Ressources naturelles Canada | Natural Resources Canada

DIALOGUE NATIONAL SUR LES EAUX SOUTERRAINES

-

NATIONAL DIALOGUE ON GROUNDWATER

January 15, 2020 (1 – 2pm (ET))

Canada

FIRST CALL - OVERVIEW

1. Participants Role call (5-10 min)
2. Opening remarks (5 min) – Daniel Lebel
3. Groundwater Geoscience Program (5 min) - Yves Michaud
4. Archetypal Aquifer Project (5 min) - Hazen Russell
5. Mapping the Principal Bedrock Aquifers of Canada (5 min) - Alfonso Rivera
6. Groundwater Information Network (5 min) - Boyan Brodaric
7. Logistics for future meetings (5 min)
    - Content
    - Format
8. Comments / suggestions (15 min)

Groundwater Geoscience Program
Phase V 2019-2024

Program's goal

- To better understand groundwater distribution, quantity, flow dynamics and possible impacts on Canada's sustainable developments

Themes and Project's titles

- Groundwater inventories - **Archetypical Aquifers**
- Cumulative effects - **Fox Creek aquifer system**
- Methods for assessing groundwater - **Water resources characterization and modeling**
- Data modeling and dissemination - **Groundwater information network**

Outputs

- Produce geoscience knowledge tools and information

Ultimate Outcome

- Better management of Groundwater resources

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Archetypal Aquifer Project:

Introduction

Groundwater Geoscience Program
National Dialogue on Groundwater

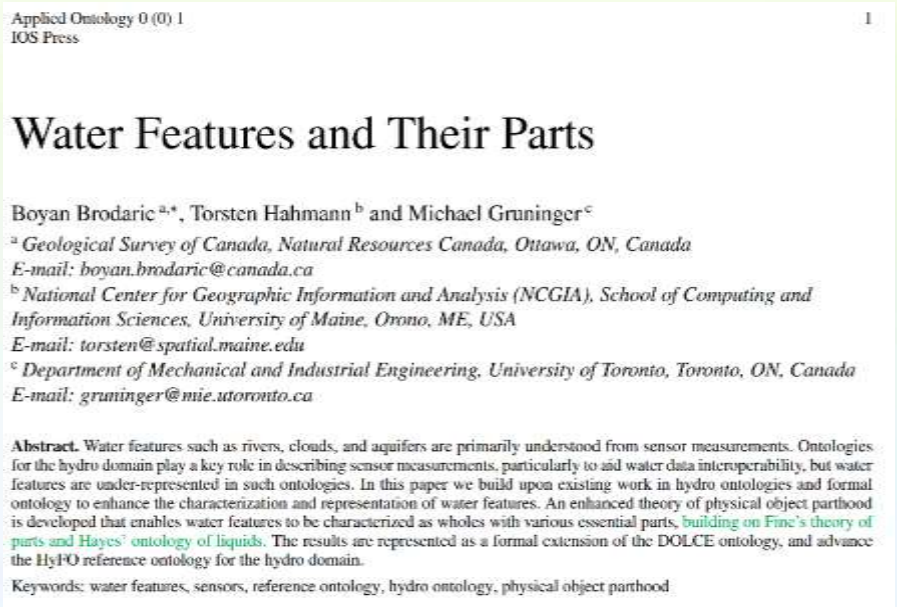
Hazen A.J. Russell

2020-01-15

Canada

AA Plan: Five Step

1. Classification development
2. Data consolidation
3. Case studies
4. Archetypal aquifer summaries
5. National synthesis maps



Applied Ontology 0 (0) 1 1
IOS Press

Water Features and Their Parts

Boyan Brodaric [a,*], Torsten Hahmann [b] and Michael Gruninger [c]
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Abstract. Water features such as rivers, clouds, and aquifers are primarily understood from sensor measurements. Ontologies for the hydro domain play a key role in describing sensor measurements, particularly to aid water data interoperability, but water features are under-represented in such ontologies. In this paper we build upon existing work in hydro ontologies and formal ontology to enhance the characterization and representation of water features. An enhanced theory of physical object parthood is developed that enables water features to be characterized as wholes with various essential parts, building on Fine's theory of parts and Hayes' ontology of liquids. The results are represented as a formal extension of the DOLCE ontology, and advance the HyFO reference ontology for the hydro domain.

Keywords: water features, sensors, reference ontology, hydro ontology, physical object parthood

Classification Development

- Move away from landform – sediment approach
- Consider three components – charge, reservoir, and confinement
- Step one –literature review / consultation

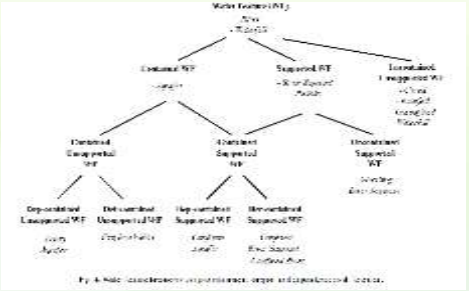


Table 2. Terminology and concepts for petroleum and groundwater plays in unconsolidated sediment

Petroleum play	Groundwater play	Comments
Source (charge)	Hydrology	"Hydrology" integrates precipitation, evaporation/transpiration, infiltration, recharge and discharge
Reservoir	Aquifer	defined by formative process, most commonly the depositional setting
Seal	Confining units	Aquitard units.
Trap		Hydrostratigraphic architecture.

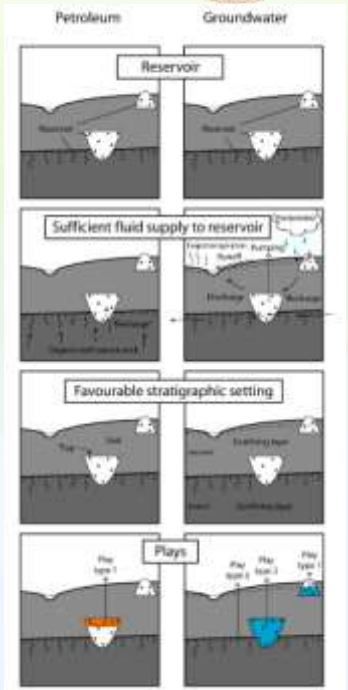
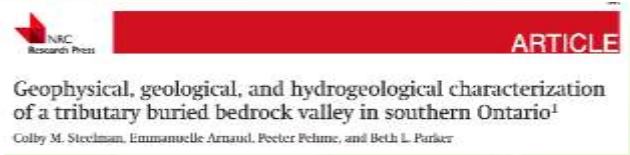
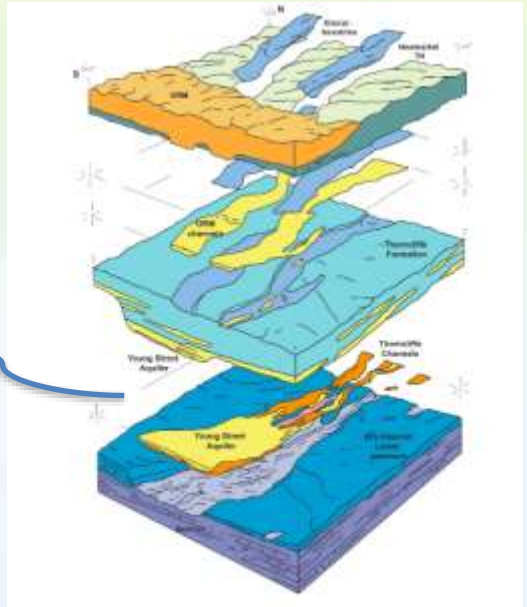


Figure 2. Comparison of terminology for two idealized petroleum and groundwater plays

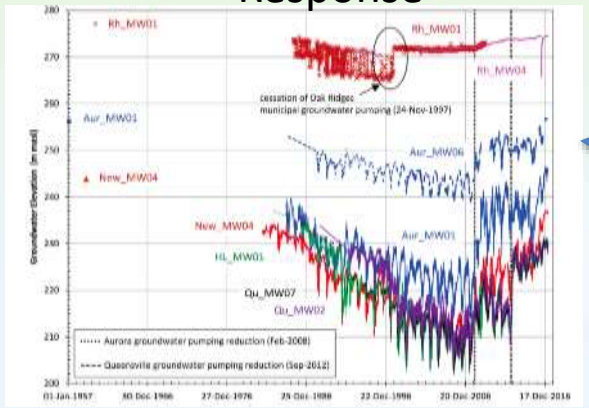
Case Studies



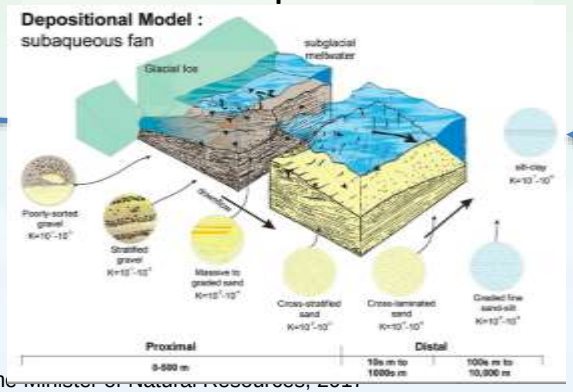
Architecture / Confining layers



Hydraulic Properties / Response



Aquifer Facies / Physical Properties



Calgary 2020

Conference: GeoConvention 2020; Calgary AB. May 11 to 13, 2020
URL: https://www.geoconvention.com

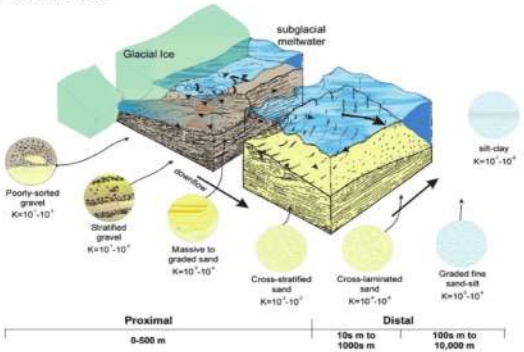
Abstract submission deadline: 2020-01-15

Technical Session URL:
https://www.geoconvention.com/uploads/docs/2020_Session_Outline_Guide.pdf

Session: Toward definition of archetypal aquifers

Convenors: Hazen Russell (hazen.russell@canada.ca), Vincent Cloutier (vincent.cloutier@uqat.ca), and Colby Steelman (csteelma@uoguelph.ca)

There is an abundance of case studies on various aquifers, and aquifer settings with a full range of data support depending upon study objectives, scale, and funding. Near surface aquifers, particularly those in surficial sediment are commonly classified by a combination of sediment - landform terminology; whereas deeper aquifers are commonly referenced by geological formation. This fails to recognize that aquifers are formed of multiple components, which may include: lithofacies, transmissivity, storage, and quality. This session seeks to consider how aquifer classification can be advanced, particularly toward development of archetypal aquifer classes. Identification of archetypal aquifer classes would help support consolidation of knowledge from case studies and enhanced integration of empirical observations, model results and theoretical frameworks. Useful aquifer archetypes support both explanatory conceptual models and link such models with geometry, properties, heterogeneity, and process for the delineation of aquifer classes. Archetypes can provide an analogue for process understanding and the spatial extrapolation of properties and hydraulic responses in areas with sparse data support, or as a guide to data collection and characterization. Submissions are invited on classification, application, and case studies (data collection, characterization) that may support development / population of archetypes.



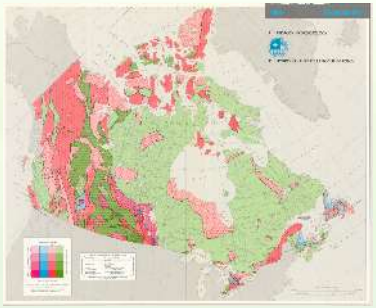
Conceptualization of depositional process model for a glacigenic subaqueous fan deposit and possible aquifer heterogeneity. Modified from Russell and Arnott, 2003; in Gerber et al. 2018.

- Outreach and community engagement
- GeoConvention 2020
  - Toward Definition of Archetypal Aquifers

Minister of Natural Resources, 2017

National Maps

- Synopsis maps at national scale are required
  - Bedrock and surficial aquifers
  - bedrock version ##
    - Rivera to present on emerging plan



1978

2014

2020

Summary / Impact

- Science based classification
- National application
- Information consolidation
- Framework for national synthesis products

NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

Mapping the Principal Bedrock Aquifers of Canada

Alfonso Rivera

Geological Survey of Canada

Quebec City, January 15, 2020

Mapping the Principal Aquifers of Canada

1. Introduction – objective
2. Background knowledge and previous works
3. Approach to the classification and delineation of bedrock aquifers
4. Summary and next steps

Introduction – why this map?

Persistent and emerging **issues** at the national scale can only be covered with an integrated Pan-Canadian map of aquifers, such as:

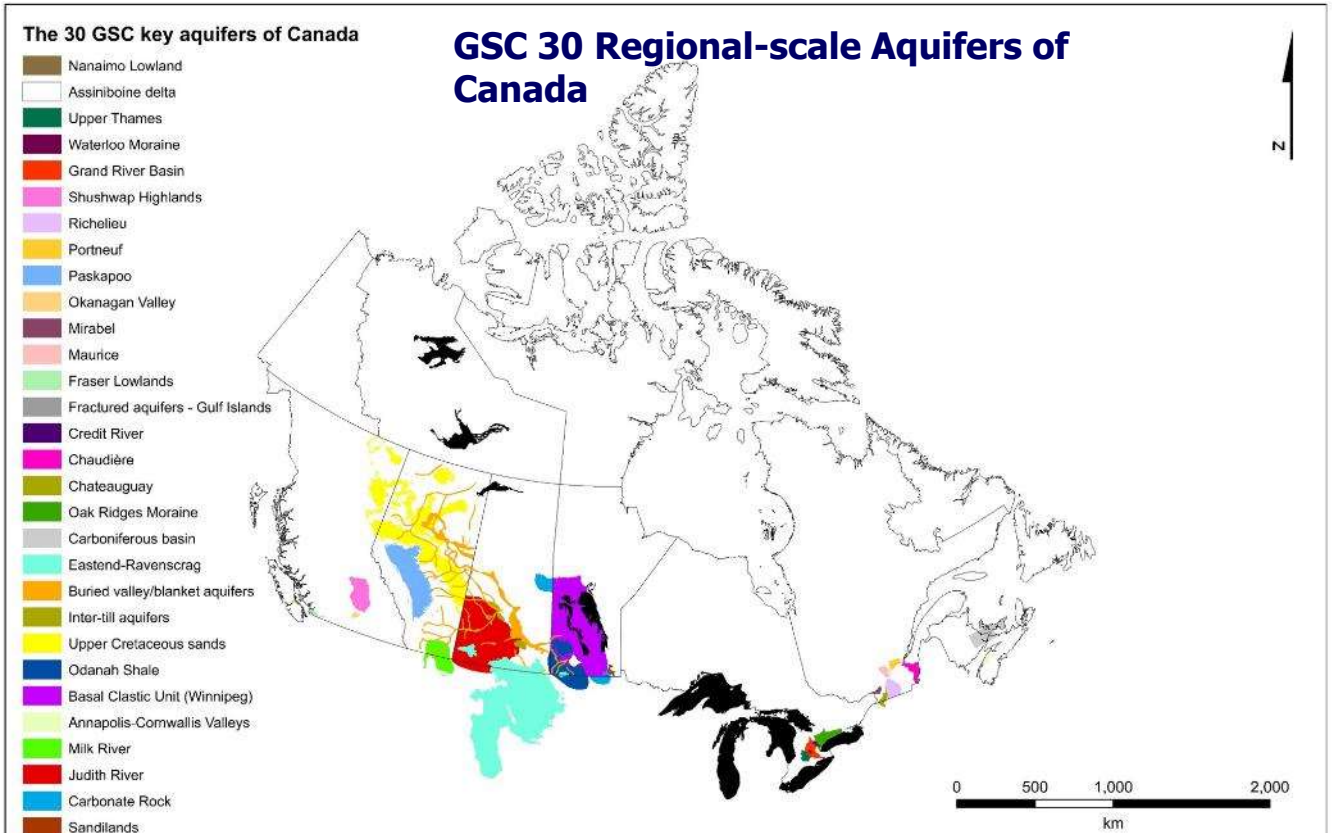
- Water availability and use (towards *sustainability* and *protection* of GW).
- Water-Energy Nexus (*oil* and *gas*, CBM, *shale gas*).
- SW/GW interactions and land use.
- *Transboundary* aquifers and GW (interprovincial and international).
- GW *monitoring* and climate *variability and change* to cover the complete mass of Canada.

Objective

CCA's (2009) First goal for GW sustainability:

"Develop a common framework for aquifer classification, characterisation and groundwater flow systems to allow integration of data from local studies into broader regional and national assessments."

Background knowledge and previous works



The assessment of these aquifers covers less than 6 % of Canada's landmass, but they can be used to extrapolate to the national scale.

Background knowledge and previous works

Build upon current knowledge and available data from the GSC, the Provinces and others

- **The hydrogeological regions of Canada** (Sharpe et al., 2014)
- **The GSC 30 archetypical Canadian aquifers (**Rivera, 2018)
- **Transboundary Aquifers** (Rivera, 2015)
- **Groundwater use in Canada** (Rivera, ed., 2014)
- **Observation wells in Canada** (Maathuis, 2004)
- **The water table across Canada** (Rivera et al., 2018)
- **Evapotranspiration in Canada** (Wang et al., 2012)
- **Groundwater recharge in Canada** (Wang et al., 2011)
- **GW storage changes 2002-2014 using GRACE** (Huang et al., 2014)
- **Regional aquifers mapped by the Provinces** (many)

Approach to the classification and delineation of bedrock aquifers

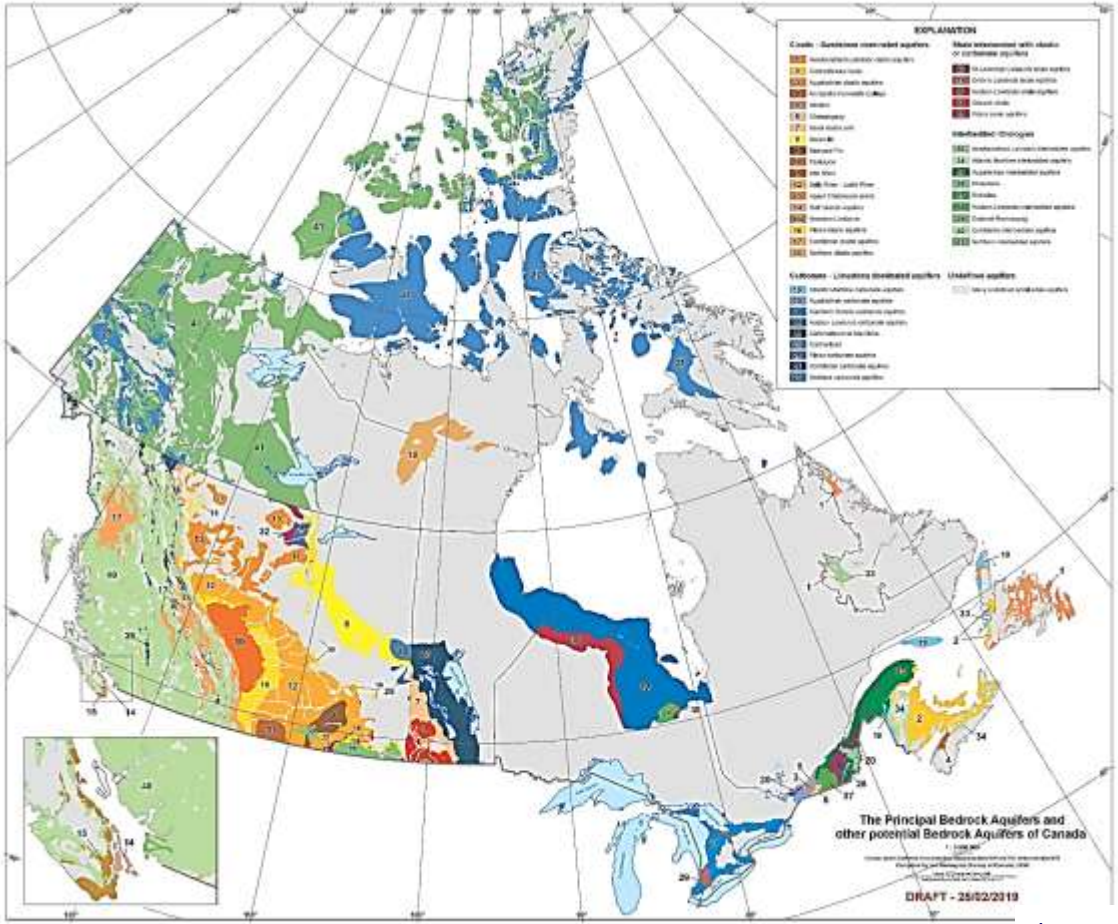
Rock type	Formation type	Origin	Lithology	Aquifer flow/ storage
UNCONSOLIDATED	(See Russell)			
CONSOLIDATED	Sedimentary	Clastic	Sandstone dominated	Intergranular, Fractured, Both
		Carbonate	Limestone dominated	
	Volcanic terrain	Volcanic	Lava, tuffs, ash	Fractured
	Basement	Igneous Granite	Crystalline	
	Shale		Shale dominated	Considered as aquitards
	Shale interbedded		Some clastic or carbonate interbeds	Considered as aquifers
	Other		Interbedded lithologies	Not considered principal aquifers, but may contribute to GWFS

(Rivera et al., 2018)

Bedrock aquifers delineation criteria, based on geological conditions

- Scales of delineation : national 1:5M and regional 1:1M.
- Bedrock aquifers are delineated in 2D horizontal with a 1000-m (x,y) resolution.
- Map both confined and unconfined bedrock aquifers.
- Two types of basic boundaries: **no-flow boundaries** and **constant-head boundaries**.
- The thickness of bedrock aquifers is from a minimum of 10 m to a maximum of 300 m.
- A fully digital, 2D-horizontal delineation.

Preliminary map of the Principal Bedrock Aquifers of Canada



(Rivera et al., 2018)

Summary and Next Steps

- A preliminary national-scale map of the principal bedrock aquifers of Canada has been initiated.
- This digital, interactive national-scale aquifer map is designed to tacking several national-scale water-related issues
- **Input from provincial partners is needed** to complete, correct, modify and agree with the national map.
- This first integrated map of the principal aquifers of Canada will be available in the *Groundwater Information Network*.

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GROUNDWATER INFORMATION NETWORK (GIN)

Boyan Brodaric

Geological Survey of Canada

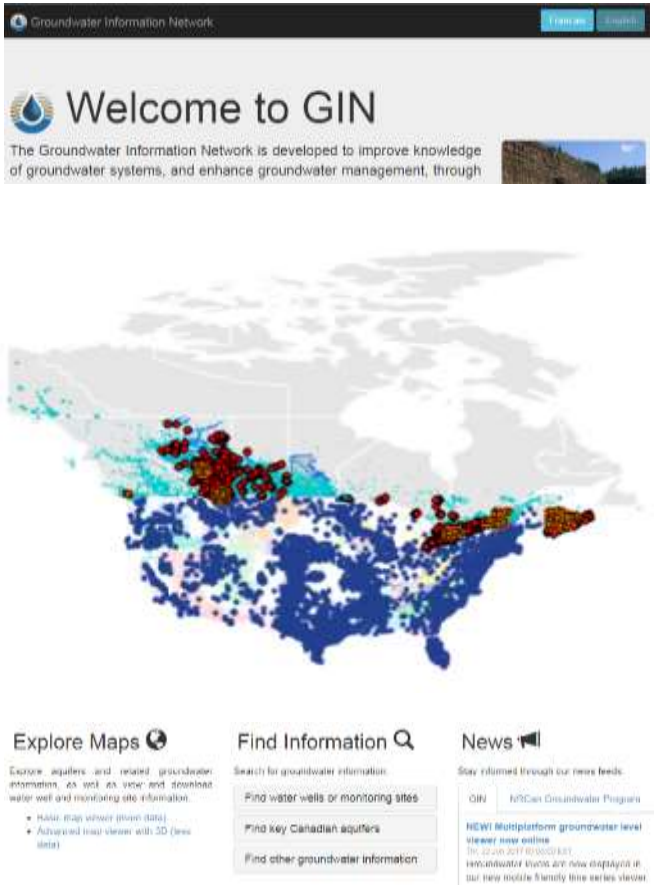
Canada

Groundwater Information Network (GIN)

- **2012 - present**
- **National** (distributed / hosted)
  YK BC AB SK MB ON QC NS NL
- **International**
  USA, EU, AU
- **Data Layers**

- **Usage**

Usage Statistics FY 2018-19	
users:	**14,442**
return visitors:	**65%**
data downloads:	**2264**
water well views	**10450**



More Stats

1.	Ontario	2,854	39.80%
2.	Quebec	2,128	26.28%
3.	Alberta	2,005	10.33%
4.	Saskatchewan	484	4.69%
5.	British Columbia	453	7.16%
6.	Manitoba	448	5.96%
7.	Yukon	341	2.91%
8.	Nova Scotia	86	1.06%
9.	Prince Edward Island	33	0.59%
10.	New Brunswick	32	0.66%
11.	Newfoundland and Labrador	20	0.47%
12.	Nunavut	2	0.05%
13.	(not set)	1	0.02%

Introducing

GIN Partner Contact: Girard, Étienne
etienne.girard@canada.ca

What's coming?

- **Data**
  Geophysical Boreholes (GSC)
  GSC projects (various)
  Data standard (GIN, GWML2)

- **New GIN portal**
  New user interface
  New data synch
  - real-time data
  New data delivery (Google-friendly)
  - Linked Data (CAN-US)
  New tools:
  - 3D well viewer
  - Complex borehole viewer
  - Groundwater dashboard
  - Water level calculator
    (well, aquifer; past, future)
  - other?

OVERVIEW

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THANK YOU
/
MERCI!