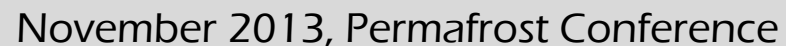


ΔΗΛΩΣΗ ΣΥΜΜΟΧΗΣ



4D Visioning for Climate Change Decision-Making in Clyde River, Nunavut

ΔΗΛΙΓΔΥ ΒΨΙΓΨΙΛΛΨ ΠΨΘΨΒΨΨΛΨ



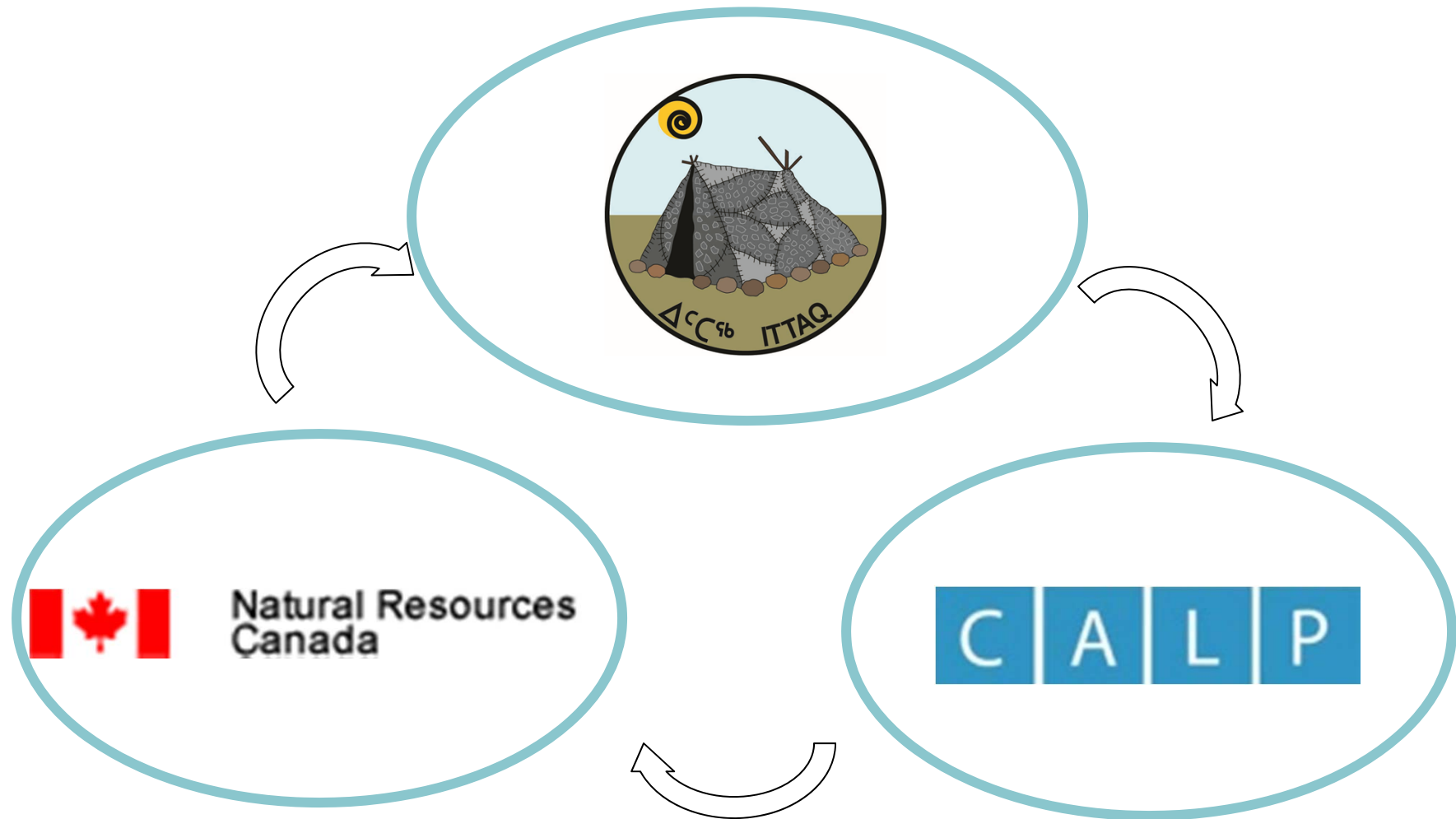
Gordon Kautuk, Ittaq Heritage & Research Centre
Ellen Pond, CALP, UBC and the Pembina Institute



November 2013, Permafrost Conference



A partnership...



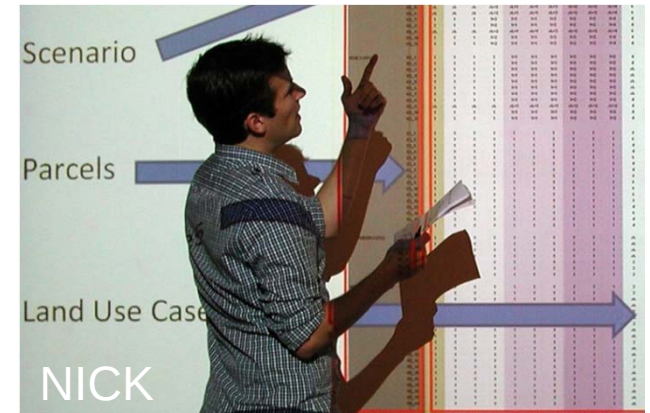


What is Ittaq?

A community-led initiative of the Ilisaqsivik Society in Clyde River, Nunavut



$\rho_{\alpha}^b d\Delta C \triangleleft^L L \triangleright \rho_{\beta}^c d\Delta C \triangleright^R b^c C^c \wedge C$
CALP, UBC



Local Climate Change Visioning

- A flexible process for understanding and planning around climate change
 - Spatial and holistic
- ᐃᓴᓂᓄᓚᐅᑦᑐᓂ ᐱᑕᓚᓪᔨᓯᓴᓂ
ᑐᓯᓯᓪᐅᓴᓴᐃᑭᓂᓇᓂᓴᓪᐅᓴᑦᑐᑭ ᐊᒻᒪᑐ
ᐸᓴᓇᐅᓯᐅᓯᓂᓇᓴᑦᑐᓯᑕ ᓯᑕᐅᑦ
ᐊᓯᓪᐸᑦᑕᐊᓂᓴᓚᓂᑕ.
 - ᐱᐃᓴᓂᑕᓂᐊᓴᓂᑐᓴᓂ
ᓇᓚᓯᒪᑦᑐᓂᑐ.



Critical Components

ኅፍፃሚናፍጥፍጥ

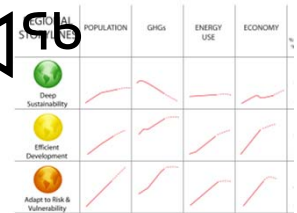
1. Participation

1. ለኅፍፃሚናፍጥፍጥ



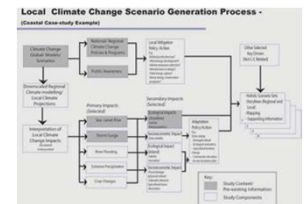
2. Scenario Building

2. ኅፍፃሚናፍጥፍጥ
ጋፍ ለኅፍፃሚናፍጥፍጥ



3. Data Integration

3. በኅፍፃሚናፍጥፍጥ
ፈጠራ ለኅፍፃሚናፍጥፍጥ



4. 3D and 4D Visualizations

4. ርዕሰ ስራ ለኅፍፃሚናፍጥፍጥ



ΔΗΛΑΡΩΣΗ ΣΧΕΔΙΑΣΜΟΥ ΓΙΑ ΤΗΝ ΕΛΠΙΣΤΕΡΗ Thinking about Clyde River in the future



Natural Resources
Canada



David Flanders, Ellen Pond
July 2011, Final Scenarios Presentation

C A L P

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Listening to the Community, March 2010

Landscape

Hazards

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Listening to the Scientists, March 2010

Landscape Hazards

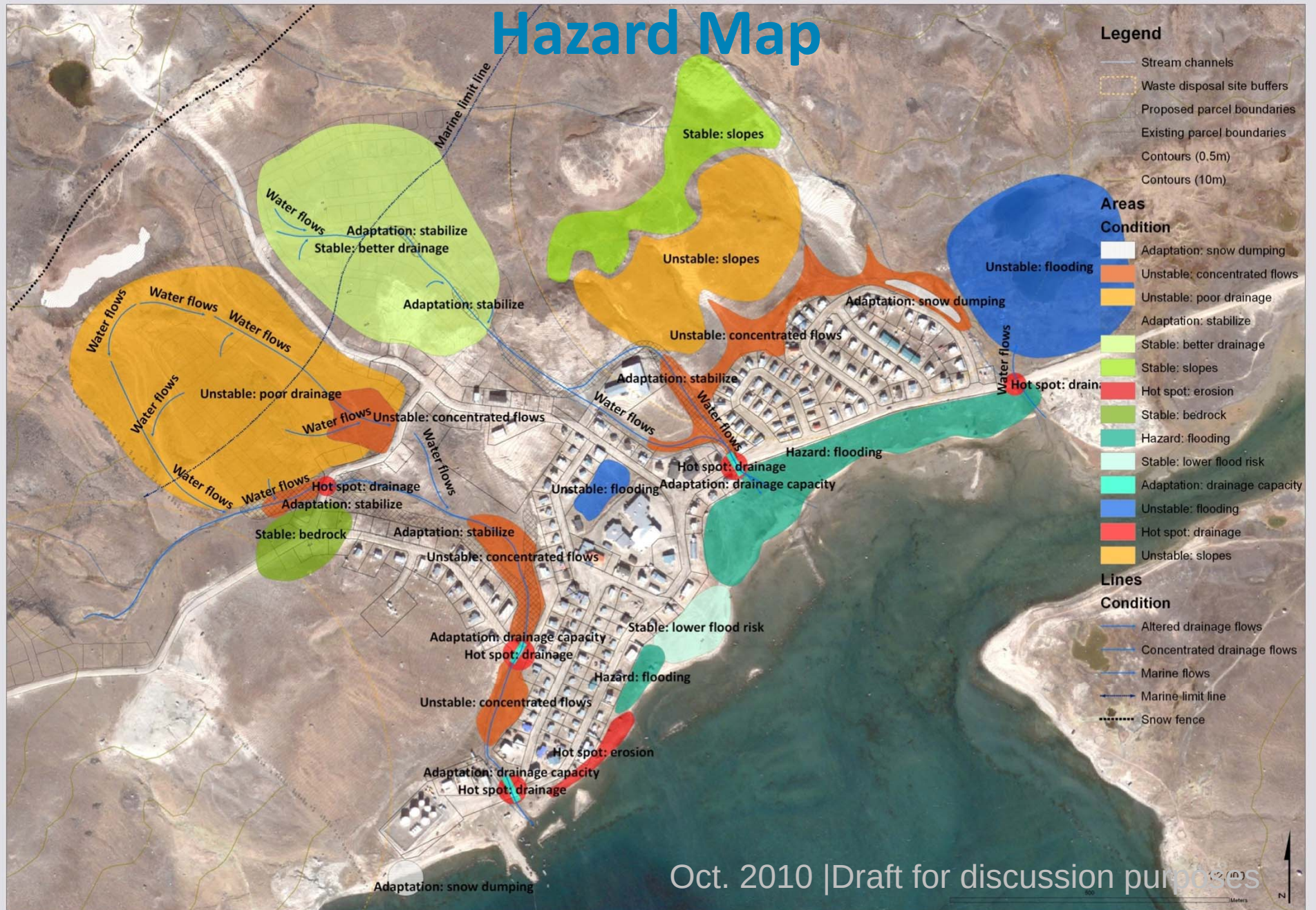
001 $\Delta^c C_0^s \sigma^s r^c$



Photo: Tanuja Kulkarni, INAC

►ⵓⵎⵓⵔⵉⵏⵉⵔ ⵎⵓⵙⵓⵔⵉⵏⵉⵔ

Hazard Map



Four scenarios, October 2010

▷ ႁႃႃႃႃႃ ႃႃႃႃႃ, ႃႃႃႃ 2010



4 issues

1. landscape hazards

2. housing

3. walkability

4. energy

4 scenarios



Clyde today:

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Surveyed Plan



መደገ ልግግር Landscape Hazards

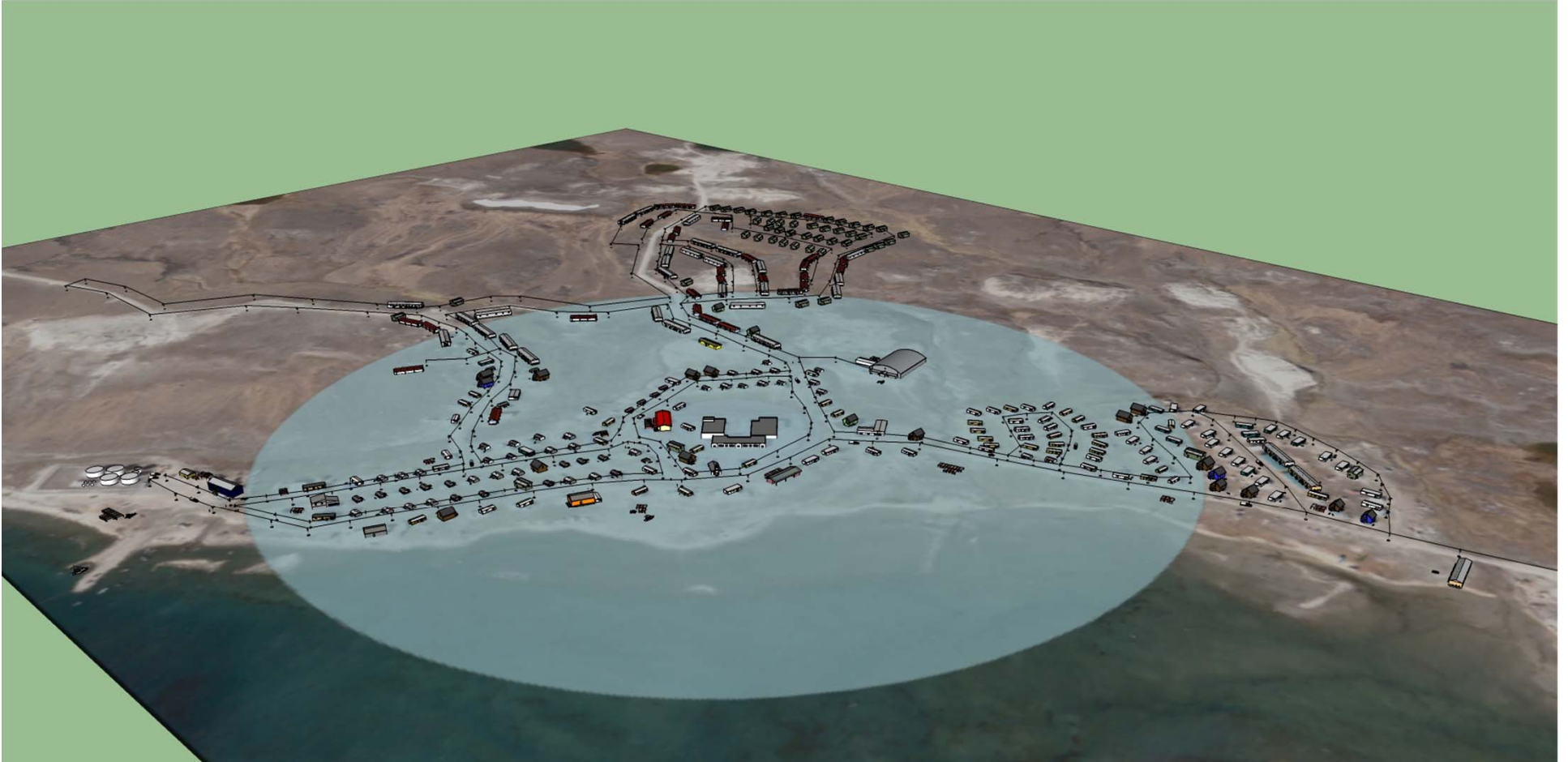


Kappianartok uivarpok (Avoids Hazards)



ᐃᑦᑦᑦᑦᑦᑦ ᑕᑦᑦᑦᑦ ᐱᑦᑦᑦᑦᑦᑦᑦᑦ: ᐱᑦᑦᑦᑦᑦᑦᑦ

Listening to the community: walking



ᑭᓐᓂᓐᓂᓐ
Qanittuq (Close Together)

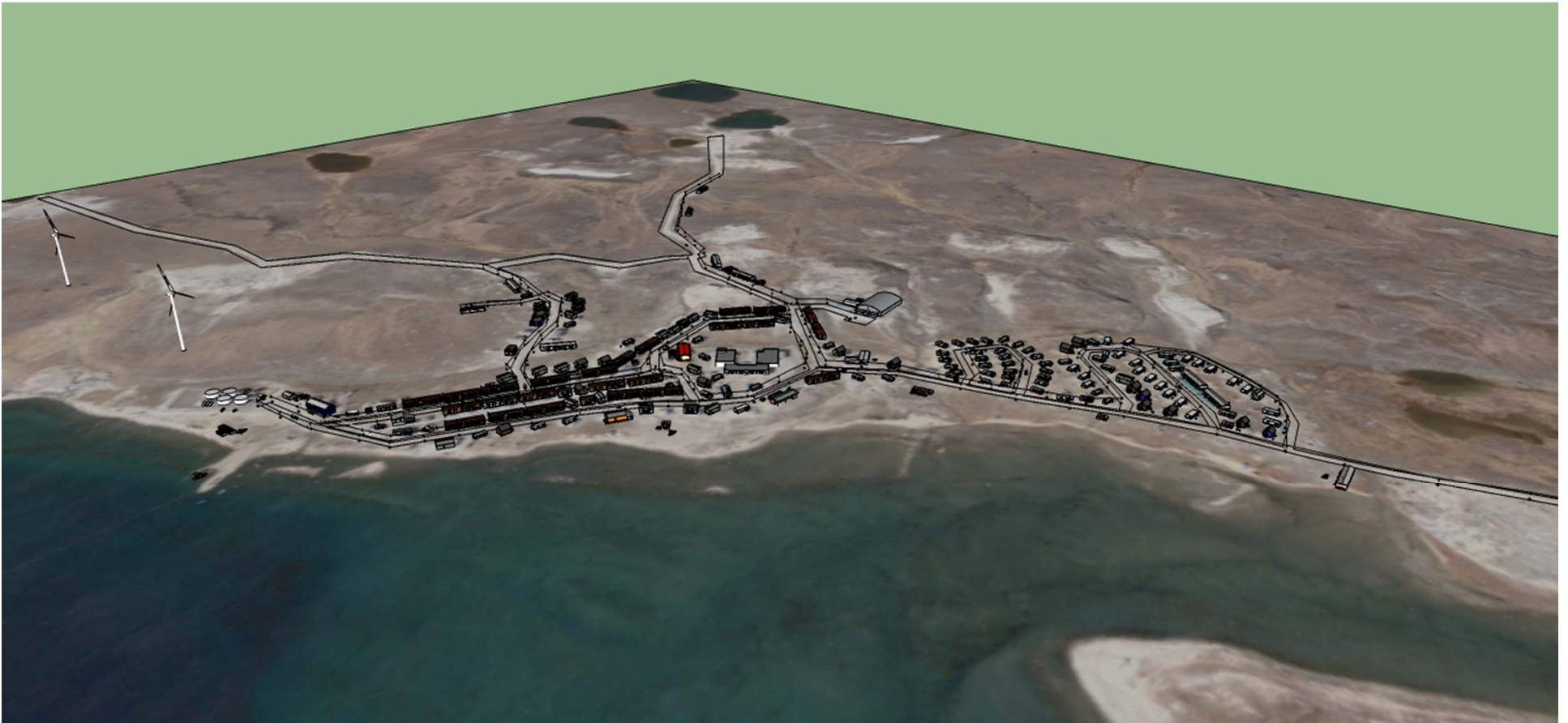


ᑭᓐᓃᓐᓃᓐ

Qanittuq (Close Together)



ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ^c
Sukannaqtumit Nangmini Atusiut
(Towards Energy Independence)



ᐱᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ

Sukannaqtumit Nangmini Atusiut (Towards Energy Independence)



ᐱᐅᐱᐱᐱᐱᐱᐱ ᐱᐱᐱᐱᐱᐱ ᐱᐱᐱᐱᐱᐱ

Sukannaqtumit Nangmini Atusiut (Towards Energy Independence)



We asked: what do you think?

ᑭᓄᑦ ᐃᑦᐱᑦᐱᐅᑦ?

What do you think about the 3D visualizations?

ᑭᓄᑦ ᐃᑦᐱᑦᐱᐅᑦ ᑭᓴᓴᐅᓂᑦ ᓴᓄᐅᐱᑦᐱᓂᑦ? ᑭᓄᑦ ᐱᐅᑦᐱᑦᐱᑦ?

Which did you like best?

ᓄᑦᐱᑦ ᐱᐅᑦᐱᑦᐱᐅᑦ? ᑭᓄᐃᓴᓴ?

What would you change?

ᓄᑦᐱᑦ ᐱᐅᑦᐱᑦᐱᑦᐱᑦᐱᑦᐱᑦ? ᑭᓄᑦ ᐱᑦᐱᑦᐱᑦᐱᐅᑦ?



What did we learn?

“b_oΔ^C ∩ σ^C ΔC “b_b▷δ\ C?

GOVERNMENT

- **Planning:** fire separation; cemetery location; better housing numbers; better population numbers; ownership
- **Buildings:** make Multi-Family more appealing
- **Cost** effective option is Multi-Family with small footprint
- **Energy:** Multi-family and District Energy (DES) would save money; energy independence concept makes sense

١٥٦

- $\langle \sigma^a \Delta \sigma^b \rangle$: $\Delta P^C \mathcal{D} \Gamma^b \triangleleft \delta \Pi^C \Pi \sigma^b$;
 $\Delta \mathcal{D} \delta \triangleright^C \Delta \sigma^b \epsilon \delta \triangleleft$; $\Delta^L \mathcal{D} \Delta^C$
 $\mathcal{Q} \Delta \mathcal{H} \triangleright \Pi^b \Gamma^C \triangleleft \epsilon^b \rho^b \Pi \triangleleft \epsilon^C \mathcal{L} \sigma^b \mathcal{H} \triangleright \mathcal{D} \mathcal{N}$;
 $\triangleleft \Gamma^C \sigma^C \Gamma^C \mathcal{D} \mathcal{Q} \mathcal{L} \Gamma \triangleright \mathcal{C} \Delta^C$
 $\mathcal{Q} \mathcal{D} \mathcal{Q} \Delta^b \mathcal{D} \Pi \mathcal{C}^C \Pi \triangleleft \epsilon^C \mathcal{D} \sigma$;
 $\mathcal{Q}^L \Gamma \sigma^b \epsilon^C \sigma^b$
- $\Delta^C \mathcal{D} \mathcal{D} \mathcal{D} \Delta^L$: $\Delta \mathcal{C} \Gamma^L \mathcal{D}^b \mathcal{L} \mathcal{L} \sigma^C$
 $\mathcal{H} \mathcal{Q} \sigma^b \mathcal{H} \triangleright \mathcal{L}^C \mathcal{D} \sigma$
- $\rho^b \mathcal{Q}^b \mathcal{D}^b \mathcal{D}^b \sigma^b$: $\Delta \mathcal{C} \Gamma \mathcal{D}^b \mathcal{L} \mathcal{L}^C$
 $\Delta^C \mathcal{D} \Delta^C \rho^b \mathcal{Q}^b \mathcal{D}^b \mathcal{D}^b \sigma^C \mathcal{D}$
 $\rho^b \mathcal{Q} \triangleright \mathcal{L} \Pi \mathcal{J}^b \triangleleft \mathcal{D}^b \Gamma^b \sigma^b \mathcal{H} \triangleright \mathcal{L}^C \mathcal{D}$
 $\triangleleft \mathcal{L} \mathcal{D} \rho^b \mathcal{Q}^b \mathcal{D} \Gamma^b \Delta^L \Gamma^b \mathcal{D}^b \mathcal{L} \sigma$
 $\mathcal{D} \rho \mathcal{J} \triangleright \mathcal{Q}^C \Pi \triangleleft \epsilon^C \mathcal{D}^b$



What did we learn?

“b_oΔ^C ∩ σ^C ΔC “b_b▷δ\ C?

COMMUNITY

- **Acceptability** - Do not like Multi-Family (too noisy) so prefer up the hill development
- Need **storage** (ATVs, skidoos, sheds)
- Opportunities for renewables exist up the hill (it's sunnier)

መርህ

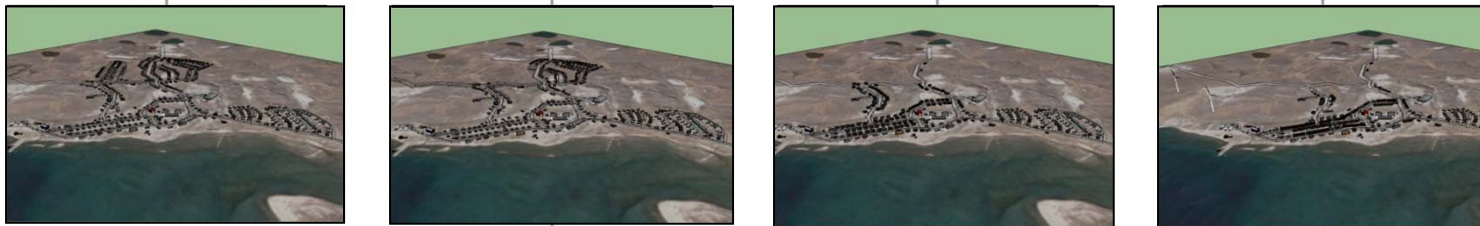
- ላቲን ልብ ወለድ ስርዓት - ለጥንታዊ ስርዓት
 ለጥንታዊ ስርዓት ለጥንታዊ ስርዓት (ጥንታዊ ስርዓት)
 ለጥንታዊ ስርዓት ለጥንታዊ ስርዓት
- የጥንታዊ ስርዓት ስርዓት (ጥንታዊ ስርዓት,
 ስርዓት, ስርዓት)
- ስርዓት ስርዓት ስርዓት ስርዓት ስርዓት ስርዓት
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Revision

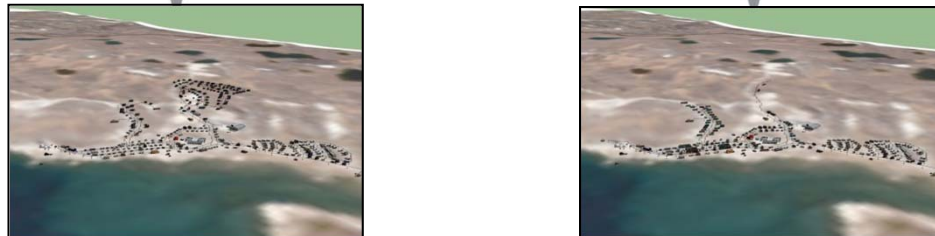
$\Delta^{\epsilon_b} \rho \dot{\rho} \Delta^{\epsilon_r} \mathcal{L} \sigma^c$

4 scenarios



feedback

2 scenarios



Current - L^oQ▷◁^{9b}



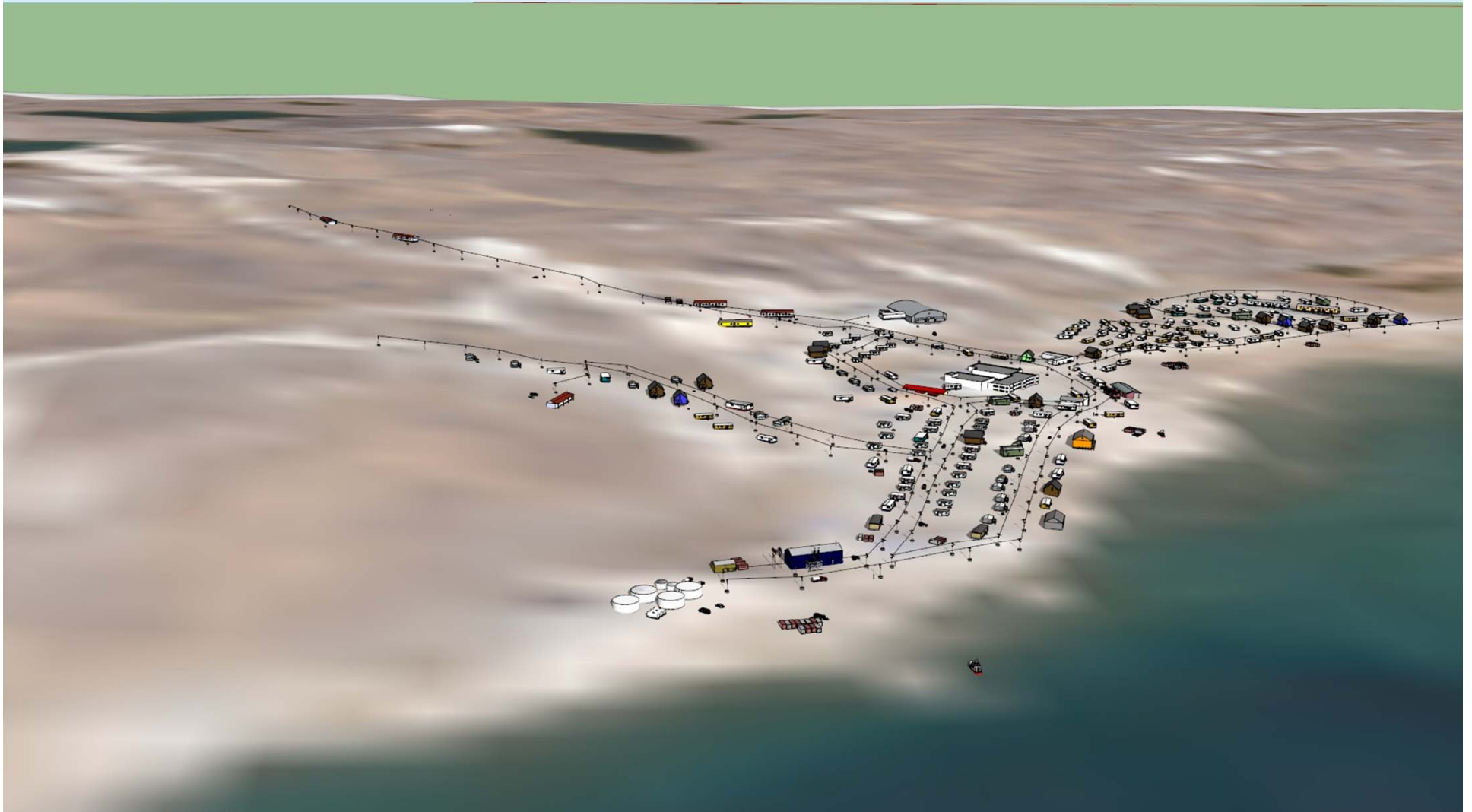
Upper ᑭᑦᑯᑦᑲᑦᑲᑦ



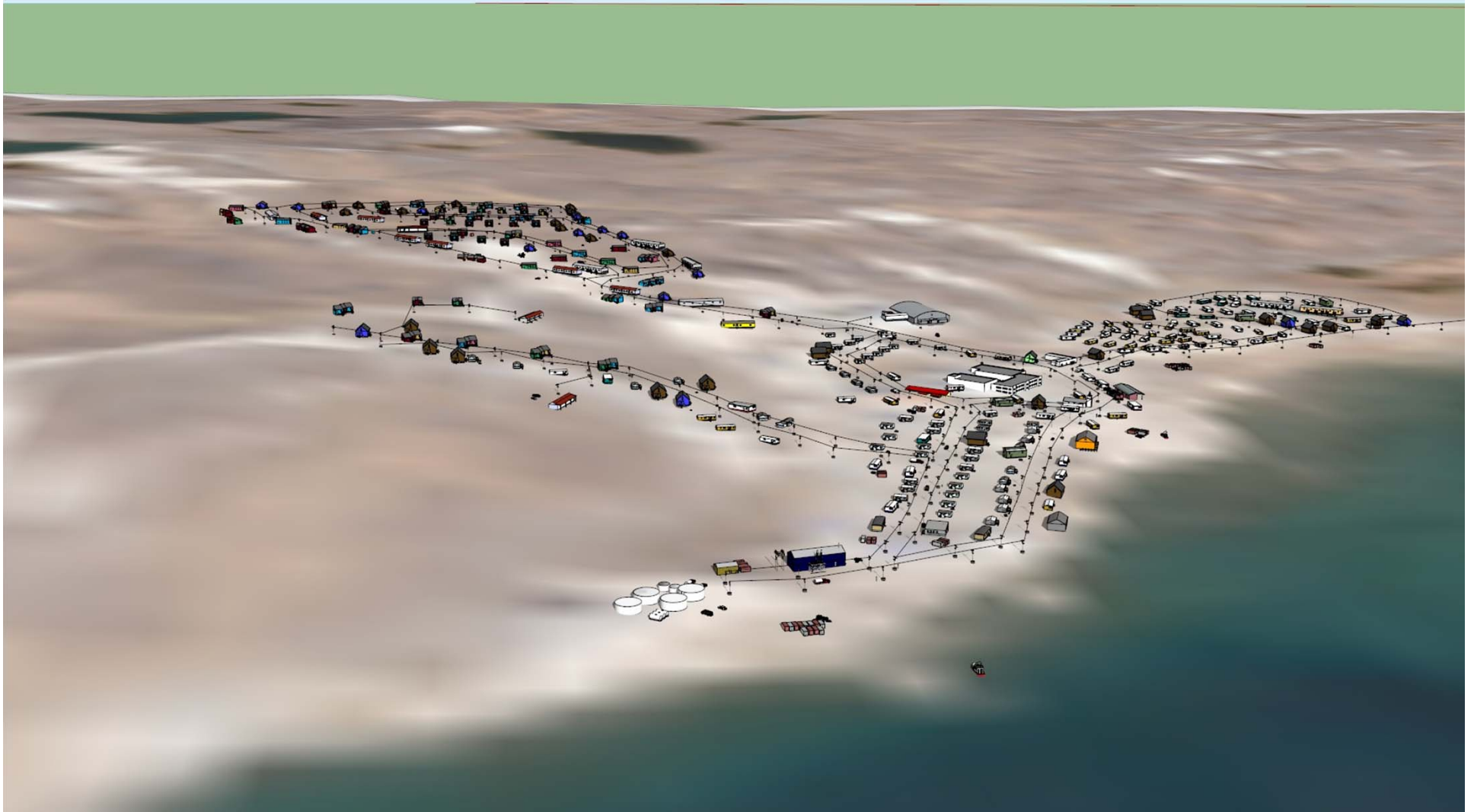
Lower
 $\gamma_b \rho^a \sigma^s \text{L}$



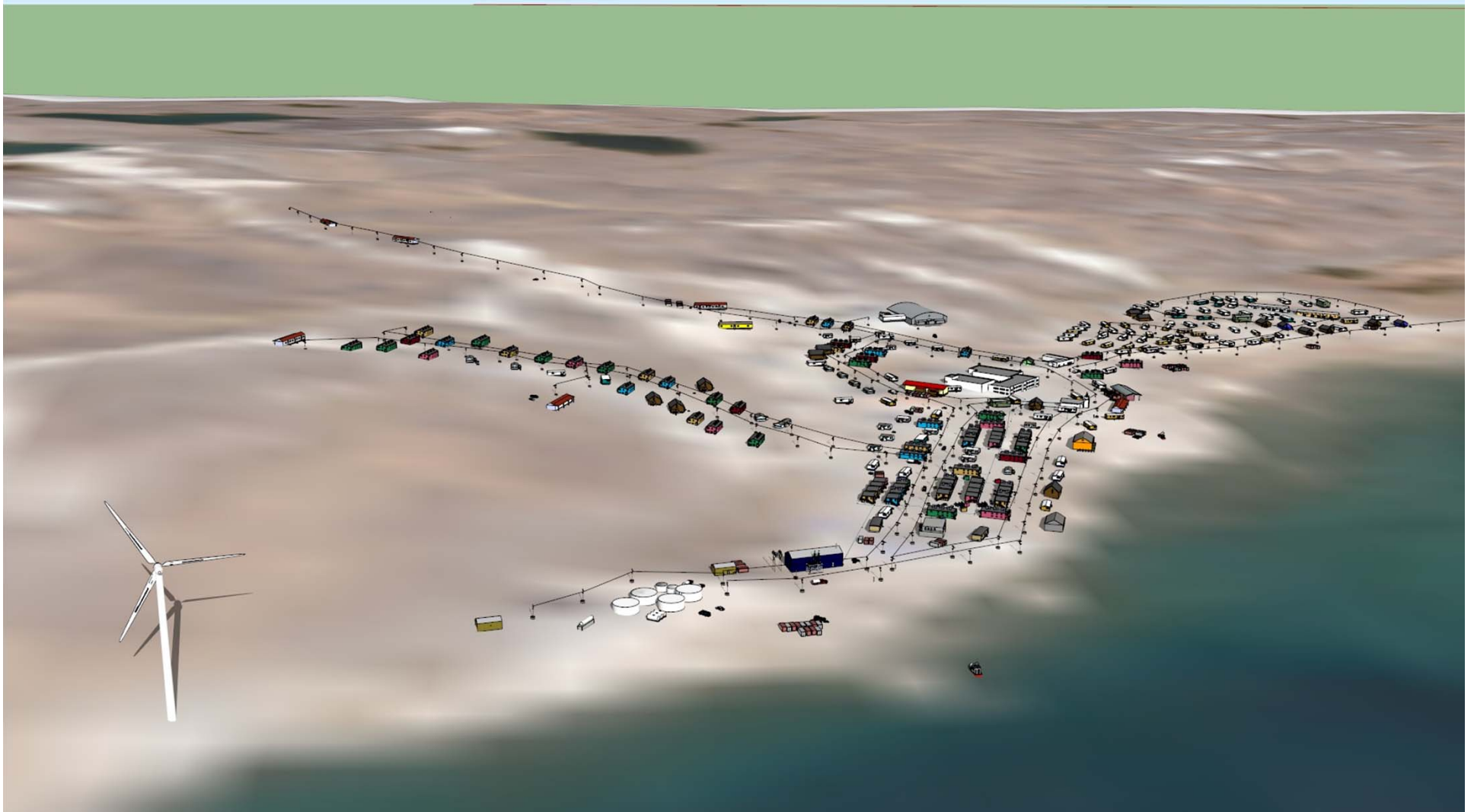
Current - $L^{\infty} \Omega \triangleright \triangleleft^{\infty} b$



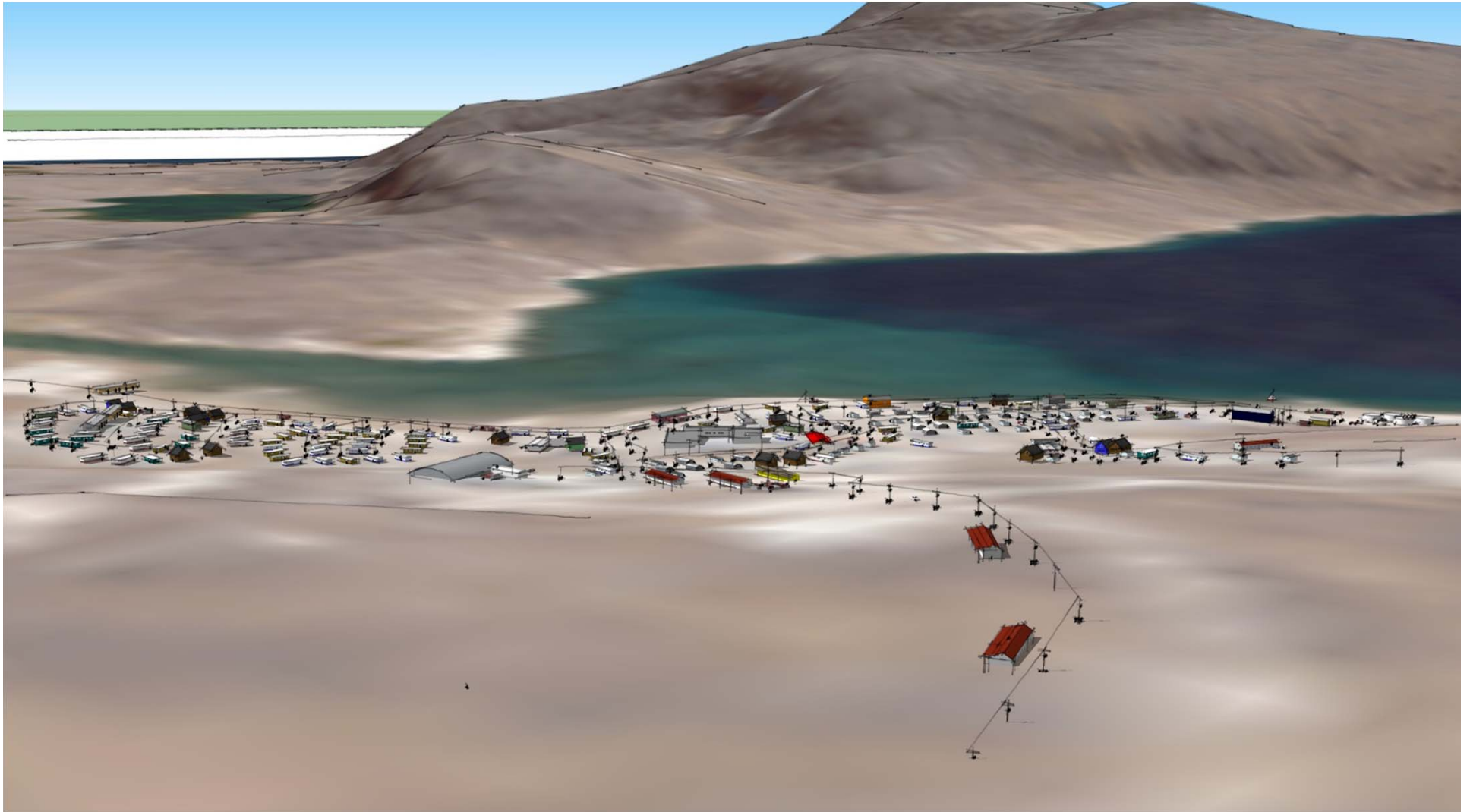
Upper town - ʻdʻnʻsʻs ʻdʻsʻ



Lower town - $\gamma^b \rho^a \sigma^c \zeta \sigma$ $\mu \alpha \epsilon^b$



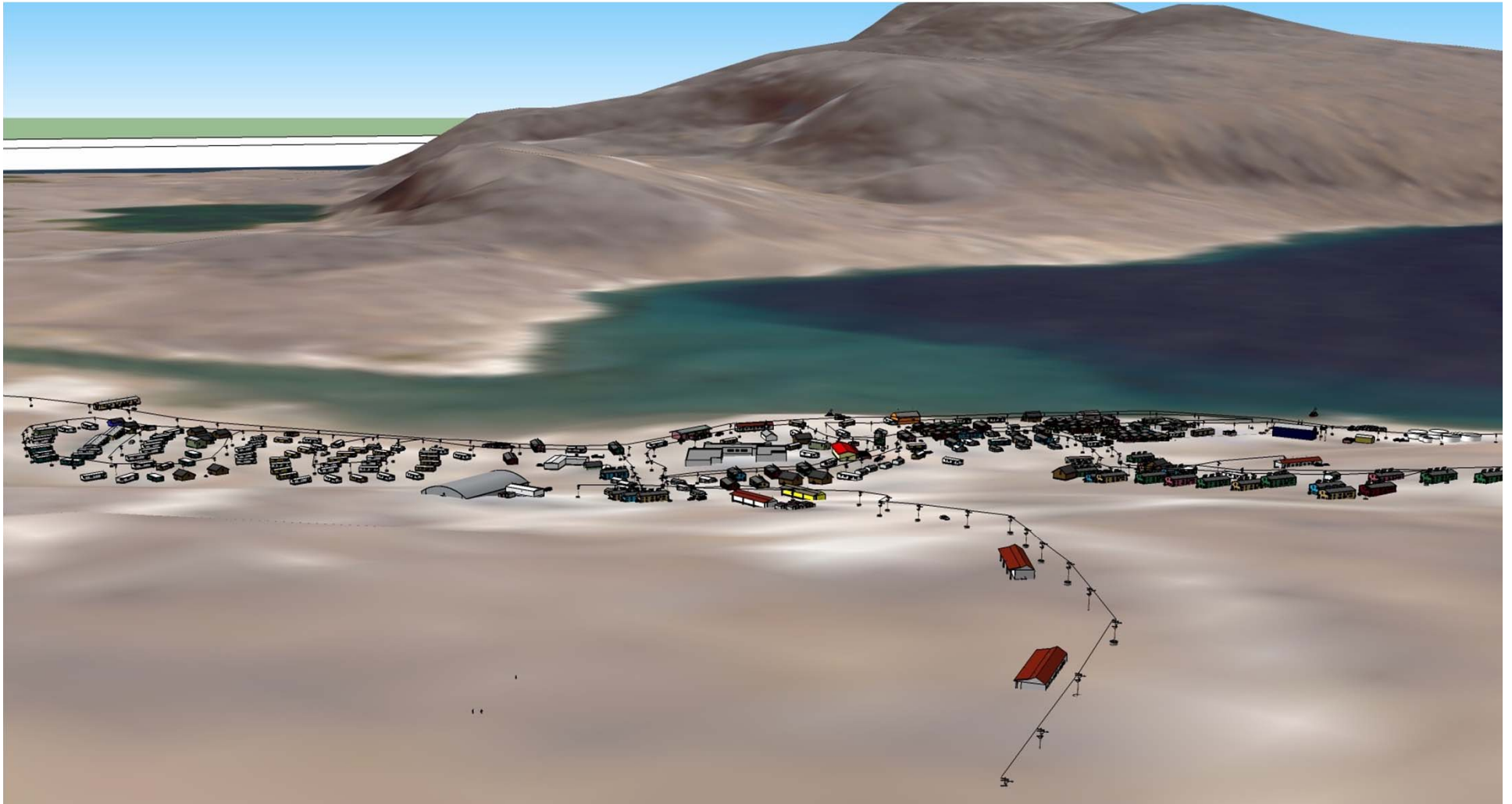
Current - $L^{\infty} \Omega \triangleright \triangleleft^{\text{qb}}$



Upper town - ഫ്ലൂറോസൈറ്റ മെൻ



Lower town - $\gamma^b \rho^a \sigma^c \iota \sigma \mu \alpha \epsilon^b$



Scenario drivers + indicators

Λ^ου^εσ^bd ^εd^{η<}c + ρ<</sup>ζ<sup>η<c





Landscape hazards



Landscape hazards



Landscape hazards



Landscape hazards



Landscape hazards



Landscape hazards



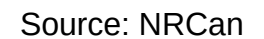
Landscape hazards



Landscape hazards



Landscape hazards

$$m\Gamma^C \supset C^C \otimes \mathbb{C}^{\otimes 2} + \Gamma_C \supset C^C \otimes \mathbb{C}^{\otimes 2} \otimes \sigma^{\otimes 2}$$


$$m\Gamma^C \triangleright^C \Delta^C C^a \triangleright^C + \Gamma^C \triangleright^C \Delta^C \triangleright^C \sigma^a$$


■ High
■ Moderate
■ Low

Source: NRCan
(Smith, Irvine)



C A L P

New buildings in drainage channel



New buildings in drainage channel



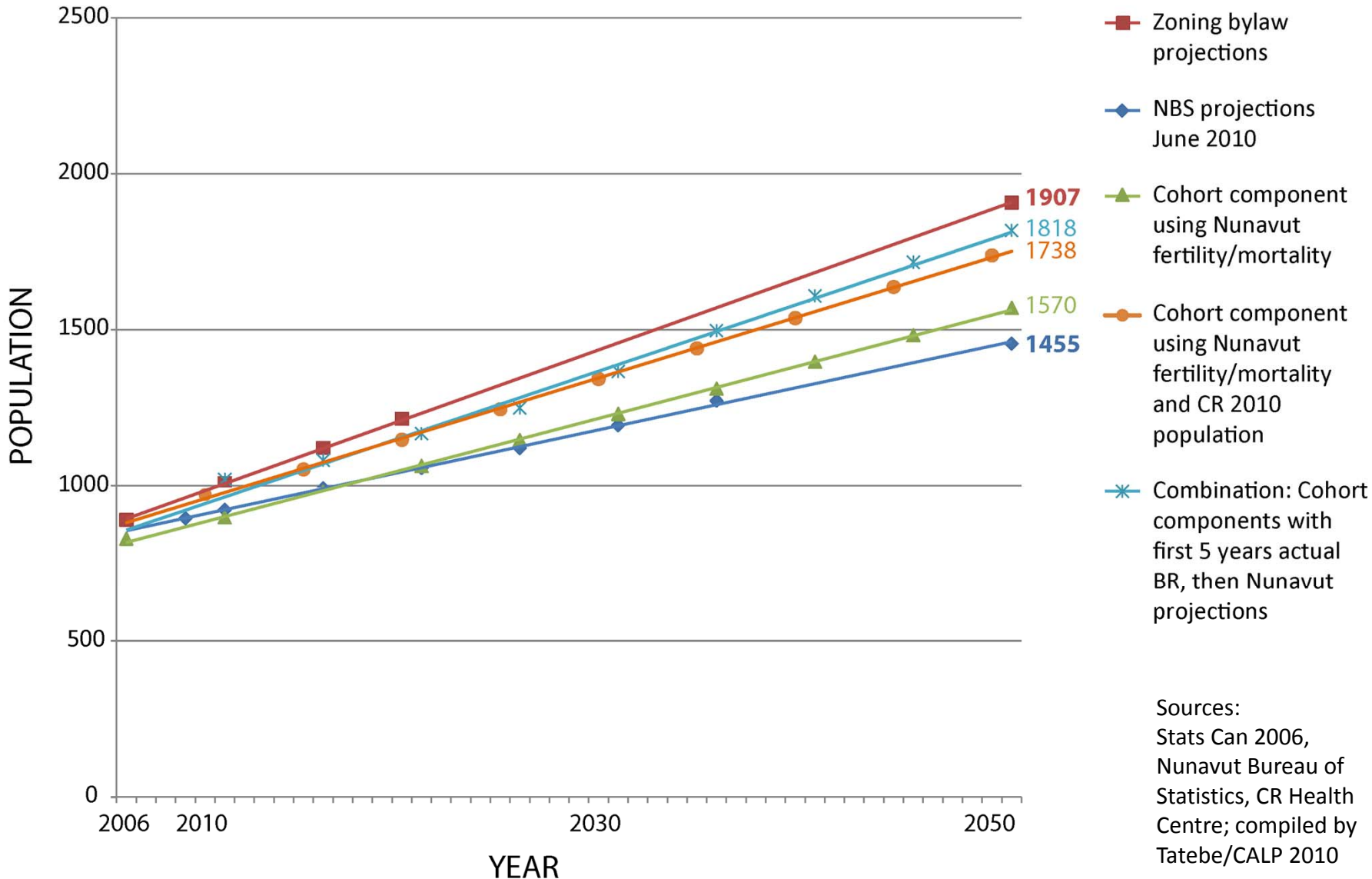


Town planning

Population growth < Density/energy

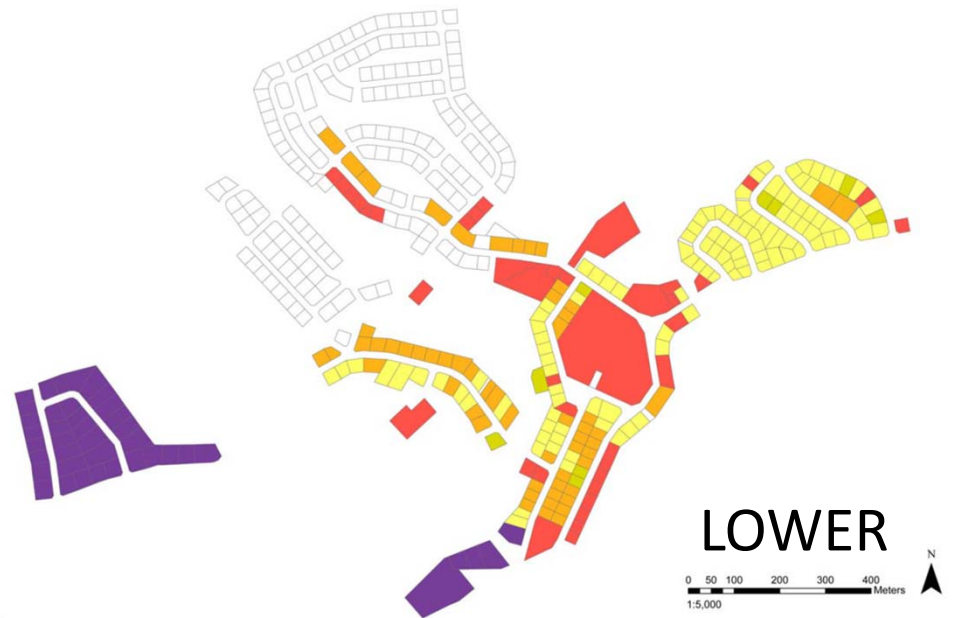
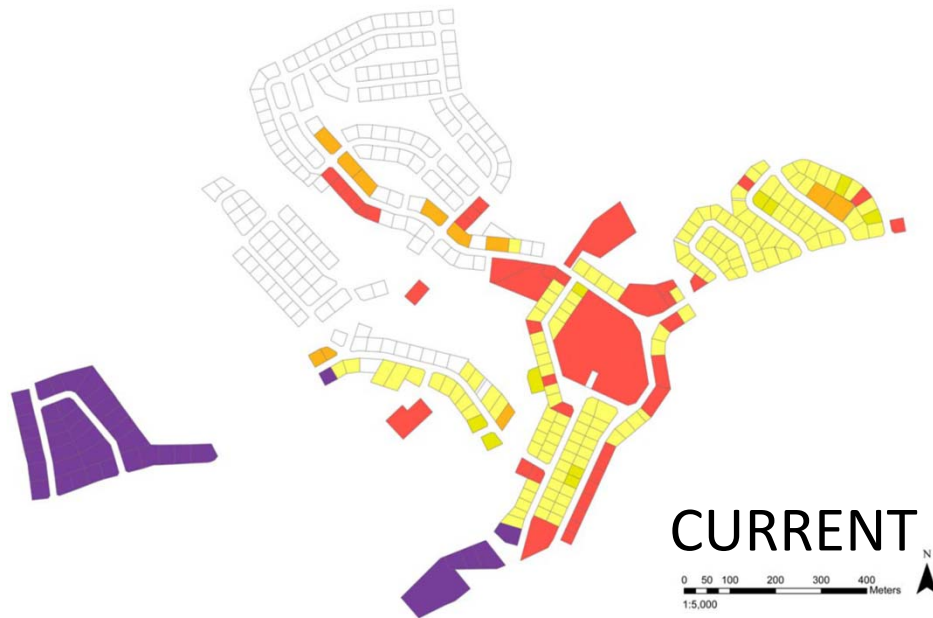
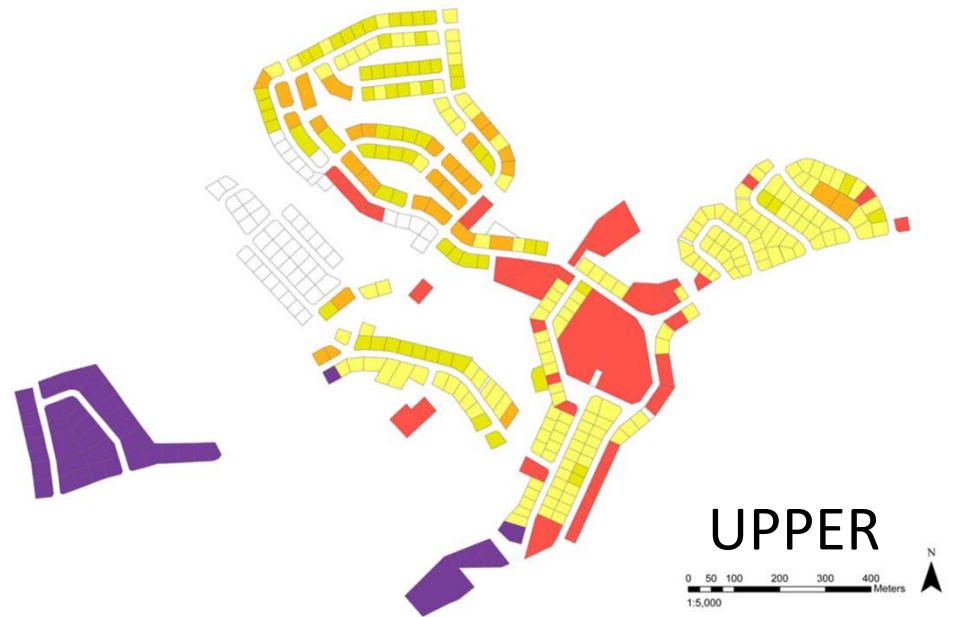
- Population growth
- Density/energy
- Population
- Pillow spaces
- Ownership
- Fire separation
- Setback
- Street access/utility truck access

ბ^aრ^b⊃∧▷^c Δ⊂რ◁^aσ^aℓ⊂ ⊆⊃▷^cℭ^aσ^c



Land use
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- | | |
|--------------------------|---|
| Single-family | $\Delta^c \supset^s b^s \Delta^c$ |
| Duplex/rowhouse | $\Delta \circ \supset \Delta^s \cdot \Delta^c - \Delta c \Gamma \cdot \Delta^c$ |
| Multi-family | $\Delta c \Gamma \cdot \Delta^s \cup \Delta^c$ |
| Commercial/Institutional | $\rho^a \Delta \supset \Delta^s b^s \Delta^c / \Delta^c \sigma \Delta^s \Delta^c$ |
| Industrial | $\Delta \Delta^c$ |



971 people
800 pillow spaces

■ 1610 pillow spaces

■ 1309 pillow spaces

* > ሦላ ማህተም ለማድረግ
 ማድረግ ለማድረግ
 ለማድረግ ለማድረግ

Q.C.C.፳፱ 2050 ልገሥቲኒ፡ **1455-1907**



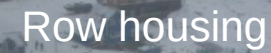
Housing - Δ^L $\rightarrow$ σ^{ϵ_b}

- Program
- Building Energy Demand
- SFD/MFD
- Snow drift
- Energy supply
- Building/unit access
- Household composition



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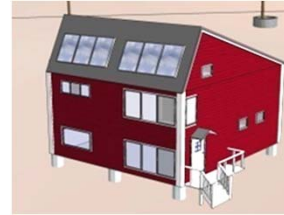
Passive solar duplex



ΔΛΔ΄ΩΣΖΰΨΔ΄ΩΨΔ΄ ΔΨΔ ΨΔ΄ΨΔ΄ New housing types for Clyde River

Ρ΄ΡΨΔ΄ΨΔ΄

Passive Solar



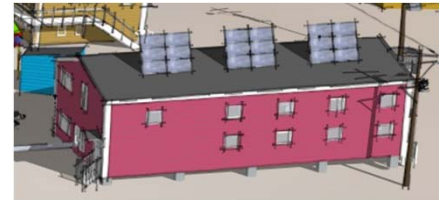
ΔΔΔΨΔ΄

Rowhouses



ΨΔ΄ΨΔ΄ Δ΄ΩΣΔ΄ ΔΨΔ ΔΔΔ΄

New triplex



ΔΔΔ΄ ΔΨΔ ΔΔΔΨΔ΄

Multiplex apartment



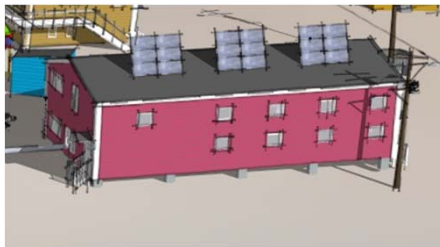
House design

- floor plan with shared spaces for skinning, sewing, etc – building off Bill's Inuit-friendly house
- orientation and the roof
- modular multi-family (Nick)

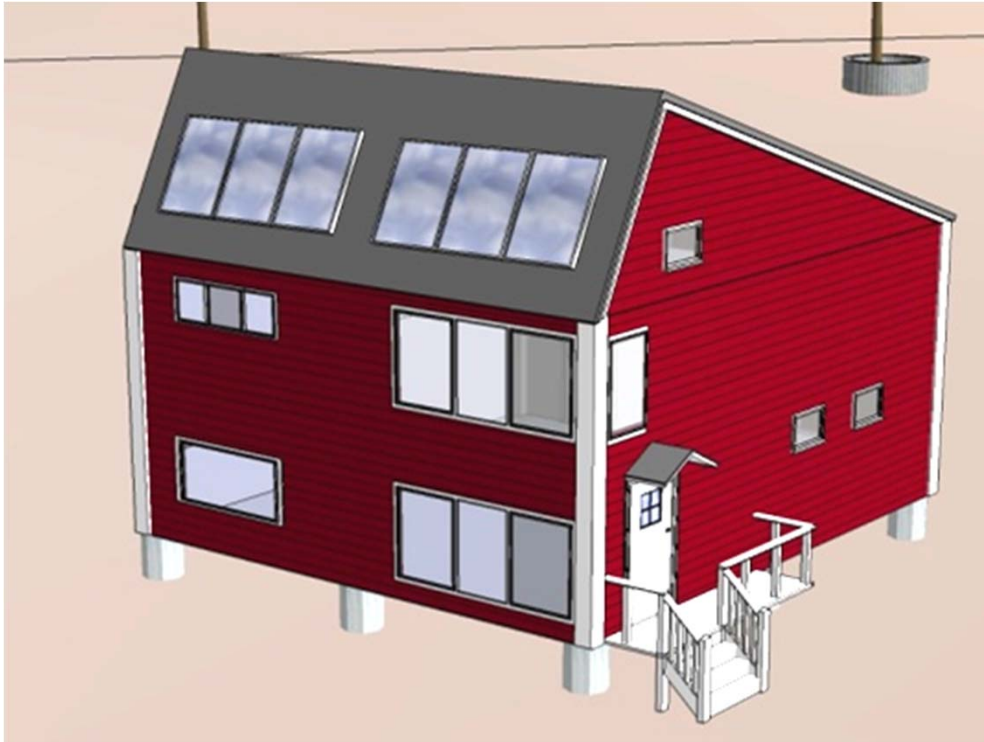
House design

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New triplex



Passive Solar



Indicators - ፍጥነት ማሳደግ

CURRENT

■ 164 SFD

55 Duplex/Row

UPPER TOWN

■ 152 SFD

230 Dup/Row 30 MFD

LOWER TOWN

■ 100 SFD

73 Dup/Row 114 MFD



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- Walkability
- Acceptability
- Social space/outdoor play
- Storage/ parking space
- Solar access



Walkability - ለሥነ ምግባር



Walkability - $\wedge r^u r \triangleright^s \sigma c^b$



Walkability - ለሥነ ምግባር



Acceptability? - $\Delta \rho_{\text{b}} / \rho_{\text{b}} \sigma_{\text{b}}?$



Indicators - ፍጥነት ማረጋገጫ

	Acceptability
CURRENT	■ n/a
UPPER TOWN	■ still testing
LOWER TOWN	■ still testing

Comparison

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	 Landscape Hazard	 Town Planning	 Housing	 Quality of Life	 Energy (Overall)
CURRENT	■ Some hazards	■ 971 people ■ 800 pillow spaces	■ 164 SFD, 55 Duplex/Row	■ n/a	■
UPPER TOWN	■ Avoids known hazards	■ 1610 pillow spaces +66%	■ 152 SFD, 230 D/R, 30 MFD	■ still testing	■ Elec: +74% ■ Heat: -4%
LOWER TOWN	■ Avoids known hazards	■ 1309 pillow spaces +35%	■ 100 SFD, 73 D/R, 114 MFD	■ still testing	■ Elec: +14% ■ Heat: -27%

[illegible]

David Flanders david.flanders@ubc.ca



Thank you for coming!

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- Questionnaire
- $\triangleleft \wedge^{\text{qb}} \text{r} \cap^{\text{b}}$

