



# Recent Advances and Future Directions for the Groundwater Information Network

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**Groundwater Information Network**  
**Réseau d'Information sur les Eaux Souterraines**



A contribution to  
**Groundwater Geoscience Program**

[http://sst.ncan.gc.ca/gg-ges/index\\_e.php](http://sst.ncan.gc.ca/gg-ges/index_e.php)



Ressources naturelles  
Canada



**Canada**



# Recent calls for action



## GW Data Access

- More online access
- Consolidate access
- Better data quality
- More data (use, monitoring)

## GW Data Management



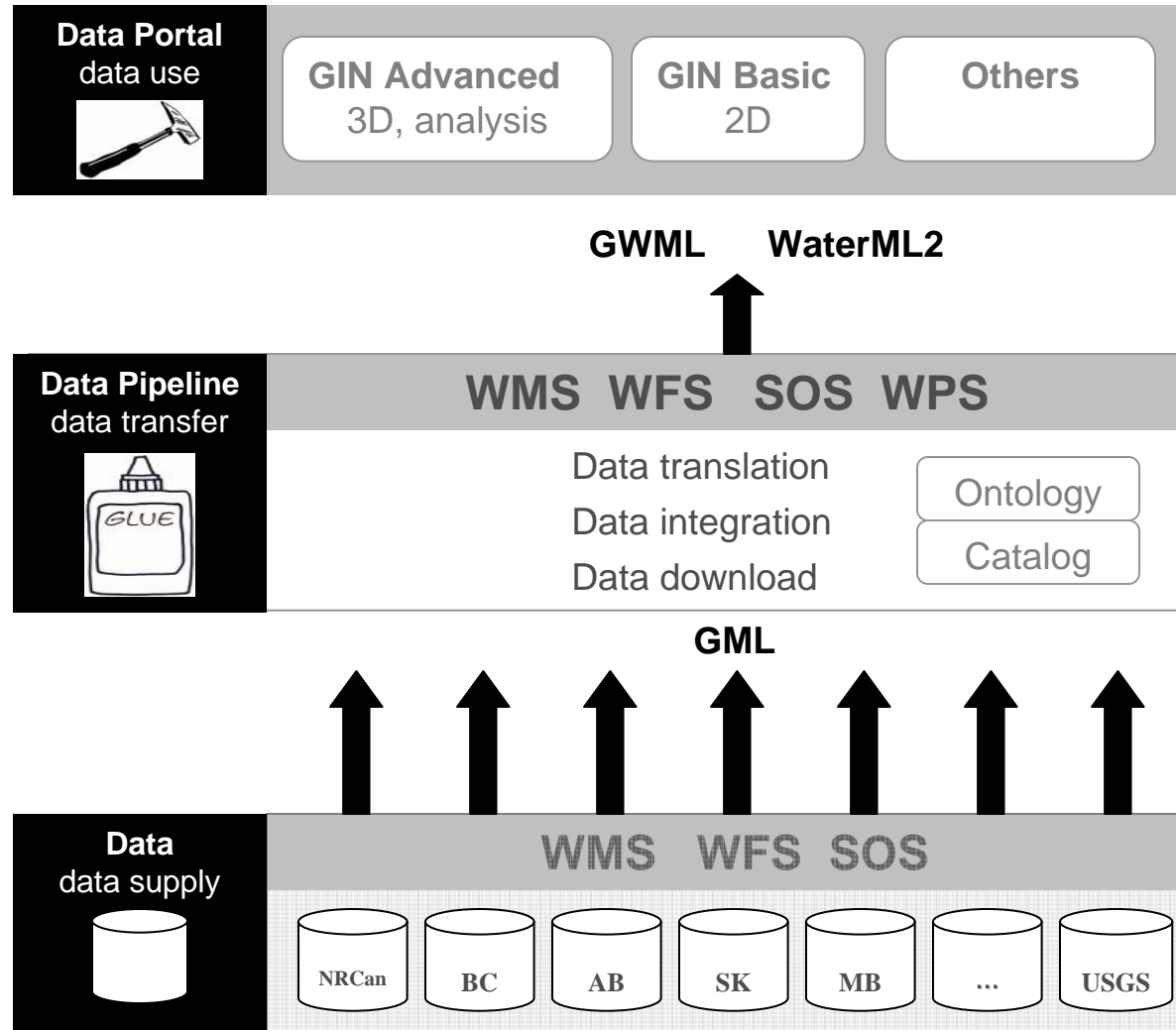
# Groundwater Information Network

- **Distributed data:** YK, BC, AB, SK, MB, ON, QC, NS, USGS
- **Seamless:** single virtual online database
- **Standards-based:** WMS, WFS, SOS, WaterML, GWML, GeoSciML
- **Multi-access:** many portals
- **Multi-data:** water well records, key aquifers, monitoring data\*
- **Funding:** partners (e.g. *LSCA, SNCA*), seeded by *GeoConnections*

The screenshot shows the homepage of the Groundwater Information Network (GIN). At the top, there is a logo with a water drop and the text "Groundwater Information Network" and "Réseau d'information sur les Eaux Souterraines". Below the logo, there are two main links: "Access basic water well and aquifer info : Water Wells and Aquifers of Canada" and "Access Google-like viewing and analysis of water well info : Analysis of Water Wells of Canada". A paragraph of text describes the GIN's mission to improve knowledge of groundwater systems and enhance management through increased access to information. It mentions that GIN connects water well databases from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia, and Yukon, and provides key aquifer information from Natural Resources Canada. The text also states that information can be accessed by clicking on a link above, viewed on a map of Canada or in 3D, queried one well or aquifer at a time, and multiple items can be downloaded in various digital formats like CSV, GML, and Google Earth. At the bottom, there is a footer with "System Administrator: gpa@gin" and "Build Date: 03/02/2011 11:35:34 AM".



# Groundwater Information Network

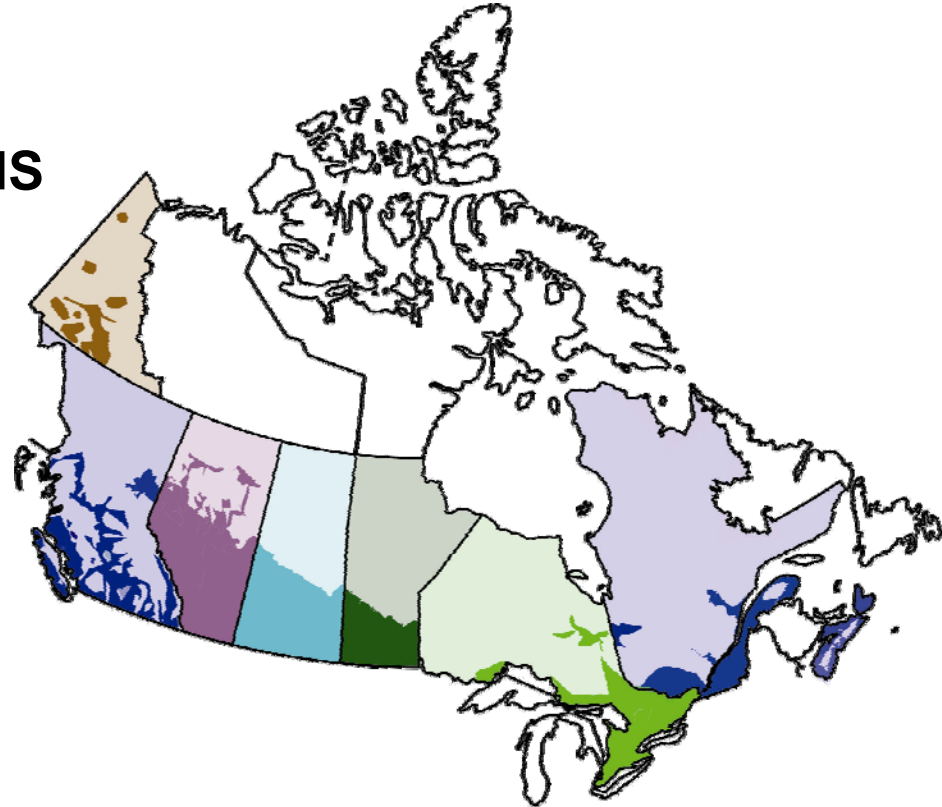




# Data: water well characteristics

## National\* coverage

- YK, BC, AB, SK, MB, ON, QC, NS
- ~2,000,000 wells
- coming soon:  
missing data (talks underway)







# Data: aquifer characteristics

## Key aquifer coverage

- mapped by NRCan & partners
- hydro/geological properties
- coming soon:  
selected provincial aquifer maps

**Oak Ridges Moraine Aquifer**

**Identity :** ngwd.key.mf.115  
**Spatial location :**

**Water volume :** Recharge 1.88 km<sup>3</sup>/a (approximate) 2009-03-05  
**Water volume :** Extractable water volume 150 km<sup>3</sup> (approximate) 2009-03-05  
**Usage :** Domestic  
**Risk :** Growing Population, Industry  
**Status :** Completed project  
**Online resource :** [NRCan source project](#)  
**Geological Unit :** (Total: 1)

Geologic Unit	Geologic Age	Lithologies
<a href="#">Oak Ridges Moraine sediments</a>	Lower age : Pleistocene	<ul style="list-style-type: none"> <li>• component: <a href="#">sand</a>, proportion: major</li> <li>• component: <a href="#">gravel</a>, proportion: minor</li> </ul>

**Hydro Geological Unit :**

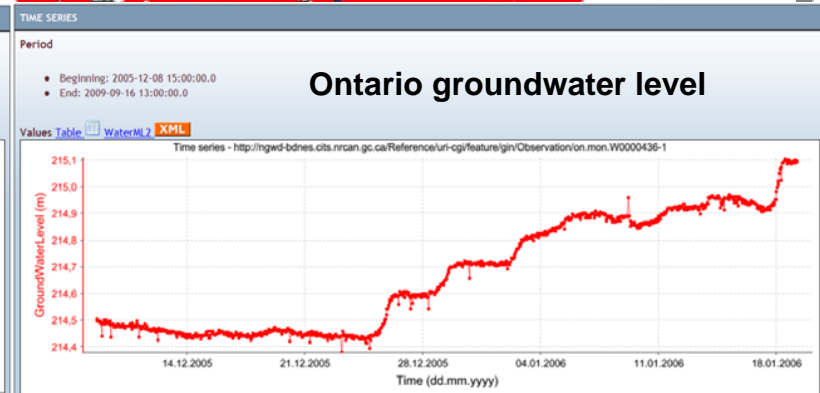
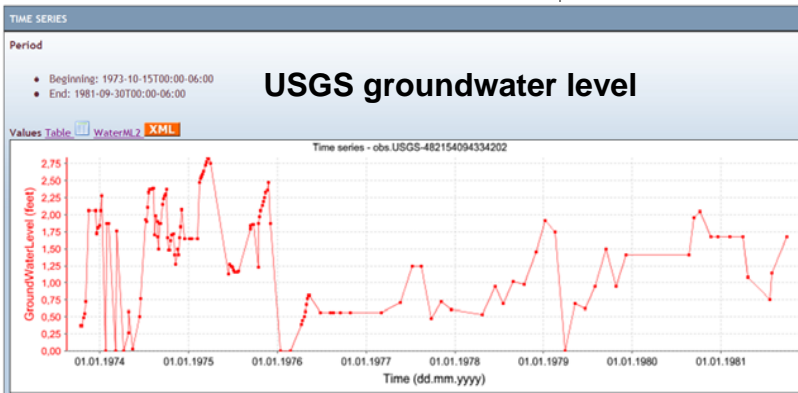
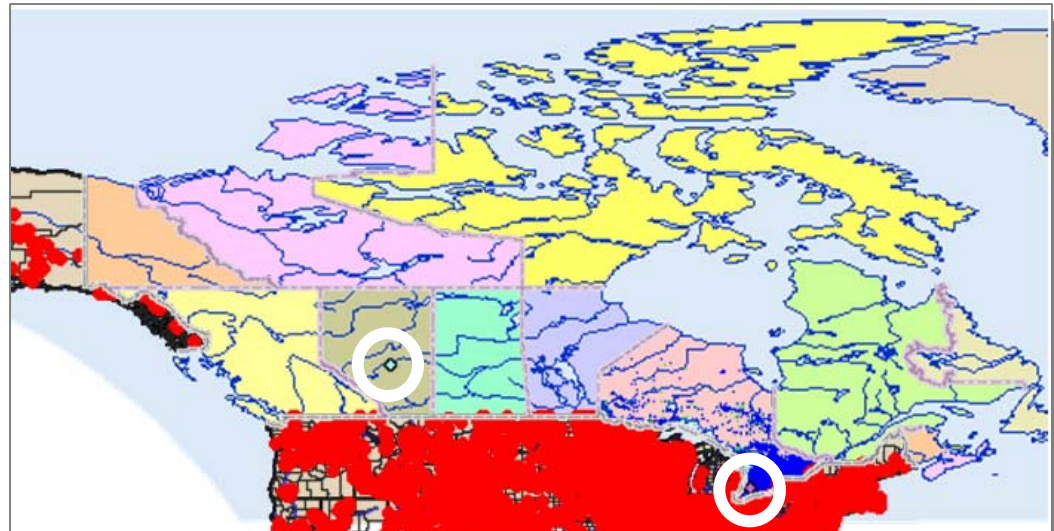
- [Oak Ridges Moraine - aquitard](#) (Proportion: 100%)



# Data: monitoring networks

## Cross-border pilot

- USGS-GIN water well characteristics
- USGS-GIN water levels
- N. American network?





# Data pipeline: data web services

## Feature data services (WFS)

- Serving aquifers, wells, and water bodies\*



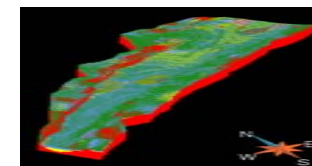
## Sensor data services (SOS)

- Serving time series data



## 3D geology services (WPS)

- Making 3D models from wells & maps



## Enhanced querying (WFS, SOS)

- Enable complex thematic querying



# Data pipeline: data standards

- **GroundWater Markup Language (GWML 1)**

wells and aquifers

NRCan (OGC)



- **Geoscience Markup Language (GeoSciML)**

geological formations and materials

IUGC – CGI (OGC)



- **WaterML2**

water time series data

OGC - WMO





# Data pipeline: data standards in use

## Observation 1:

**Name:** obs.USGS-474917093144601  
**Feature of interest (GWML):** Water Well #  
**Procedure:** urn:ogc:object:Sensor:usgs-gw:USGS-474917093144601  
**Observed property:** urn:ogc:def:property:OGC:GroundWaterLevel

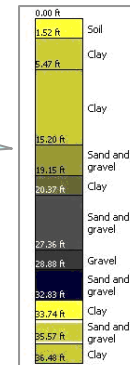
METADATA	
Contact	<a href="http://cida.usgs.gov">http://cida.usgs.gov</a>
Date stamp	
Identification Info	urn:OGC:unknown
Intended sampling Interval	<b>Period</b> <ul style="list-style-type: none"><li>Beginning: 1970-09-04T00:00-06:00</li><li>End: 1999-07-24T00:00-06:00</li></ul>

GWML1  
GeoSciML

WFS

WaterML2

SOS

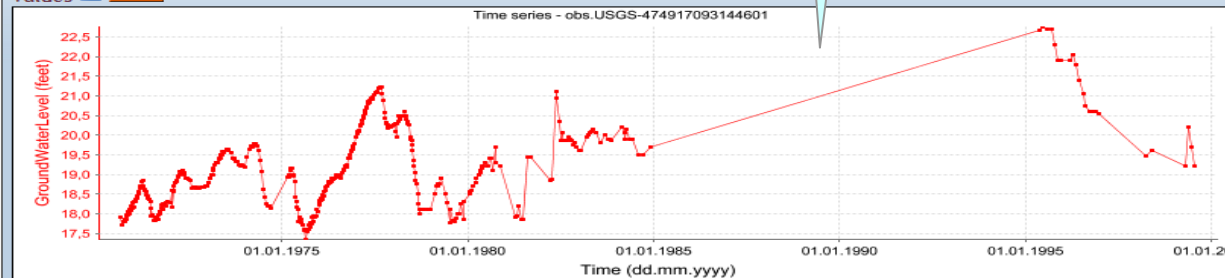


## TIME SERIES

### Period

- Beginning: 1970-09-04T00:00-06:00
- End: 1999-07-24T00:00-06:00

Values XML

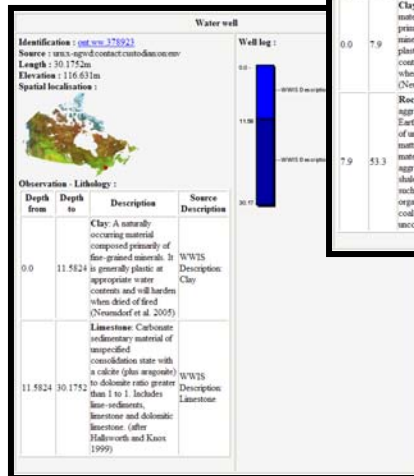
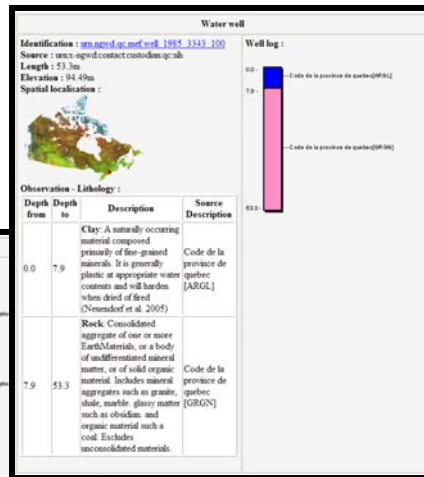
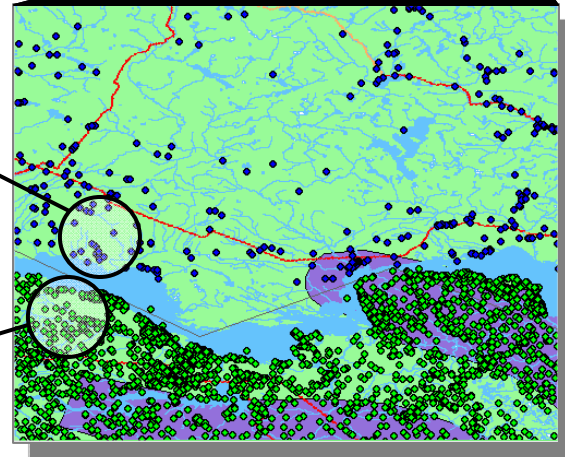
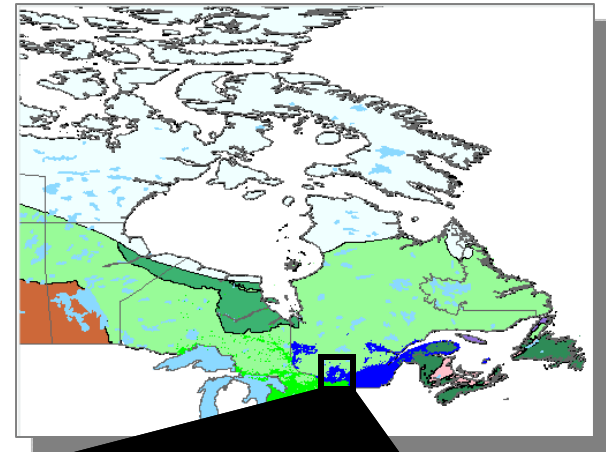




# Data pipeline: performance

## ■ 2 provs

50 wells = 2.17 secs, 1.08 Mb  
 500 wells = 15.01 secs, 7.74 Mb  
 2500 wells = 69.97 secs, 40.80 Mb  
 5000 wells = 142.27 secs, 80.41 Mb





# Data pipeline: specifications



Groundwater Information Network  
Réseau d'Information sur les Eaux Souterraines

English Français

[www.gw-info.net](http://www.gw-info.net)

Access basic water well and aquifer info :

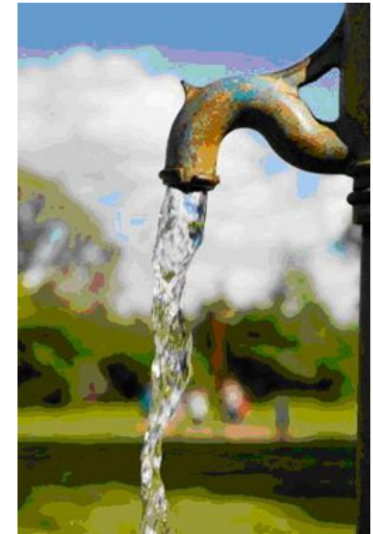
[Water Wells and Aquifers of Canada](#)

Access Google-like viewing and analysis of water well info :

[Analysis of Water Wells of Canada](#)

The **Groundwater Information Network** (GIN) aims to improve knowledge of groundwater systems and enhance groundwater management through increased access to groundwater information. GIN connects water well databases from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, Nova-Scotia, and Yukon, and provides some key aquifer information from Natural Resources Canada. The information can be accessed by **clicking** on a link above. It can then be viewed on a map of Canada or in 3D, queried one well or aquifer at a time, and multiple items can be downloaded in a common structure using a variety of convenient digital formats such as [GWML](#) (Groundwater Mark-up Language), Excel, ESRI and Google Earth. The information is accessed dynamically from its host location using open geospatial information standards, and then translated on-the-fly to the selected output format. The project was initiated with [GeoConnections](#).

GIN OGC [WMS](#) and [WFS](#) services.



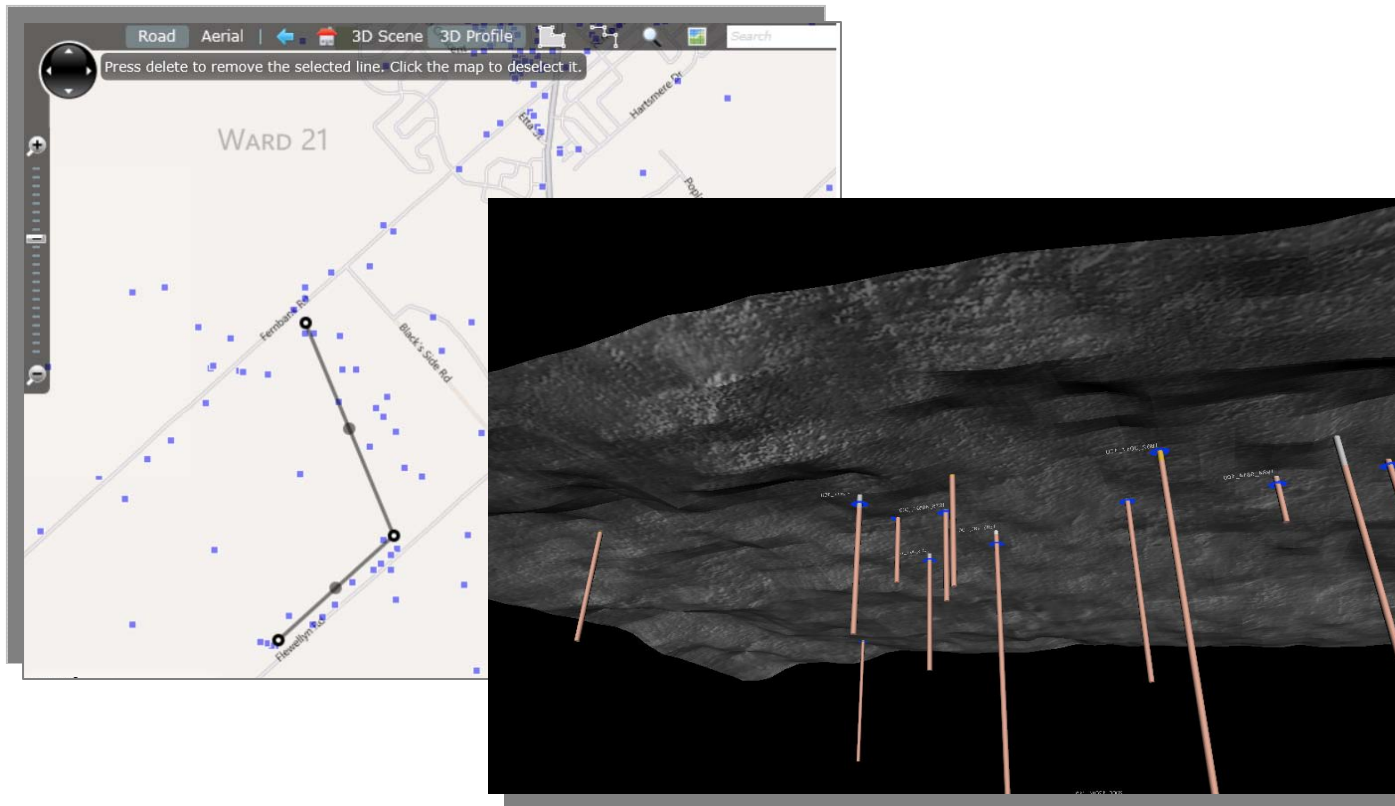
System Administrator: [sysadmin](#)  
Build Date: 03/02/2011 11:35:34 AM





# Data portal: advanced features

- 3D viewing of wells under land surface





# Data portal: downloading

- many formats for downloading data

**Status**

13	Data source	Status	Processed	Action
	Saskatchewan Watershed Authority	completed	205.98 Kb	<input type="button" value="finished"/>
	Alberta Waterwell database	completed	1403.84 Kb	<input type="button" value="finished"/>

Select download format:

- Zip GWML
- Zip GWML
- GWML
- PDF
- Google Earth
- Excel
- Ascii
- Zip Shapefile
- Zip ESRI Geodatabase XML Import
- Zip 3D

[Avis importants](#)

Developed by:

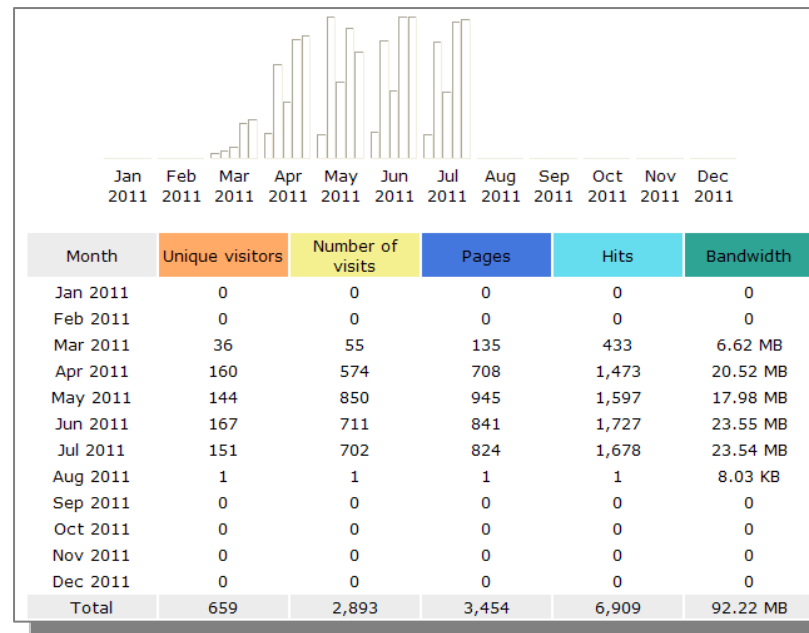




# Data portal: usage statistics

## Modest, consistent usage since Mar 2011

- Re-use by 3<sup>rd</sup> parties (e.g. AB WEHUB)
- Positive feedback from survey of users (i.e. ON GW Assoc.)





# Data portal: future

## 3D viewing

- Option to hang wells from DEM, ignoring reported elevation
- Improved legends

**More thematic and location querying**

**More 3<sup>rd</sup> party portals**

**Dial-up and mobile apps**

**Enhanced time series graphing tools**

**Redesign 'basic' interface**



# Summary

**GIN fully operational since Mar 2011—but need marketing campaign to raise awareness**

**Discussions underway to expand water well and aquifer contributions**

**Technology solutions ready for incorporation of monitoring data—tbd with partners**

**Technology solutions ready for interoperability with surface water data—when available**



# Thank you – Merci

**GIN : Groundwater Information Network**

**RIES : Réseau d'information sur les eaux souterraines**

- <http://gw-info.net>
- <http://es-info.net>



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Groundwater Information Network

Brodaric, et al., Latornell 2011

Aliston, Nov. 18, 2011



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