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√ਰ 2022

#### City of Iqaluit

Evaluation of Options for Long-Term Water Supply

June 2022





## $\Delta^{\varsigma}b \Delta^{\varsigma}$ $\Delta a C < D > \label{eq:delta-substitute}$ $\Delta^{\varsigma}b \Delta C^{\varsigma}b C < \Delta C^$

#### City of Iqaluit Water Supply - Status

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The Lake Geraldine Reservoir is the City's only water supply. The reservoir fills naturally by snowmelt and rain in summer. In winter, water is used but not replenished.

The City currently uses up to 80% of the water in the reservoir by end of winter.

To meet overwinter demand, the reservoir must be full before winter starts; supplementation from Apex River has been ongoing since 2018.



## $\Delta^{\varsigma}b \triangle^{\varsigma}$ $\Delta c < > >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}\delta^{\circ}U - C < < > >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}\delta^{\circ}U - C < > >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}\delta^{\circ}U - C < >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}\delta^{\varsigma}U - C < >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}U - C < >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}U - C < >^{\circ}UC \Delta L^{\varsigma}b^{\varsigma}U - C < >^{\circ}UC \Delta L^{\varsigma}b^$

#### City of Iqaluit Water Supply - Status

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To address water use and demand, the City has:

- repaired leaks in the distribution system
- Introduced conservation measures such as car wash ban
- promoted Waterwise to help residents and businesses conserve water



## $\Delta^{\varsigma}b \Delta^{\varsigma}$ $\Delta \alpha C < D >^{\varsigma}UC \Delta C^{\varsigma}\delta^{\varsigma}U - D \Delta^{\varsigma}C^{\varsigma}\delta^{\varsigma}U - D \Delta^{\varsigma}U - D \Delta^{\varsigma$

#### City of Iqaluit Water Supply – Look Ahead

Under the high-growth planning scenario, water demand in 2050 may be double what it is today - may need 1.8 billion litres more each year.

The Lake Geraldine reservoir alone cannot supply nor store this amount. This is affecting City development and ability to address the housing shortage.

Additional water sources and water storage are needed.

#### Διρηδι σσας Κρληρις ΔΓιριθής - Υδης Οθραίσιρ

#### City of Iqaluit Water Supply - Look Ahead

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New federal funding will be used to build a new reservoir, a new supply system and to upgrade the treated water distribution system.

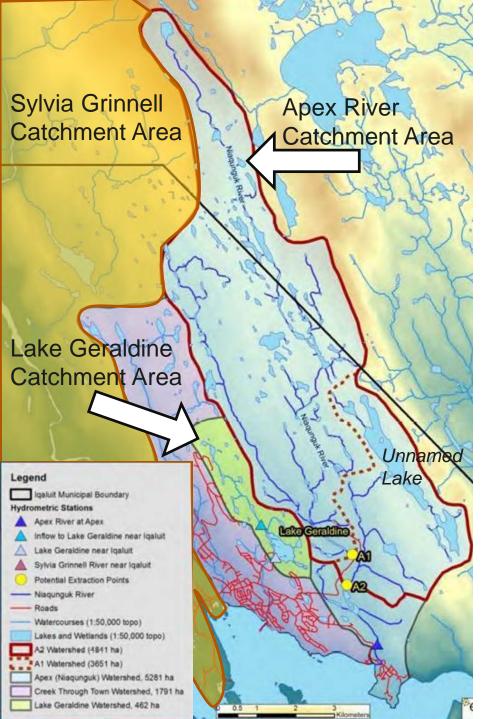
The City needs to select a permanent new (additional) water supply system to be constructed as soon as possible:

- Design in 2022-2023
- Permitting (water licence amendment) 2023-2024
- Construction 2024-2026 (may be phased)
- In-service 2026

Annual supplementation from Apex River will continue in the meantime.

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Overview of Options



#### $\Lambda^{\circ}U^{\prime}C$ $\Delta^{L}\Gamma^{\varsigma b}D^{\varsigma}\dot{\Lambda}^{\varsigma}C$

#### Three Watersheds

ΔΓ<sup>6</sup>C<sup>6</sup>δ<sup>6</sup> Ανροίο ΔιΓ<sup>6</sup>C<sup>6</sup>δ<sup>6</sup> ΔιΓ<sup>6</sup>C<sup>6</sup>δ<sup>6</sup>

Lake Geraldine is supplied by a small watershed catchment area

The Apex River watershed catchment area which includes Unnamed Lake

The Sylvia Grinnell River watershed with catchment area over 20 times larger than the Apex River watershed area



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## Apex River (Niaqunguk) and Unnamed Lake

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Unnamed Lake (UNL) – as a headwater lake of the Apex River, has been identified as an option which would provide supply and storage.

The Apex River could supply enough additional water to refill the reservoir if all the water in the river was available (EXP, 2014; Nunami Stantec 2022)

Flows are highly variable, however, and could not provide guaranteed water supply to the City on it's own.



## Δ<sup>ς</sup>b<sub>Δ</sub><sup>c</sup> d<sup>c</sup>b Sylvia Grinnell River

 $\Delta\Gamma^{\text{th}}$   $\dot{\alpha}^{\text{LC}}$   $\Delta\Gamma^{\text{th}}$   $\Delta$ 

 $\Delta\Gamma^{\text{G}}C^{\text{G}}\Delta\nabla^{\text{G}}U$   $DPD^{\text{G}}U$   $DC^{\text{G}}D^{\text{G}}U$ 

Water supply is enough in summer (City would need to take less than 2% of its flow)

Water taking in winter is not recommended

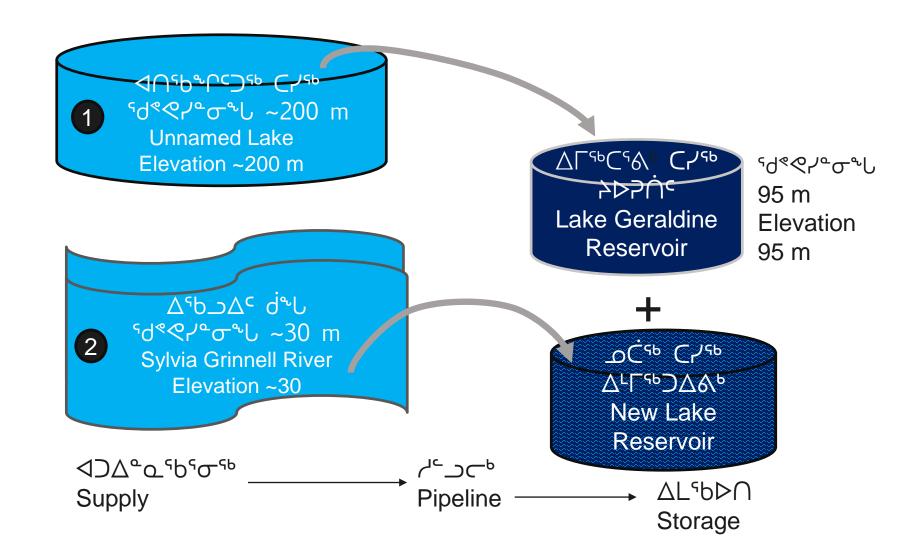
The City recognizes the cultural and recreational importance of the river – HTA has voiced strong concerns about taking water from this river

### $\Delta\Gamma^{5b}C^{5}\Delta^{5}C^{5}$

#### Water Supply Concepts



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UNL △৴<sup>IL</sup>L,৴<sup>Sb</sup> UNL Concept

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Unnamed Lake was used for emergency supply in 2019

Lake could provide additional supply to support a population of 17,000 (or 2040 under high growth)

Have been collecting data since 2018 but more lake outflow measurements are needed to confirm water balance

Water is available year-round



UNL △৴<sup>L</sup>L,৴<sup>Sb</sup> UNL Concept

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- Δ<sup>L</sup>Γ<sup>16</sup>
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   4.5 km
   Δ<sup>C</sup>C<sup>16</sup>
   Δ<sup>C</sup>L<sup>16</sup>
   4.5 km
   Δ<sup>C</sup>C<sup>16</sup>

- Could pump continuously to meet demand or, in summer only to fill the reservoirs
- Mostly downhill Minimal pumping required, and can generate carbon free hydropower if desirable
- Needs a new water intake and approx. 4.5 km of new pipeline
- Needs new road or upgrade to existing temporary road
- Could additionally take water from the Apex River up to 6.8 million cubic metres available in open-water which could supply up to an additional 46,000 residents



UNL △ద<sup>L</sup>L UNL Concept

#### 4ητους Cληρο Διροδι Δημηρηγοίο Δημηροίο Unamed Lake Fishery Considerations

- ΔLΔ>Δσ<sup>56</sup> 4Π<sup>5</sup>6<sup>5</sup><sup>5</sup>Γ<sup>1</sup>C)<sup>56</sup> C/<sup>5</sup>6σ<sup>6</sup> 4<sup>1</sup>OΔσ4<sup>56</sup>C d<sup>6</sup>σ<sup>5</sup>6σ<sup>6</sup>6
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   d<sup>5</sup>6<sup>5</sup>6
- Δ<sup>L</sup>Γ<sup>5</sup>b)<sup>5</sup>bCDδb 5>050CD6b
- May harm fish in the lake because would need to take more than 10% of the under-ice volume; however a fish study was not able to confirm presence or absence of fish
- Taking water from UNL will affect flow in the Apex River.
- Simple to construct; don't need the additional reservoir initially
   —may advance the project timeline
- The watershed would need to be protected.



UNL

Δ/LL/
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Concept

#### $\Delta P \Delta^{\circ} \Delta^{\circ} d^{\circ} \Delta P \subset U > ^{5} D^{\circ}$

#### Summer Only Operations

- ΔL<sup>1</sup>b>∩Ċ<sub>1</sub>Δ<sup>1</sup>bS<sup>1</sup>D<sup>1</sup> ΔΓ<sup>1</sup>bC<sup>1</sup>δ<sup>1</sup>UC 5σ4σ.

- ΦCPYITY ΔΡΦΙΦΠΟΓΙΖΕΦΡΥΝΟΙΥ HDPE ΖΕΔΕΙΘΕΘΕΝΟΙΑ
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- Would require a reservoir for storage at Geraldine
- Flow rates are 4 times larger than year round operations
- Pipe size would at least twice as large as for year round operations
- A single uninsulated HDPE Pipe with air release and drain points vaults would be appropriate



UNL △ద<sup>L</sup>Ldsb UNL Concept

#### 495JCL56 4DCA°056<0

#### Year Round Operations

- ΔĊΓ<sup>®</sup> ΔΓ<sup>®</sup> ΔΓ<sup></sup>
- CΥ<sup>56</sup> ΑΡΡΠ΄ ΔΓ<sup>56</sup>C<sup>5</sup>δ<sup>5</sup>υ CCΔ<sup>6</sup>α<υΌυυα<sup>56</sup> Δ<sup>5</sup>ĠυσΕ<sup>56</sup>,
   ΔΓ<sup>56</sup>ΥΔ<sup>5</sup>υσΕ<sup>56</sup> ΔΓ<sup>56</sup>ΥΔ<sup>5</sup>υσΕ<sup>56</sup>,
   Δ<sup>1</sup>Γ<sup>56</sup>ΥΔΓΔ<sup>5</sup>υσΕ<sup>56</sup>
- LYDAYSON  $\Delta$ PA%N%N HDPE HSST  $\Delta$ PSST  $\Delta$ PST  $\Delta$ PSST  $\Delta$ PST  $\Delta$ PST
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- Would not necessarily require a new reservoir for storage.
- Could be built and operational before a reservoir
- Lake Geraldine would be kept mostly full year round, supply from UNL would be kept at about the daily demand rate
- Pipe size and pumps are is smaller than for summer only operations
- Double insulated HDPE Pipelines with regular access vaults for thaw access, air releases and drain points would be required
- A heating station and recirculation station would be required



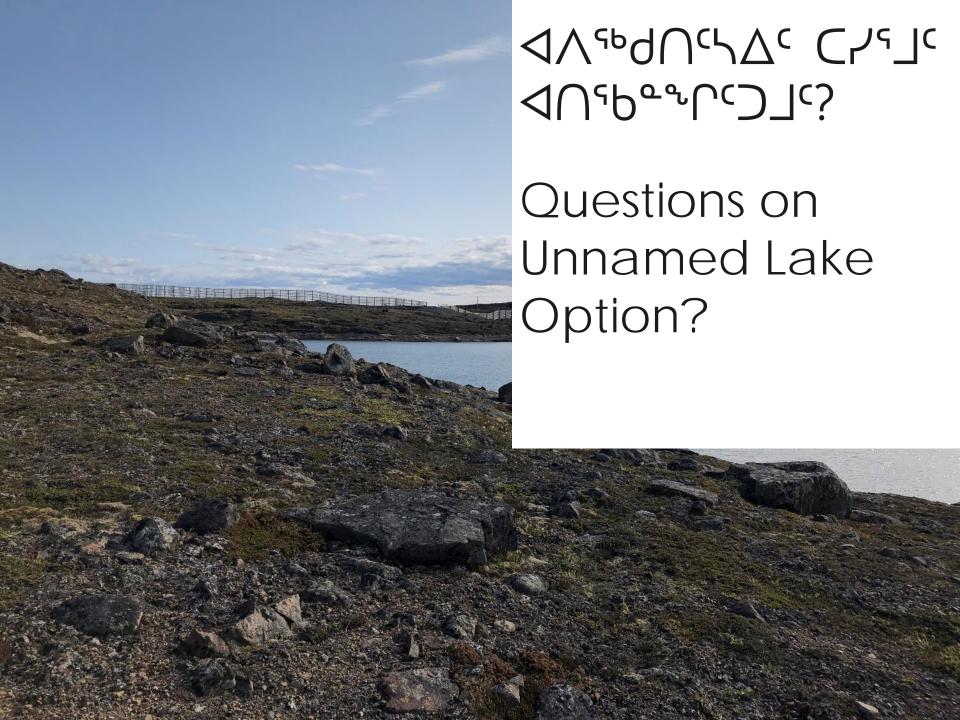
UNL △৴<sup>L</sup>L,৴<sup>Sb</sup> UNL Concept

#### 495JCL56 4DCA°056<0

#### Year Round Operations

- Φ'λ<υ\ρωρως Δ'ĠJĊĿω Φρωυνος Ζ'ωċς</li>
   Δραωρισης Δια Ρηπαίδιης Φ'λ<υ\ρι (2+km)</li>
   ἰω Φρωσος Φλωσος
  - ხ<sup>ಒ</sup>ቦ<sup>հ</sup>bc²σ<sup>ಒ</sup>Γ
  - Pdebala
  - Δ<sup>1</sup>
     <l
  - € كن
- Similar year-round operation pipelines with insulated supply and return lines of similar lengths (2+ km) are currently in use in other locations in Nunavut including:
  - Rankin Inlet
  - Gjoa Haven
  - Cambridge Bay
  - CFS Alert





SGR △/<sup>L</sup>L/<sup>5b</sup> SGR Concept

## Δ<sup>1</sup>b<sub>-</sub>Δ<sup>1</sup>d<sup>1</sup>b<sub>-</sub> ΔL<sup>1</sup>b<sup>1</sup>σ<sup>1</sup>b Sylvia Grinnell Supply

¿LCDL ∇Γρ202 مهر 2020 ماد

 $\Delta$ L%  $\Delta$ P%d $\Delta$ %  $\Delta$ D $\Delta$ %  $\Delta$ P%  $\Delta$ 

ユュαΔϧιμ/Lժσμ Δυσσικ Λλήμιο Οντικο 100 Αμπου 2018

Provides enough supply to 2050

Water available in summer only to protect fish

Detailed studies completed in 2017 and 2018



SGR ∆৴<sup>L</sup>L.৴<sup>ናь</sup> SGR Concept

## ר'שב'י Pumping and Pipeline

- Δσ<sup>6</sup>U A C<sup>6</sup>
   Δσ<sup>6</sup>U
- Δσ<sup>6</sup>U B ΛΡσ<sup>66</sup>\<sup>66</sup> Δ<sup>1</sup>Γ<sup>66</sup> ΔΔΛ<sup>2</sup>

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Two potential intake sites in river: Site A and Site B

- Site A has existing road access by the airport runway
- Site B is better for water taking

4.5 to 7 km of new pipeline and additional pumps to move water up to 146 m uphill

Needs new road and powerline



SGR △୵<sup>L</sup>L,<sup>ノ</sup><sup>Sb</sup> SGR Concept

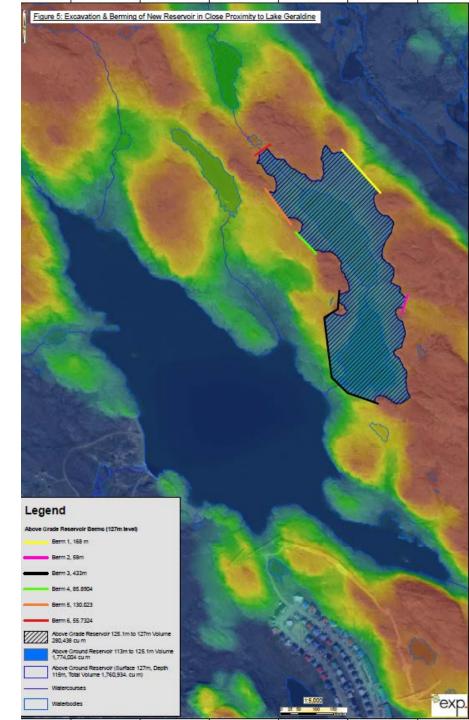
# △∠L<sup>c</sup>S<sup>6</sup>Z<sup>6</sup>Z<sup>6</sup>Z<sup>6</sup>Considerations

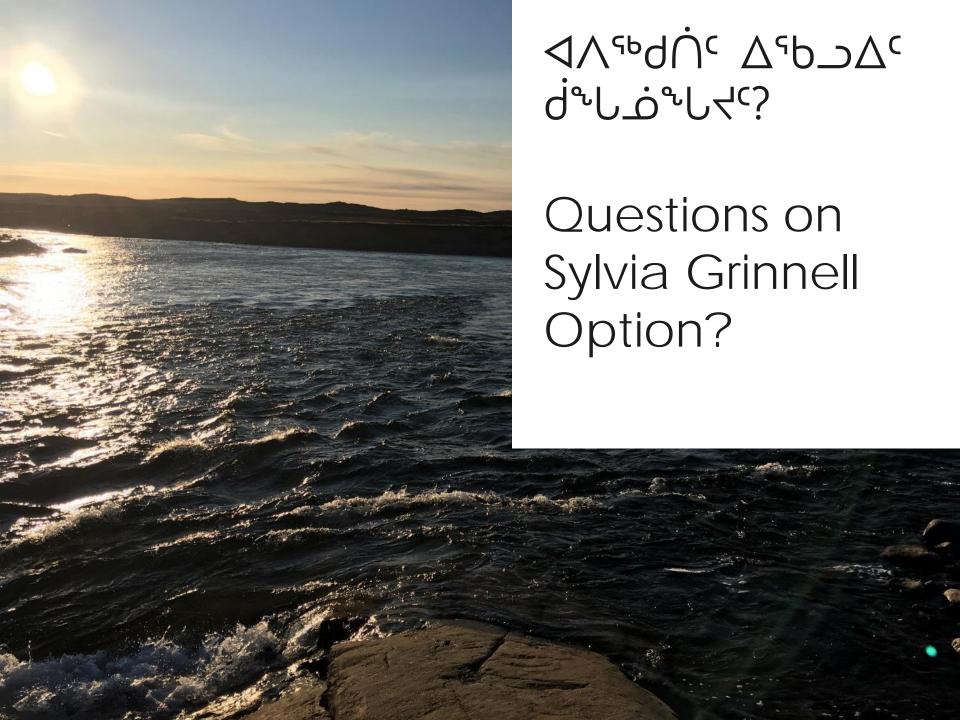
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Needs new reservoir to store additional water (because cannot add water in winter)

Minimal impacts to fish and fish habitat but Sylvia Grinnell is important recreational and Indigenous fishery







#### 

#### Implementation

- Δ<sup>5</sup>b Δ<sup>c</sup> d<sup>3</sup>l Δ<sup>6</sup>l (SG) ペーンー Δ<sup>L</sup>L δ Δ<sup>L</sup>L 5σ<sup>3</sup>l C Δ<sup>6</sup>Γσ<sup>5</sup>l 7.5 km x 500 mm.
- 4∩ነ6°∿Γ')
   C/∿ሀσ' /'೨୯ Δ¹L'6 4¹L೨'σ°ሀር 4°Γσ°ሀ 4 km x 200-300 mm.
- Δ<sup>5</sup>b Δ<sup>c</sup> d<sup>3</sup>l Δ<sup>5</sup>l L<sup>5</sup>l L<sup>5</sup>
- 4066°60' CYUDC Y CON LONG CONTRACTOR 4°60' ACOUNTY.
  - 40%  $\Delta C_{A} = \Delta C_{A} + \Delta C_{A}$
- Δ¹b¬Δ¹ d³lσ ペーンー CCNԿCԻԿՐ andー d8NCԻペーンσン 4Ͻ¹CÞσ³lσ, Λγη4Ͻ∀b'cÞペ'Ͻ¾.
- Sylvia Grinnell (SG) Pipeline aprox. 7.5 km x 500 mm dia.
- UNL pipeline aprox. 4 km x 200-300 mm dia.
- SG Pump Power required 500 HP
- UNL Pump Power required minimal
  - UNL Pumps are only used to fill pipeline to start syphon flow going and for circulation
- SG pipeline must be filled and drained every season, taking significant effort.
- UNL operating year round must be insulated and heated, adding to operating costs.



#### 4674Uc 46%Cc

#### Capital Costs

- Δ¹b Δ¹ d³l ΔÞ♭d¹ ΔÞ C Θ¹Ͻ¹ゅ \$9.1Γ C þ ڹϽσ
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- 40%でいった Cイト 4トとよった 4ら、Jで上が \$7.6 「でからいった」
- ΦΡΡΦσ Διγημος Δι
- Sylvia Grinnell Summer Operations \$9.1 M
- Unnamed Lake Year Summer Operations \$5.5 M
- Unnamed Lake Year Round Operations \$7.6 M
- Either of the summer operations require a reservoir in addition to Lake Geraldine to provide water in the winter to the community. That reservoir is not included in the above costs.

Year round operations maintain Lake Geraldine at near full level and do not require an additional reservoir.



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- $\Delta$ 6 של לאט לאטלי לאכס אר  $\Delta$ 6 אר 700 אר  $\Delta$ 6 לאט לאטלי לאכס אר  $\Delta$ 6 אר 700 אר  $\Delta$ 6 לאטכאריר רישלארי כער  $\Delta$ 6 ארכאריר באלאיר באלאיר באלאיר באלאיר באלאיר באלאיר באלאיר באלאיר אייר באלאיר באלא
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- Sylvia Grinnell Summer Operations High 700 HP of continuous pumping required
- Unnamed Lake Year Summer Operations Low Minimal to no pumping required
- Unnamed Lake Year Round Operations Medium –
   Minimal to no Pumping Required, but heating of circulation water probably required
- Costs include pumping and heating.
   They do not include staffing costs



## b∩L¹b∩¹b¹b°C¹σ⁵b Engagement

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- ΔLPbd<sup>c</sup> ÞLd<sup>c</sup>σd<sup>c</sup>Ω<sup>c</sup> Δbd<sup>c</sup>Ω<sup>c</sup> Δ<sup>c</sup>DΔ<sup>c</sup> d<sup>c</sup>Uσ<sup>c</sup> ΔΓ<sup>c</sup>DΔ<sup>c</sup> d<sup>c</sup>C

- Several meetings held with HTA since 2018
- HTA does not support taking water from Sylvia Grinnell River
- HTA encourages looking at Unnamed Lake and Apex River as options for water supply



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#### **Evaluation Summary**

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- Δ'b\_Δ' d³Ն ላÞታΔ° ω⁵d' ላÞ ω
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- Considering capital and operating costs, without including the required reservoir, UNL summer only operations is the lowest capital and operating cost.
- For capital costs including the reservoir, UNL year round operations is the lowest cost system, as it does not require a reservoir
- Sylvia Grinnell Summer operations has both the highest capital and operating costs
- Year round operations of UNL are very similar to other communities in Nunavut.



ΔιΓιηλακή ασίκη - ρησίση ιδαδορίσηνο Supply Options - Next Steps

## Pucif badcdida Next Steps

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- City to confirm preferred option (June 2022)
- Complete additional site investigations and environmental studies (summer 2022)
- Ongoing engagement and consultation
- Progress design and permitting (2022 2023) –
   Note that an amendment to the water licence will be required for all options



