Shifting Ground: Addressing Environmental Instability through a Method of Two-Eyed Seeing in an Arctic Community

by

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Dalhousie University is located in Mi'kmaq'i,
the ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

This thesis is dedicated to the Hamlet of Tuktoyaktuk, and to the elders and leaders who have and continue to protect Inuit land, culture and language for future generations.

Contents

Abstract

Given the necessity of addressing the impacts of climate today, research and practice must engage local ecological, cultural, and technical knowledge to drive meaningful and respectful research. Through field work and conversation in the Arctic community of Tuktoyaktuk, and a survey of building practices, this thesis uses the method of Two-Eyed Seeing, developed by Mi'kmaq Elder Albert and Murdena Marshall, to harness the strengths of both Inuit knowledge and ways of knowing and Western knowledge and science. The purpose of this method is to acknowledge the success of diverse perspectives (and indigenous methodologies) in research and design. These results inform the design of a research centre that leverages indigenous and Western knowledge and extracts the design implications of climate and context as a responsive design strategy.

Acknowledgements

First, I would like to recognize the community of Tuktoyaktuk. I am grateful for their welcome of a visitor on their land, with incredible kindness and patience as we learned together through story, and experience.

I would like to thank Shawn Stuckey (Senior Administrative Officer) and the Hamlet of Tuktoyaktuk, who generously supported my work on the ground. The Hamlet governments work continues to shape policy and advise research that is committed to inclusive, participatory methods in a response to the impacts of climate change.

To those who have shared coffee and conversation along this journey. Your work in research, education and building inspire the basis of this thesis and will continue to influence my academic and profession pursuits.

It's been a privilege to work with my thesis committee this past year, who have supported and guided this project. First, thank you to my supervisor, Sarah Bonnemaison, whose knowledge has grounded this thesis in community and place. Your care and guidance to research extends far beyond your academic work. Thanks to my advisor, Dustin Whalen, who has been the foundation of this thesis. I would not have been able to complete this project without your knowledge and sensitivity to community research. Thanks to Steve McFarlane, who has challenged me to think deeper about environment, culture and program. Our conversations will inspire my own design practice beyond the layers of this thesis.

Thank you to my friends and family who have supported me over the past 4 years. Sara, Charlie, Fiona, Chelsea, Alex and Adryn, you have taught me so much patience and care through these years. To upper studio, thank you for countless laughs, advice, and encouragement. It's been wonderful. Thank you Nick, for sticking by my side through this all. Your support has been unconditional.

Finally, to my wonderful parents Brenda and David and my brother, Leighton, thank you.

Chapter 1: Introduction

Climate change significantly impacts lives and communities around the world. Architecture is one discipline that is working to address climate change consequences through design and building. A particular consequence of climate change is rising sea levels and its obvious effects on coastal communities. This thesis explores how Two-Eyed Seeing as method can better address the complex ecological, social, and technical challenges present in the Northern Canada.

Western Canadian Arctic

The Western Canadian Arctic (Beaufort Sea) is one of the fastest changing landmasses in the world due to the climate driven impacts of coastal erosion and storm surge flooding (Oppenheimer and Glavovic 2019).

There are two highly knowledgeable groups of people in the region: the Inuit, who have intimate geographic knowledge and lived experience of land which surpasses most physical records; and, more recently, the scientific research community, which is intensely monitoring and recording changes in lifestyle, habitat, and environment due to climate change.

Both Inuit and Western researchers share a responsive understanding of landscape and are increasingly recognized as critical partners in research and climate monitoring.

This thesis uses Two-Eyed Seeing as a guiding approach and programmatic method to harness the strengths of both Inuit and Western knowledge establishing the design of a research center in context. Knowledge is important to both Inuit and Western worldviews (but is translated different

ways), and the role of the center is to engage the community and visiting researchers, further develop relationships and partnerships, and continue knowledge translation and exchange between cultures and generations.

Fieldwork

The purpose of the research is to understand how weaving between worldview and welcoming different perspectives in research and design might support cultural continuity into the future.

- a multidisciplinary approach (engaging architecture, anthropology, and environmental sciences)
- understanding and comparing Indigenous knowledge and ways of knowing with scientific and westernized knowledge.

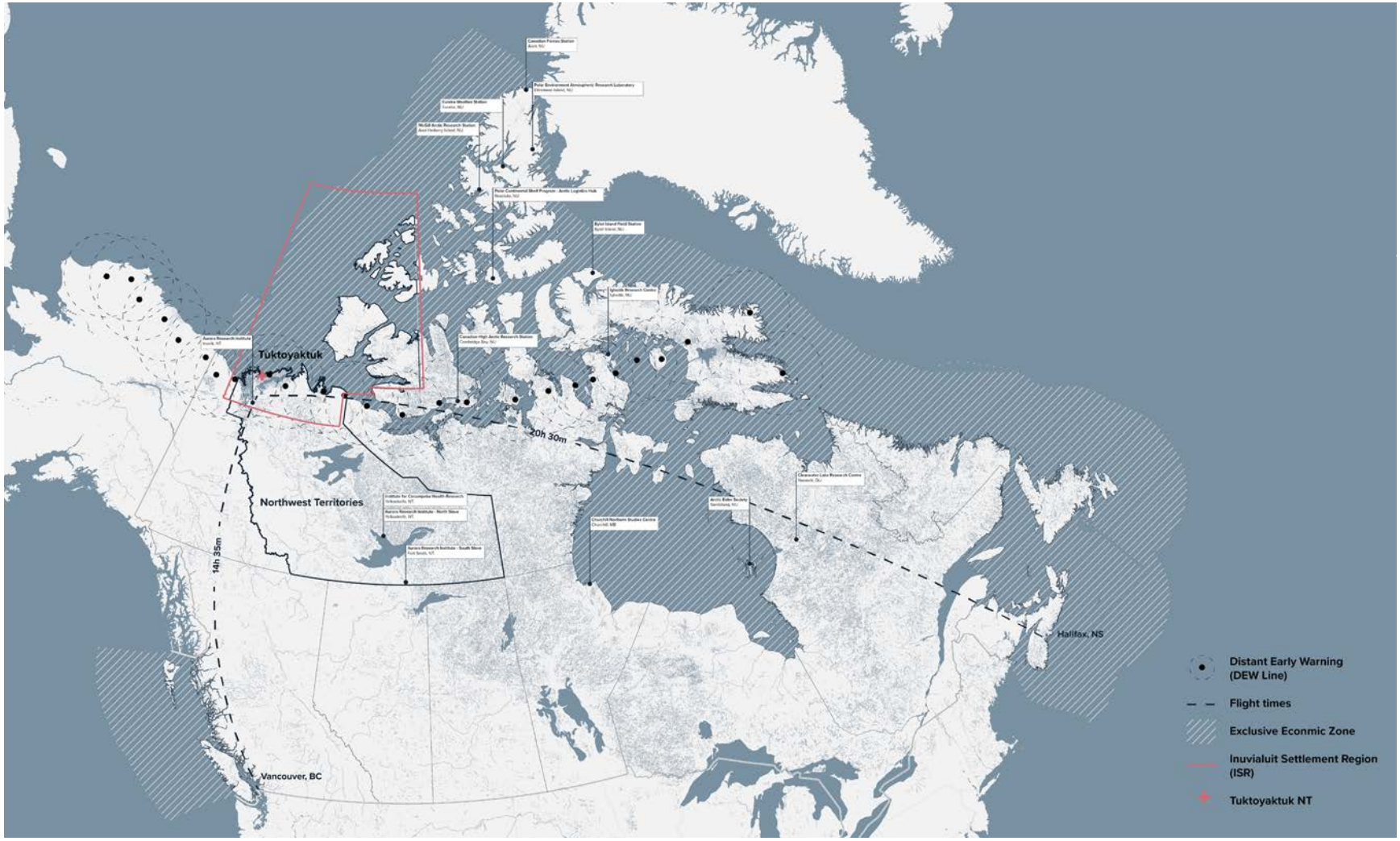
During my fieldwork in Tuktoyaktuk the objectives of my research are

- to identify settler building typologies in Tuktoyaktuk,
- to identify building conditions and adaptations made to such buildings by residents,
- to understand how outdoor spaces and buildings are used (dwelling, gathering, work, trade, learning, leisure, etc.),
- to incorporate a breadth of perspectives and literature in research; traditional and scientific; youth and adults, private and public, government and community, and
- to understand the identified elements and indigenous knowledge and translate them into the design of a community building.

Looking south east towards airstrip in Tuktoyaktuk taken in August 2021. Landscape is squeezed by the Arctic Ocean during ice free season.

Thesis Question

How can principles of Two-Eyed Seeing and co-learning inform the design of a research centre that leverages Indigenous and Western knowledge and extracts the design implications of climate as a responsive strategy?



Map of Canada. Waterbodies, research stations and distant early warning monitoring stations. (Geospatial data informed by NRC 2018)

Chapter 2: Tuktoyaktuk

Mackenzie-Beaufort Field Work

August 19 to September 3, 2021

This past summer I was part of the Mackenzie-Beaufort Field campaign. Fieldwork comprised of work for ArcticNet Research project and for my thesis research. Recognizing the relatively short period in which I visited the community, methods focused on learning about the spatial configuration, building typology, material culture and natural context of Tuktoyaktuk. The fieldwork is throughout the report.

The visiting fieldwork team included Angus Robertson (Natural Resources Canada); Lina Madaj and Fleur van Crimpen (Vrije Universiteit Amsterdam), Bay Berry (Université du Québec à Rimouski), and myself. The trip pre-field planning and during-field support was from Dustin Whalen (Natural Resources Canada).

Collage of Tuktoyaktuk fieldwork.

Research

Climate research has produced a series of permanent and semi-permanent facilities across the Canadian Arctic. Polar Knowledge Canada (POLAR) classifies research stations under four major categories: primary, experimental, community research centres and seasonal field camps (Government of Canada n.d.). Primary and experimental stations are considered more permanent, offering a range of services which include equipment storage and rentals, laboratory space, office space and meeting rooms, workshops, etc. These facilities are typically located centrally and support the network of a smaller seasonal and community-based facilities. Smaller facilities are typically embedded in and around communities, providing infrastructure for immediate processing of data, sharing and disseminating research, and temporary storage of equipment and materials necessary for fieldwork operations.

Multi-purpose space. CHARS. (Government of Canada n.d.)

Knowledge sharing centre. CHARS. (Government of Canada n.d.)

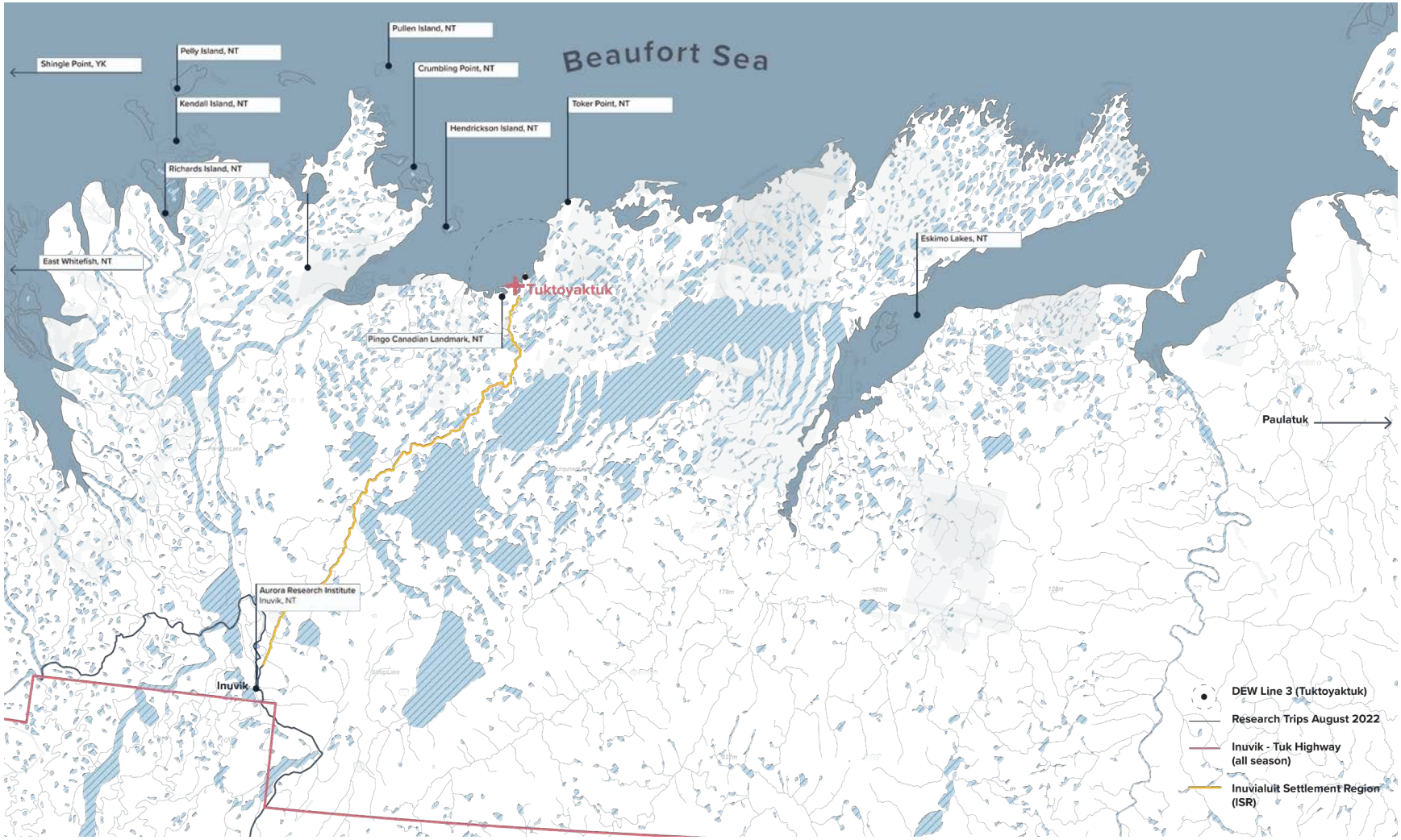
Interpretation room. CHARS. (Government of Canada n.d.)

Connectivity between primary and community-based facilities is instrumental in collecting, interpreting, and disseminating knowledge and climate data across the Arctic. Primary research facilities are acknowledging the need for greater connectivity to community facilities to properly engage Indigenous methods and knowledge in process. Additionally, physical facilities are beginning to engage community members in their facilities. The Canadian High Arctic Research Station (CHARS) campus is operated by POLAR and is an example of a research facility that operates with Indigenous and Western worldviews in mind. Approximately a third of the facility is open to the public and includes research and technology labs, knowledge sharing and education spaces and community engagement space (Government of Canada n.d.).

Research specific to the Inuvialuit Settlement Region (ISR) is managed through the Inuvialuit Regional Corporation (IRC) and Aurora Research Institute (ARI). The IRC was established in 1984 to manage land outlined in the Inuvialuit Final Agreement. The IRC's goal is to "continually improve the economic, social and cultural well-being of the Inuvialuit" and represents the collective interests of the six communities located in the Inuvialuit Settlement Region: Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk and Ulukhaktok (IRC n.d.). The ARI operates within Aurora College as their research division. Their mandate is to "improve the quality of life for NWT residents by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals" (ARI n.d.b).

Map of ISR Communities. (NRC 2018; IRC n.d.)

Currently, research space is isolated from Tuktoyaktuk, located a 2.5-hour drive away in the community of Inuvik. There is a need for a dedicated space in Tuk that strengthens community relationships to research and provides a co-learning environment. To fill this need, this thesis proposes a research centre that provides space for collaborative community research activities between researchers and community members.

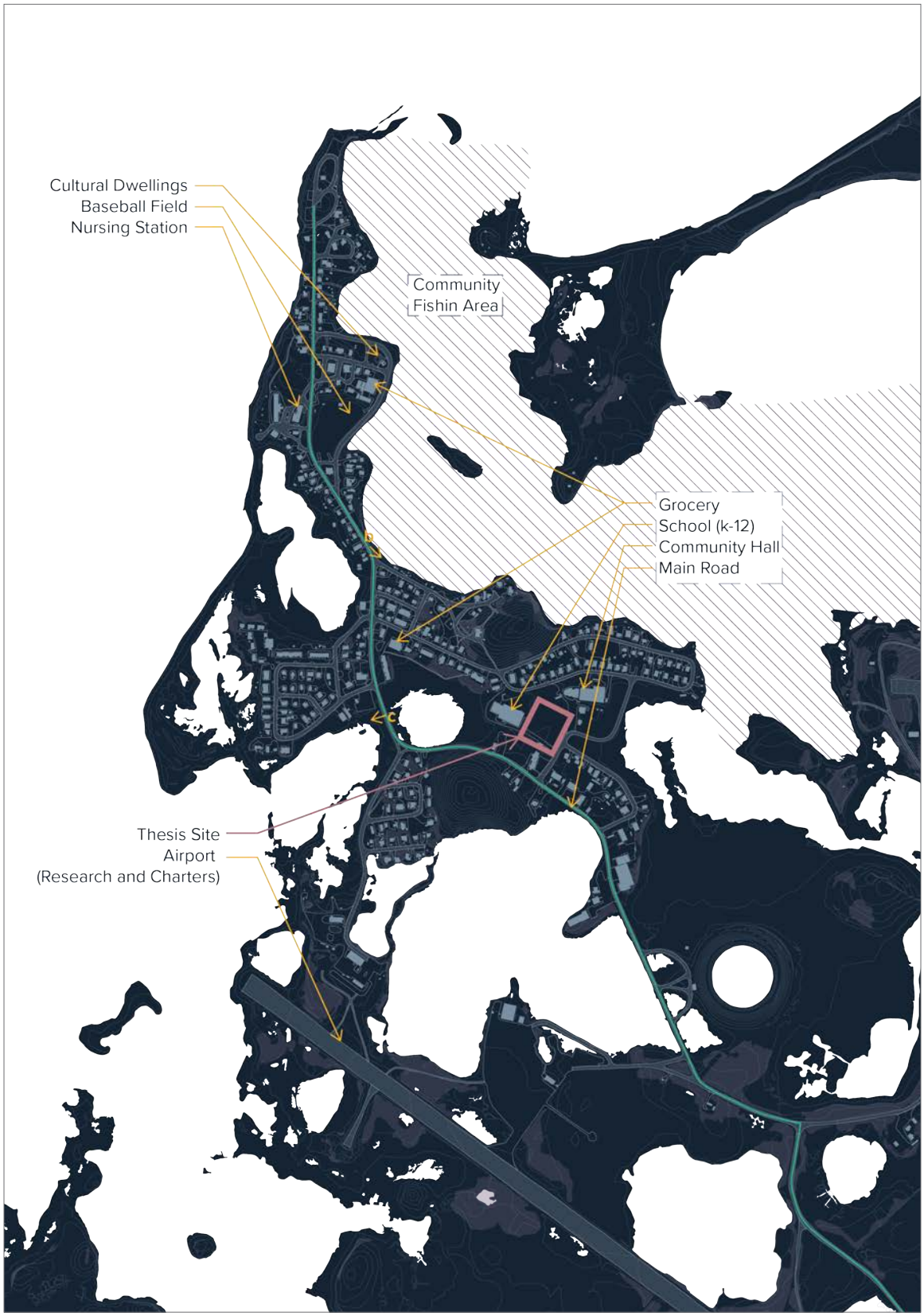


Map of Inuvialuit Settlement Region. Research fieldwork and fluvial data. (Geospatial data informed by NRC 2018)

Community

Tuktoyaktuk is a community of 1000. The community has a strong collectivity and relations to one another and to their environment. Activities and processes observed are connectivity (taking care of others in the community: elders and youth first, Facebook and technology, exchange of goods, food, resources, etc.), play and socialization (community baseball tournaments, hockey, bingo, ceremony, Arctic games etc.), building, education and community driven research.

Walking route in August, 2021.



Map of Tuktoyaktuk, NT. Highlighting main access and community spaces. (Base map data collected from the Government of Northwest Territories n.d.)

Northern Perceptions

To many, the Canadian Arctic remains a mystery. This has produced and reproduced varied and unclear perspectives on population, landscape, and architecture. The North has been described for centuries by explorers, artists, and scientists often formulating new and upholding past perspectives on landscape, culture, and architecture. To properly frame the process and method of this thesis, I will briefly describe Tuktoyaktuk in terms of its geography and culture.

Tundra vegetation around Tuktoyaktuk

Climate

In the North, landscape and communities have and are experiencing change faster than anywhere else. It's a landscape of extremes, oscillating between freeze and thaw, complete darkness, and daylight where the impacts of climate change are having disproportionate impacts (Bone 2016).

Tuktoyaktuk is located in the tundra biome, where tree growth is prohibited by cold temperatures and permafrost. The environment is low and flat with large ice hills, called "pingos" providing the only topographic relief (Alunik, Kolausok, and Morrison 2003, 3). Located on the delta of the Mackenzie River, Tuktoyaktuk has a rich history of habitation. The surrounding area and stretch of shallow coastline allow for harvesting of whale, fish, seal, and caribou. The area is also well vegetated, consisting mainly of low-lying shrubs, sedges, reindeer mosses, grasses, and a wide variety of flowers. Tundra vegetation is low-lying to avoid impacts of Arctic wind and take advantage of the strong air temperature gradient: 20°C close to ground, dropping as much as half 10cm up from the ground (Bone 2016, 23).

In July mean temperature is a high of 15.2°C, low of 6.0°C. The January mean high -25°C, low -31.6°C. Winds are predominantly from the northwest (Alunik, Kolausok and Morrison 2003, 212).

Summer and spring comparison (Bottom: Inuvik, Northwest Territories 2014)

Arctic light (or absence of in winter) and the horizontality of landscape are important considerations in design. On the summer solstice, the sun remains 44 degrees above the horizon influencing livelihood and habitation with 24h sunlight. The reverse applies in for the winter solstice where the sun remains -2 degrees to the horizon, leading to 24hrs darkness and twilight.

Additionally the accumulation of snow drifts presents significant challenges to infrastructure and building access. Tuktoyaktuk has average yearly snowfall of 103 cm with

most winter days having wind speed above 12 km/hr reaching to over 60km/hr. Literature on snow drift analysis in the north suggests drifts can accumulate more than 10 times the building height depending on building form and siting (Strub 1996).

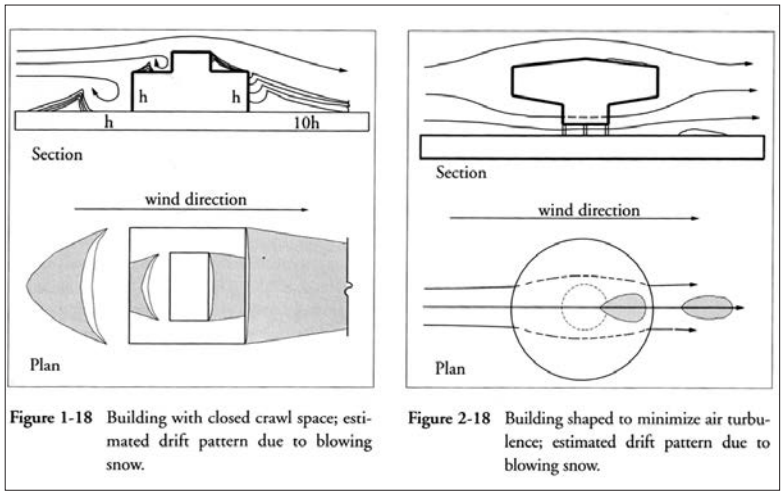


Figure 1-18 Building with closed crawl space; estimated drift pattern due to blowing snow.

Figure 2-18 Building shaped to minimize air turbulence; estimated drift pattern due to blowing snow.

Building snow drift Analysis. (Strub 1996)

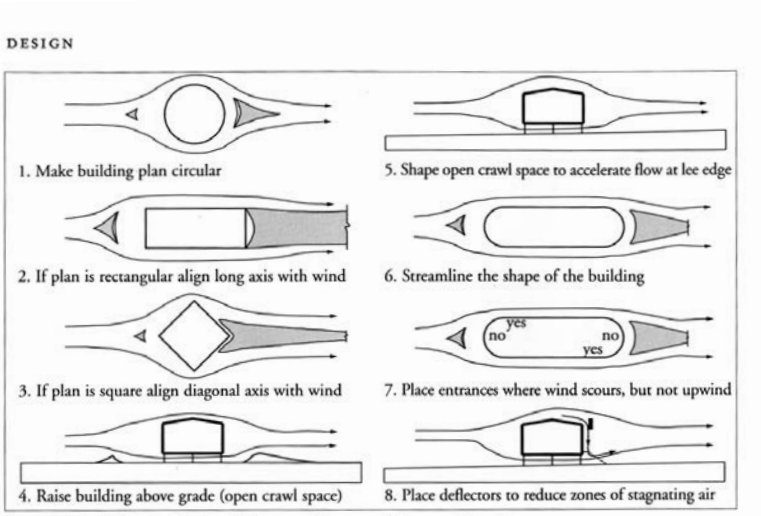
Eight rules for building in the Arctic (Strub 1996)

1. Make the building circular in plan.
2. If the building is rectangular, align the long axis parallel to prevailing wind.
3. If the building is square in plan, align the diagonal axis parallel to the prevailing wind.
4. If the Building must be raised to permit accelerated airflow beneath the structure, align the short axis parallel to the prevailing winds.
5. Shape the ground below the structure to that airflow accelerates most at the lee edge of the building.

6. Streamline the shape of the building by keeping the roof profile low or align the ridge with prevailing winds.

7. Place the place of entryways and exits parallel to the prevailing winter wind, so that adjacent ground will be scoured.

8. As a last resort, apply panels to the building to deflect air flow into zones of stagnating air.



Eight rules of thumb for controlling snowdrifts around buildings. (Strub 1996)

April snow build up on southeast facade and entrance. (Ott 2017)

Culture

Since the end of World War II, the Canadian government has increased its presence in Northern Canada, systematically

colonizing the Inuit, a semi-nomadic hunter gatherer society, into permanent settlements. However, communities were never consulted during these processes and implementation of federal policies, were often “fraught with acts of neglect, resistance, and broken promises” (Sheppard and White 2017, viii). The result has led to unsustainable and ill-suited climate and culturally appropriate housing and infrastructure for the Inuit way of life and the environmental conditions of the Arctic. This has also influenced cultural practices and teachings as parents lose the skills of ‘being on the land’ and intimately understanding nature. Many of today’s youth do not have traditional knowledge and do not have Western knowledge – they struggle in each environment.

Contemporary Inuvialuit identity weaves between traditional knowledge and ways of knowing with contemporary society and technology. This region is home to caribou, muskox, Arctic char, whitefish, and beluga whales; among a variety of animals that have and continue shape livelihood and culture of the region (Alunik, Kolausok and Morrison 2003). Historically, the vast distances of landscape and often changing hunting grounds, meant the Inuvialuit were extraordinarily self-sufficient and mobile. Until the 1950s, Inuvialuit mobility primary was by dog team and sled (Sheppard and White 2017). Between 1950 and 1975, forced settlement and government interventions lead to a decline in dog teams, and snowmobiles became more widely used by the Inuit.

Land-based practices (hunting, trapping, fishing) and mobility continues to shape livelihood and Inuvialuit identity, culture, and survival and now is a hybrid of traditional practices and modern methods. Economics and trade follow along with this hybrid of contemporary technology and

traditional knowledge, often hunting and gathering food, cooking, and processing and selling and trading on buy and sell groups like Facebook Marketplace. Connectivity with the community is influenced by mass media, with community radio broadcasting ceremonies, traditional legends and story, and weekly community events like bingo and occasional feasts and distribution of country food.

Youth in Tuktoyaktuk are beginning to have more access to a mix of Western and Indigenous education programs in local schools and organizations. Community driven research projects and organizations are also doing a lot of work with Indigenous communities. The Mackenzie Beaufort region alone has over 150 active research licenses. Many of the communities participating in these projects are directly involved. Communities are prioritizing research to empower local members by developing partnerships and community-based monitoring programs with visiting researchers. These partnerships keep researchers accountable and facilitate knowledge transfer between Indigenous and Western members. Benefits of these partnerships are supporting environmental and economic program in the local communities through awards and grants.

Building

Fieldwork in the community included documentation of building criteria (building use, construction type, foundation types, heating systems and additional information).

While studying building conditions I identified settler typologies present in the town including Greenlander, Wolfenden, Weber and Trailer (Shappard and White 2017).

Through identifying the base models used in the built fabric of Tuktoyaktuk, this thesis can further recognize buildings that have been adapted to accommodate dwelling and spatial needs of the community.

Greenlander building type. Additional side entry with kitchen, bath and bedroom added to the original building.

Woolfenden building type

Weber building type.

Examples of adapting existing building types to accommodate dwelling and climate practices of building in the Arctic.

Inuvialuit culture and geography is highly complex, involving negotiation between Indigenous and Western processes that continue to dictate livelihood in the north. Contemporary identity is both rooted in tradition, while welcoming incorporating contemporary technologies and practices. Community organizations are beginning to recognize the strengths of community driven research and empowering local knowledge towards socio-ecological solutions. An opportunity lies with architects as well to work in tandem with communities in both discourse and design. Finding common ground in cross cultural research and practice is a necessary challenge when working in the North.

Chapter 3: Indigenous Research Methods

Eurocentric research has played a significant role in the colonization and oppression of Indigenous people (Wilson 2008). Most research has been conducted on and about Indigenous peoples rather than with, often through questionable research practices. Employing the “helicopter approach” where visiting researchers would arrive in communities, collect data, and rarely if ever return (Smylie et al. 2004). As a result Indigenous peoples have expressed skepticism and research fatigue, using phrases such as “we’ve been researched to death” (Blair 2016; Castellano 2014; Maar et al. 2011).

To situate myself within this research, I recognize my own experience and role as a Western researcher, who has attended and practiced largely within Western institutions and communities. To properly facilitate research with the community of Tuktoyaktuk, this thesis engages in new methodologies that depart from Western approaches to knowledge and welcome more diverse, cross cultural communication.

Indigenous Research Paradigm

Indigenous Research Paradigm “four entities”. (Wilson 2008, 70)

In *Research is Ceremony*, Shawn Wilson shares the concept of the Indigenous Research Paradigm (2008). Wilson defines a research paradigm as a set of underlying beliefs or assumptions that guide the framework which research is conducted (2008, 33). The set of beliefs that make up research paradigms are the interrelated concepts of ontology, epistemology, methodology and axiology (Wilson

2008). Wilson indicated the importance of relationships to an Indigenous Research Paradigm:

> Just as the components are related, the components themselves all have to do with relationships. Ontology and epistemology are based upon a process of relationships that form a mutual reality. The axiology and methodology are based upon maintaining accountability to the relationships. There that sums up the whole book in one paragraph. (Wilson 2008, 70-71)

Wilson argues the issue with Western research on Indigenous communities is on "pulling up" Indigenous communities standards to the dominant paradigm (2008). The objective of an Indigenous paradigm isn't to justify its methods within the Western system, rather it can "provide ways to celebrate the uniqueness and glory of Indigenous cultures while allowing for the critical examination of shortcomings" (Wilson 2008, 19).

Respect, Relationality and Reciprocity

As Indigenous Research paradigms call for the inclusion of Indigenous methodologies, we can further understand what grounds the paradigm unique from its Western counterparts. Wilson states an Indigenous research paradigm should be guided by "Three R's" Respect, Reciprocity and Relationality (Wilson 2008). Wilson cites Evelyn Steinhause's statement "respect is more than just saying please and thank you, and reciprocity is more than giving a gift" (2008, 86). Indeed, this statement and this research criteria follows research principles set by the community of Tuktoyaktuk and territorial organizations, as researchers, Indigenous and non-Indigenous alike, will not be allowed to conduct research without approval from the community. According to these principles researchers must engage in a "deep listening and hearing with more than the ears," and develop a "reflective, non-judgmental consideration of what is being

seen and heard," as well as an "awareness and connection between logic of mind and the feelings of the heart" (2008, 59).

In developing research methods for this thesis, I focus on the key principle of "relationality and relational accountability" to be contextual to the north and reflective of the core strengths of both Indigenous knowledge and ways of knowing and Western research and science (Wilson 2008, 6).

Two-Eyed Seeing

Two-Eyed Seeing is the guiding method of this thesis, situating the design within its theoretical and programmatic study. Two-Eyed Seeing, was developed by Mi'kmaq elders Albert and Murdena Marshall, and Cheryl Bartlett and is based on the Integrative Science & Health (Integrative Science) undergraduate program which was co-created at Cape Breton University (CBU). In their words, Two-Eyed Seeing consists of

> Learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing … and learning to use both these eyes together, for the benefit of all. (Bartlett, A. Marshall, and M. Marshall 2012, 335)

Background

The Integrative Science Program, Toqwa'tu'kl Kjijitaqnn, at CBU originated with three objectives, first "reverse the situation whereby there was an almost total absence of Aboriginal students in science and science-related programs", second, "bring together Indigenous and Western scientific knowledges and ways of knowing" and third, to welcome the different knowledge backgrounds respectfully and equally to enrich through participation and "for the

benefit of all" (Bartlett, A. Marshall and M. Marshall 2012, 337).

Two-Eyed seeing is most aligned with the Western theory of Transdisciplinary research (Bartlett, Marshall and Marshall 2012). Recognizing the benefit of engaging in both Indigenous and Western approaches, and seeing the strengths of both eyes, this thesis recognizes the crossover between both approaches. Defining features in a Transdisciplinary approach are as follows (Pohl 2011, 620):

1. Relates to socially relevant issues
2. Transcends and integrate disciplinary paradigms
3. Includes non-academic actors
4. Unity of knowledge
5. Participatory processes

Albert Marshall brought forward Two-Eyed Seeing in 2004, as the guiding principle of Integrative Science. Two-Eyed Seeing reflects the objectives of Transdisciplinary research and has the larger importance of "cross-cultural dialog, understanding, and healing" (Bartlett, A. Marshall and M. Marshall 2012, 332). The three authors share that the success of this approach is critical understanding and responding to complex social, economic, and environmental challenges communities have. As Elder Albert indicates below, we must collectively consider and share knowledge and ways of knowing to encourage change.

> Two-Eyed Seeing adamantly, respectfully, and passionately asks that we bring together our different ways of knowing to motivate people, Aboriginal and non-Aboriginal alike, to use all our understandings so we can leave the world a better place and not compromise the opportunities for our youth (in the sense of Seven Generations) through our own inaction. (Bartlett, A. Marshall and M. Marshall 2012, 336)

Co-learning Journey

To engage Two-Eyed Seeing as a method for and work within an Integrative Sciences approach, we embark on a co-learning journey. Co-learning practices four principles of reciprocity, collectivity, creativity, and weaving capacity. Elders Albert and Murdena describe this as participants being “able to place the actions, values, and knowledges of their own culture in front of themselves” to recognize and take ownership over them. Acknowledging ourselves is critical as co-learning involves learning together, learning from our similarities and differences, and learning how to weave back and forth between Indigenous and Western worldviews (Bartlett, A. Marshall and M. Marshall 2012).

8 Lessons Learned

Albert and Murdena Marshall, and Cheryl Bartlett identify eight lessons learned which is their own synthesis and reflection of their years Integrative Science and Two-Eyed Seeing research and application.

1. Acknowledge that we need each other and must engage in a co-learning journey.
2. Be guided by Two-Eyed Seeing.
3. View “science” in an inclusive way.
4. Do things (rather than “just talk”) in a creative, grow forward way.
5. Become able to put our values and actions and knowledges in front of us, like an object, for examination and discussion.
6. Use visuals.
7. Weave back and forth between our worldviews.
8. Develop an advisory council of willing, knowledgeable stakeholders, drawing upon individuals both from within the educational institution(s) and within Aboriginal communities.

Two-eyed seeing is especially appropriate in Arctic communities as communities and research practices are in transition, combining modern technologies with traditional knowledge and ways of knowing.

Collage of Tuktoyaktuk relations to landscape people, and spirit.

Chapter 4: Design

This thesis designs the Tuktoyaktuk Climate Centre through the method of Two Eyed Seeing. The design language and program harness the strengths of collective community relationships and responds to the ephemeral rhythmic change of the environment (wind, natural light and snow).

Design Criteria

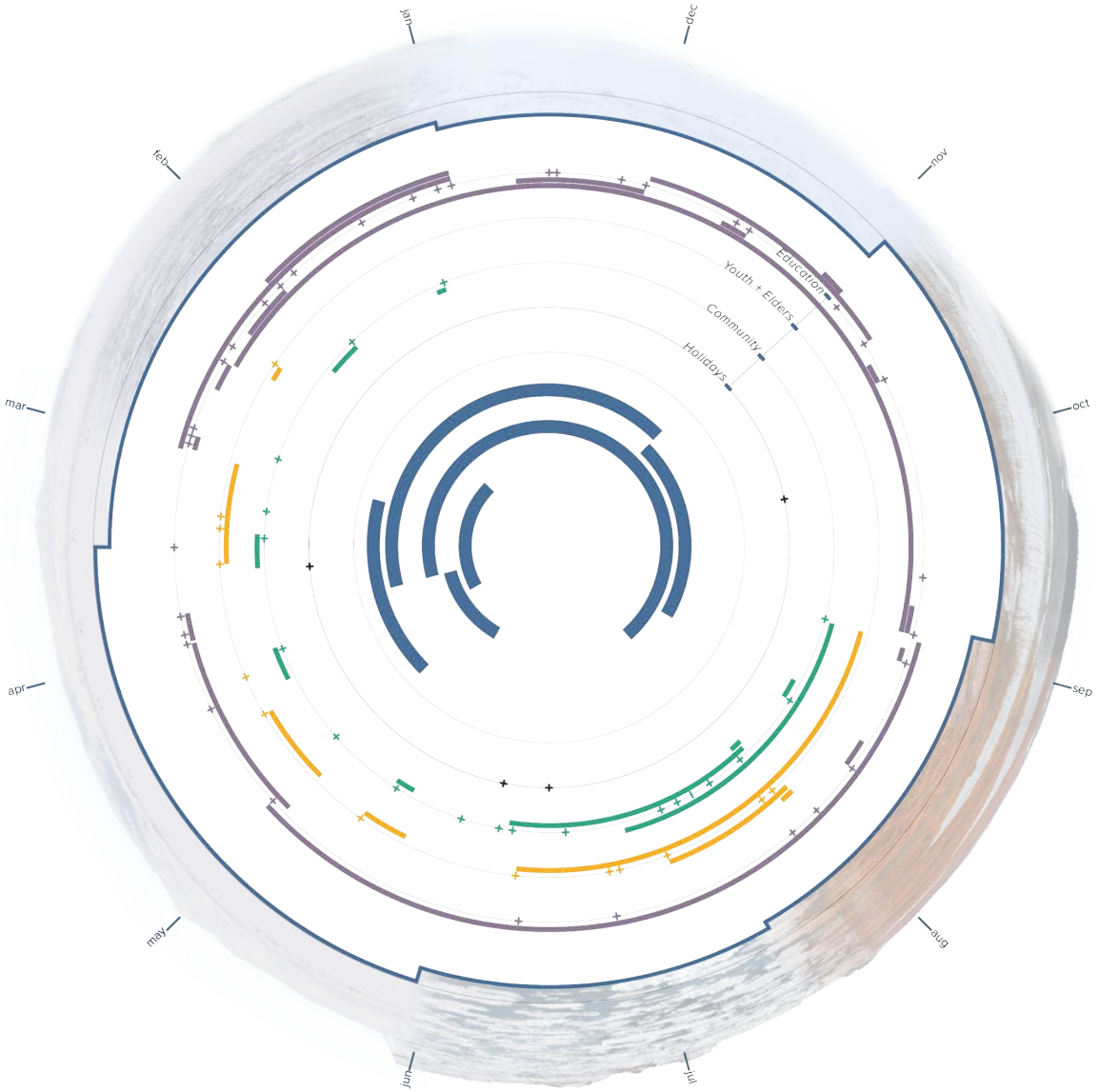
Program

The community of Tuktoyaktuk has strong relations with their environment. It is critical to situate the community and this research in the contemporary as the Inuvialuit identity weave together traditional practices with contemporary life and technology.

The natural environment carries important tradition, generational teachings, and knowledge – overall pedagogy of place (Wilson 2008, 87). Indigenous knowledge itself is held in the relationships and connections formed with the environment.

Spirituality is not distinct from the indigenous worldview and is essential to mental, physical, and emotional health (Wilson 2008, 89). Spirituality has taken many avenues in contemporary indigenous identity, and this thesis focuses on the importance of spirituality in ceremony and story.

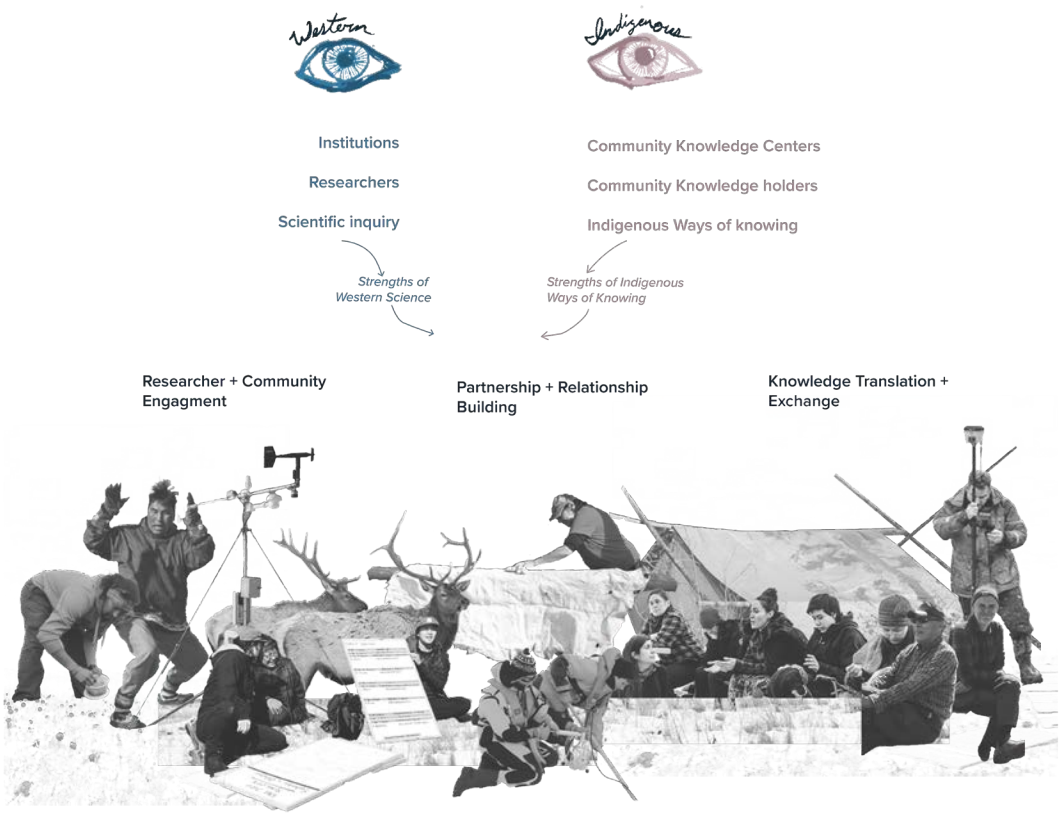
Relationships with people follow the same level of importance and often are included when talking about ‘relationships with the environment’. The blurred boundary between community and land, illustrate an interrelation that is sacred to indigenous people.



Collage of community practices overlapping throughout a calendar year. Events are categorized as holidays, community, youth and elders, education. The inner overlap is showing significant hunting and migratory seasons of the area. The outer portion shows Inuit seasons of January to mid-March: Ukiuq, mid March to late May: Upingaksaaq, late May to mid July: Upingaaq, mid July to early September: Aujuq, early September to late October Ukiaqsaaq, and late October to early January: Ukiaq.

Two-Eyed Seeing

The use of Two-Eyed Seeing as a guiding approach and programmatic method is to harness the strengths of both Inuit and Western knowledge to establish the design of a research centre in context. Knowledge is important to both Inuit and Western worldviews, and the role of the centre is to engage the community and visiting researchers, further develop relationships and partnerships, and continue knowledge translation and exchange between cultures and generations.



Collage of program method. Two-Eyed seeing approach to research.

Site

The centre is in the community and education hub of the town. Its adjacent neighbours include a Smitty's bed and breakfast, which is one of two locations where researchers stay when visiting Tuk, Mangilaluk school, Kitti community hall. The programmatic and formal relationship of the centre and the adjacent education, gathering, and dwelling spaces emphasize the guiding principle of Two Eyed Seeing of a community based, co-learning approach to research.

Site plan showing program adjacencies on site (1) Mangilaluk school (2) Kitti community hall (3) Tuktoyaktuk arts and crafts centre (4) Smitty's BnB/housing (5) thesis site (6&7) residential neighbourhoods

Climate

Tuktoyaktuk has considerable climatic characteristics that must be considered in design. Ongoing research in the community outlines the significant challenges to building in Northern regions. Acknowledging the complexity of these challenges, this thesis responds to site characteristics of snow, wind and natural light. Through observation, conversation and review of literature, this map illustrates a series of additional site constraints that were considered after situating the project programmatically on this site.

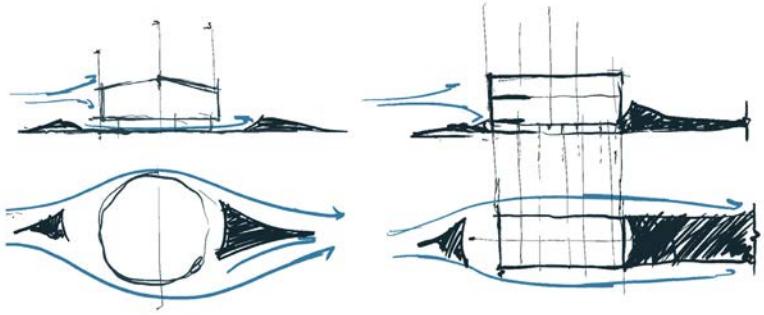
Site plan showing site analysis: driftwood buildup, snow shadow, high tide, storm surge, pedestrian routes, secondary roads, main roads, winter wind direction, and sun dial.

Wind, Snow and Light

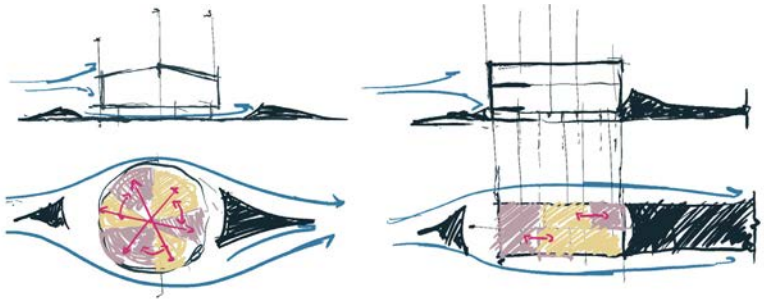
The design extracts the spatial implications of climate and context as a responsive design methodology/strategy.

Accumulation of snow drifts present significant challenges to infrastructure and building access. Tuktoyaktuk has an average yearly snowfall of 103 cm with most winter days having wind gusts reaching over 60km/hr. Literature on snow drift analysis in the north suggests drifts can accumulate up to 10 times the building height depending on building form and siting (Strub 1996, 94–97).

The underlying significance of the circle is a response to the environmental constraints of building in the Arctic. The circle as a form is the least obtrusive on snow build up and creates the smallest snow shadow on leeward side of the building.



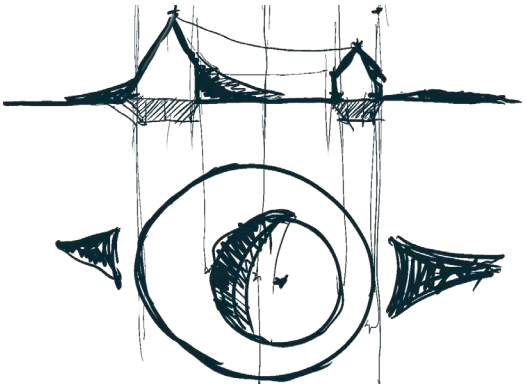
Sketch comparison of the relationship between building form and snow build up on the leeward side of building



Sketch comparison of program relationships of a circular and rectilinear building plan

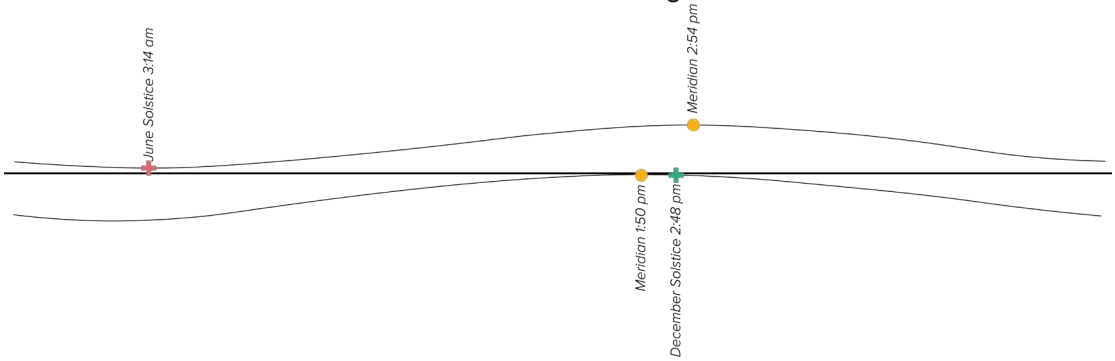
Conventionally deploying program within a rectangle creates relationships between adjacent spaces, however creates hierarchy. Rotating the program in on itself allows for similar relationships with adjacent spaces while encouraging connections across the centre.

Developing this idea further and allowing for an open central courtyard and a change in roof pitch, the design is able to respond to climate while encouraging programmatic connections between spaces and across the courtyard.



Sketch showing the implications of a courtyard in the centre allowing for snow to be carried over the roof and deposited in the courtyard.

On the summer solstice, the sun remains 44 degrees above the horizon governing livelihood and habitation with 24 hour sunlight. The reverse applies for the winter solstice where the sun remains -2 degrees to the horizon, leading to 24 hour darkness and twilight.



Winter and summer solstice sun chart for Tuktoyaktuk, NT. (Diagram informed by Time and Date n.d.)

Building materials and form respond to the light of the site. Silver metal cladding addresses the temporal nature of the site. In the winter, the facade mimics its environment, reflecting twilight, lighting the surrounding dark environment. During the summer and 24 hour sunlight, the reflectivity of metal cladding prevents heat gain.

Research Centre

Program

The design of the research centre bridges Western and Indigenous ways of knowing (Two-eyed seeing) and responds to the climate through program, design language, and siting.

These design elements carry principles from both cultures and incorporate Two-eyed Seeing 8 lessons learned throughout the centre. The elements are as follows:

The main entrance (with lower roof) through a building cutout on the east in accordance Indigenous cultural teachings (ways of knowing and being) and the technical analysis of placing entry ways parallel to the prevailing winds “so the adjacent ground will be scorned”. The airlock provides an intermediary between exterior and interior spaces and allows for storage for clothing, boots, and gear.

Adjacent to the entry is a sunken hearth, providing an informal space to meet and tell stories. A skylight above allows winter stargazing towards the Southeast.

Members then arrives at an administrative office which is supported by an open mapping and archival space.

As users continue to circulate along the outer edge of the plan, the generous circulation provides flexible gallery space

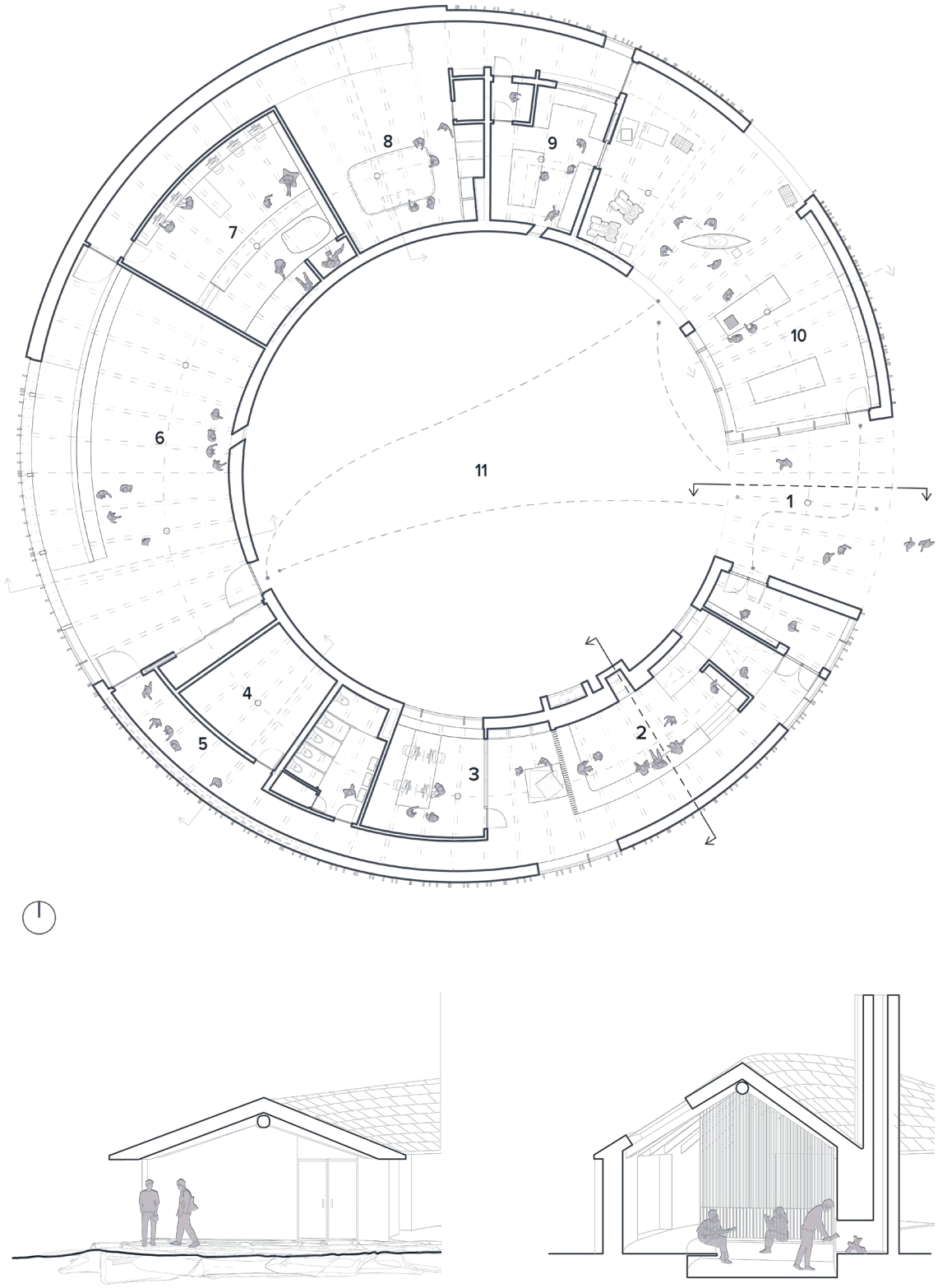
for presentation of research. The flexibility and informal nature of the space supports the ongoing presentation and engagement of members in land and climate-based research.

A larger gathering and performance space emphasize collectivity and engagement between community and research members. This space recognizes the importance of community performance and craft in research and partnership.

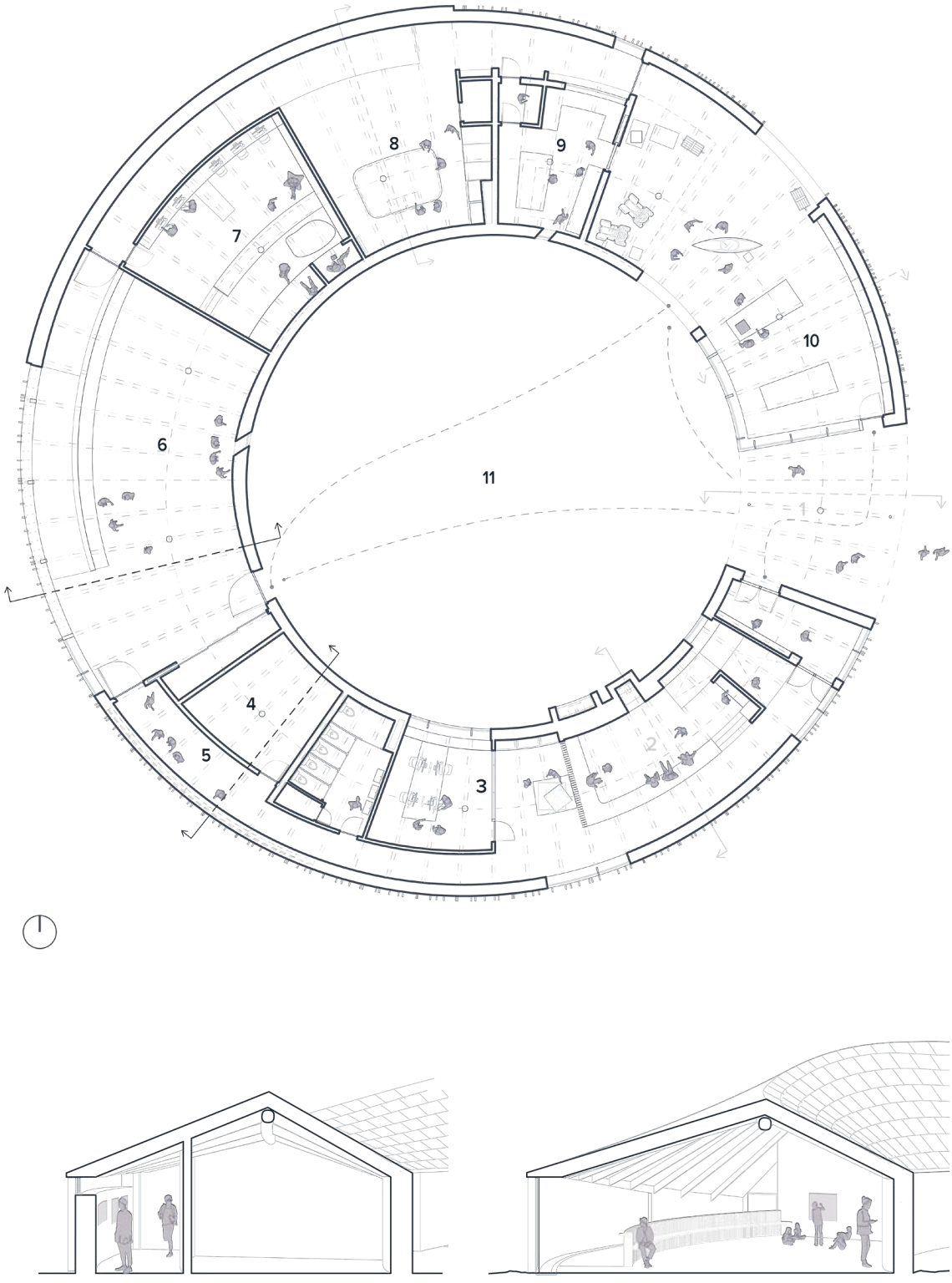
The literary and media space (towards the NW) is located under the higher part of the roof, shaped in response to the strong winter winds. The literary and media room provide a quiet space to connect with other communities and research camps through contemporary.

Moving towards the north, we have the wet spaces: a kitchen for food preparation and a climate laboratory for land-based processing of collected samples. The adjacency of these spaces works formally as wet spaces but also emphasize an importance relationship between land-based research and food, monitoring the health and sustainability of marine and land-based animals - connecting the significance between hunting/animal and landscape/climate.

The large garage provides an enclosed space for fabrication and repair. This space acts as an extension of the adjacent lab and is a space where technical education takes place. The garage allows this education while giving members space to store, repair and assemble weather monitoring stations, drone and digital mapping tools, and a spectrum of other research gear.



Building plan: (1) entry, (2) hearth, (3) admin and mapping space, (4) mechanical, (5) gallery, (6) performance, (7) literary and media, (8) kitchen, (9) climate laboratory, (10) garage, (11) courtyard. Short sections: (left) entry, (right) hearth.



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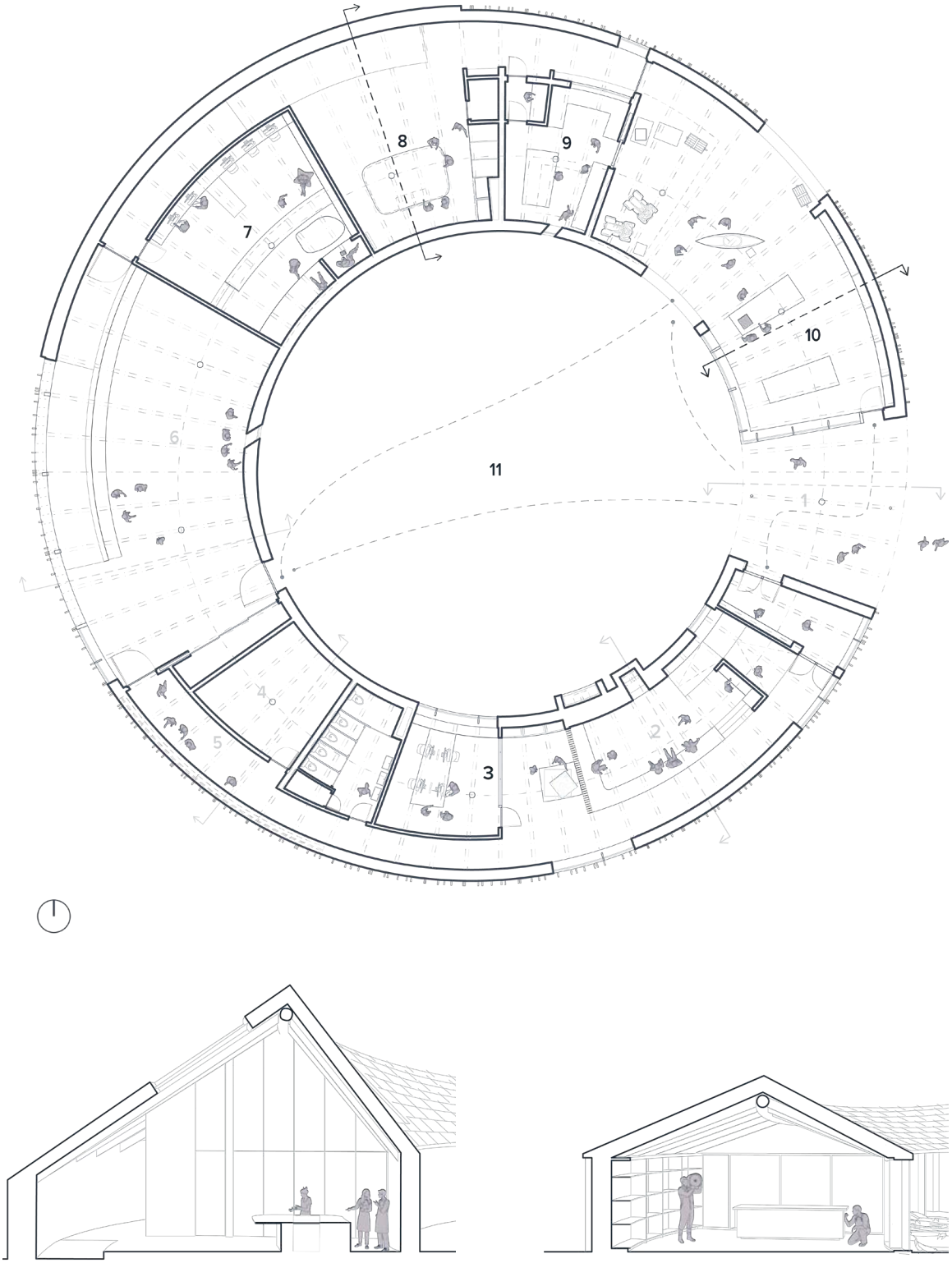


Building plan: (1) entry, (2) hearth, (3) admin and mapping space, (4) mechanical, (5) gallery, (6) performance, (7) literary and media, (8) kitchen, (9) climate laboratory, (10) garage, (11) courtyard. Short sections: (left) kitchen, (right) garage.

Responding to Site

A section from northwest to the southeast emphasizes the spatial implications of the roof as the northwest edge lowers itself to exterior topography. The roof strategy and its dynamic play between pitch and height of the roof is in response to strong winter winds from the northwest and the design challenge of controlling snow drifts

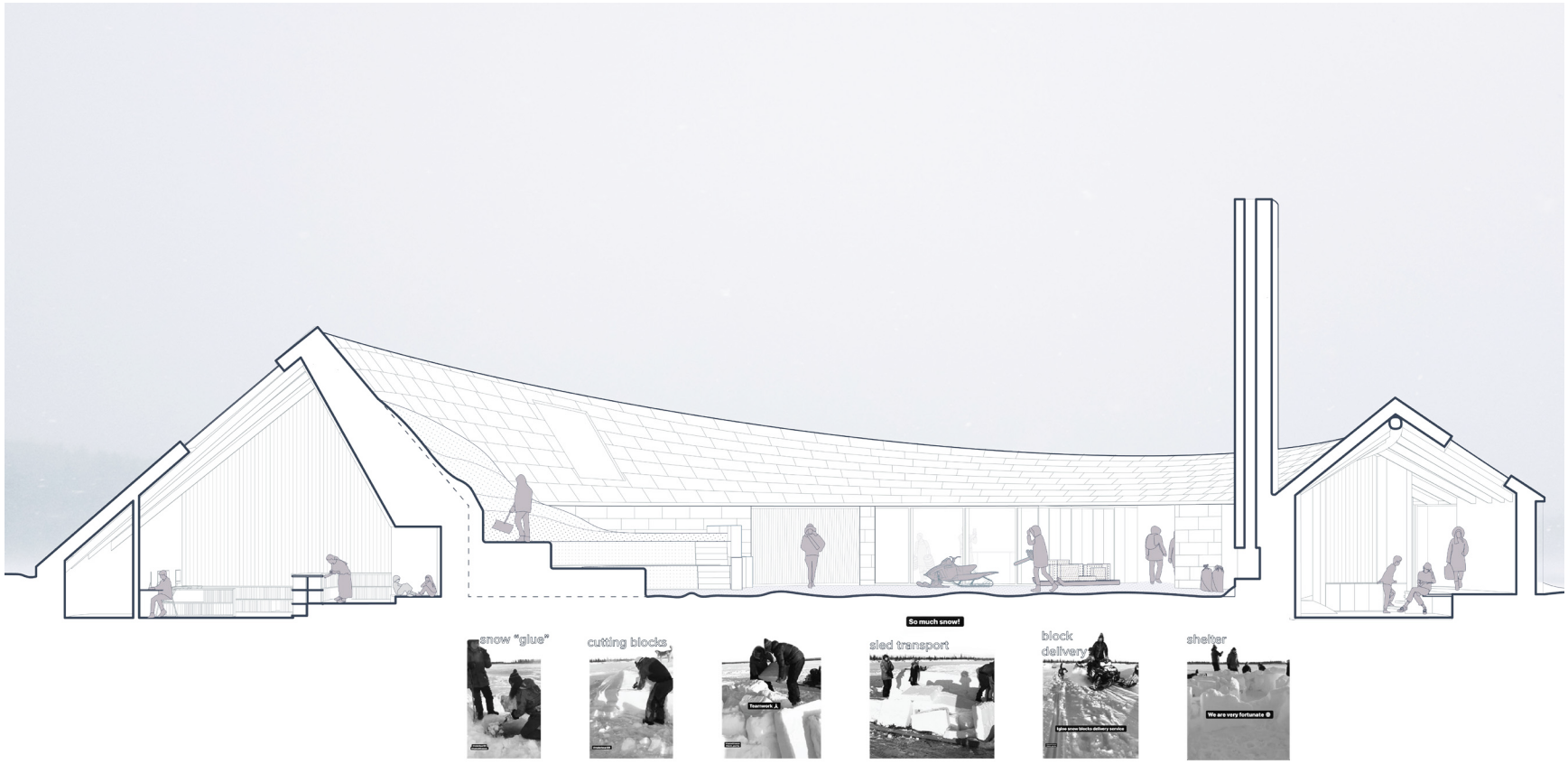
As winter progresses the interior courtyard is an active register of snow, as snow is transported over the building and deposited in the courtyard.

This registration of climate further articulates the duality between traditional knowledge and ways of knowing, and western technology and science. Shaping, inhabiting, and studying snow engages climate research and monitoring (snow, wind, sampling) with traditional story and building techniques that continue to serve community identity and relationship with land.

Changing Seasons

During the winter, as centre sculpts and registers snow in the courtyard, occupiable space grows. The packed snow becomes a primary space for gathering, as snow block can be carved out wind packed snow areas using chainsaws, the blocks are then brought in the courtyard allowing for creative agency in inhabiting the new landscape and celebrating the temporal conditions of winter.

In early January, the community celebrates the sunlight festival. Arctic twilight enters the clerestory and skylight spaces throughout the plan, connecting the visitor to the outside during seasonal change.



Building section from northwest to southeast. February. The lowered roof towards the northwest allows for as snow is transported over the building and deposited in the courtyard. The snow becomes a building material, connecting traditional approaches with contemporary technology and science. Image series at the bottom of the page have been adapted from Tundra North Tours 2022.

During this celebration, the snow packed assembly space and the interior hearth (skylight above) continue to emphasize programmatic methods as spaces of creation, sharing, and storytelling, while positioning the viewer towards the Southeast Arctic sky.

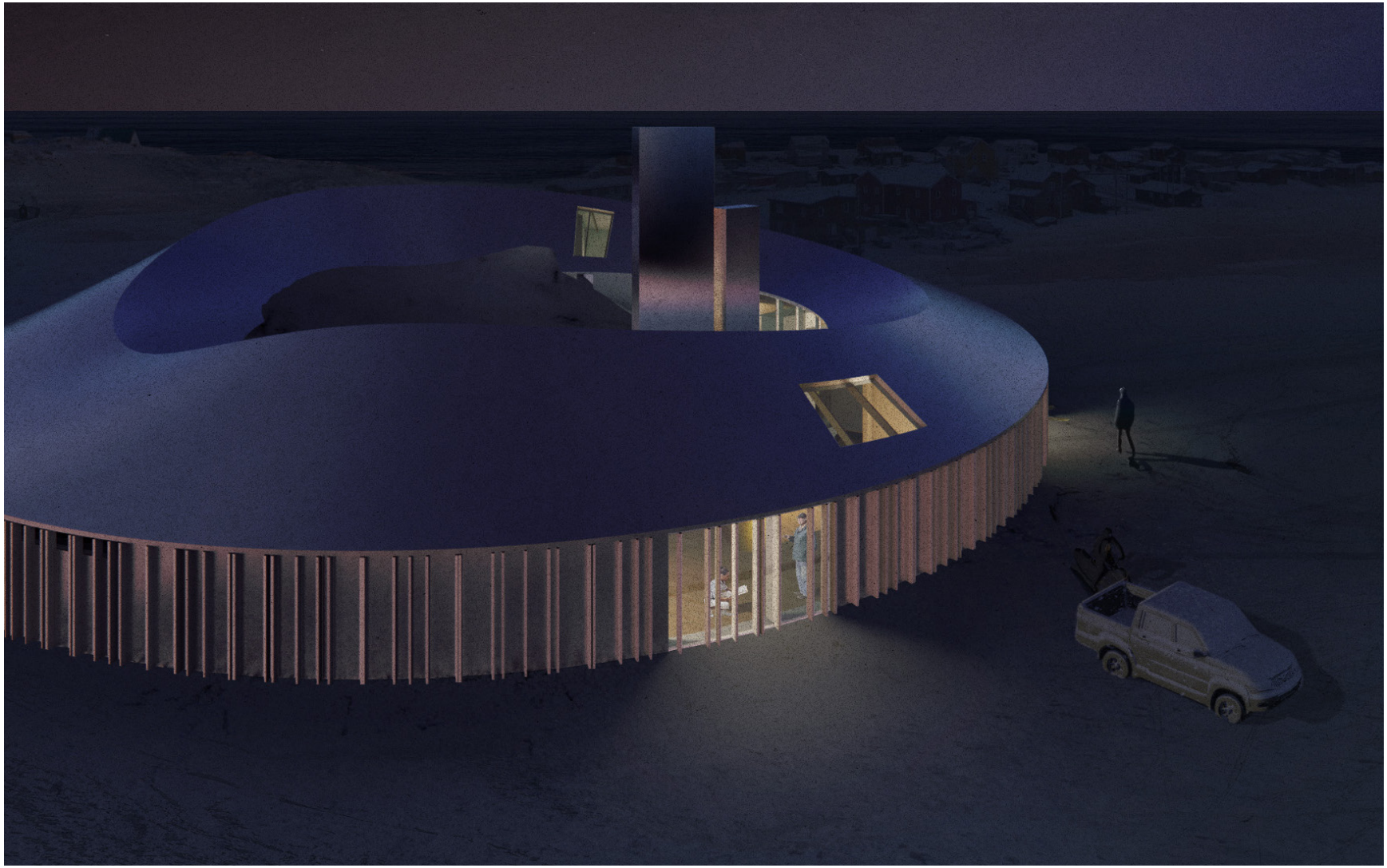
The interior gathering space supports the centres neighbouring buildings (school, craft/learning centres) and is flexible, allowing education activities between youth and researchers, small community ceremony, and display of craft. Hybrid land-based and classroom-based education is part of the local school curriculum and having a space to support those activities is essential for co-learning: developing community-researcher relationships through knowledge translation and collective research activities.

The purpose of this space is to build partnerships outside of a traditional classroom or research lab. This is effectively paired with indigenous approaches of learning from the elders and working with the youth as the youth are the next generation which will carry knowledge to future generations.

Land-Based Research

Landscape is the important part to both the community members and visiting researchers. The greater importance of the centre and the relationships created within, happen in research camps spread around the Mackenzie Beaufort region.

There are over 2000 active research licenses in the Inuvialuit Settlement region (ARI n.d.a). A significant portion are beginning to incorporate principles of traditional knowledge into their proposals and research practices. Dustin Whalen and his team have been working alongside the community



Rendering (south) of the building during winter twilight. The facade mimics the snow, reflecting low Arctic light allowing the roof and chimneys to locate members geographically. The opening of the entry and transparency of the workshop guide members into the centre.

Rendering of the interior gathering space. Community and visiting researchers learn with children from the neighbouring school. Classroom based learning supplements field trips around the Mackenzie Beaufort region. A display of community research engage members in discussion.

of Tuktoyaktuk for the past 15 years, maintaining strong relationships with members and commitment to co-learning and weaving between Indigenous knowledge and Western science. Through this partnership the Tuktoyaktuk Community Climate Resiliency Project has been nominated for an Arctic Inspiration Prize (Arctic Inspiration Prize n.d.). This research project is in response to the climate driven challenges that threaten habitation and community way of life. Local community members lead the team alongside Dustin to ensure the project empowers locals to build and disseminate knowledge through community-based monitoring practices.

An essential component of these community lead projects involves co-learning with visiting researchers. The monitoring and recording of climate data happens throughout smaller camps around the region. These camps collect and relay data back to primary research centres completing the network of data collection and processing.

The research centre provides this connection with other communities and camps as the centre integrates video and web-based technology for community use.

Climate monitoring tools are stored and serviced in the garage space in advance of being sent to their respective locations around the Mackenzie Beaufort region.

The temporary shelter fabricated within the centre (which has similar details to the main structure) provides a space that responds to Indigenous and Western knowledge of mobility, materials, and connection to landscape. Mobilizing these temporary shelters is a critical step for the overlap of Western research and land-based knowledge.

Rendering of the entry through the cutout on the east. Community and visiting researchers prep and load climate monitoring gear which is stored and serviced at the centre into vehicles to be transported to seasonal and temporary research camps around the Mackenzie Beaufort region.

Rendering of the temporary shelters set up at a temporary camp. These camps act as a network with the main research space in Tuktoyaktuk. Materials (small wood members, steel connections, animal hide, solar panel roof) negotiate Indigenous and Western approaches to research.

Chapter 5: Conclusion

Prior to thesis and planning fieldwork in Tuktoyaktuk, I was uncertain of my place in research. As a southerner, I am aware of my position as an outsider and the painful legacy tools of colonization have had on Inuit communities and their land. Now, at the end of this project, I can reflect how this research has changed me personally and professionally as a researcher and emerging architect.

Critical Inuit Studies by Pamela Stern and Lisa Stevenson was influential in shaping my fieldwork and positioning of my thesis topic (2006). A contributor of the book, Peter Kulchyski describes a method of community research of “going there” and “visiting, listening, talking, waiting, assisting mimetically adopting to the extent possible the norms of community life” (Stevenson and Stern 2006, 6). This method was critical in deconstructing my understanding and predominantly western approach to research and directed my process towards more respectful methods.

This involved a great deal of flexibility while in Tuktoyaktuk as my work for thesis didn’t follow a set schedule. As I walked, observed, and shared the reasons why I was in Tuktoyaktuk, community members were evidently curious. This curiosity was shared and was the beginning of building connections with community members through helping them with various activities of fishing and building repair or simply being invited back for dinner or tea or coffee the next day. At times it was challenging, continually being attentive to your surrounding, reflecting, processing, and responding to information. This was outweighed by an incredible warmth of community members in inviting me into their home to share food, personal experience, and Inuit story.

At the beginning of my thesis, my research focused on a dominant institutional ideal of research, studying the scientific and technological conditions of building in the community. Eventually, I re-engaged in Inuit led literature and shifted my focus using Two-Eyed Seeing as a method. I used Two-Eyed Seeing and other Indigenous research methods to reflect and understand the complex social, environmental, and technological conditions of my experience in Tuktoyaktuk. Through Two-Eyed Seeing, I was able to negotiate research from my fieldwork and literature through my own eyes, a dominant institutional world view, and those of an Indigenous worldview. These methods properly ground the research in the community while maintaining a respectful and reconciliatory approach to research.

The design of a research centre creates a space for research, allowing both local and visiting members to collect, process and disseminate research. Through a method of Two-Eyed Seeing, the design incorporates both Western and Indigenous approaches to research in design, creating spaces that engage the eight lessons learned and emphasize co-learning. The core principles of Two-Eyed Seeing focused the design on inclusive programs, offering space that is public and accessible for the community, rooms that allow informal meeting and conversation, a climate and land-based laboratory for processing samples, a range of spaces to display of research through visual presentation, a garage and storage space that engages fabrication and repair alongside technological education, and more.

This thesis presents a preliminary step in building research and design in northern communities; however, we must recognize its place as a small part in a need for projects that further engage the complex social, technological, and

environmental challenges present. To properly respond to site, a deeper comparison of Indigenous research methods must accompany proper consultation with locals. The impacts of climate change are rapidly changing Northern Canada. Solutions must also respond, engaging technology and systems thinking to help communities adapt in place.

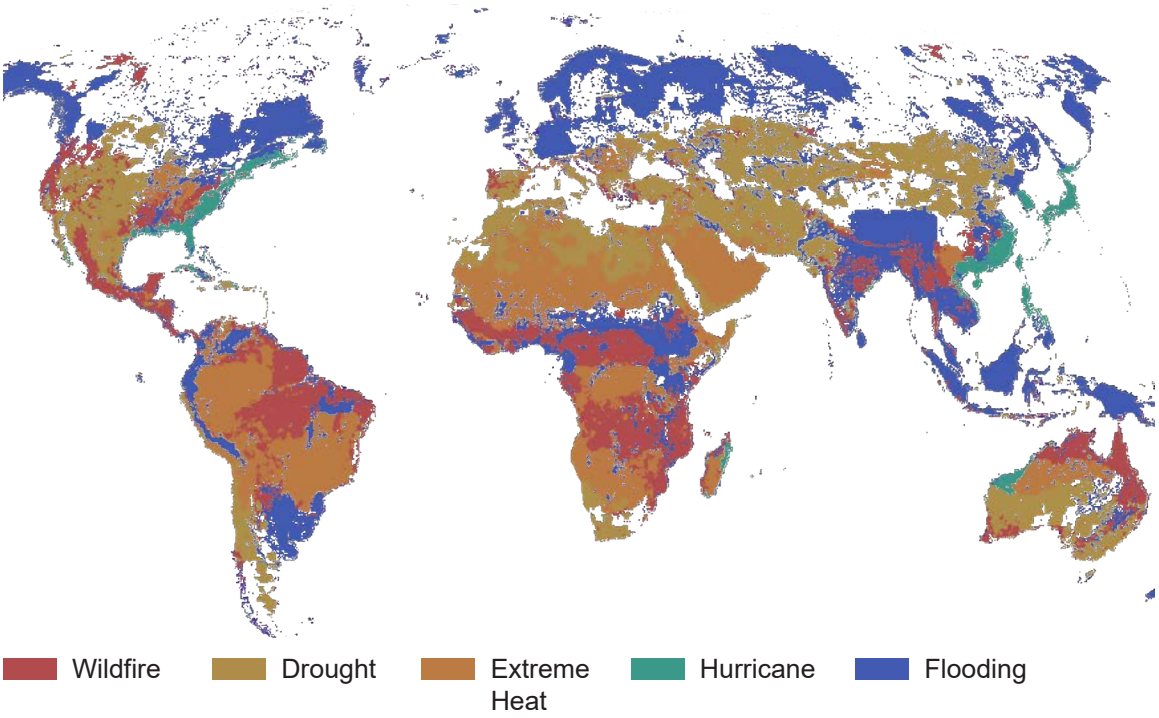
Appendix: Building on Ground

My initial research focused on the elemental architectural situation of the building's relationship to ground. This study emerged from my fieldwork, documenting, and discussing the fragile state of ground that is threatened by the impacts of climate change.

This thesis uses Toma Berlanda's Architectural Topographies to define and categorize the relationship between building and ground. Berlanda describes this as "the physical and material relationship between construction and ground," which can be distilled to three primary situations of "interlock, adjacency, or separation" (Berlanda 2014, 2). The simplification into three primary situations allows us to analyze the different relationships of buildings meeting the ground in certain climate conditions of extreme environments, like the Arctic.

Studying the relationship between building and ground along with a survey of how buildings meet the ground in extreme climates (hot, cold, wet, dry), we learn considerable knowledge of place and can evaluate it on the criteria of how it informs us about local culture, environment, and technology. This elemental architectural relationship also is representative of culture, social systems, economics, life, habitat, etc. of place.

Sketch representations of Toma Berlanda's primary relationships between building and ground Interlock, adjacency, or separation (left to right). 2014

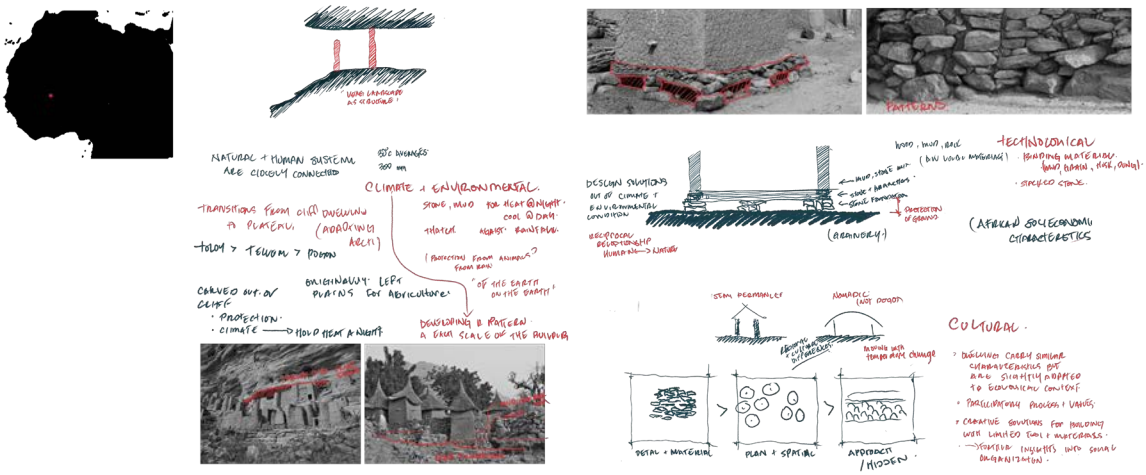


Global climate risk data. Identifying regions that will experience extreme occurrences of wildfire, drought, extreme heat, hurricane or flooding. (Map modified from Boland et al. 2020.)

By studying conditions of vernacular building in extreme climates, we learn considerable knowledge of place and can evaluate it on the criteria of how it informs culture, environment, and technology. Select examples of this study are as follows:

Eastern Mali

In eastern Mali, the Dogon people have adapted to their landscape conditions of the plateau, cliff and plain. The buildings have evolved from in the ground (interlock) to on the ground (adjacency) over centuries. Through studying the different ground conditions, we can understand primitive concepts in protection and shelter from climate and their environment, cultural identification of program and values, and knowledge of technological solutions of materials, adaptation, and repair.



Notes on Dogon country vernacular building practices. Field Study of the World 2019.

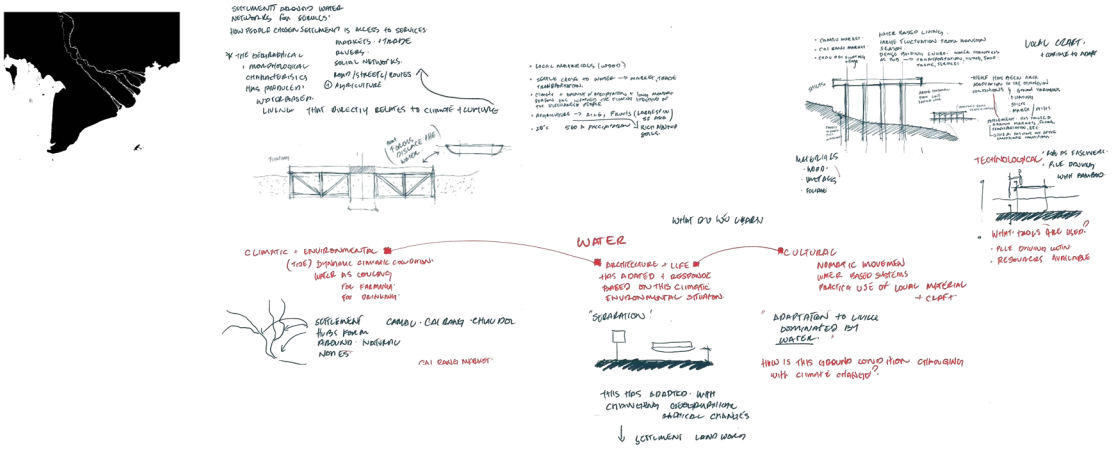
Mekong Delta

In the Mekong Delta (southern Vietnam) the low-lying geography, natural conditions, and tropical monsoon climate have produced water-based communities and an architectural condition of separating the building from the landscape. Along the delta at several river junctions, houses are floating or on stilts to protect against changing water levels while maintaining access to the economic and cultural benefits of the rivers (transportation, farming, social, markets, etc). This separation of building and landscape further reveal elements of the social systems present (in terms of food, trade, and transportation) and technological concepts of bracing and water as cooling.

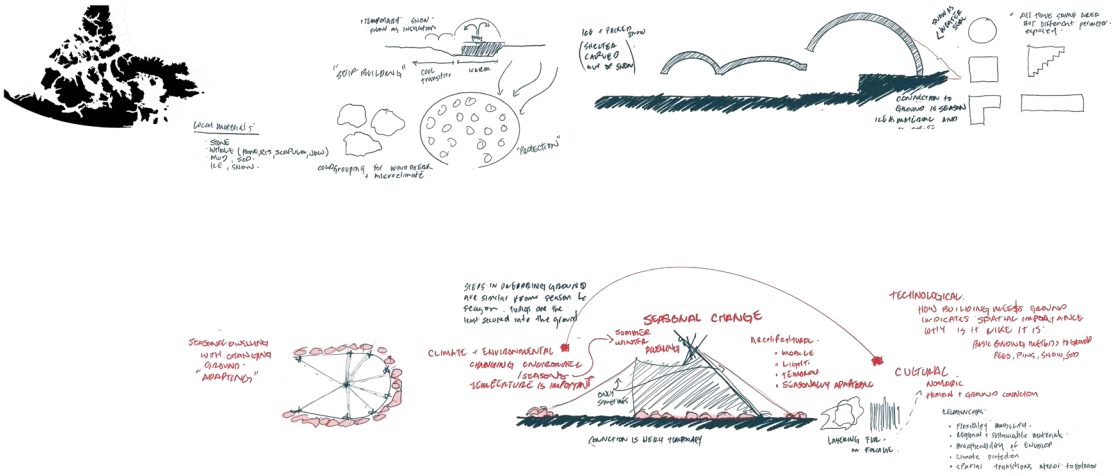
Arctic

In the Arctic, seasonal change defines ground and how local populations interact and inhabit landscape.

The types of building and ground conditions align with this seasonality and change of environment. The variation



Notes on Mekong delta vernacular building practices.



Notes on Arctic vernacular building practices.

of ground conditions teaches us about the temporality, and close relationship between culture and landscape. Landscape to building relationship of structures that are in the ground (interlock) vs on the ground (adjacency) indicate technological knowledge of insulating and protecting space from the environment.

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