# Strategic planning scenarios for Salluit, Nunavik
# Future visions based on geomorphological hypotheses

*What if housing were designed to bring people together in a solidary habitat?*


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INTRODUCTION / The development of the community of Salluit faces major geomorphological constraints, such as a rugged topography, ice-rich permafrost, and a generalized depletion of gravel pits. Thawing of the permafrost is a direct consequence of climate change and has impacts on the ground and, consequently, on the integrity of building foundations. Salluit's relatively high population growth rate, paired with overpopulation and the inadequacy of most existing dwellings, also implies **a pressing need for adapted and culturally sensible housing and infrastructure.**

GOALS / This thesis project is a collaborative work involving two urban design master's students from the School of architecture and one master's student in geography. Our main goal was to **imagine a wide range of planning scenarios that would lead to specific long-term, realistic, "strategic" land uses for the planning of Northern villages**.

METHODOLOGY / A main part of the process was to build a **graphical tool that would facilitate collaborative work sessions around planning** (See «Hypothesis & planning tools» section). This tool aims to represent these planning scenarios based on the main issues of the village of Salluit. **As a preliminary application of this method, various meetings with the key planning bodies helped identify some urgent needs for the community.** In this regard, the one strategic planning scenario developed was oriented towards pragmatic concerns, namely the geomorphological hypotheses. It also had to illustrate how **a denser urban form could efficiently delay the imminent saturation of the village's constructible areas**, while simultaneously enhancing the quality of living spaces. (See «Proposition» section)

OUTCOME / The expected outcome of this collaborative project was the elaboration of a sustainable planning scenario for Salluit and the modelling of the complexity of urban design in Nunavik villages, which would result in **a planning tool for further collaborative or participatory processes.**

## COLLABORATION WITH THE SALLUIT COMMUNITY

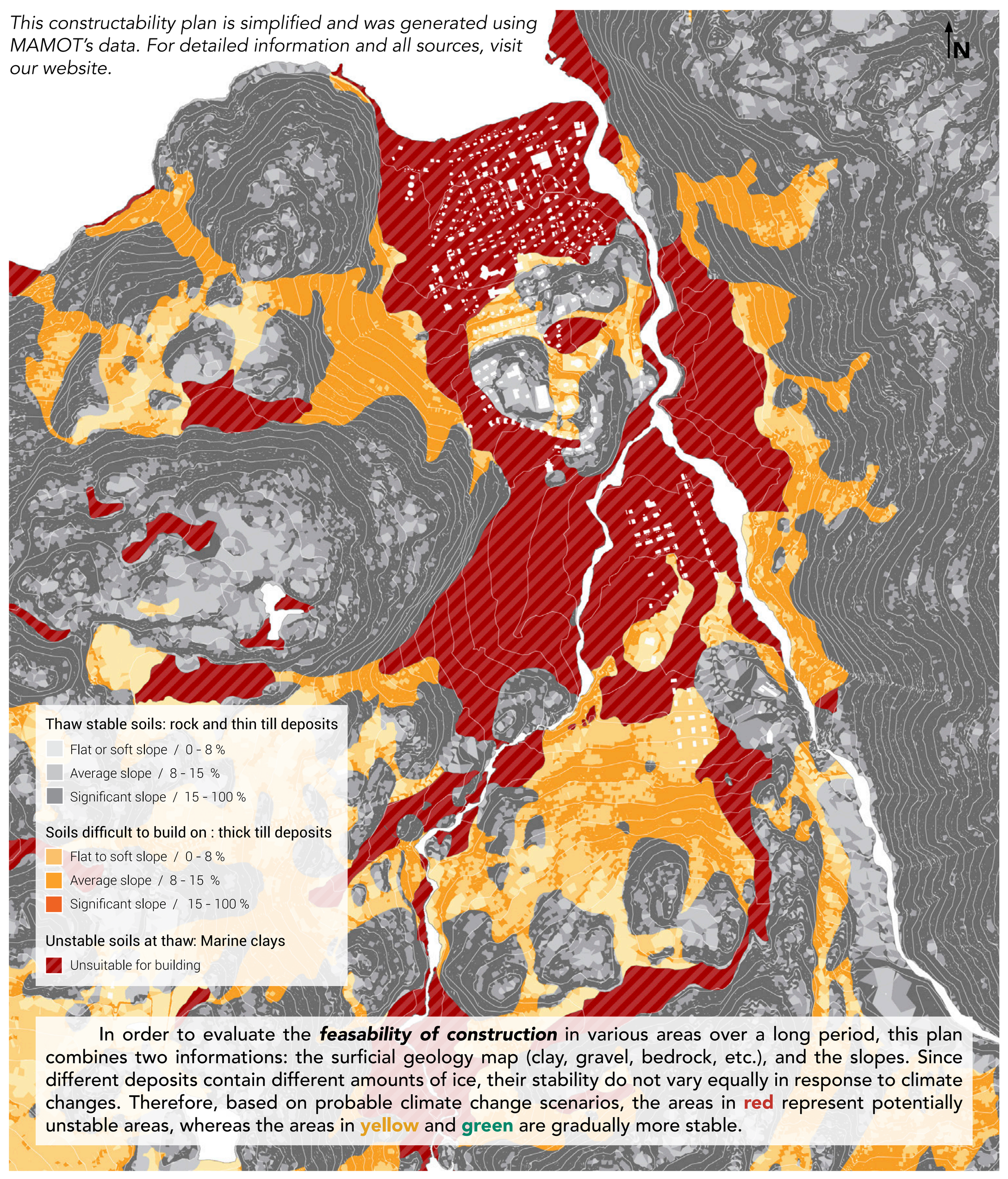
*August 2018 - Meeting with representatives from the Northern Village (N.V) in Salluit*
*From left to right : Inuluk Papigatuk (N.V), Sarah Gauthier (U.Laval), Susie P. Alaku (N.V), Michel Allard (U.Laval)*

A first meeting with the community took place in April 2018. The aim was to present the first scenario explorations to the inhabitants informally (at the coop store), but also to the land use planing stakeholders (Land holding, Kativik Regional Government (KRG) and representatives of the northern village (N.V).

During this 2nd meeting (photo above), the outcome of this thesis project was returned to the community in order to continue this joint discussion around the future of Salluit.

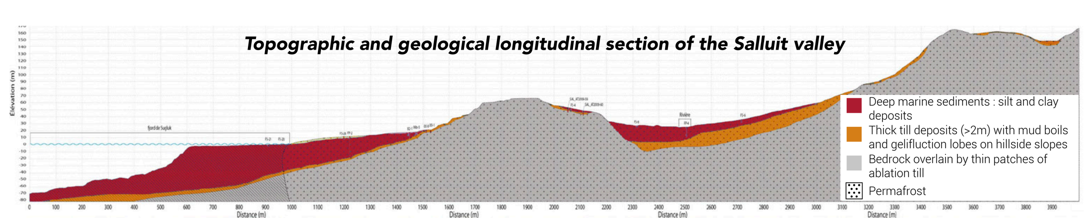
## GEOMORPHOLOGICAL AND CONSTRUCTION CONSTRAINTS

*This constructability plan is simplified and was generated using MAMOT's data. For detailed information and all sources, visit our website.*




In order to evaluate the ***feasability of construction*** in various areas over a long period, this plan combines two informations: the surficial geology map (clay, gravel, bedrock, etc.), and the slopes. Since different deposits contain different amounts of ice, their stability do not vary equally in response to climate changes. Therefore, based on probable climate change scenarios, the areas in **red** represent potentially unstable areas, whereas the areas in **yellow** and **green** are gradually more stable.

***Topographic and geological longitudinal section of the Salluit valley***




*Modified document from (p.4): Allard, M., L'Hérault, É., Giberyen, T. et Barrette,C., 2010, L'impact des changements climatiques sur la problématiquede la fonte du pergélisol au village de Salluit, Nunavik : S'adapter et croître., Centre d'études nordiques,Université Laval, rapport au Ministère des affaires municipaleset de l'occupation du territoire du Québec., 53p.*
*(Colours and captions have been modified for the purposes of representation and legibility of this poster)*

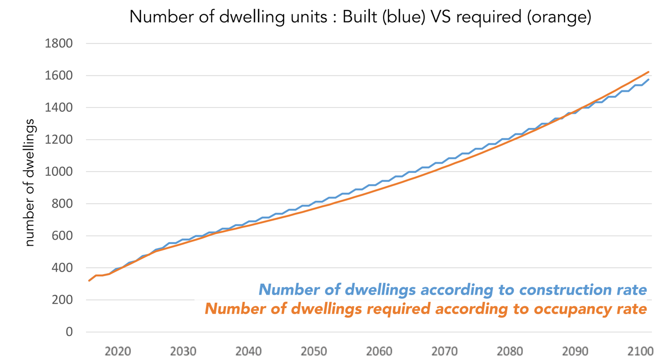
## DEMOGRAPHIC FORECAST

**General**
Population 2016: 1501 habitants (hab.)
Number of dwellings 2016: 320 logements (log.)

**Growth indexes**
Until 2035: [illegible] %
Until 2050: [illegible] %
Until 2070: 1.5 %
Until 2100: 1.5 %

**Construction**
Frequence: 2 ans
Number: 20 logements (log.)
Max number per year: 20 logements (log.)
Increase factor per year: 1.0075

Number of dwelling units : Built (blue) VS required (orange)




| Horizon | | Population | | | | Logements | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ajoutés / an | | | | | Selon objectif de taux d'occupation | | | | |
| Année | | Taux de croissance global | Population | ΔPop par phase | ΔPop 2018 | Programme de base (par phase) | Avec subvention (par phase) | Nombre total de logements | ΔLog. p/r 2018 | Taux d'occup. | Ajouts par phase pour ΔPop | Ajouts global | Nombre total de logements | Taux d'occup. | Rouge : déficit du réel |
| | | % | hab. | hab. | hab. | log. | log. | log. | log. | hab./log. | log. | log. | log. | hab./log. | log. |
| 2035 | 15 | 2.30 | 2312 | 741 | 741 | 169 | 100 | 621 | 269 | 3.72 | 255 | 255 | 14 | 13.86 | 617 |
| 2050 | 30 | 1.95 | 2891 | 579 | 1320 | 191 | 0 | 812 | 460 | 3.56 | 154 | 409 | 11 | 11.39 | 771 |
| 2070 | 50 | 1.78 | 3893 | 1003 | 2323 | 272 | 0 | 1084 | 732 | 3.59 | 267 | 676 | 15 | 15.34 | 1038 |
| 2100 | 80 | 1.68 | 6086 | 2192 | 4515 | 491 | 0 | 1575 | 1223 | 3.86 | 585 | 1261 | 24 | 23.98 | 1623 |

## TIME LINE

This timeline projects the average state of ***permafrost*** in the village, based on a realistic climate change scenario. Other projections include ***population growth*** and ***dwellings built*** in the studied area, at various rates.

**2010**

2016
Average air temperature: –5,1°C to –3,9°C
Average precipitations: 400mm to 452mm
Active layer depth: 1,3m

Population: 1571
Number of dwellings: 431

**2020**

**2030**

2035
Expected population: 2300
Growth rate: 2,3%

2036 – 2048
VILLAGE SATURATION WITH CURRENT DEVELOPMENT MODEL
If its density is as per existing, the studied area can hold ~340 dwellings.

**2040**

2050
Average air temperature: –4,2°C to –2°C
Average precipitations: 409mm to 495mm
Thaw settlement: up to 30 cm
Permafrost temperature at 5m depth: –3°C

Expected population: 2900
Growth rate: 1,5%

**2050**

**2060**

**2070**

Average air T°: -3,2 to +1,4°C
Average precipitations: 422mm to 550mm
Active layer depth up to 1,6m
Thaw settlement up to 60 cm
Permafrost temperature at 5m depth: -2°C

Expected population: 4300
Growth rate: 1%
2080

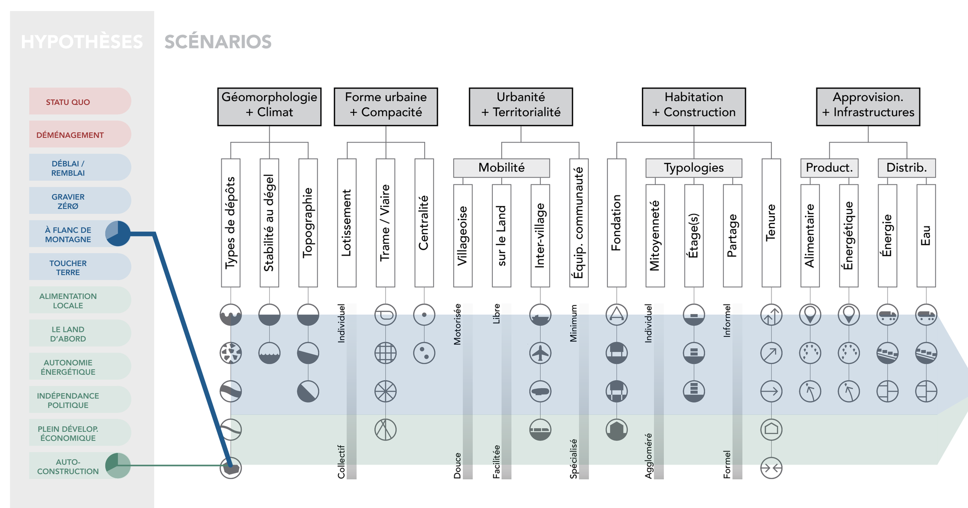
2078 – 2100 +
VILLAGE SATURATION WITH PROPOSED SCENARIO
If its density is as per the project, the studied area can hold ~1030 dwellings.

**2080**

**2090**

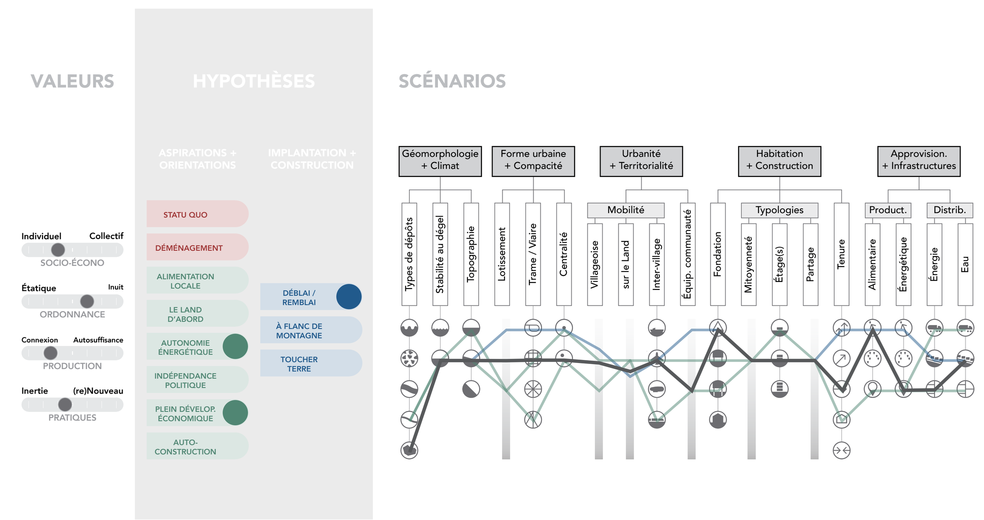
Climate projections by Leblanc, 2013. Predictive modelling of permafrost temperature and active layer depth by Allard et al., 2010; Leblanc, 2013.

## HYPOTHESIS & PLANNING TOOLS



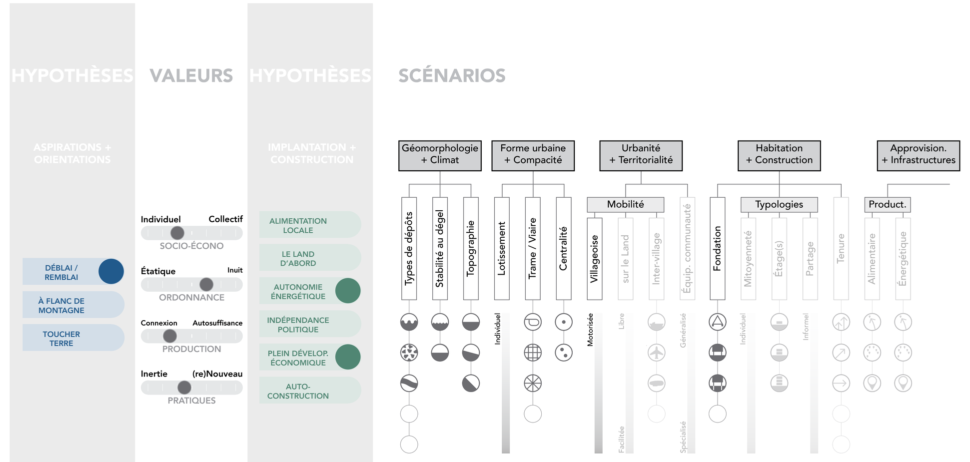

This section illustrates 3 iterations of the planning tool. That tool identified **five major domains of reflection – geomorphology, urban form, urban experience, construction, and infrastructure –** which were further broken down into "planning variables".

These **variables** were then allowed to vary based on realistic or idealistic hypotheses, which were either geomorphological or sociocultural in nature. Therefore, a "scenario" would result from the combination of hypotheses, which, graphically, could be illustrated as a "trajectory" through the "planning variables".




In this iteration, tendencies (or «design values») precede the formulation of assumptions. They can be expressed in a participatory process. **Social or cultural assumptions** precede **geomorphological or constructive assumptions.**

Each hypothesis of the combination traces its trajectory. This results in appropriate value fields for the variables, in which a complex scenario is plotted.



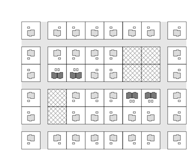

In this last iteration, **Geomorphological and constructive aspects** are prioritized since the development of certain sectors is inevitable in the near future.

This pragmatic approach optimizes the occupation of development sectors, and establishes the bases (forms and urban functions) that can subsequently support various aspirations.

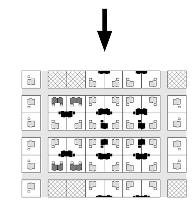
## PROPOSITIONS

### Proposition 1: A Compact Environment

The ***Compact Environment*** proposition is a simple short-term solution to the scarcity of gravel. Since most existing houses are built on adjustable screwjacks, on pads, it could be possible to move them closer to the streets. This could free some space to build small dwellings in between (for family members, for instance), which could then share the lots for storage and daily activities.

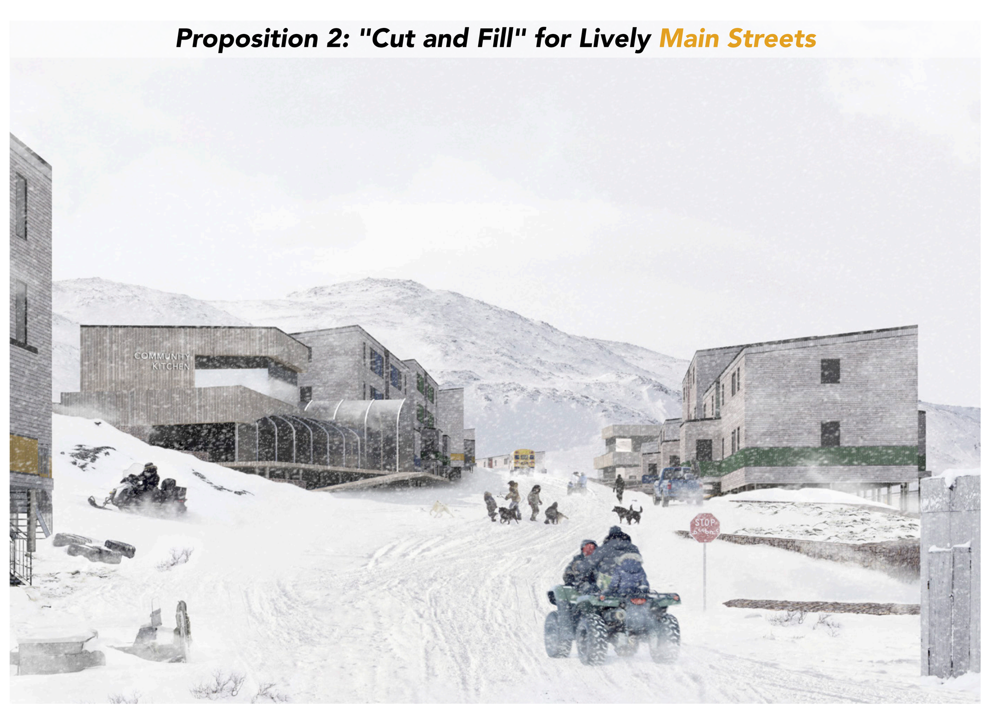


SALLUIT 1 : TYPICAL MODEL
**8,5 dwellings/hectare**



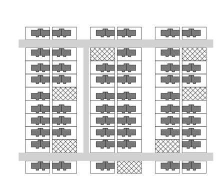
COMPACT ENVIRONMENT
**13,3 dwellings/hectare**

### *Proposition 2: "Cut and Fill" for Lively Main Streets*



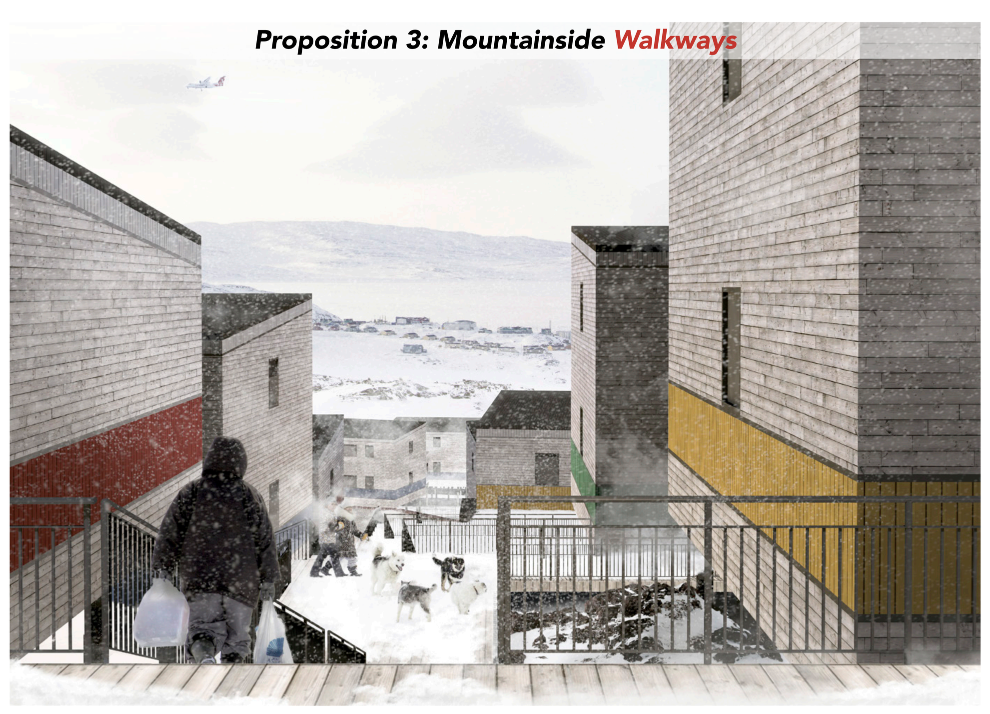
The ***Cut and Fill*** proposition applies to areas of till deposits, where the bedrock is at a depth of only a few meters. The shallow excavation of stone, gravel and sand can free up just enough materials to be used as backfill for main streets.

It is then possible to "sculpt" carriageways in uneven terrain, perpendicular to the slopes. The resulting streets could support trucking (which can feed partial Utilidor systems) and all other means of transportation. Most importantly, these wide spaces are ideal for large constructions, such as community facilities, stores and appartment buildings for young adults. Because the bedrock is close to the surface, these buildings could be built on piles, which further reduces the need for gravel.



CUT AND FILL + MONTAINSIDE
**28 dwellings/hectare**

### *Proposition 3: Mountainside Walkways*

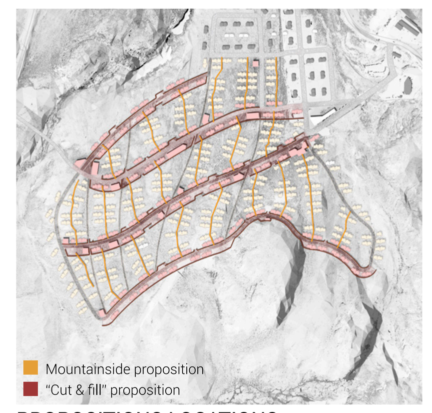


The ***Mountainside Walkways*** proposition takes advantage of Salluit's typical sloped terrain for the downhill distribution of services (water and fuel), which can be done through shared networks (such as Utilidors) under short walkable platforms.

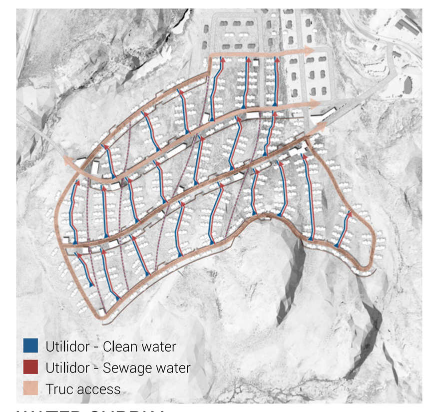
These connected platforms allow access to all dwellings on foot, and give rise to interesting sheltered spaces, for shared storage or personnal use around the houses. Since these structures and houses can be built on piles as well, it eliminates the need for gravel. In turn, this preserves plenty of naturel ground on the lots, which provide individual access to all dwellings as well.

By developping a «thin» type of house (which can sit confortably on slopes) with a varying number of storeys, it is possible to produce different densities. This can accomodate for different preferences and family sizes – see house plan at the bottom right of the poster

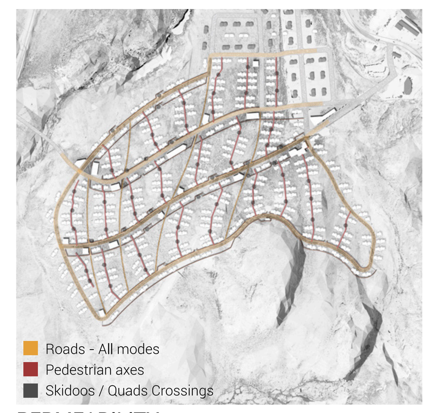
## SALLUIT 2078



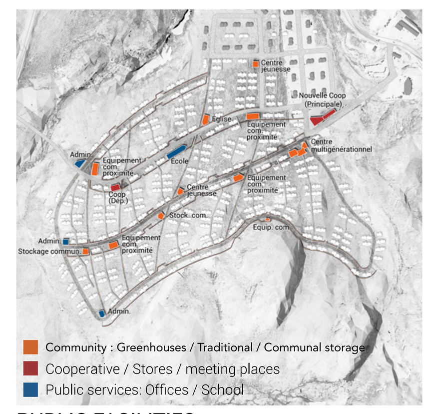

PROPOSITIONS LOCATIONS



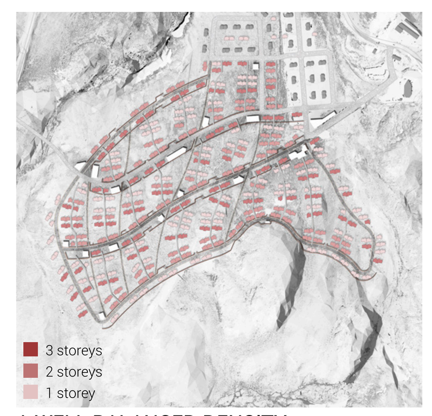

WATER SUPPLY



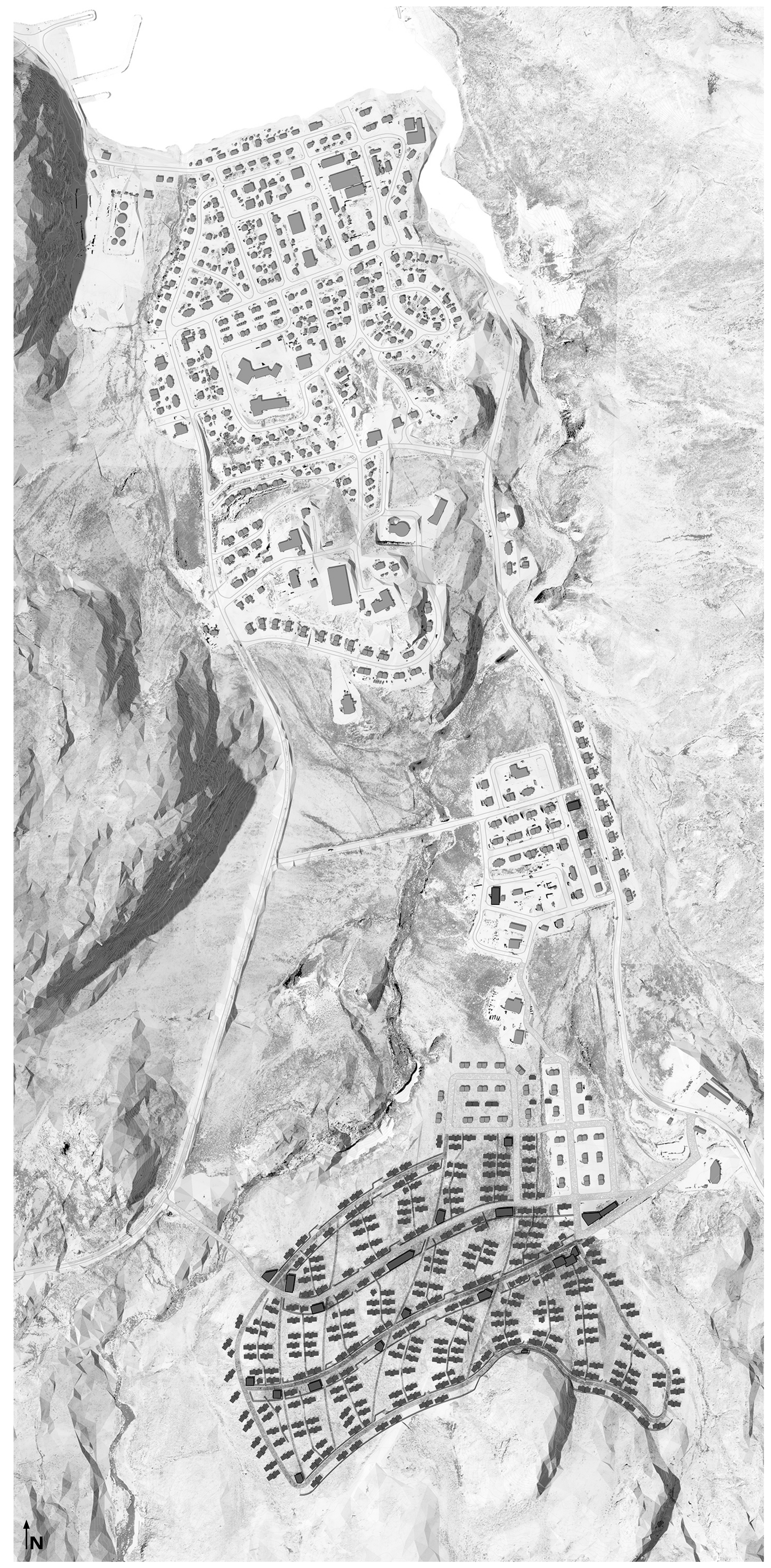

PERMEABILITY




PUBLIC FACILITIES



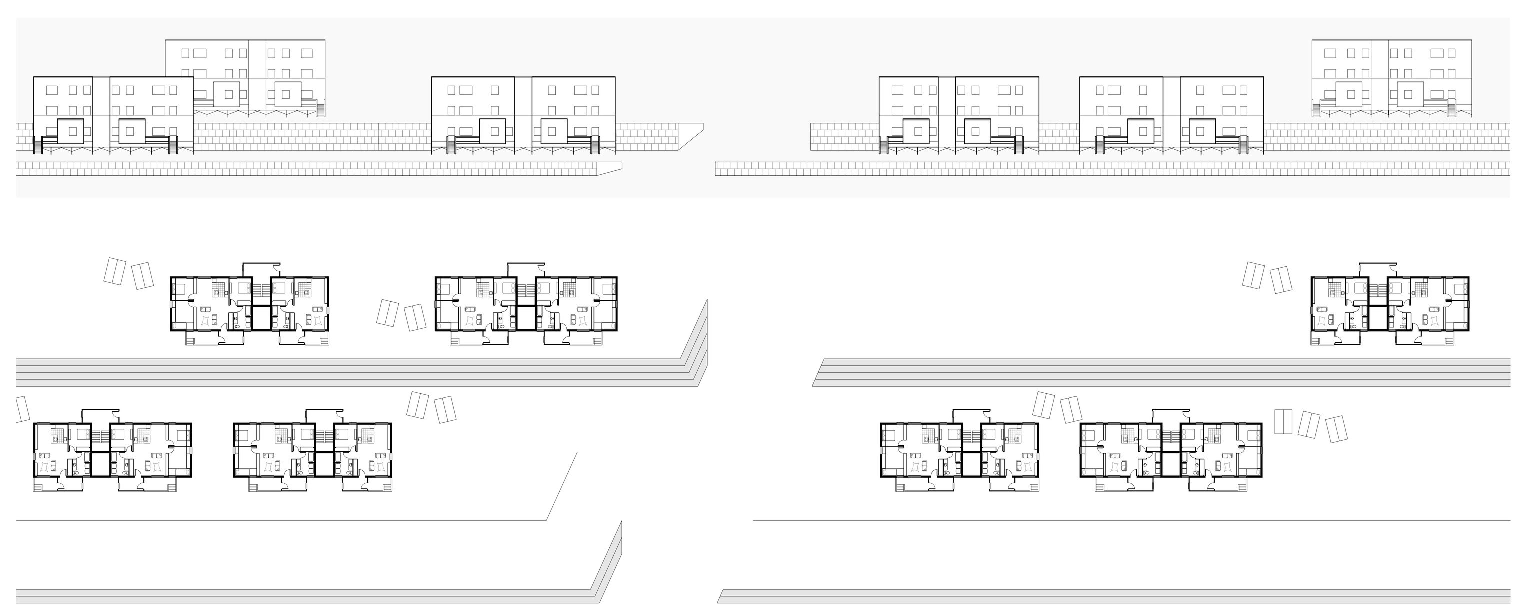

A WELL BALANCED DENSITY



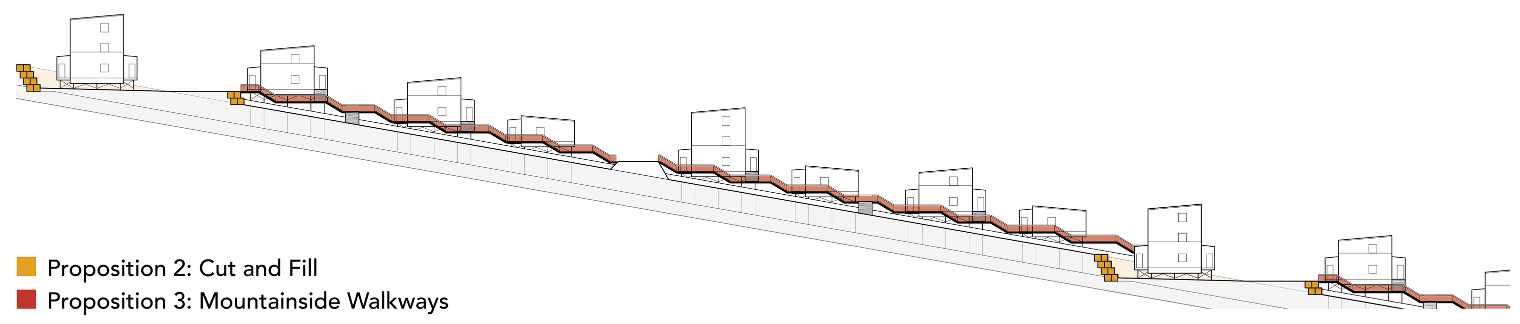

This plan projects the development of Salluit over a 60-year period on a 37 hectare area, on the south side of the village. It applies alternative ways of building on bedrock and light slopes, with intersecting ***main streets*** and ***walkways***.

The main difference with the current development model is the density: the houses are arranged in close-knit, solidary clusters. In total, using this method, the studied area could house up to 1030 dwellings. This is about three times more than is possible with the current construction and planning methods.

## CUT AND FILL - DETAILS



## MOUNTAINSIDE - DETAILS





**Sources used in document :**

Allard, M., E. L'Hérault., T. Gibéryen et C. Barrette (2010). L'impact des changements climatiques sur la problématique de la fonte du pergélisol au village de Salluit, Nunavik. Rapport final : Salluit : s'adapter et croître. Rapport produit pour le Ministère des Affaires municipales et occupation du territoire du Québec, Centre d'études nordiques, Université Laval, Québec, 53 p.

Mathon-Dufour, V., Sarrazin, D., Allard, M., L'Hérault, E. et Aubé-Michaud, S. (2016) Suivi climatique et géothermique au village de Salluit : Mise à jour des données climatologiques et géothermiques de 2013 à 2015. Rapport produit pour le Ministère des Affaires municipales et occupation du territoire du Québec, Centre d'études nordiques, Université Laval, Québec, 47 p.

Leblanc, A. M. (2013) Modélisation tridimensionnelle du régime thermique du pergélisol de la vallée de Salluit au Québec nordique en fonction de différents scénarios de réchauffement climatique (Thèse de doctorat, Université Laval, Québec, Canada)