



Ressources naturelles
Canada

Natural Resources
Canada



NATIONAL DIALOGUE ON GROUNDWATER (NDGW)

APRIL 7, 2021

DIALOGUE NATIONAL SUR LES EAUX SOUTERRAINES (DNES)

7 AVRIL 2021

Canada

OVERVIEW

1. Welcome participants – 5 minutes
2. Presentations
 - a. **Pan-Canadian Geoscience Strategy** by Réjean Couture (GSC) – 10 minutes
 - b. **Water well records: less can be more** by Abigail Burt (OGS) – 15 minutes
 - c. **Groundwater Research at CanmetENERGY Devon** by Nicholas Utting (NRCan) – 10 minutes
3. Questions – 5 minutes
4. Discussion – 15 minutes
 - a. Field season and Covid safety from all jurisdictions
 - b. External stakeholders
5. Next meeting – June 2, 2021 (1-2pm (ET))



Pan-Canadian Geoscience Strategy

Updates and opportunity for comment

National Dialogue on Groundwater
April 7, 2021

Purpose

- Ensure awareness of PGS.
- Set the stage for further **feedback/discussion**.
 - Gather input on PGS Priority Areas
 - Identify ways in which PGS can support your **mandates/goals**
 - Identify opportunities for **collaboration/cooperation**



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Pan-Canadian Geoscience Strategy (PGS)

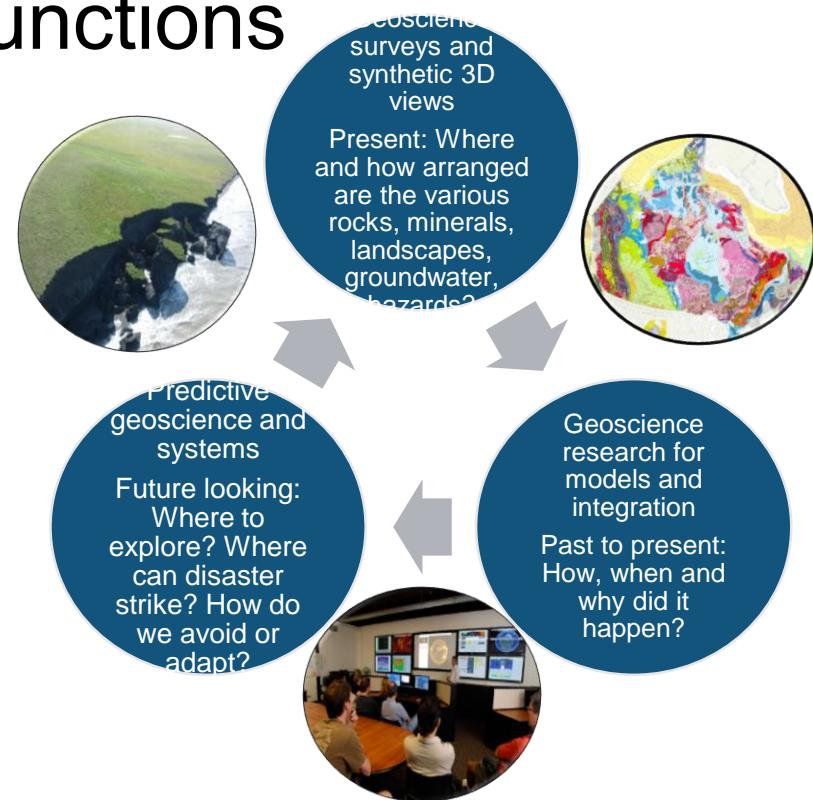
- The PGS will support the development and deployment of next generation, world-leading geoscience to enable geological resource development (includes mineral, energy, environmental, and public safety geoscience).
- Drivers:
 - Energy and Mines Ministers (2019)
 - Stakeholders
 - Cooperation under the Intergovernmental Geoscience Accord (IGA)
 - New technologies
 - Economic/infrastructure needs
 - International commitments (e.g. climate change, critical minerals, sustainable development)



Geological Surveys' Role & Functions

Geological surveys in Canada bring **foundational knowledge to partnerships with other experts** to tackle some of Canada's 21st century challenges, such as:

- Searching for deeply hidden **resources**
- Better understanding **climate change** and its impacts
- Studying effects of natural resources development on **groundwater, air and soil**
- Looking to the past and future using a variety of tools such **seismic surveys, drones, 4D modelling, AI**, etc.
- Providing support for **evidence-based decision making**, including for provinces, territories and communities and communicates its science and its benefits to Canadians
- Building partnerships with **Indigenous people**, by integrating traditional knowledge, transferring science and capacity building

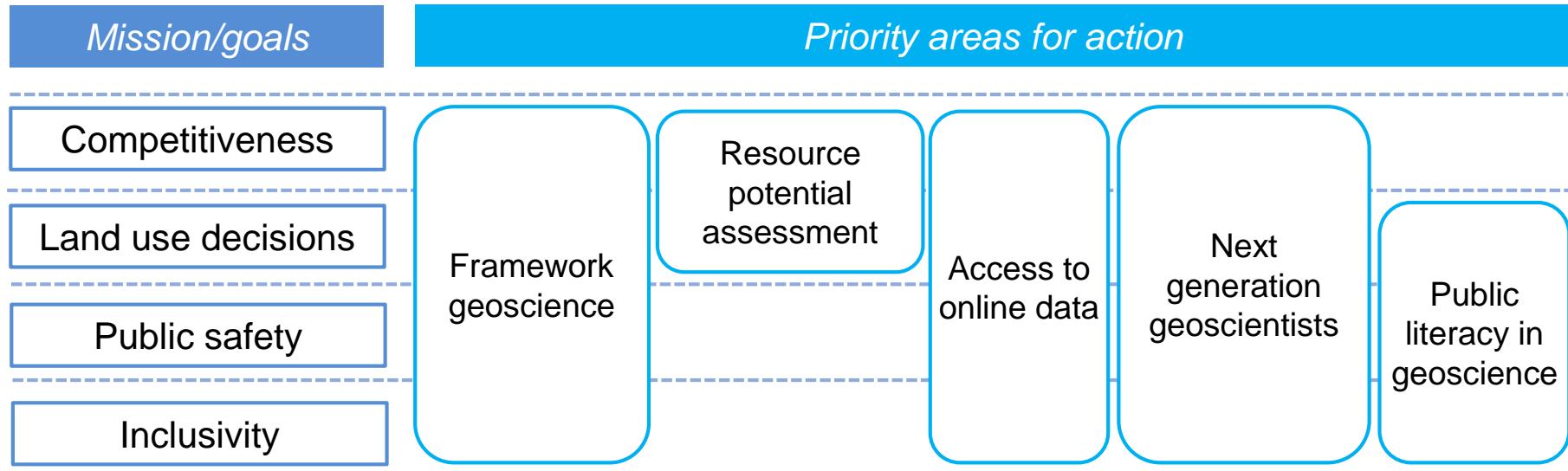


DATA - KNOWLEDGE - ACCESS



Pan-Canadian Geoscience Strategy

VISION: Provide geoscience information to underpin the responsible development of Canada's geo-resources and serve the public good.



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Proposed Priority Areas for the PGS

Priority Areas	Purpose
Framework Geoscience	Understand all aspects of geology in each particular area through unifying geological models or frameworks.
Resource Potential Assessments	Science-based information to decision-makers, including governments, communities, and Indigenous groups.
Access to Online data	FAIR (findable, accessible, interoperable, reusable) data.
Next Generation Geoscientists	The training of next-generation geoscientists.
Public Literacy in Geoscience	Enhancing public awareness/trust of science.



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Priority Area 3: Access to online data

Purpose:

- FAIR (findable, accessible, interoperable, reusable) data

Issues:

- Fragmented data (e.g. location, format, availability)

Potential solutions:

- Common approaches and standards
- National geoscience data network/portal(s)
- Local data enhancement



PGS Development

Aug. 2019

Tasking from Ministers

Planning Stage 1: Development of overarching vision and mission

- Considered CMMP and Geological Survey mandates and capacity
- Sought preliminary input from stakeholders

Sept. 2020

Check-in with Ministers

Planning stage 2: Preliminary planning of priority areas for action seeking input from stakeholders and Indigenous peoples

Sept. 2021

Presentation of PGS to Ministers

- Include room for the PGS to further evolve
- Include Indigenous engagement plans

First steps towards plan implementation



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For further discussion

- How can the PGS help to support or advance your goals/mandate?
- Are there areas where you or colleagues could contribute to the PGS?
- Do you see parallels between PGS and any of your programs/initiatives? How can we cooperate to avoid redundancies?
- Do you have additional feedback?

Thank you!
We welcome more of your comments at
nrcan.ngsc-cncg.rncan@canada.ca



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ANNEX



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Priority Area 1: Framework Geoscience

Purpose:

- Understand all aspects of geology in each particular area through unifying geological models or frameworks

Issues:

- Inconsistencies (e.g. in datasets, analytical methods)

Potential solutions:

- Foundational mapping
- Targeted studies
- Canada-wide geology compilations
- Emerging resources
- Climate change
- Innovative detection tools



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Priority Area 1: Framework Geoscience

Foundational Mapping

- Fill gaps in geology, geophysical coverage
- Underpin framework geoscience

Targeted Studies

- Dependent on regional resource endowment and knowledge gaps
- Can enable metallogenic syntheses, resource assessments, etc.

Canada-wide geology compilations

- Both national and regional scale
- Examples include initiatives such as Canada 3D



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Priority Area 1: Framework Geoscience

Study of emerging resources

- Strategy to address conventional as well as emerging resources
- Scope could include critical minerals, geothermal energy, etc.

Innovative detection tools

- Development of innovative tools for field work (e.g. drone-supported data collection)
- Innovations in how data are used (e.g. machine learning)

Considering climate change

- Strategy to assess potential geo-hazards associated with climate change
- Particularly important in Canada's North



Priority Area 2: Resource Potential Assessments

Purpose:

- Science based information to decision-makers
(e.g. future exploration, development and commodities trends)

Issues:

- Inefficiencies (e.g. case-specific approaches)

Potential solutions:

- Common approaches and standards
- Resource potential assessments
- Plain-language summaries
- Gap-analysis



Priority Area 3: Access to online data

Purpose:

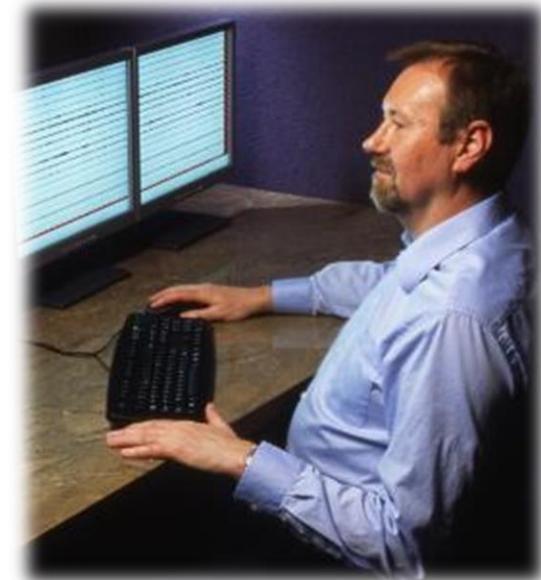
- FAIR (findable, accessible, interoperable, reusable) data

Issues:

- Fragmented data (e.g. location, format, availability)

Potential solutions:

- Common approaches and standards
- National geoscience data network/portal(s)
- Local data enhancement



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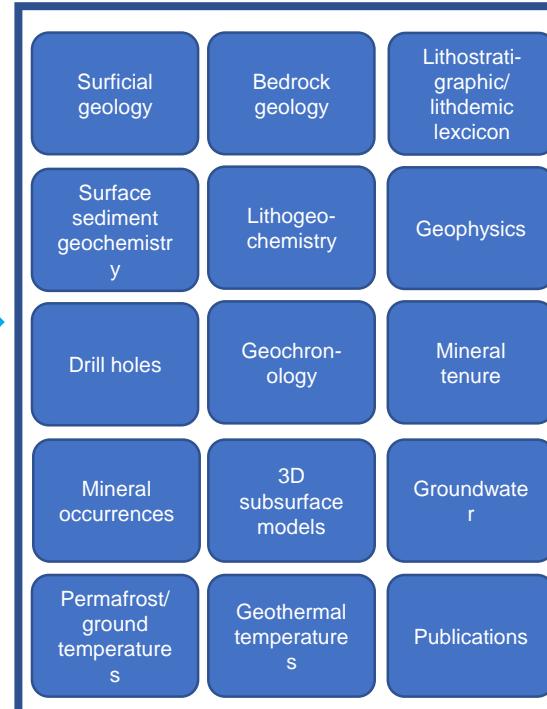
Priority Area 3: Access to online data

Locally Operated and Managed Data



Federal, provincial, and territorial geoscience databases

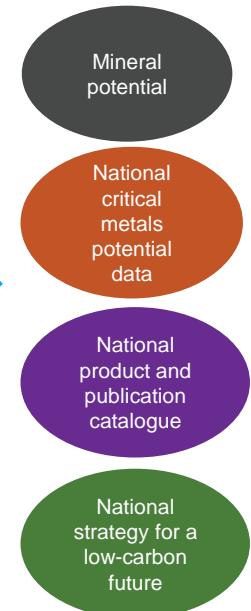
Data coordination & integration tools
(e.g. AI-based)



Spatial data infrastructure that connects distributed data, metadata, people and tools, enabling efficient and flexible use of data for multiple purposes

Various users & analyses

Potential products



PGS Outcome: Enhanced online delivery, discoverability, and access to analytical-ready data

Priority Area 3: Access to online data

Common approaches and standards	National geoscience data network/portal(s)	Local data enhancement
<ul style="list-style-type: none">• Data are managed independently by each jurisdiction as important assets.• Contributors agree to data standards and data are transformed or mapped to a consistent vocabulary.• To be interoperable and analysis ready, data users need the standards to consume the data.	<ul style="list-style-type: none">• New data networks need to be publicly accessible and discoverable.• A Canadian Geoscience Data Portal connects consumers with geoscience data.	<ul style="list-style-type: none">• Data are all owned and managed independently by jurisdiction.• Investment will be required to ensure all jurisdictions' data can be accessed.



Priority Area 4: Next-Generation Geoscientists

Purpose:

- Next-generation geoscientists

Issues:

- Availability of 'qualified' students; capacity to train

Potential solutions:

- Paradigm shifts
- Best practices
- National repository
- Partnerships



Priority Area 5: Public Literacy in Geoscience

Purpose:

- Public awareness/trust of science

Issues:

- Misinformation/misunderstanding

Potential solutions:

- Co-ordinated outreach
- Partnerships
- Plain-language summaries



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The Canadian Minerals and Metals Plan (CMMMP)

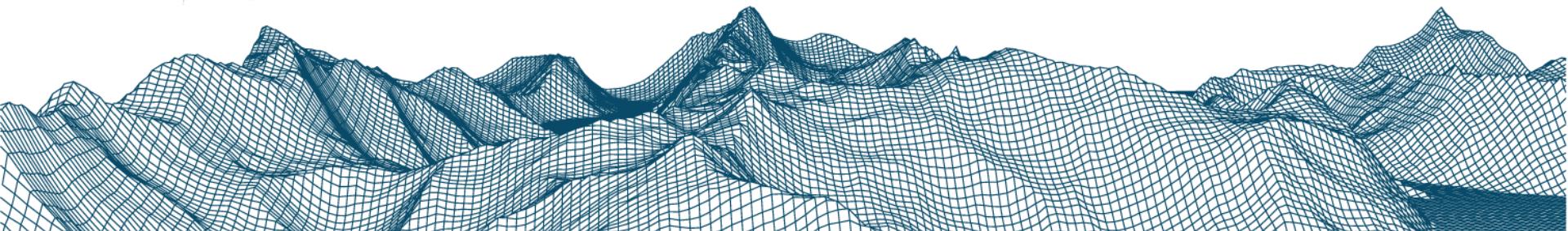


THE VISION

Canada is home to a **competitive, sustainable and responsible** minerals industry that benefits all Canadians.

The country is a **global leader** in mining-related **science, technology, social and environmental practices** with a clear and predictable regulatory environment, innovative clean technology solutions, and best management practices.

It boasts a **skilled and diverse workforce**, an attractive **investment climate**, **partnerships with Indigenous Peoples**, and strong relations with communities.



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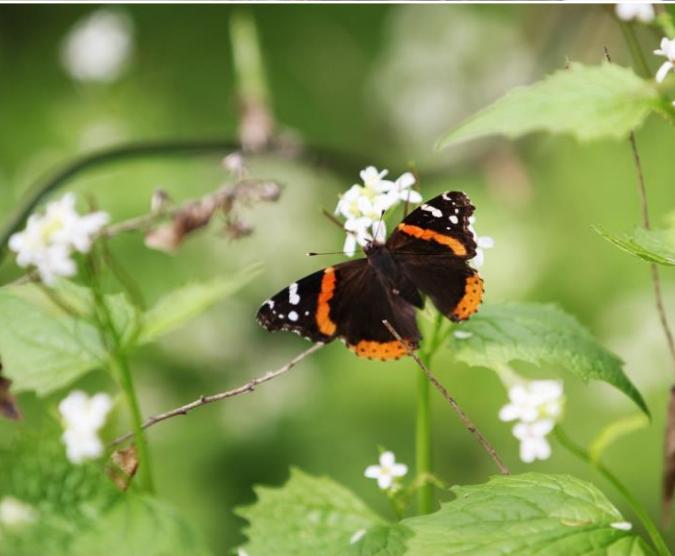
Water Well Records

Less CAN be more

Abigail Burt, Riley Mulligan, Frank Brunton and Kei Yeung
Ministry of Energy, Northern Development and Mines (ENDM)

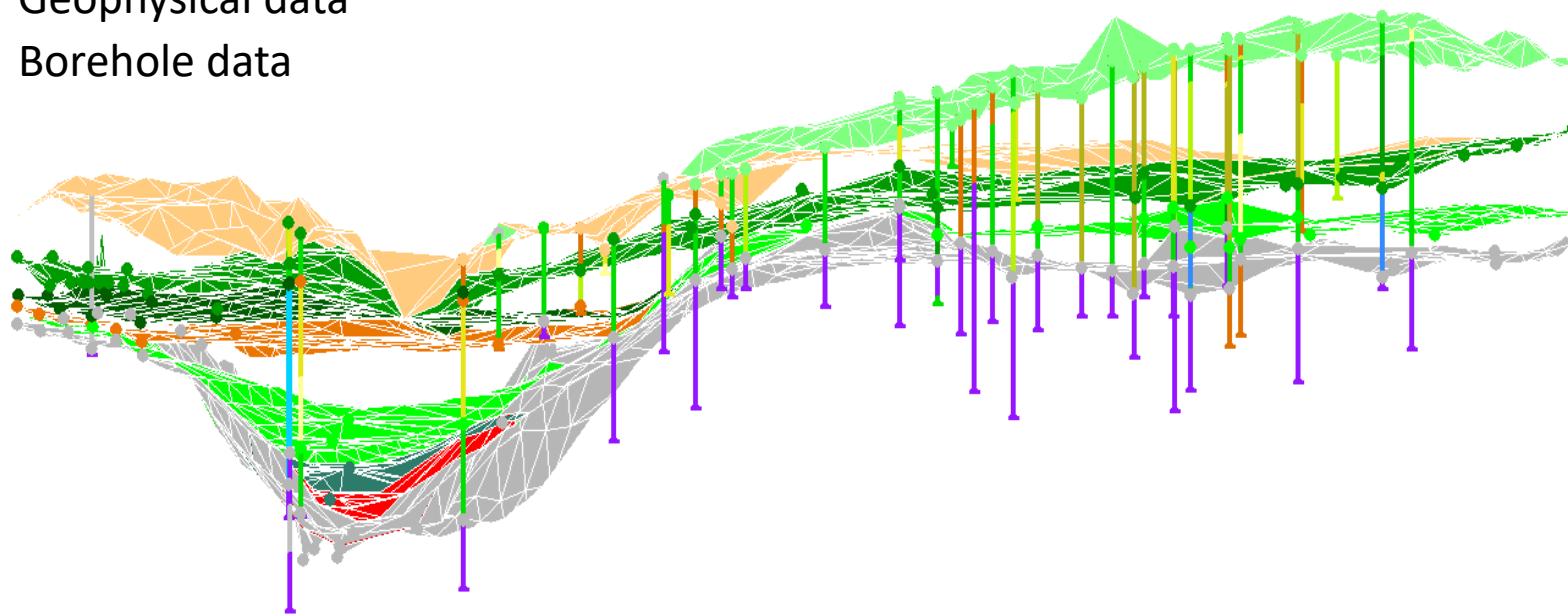
Natalie Spina and Tim Cheng
Ministry of Environment, Conservation and Parks (MECP)



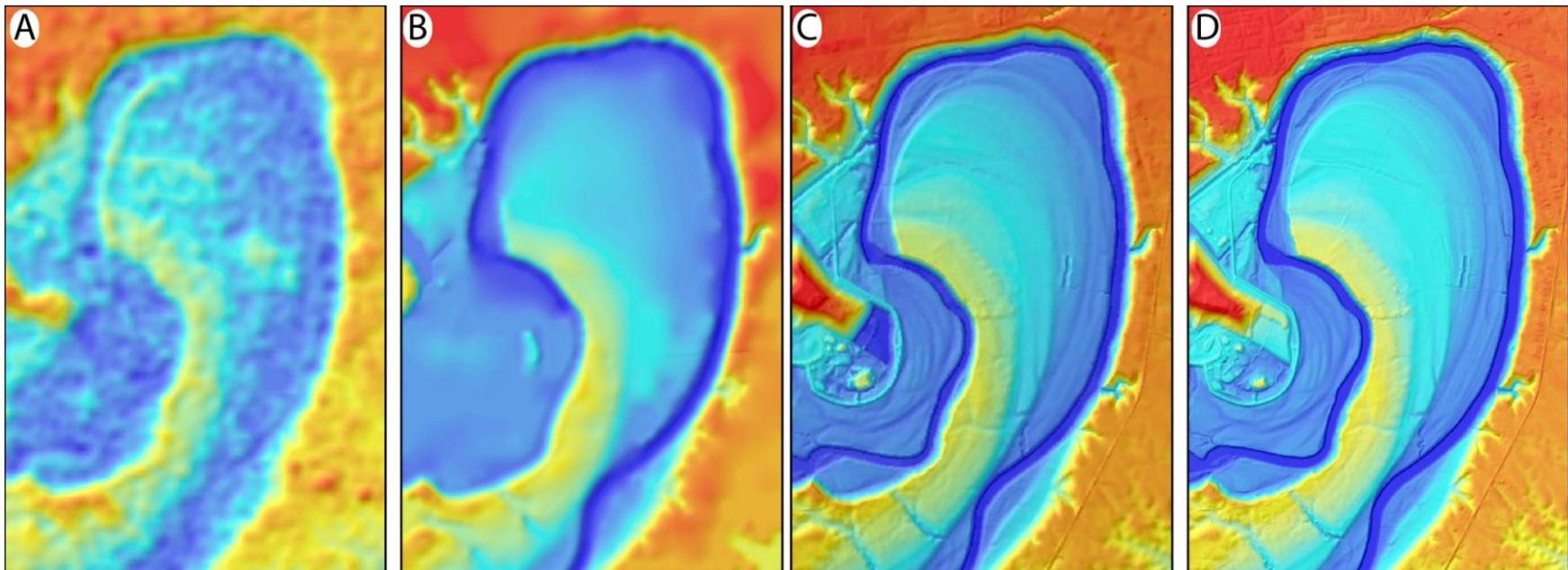


Let's talk about data....

- Elevation data
- Geological data
 - Map data
 - Geophysical data
 - Borehole data



Elevation Data



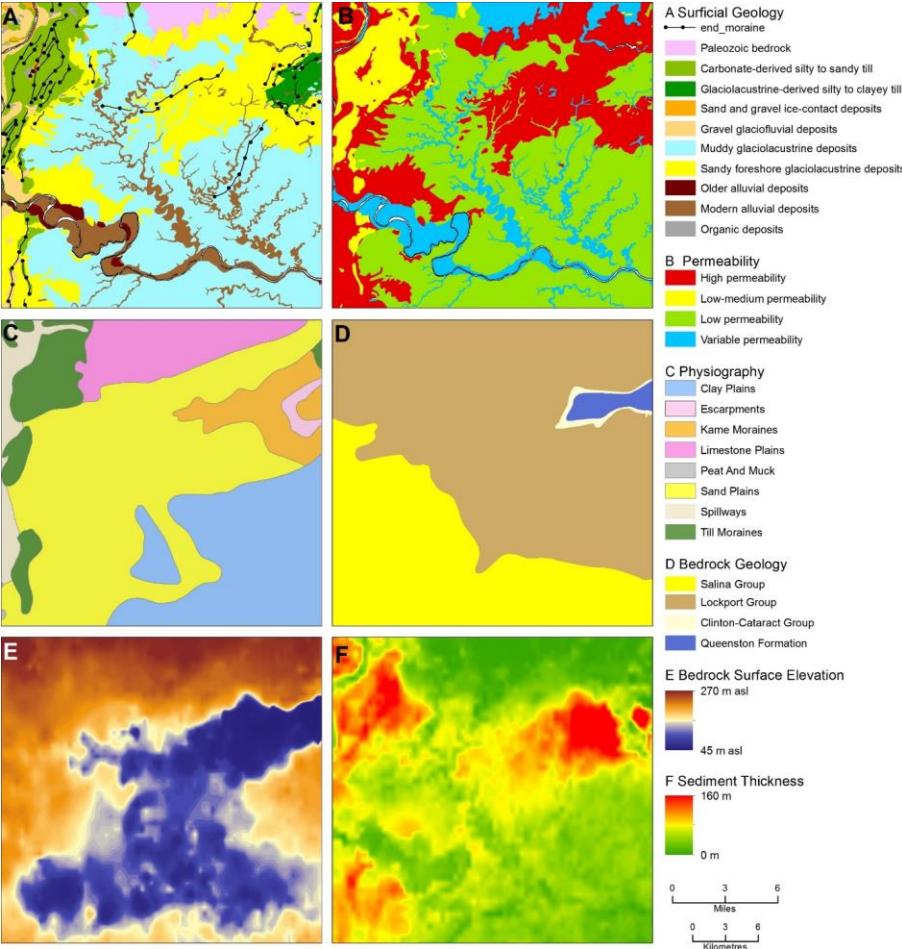
30 m cells
 ± 5 m



50 cm cells
 ± 10 cm



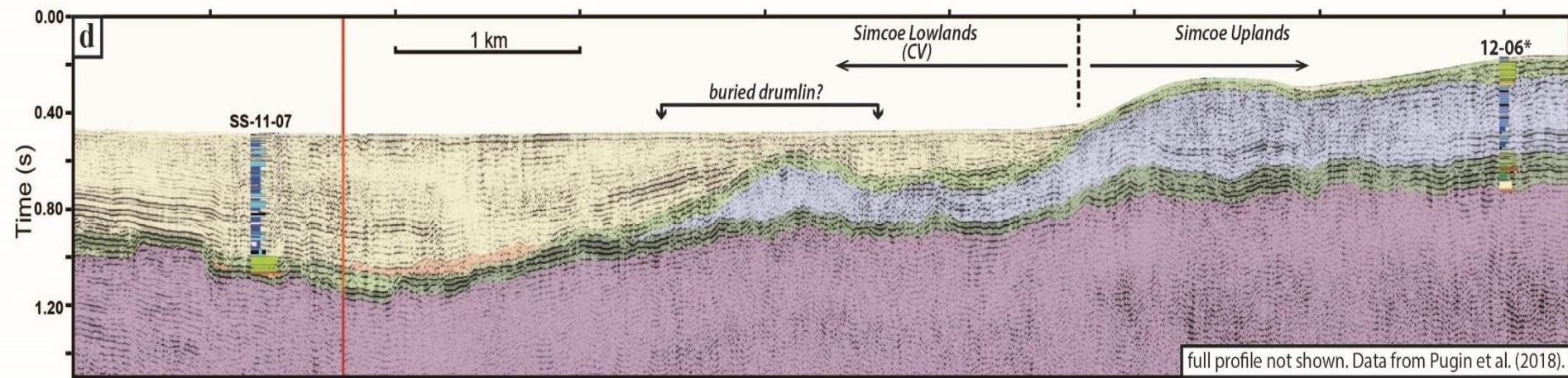
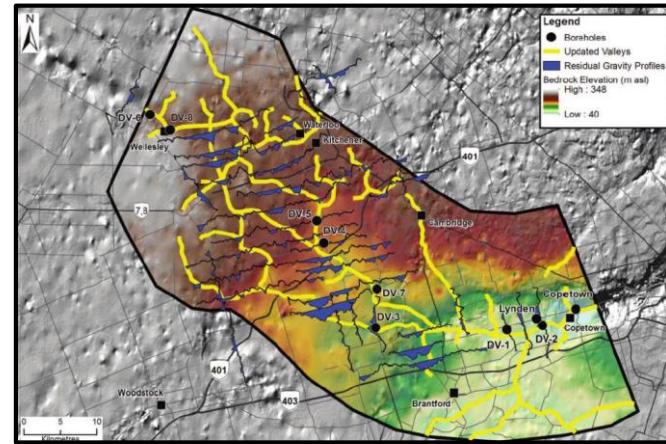
Geological Map Data



- Fully attributed, seamless GIS maps
 - Surficial geology (MRD 128)
 - Physiography (MRD 228)
 - Paleozoic bedrock geology (MRD 219)
 - Drift thickness (MRD 207)
 - Karst (GRS 005)
- FREE!!!!

Geophysical Data

- Gravity helps us find buried valleys
- EM data constrains what's in the valleys
- Seismic data helps connect the dots between boreholes



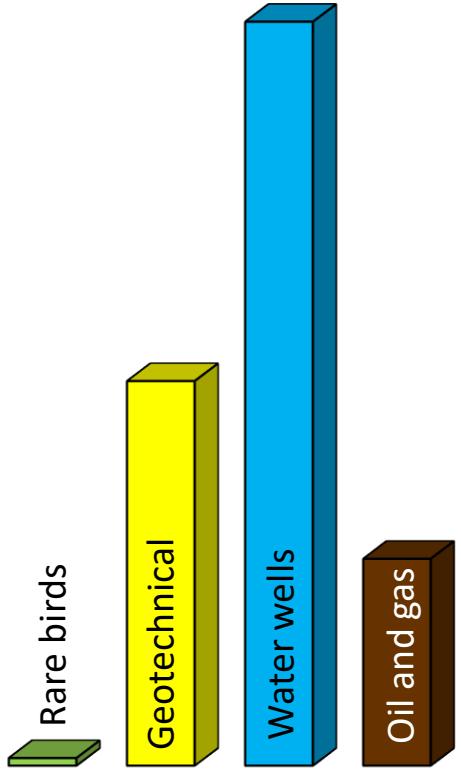
Boreholes, Sections and Wells

Niagara Peninsula 3D
sediment mapping project
subsurface database

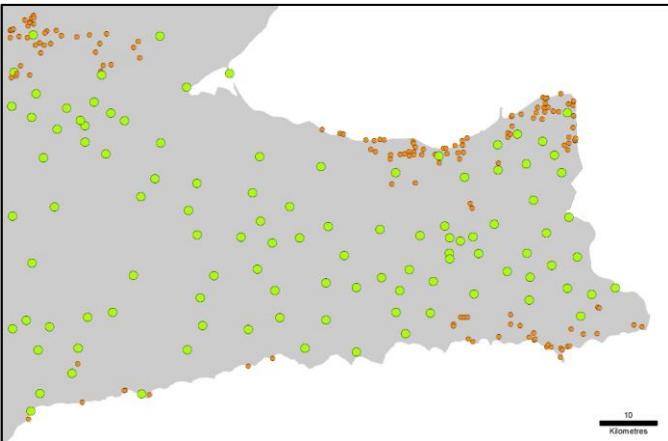
- 46 345 records
- 9.2 / km²



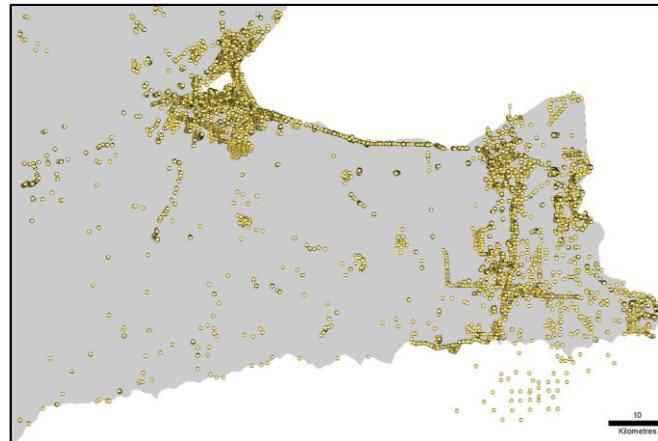
Boreholes, Sections and Wells



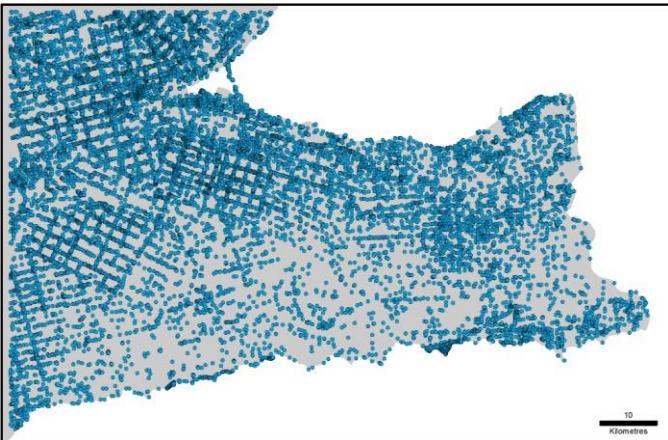
Cored boreholes, sections, hand auger



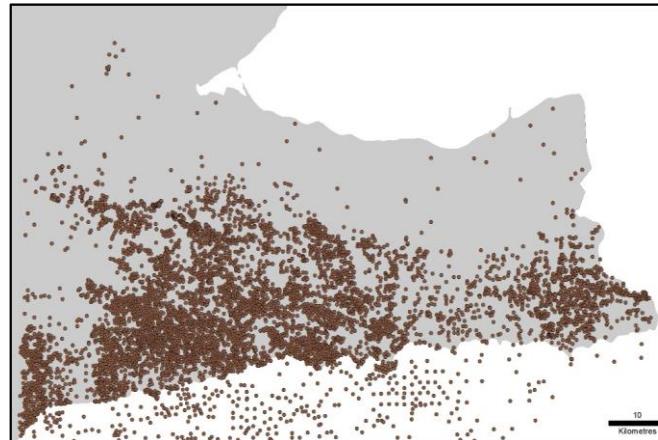
Geotechnical records



Water well records



Oil and gas records



Thematic Maps

Surficial Geology Soils Bedrock Lithology & Elevation

Elevation
m asl

188



184

180

176

172

168

164

160

156

152

148

144

140

136



~ 40 m of sediments between
ground surface and top of bedrock

Surficial Geology - Sediment Texture

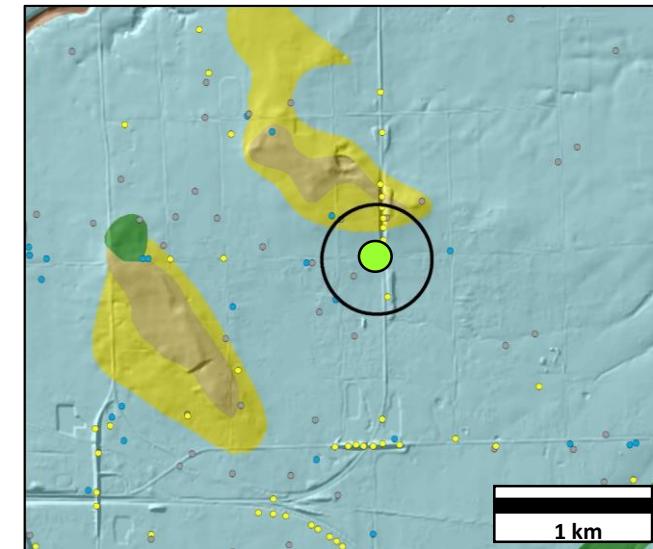
White	No recovery
Blue	Clay
Light Blue	Silty clay
Yellow	Silt to fine sand
Orange	Fine to medium sand

Bedrock Geology

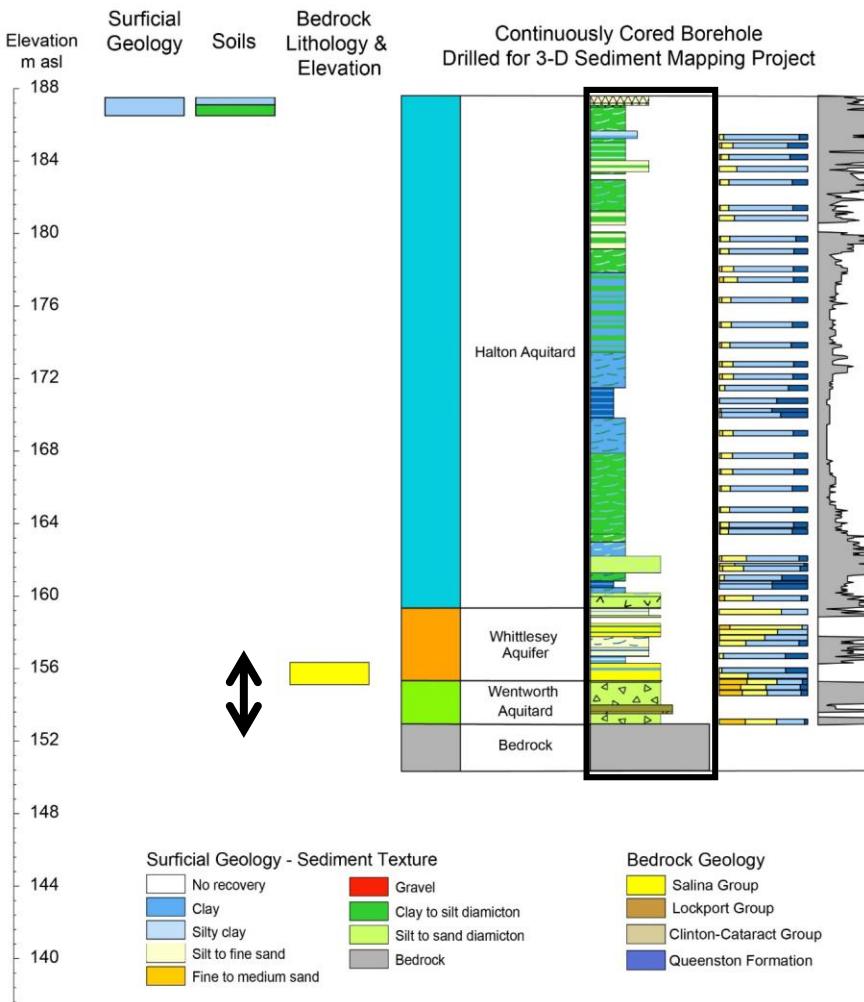
Red	Gravel
Green	Clay to silt diamictic
Light Green	Silt to sand diamictic
Grey	Bedrock

Yellow	Salina Group
Brown	Lockport Group
Tan	Clinton-Cataract Group
Dark Blue	Queenston Formation

Beaches and littoral sands
overlying glaciolacustrine clay which
blankets clayey diamicton

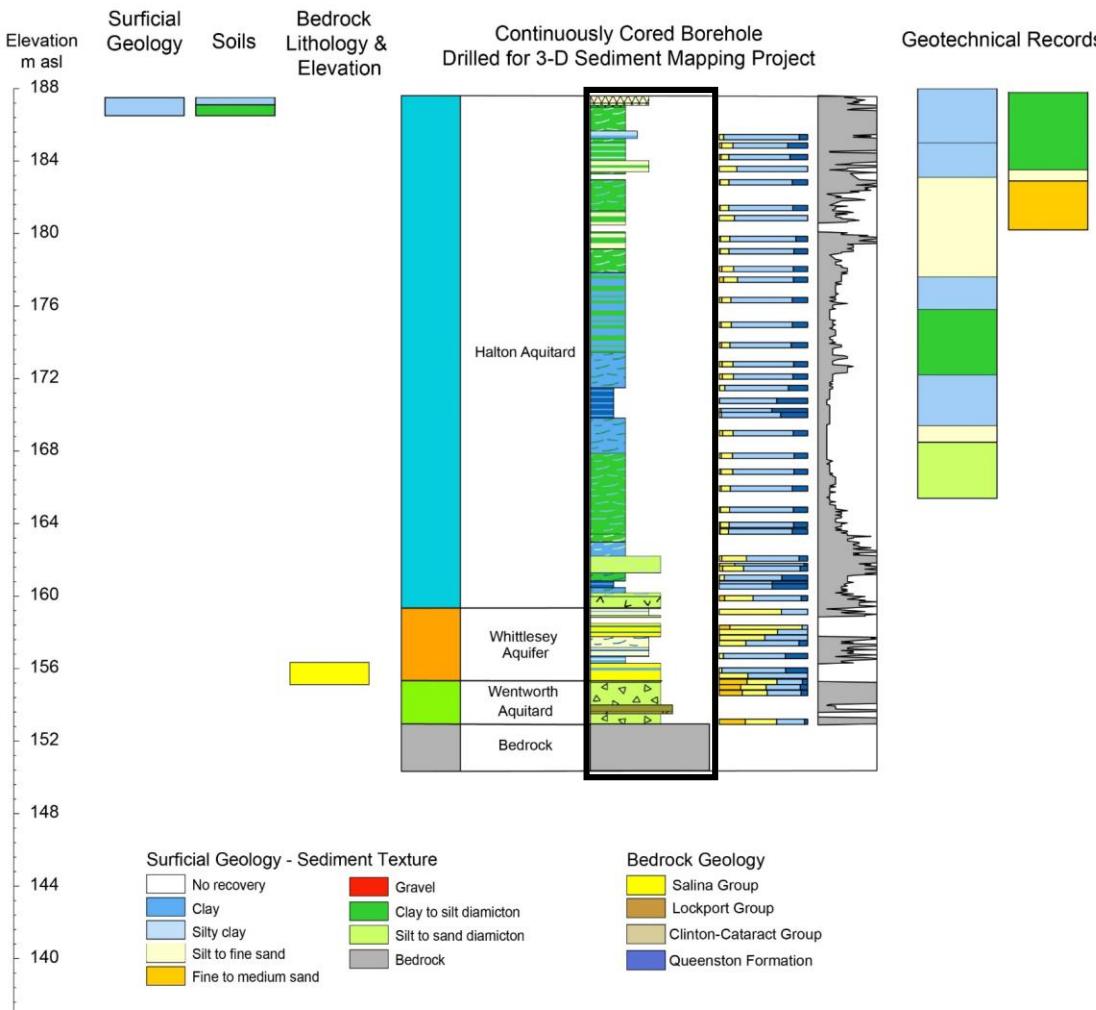


Thematic Maps



- Detailed!
- Stratigraphy, hydrostratigraphy
- Quaternary history
- Context

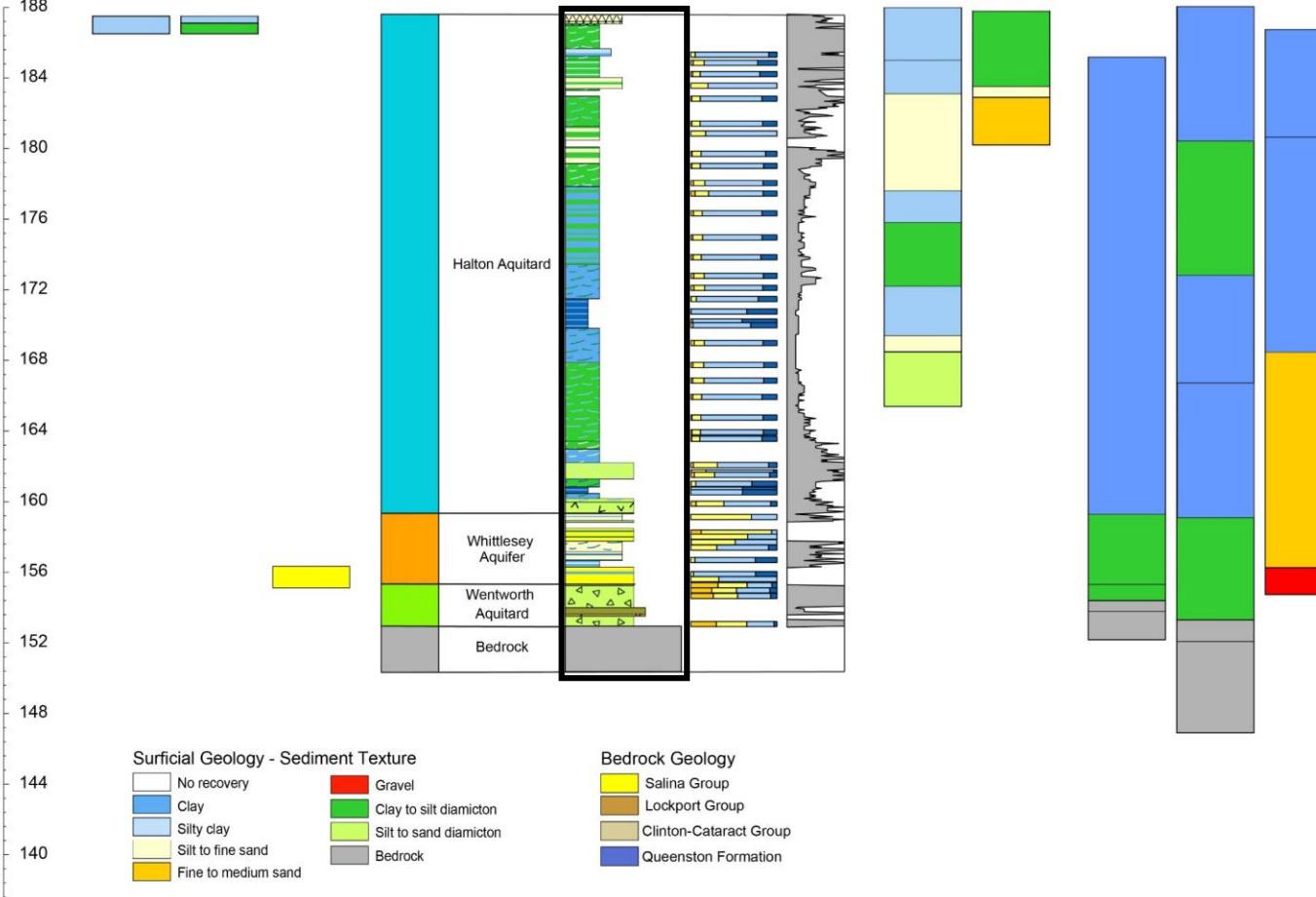
Thematic Maps



- Variable quality
 - Drilling method
 - Purpose
 - Experience
- Often shallow
- Clustered

Thematic Maps

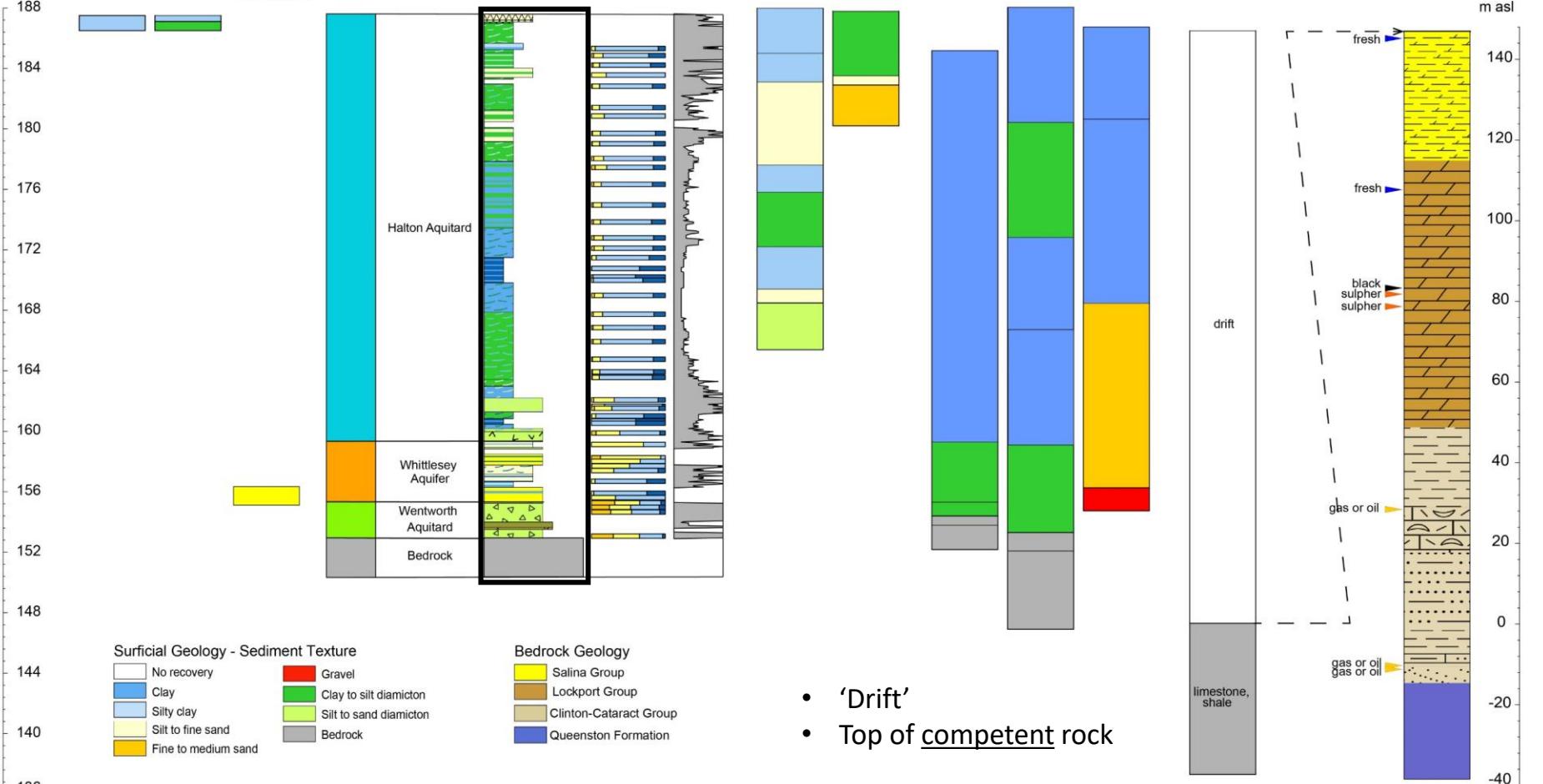
Surficial Geology Soils Bedrock Lithology & Elevation



- Low quality
- Plentiful!

Thematic Maps

Surficial
Geology Soils Bedrock
Lithology &
Elevation



A word cloud diagram where the size of each word represents its frequency or importance. The words are color-coded by category:

- Shale:** MUCK, GREYWACKE, CRYSTALLINE, DARK-COLOURED, PREVIOUSLY DUG, IRON FORMATION, FRACTURED, OVERBURDEN, CONGLOMERATE.
- Sand:** PEA GRAVEL, FILL, FOSILIFEROUS, MEDIUM GRAVEL, WOOD FRAGMENTS.
- Silt:** SOFT, CLAYEY, BASALT, FLINT, DIRTY, COARSE SAND.
- Clay:** POROUS, OTHER, LAYERED, HARD, SILT, CHERT, THICK, LIMY, DRY, PREV. DRILLED.
- Gravel:** MARBLE, WATER-BEARING, PACKED, GYPSUM, QUARTZITE, GRAVELLY, SOAPSTONE, TOPSOIL, QUARTZ, TILL, GRANITE, CLEAN, SHARP.
- Stones:** SLATE, SCHIST, DOLOMITE, FINE-GRAINED, COARSE GRAVEL, LIGHT-COLOURED, LOOSE, DENSE, ROCK, CEMENTED, VERY SILTY.
- Medium Sand:** GNEISS, PEAT, QUICKSAND, SANDSTONE, STICKY.
- Limestone:** GREENSTONE, WEATHERED, STONEY.

Where does the data come from?

Drillers logs

- Paper → digital
- Open descriptions

The Ontario Water Resources Act
WATER WELL RECORD

Ministry of the Environment
Ontario

6811403

WENTWORTH (EAST FLAMBORO) FLAMBOR CON.5 10
KRAUS Y. NURSERIES LTD. CARLISLE, P.O. ONT. LOR 1HO 29 - 3 - 88

LOG OF OVERTURBEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOR	ROCK IDENTIFICATION	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH (FT.)	THICKNESS (FT.)
BROWN	SAND	GRAVEL	LOOSE	0	17
BROWN	FINE SAND		LOOSE	17	48
BROWN	SANDY CLAY	GRAVEL	TR. LOOSE	48	53
BROWN	GRAVEL		PACKED	53	60

WATER RECORD

DEPTHS (FT.)	WATER LEVEL (FT.)	WATER LEVEL (FT.)
60	60	60
64	188	188
68	60	60

CASING & OPEN HOLE RECORD

DEPTHS (FT.)	WATER LEVEL (FT.)	WATER LEVEL (FT.)
60	60	60
64	188	188
68	60	60

PLUGGING & SEALING RECORD

DEPTHS (FT.)	WATER LEVEL (FT.)	WATER LEVEL (FT.)
60	60	60
64	60	60
68	60	60

LOCATION OF WELL

18123

WELL

18123

WATER USE

METHOD OF CONSTRUCTION

CONTRACTOR: O'CONNOR WELL DRILLING LTD. 4005
ER # 1 MILLGROVE, ONT. LOR 1YO
S.W. O'CONNOR
OWNER OR TENANT CONTRACTOR
APR 28 1988
OFFICE USE ONLY
T-0293
CSS.E.S.



Database Structure

Tables

_code_casing_material
_code_construct_method
_code_County
_code_Elev_rel
_code_final_status
_code_formation_Material
_code_location_method
_code_UTM_rel
_code_water_kind
_code_water_state_after_test
_code_Well_Type
_codeColor
_codeMoeTownship
_codePumpMethod
_codeWaterUse
Copy Of COUNTYLIST
COUNTYLIST
tblBore_Hole
tblCasing
tblFormation
tblHole
tblMethod_Construction
tblPipe
tblPlug
tblPump_Test
tblPump_Test_Detail
tblScreen
tblWater
tblWWR

tblFormation

FORMATION	BORE_HOLE	LAYER	COLOR	MAT1	MAT2	MAT3
30145033	23045033		6	02		
30145073	23045073		6	28	11	77
30145082	23045082		6	02		
30145875	23045875		6	05	11	79
30145876	23045876		6	05	11	79
30145877	23045877		6	02	85	
30145878	23045878		6	11	28	79
30145879	23045879		6	05	28	79
30145880	23045880		6	02	85	
30145881	23045881		6	10	77	
30145882	23045882		8	02	85	
30145883	23045883		8	02	85	
30145884	23045884		6	05	11	12
30145886	23045886		6	02	85	
30145887	23045887		8			
30145888	23045888		6	28	11	01
30145891	23045891		2	11		
30145892	23045892		6	01	28	84
30145893	23045893		6	02		
30145894	23045894		6	02	28	85
30145895	23045895		6	02	85	
30145896	23045896		6	02	28	85
30145897	23045897		6	02	85	
30145898	23045898		6	02	85	
30145899	23045899		6	28	11	01
30145900	23045900		6	02	28	11
30145901	23045901		6	28	84	01
30145902	23045902		6	05	34	06
30145903	23045903		6	28	06	77
30145904	23045904		6	28	01	
30145905	23045905		6	05	84	
30145906	23045906		8	02		
30145907	23045907			28	11	
30145908	23045908			05	81	

_codeColor

CODE	DES	ABBREV_CO
0	WHITE	WHIT
1	GREY	GREY
2	BLUE	BLUE
4	GREEN	GREN
5	YELLOW	YLLW
6	BROWN	BRWN
7	RED	RED
8	BLACK	BLCK
9	BLUE-GREY	BLGY
*		

Database Structure

Tables

_code_casing_material
_code_construct_method
_code_County
_code_Elev_rel
_code_final_status
_code_formation_Material
_code_location_method
_code_UTM_rel
_code_water_kind
_code_water_state_after_test
_code_Well_Type
_codeColor
_codeMoeTownship
_codePumpMethod
_codeWaterUse
Copy Of COUNTYLIST
COUNTYLIST
tblBore_Hole
tblCasing
tblFormation
tblHole
tblMethod_Construction
tblPipe
tblPlug
tblPump_Test
tblPump_Test_Detail
tblScreen
tblWater
tblWWR

◀ ▶

tblFormation

FORMATION	BORE_HOLE	LAYER	COLOR	MAT1	MAT2	MAT3
30145033	23045033	1 6		02	11	77
30145073	23045073	1 6		28		
30145082	23045082	1 6		02		
30145875	23045875	1 6		05	11	79
30145876	23045876	1 6		05	11	79
30145877	23045877	1 6		02	85	
30145878	23045878	1 6		11	28	79
30145879	23045879	1 6		05	28	79
30145880	23045880	1 6		02	85	
30145881	23045881	1 6		10	77	
30145882	23045882	1 8		02	85	
30145883	23045883	1 8		02	85	
30145884	23045884	1 6		05	11	12
30145886	23045886	1 6		02	85	
30145887	23045887	1 8				
30145888	23045888	1 6		28	11	01
30145891	23045891	1 2		11		
30145892	23045892	1 6		01	28	84
30145893	23045893	1 6		02		
30145894	23045894	1 6		02	28	85
30145895	23045895	1 6		02	85	
30145896	23045896	1 6		02	28	85
30145897	23045897	1 6		02	85	
30145898	23045898	1 6		02	85	
30145899	23045899	1 6		28	11	01
30145900	23045900	1 6		02	28	11
30145901	23045901	1 6		28	84	01
30145902	23045902	1 6		05	34	06
30145903	23045903	1 6		28	06	77
30145904	23045904	1 6		28	01	
30145905	23045905	1 6		05	84	
30145906	23045906	1 8		02		
30145907	23045907	1		28	11	
30145908	23045908	1 6		02	28	11

◀ ▶

_code_formation_Material

CO	DES	ABBREV
00	UNKNOWN TYPE	UNKN
01	FILL	FILL
02	TOPSOIL	LOAM
03	MUCK	MUCK
04	PEAT	PEAT
05	CLAY	CLAY
06	SILT	SILT
07	QUICKSAND	QSND
08	FINE SAND	FSND
09	MEDIUM SAND	MSND
10	COARSE SAND	CSND
11	GRAVEL	GRVL
12	STONES	STNS
13	BOULDERS	BLDR
14	HARDPAN	HPAN
15	LIMESTONE	LMSN
16	DOLOMITE	DLMT
17	SHALE	SHLE
18	SANDSTONE	SNDS
19	SLATE	SLTE
20	QUARTZITE	QRTZ
21	GRANITE	GRNT
22	GREENSTONE	GRSN
23	PREVIOUSLY DUG	PRDG
24	PREV. DRILLED	PRDR
25	OVERBURDEN	OBDN
26	ROCK	ROCK
27	OTHER	----
28	SAND	SAND
29	FINE GRAVEL	FGVL
30	MEDIUM GRAVEL	MGVL
31	COARSE GRAVEL	CGVL
32	PEA GRAVEL	PGVL
33	MARL	MARI



 Ministry
of the
Environment

The Ontario Water Resources Act
WATER WELL RECORD

Ontario	11	6811403	WENDELL	
1. PRINT ONLY IN SPACES PROVIDED 2. CHECK <input type="checkbox"/> CORRECT BOX WHERE APPLICABLE				
COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON. BLOCK, TRACT, SURVEY ETC	LOT	RS-EE
WENTWORTH	(EAST PLAMBORO) PLAMBORO	CON. 5	10	
OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED 44-53		
KRAUS V. NURSERIES LTD.	CARLISLE, P.O. ONT. L0R 1H0	DAY	29	3-88
21	ZONE	EASTING	NORTHING	AC.
				ELEVATION FT.
				MAIN CODE

31							
32							
41	WATER RECORD						
WATER FOUND AT FEET	KIND OF WATER						
60	<input type="checkbox"/> FRESH <input type="checkbox"/> SALTY <input type="checkbox"/> MINERALS <input type="checkbox"/> GASES <input type="checkbox"/> FRESH & SALT <input type="checkbox"/> FRESH & MINERALS <input type="checkbox"/> SALT & MINERALS <input type="checkbox"/> FRESH & GASES <input type="checkbox"/> SALT & GASES						
15-18	<input type="checkbox"/> FRESH <input type="checkbox"/> SALTY <input type="checkbox"/> MINERALS <input type="checkbox"/> GASES <input type="checkbox"/> FRESH & SALT <input type="checkbox"/> FRESH & MINERALS <input type="checkbox"/> SALT & MINERALS <input type="checkbox"/> FRESH & GASES <input type="checkbox"/> SALT & GASES						
25-28	<input type="checkbox"/> FRESH <input type="checkbox"/> SALTY <input type="checkbox"/> MINERALS <input type="checkbox"/> GASES <input type="checkbox"/> FRESH & SALT <input type="checkbox"/> FRESH & MINERALS <input type="checkbox"/> SALT & MINERALS <input type="checkbox"/> FRESH & GASES <input type="checkbox"/> SALT & GASES						
30-33	<input type="checkbox"/> FRESH <input type="checkbox"/> SALTY <input type="checkbox"/> MINERALS <input type="checkbox"/> GASES <input type="checkbox"/> FRESH & SALT <input type="checkbox"/> FRESH & MINERALS <input type="checkbox"/> SALT & MINERALS <input type="checkbox"/> FRESH & GASES <input type="checkbox"/> SALT & GASES						
51	CASING & OPEN HOLE RECORD						
INSIDE DIAMETER	MATERIAL	WALL THICKNESS	DEPTH - FEET				
64	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> COATED <input type="checkbox"/> CONCRETE <input type="checkbox"/> CEMENT <input type="checkbox"/> PLASTIC	12	10	15-18	18-21	21-24	24-27
			.188	+1	60		
15-18	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> COATED <input type="checkbox"/> CONCRETE <input type="checkbox"/> CEMENT <input type="checkbox"/> PLASTIC	18	10	15-18	18-21	21-24	24-27
25-28	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> COATED <input type="checkbox"/> CONCRETE <input type="checkbox"/> CEMENT <input type="checkbox"/> PLASTIC	24	10	15-18	18-21	21-24	24-27
30-33	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> COATED <input type="checkbox"/> CONCRETE <input type="checkbox"/> CEMENT <input type="checkbox"/> PLASTIC	30	10	15-18	18-21	21-24	24-27
SCREEN	SIZES OF OPENINGS	1/8-1/4	1/4-1/2	1/2-1	1-1 1/2	1 1/2-2	2-2 1/2
	INCHES						
	MATERIAL AND TYPE						
61	PLUGGING & SEALING RECORD						
DEPTH SET AT FEET	MATERIAL AND TYPE	LEAD Packer ETC.					
FROM	TO						
10-13	14-17						
18-21	22-25						
24-29	30-33						

FINAL STATUS OF WELL	<input checked="" type="checkbox"/> WATER SUPPLY <input type="checkbox"/> ABANDONED - INSUFFICIENT SUPPLY <input type="checkbox"/> OBSERVATION WELL <input type="checkbox"/> ABANDONED - POOR QUALITY <input type="checkbox"/> TEST HOLE <input type="checkbox"/> UNFINISHED <input type="checkbox"/> DRAINSAGE WELL <input type="checkbox"/> OTHER	HWY S6	17 P.M.V. 10/10/84	CEM RUS
WATER USE	<input type="checkbox"/> COMMERCIAL <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> STOCK <input type="checkbox"/> IRRIGATION <input type="checkbox"/> DOMESTIC <input type="checkbox"/> OTHER	W56		
METHOD	<input type="checkbox"/> CABLE TOOL <input type="checkbox"/> BORING <input checked="" type="checkbox"/> ROTARY (CONVENTIONAL) <input type="checkbox"/> DIAMOND <input type="checkbox"/> OTHER			

OF CONSTRUCTION		<input type="checkbox"/> ROTARY INVERSE <input type="checkbox"/> ROTARY <input type="checkbox"/> DRILLING <input type="checkbox"/> DIGGING <input type="checkbox"/> OTHER	DRILLERS REWARD	
			18123	
NAME OF WELL CONTRACTOR O'CONNOR WELL DRILLING LTD.		WELL CONTRACTOR NUMBER 4005	DATE RECEIVED APR 28 1988	
ADDRESS R.R # 1 MILLGROVE, ONT. L0R 1V0			EX. CONTRACTOR DATA SOURCE	
NAME OF WELL TECHNICIAN B.W.O'CONNOR		WELL TECHNICIAN'S LICENCE NUMBER T-0290	EX. INSPECTOR DATE OF INSPECTION	
CONTRACTOR <i>J.B. O'Connor</i>		NARRATION DATE SAT NO YR	REMARKS	
		OFFICE USE ONLY		

Sandy clay, gravel,
loose

Diamicton *Ice-margin*

Clay, sandy, loose
Glaciolacustrin
e
Fan

Well ID

Well ID Number: 6811403

Well Audit Number: 181

Well Tag Number: *This table contains information from the original well record and any subsequent updates.*

Well Location

Address of Well Location	
Township	BEVERLY TOWNSHIP
Lot	010
Concession	CON 05
County/District/Municipality	WENTWORTH
City/Town/Village	
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 566183.30 Northing: 4795373.00
Municipal Plan and Sublot Number	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	LOOS	0 ft	17 ft
BRWN	FSND	LOOS		17 ft	48 ft
BRWN	CLAY	SNDY	LOOS	48 ft	53 ft
BRWN	GRVL	PCKD		53 ft	60 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
------------	----------	---	---------------

Method of Construction & Well Use

Method of Construction	Well Use
Cable Tool	
	Domestic

Accessing the data

Subscribe to updates to this dataset using RSS.

[Subscribe](#)

Well records

This dataset provides information submitted by well contractors as prescribed by Regulation 903, and is stored in the Water Well Information System (WWIS). Spatial information for all of the well records reported in Ontario are also provided.

Well record map

*[WWIS]: Water Well Information System

This dataset is related to:

- Well records
- Map: Well records
- Topic: Drinking water
- Law: Reg. 903: Wells

Related data:

- Petroleum wells

For more information

wellhelpdesk@ontario.ca

Data



Data Available

The data described here is available for you to use. [\[Learn more\]](#)
[See the license for how you're allowed to use this data.]

Covers 1899-01-01 - 2020-07-01

WWIS - Microsoft Access 🔥

Last Updated: November 30, 2020 | [English](#)

[About](#) [Open](#)

WWIS - GIS Shapefile 🔥

Last Updated: November 30, 2020 | [English](#)

[About](#) [Open](#)

Well Record Data Report 🔥

Last Updated: November 30, 2020 | [English](#)

[About](#) [Open](#)

Supporting files

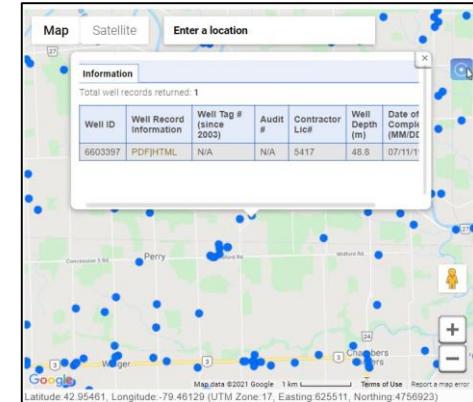
Metadata record 🔥

Last Updated: April 30, 2020 | [English](#)

[About](#) [Open](#)



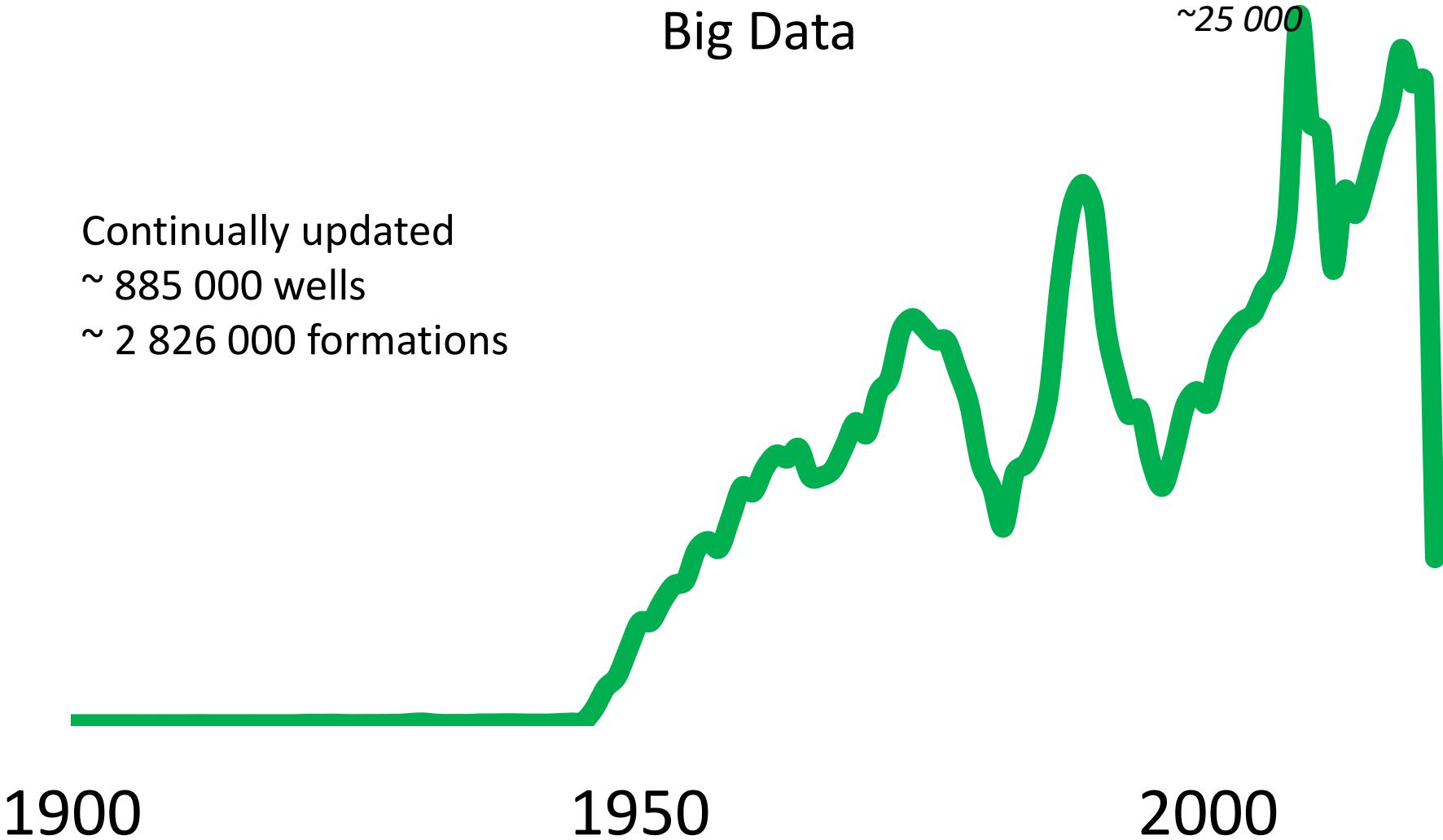
Individual records



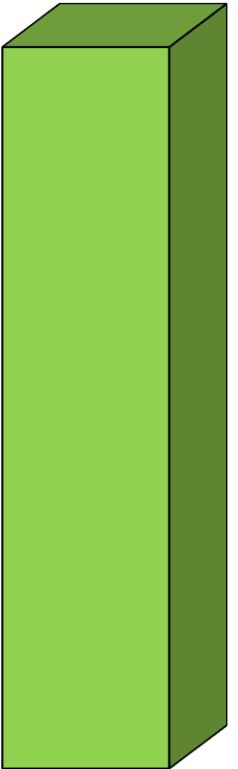
Groups of records

Big Data

Continually updated
~ 885 000 wells
~ 2 826 000 formations



Unique Combinations of Terms



Top 100

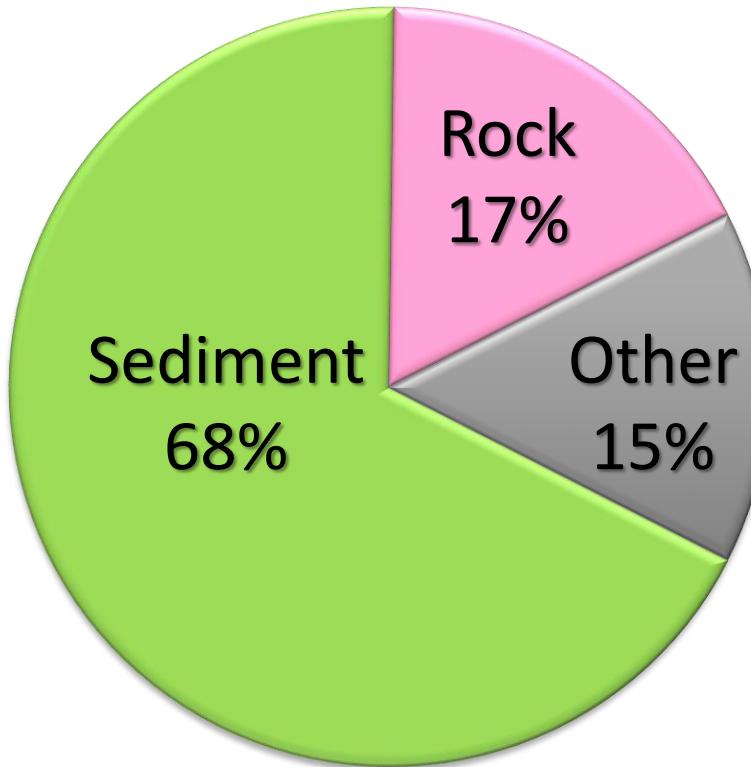
Remaining

37 736

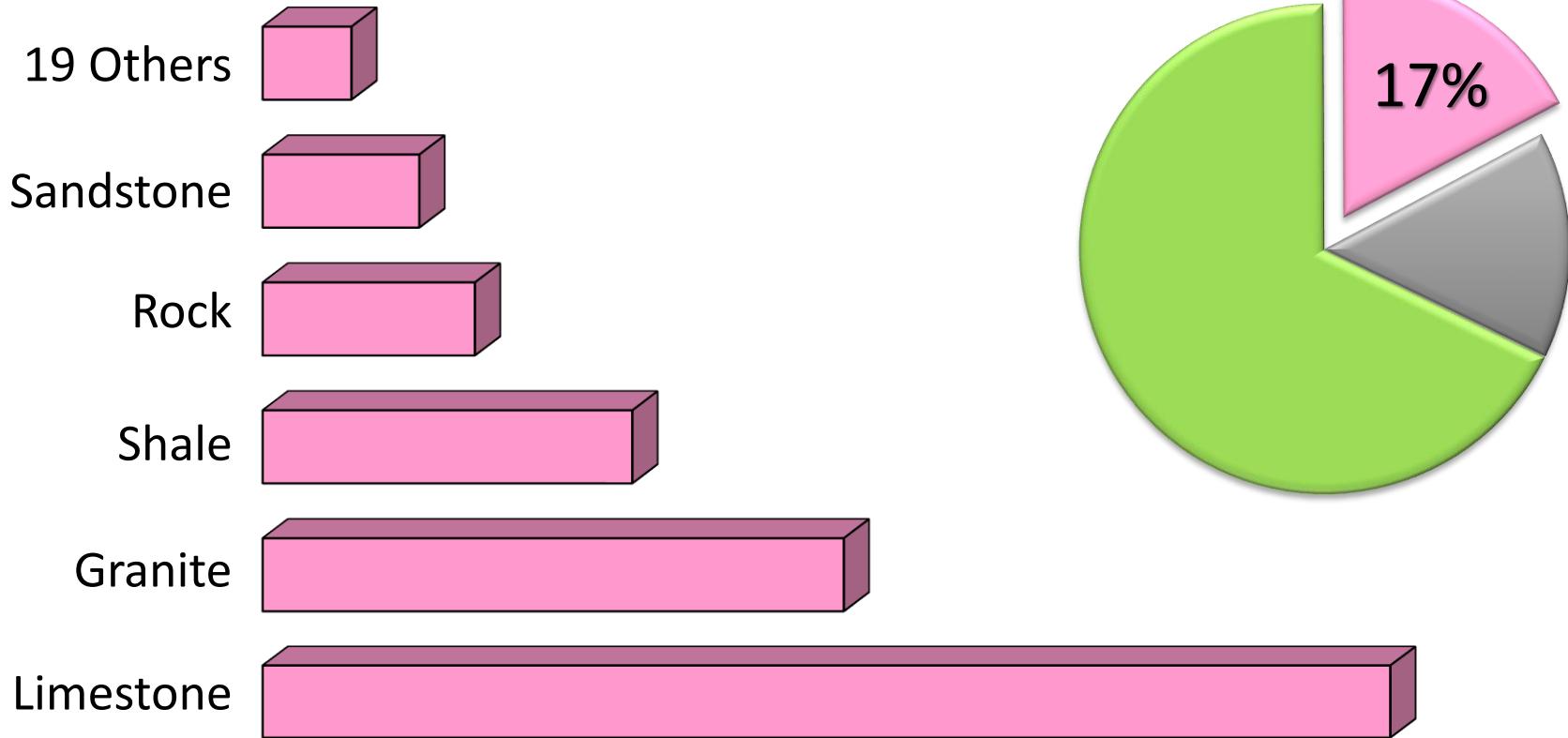
GREY LIMESTONE NA NA	111560	4.02497 ROCK NA NA	9294	0.33532 GREY CLAY NA SOFT	4249	0.1533 TOPSOIL CLAY NA	2571	0.09276
TOPSOIL NA NA	73168	2.63983 SAND GRAVEL NA	9284	0.33496 BROWN COARSE SAND NA NA	4226	0.15247 BROWN CLAY DENSE NA	2523	0.09103
GREY CLAY NA NA	72891	2.62983 GREY CLAY SOFT NA	9205	0.33211 BLUE CLAY GRAVEL NA	4209	0.15186 GREY CLAY SILTY NA	2515	0.09074
BROWN CLAY NA NA	72462	2.61436 CLAY MEDIUM SAND NA	9143	0.32987 BROWN SAND PACKED NA	4174	0.15059 BROWN SAND FILL NA	2501	0.09023
BROWN SAND NA NA	66386	2.39514 BROWN SAND SILT NA	8874	0.32016 GREY GRAVEL CLAY NA	4088	0.14749 GREY GRANITE NA HARD	2496	0.09005
						GREY LIMESTONE FRACTURED		
BLUE CLAY NA NA	64601	2.33074 BLUE SHALE NA NA	8827	0.31847 BLUE CLAY SOFT NA	4043	0.14587 NA	2487	0.08973
CLAY NA NA	53150	1.9176 GREY CLAY SAND NA	8087	0.29177 GREY LIMESTONE ROCK NA	3916	0.14129 GREEN GRANITE NA NA	2484	0.08962
LIMESTONE NA NA	51198	1.84717 GREY FINE SAND NA NA	7994	0.28842 BROWN TOPSOIL SOFT NA	3902	0.14078 BROWN SILT NA NA	2466	0.08897
GREY GRANITE NA NA	45884	1.65545 BROWN FILL NA NA	7811	0.28181 GRAVEL BOULDERS NA	3883	0.14009 CLAY SAND NA	2454	0.08854
BROWN TOPSOIL NA NA	44486	1.60501 BROWN SAND GRAVEL LOOSE	7798	0.28134 GREY HARDPAN STONES NA	3827	0.13807 GREY CLAY SAND STONES	2435	0.08785
GRAVEL NA NA	43332	1.59945 GREY HARDPAN NA NA	7577	0.27337 GREY SILT SAND NA	3755	0.13548 BROWN GRAVEL CLAY NA	2424	0.08746
BROWN LIMESTONE NA NA	36893	1.33106 BROWN CLAY SANDY NA	7420	0.26771 UNKNOWN TYPE NA NA	3730	0.13457 BLUE CLAY MEDIUM SAND NA	2417	0.0872
BLACK TOPSOIL NA NA	34158	1.23239 GREY LIMESTONE NA HARD	6950	0.25075 BROWN CLAY STONES HARD	3723	0.13432 BROWN TOPSOIL NA SOFT	2335	0.08424
RED GRANITE NA NA	33992	1.2264 BROWN SAND LOOSE NA	6884	0.24837 BROWN HARDPAN NA NA	3686	0.13299 RED LIMESTONE NA NA	2302	0.08305
MEDIUM SAND NA NA	30886	1.11434 GREY LIMESTONE LAYERED NA	6814	0.24584 GREY GRAVEL SAND NA	3660	0.13205 BROWN SAND GRAVEL SOFT	2287	0.08251
BROWN CLAY STONES NA							2273	0.08201
GREY CLAY STONES NA							2262	0.08161
BLACK GRANITE NA NA							2250	0.08118
BROWN SAND GRAVEL NA							2240	0.08082
HARDPAN NA NA							2239	0.08078
GREY LIMESTONE HARD NA							2238	0.08074
SAND NA NA							2237	0.08071
GREY CLAY GRAVEL NA							2222	0.08017
PREVIOUSLY DUG NA NA							2194	0.07916
GREY SAND NA NA	15442	0.55713 BROWN SAND STONES NA	6105	0.22026 NA	3443	0.12422 GREY SAND LOOSE NA	2193	0.07912
CLAY STONES NA	14526	0.52408 GREY SAND GRAVEL NA	5960	0.21503 GREY CLAY SAND GRAVEL	3415	0.12321 GREY NA NA NA	2173	0.0784
BLUE LIMESTONE NA NA	14507	0.52324 BROWN CLAY PACKED NA	5872	0.21186 BROWN SAND SILT LOOSE	3330	0.12014 GREY CLAY SANDY NA	2151	0.07761
NA NA NA	14478	0.52235 BROWN SHALE NA NA	5469	0.19732 HARDPAN BOULDERS NA	3304	0.1192 GREY HARDPAN BOULDERS NA	2143	0.07732
GREY SANDSTONE NA NA	14104	0.50886 GREY CLAY DENSE NA	5433	0.19602 RED SANDSTONE NA NA	3265	0.1178 BLUE CLAY SAND NA	2134	0.07699
FINE SAND NA NA	12494	0.45077 GREY MEDIUM SAND NA NA	5318	0.19187 WHITE GRANITE NA NA	3242	0.1167 BROWN SAND GRAVEL PACKED	2128	0.07678
RED SHALE NA NA	12261	0.44236 BLACK LIMESTONE NA NA	5278	0.19042 GRAVEL STONES NA	3220	0.11617 GREY CLAY STONES DENSE	2112	0.0762
WHITE LIMESTONE NA NA	12199	0.44013 CLAY BOULDERS NA	5166	0.18638 BROWN CLAY STONES PACKED	3156	0.11387 BROWN TOPSOIL HARD NA	2105	0.07595
GRANITE NA NA	12140	0.438 BROWN SANDSTONE NA NA	5102	0.18408 HARDPAN STONES NA	3081	0.11116 RED MEDIUM SAND NA NA	2105	0.07595
GREY ROCK NA NA	11276	0.40683 GREY SILT CLAY NA	5077	0.18317 BOULDERS NA NA	3077	0.11102 BROWN SAND NA SOFT	2104	0.07591
GREY GRAVEL NA NA	11114	0.40098 GREY GRANITE HARD NA	5063	0.18267 BLACK NA NA NA	3075	0.11094 BLACK ROCK NA NA	2101	0.0758
YELLOW CLAY NA NA	1081	0.39979 GREY CLAY SILT SOFT	5035	0.18166 RED SAND NA NA	3070	0.11076 GREY CLAY MEDIUM SAND NA	2078	0.07497
SHALE NA NA	1026	0.39781 BROWN GRAVEL SAND NA	5030	0.18148 SILT NA NA	3030	0.10932 GREY LIMESTONE NA LAYERED	2068	0.07461
BROWN CLAY SAND NA	11019	0.39755 BROWN CLAY BOULDERS NA	4664	0.16827 BROWN SAND GRAVEL FILL	2994	0.10802 BLACK OTHER NA NA	2041	0.07364
GREY SHALE NA NA	11009	0.39719 GREEN LIMESTONE NA NA	4660	0.16813 RED GRANITE HARD NA	2970	0.10715 BLUE CLAY SILT NA	2019	0.07284
RED CLAY NA NA	10571	0.38139 GRAVEL MEDIUM SAND NA	4650	0.16777 SAND BOULDERS NA	2917	0.10524 GREY CLAY NA HARD	1996	0.07201
CLAY GRAVEL NA	10558	0.38092 BROWN SILT SAND NA	4585	0.16542 STONES NA NA	2811	0.10142 GREY LIMESTONE SOFT NA	1972	0.07115
BROWN SAND CLAY NA	10506	0.37905 BROWN CLAY SILT NA	4577	0.16513 SAND CLAY NA	2801	0.10106 BOULDERS		
BROWN CLAY GRAVEL NA	10067	0.36321 GRAVEL CLAY NA	4536	0.16365 GRAVEL SAND NA	2794	0.1008 GREY CLAY SILT DENSE	1962	0.07079
BROWN MEDIUM SAND NA NA	10041	0.36227 GREY SAND SILT NA	4391	0.15842 GREY LIMESTONE SHALE NA	2722	0.09821 GREY SILT CLAY SOFT	1961	0.07075
BLACK SHALE NA NA	9999	0.36075 GREY CLAY BOULDERS NA	4386	0.15824 GREY CLAY PACKED NA	2693	0.09716 CLAY SILT NA	1944	0.07014

Why reduce complexity?
Duplicated effort costs everyone!

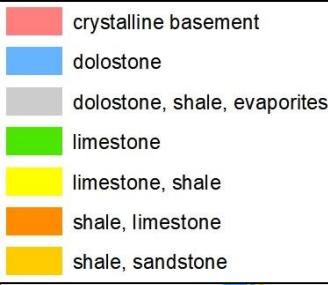
4 715 313 Material Descriptions



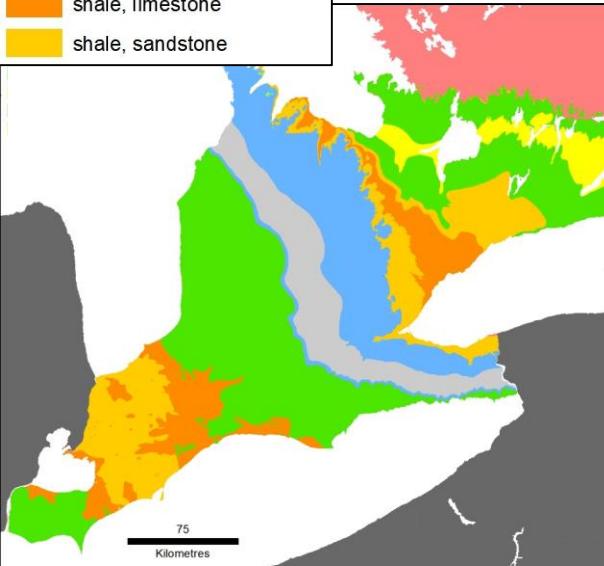
Rock Descriptors



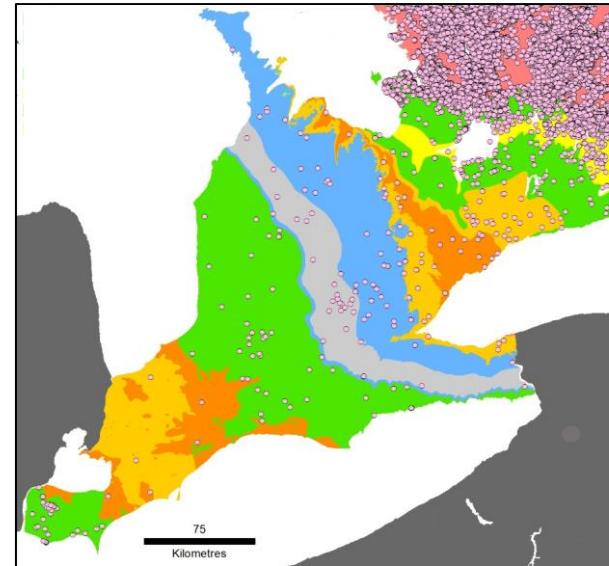
schist - Greywacke - Feldspar - Gypsum - Iron Formation - Crystalline



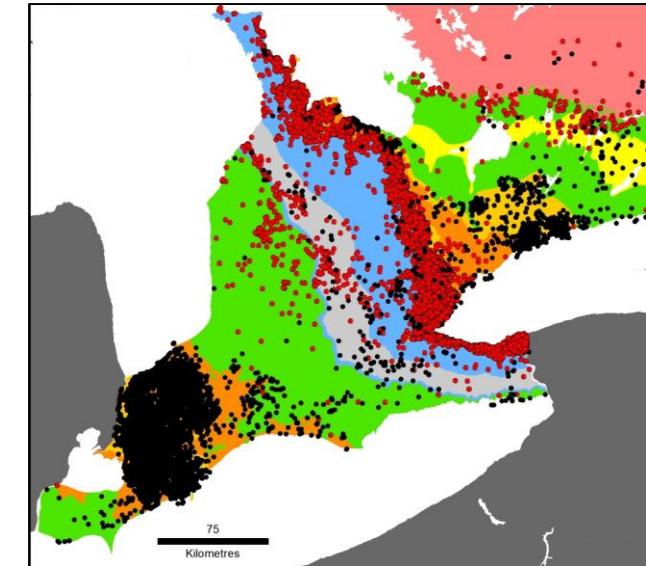
Mapping Bedrock Using Water Wells



Bedrock lithology



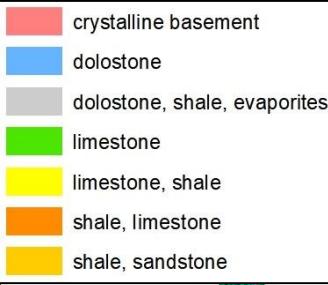
Granite



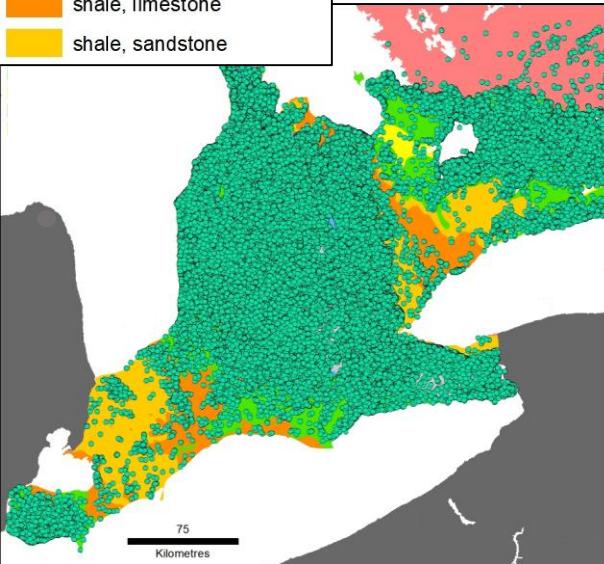
Red and black shale

- | | |
|---------------|------------------|
| ● Granite | ● Blue limestone |
| ● Red shale | ● Dolostone |
| ● Black shale | ○ Gypsum |
| ● Limestone | ● Marble |

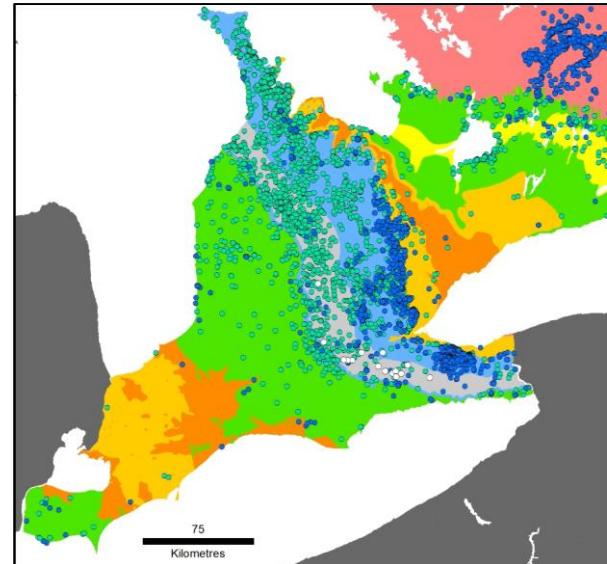
Note: Query was not confined to the uppermost rock unit



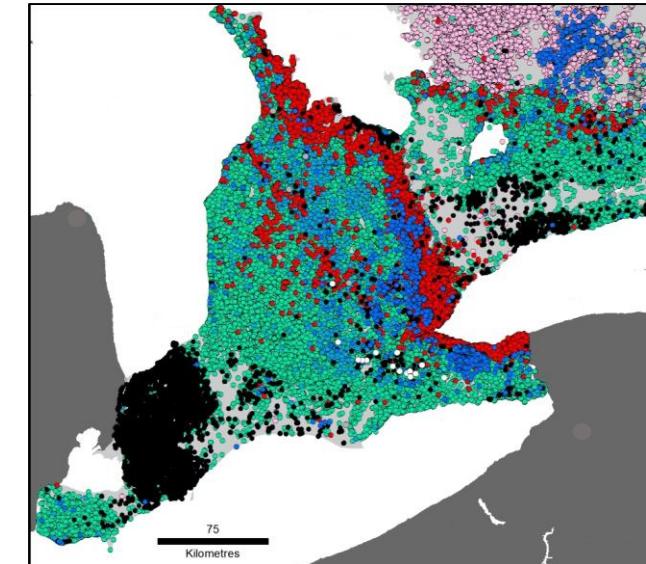
Mapping Bedrock Using Water Wells



Limestone



Dolostone, gypsum and 'blue'
limestone

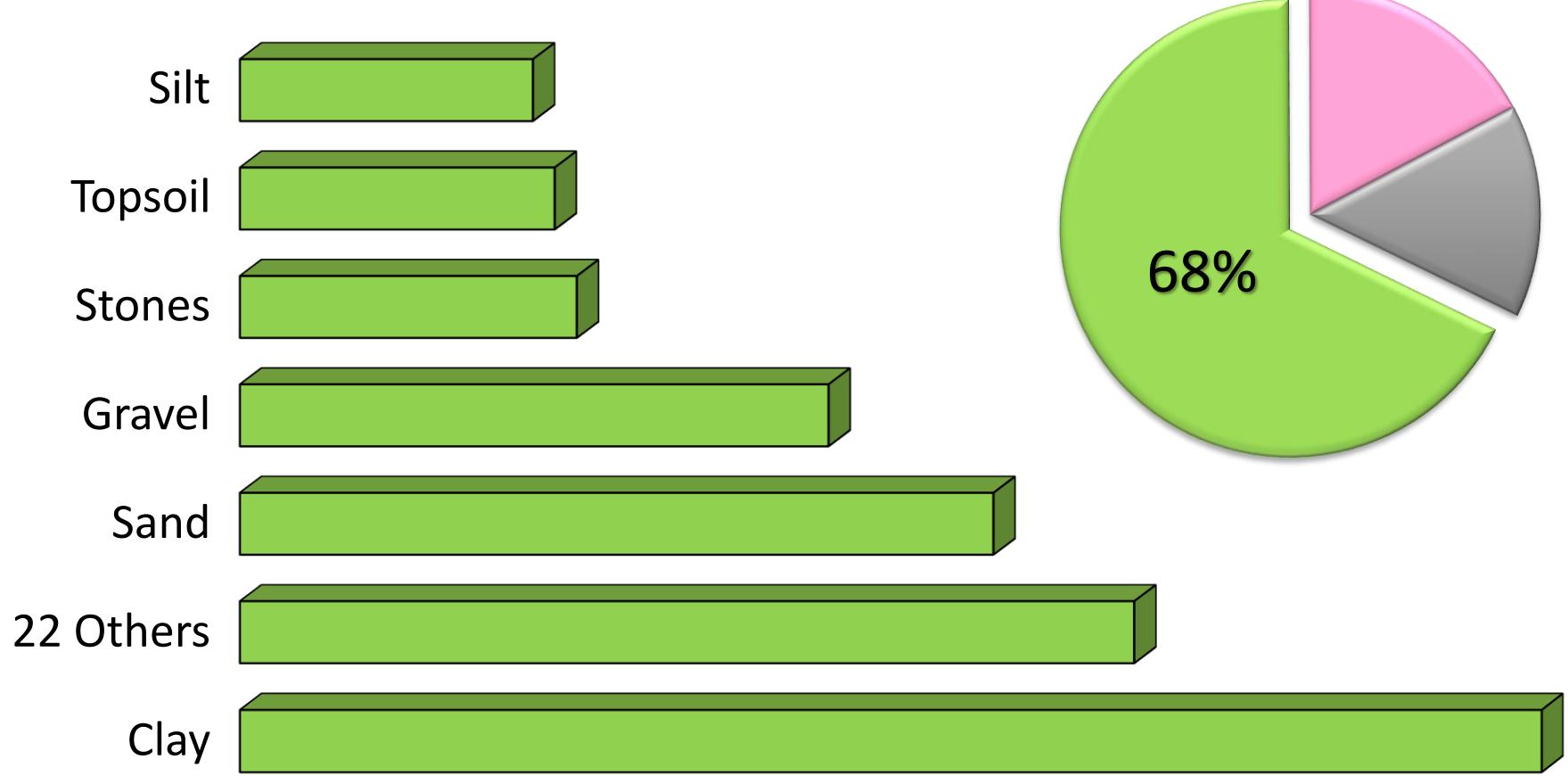


Completed map

- | | |
|---------------|------------------|
| ● Granite | ● Blue limestone |
| ● Red shale | ● Dolostone |
| ● Black shale | ○ Gypsum |
| ● Limestone | ● Marble |

Note: Query was not confined to the uppermost rock unit

Sediment Descriptors



Stoney - Overburden - Peat - Medium Gravel - Gravelly - Wood Fragment

Medium Sand - Boulders - Hardpan - Fine Sand - Fill - Sandy - Coarse Sand - Till - Silty - Coarse Gravel - Quicksand - Fine Gravel - Muck

Why the OGS?

We use water well records to answer questions about

- ➡ Bedrock
- ➡ Sediment
- ➡ Water



Frank Brunton

Andy Bajc (retired)

Kayla Dell

Elizabeth Priebe

Abigail Burt

Riley Mulligan

Stew Hamilton

Project Objectives

Phase 1 - The Future

- Develop a simple nomenclature for describing geological materials

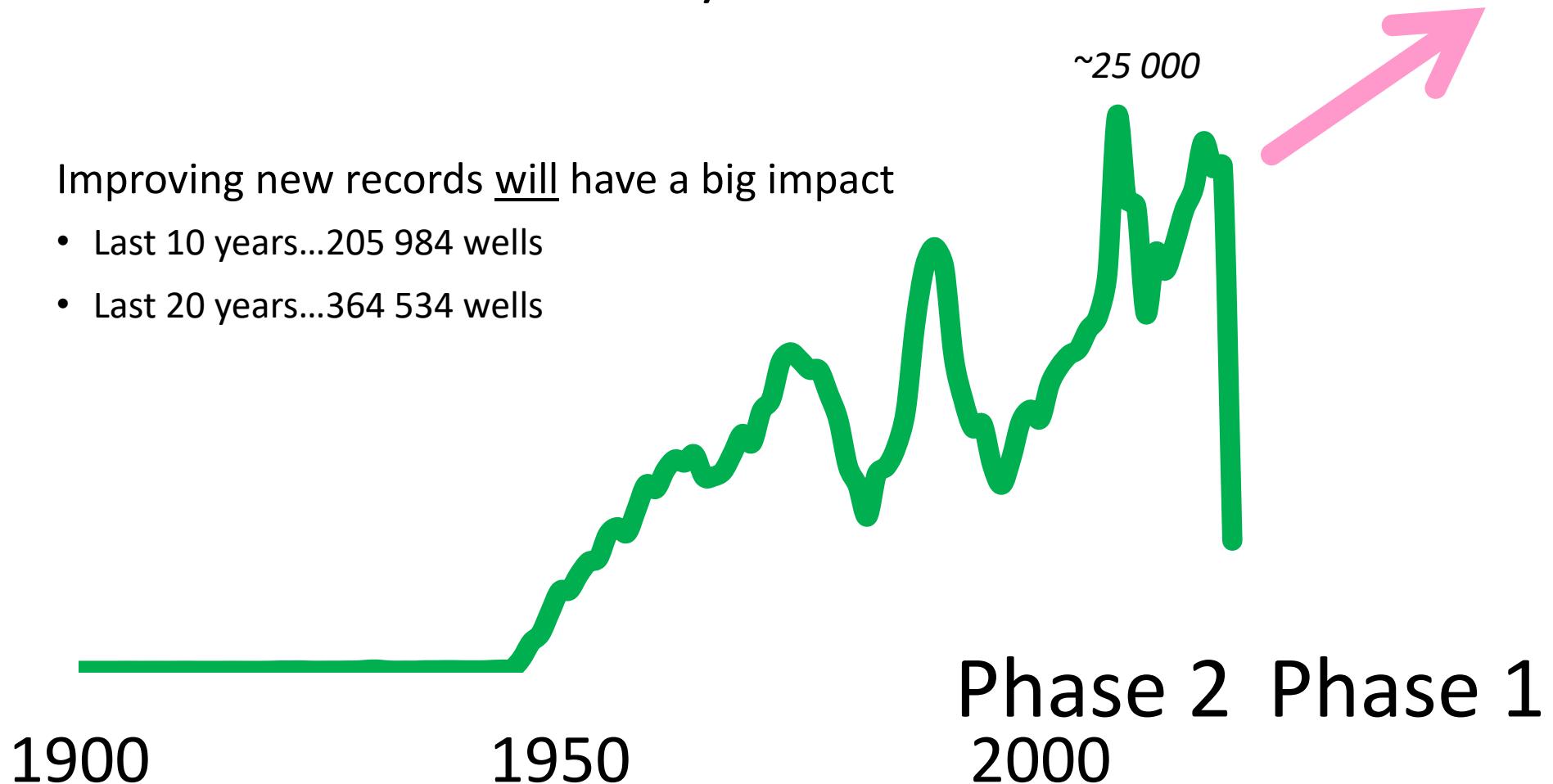
abigail.burt@ontario.ca

- Develop a guidance document for using the new nomenclature
 - Simple description
 - Tips for identifying materials
 - Photographs (section, core, cuttings)

Why Bother?

Improving new records will have a big impact

- Last 10 years...205 984 wells
- Last 20 years...364 534 wells

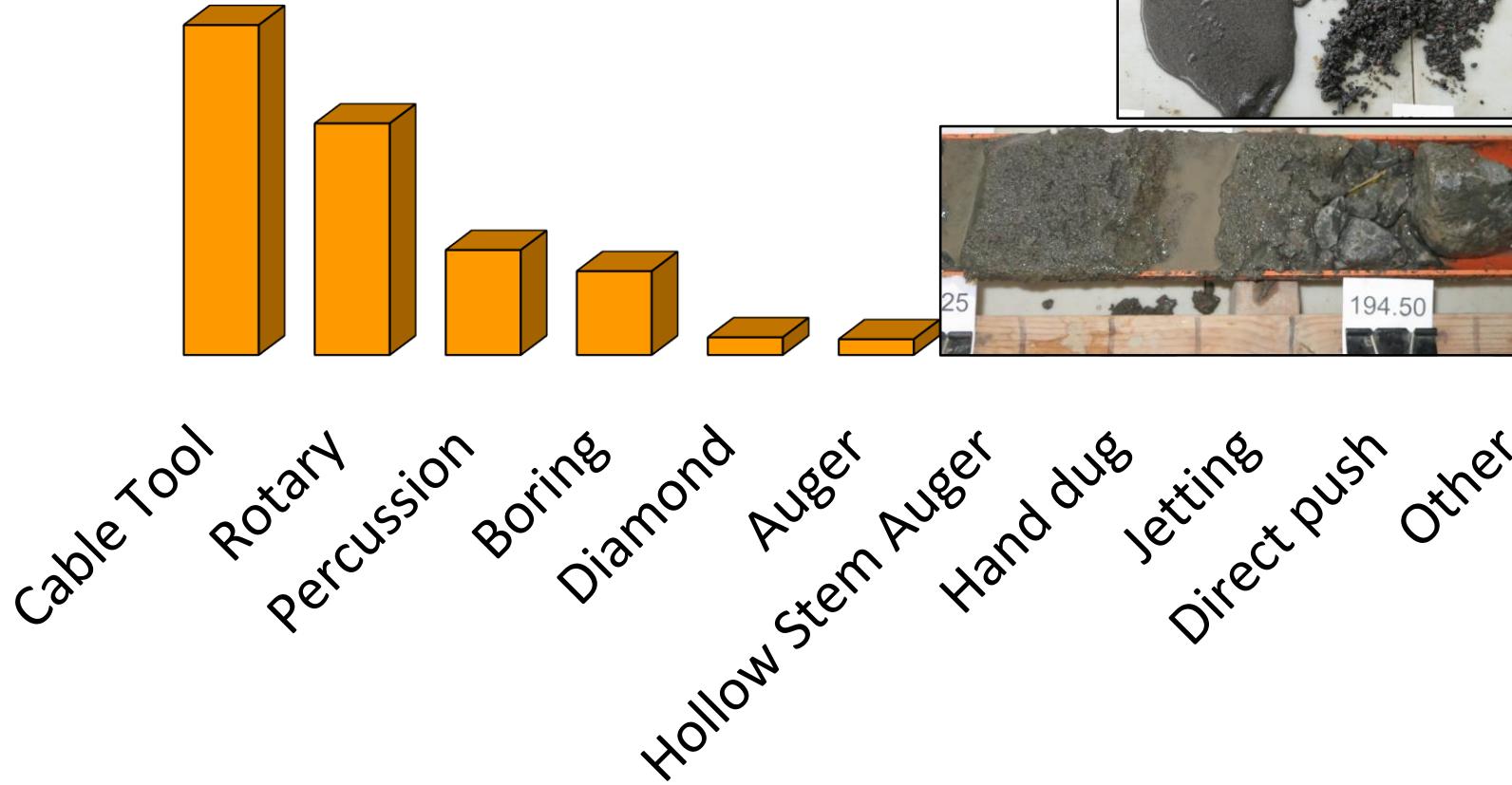


Project Objectives

Phase 2 - The Past

- Translate geological materials in historical well records to the new nomenclature
 - Conversion not correction
 - Retain the original terms

Construction Method



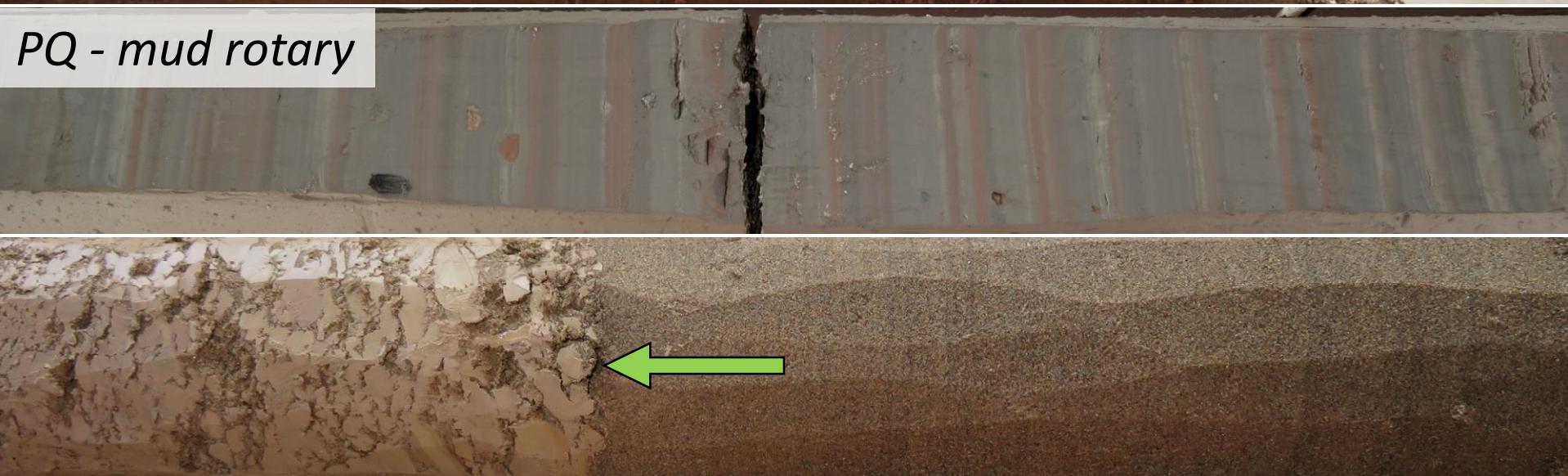
Soni
c



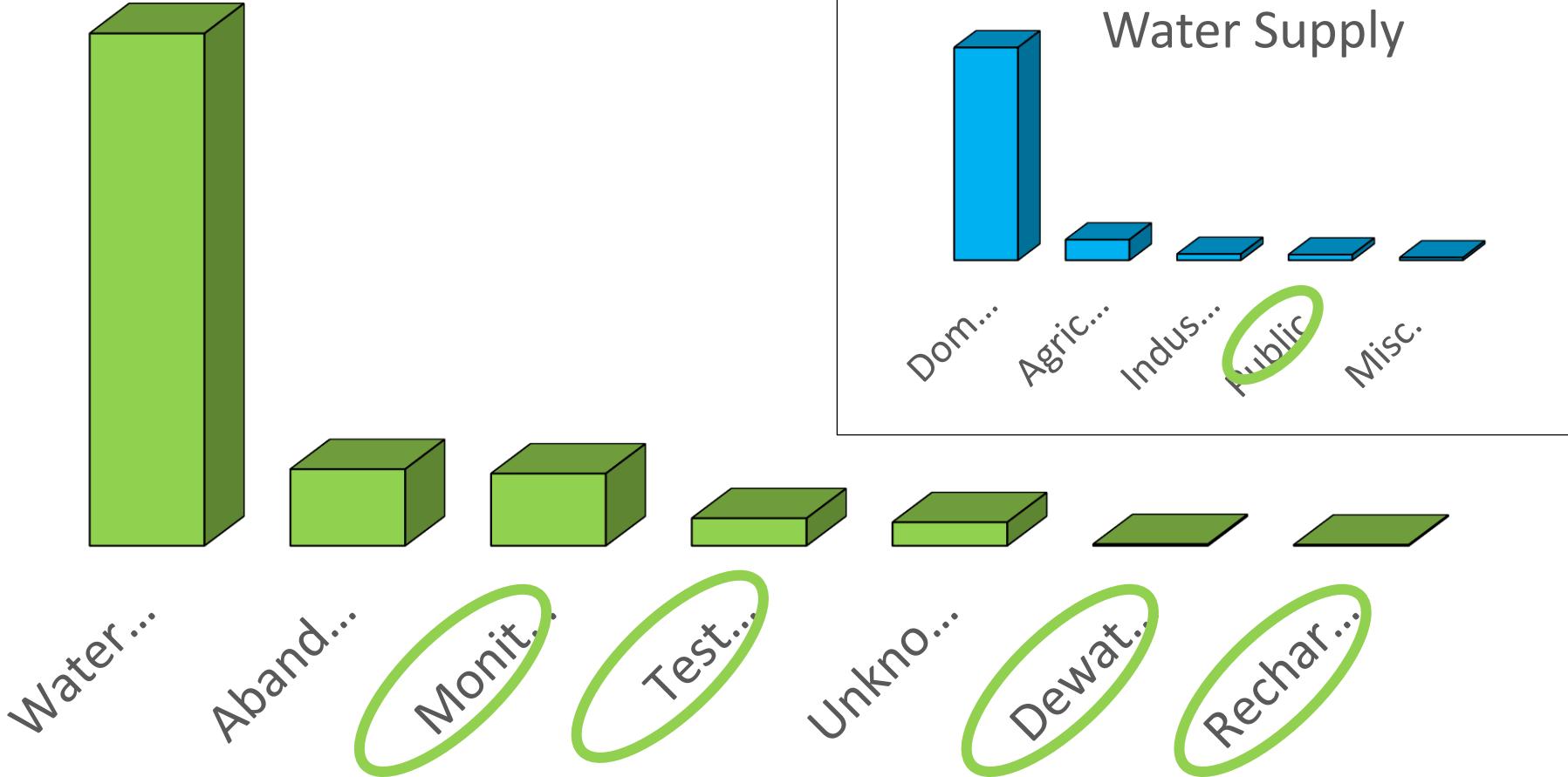
Split spoon



PQ - mud rotary



Well Status and Usage



Repetitive Terms

Sand

Sandy

Coarse sand

Medium sand

Fine sand

Quicksand

Coarse-grained

Medium-grained

Fine-grained

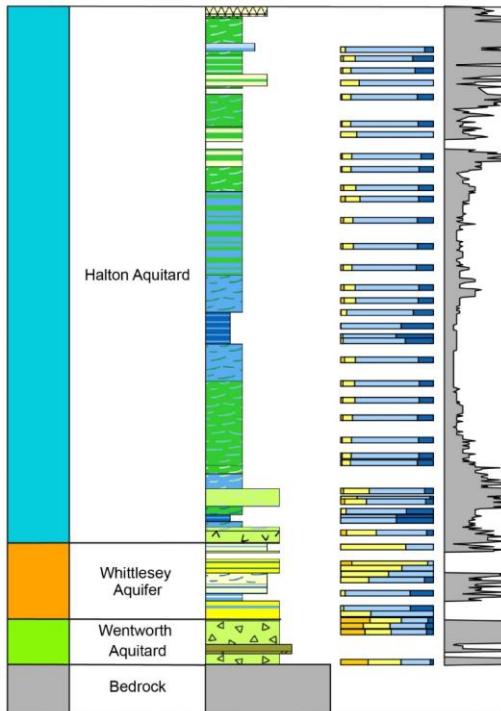
Water-bearing

Soft

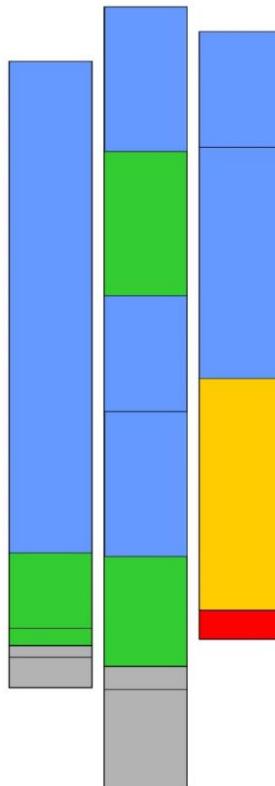
Current Term	Replace with.....	
	Mat1	Mat2
Sand	Sand	
Sandy	***	Sand
Sandy	Sand	***
Coarse sand	Sand	Coarse-grained
Medium sand	Sand	Medium-grained
Fine sand	Sand	Fine-grained
Quicksand	Sand	Soft
Quicksand	Sand	Water-bearing

Meaningless Terms?

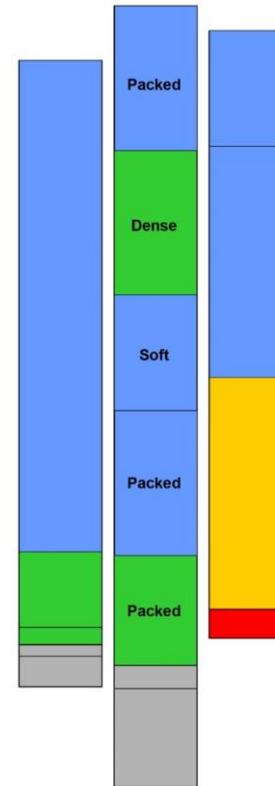
Continuously Cored Borehole
Drilled for 3-D Sediment Mapping Project



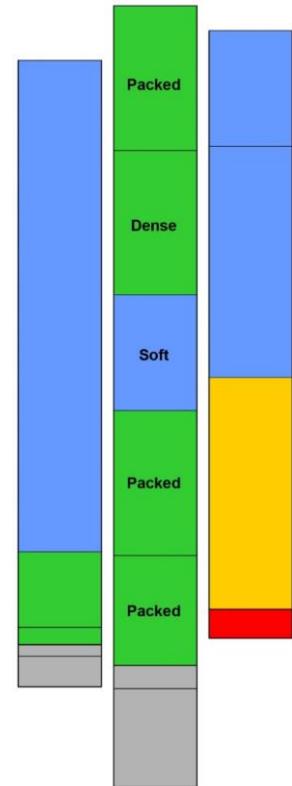
Water Well Records



Water Well Records



Water Well Records



Sticky crap?

Common Usage - Clay

Particles that are 0.002 mm and smaller

Grey and shiny when wet, impermeable so very bad to have below your home foundation, or in a driveway - because it doesn't allow drainage!

Finest fractions resulting from natural weathering of rocks and that retain sufficient moisture to be plastic

Minerals including kaolinite, illite, chlorite, vermiculite, talc and montomorillonite

Think particle shape and micron size has something to do with it

Sediment that is 30% or more clay-sized particles

Tiny particles we define using our teeth or trying to squeeze into a ribbon with our fingers...but more precisely with lasers in the lab

Percentage of clay portion in a soil - more than 35% passing the 63 micron sieve, but also based on its engineering behavior and if it exhibits cohesion

Zero clue

You mean gumbo?

Particles that are 0.004 mm and smaller

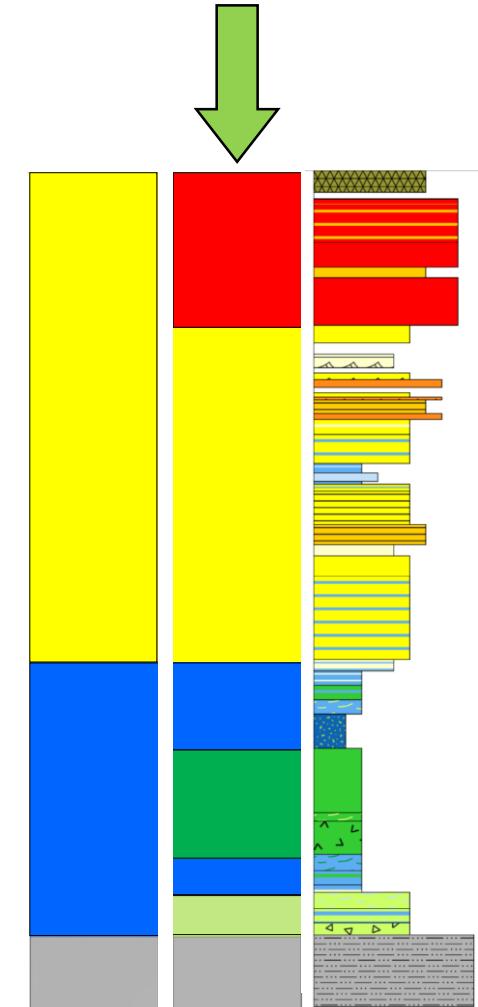
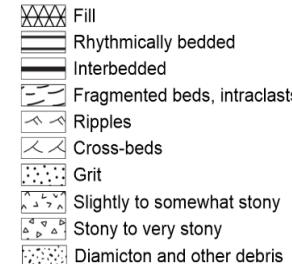
As in that heavy, wet sticky stuff that you can't build easily on? Guess it adds minerals to your soil though.

Properties of the grains have specific characteristics that help make them create an effective aquitard

Particles that are 0.005 mm and smaller

Compromise!

- What we want vs what we can reasonably expect to get
- What others want (other geologists, hydrogeologists, engineers, environmental scientists, well technicians, drillers)
- Abigail, detailed logs belong in a survey database, not on a water well record



Questions?

Abigail Burt (OGS) - Project Lead

Riley Mulligan (OGS)

Frank Brunton (OGS)

Kei Yeung (OGS)

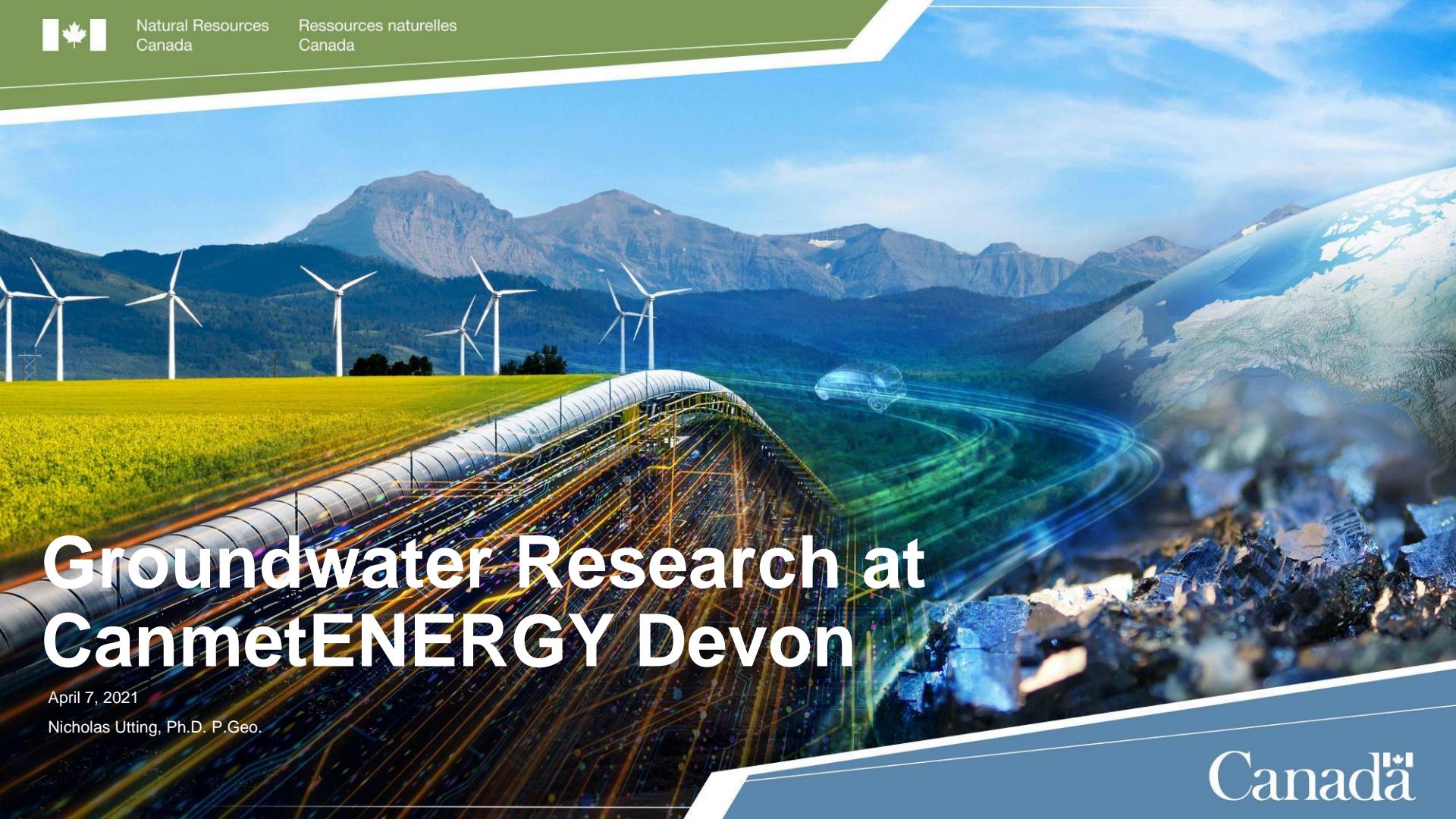
Natalie Spina (MECP)

Tim Cheng (MECP)



Natural Resources
Canada

Ressources naturelles
Canada



Groundwater Research at CanmetENERGY Devon

April 7, 2021

Nicholas Utting, Ph.D. P.Geo.

Canada

CanmetENERGY in Devon

- NRCan research lab in Devon, Alberta
- Part of Strategic Petroleum Policy and Investment Office (SPPIO)
- Research relates to upstream and downstream sectors of oil and gas, and other energy streams (e.g. renewables)
- Lab employs ~80 researchers and technologists



Upstream and Environment (U&E) Team Key Research Areas



Extractive Technologies

Surface Mining: Ore and Froth Treatment, Non-Aqueous Extraction
In Situ: SAGD, solvents, foams



Tailings Research

Dewatering: Geomechanical, geochemical
Tailings Ponds: OSPW, near-long term Impacts, treatment



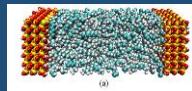
Geoscience

Geochemistry: Noble gases, contaminant transport
Resource Development: Orphan wells, fracking, geothermal



Oil Spill Science

Oil Spill Science: Dilbit and conventional crude onto/into water
Spill Response Support: Oil migration behaviour, technology testing
Fate and Effects: Toxicology and long-term behaviour of oils



Modelling and Simulation

Physical process simulation: Multiphase flow in porous media
Machine Learning / AI: Multiple processes, data interpretation



Emerging Technologies

Energy Storage: Renewable energy storage
Critical Minerals: Lithium extraction from brines

IoT Sensors



Groundwater Related Research

Big Picture: Research focuses on potential water quality impacts of oil and gas exploration, development and transportation.

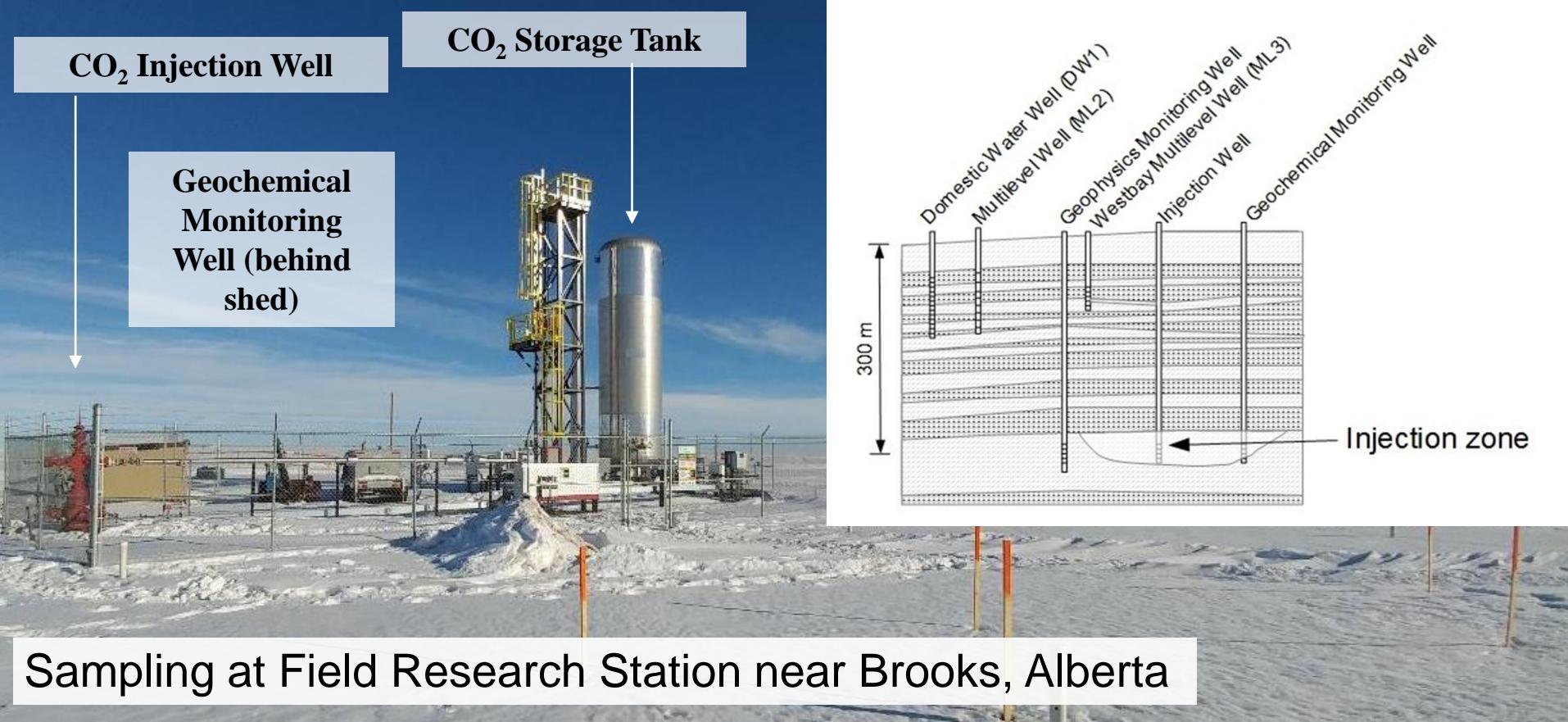
- Hydraulic fracturing
- Subsurface gas migration
- Oil spills
- Contamination at orphan and abandoned well sites
- Leaching from oil sands tailings



Noble gases as a tracer of subsurface gas migration

- **Lead:** Dr. Nicholas Utting
- **Collaborations:** CMC Research Institutes, U. Calgary, U. Edinburgh, Ohio State University
- Continuation of previous Program of Energy Research and Development (PERD) project
- **Goal:** Further develop use of noble gases as a tracer of subsurface gas migration
- **Methods:** Sampling water wells and surface casing vents; samples collected for noble gases and reactive gases; field gas analysis
- **Interesting observations:** Have observed changes in surface casing vent flows over time





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Behaviour of Diluted Bitumen Spills to Groundwater

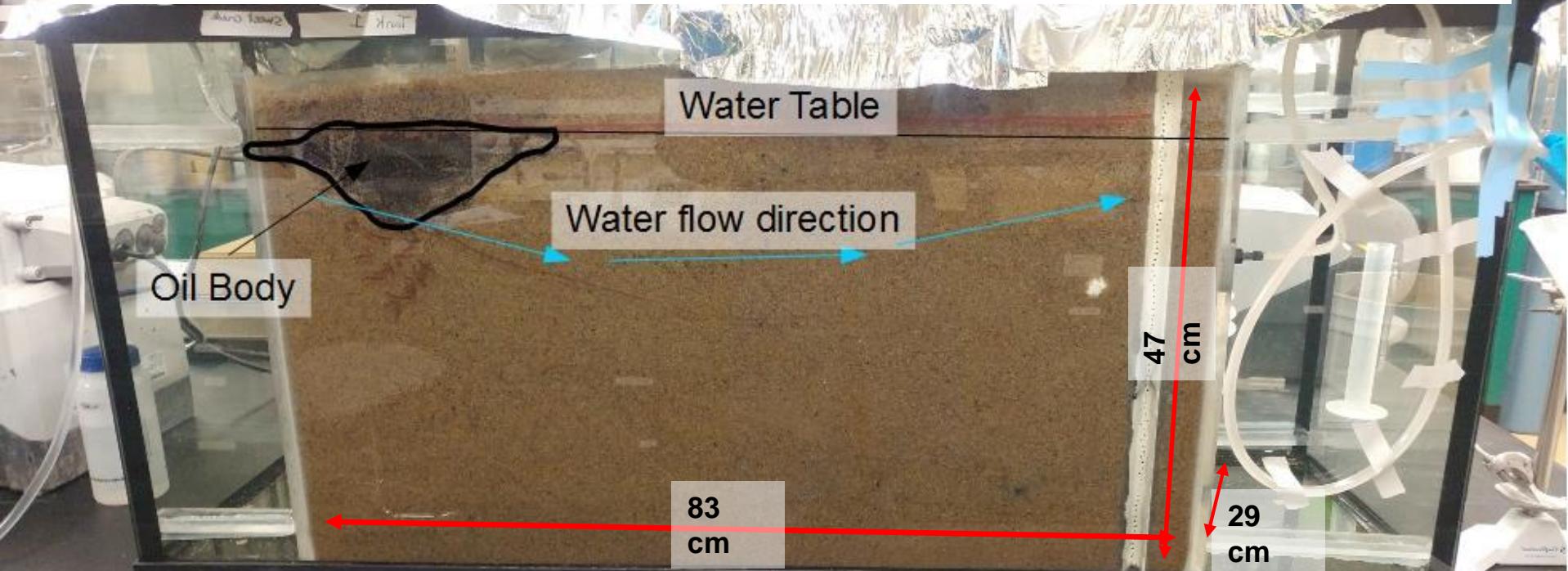
- **Lead:** Dr. Nicholas Utting
- **Collaboration:** GSC Quebec Dr. Jason Ahad
- **Goal:** Improve the understanding of a spill of diluted bitumen compared with a spill of conventional crude
- **Methods:** Simulated groundwater spill in lab spill tanks
- **Interesting observations:** Concentrations of ethylbenzene, toluene, xylenes lower in diluted bitumen experiments than conventional crude experiments



Trans Mountain Expansion Project



Methods: Groundwater simulation tank



Contamination at Orphan and Abandoned Wells

- **Lead:** Dr. Nicholas Utting
- **Collaboration:** U. Alberta Dr. Dan Alessi and M.Sc. candidate Carmen Ricard
- **Goal:** Study potential for migration of organic contaminants from oil and gas sumps
- **Methods:** Field sampling of sumps, plan to conduct lab based leaching experiments
- **Interesting observations:** Sumps dating from the 1960s still have hydrocarbon contamination

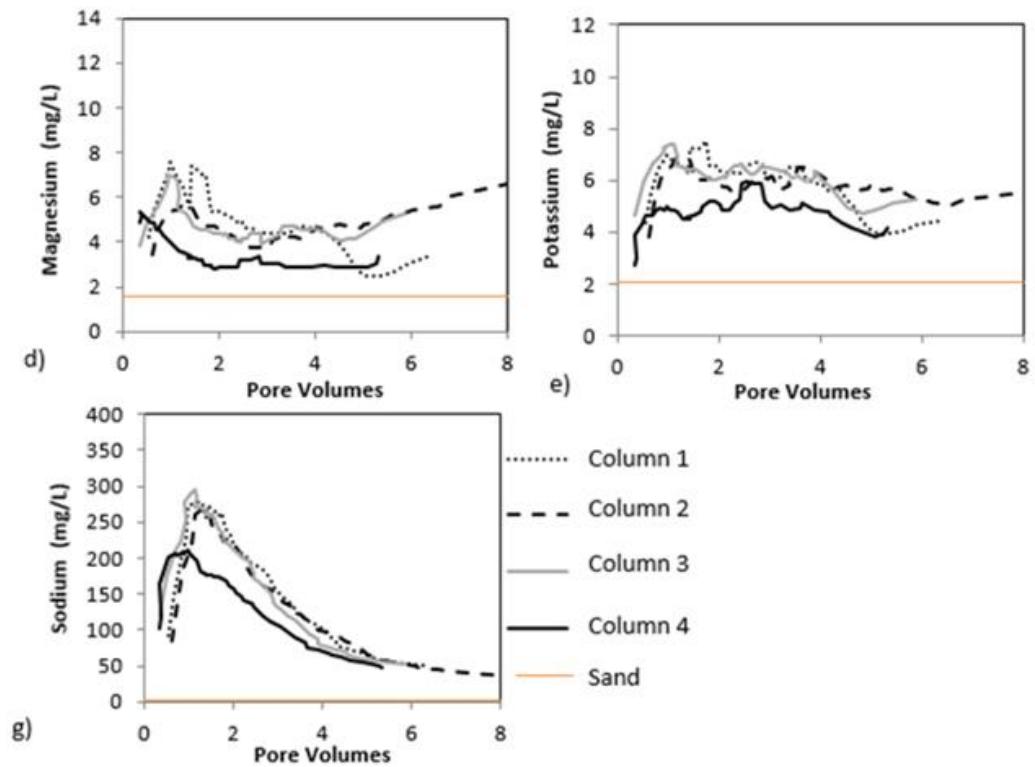




Leaching from oil sands tailings

- **Lead:** Dr. Nicholas Utting
- **Goal:** Improve the understanding of the chemistry of water that may leach from oil sands tailings
- **Methods:** Static leaching tests and long term column leaching tests
- **Interesting observations:** Concentrations of some ions increase later in the experiments





Leaching of different ions occurs at different rates

Characterization of Hydraulic Fracking Flowback and Produced Water

- **Lead:** Dr. Xiaomeng Wang
- **Collaboration:** GSC Calgary Dr. Dennis Jiang
- Continuation of previous PERD project
- **Goal:** Understand chemistry of flowback and produced water chemistry over time, evaluate effect of operational conditions on flowback chemistry, and transport mechanisms should a fluid spill happen near surface.
- **Methods:** Chemical and isotopic analysis of some flowback and produced waters, autoclave experiments



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Thank you!

Next meeting June 2, 2021

Merci!

Prochaine rencontre le 2 juin 2021

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