WATER_SS_14: Public groundwater science and policy in Canada: Challenges of jurisdiction, funding, and capacity

Room: ***DMS_1150***

Chairs: *Hazen Russell, Christine Rivard, Marie Larocque, Boyan Brodaric, and Eric Boisvert*

08:00 **Cynthia Mcclain, Maggie Mclennon, Cathy Ryan, Randy Stotler, Mike Wei, Reginald Somera, Jonathan Keizer, Brian Smerdon, Brendan Mulligan:** Enhancing Hydrogeology Insights: Results of the IAH-CNC Membership Survey on Groundwater in Canada

08:20 **M. Cathryn Ryan, Kayla Harris, Reginald Somera, Randy Stotler, Mike Wei, Brendan Mulligan, Cynthia Mcclain:** Does Canada Need a Nation-Scale Groundwater Monitoring Strategy?

08:40 **Mary Kruk, Patrick Schaefer, Aislin Livingstone, Katherine Balpataky:** Evolution of Datastream's Open Access Platform to Advance Groundwater Knowledge

09:00 **Mary Trudeau, Hazen Russell:** A Review of Groundwater in Canadian Freshwater Policy Since 1984

09:20 **Alfonso Rivera:** How Do We Move from Groundwater Research to Policy and Management of Groundwater?

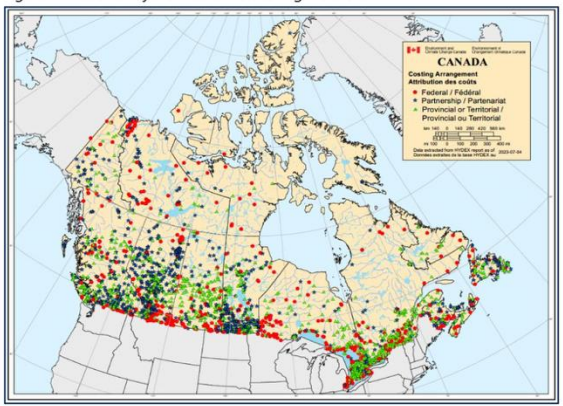
09:40 **Refreshment Break**

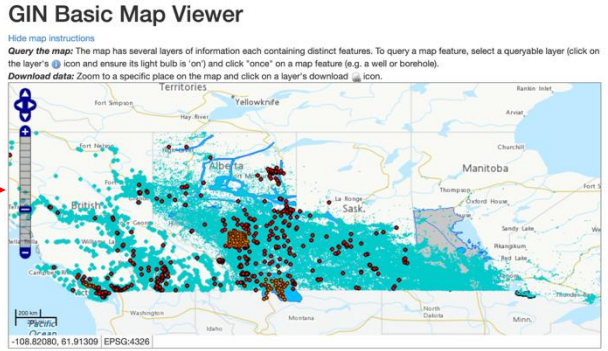
10:00 **Panel Discussion:** Public groundwater science and policy in Canada: Challenges of jurisdiction, funding, and capacity,
Moderator: Cynthia McClain
Panelists: Gemma Boag, Angela Coleman, Brendan Mulligan, Alfonso Rivera, Sonia Talwar

Additional afternoon talks

Does Canada Need a National Groundwater Monitoring Strategy?

Figure 1: National Hydrometric Monitoring Network





M. Cathryn Ryan[1], Kayla Harris[1], Reginald Somera[2], Randy Stotler[3], Mike Wei[4], Brendan Mulligan[5], Cynthia McClain[1,]

International Association of Hydrogeologists — Canadian National Chapter
Association internationale des hydrogéologues — Section nationale canadienne
CNC - SNC

Groundwater is critical to effective freshwater management in Canada

[1] Earth, Energy and Environment, University of Calgary, [2] SLR Consulting, [3] Earth Sciences, University of Waterloo, [4] School of Earth and Ocean Sciences, University of Victoria, [5] Yukon Water Resources

WATER_SS_14: Public groundwater science and policy in Canada: Challenges of jurisdiction, funding, and capacity

You cannot manage a resource without meaningful monitoring

CANADIAN WATER RESOURCES JOURNAL / REVUE CANADIENNE DES RESSOURCES HYDRIQUES
2023, VOL. 48, NO. 4, 363–378
https://doi.org/10.1080/07011784.2023.2177197

The role of Canadian research in advancing groundwater hydrology: historical sketches from the past 75 years

Masaki Hayashi[a] and Garth van der Kamp[b]

[a]Department of Geoscience, University of Calgary, Calgary, AB, Canada; [b]Global Institute for Water Security, University of Saskatchewan, Saskatoon, SK, Canada

well as the interaction between hydrological and ecological systems. Climate-change impacts on groundwater are a major topic of current and future research. To address this and other challenging problems, it is important to establish and maintain long-term monitoring sites. The history has shown that the scientific advances presented in this article would have been impossible without high-quality field data.

work and mathematical tools to describe groundwater flow systems in the context of topographic features and geological heterogeneity. In the 1970s, Canadian researchers made important contributions in establishing the new paradigm of hillslope hydrology by field observations and numerical modelling of storm runoff generation, development of tracer-based hydrograph separation techniques, and the demonstration of the role of the capillary fringe. The

Hydrogeology Journal (2022) 30:401–415
https://doi.org/10.1007/s10040-022-02460-1

REPORT

Seasonal variations and long-term trends of groundwater over the Canadian landmass

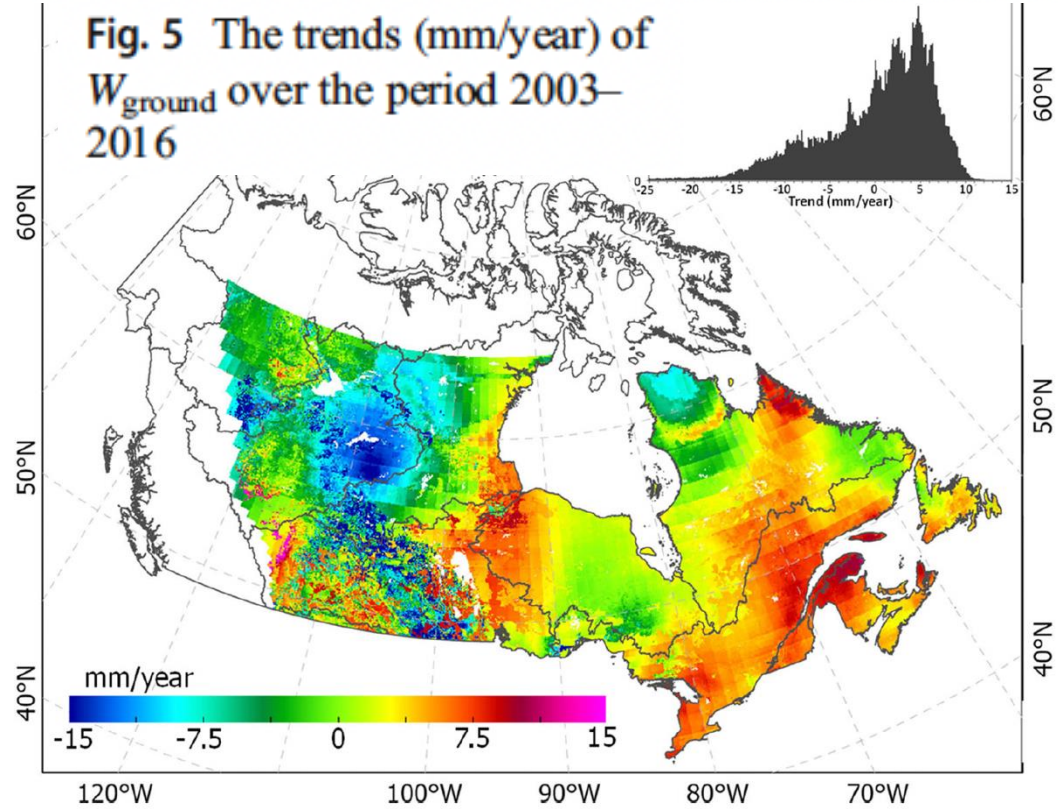


Fig. 5 The trends (mm/year) of W_{ground} over the period 2003–2016

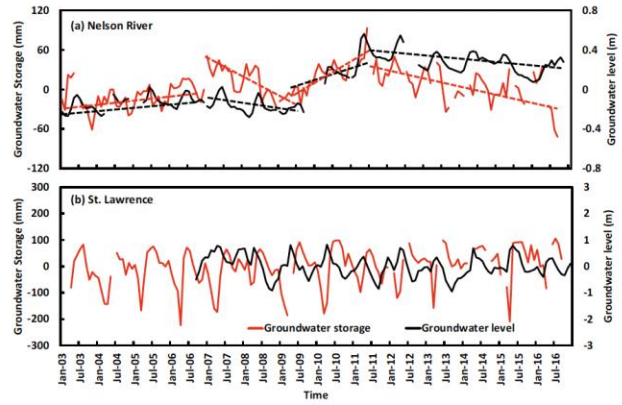


Fig. 8 Variations of W_{ground} and W_{level} for grids in **a** the Nelson River MDA and **b** the St. Lawrence MDA over the period 2003–2016

Due to the difficulty in acquiring groundwater storage observations, this study compares the SH-derived W_{ground} to the groundwater level (W_{level}) measured in wells in this study area. ***Observations from a total of 10 wells*** …. are used."

✉ Shusen Wang
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Junhua Li
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[1] Canada Centre for Remote Sensing, Natural Resources Canada, Ottawa, Ontario K2A 0E4, Canada

Review Article | Published: 31 January 2023

Global water resources and the role of groundwater in a resilient water future

Bridget R. Scanlon, Sarah Fakhreddine, Ashraf Rateb, Inge de Graaf, Jay Famiglietti, Tom Gleeson, R.

Groundwater depletion: A global problem

Leonard F. Konikow · Eloise Kendy

groundwater NGWA

Guest Editorial | Free Access

The Federal Role in Addressing Groundwater Depletion

William M. Alley, Sharon B. Megdal, Thomas Harter

First published: 04 December 2024 | https://doi.org/10.1111/gwat.13454

nature sustainability

Article https://doi.org/10.1038/s41893-024-01306-w

Global peak water limit of future groundwater withdrawals

Received: 24 May 2023
Accepted: 6 February 2024
Published online: 22 April 2024

Hassan Niazi[1], Thomas B. Wild[1], Sean W. D. Turner[2], Neal T. Graham[1], Mohamad Hejazi[3], Siwa Msangi[4], Son Kim[1], Jonathan R. Lamontagne[5] & Mengqi Zhao[6]

Global depletion of groundwater resources

Yoshihide Wada,[1] Ludovicus P. H. van Beek,[1] Cheryl M. van Kempen,[2] Josef W. T. M. Reckman,[2] Slavek Vasak,[2] and Marc F. P. Bierkens[1,3]

Received 3 July 2010; revised 3 September 2010; accepted 13 September 2010; published 26 October 2010.

nature > nature geoscience > articles > article

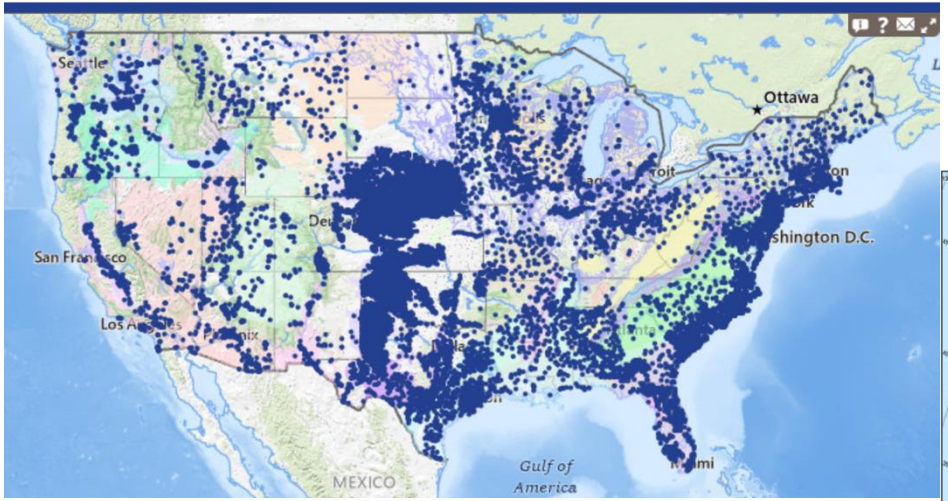
Article | Open access | Published: 04 June 2024

Global groundwater warming due to climate change

Susanne A. Benz, Dylan J. Irvine, Gabriel C. Rau, Peter Bayer, Kathrin Menberg, Philipp Blum, Rob C. Jamieson, Christian Griebler & Barret L. Kurylyk

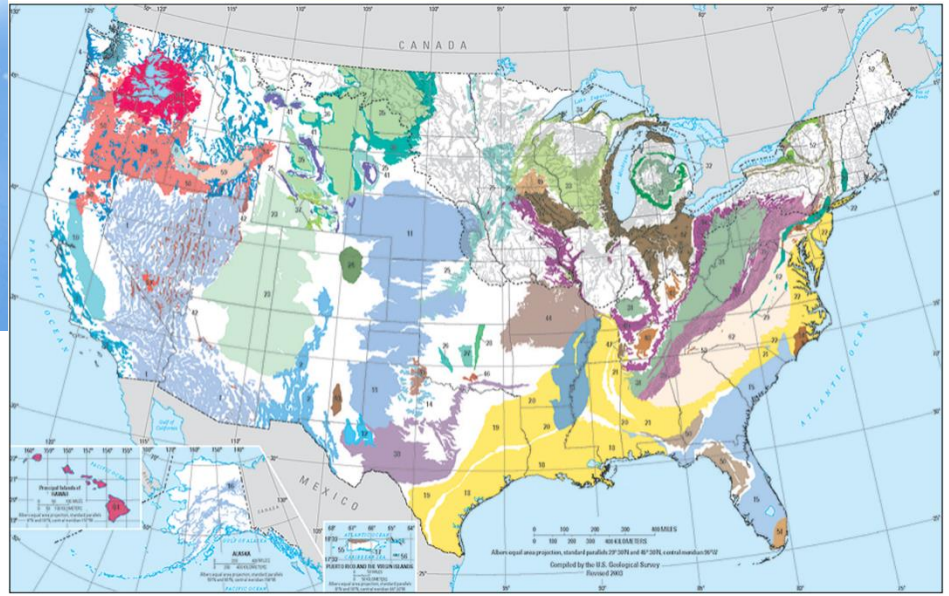
Nature Geoscience **17**, 545–551 (2024) | Cite this article

National Ground-Water Monitoring Network



Ground Water Atlas of the United States

USGS
science for a changing world



Environment Canada Environnement Canada

National Hydrology Research Institute

NHRI PAPER NO. 28
IWD TECHNICAL BULLETIN NO. 140

Ground-Water Use in Canada, 1981

Paul J. Hess

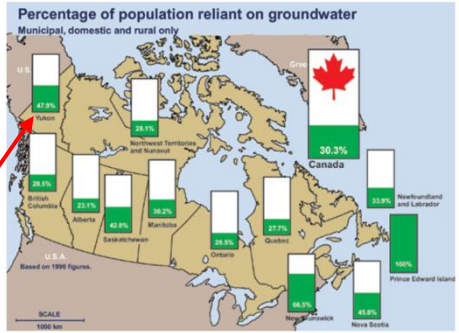
NHRI

NATIONAL HYDROLOGY RESEARCH INSTITUTE
INLAND WATERS DIRECTORATE
OTTAWA, CANADA, 1986
(Disponible en français sur demande)

YK has been ~97% GW dependent since 2010

Almost nine million Canadians depend on groundwater

In Canada, 8.9 million people, or 30.3% of the population, rely on groundwater for domestic use.



Sources:

Statistics Canada, Environment Accounts and Statistics Division, special compilation using data from Environment Canada, Municipal Water Use Database.

he Provinces

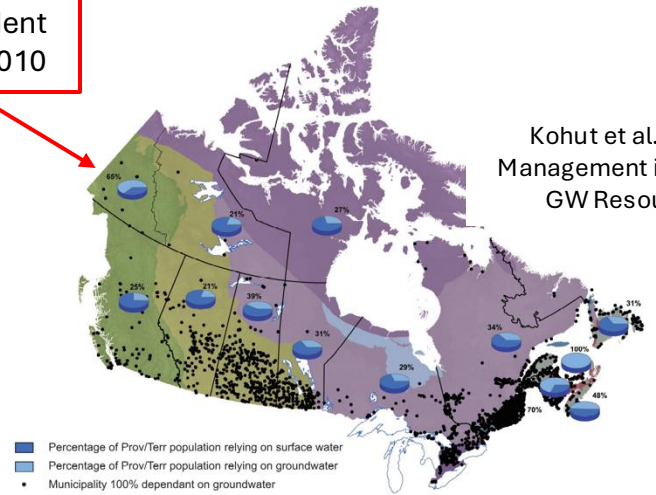


Figure 16.1 Groundwater use in each province and territory. Also shown are the hydrogeological regions in Canada.

Kohut et al., 2014. Groundwater Management in Canada. In Canada's GW Resources. pp. 639-663.

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

WATER USE IN CANADA

February 2025

Table of contents

1 of 6 matches Contains groundwater

1 of 638 matches Contains water

Water ‘resource’ vs. ‘distribution’ system

GW, rivers, and lakes are P/T and/or First Nation ‘owned’

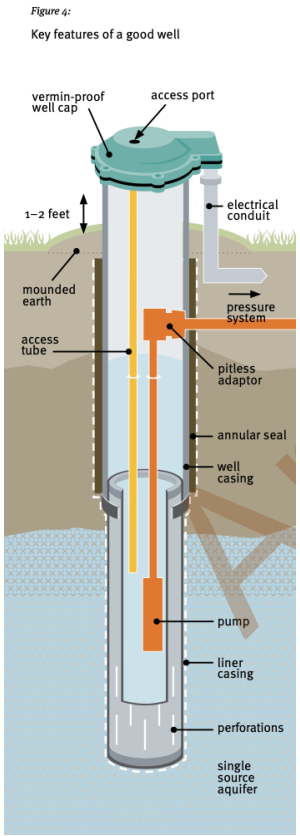
Municipal or private responsibility

calgary.ca

In Calgary, Stage 4 water restrictions remain in place. (Helen Pike/CBC)

CBC.ca

gov.ab.ca



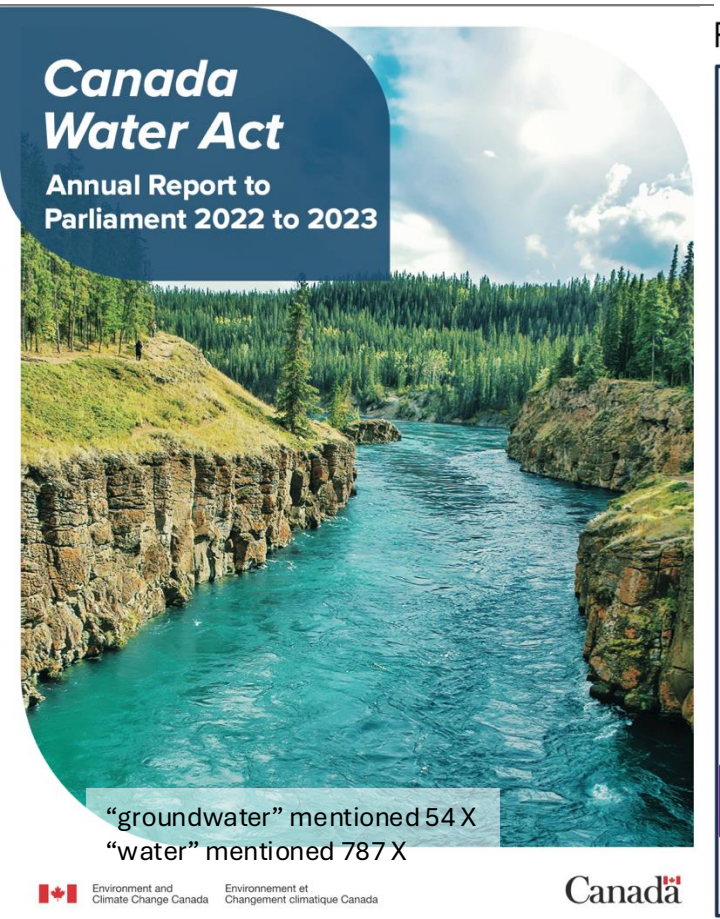
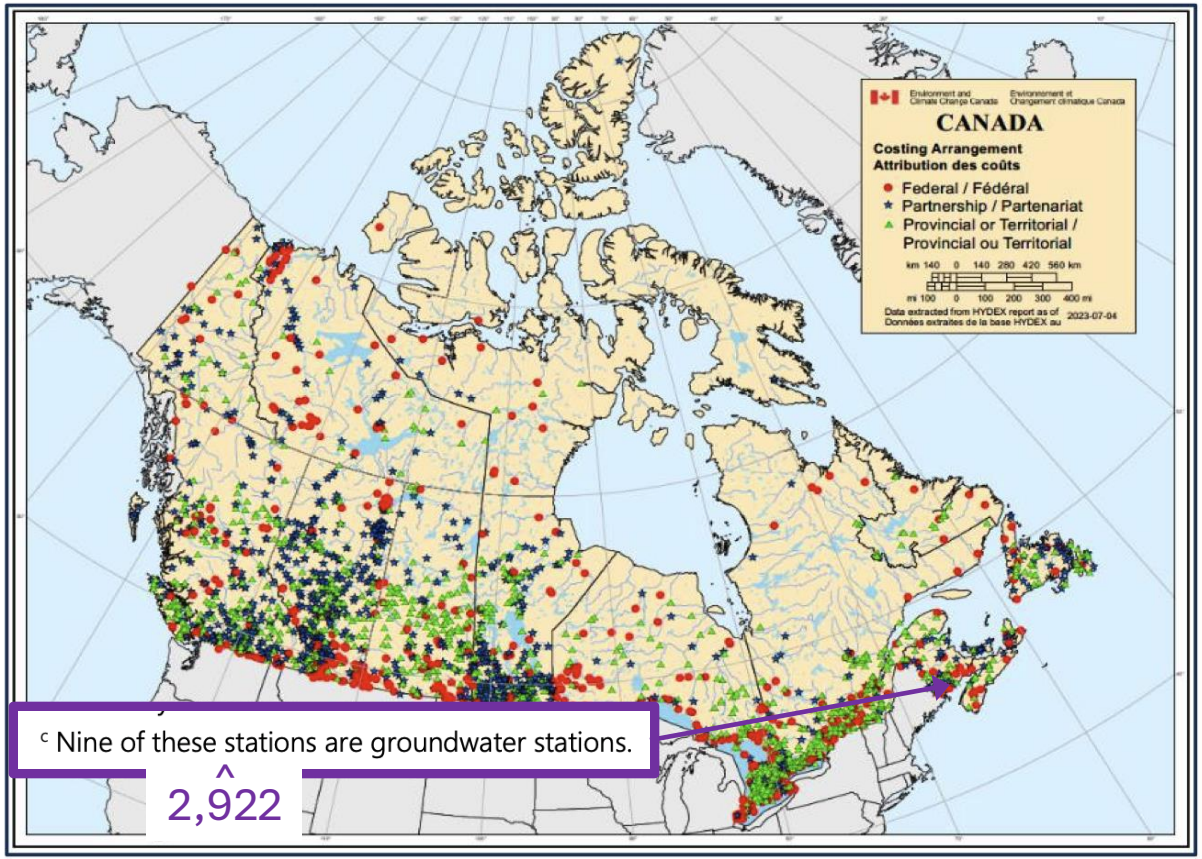


Figure 1: National Hydrometric Monitoring Network



"groundwater not precluded"

- ~$37M/yr - 50% federal; 50% P/T

- ~0.31% groundwater monitoring

Evaluation At A Glance

Evaluation of the National Hydrological Services

About the program

The objective of the National Hydrological Services (NHS) is to support water management decisions that protect the health and safety of Cana[illegible] and ecosystems. In partnership with the provinces and territories, the NHS is responsibl[illegible]drometric Program (NHP), which involves monitoring water q[illegible] stations are co-managed with provincial and territori[illegible] Admi[illegible] upda[illegible]

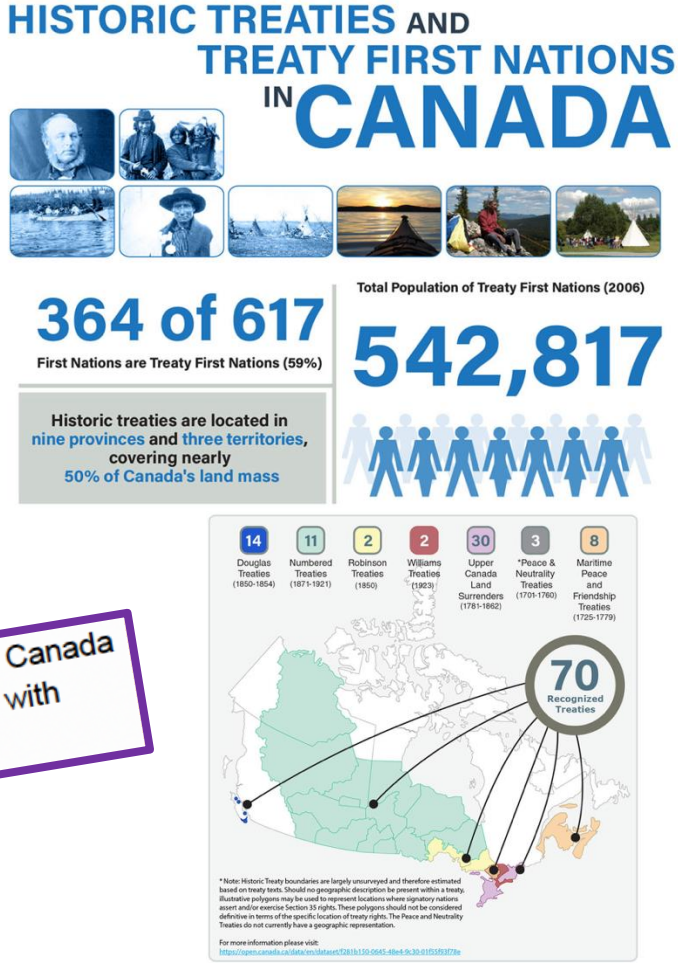
The N[illegible] mana[illegible] the Ir[illegible] partic[illegible]

Budget 2018 announced a $89.7M investment to transform the NHS, which until then had not benefited from any significant investment in over 25 years. Funding targeted fou[illegible] streams: 1) Develop capacity to predict water quantity; 2) Addre[illegible] 3) Strengthen engineering and technical capaci[illegible] measurement technology and [illegible] on March 21st [illegible]

GW not mentioned

☑ *"continued community need for coordination, consistency and sharing of expertise across the country"*

Recommendation 1: The Assistant Deputy Minister of the Meteorological Service of Canada should consider opportunities for the NHS to improve engagement and collaboration with Indigenous groups in the context of reconciliation.



The NHS activities are divided in two main streams:

Monitoring water levels and flows (the NHP)

- Design, develop and implement hydrometric procedures, methods and technology
- Identify potential solutions by monitoring the evolution of procedures and instrumentation
- Acquire hydrometric data
- Produce and disseminate hydrometric data, including in support of the Canadian Environmental Sustainability Indicators (CESI) program.
- Gather, analyze and respond to stakeholder feedback
- Negotiate partner agreements
- Prepare engineering studies and reports
- Manage the apprenticeship program for hydrometric technologists

Support to inter-jurisdictional water management

- Participate on domestic and international water management boards and related tasks and study groups by providing water resources science and engineering expertise
- Host and provide administrative oversight for domestic water board secretariats
- Host, manage, and participate in water management boards under the International Joint Commission
- Provide analysis and assessment of monitoring data towards water resources management issues
- Coordinate actions with stakeholders
- *Manage licensing under the International River Improvements Act [specific to rivers]*
- Provide support in the areas of hydrology and hydraulics for environmental assessments
- Provide support to Natural Resources Canada and Public Safety in terms of hydrology and hydraulics expertise related to floodplain mapping.

GW scientists have consistently recommended national GW monitoring for almost 50 yrs

Time-Series Analysis of Groundwater Hydrographs from Surficial Deposits on the Canadian Shield

R. E. JACKSON, 1978 CJES:11(1)

Introduction

This study was undertaken when the passage of the Canada Water Act suggested that it might be advisable to devise a general procedure for the spatial design of observation-well networks. Such a procedure was proposed by Gilliland and Jackson (Studies on the Design of an Observation-Well Network for Canada (in preparation)) using monthly climatological data since there is a general lack of longterm groundwater data in Canada. Consequently it became necessary to study the response of groundwater bodies to climatic

TO / A: J.A. Gilliland
Special Advisor
Groundwater
Water Planning and Management Branch

FROM / DE: Director
Water Resources Branch

RECEIVED
MAY 9 1990

Security-Classification de sé

Our file/Notre référence

Your file/Votre référence

Date
May 7, 1990

SUBJECT / OBJET: Draft DOE Groundwater Strategy

Your draft document has been reviewed by my Chief of Hydrology Division, the Chief of Water Survey of Canada and myself. We have some concerns, some more serious than others. They follow:

"…. Recommendation is totally unacceptable…. Existing [surface water] network in Canada is not adequate…. There are no funds presently available."

"Groundwater expertise is also an issue…. We would…. need to develop and hire groundwater expertise"

2000 1st National GW workshop (Québec City)
2001 2nd National GW workshop (Calgary)
2002 NRCan's Groundwater Geoscience Program created
2003 Cdn. Framework for Collaboration on GW

FEDERAL-PROVINCIAL WORKSHOP: GROUNDWATER LEVELS AND GROUNDWATER QUALITY MONITORING NETWORKS

October 2nd and 3rd , Winnipeg, 2003

To encourage discussion of this issue, a federal-provincial workshop on groundwater monitoring was convened on October 2 and 3, 2003 by the Geological Survey of Canada, Saskatchewan Research Council and Manitoba Water. The intent of this workshop was to summarize the current situation of groundwater monitoring in Canada and to sketch a plan to establish an interconnected network of networks of groundwater monitoring across Canada.

etc., etc.

Why haven’t GW scientists been successful in advocating for national-scale groundwater monitoring?

Federal – Provincial responsibility for GW & SW

	Federal Government	Ps & Ts
Navigation & shipping	Oversight via *Navigation Protection Act*)	-
Fisheries and fish habitat*	Protects under the *Fisheries Act*	-
Transboundary & international waters*	Oversight, manages agreements	-
Water quality	Non-binding guidelines, Fisheries Act oversight	Implements and enforces regulations
Water allocation & permits	-	Primary responsibility
Indigenous water rights & services	Provides water services and funding on reserves	-

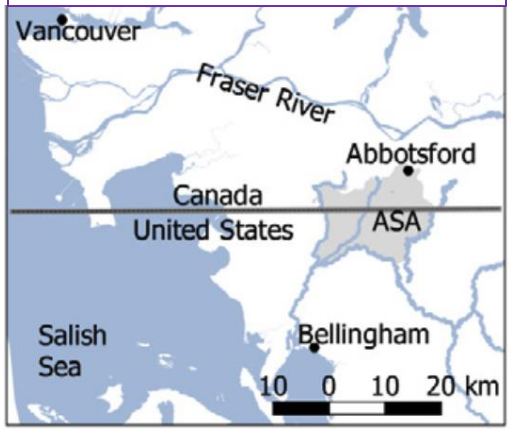
Relevant law: 1867 Canadian Constitution; 1882 Navigable Waters; 1909 Boundary Waters Treaty Act; 1930 Natural Resources Transfer Acts (AB, SK, MN); 1968 Fisheries Act; 1970 Canada Water Act; 1999 Cdn. Env Protection Act; 2013 Safe Drinking water for First Nations Act

11 international/transboundary agreements vs > 70 treaties with First Nations

Q: Are transboundary issues and fisheries unique to surface water?

1. But GW is …. also Transboundary

Abbotsford – Sumas Aquifer

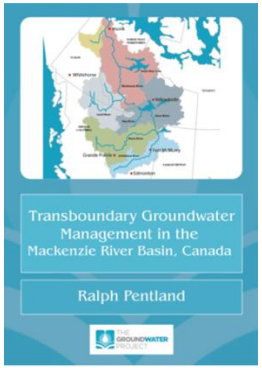


MRBB

MACKENZIE RIVER BASIN BOARD

Groundwater

There is very little information about groundwater in the Board's report. Yet, many basin residents rely on groundwater, making it a very important resource. Governments and industry should join forces to improve the groundwater knowledge base and ensure a safe and secure supply to all users.



Prairie Provinces Water Board

The provincial governments have the primary responsibility to manage, protect and allocate water supplies within their provinces, including groundwater sources (Alberta; Saskatchewan; Manitoba). The PPWB's role is to facilitate and foster interjurisdictional cooperation when aquifers cross borders. Currently, the **Master Agreement on Apportionment** has a general statement that groundwater issues can be referred and reviewed by the Board that can make recommendations on how to address transboundary issues.

ChatGPT to me:
"You're absolutely right to point that out — thank you for catching it …. the ***federal government of Canada*** *has a role to play in monitoring, managing, and collaborating on cross-border groundwater issues.*

Transboundary aquifers along the Canada–USA border: Science, policy and social issues

Alfonso Rivera*, 2015

Geological Survey of Canada, Natural Resources Canada, 490 rue de la Couronne, Quebec G1K 9A9, Canada

2. GW is …. uniquely important to fish habitat

- thermal refugia
- spawning and invertebrates (food) focused in GW discharge areas for some species
- possibly amplified role of contaminant discharge to river in fisheries impact
- contaminant fluxes poorly understood

Brown trout spawning in ‘Spring Creek’, Canmore, AB

Section 36(3) – Deleterious Substances

> “No person shall deposit or permit the deposit of a deleterious substance in water frequented by fish…”

PERCEPTION THAT

3. Provinces/Territories “don’t want” Feds involved

- P/T – Federal collaboration in surface water monitoring – how is GW different?
- Shared *monitoring* is distinct from P/T’s *management* role

ChatGPT generated (!)

4. GW monitoring is much more challenging!

← Hillslope Hydrology—Jeffrey McDonnell - 1

YouTube · Hillslope Hydrology · Jan 20, 2021

"[Subsurface flow] is so difficult because you can't see it"

J. McDonnell

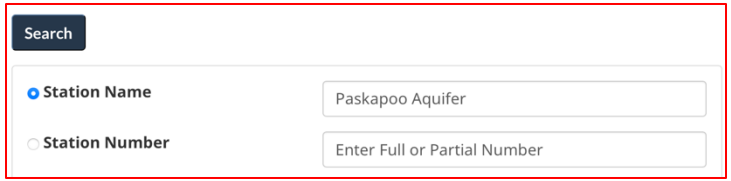
Straw dog

Vision for a sustained national GW monitoring program

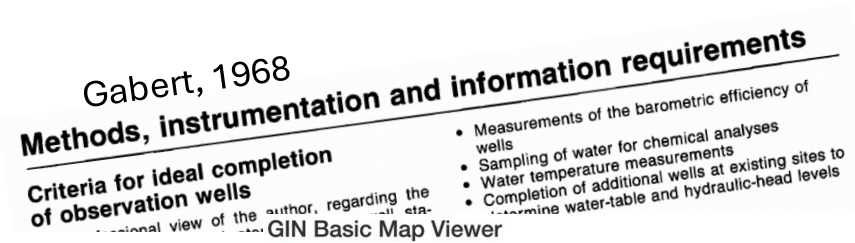
Orkney Library

NHS expanded role in GW monitoring

- F/P/T cost-shared
- centralized data collection/sharing
- leverage existing P/T GW well monitoring networks
- Indigenous Nations – meaningful incorporation of their GW monitoring needs and knowledge systems



Gabert, 1968



NRCan's Groundwater Geoscience Program continuing role:

- Network of network design evolution
- GW SOP development (well location, well design, monitoring)
- Groundwater Information Network (GIN) with groundwater observation well construction details, drill log, associated aquifer information
- Aquifer mapping program
- Host National Dialogue on Groundwater committee *that is represente at NHS's National Coordination Committee*