilulissat never sets. The longest day of the year is in June, where the average daylight is 24 hours. Winter in Ilulissat lasts from November to March, where days are short and intense, with an average daylight of 2 hours in January. The month with the shortest days and where the darkness dominates everything, is December, with average no hours of daylight. The sun begins to rise again in mid-January. The transition from winter to summer

happens quite fast, in spring you can see day by day that days become longer and the nights brighter. In April the days have already started to be quite long, even though the temperature is still below freezing. The average daylight in May is 22 hours. As fast as the spring arrives, summer becomes winter on the same speed. The autumn can be an intense period where the average daylight in October has dropped to 9 hours.

Precipitation is quite scarce in Ilulissat. Months with the highest number of rainy days are in March to May and September to November with the average rainy days of 9 days. Average rainfall in May is 23 mm and average rainfall in October is 35 mm. The months with lowest number of rainy days are February, May, June and July with average 7 rainy days. The average annual rainfall is 247 mm in Ilulissat which means that snowfalls in winter are usually light, perhaps long lasting but not abundant. Compared to other nordic countries, the average rainfall in Reykjavík is 800 mm, Oslo 800 mm, Copenhagen 525 mm and Malmo 605 mm.



3.4 Population and housing

Ilulissat is the biggest town in the Avannaata community with about 4.556 inhabitants distributed on 1.736 households. The dwellings can be distributed into 40% single-family houses, 20% semi-detached houses or row houses and 40% apartments in a multi-story buildings or blocks. Preferred housing and the ones that have been on the rise for the last fifteen years are single-family housings and row houses. The average persons per household is 2.6. 40% of the houses in Ilulissat are owned by the government of Greenland.

stagnated in the last ten years and is now decreasing. Outward migration from Ilulissat is mainly to Nuuk, the capital of Greenland. From 2014-2018, the average migration of people aged 17-24 years old from Ilulissat to Nuuk was 73.4 people per year. This migration has increased every year and had 79 people aged 17-24 that migrated in 2018. The main reason for emigration of this age is to seek education in Nuuk as there is no high school in Ilulissat.

Population in Ilulissat increased steadily from the year 1980 but has



3.5 Economy and education

Fishing is the largest industry in Greenland, 90% of the country's export is fish. In Ilulissat the fishing industry is the town's principal industry as well. Fishing in Ilulissat is a coastal catch mainly for Greenland Halibut and prawns. Mostly all processions take place at the port area, at the Royal Greenland factory which is owned by the Greenland Government. These fishings are regulated by quota and license regulations decided by the government. Decisions are based on biological advice to ensure a sustainable use of the natural resources of the country. As Ilulissat is the leading tourist destination in Greenland, tourism is the other major industry in town and is increasing every year.

EDUCATION

There are two elementary schools in Ilulissat, Atuarfik Mathias Storch and Atuarfik Jorgen Bronlund. These schools cover the compulsory education from the age of six to sixteen. Five day nurseries and five kindergartens can be found in Ilulissat and as well a day-care facilities, before and after school care, a recreational club for children and a vocational school. One college is in Ilulissat, the Greenlandic College of Social Education, which offers a variety of social education programmes. No high school is in Ilulissat.



3.6 Tourism

In recent years, Greenland has experienced considerable growth in the tourism sector and Ilulissat is currently the tourist destination with the highest number of visitors in Greenland. Tourism in Ilulissat is for sure an important economic lifeline for the town and has a large impact on the town's resources and infrastructure. Each year about 80.000 people visit Greenland, about 30.000 of them goes to Ilulissat (Greenland Statbank, 2018). Ilulissat is known for its number of sled dogs, so sled rides to the hinterland and the fishing grounds by the arms of Kangia or to Ilulissat Icefjord the UNESCO's World heritage site are among the most important and most popular activities in the town for many tourists. The tourism in Ilulissat is characterised

by a short high season that runs from early July to late August, but in recent years the seasons have changed with increasing number of visitors in April, May and September. Most of the visitors visit Ilulissat to sail on the icefjord, to hike in the hills, go dog sled riding or just to explore the town of Ilulissat and to get to know Greenlandic culture and traditions. Several tourist offices are located in the center area of Ilulissat and the town has a wide range of hotels, restaurants and shops. This busy tourism industry really defines the heart of the town.

Ilulissat Icefjord

The Ilulissat Icefjord, also known as "Kanglia" is located at Disko Bay, covering a stretch of 60 km, between the Greenland icecap and Disko Bay. It was accepted to UNESCO's world heritage list in 2004, with reference to its unique and outstanding natural beauty and special glaciological character and is the northernmost UNESCO's World Heritage Site. The protected area is At the bottom of the Ilulissat Icefjord is Sermeq Kujalleq, the largest and most productive glacier outside Antarctica and the fastest moving glacier in the world, moving at the rate of forty meters a day, calving icebergs one by one, more than one hundred meters in height. Sermeq Kujalleq runs directly from the Greenland icecap and produces 10% of all icebergs in Greenland. Those icebergs float into the Ilulissat Icefjord and out to the North Atlantic ocean.

The icefjord is Greenland's and therefore Ilulissat most important tourist attraction were you can see one of the world's most attractive calving glacier at close quarters. Nowhere is there more substantial proof of climate change were it is evident right in front of your eyes as the glacier has pulled back almost ten kilometers between 2001 and 20014.

This unique place attracts great attention and interest from people around the world and many researches are being done about the movement of the glacier which has intensified the international society's focus on it. Ilulissat is now a home for a number of international meetings and conferences concerning climate change.

Today Ilulissat does not have a inde-

pendent tourism information center. Informations about the Icefjord and the unique environment of Ilulissat is left to many smaller tour operators. In 2015, Greenland's government with then Qaasuitsup municipality (Now Avannaata municipality) and the philanthropic association Realdinia joined in partnership to create a center for the Ilulissat Icefjord. They invited six selected international teams of architects to participate in a competition for the design of the center. According to the competition invite, the center is supposed to be a natural point of departure for all visitors to Ilulissat and a opportune, unifying framework of Arctic tourism which is a fast increasing industry in Ilulissat. The center is to present and interpret new knowledge and research about the ice cap, the icefjord and global climate change. The winning proposal "The flight of a snowy owl through the landscape" by the danish architecture firm, Dorte Mandrup is supposed to be finished in 2020.



“Colourful wooden houses perch on the bedrocks like guardians and dot the white arctic landscape. Icebergs peek in between the houses, unsuspecting of their magical existence. This is Ilulissat. “

3.7 Life and character

Traditional colourful wooden houses perch on the bedrocks like guardians and dot the white arctic landscape. Icebergs peek in between the houses, unsuspecting of their magical existence and the character they create for the town. Wooden pavements and stairs create good access between the houses and make walking easier on the hilly bedrocks at the same time where you can experience the view over the whole Disco Bay.

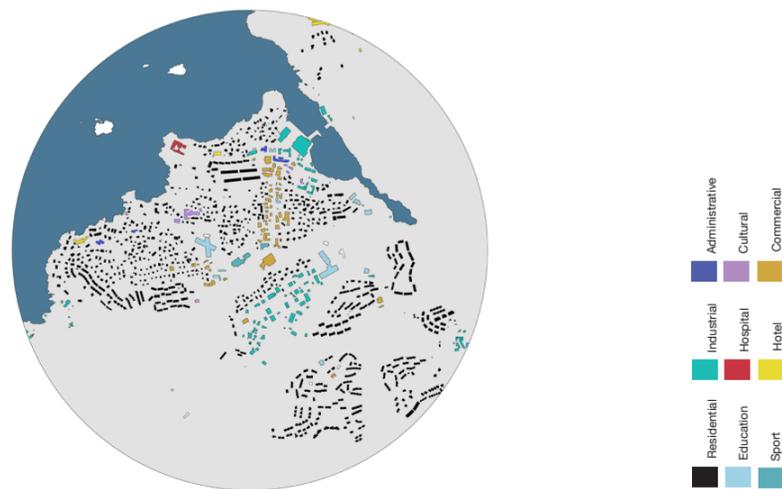
It is a town where life is lived in a quite traditional Greenlandic manner. The sledge dogs are a natural part of the environment and a big part of a transportation in the rural landscapes that surround the town and on the frozen sea. The dogs pull the sledges across the ice when hunting and fishing and as a means for transport. These traditional ways of hunting and fishing are still today a part of the lifestyle even though more modern alternatives are being used like snowmobiles.

Among the colorful wooden houses the sledge dogs existence create an important character of the town as well. Whether it is the dogs that rest at some of the dogs area that are scattered

around the town or the little puppies that run around the streets and greet you with pride when you walk by them.

The fishing industry is the biggest and the most important industry for the town of Ilulissat. The harbour area is always busy, filled with life and hard working people and boats, big and small rushing to and from the fishing grounds close to the enormous icebergs that linger in the mouth of the Icefjord. The sea by the icebergs is very nutritious so it is a really important fishing ground for a good catch.

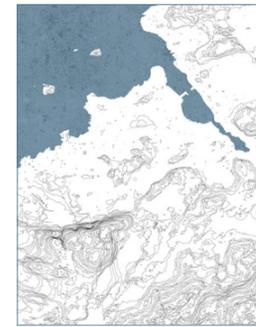
The everyday life in the town is not so much different from other smaller towns in Scandinavia, except it is really characterised by the climate and geology. The difference might be the most common transport, that is by foot, on a snowmobile or with a taxi. It is easy to see the life and habits of the local people there, and you feel the life while walking through town. The best part is the character of the locals, everywhere you go and whoever you meet, you are always greeted with a smile. Such a friendly nation is hard to find elsewhere.



4.0 Physical environment

Ilulissat has a quite a irregular road system, the main reason for this is that houses are mostly built on bedrocks as the lower grounds are not suitable for building mostly do to permafrost and the need for dog areas for the sled dogs. A view is as well really important in Greenland, the relationship to the ocean is an important cultural relationship and it is really uncommon to not have a house without seaview. There is no ownership of land in Greenland so each ground is a common ground and the ocean is your garden. This special infrastructure creates a strong and a dramatic character of the town of Ilulissat and at the same time the town can be defined by the surrounding unique natural landscape, its relationship to the ocean, its location in a rugged terrain surrounded by mountains, with spectacular views over the Icefjord and the whole Disko Bay.

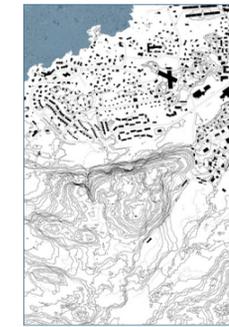
The town itself can be divided into few different areas, the oldest part is located by the harbour, north of the town, the center, which is close to the harbour area and then the western part that contains the largest and the oldest residential area, where the main urban function extends southwards from the town center. The town is centered on a main street, leading from Fredericiap Aqq. to Kusangajannuaq, along or close to those streets is the largest and the main service and business area that contains a bank, tourism office, few supermarkets, shops, post office, restaurants and cafés. The local square in the center of the town includes a marketplace where the local hunters and fishermen sell their catches. The tourism office, World of Greenland is also located on this square, the square is a roughly defined urban space that does not function optimally as a gathering point, it is



Topography



Road structure



Build structure



Dog area and urban opportunities

more like a crossroad for people and cars. The local hospital and a college is also located in or near the center area. In town there are as well areas mainly for industry. Industry is concentrated in three locations, one is the harbour area, around the port which is the base of the largest industry if the town; fishing. The center of activity is this area, used for multiple purposes. It was the first trading district in the town and illustrates the architectural heritage from the 1700s up to the 1950s and still plays an important role as the municipal administrative area in the town. Two other business areas with industry can be found in the southwestern part of the town, on the foot of the Telebakken hill to the southwest and north of the quarry southeast of town. After urban growth in recent years towards the east of the town this industry area is closed to be in the middle of the town, and access to one

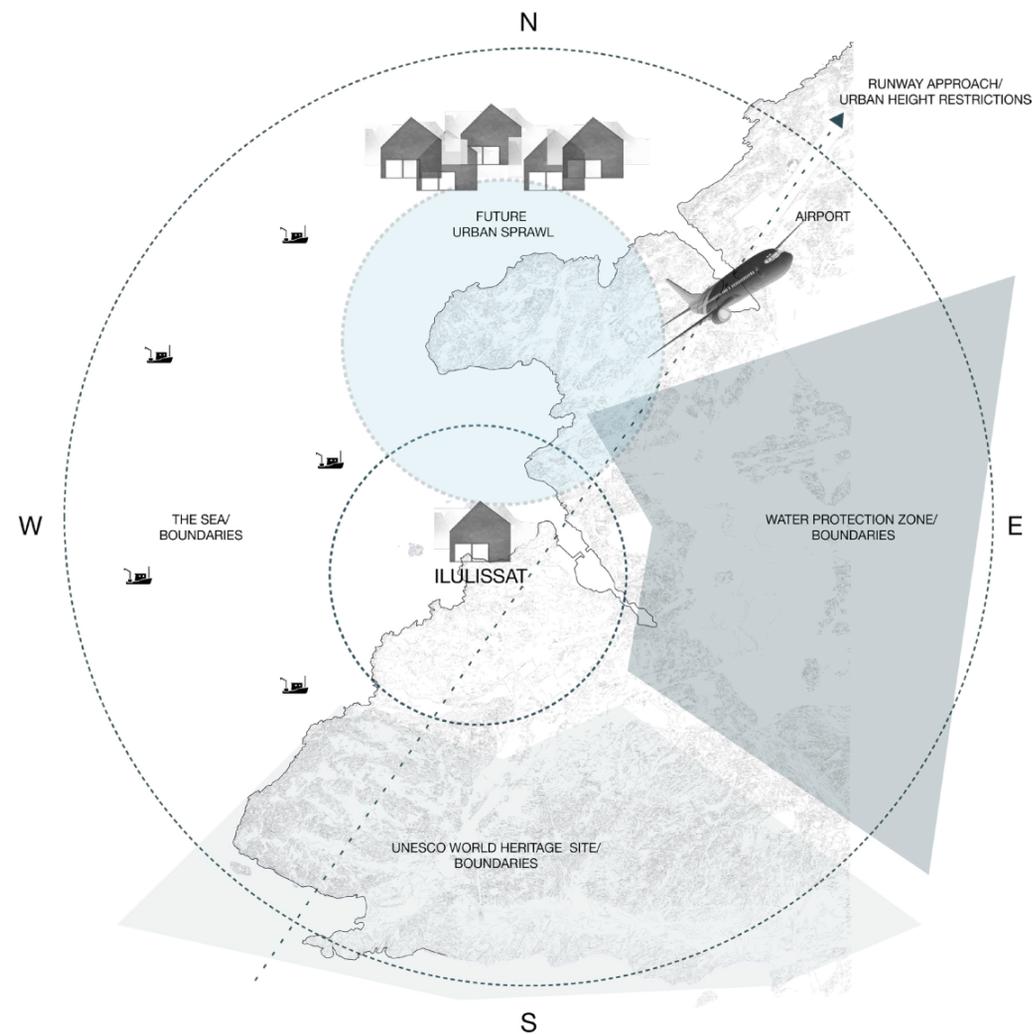
of the elementary school in Ilulissat, Atuarfik Jørgen Brønlund elementary school is through this industry area.

Throughout the years Ilulissat has grown considerably in all directions. In the recent decades, the town has expanded further from the harbour area towards the Icefjord but lately the urban expansion has been towards the north, towards the airport.

URBAN GROWTH

Ilulissat is the principal town of the Avannaata municipality and has a status of being the growth centre of North Greenland and is in need to be carefully developed to stand out without losing its character and identity. Throughout the years Ilulissat has grown considerably in all directions. In the recent decades urban development concen-

“There are several restrictions that make the urban expansion in Ilulissat challenging.”



Map of Ilulissat showing the boundaries that restrict urban growth

tration in Ilulissat has been on development further from the harbour area towards the southern part of the town and to the east of the town towards the icefjord hill and in areas in the north, between the harbour area and Hotel Arctic. In this area mostly large single-family houses have been built. the Icefjord but lately the focus is on urban expansion towards the airport, north-east of the harbour or south of the lake for large contiguous residential area and there is as well an idea to develop further north from the town, between Hotel Arctic and the airport.

URBAN GROWTH BOUNDARIES AND RESTRICTIONS

There are several restrictions that make the urban expansion in Ilulissat challenging. Urban development to the east is now restricted by a water protection zone and the UNESCO's world heritage site has a natural boundary to the south of the town. North of the town, regulated zones exist around the

airport in the shape of obstacle limitation surfaces and this can refer to the whole town regarding heights of buildings. Mostly all areas in town is located under this obstacle limitation surface where buildings and other facilities cannot be established higher than level 73 meters and roads not higher than level 67 meters.

Lack of housing is a problem in Ilulissat as in other major towns in Greenland and according to municipality there is more than five years waiting list for housings in the town. In order to keep pace regarding housing demands, with increase in tourism in the area and to change the pattern regarding migration the town is in desperate need to facilitate more housings and other services.



5.0 Designing in the Arctic

The remoteness of an Arctic settlement, sparse population, extreme climate conditions and lack of daylight and low sun angles requires us to critically focus on climate and weather. This focus can have great and varied benefits and by adopting climate-sensitive approach to urban planning policy in the Arctic we can render everyday life less stressful and create a more quality in the built environment both physically and mentally.

In the Arctic the sun angle is very low as in other northern settlements so the preservation of sun and light is an important factor in architecture and urban design. By adapting the urban form to light and sun we can create more liveable conditions with less shadows and more light. To preserve solar access buildings need to be higher in the north and lower in the south and to even create more solar access in closed urban form we can create openings in the urban form in the south and therefor preserve solar access in courtyards. It is recommended that a distance between buildings that are placed north to south is not less than four times the height of the buildings so that people can enjoy the sun over the summer

months.

The wind in the Arctic can be extremely cold where the air temperature is way below the human body temperature and the wind can have as well a crucial effect on living conditions in the urban environment. The interaction of direction and prevailing wind conditions, both in terms of prevailing sunny conditions and storms, is an important part of designing in the Arctic. To shelter from the wind the built structure needs to be higher to the north and to the prevailing wind direction to prevent the winds to enter the urban form. Low rise buildings and density is said to create less wind mess in the environment and therefore better living conditions. Roofscapes can play an important role as well in creating better environment with less wind effects as the forms of the roofs can diminish the wind to enter or direct it away from open spaces. Hipped roofed houses area ideal in directing the wind away and to create less windy space on ground.

Apart from the climate there are other important factors to focus on as well, and that is the people and those who live under these climate conditions. According to Erskine, the Arctic environment should be planned to offer easy

human contacts, but also personal freedom and privacy. A meditation between the habitants and the extreme nature is as well important. With more density in the urban form we can create this climate sensitive environment and at the same time support easy human contacts and social sustainability.

The nature is an extremely important part of Greenland, it is a source of sustenance and it strongly identifies the visual character of towns and settlements in Greenland. The nature is the livelihood of most of the people of the Arctic and those indigenous people are in some way a very unique and a strong part of the natural environment, they know that the nature is dominant and they, the humans are the exceptions. Therefore the built structure has as well to be developed that reflects this order of priority, it needs to interact with the landscape, a solid relationship needs to be created and a linkage between the built environment and the extreme climate has to be clear.

The built structure and urban form in many towns and settlements in Greenland is visibly very sparsely spreaded. Preferable houses are small single-family houses and most of them perch on bedrocks overlooking their garden,

the sea. It is a strong characteristic of an Arctic settlement and this built structure seems to be in a good relationship to the nature but perhaps without a linkage to the extreme and harsh climate conditions and with lack of connection to the physical human needs for social sustainability.

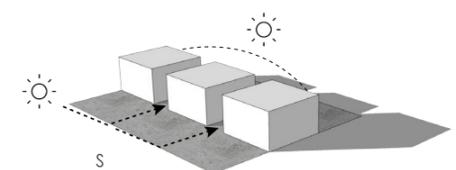
A new sustainable form of urbanism and architecture in these settlements like Ilulissat needs to be developed further to create a more climate sensitive approach to the urban life, that is at the same time a culturally sensitive environment. This does not mean that we need to adapt westernised modern standard of life to the Arctic but to adapt the built environment to the climate in peace with the natural environment and in favour of the humans and their needs.



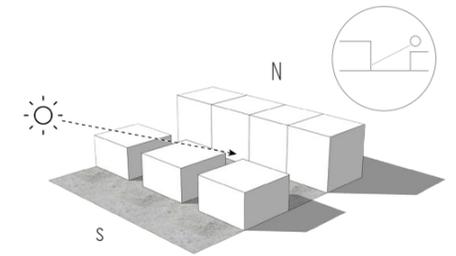
5.1 Designing in the Arctic guidelines

Climate sensitive approach

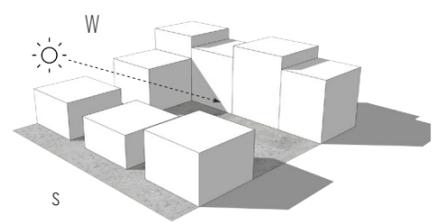
- Preserve solar access



Built form has openings to the south to create more solar access in closed urban form and preserves solar access in courtyards.

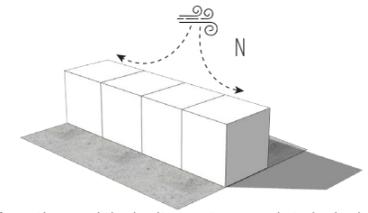


To preserve solar access where low sun angle is dominant buildings need to be higher in the north and lower in the south.

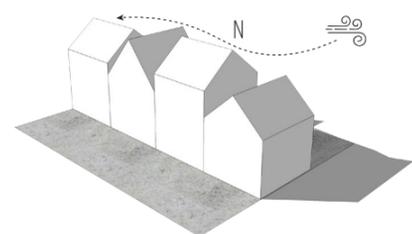


Buildings are lower in east and the urban form has more openings to create access for the evening sun to the courtyards.

- Shelter from wind



To shelter from the wind the built structure needs to be higher and more closed to the north and to the prevailing wind direction to diminish cold and strong winds to enter the urban form.



Forms of the roofs can prevail the wind to enter or direct it away from open spaces. Hipped roofed houses are ideal in directing the wind away and to create less windy spaces on ground and in courtyards.

6.0 The proposal

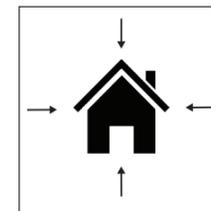
6.1 Vision

*A vision for a quality environment and a sustainable future for new generations.
Where traditions and cultural values
don't get lost in future changes.*



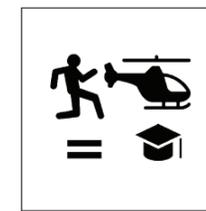


6.2 Strategy



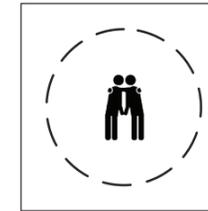
Avoid unnecessary urban sprawl

Recycle and capitalize on density. A sustainable goal that can reduce future car use and create social sustainability and a livability under harsh climate conditions.



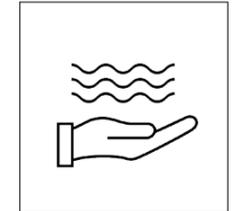
Reduce student emigrants

Invest in the local economy by providing education for the emigrating youth and at the same time tackle decrease in population.



Support cultural identity and social well-being

Establish a stronger relationship between the culture and the people by promote better meetingplaces that can support cultural identity, social interactions and well-being.



Increase opportunities for economical growth

Create more sustainable opportunities for more diverse economy and boost economic growth through Greenlandic local resources.



6.3 Design principal



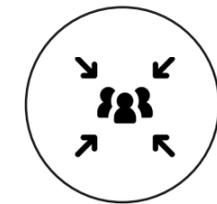
Culturally sensitive Architecture

By working with the traditional Greenlandic houses and their scale.



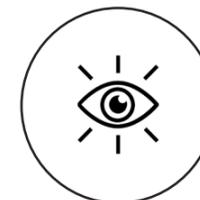
Climate sensitive approach

By focusing on micro-climate in the urban form with density, building heights, forms, structure and roofs.



Social sustainability

By providing good shared spaces for easy human contacts.



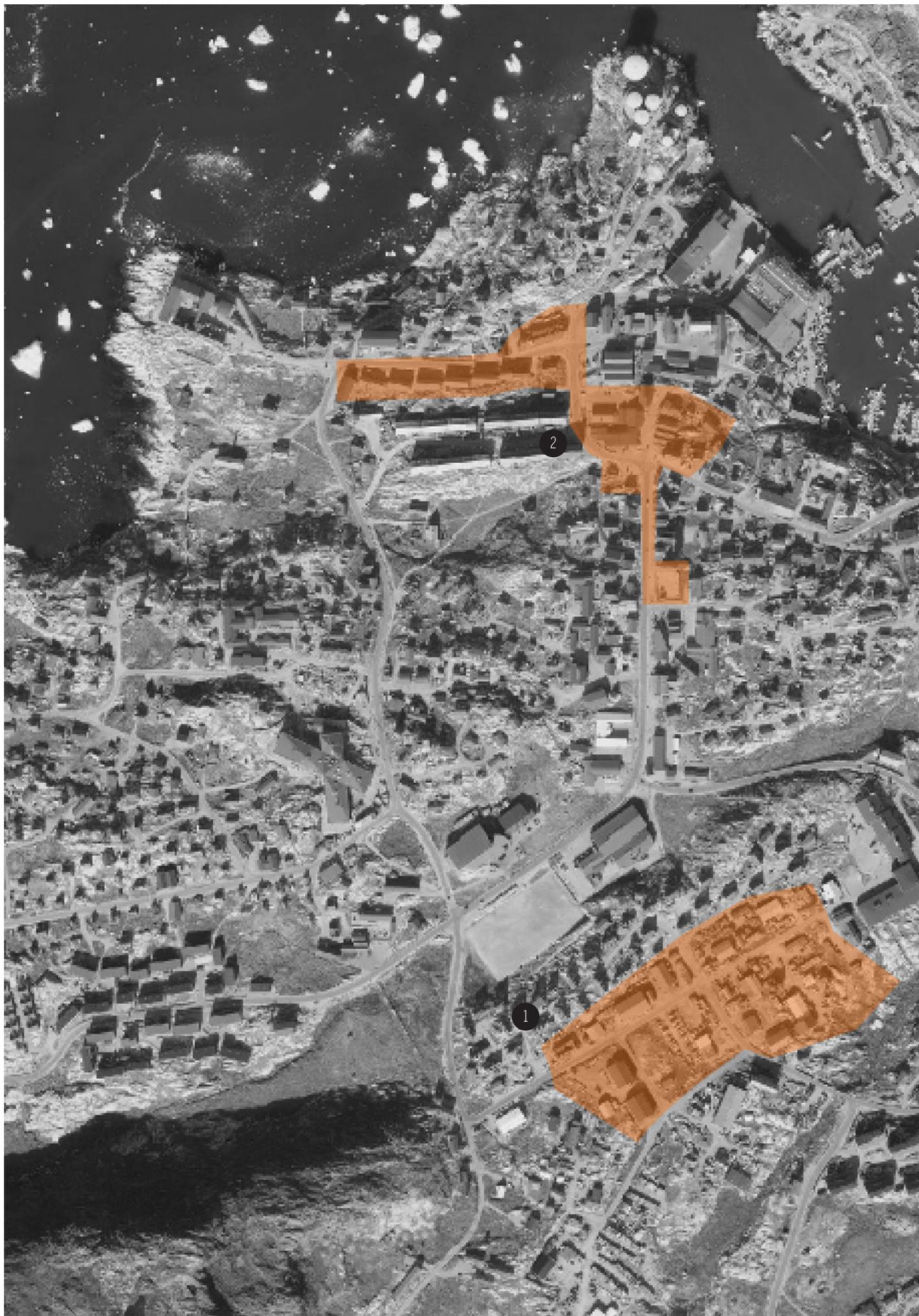
Visual stimulation

By creating a diverse, colorful and a vibrant urban form that is visually stimulating.



Energy efficiency

By creating a dense urban environment with detached houses.

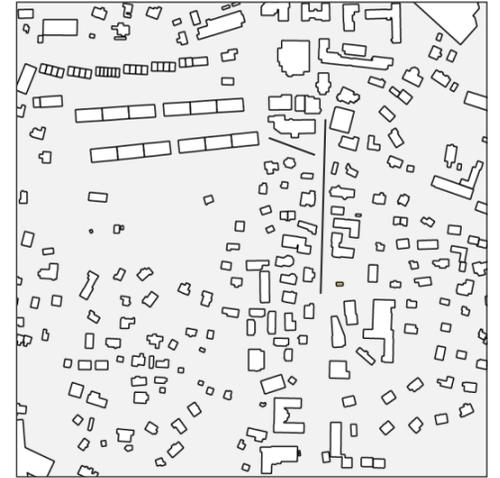
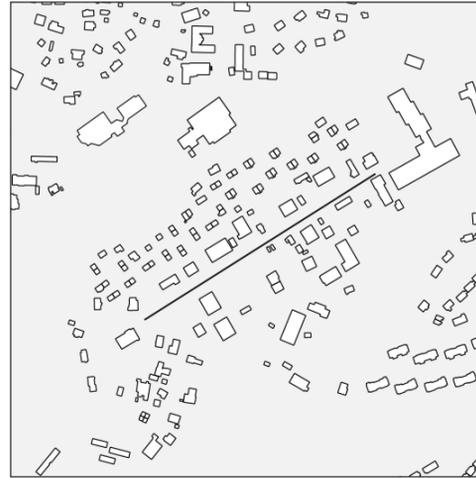


6.4 The design sites

The main proposal's site is an industry area where urban recycling takes place. During urban growth in the last years the town has expanded towards the industry area and around it. The site sits on a hill with a beautiful view over the town. Atuarfik Jørgen Brønlund, one of the elementary schools in Ilulissat is situated at the eastern part of the area. The main access to the school leads from south-west to south-east and runs directly through the industry area. As other areas in Ilulissat the site has a rocky surface but has been flattened out in many places for build structure and roads. Permafrost areas that are not suitable for build structure can be found scattered around the

site. The site is next to a housing area without any barriers that divides the areas apart. Therefore the houses next to an industry plot have an unattractive surroundings and views.

Urban acupuncture takes place in the heart of the city where plots with abandoned buildings get a new stronger urban function with new structure to create a more resilient town for future challenges, a town that is both environmentally, socially and economically sustainable. The design site leads from the main commercial street through the town's square and down the street leading to the hospital.



Design site photos/ Urban recycling



Design site photos/ Urban Acupuncture



Design site / Urban recycling / Before



Masterplan / Urban recycling

Sport center

Grocery store

N

Elementary school

A1

B2

B1

C2

C1

A2

Kindergarten

Community center /
Fab Lab

Boat parking





6.5 Urban recycling

A new urban structure adapted for the future and its future generations in Ilulissat. In this proposal my focus is on climate sensitive architecture, sustainability and how that can turn future challenges like climate change, housing demands and emigration to opportunities. The location and the landscape of this industry area gave me an opportunity to work with my goals for this project. It gave me an opportunity to minimize unnecessary future urban sprawl north of the town, by moving the industry area and create a densely built climate sensitive environment with homes for about 800 people. The density of the urban structure not only creates more homes to work with the emigration but it creates a quality environment which supports social and environmental sustainability and easier human contact.

A climate sensitive urban structure like in this proposal has higher buildings to North and to North-East to shelter the environment for cold and strong winds. Buildings are lower in south with openings to maximize daylight and sun to enter courtyards. Focus was on creating roofscapes that prevent the strongest wind from North-East to enter the built environment. This urban structure can create a good microclimate and sheltered shared spaces for the inhabitants. The densely built structure, with

attached family houses can as well reduce heating cost and support the household economy.

The urban structure is completely landscape oriented and follows the landscape and existing road structure, where the build structure needed to obey for the natural environment and that way I was able to create a strong relationship between the landscape and the built environment. Housing scale support Greenlandic architectural culture and traditions and answer the people's housing wish for a single family homes but in a new modernized way to create more quality environment to live in.

This new urban area not only holds the housings and the school but as-well a community center, a fab Lab center in one of the industry buildings to strengthen the new community even more and a new kindergarten for growing population. With new sidewalks and passages in the area and on both sides of the main road the children in Ilulissat can now walk safe to school and visually and emotionally feel the existence of a community in close connection with their daily routines and activities.



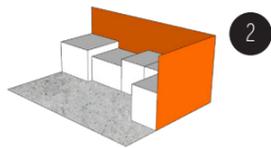
Detail plan/ Urban recycling

This detail plan is a zoom-in of a part of the master plan for the industry area. The main road has been refined with concrete pathways on both sides of the road. This road leads to the elementary school and is now a safe road for children and other pedestrians. The buildings on the left side of the road are mostly detached and have a south facing entrances. Detached buildings are supposed to create a more closed and dense structure by the road. Boat and car parking are by roads between buildings leading north. What was left of permafrost areas where intentionally left out on the whole side. The permafrost areas are an important areas where vegetation are visible during the summer month. Wooden structure throughout the side create an access to buildings where permafrost areas are and in courtyards to create a more visible softer feel of the environment and for creating an useable outdoor space by the buildings. Buildings by the main road on the right side are detached and higher and create the same closure for the street as the buildings on the left. Higher structure is to stop the cold northern winds to enter the private shared spaces. Buildings facing north-east are higher as well as they are facing the prevailing wind of the area. South facing buildings are lower and the structure has more openings to create a space for the sun to enter the courtyards. Buildings facing east are lower than buildings facing north and have more openings in the urban form to create access for the evening sun to enter the courtyards. Courtyards in this plan are quite big to maximize the light and they have a multiple purpose. They have a space for people to connect, they can hold a shared greenhouse, a playground and a space for clothesline for people to dry their clothes outside.

Climate sensitive approach



Openings in the urban form and lower buildings to south to maximize access for the sun to open spaces.



Closure in the urban form to north and north east to minimize wind effects to open spaces.

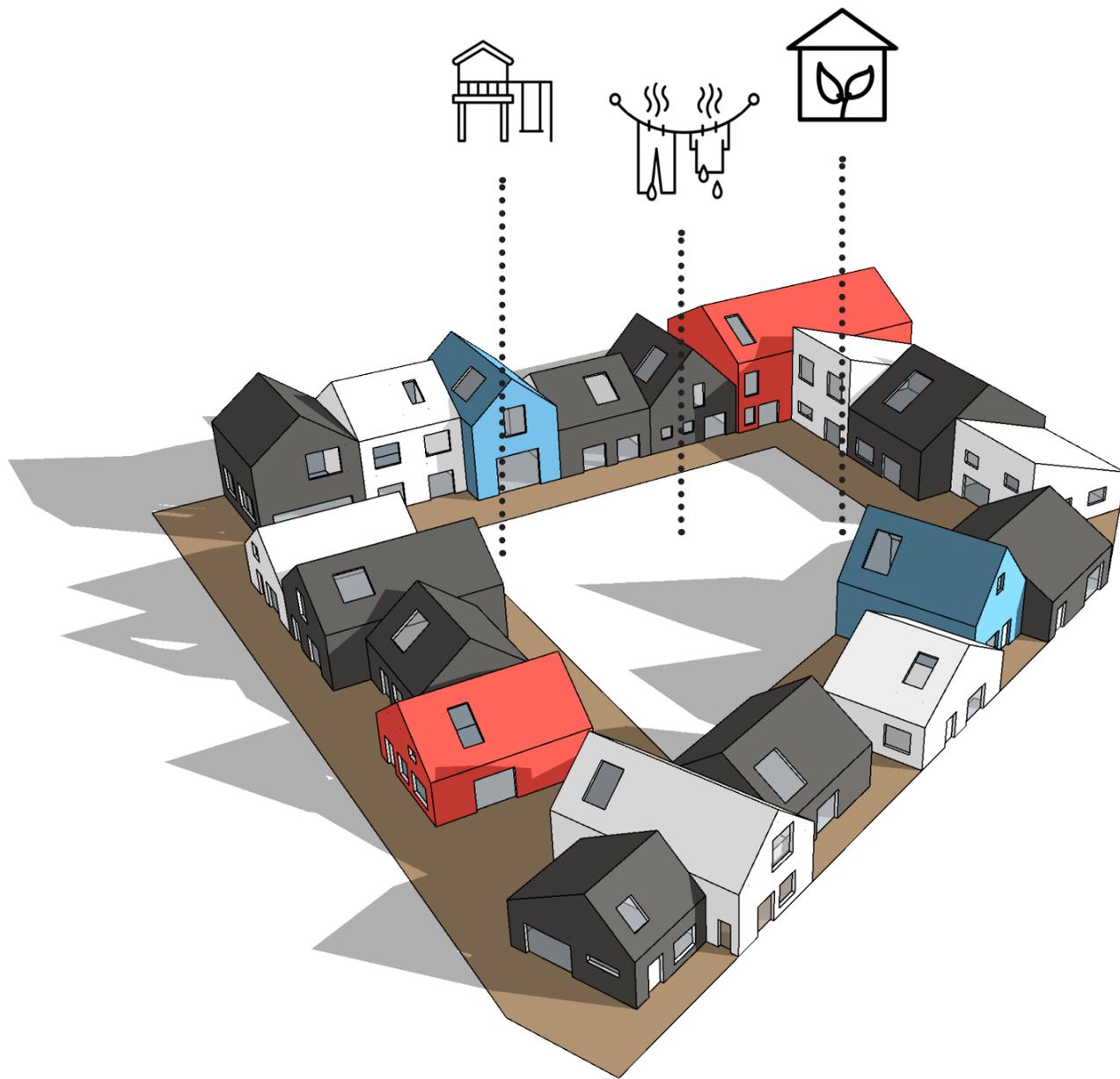


Higher buildings in north and north east for less windy and more sunny open areas.



Buildings facing east are lower for maximizing evening sun access to the courtyards.

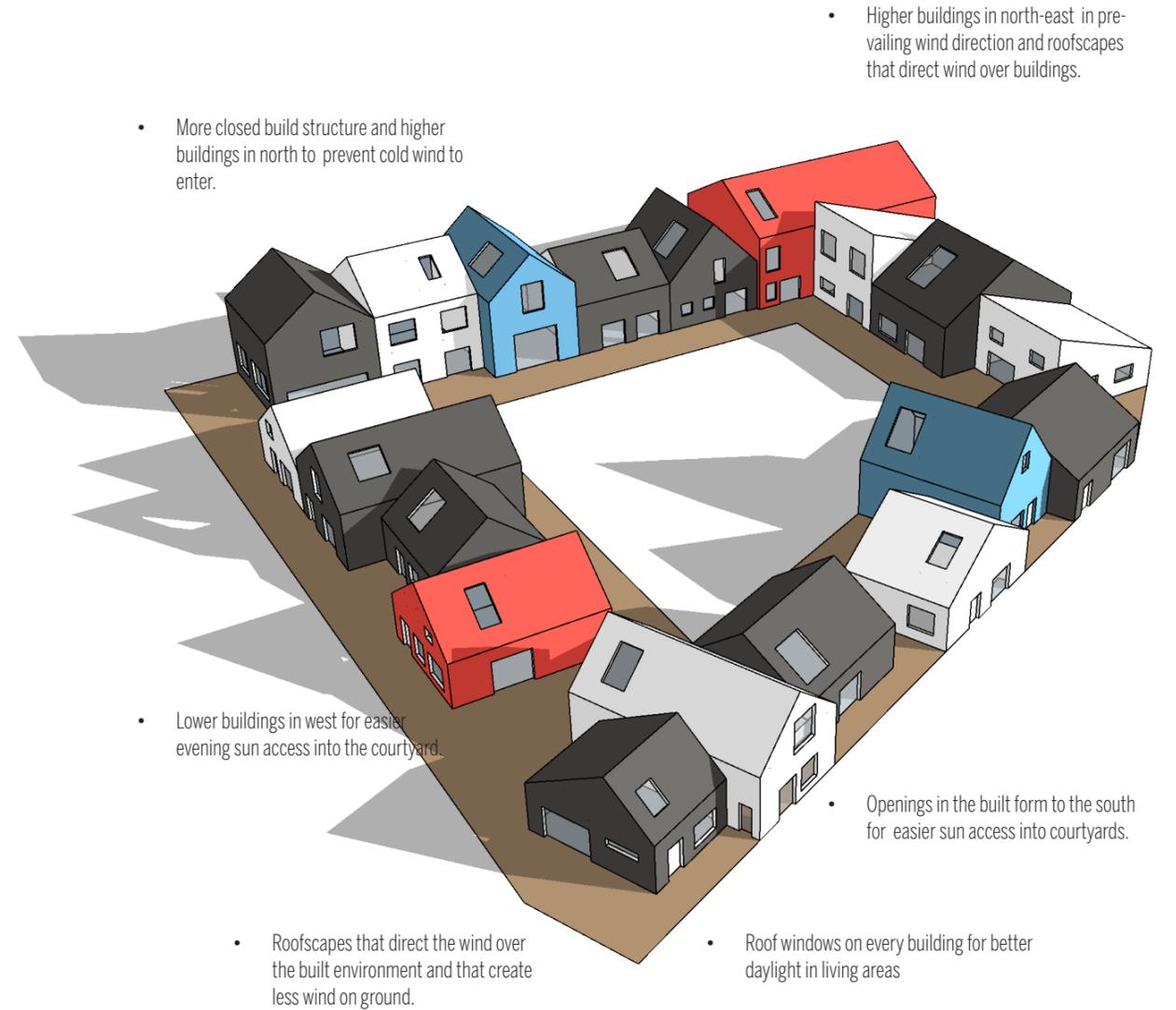
Courtyard possible functions



The courtyards that are formed in this urban structure are quite big to increase daylight and sun access to these shared private spaces and to increase opportunities for different and useful functions. It is a part of the Greenlandic culture to dry the clothes outside, therefore there is a space for every housing unit to have clothing lines outside. The courtyards can

as well hold a communal greenhouse where people can grow their own vegetable during spring and summer. A playground can as well be placed in the courtyard along with a shared space in the form of a deck for the people to barbeque or for relaxation in a good summer day. Other opportunities is to have a storage shed and kayak parking.

Climate sensitive urban form



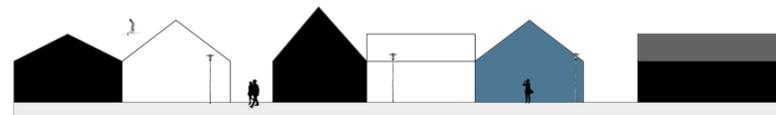
Urban recycling, landscape and build structure / Section A1-A2



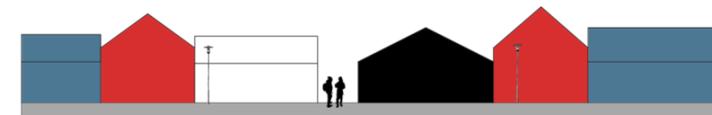
Urban recycling, north facing structure / Section B1-B2



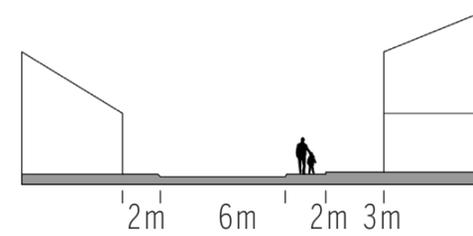
Urban recycling, south facing structure / Section C1-C2



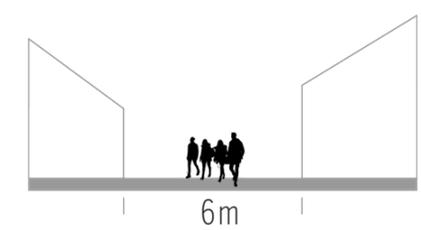
Urban recycling, south facing structure / Section D1-D2



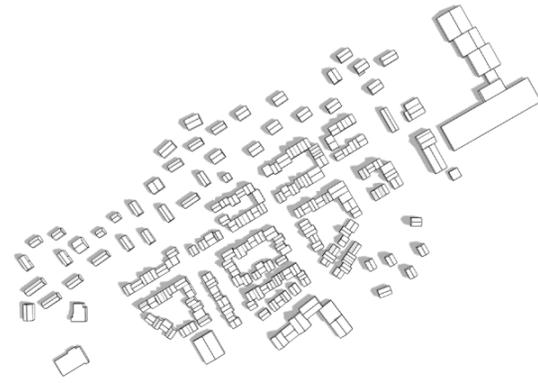
Main street section



Pedestrian street section



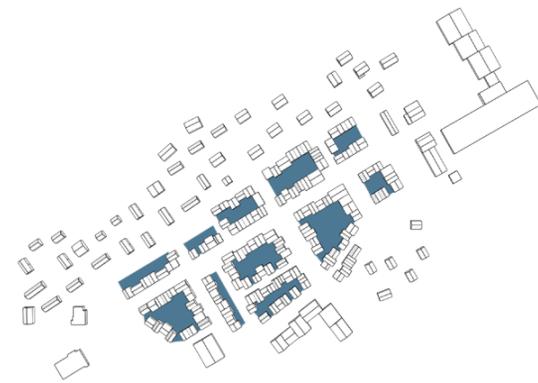
Diagrams



The new build structure



Main road



Shared private spaces

Visualization / Pedestrian street



Visualization/ Courtyard



Design site/ Urban acupuncture/ Before



Hospital

Church

Elementary school

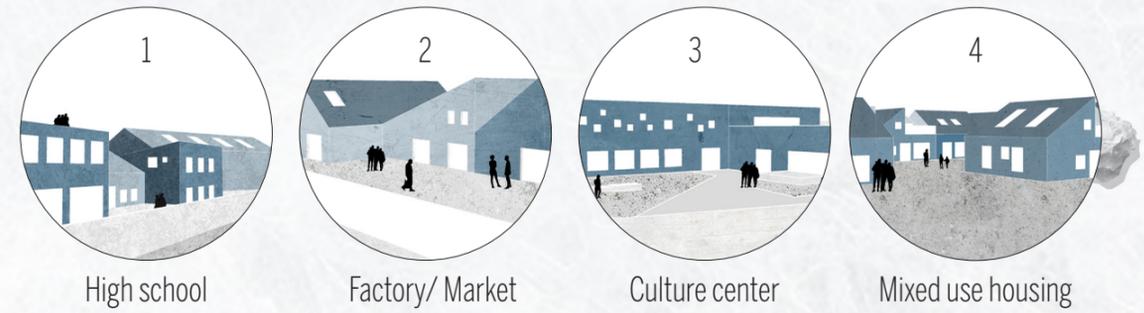
Center

Commercial street

Royal Greenland

To airport

Visualization/ Culture center



6.6 Urban acupuncture

Urban acupuncture is to strengthen the core of Ilulissat both socially, economically, environmentally and to create a more vibrant, safe and resilient town for the future. A task that can as well boost diverse environment, economy and economic growth. The urban acupuncture takes place on four different plots where there are eg. abandoned buildings or where I saw important opportunities for these goals. Most of the buildings are planned by the mu-

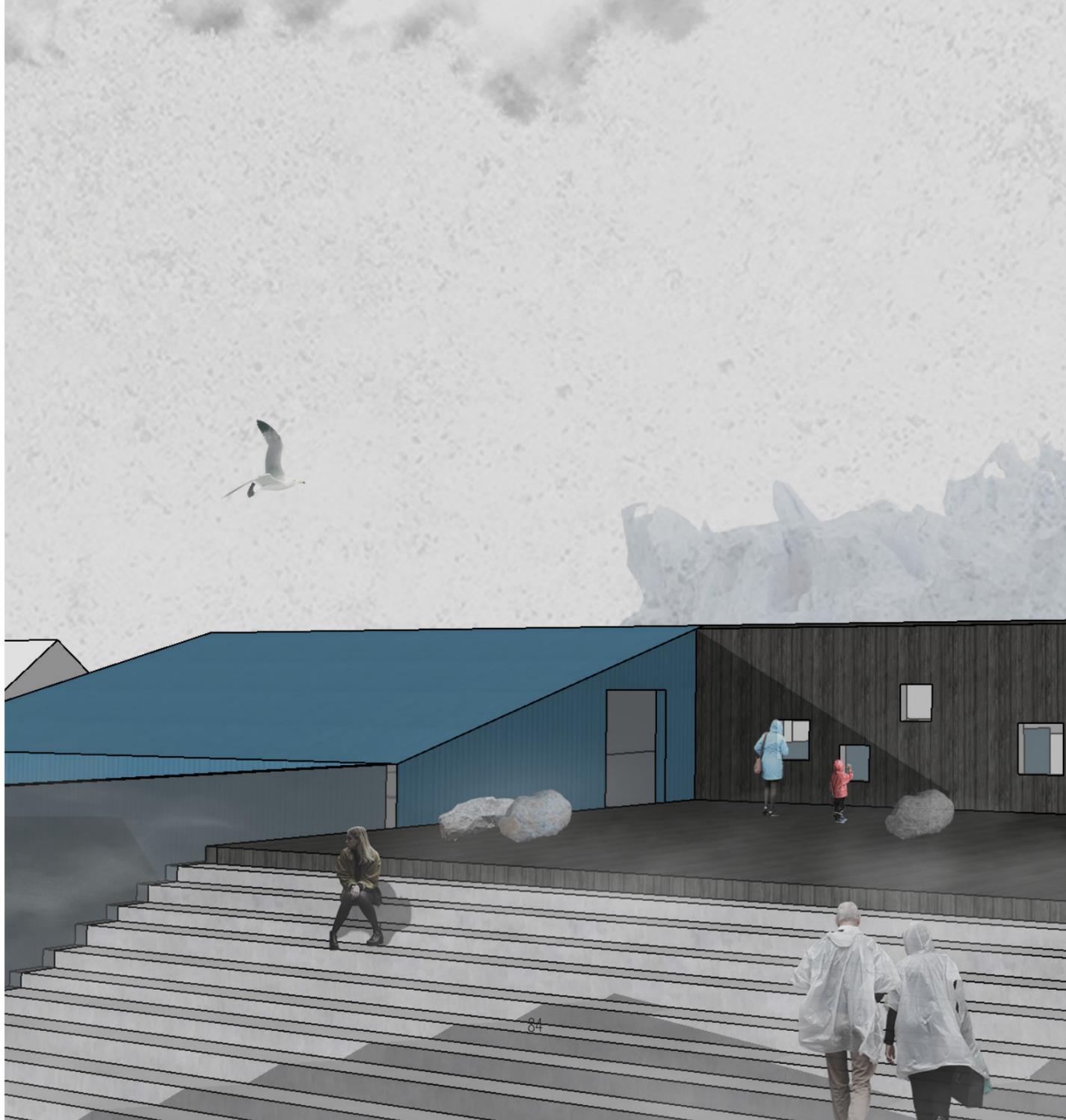
nicipality to be demolished do to mold or other factors. Another task was to make sidewalks and passages and a traffic circle to slow down fast traffic for a more safer and easily walkable town center. More info about each urban acupuncture tasks on the next page.



Visualization / Culture center rooftop



Section / Culture center and rooftop public space



Ilulissat Highschool

Centrally based high school with sea view creates a healthy environment and a vibrant life in Ilulissat and offers higher education for the migrating students. The school is economically and socially beneficial for Ilulissat both for the life it creates and the possibilities for people to live at their home base.



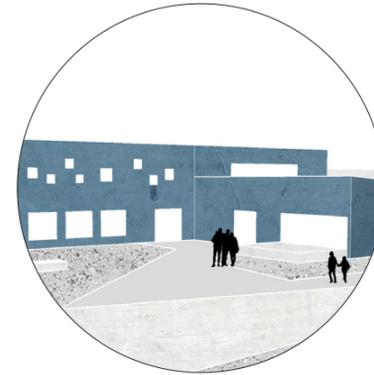
Factory/ Market

Abandoned old factory building on site can be refurbished and brought to life as a Dulse seaweed factory, a fish market where the locals can sell their catch of the day and a restaurant that offers fresh local fish every day. A new economical opportunity in the heart of the old town that creates jobs and a vibrant life. The Dulse seaweed factory can produce edible dried Dulse both for locals and for export. Other opportunities are to experiment with the seaweed as an insulating material for houses in Greenland to reduce import of these material and to create opportunities for more sustainable buildings.



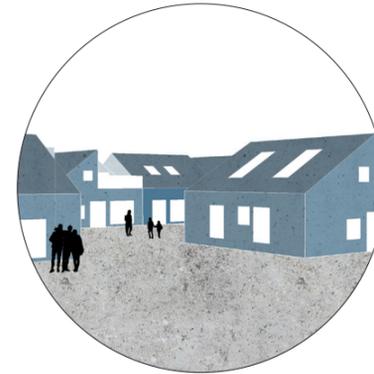
Culture center

To create a stronger community with a cultural facility, a place for happenings and gatherings, the heart of the town can be filled with vibrant life. Situated on the main center square in Ilulissat this urban construction creates a better usage of the square and extension of it as the building roof top is an outdoor public place as-well.



Mixed use housing

Situated on the main shopping street in Ilulissat. The housing structure is climate adapted and has a good public place and creates a shelter from the weather. This urban function has stores on the first floor and apartments on the second floor and in some cases a garret.



Detail/ Urban acupuncture, the center square

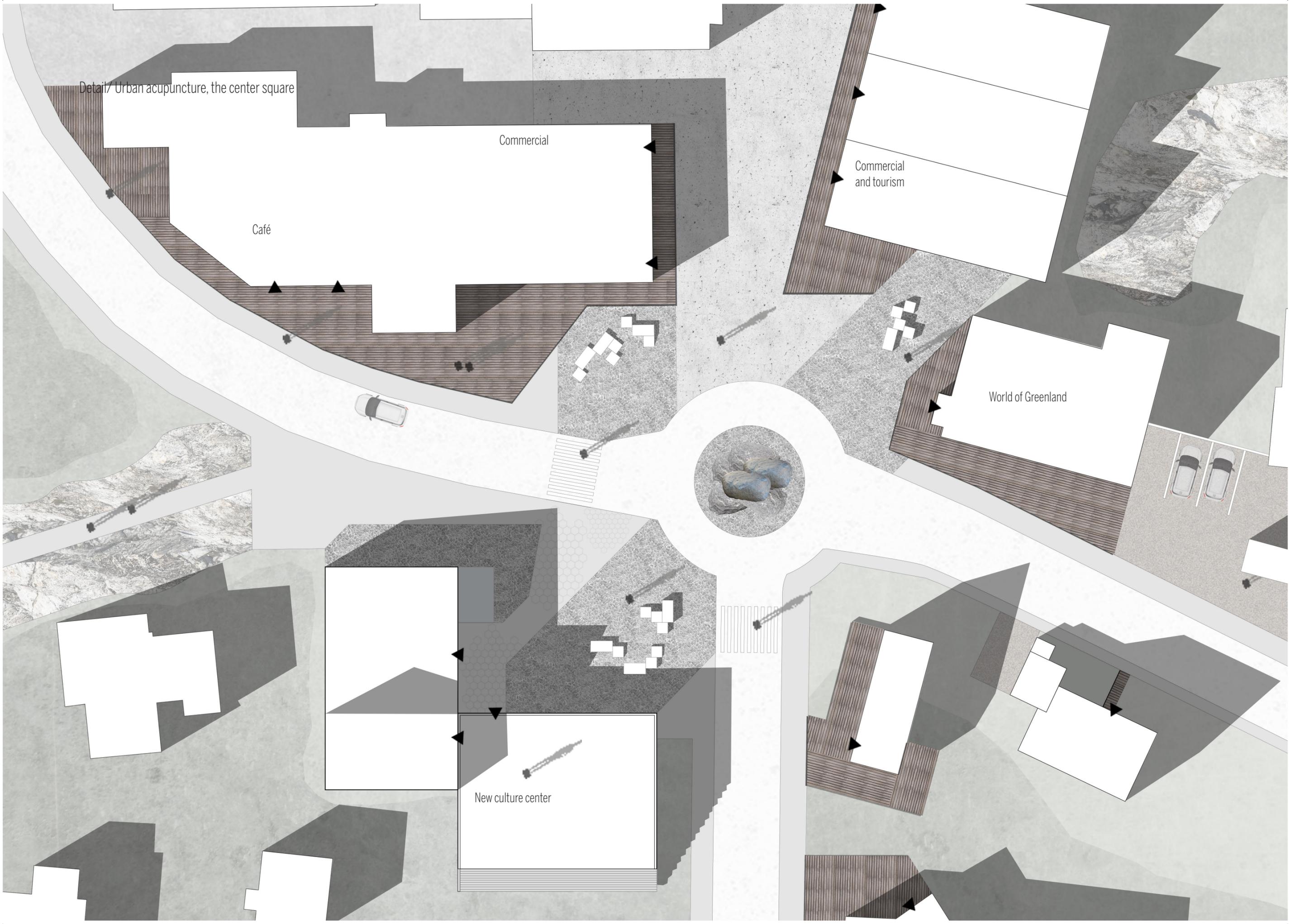
Commercial

Café

Commercial and tourism

World of Greenland

New culture center



7.0 Conclusion

On a very early phase of this project I decided that I needed to create a realistic project, a project that would not have severe effects on the environment and neither for the economy. In my mind this project is about the people who live under harsh conditions, both environmentally, climatically and socially.

Greenland is facing a tremendous changes, changes that will and already have had an impact for the whole society. Do to climate change the environment is suffering, traditional way of life are changing and everything else follows. In these changes I saw a need to adapt the urban environment in Ilulissat to these changes, both to create a better liveability and to prepare the town for the future. In this project I introduce a new way of living in an Arctic environment, a climate and culturally sensitive environment for new generations. The new urban form is created with a climate sensitive approach and an approach to support social sustainability.

I am proposing new homes for about 900 people and if the municipality would follow up on this they can avoid this unnecessary urban sprawl of the town of Ilulissat they are planning, which will create a more sustainable environment and with that number of new housing it might solve housing demand in Ilulissat for a while and hopefully minimize the decrease in population. By proposing new urban function in the city center the town can eg. be more lively with stronger and more vibrant atmosphere and create important economic opportunities and offer the migrating youth a continued education in their own hometown.

I do believe that my strategy and my design principles focusing on climate sensitive architecture, which I propose, can be applied to many other northern settlements that are dealing with the same or similar harsh conditions. Even though this urban form with courtyards can be found all over the world this form is not typically how they build in an Arctic settlement but the need for it might be bigger than we can think. We need to put all of our focus in creating a better liveability wherever in the world, in this particular settlement a good micro climate, preserved solar access, less wind, density and an environment that stimulates the senses is needed to create a better livability, sustainability and a quality in life.



Physical model of the the new urban form / urban recycling

8.0 Motivations and reflections

My first visit to Greenland was in 2000. My first experience gave me an understanding of an human survival and I thrived for more knowledge about this unique culture and indigenous way of life. I worked as an flight attendant for Air Iceland and over the next 7 years working for the airline I had been to mostly all airports in Greenland. I fell in love with Greenland from my very first visit, there is something beautiful about the remoteness, the culture, the nature and then the unpredictable weather. In 2004 I was based in Ilulissat several times during the summer. Ilulissat immediately became one of my favourite places in the world. The healing effect of the nature is something I can not describe. This feeling to be able to “zero yourself” every day is magical.

When it came to the decision to choose my subject for my master thesis project I knew I wanted to challenge myself and I wanted to work with something that would give me more new knowledge before I would finish my education. Ilulissat came unexpectedly to me one night. I believe that my subconsciousness led me to Ilulissat after being reading news and watching devastating documentaries about climate change.

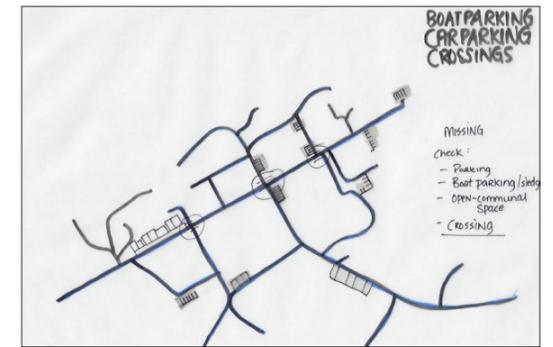
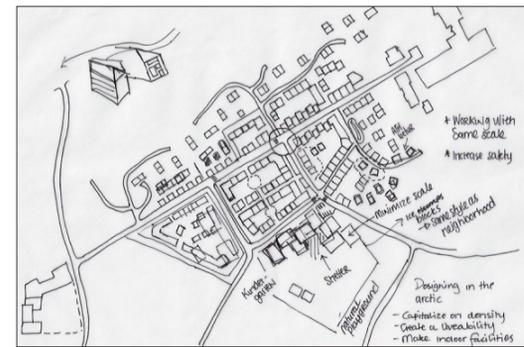
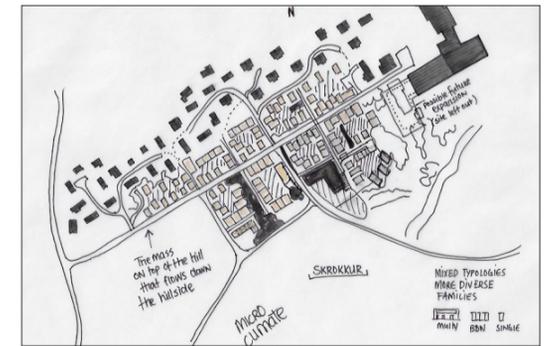
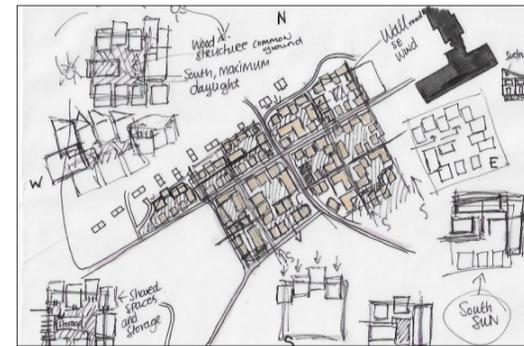
After one month of analysing work I went to Ilulissat for a week stay. After the first two days in Ilulissat I felt that I could not go far with my project. On day three I wanted to build a dome over the whole town. The -22 c° seemed to be unsurmountable. But on day four I got used to the climate and I got familiar with the town again. With great help from Snorre Bochsén Westh and Sam Abedini from

the municipality I found places where I could develop my strategy. A big thank you to them, without them I would still be “lost” in Greenland. Andreas Olsson, my supervisor, thank you for all of your help with this project and for the help the last two years. My fellow classmates, team SuDes, this would not have been so much fun without you. To all of my other teachers and lecturers, you are an inspiration to me.

The last two years here in Sweden have been the greatest ride. I feel privileged to have been able to follow my dream. But nothing of this dream would have come true if it was not for my family and friends. To all of my nieces, thank you for your crazy support. To my friends in Iceland, you are awesome. Dear Omar, my partner, thank you for believing in me and following my dreams with me. Mamma, my biggest supporter thank you for all the encouraging phone calls and visits to us in Lund. Pabbi, thank you for taking a good care of our family. Rakel, my little sister, you're admiration of everything I do has giving me more courage and bigger believe in myself, you're the world's best sister. Guðmundur Egill, my little heart, without you I would not be here.

I dedicate this to you.

9.0 Urban design process



From analysis to sketch ,
from sketch to design.

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2019
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