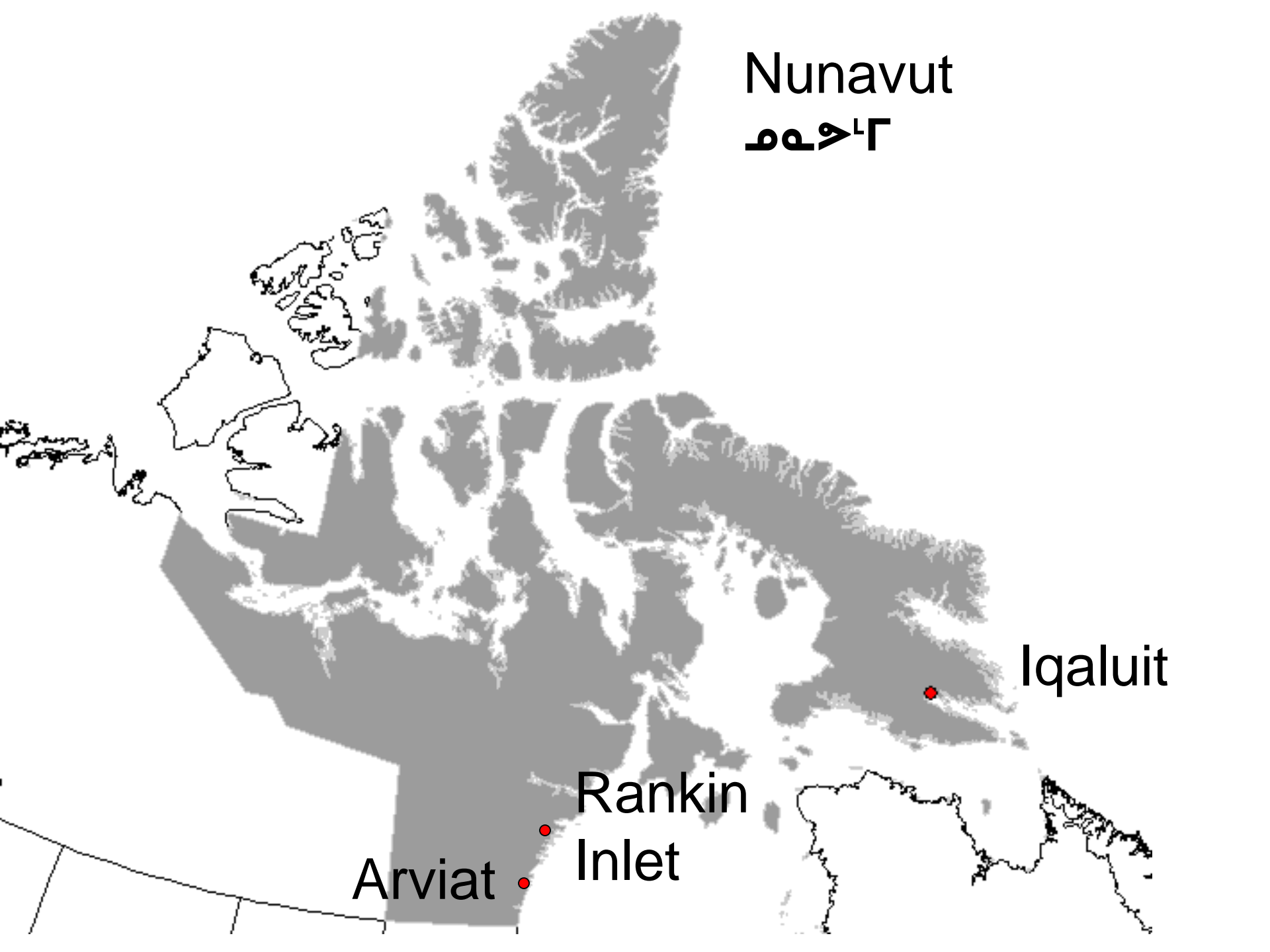


# Vulnerability of fresh water supply in Arctic Canada

**Andrew S. Medeiros\* and Michael Bakaic**  
**York University, Department of Geography**





Nunavut

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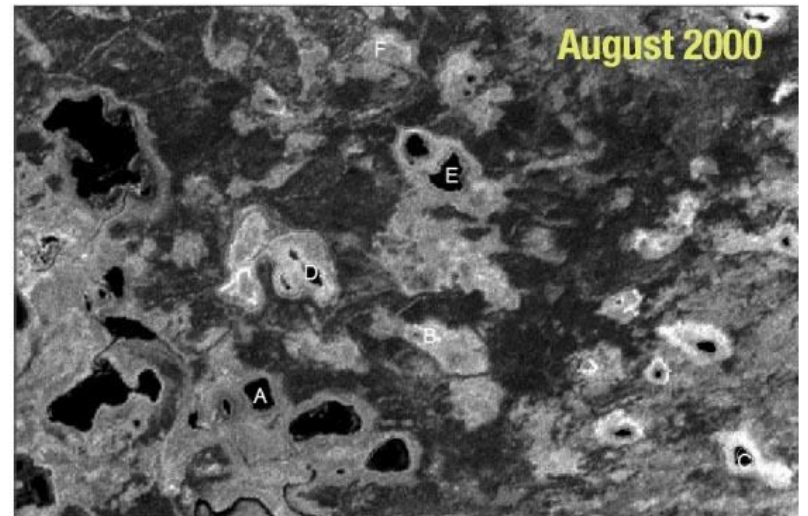
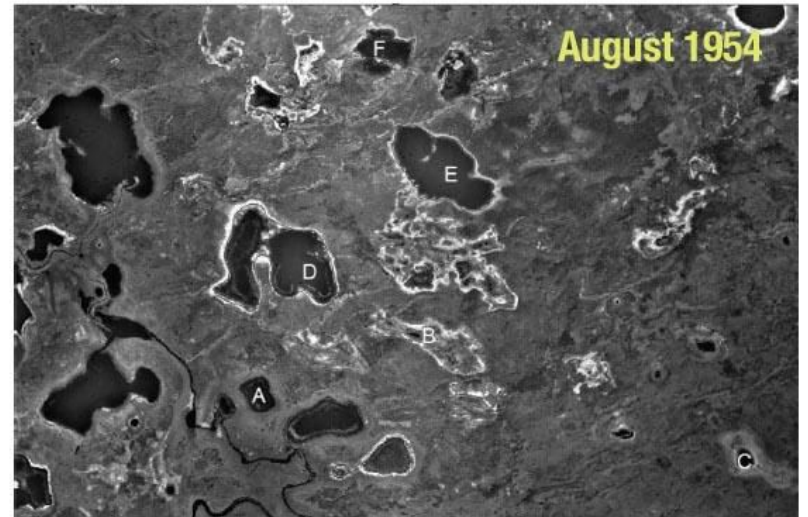
Iqaluit

Rankin  
Inlet

Arviat



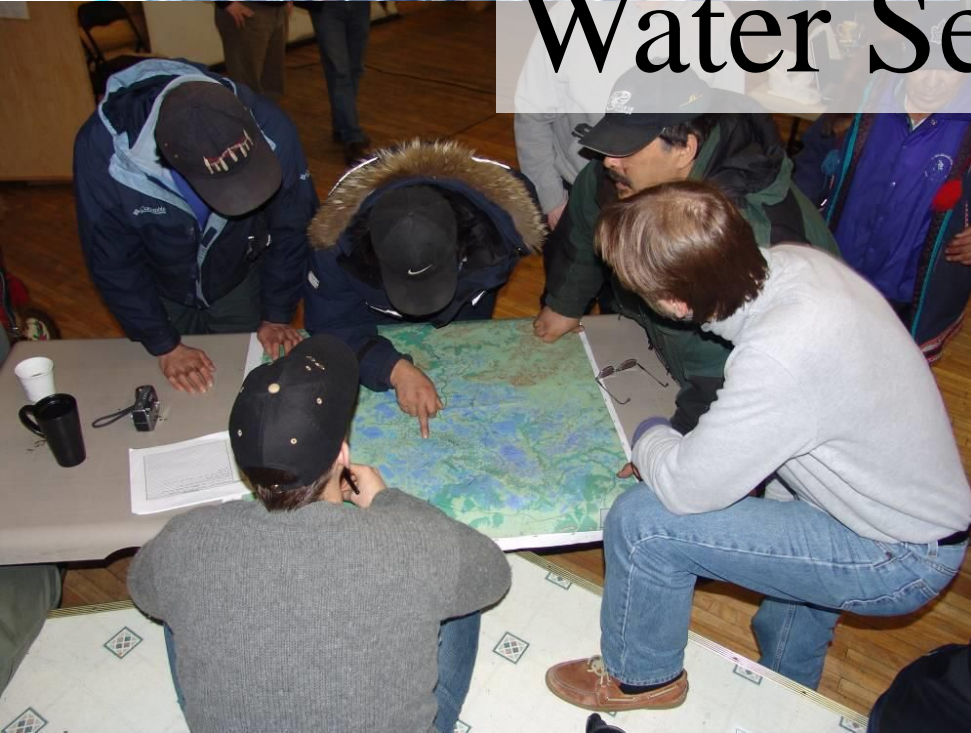
# Environmental Change and Arctic freshwater systems







# Water Security

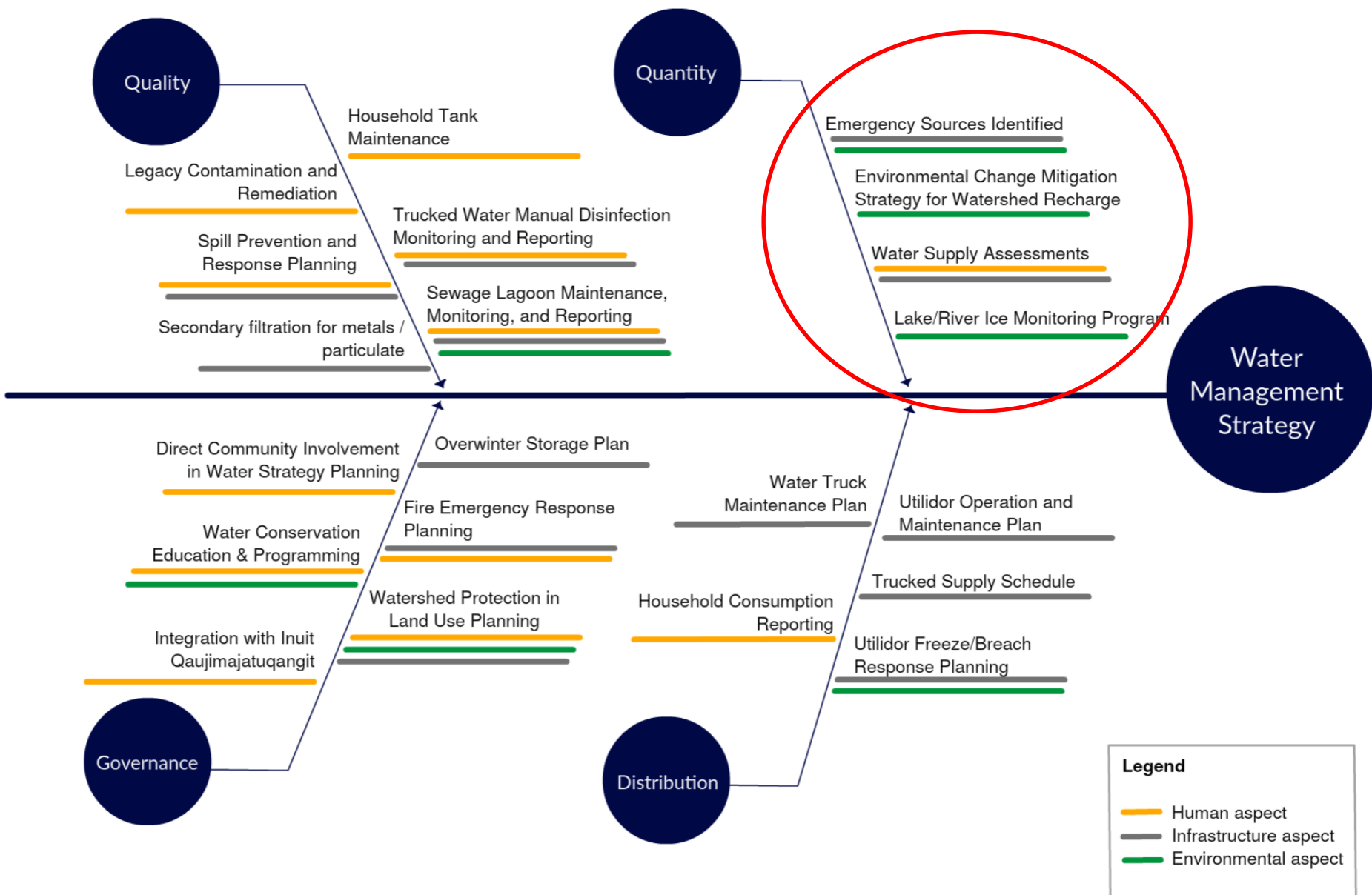




# Water Security

Survey of Residents determined:

- Residents often drink untreated flowing water sources
  - Traditional Ecological Knowledge of water borne pathogens
  - Distrust of municipal water supply
- Concerns over **water quantity**
  - Demand exceeds long-term supply
  - Households often run out of water
  - Knowledgeable about municipal plans for water development
- Concerns over **water quality**
  - Identification of several areas residents would not consider drinking water from





# Water Quantity Issues



# Water Risk Assessment

- **Problem:** Climate stress and increased populations causing widespread risk to water infrastructure and supply



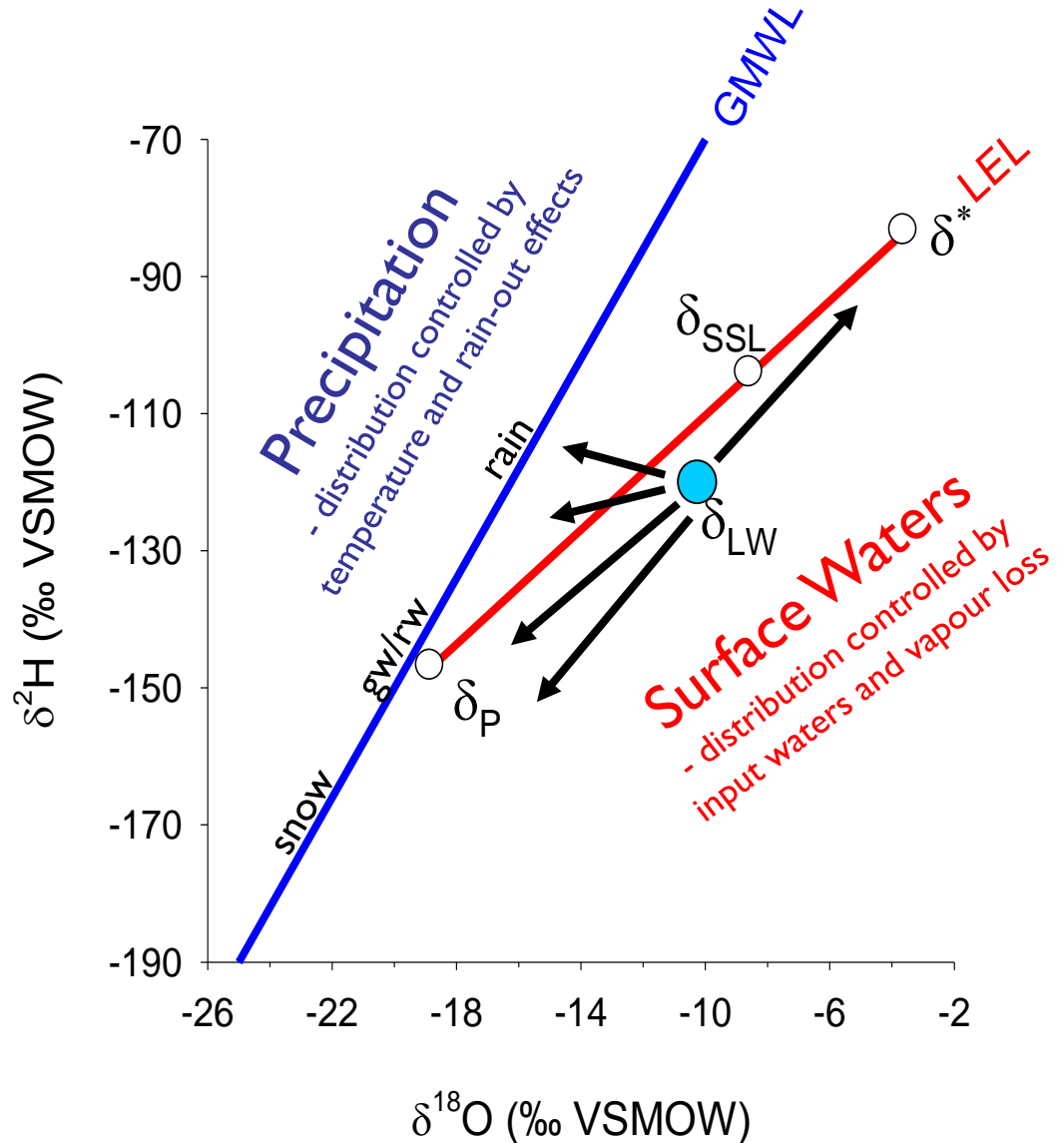
- Use estimates of water source volumes to:
- Calculate input vs output
  - Determine water-balances
  - Model risk assessment scenarios
  - Provide adaptation recommendations



# Indicators: Isotopes

## Lake-Water isotope Tracers

- $\delta^{18}\text{O}$  ,  $\delta^2\text{H}$ 
  - Monitoring of Lake Water Balances
  - Hydrologic pathways



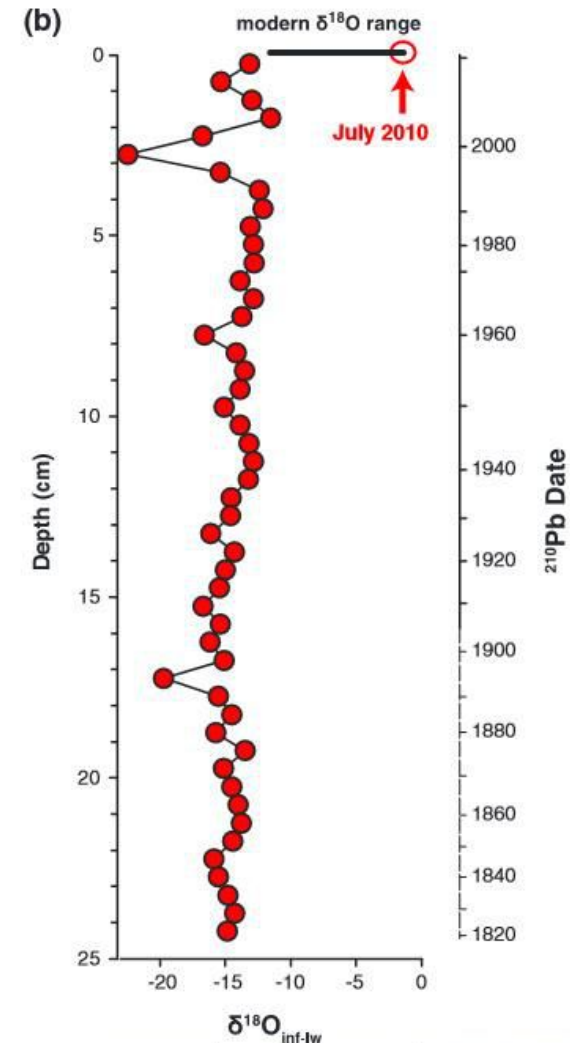
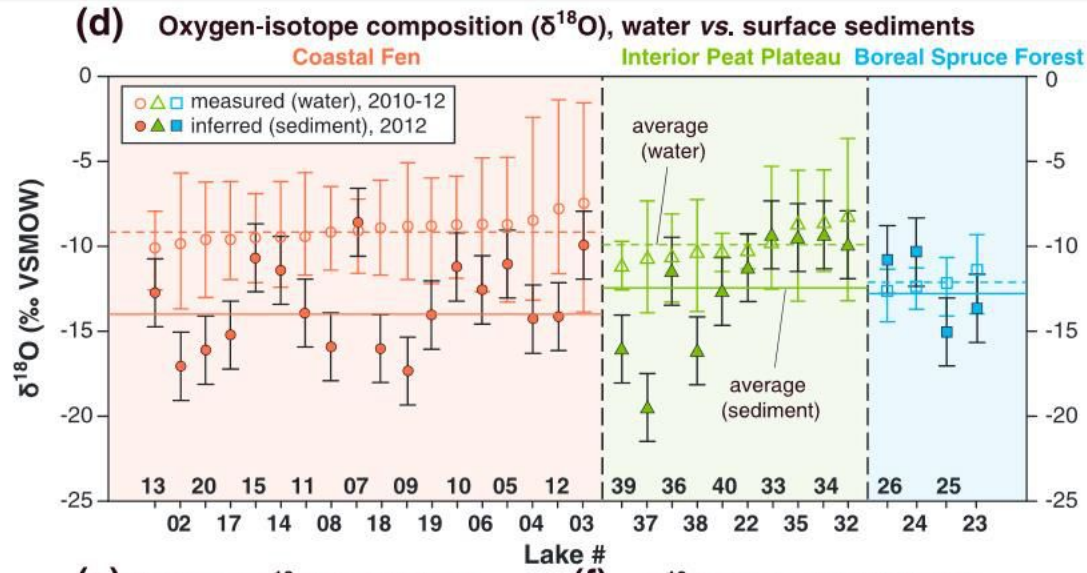
# Evaporative Stress



Churchill, Manitoba

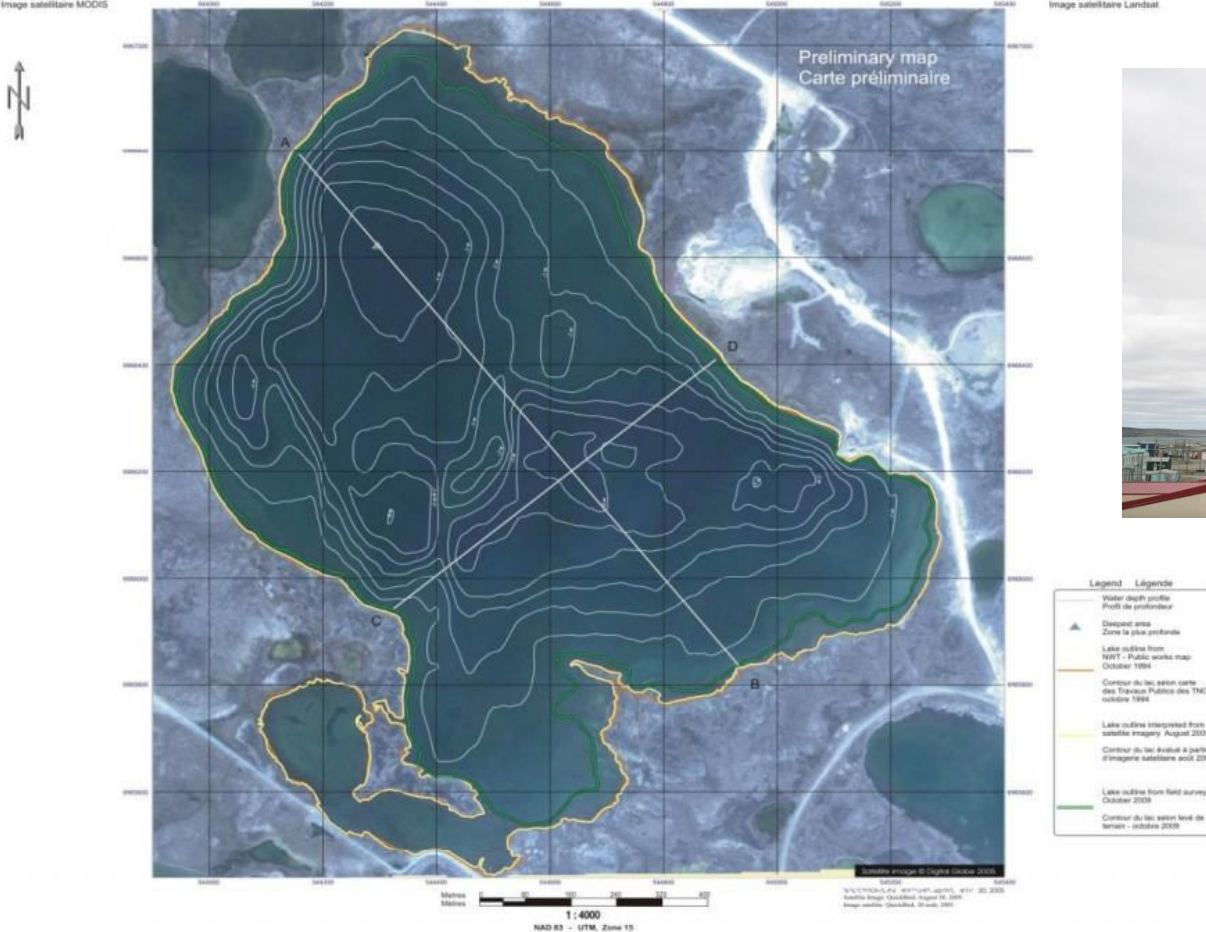


# Vulnerability



# Running Out of Water

## Rankin Inlet, Nunavut





# Supplemental Water Supply?

## Char River outlet - 2007





# Char River outlet - 2006

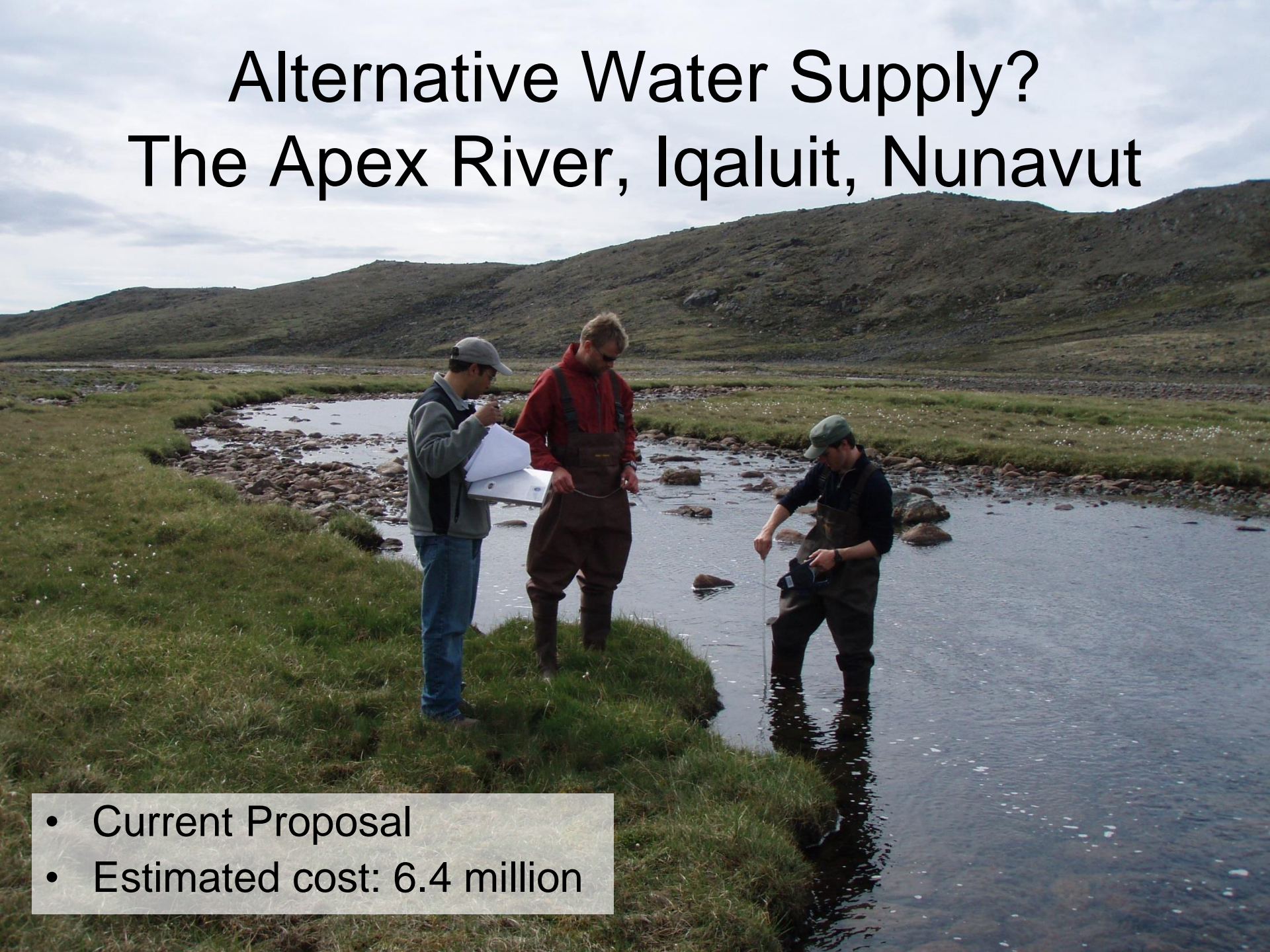


- Cost: ~\$5 million
- Extension of supply: 5 years



# Alternative Water Supply?

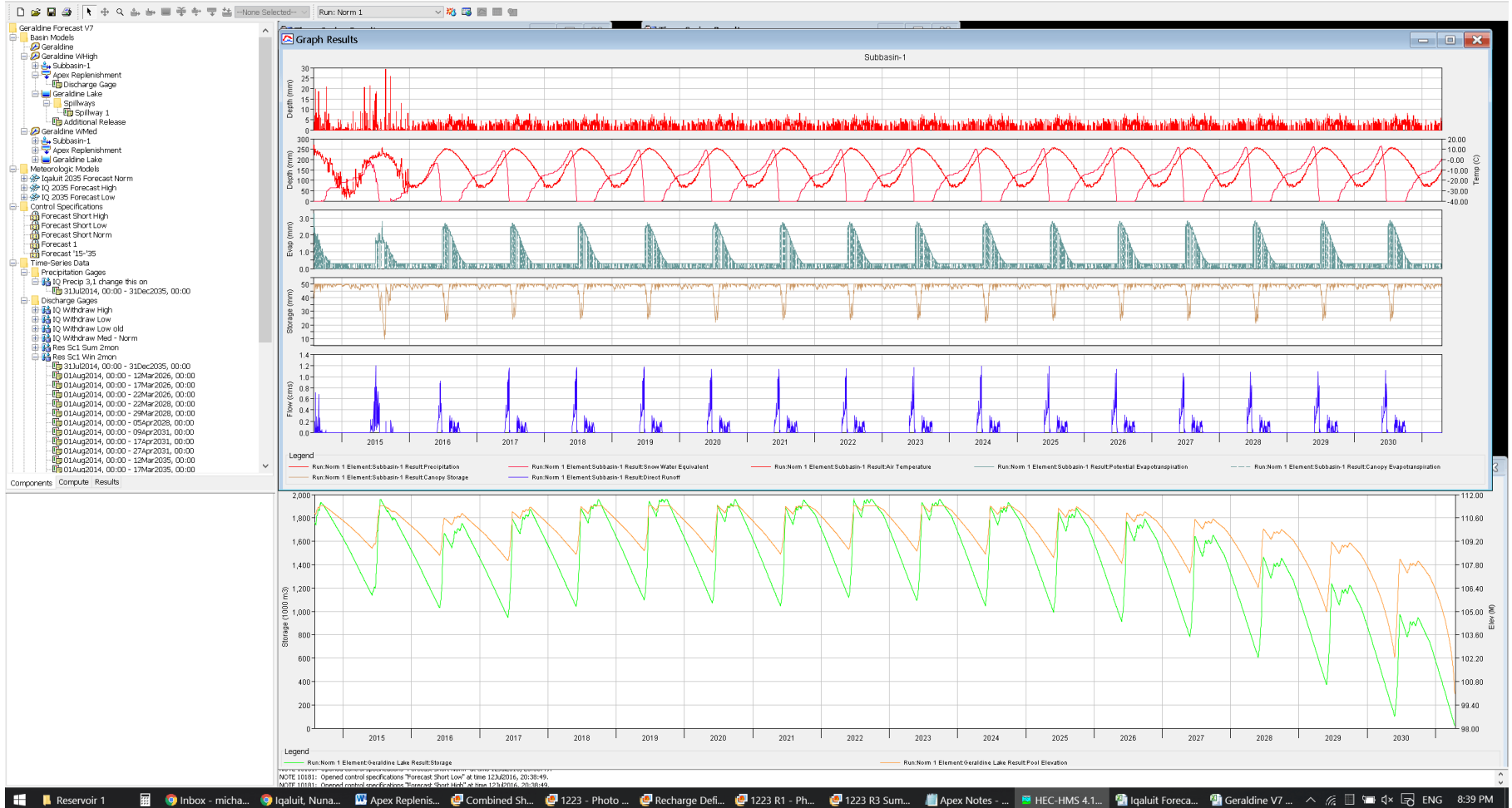
## The Apex River, Iqaluit, Nunavut

- 
- A photograph showing three people in a river field site. Two people are on the grassy bank, one holding a clipboard and the other in waders. A third person is in the water, also in waders, using a long pole. The background shows a wide river and rolling hills under a cloudy sky.
- Current Proposal
  - Estimated cost: 6.4 million

# Hydrologic Modelling

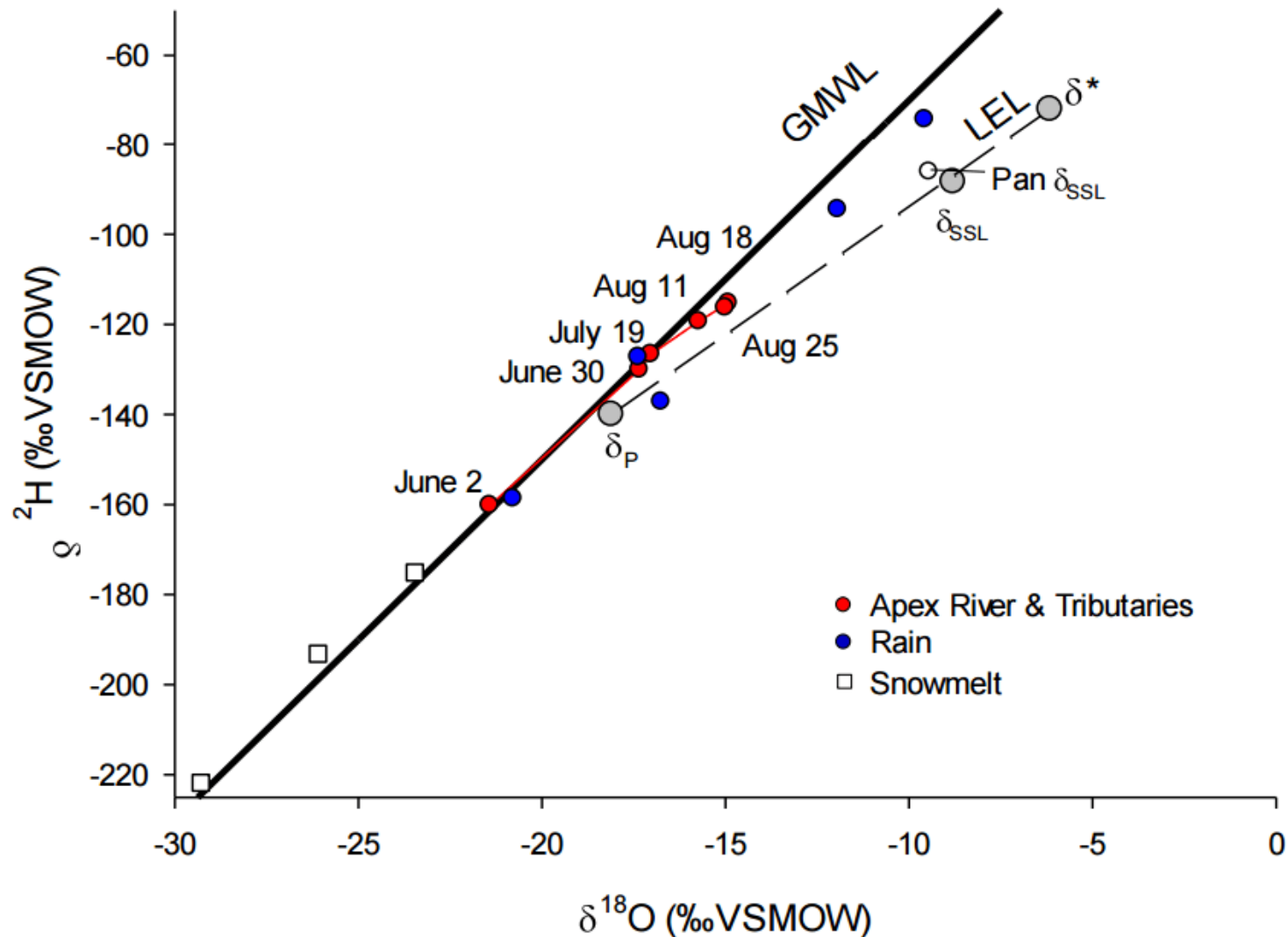
HEC-HMS 4.1 [C:\Users\Michael\Google Drive\York MES\ENVS 6599 NU Water Resource Assessment\HMS Models\Iqaluit - Geraldine\Geraldine\_Forecast\_V7\Geraldine\_Forecast\_V7.hms]

File Edit View Components Parameters Compute Results Tools Help





# Water Balance Modelling



# Summer Rainfall



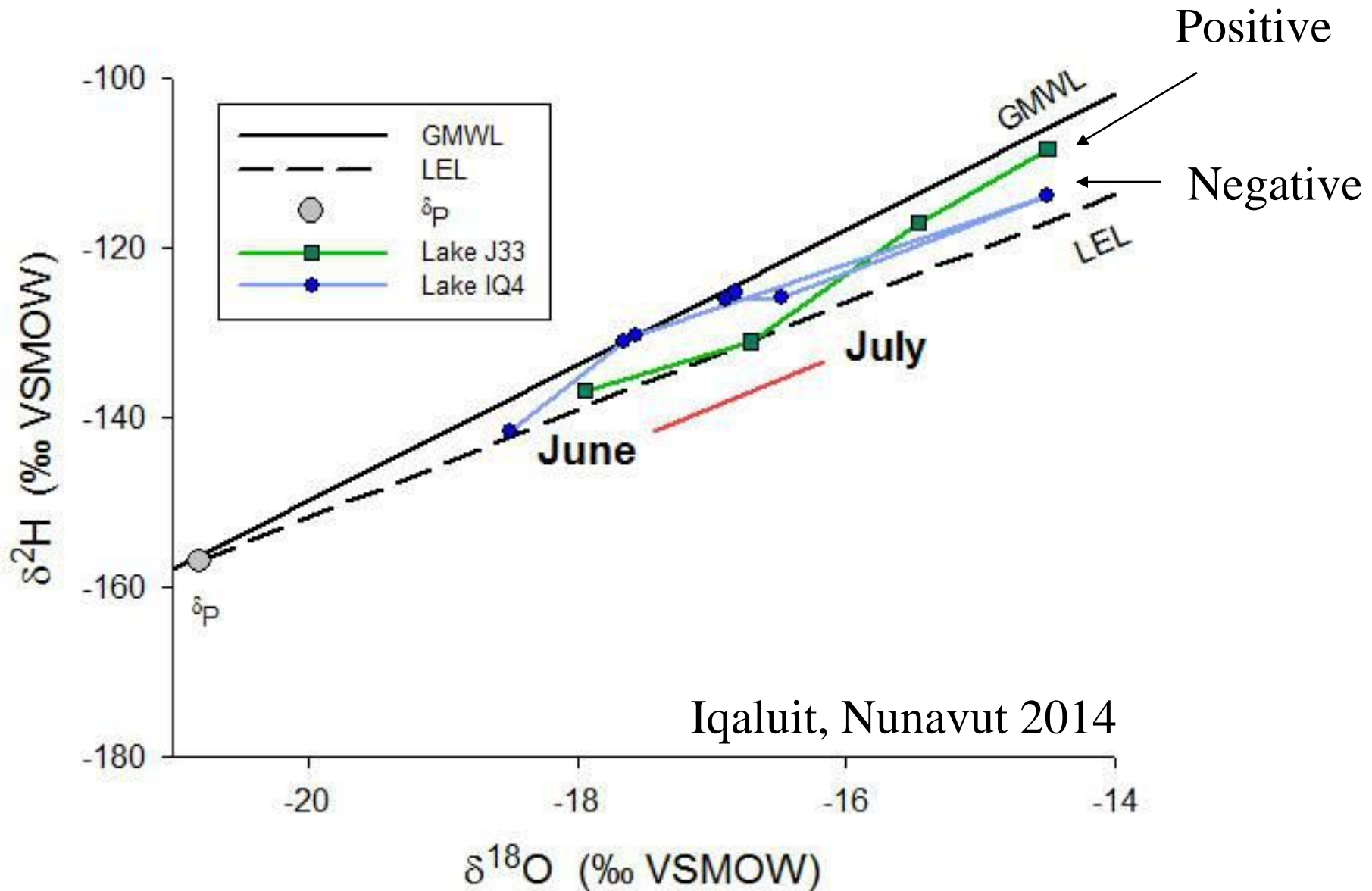


# Evaporative Stress

Jessica Peters  
BES Honours Thesis,  
Wilfrid Laurier University

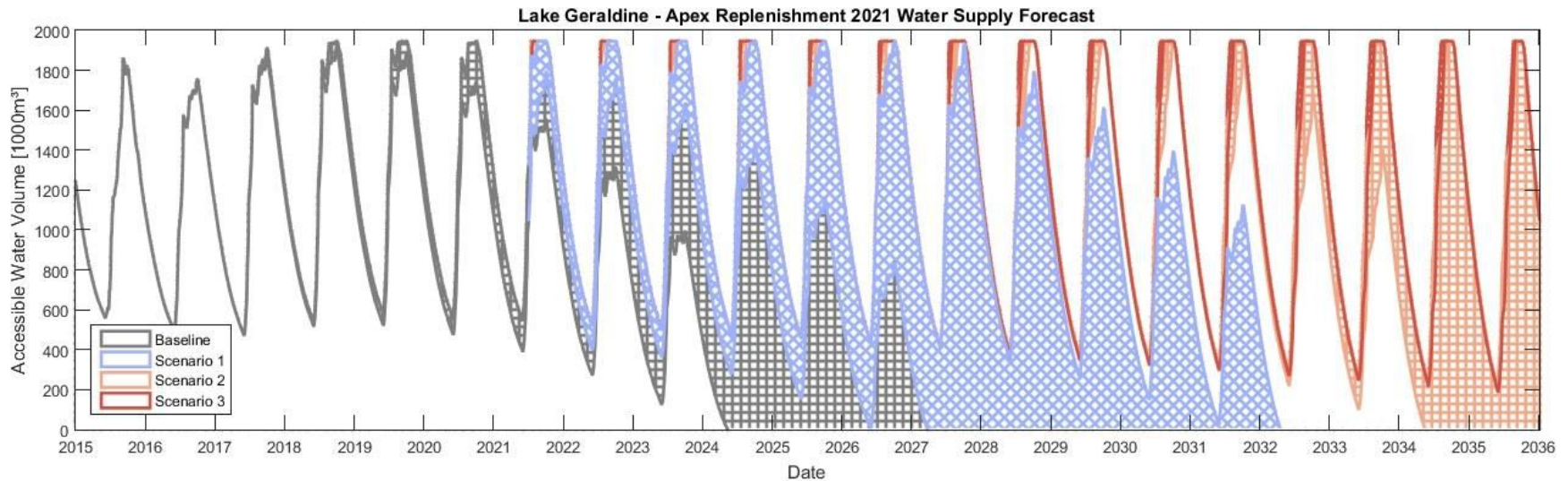


# Isotope Hydrology: Seasonal Pattern





# What do we find?



- Supplemental Water replenishment from local river provides 3-5 years worth of water
- Cost / Benefit question
- Alternative sources of water?

# Water Risk Assessment

- **Problem:** Evaporative stress and increased populations causing widespread risk to water infrastructure and supply



Use estimates of water source volumes to:

- Calculate input vs output
- Determine water-balances
- Model risk assessment scenarios
- Provide adaptation recommendations

**Government has no estimates of water volumes for 19 of 25 Nunavut communities**



# Solution: Basic Bathymetric Surveys and Water Sampling

- Simple measurements of depth
- Collection of water and sediment
- Isotope analysis + Hydrologic modelling
- Estimated cost per community: ~\$10-15,000



→ Minor costs but not a funding ‘priority’

# Freshwater Policy?

- Nunavut Waters and Nunavut Surface Rights Tribunal Act – 2014
- Municipalities own and operate water infrastructure
- Maintenance and management from Department of Community and Governmental Affairs
- Permits and licensing from Nunavut Water Board
- **No territorial freshwater management policy framework exists**



# Freshwater Policy

- Severe need to bring various government and non-government stakeholders together to address lack of freshwater policy or management
- Government of Nunavut has no person(s) in charge of freshwater policy or planning
- Climate change adaptation group has no freshwater adaptation strategy
- **Water Security is as important as food security**

# Thank you!

- Undergraduate Honours Thesis Students: Cait Carew, Jessica Peters, Heather Haight, Anthony Todd
- Field Assistance: Ryan Scott, Chris Luszczyk, Ray Biastoch
- University of Waterloo – Environmental Isotope Lab
- Northern Partners: Nunavut Research Institute, Nunavut Arctic College
- Collaborations: Suzanne Tank, Brent Wolfe, Roland Hall, Roberto Quinlan, Marc Amyot, Gwyneth MacMillan, Konrad Gajewski, Sarah Finkelstein, David Porinchu, and many many others..
- Funding: NSERC, PCSP, ACUNS / The W. Garfield Weston Foundation



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FOUNDATION



# Freshwater Policy

