

# Urgent need to avert threat of drinking water disaster in Bruce-Grey's Karst regions

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Drinking Water Assessment Report, Grey  
Sauble, Saugeen Valley, NBP

# Overview

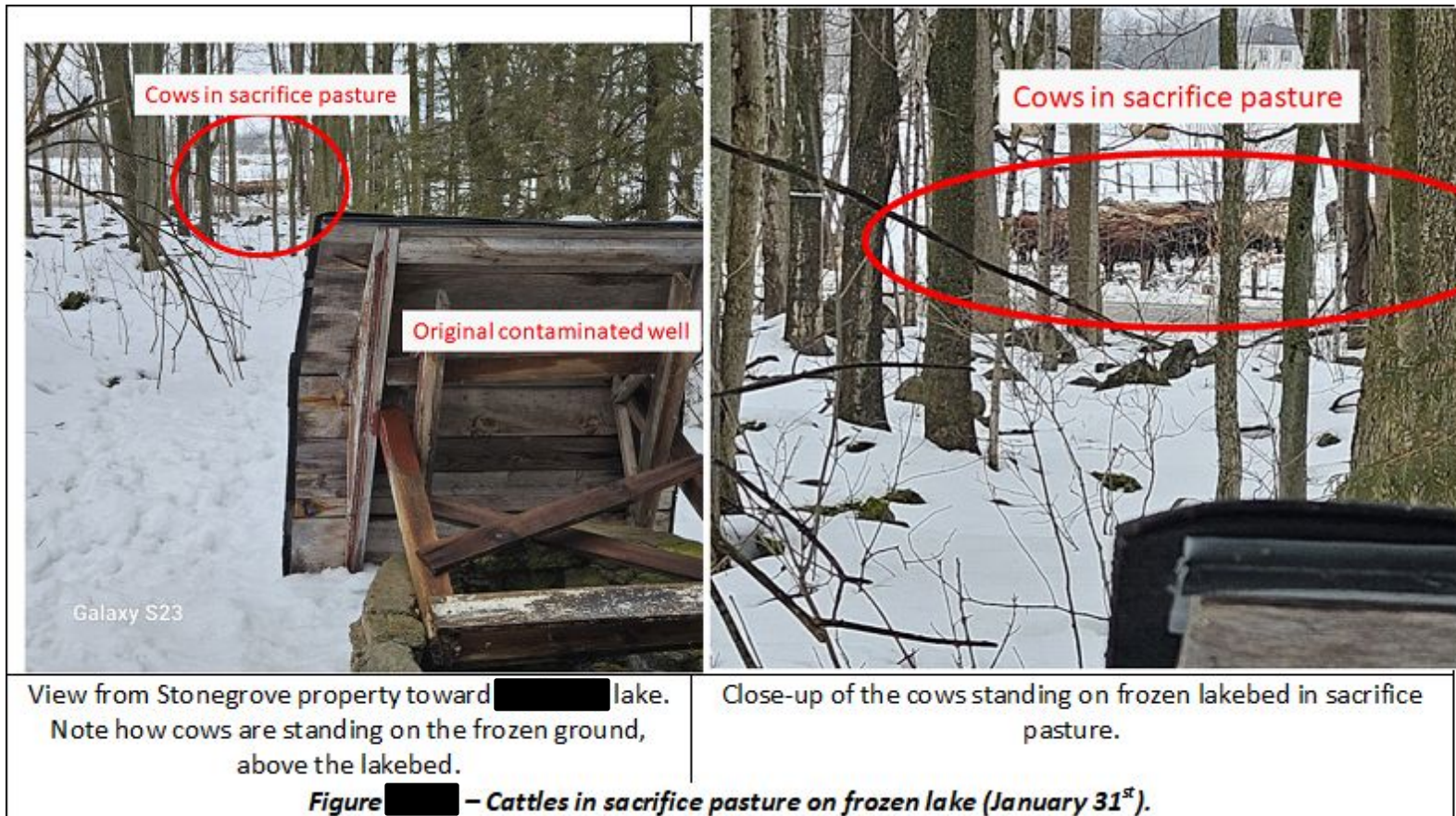
- 1. Inspiration:**  
**Contamination of a cluster of wells**
- 2. Bruce-Grey:**  
**Confluence of three risk factors**
- 3. Precedent case Door Peninsula, Wisconsin**
- 4. Potential policy responses**

# Manure straight out of the well...



Galaxy S23

# Contamination of private well in Karst









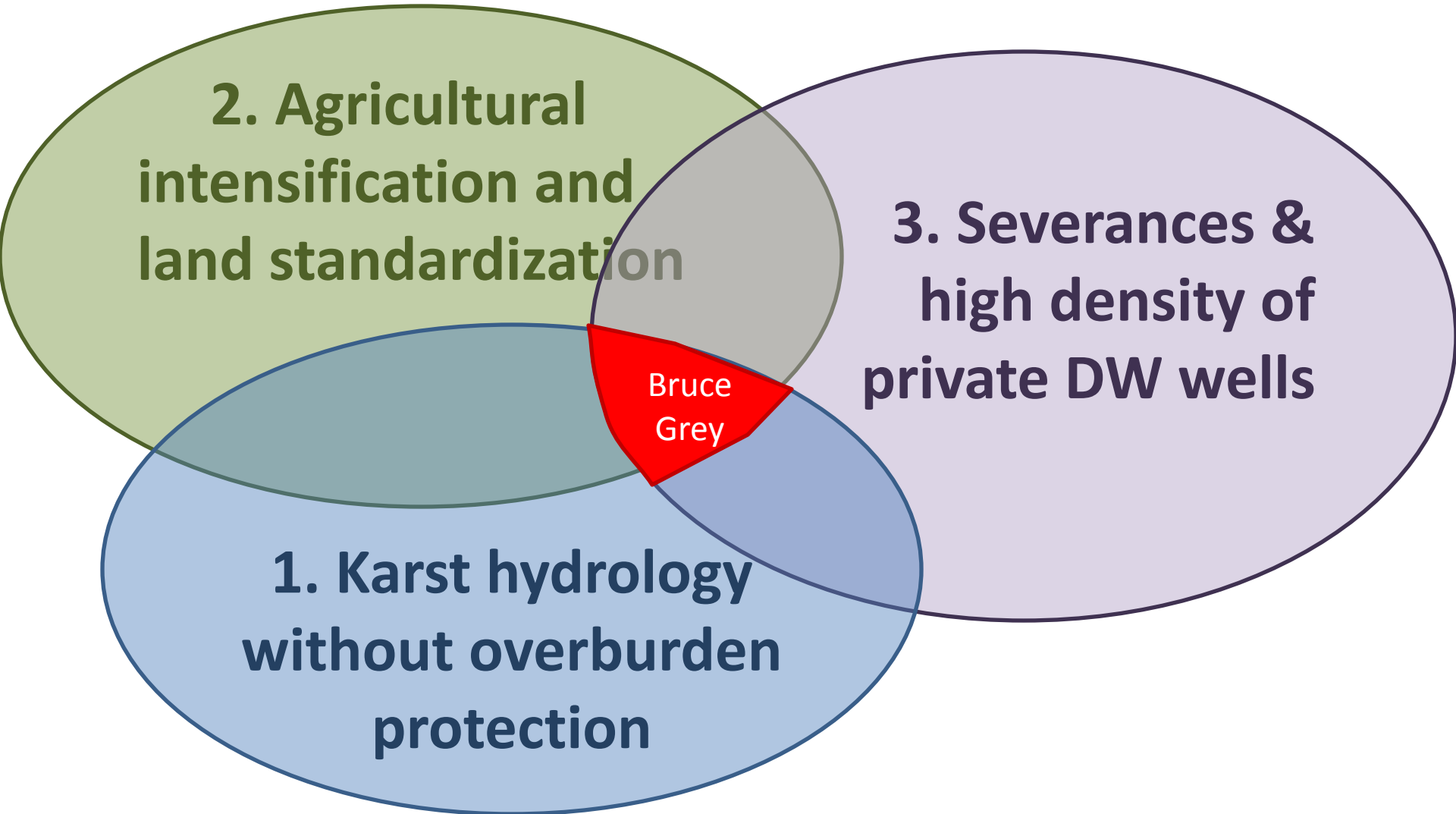
# The “normal” solution:

- 1) fill in any ground depression.
- 2) Plant corn.

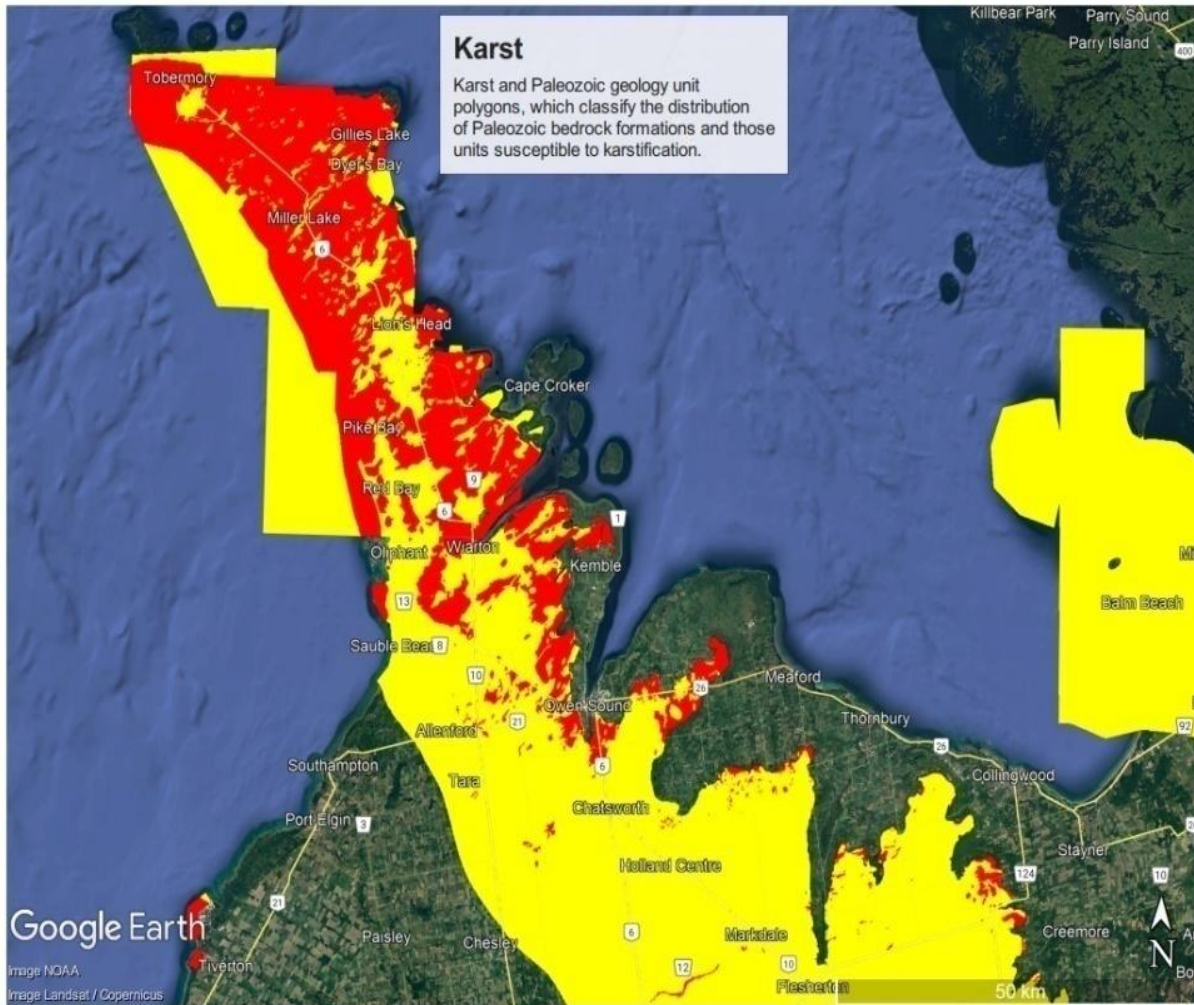


All's well that ends well ?!?

# Confluence of three risk factors

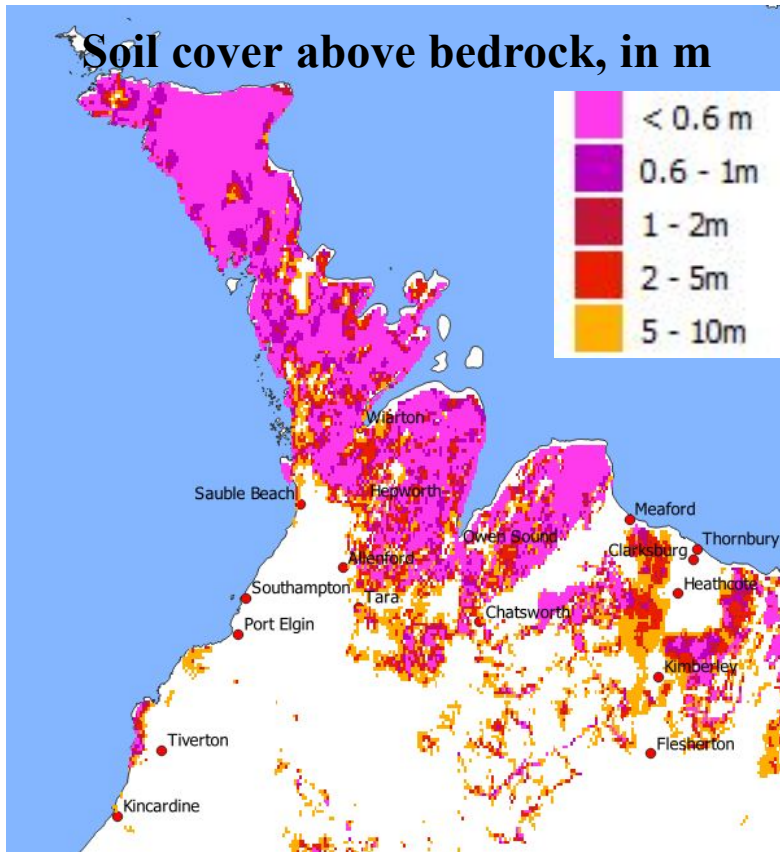


# Risk Factor 1: Surfacing karst





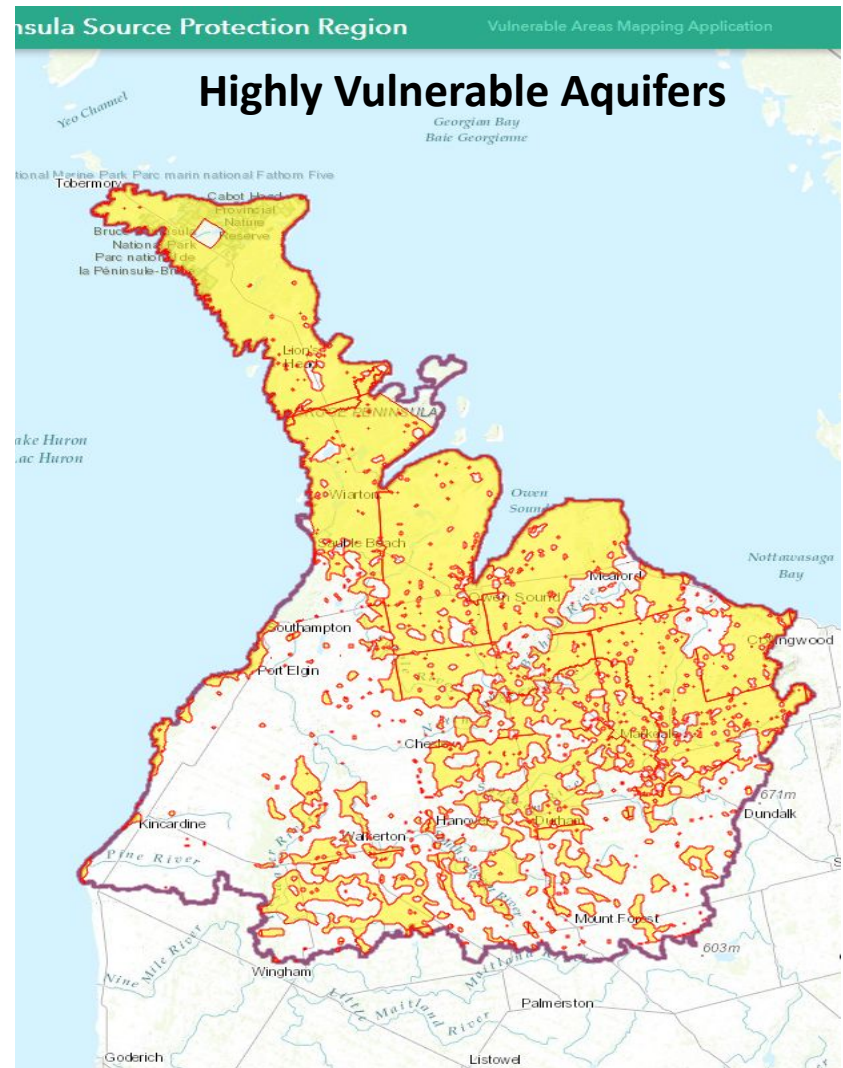
# Risk Factor 1: No overburden protection



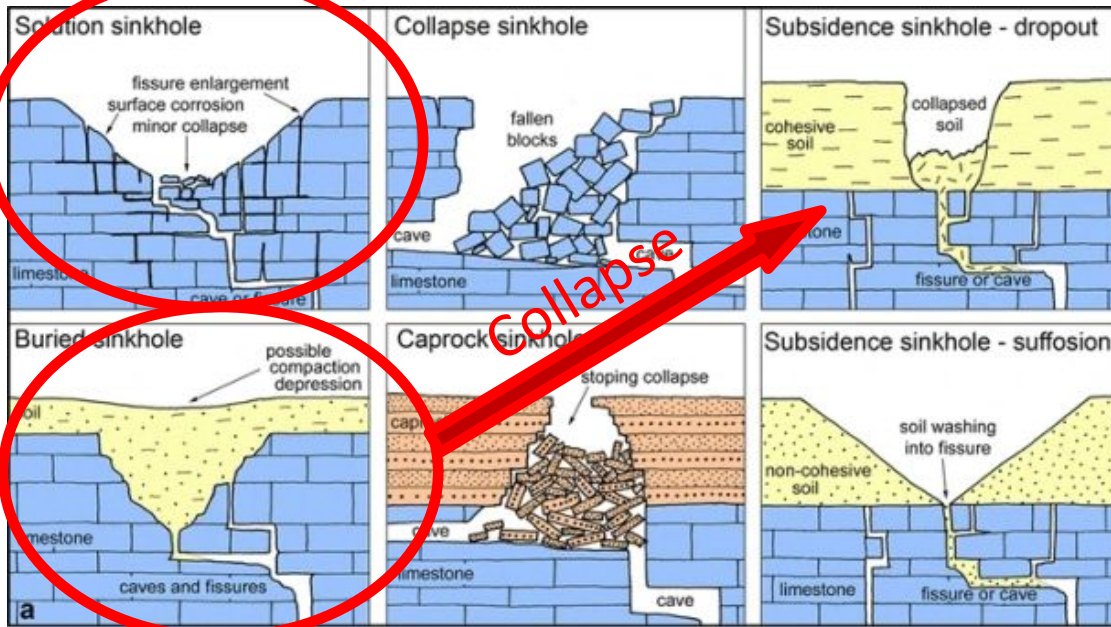
The thinness of aquifer protection with soil (“overburden” or “drift”) in metres.

Data source: Bedrock & Overburden, MNR

Data generation method: Difference of DEM and Bedrock

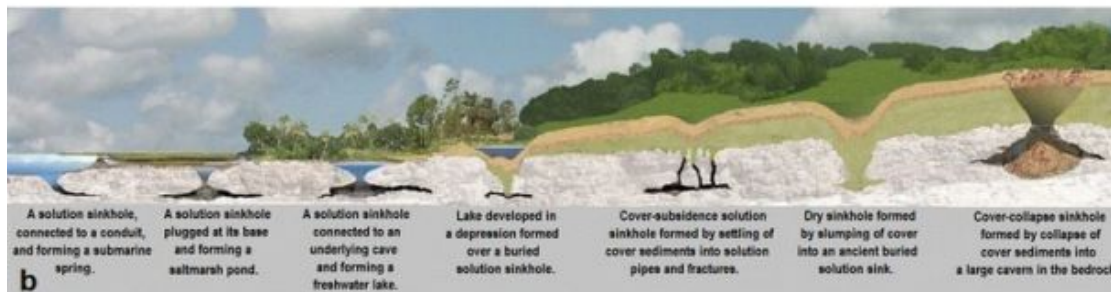


# Risk Factor 1: Karst features - Sinkholes



Filled in

Collapse





## Risk Factor 2:

# Industrialization of Agriculture From pasture-based beef to cornfed feedlots

Jackson - 2005

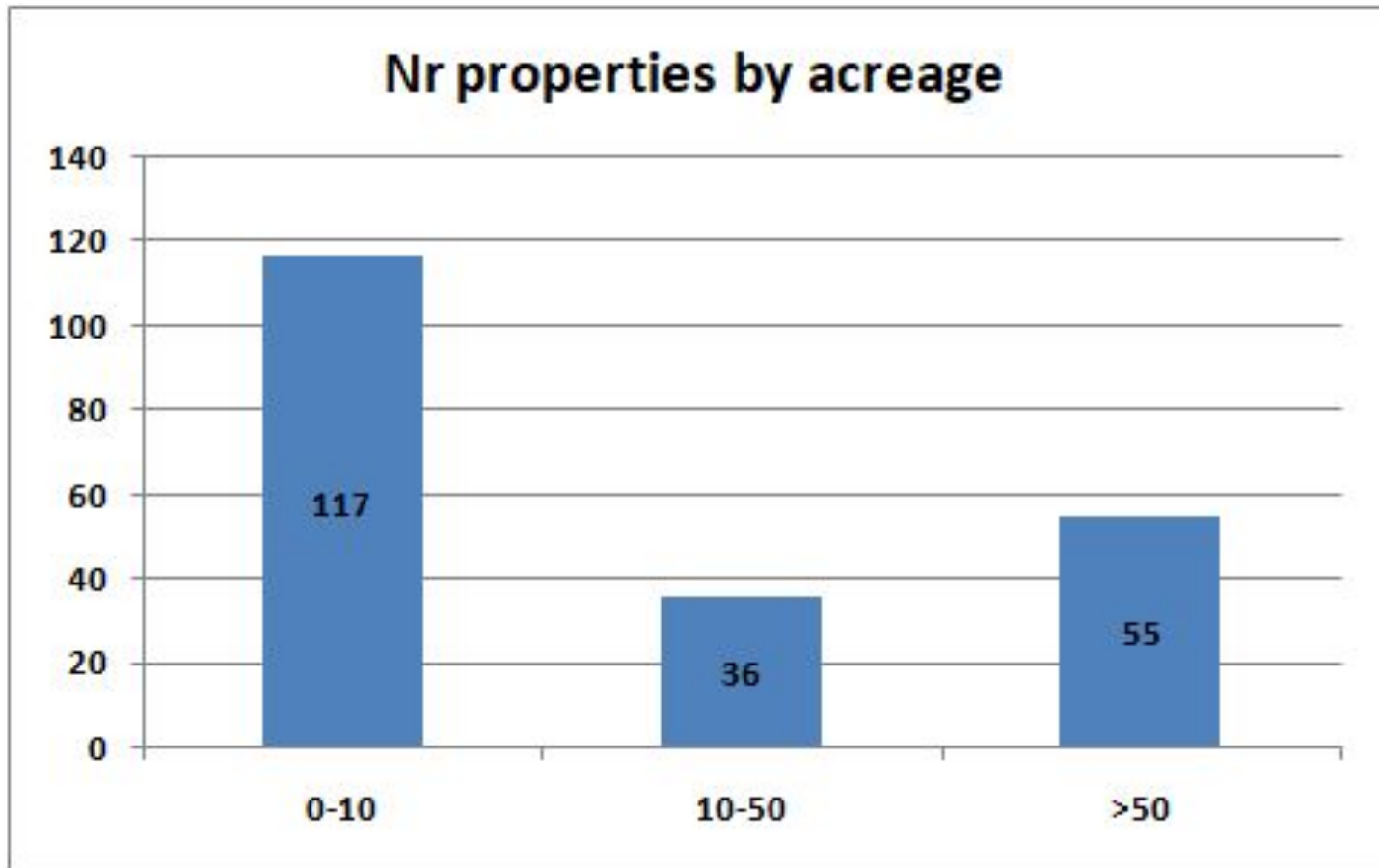
Jackson - 2021





# Risk Factor 3:

## Mixed residential-agricultural landscape



# Confluence of three risk factors

What could possibly go wrong?

1. Karst geology & aquifers
2. Agricultural intensification
3. Mixed residential-agricultural landuse

Downtown Kemble:  
Drainage ditch exposes bedrock;  
Cash cropping soils bare >6 months  
Regular manure application

Precedent case:

**DOOR PENINSULA, WISCONSIN**



# Kewaunee County & Door Peninsula



*Map of the Niagara Escarpment,  
PC: Qviri, CC-BY-SA 3.0, via Wikimedia Commons*



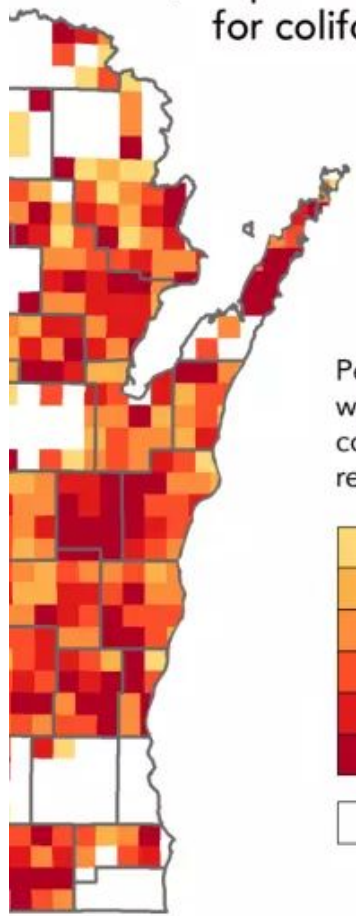
*Fracture traces in the limestone bedrock leave visible traces through the shallow overburden*



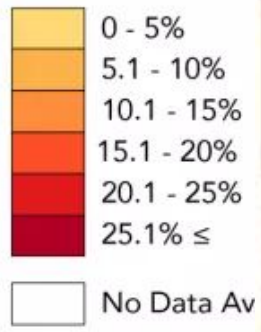


# water wells around Wisconsin

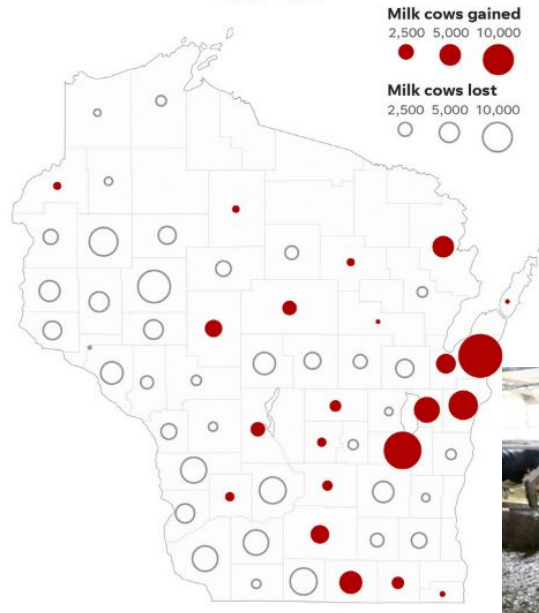
ria are dangerous, but  
 he presence of viruse  
 ogens. While municipi  
 eria, private wells are  
 ly of nearly 4,000 priv  
 wells, 18 percent  
 for colifor



Percentage of drinking water wells that tested positive for coliform bacteria. Each square represents one township.



Change in milk cows,  
 2001-2019



# Kewaunee – Research

## Two research studies by USDA

1. Borchardt MA et al.  
**Sources and risk factors for nitrate and microbial contamination of private household wells in the fractured dolomite aquifer of northeastern Wisconsin.**  
Environmental Health Perspectives. 2021 Jun 23;129(6):067004.
2. Burch TR et al.  
**Quantitative microbial health risk assessment for contaminated private wells in the fractured dolomite aquifer of Kewaunee County, Wisconsin.**  
Environmental health perspectives. 2021 Jun 23;129(6):067003.



# Kewaunee – Research results (1)

## **Sources of contamination**

- **Pathogens: point sources**

- Barnyards & manure runoff near sinkholes
- Leakage from manure storage and silage storage

- **Nitrates: diffuse sources**

- Manure application on bare soil with shallow overburden
- Leakage from manure storage and silage storage

**Septic systems comparatively irrelevant.**

# Kewaunee – Research results (2)

## Main health risk identified:

- gastro-intestinal illnesses primarily linked to manure runoff from nearby farms.

## Broader Health risks:

- **Gastrointestinal Illnesses** incl. diarrhea, vomiting, and stomach cramps.
- **Acute Infections** incl. fever, nausea, and dehydration. In severe cases, these infections can be life-threatening.
- **Chronic Diseases:** , for example, high levels of nitrates are linked to methemoglobinemia, or "blue baby syndrome".
- **Neurological symptoms and disorders**, incl. Alzheimers.
- **Cancer:** increase the risk of cancer.

# Kewaunee County's Policy Response

- **Public Health & Groundwater Protection Ordinance:**
  1. Appropriate land use and management practices, specifically targeting geographically vulnerable areas like those with Karst geology.
  2. Monitoring and early warning systems.
  3. Support of citizens with well issues
- **Agricultural Restrictions:**

Control the spread of manure in sensitive areas, aiming to reduce the runoff that contributes to groundwater contamination.

  - Silurian Bedrock Agricultural Performance Standard
  - Kewaunee County's Ordinance Chapter 39
- **Legislation regulates Stronger Permit Requirements:**

for new CAFOs (Concentrated Animal Feeding Operations).
- **Education Initiatives:**

such as the Peninsula Pride Farmers, collaborations with local school districts, public health, etc.



# Silurian Bedrock Agricultural Performance Standard NR 151.075

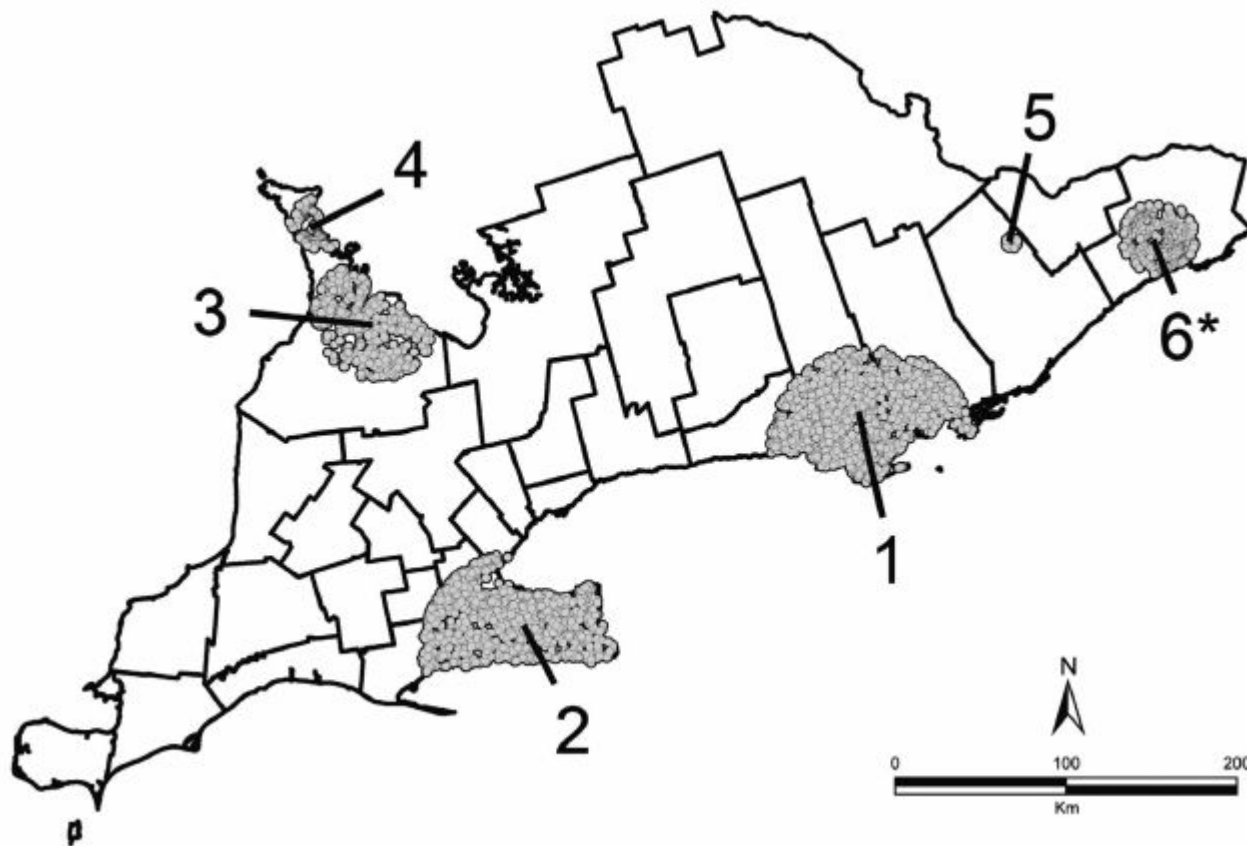
- **Mandatory Bedrock Verification**  
Farmers must verify the depth to bedrock using the best available data before applying manure (*Information gathering*)
- **Manure and silage storage** - Additional requirements
- **Restrictions of Manure Application in Critical Areas**
  - ***Diffuse pollution: Strict prohibition***  
Mechanical manure application in fields where depth to bedrock is <24"
  - ***Point pollution: Horizontal Setbacks***  
near features like sinkholes, closed depressions, and areas where the depth to bedrock or the apparent water table is shallow
  - ***Point and diffuse pollution: Restrictions on Sloped Fields***  
on fields with a slope of >6%, especially those with concentrated channels that drain directly to a closed depression.

# Kewaunee – Two supreme court cases Community vs. Dairy lobby



**BACK AT HOME, IN BRUCE-GREY ....**

# Bruce-Grey Drinking Water under Threat



Dr. Anna Majura's Public Health study (2008-2012 data):  
**Hotspots for water contamination and health risks**

<https://www.publichealthontario.ca/en/About/News/2017/RIA-Private-Well-Water>



# Bruce-Grey Drinking Water under Threat

**My informed opinion:**

**If the current trend continues,**

- **Widespread water contamination not a question of IF, only a question of WHEN.**

- **Community action will happen.**  
Either *before* a water disaster or *afterwards*!

# Bruce-Grey Drinking Water under Threat



## At risk:

- Economic costs for region's tourism industry,
- Rural values of properties
- Reputation as retirement haven!
- Government agencies in the Walkerton region... negligent AGAIN?

Will agencies act “**proactively, swiftly, transparently, and responsibly**”, as Justice O'Connor recommended?

# Potential policy response in Bruce-Grey

## Recommended strategy:

- a) **Explicitly recognize that**
  - “Confluence threat” puts at risk the lives and property values of thousand of rural homeowners.
  - Private wells are private responsibility, but the groundwater itself is public responsibility
- b) **Act immediately**, within current policy framework.
- c) **Coordinate with Grey County. Your groundwater comes from there.**
- d) **Work toward better Provincial regulations** around Karst & mixed landuse.

## Immediately possible policy actions:

1. **Form a working group on rural water quality**
2. **Monitor aquifer nitrates** in mixed landuse areas
3. **Implement broad education campaign**
  - Inform about Karst and extremely-vulnerable aquifers, incl. new homeowners and farmers
  - Provide information through realtors
  - Require bedrock assessment when farm ownership changes
4. **Recommend Wisconsin’s Silurian Bedrock Agricultural Performance Standard**
5. **Restrict agricultural uses** near residential housing clusters with highly vulnerable aquifers through bylaws

Thank you for your time  
and attention!

**Thorsten Arnold, PhD**

**More on my homepage:**

**[www.ThorstenArnold.com/category/karst](http://www.ThorstenArnold.com/category/karst)**  
**[contact@thorstenarnold.com](mailto:contact@thorstenarnold.com)**