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A path toward aquifer management through the empowerment of water stakeholders

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CANADA 1842 GEOLOGICAL SURVEY - COMMISSION GÉOLOGIQUE

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Content

- Water stakeholders and their roles
- Sustainable groundwater management
- Quebec's aquifer assessment program (PACES)
- Communication tools on groundwater resources :
  - Hydrogeological conceptual models
  - Sustainable development indicator maps
- Academic (RQES) information transfer workshops
- Towards regional groundwater management

Water Stakeholders - Government

- **Environment ministry (MDDELCC)**
  - Groundwater is under provincial jurisdiction
  - Responsible for potable water quality
  - Aquifer assessment program
  - Groundwater monitoring network
  - Source water protection
  - Regulations and permitting

Water Stakeholders - Universities

- **Inter-university research group (GRIES)**
  - Produced knowledge through PACES projects
  - Scientific and technical exchanges
  - Standards (maps, data bases, reports…)
- **Network with water stakeholders (RQES)**
  - Outreach to water stakeholders
  - Groundwater information transfer workshops

Water Stakeholders – Local & Regional

- **Watershed organizations (OBV):**
  - Governance on water resources
- **Regional municipalities (MRC):**
  - Land-use planning
- **Municipalities:**
  - Water supply and its protections; permitting
- **Users:** farmers, industries, private well owners, etc.
- **Professionals:** local studies and infrastructures

Objectives of Water Management

Water management must ensure:

- adequate supply — **Quantity**
- of good quality water to the population — **Quality**
- while preserving ecosystems, — **Ecosystems**
- by adapting human activities — **Governance**
- within the limits of nature — **Sustainability**

Adapter after UN Conference on Environment and Development Rio de Janeiro, Brazil, 1992

What Prevents Management?

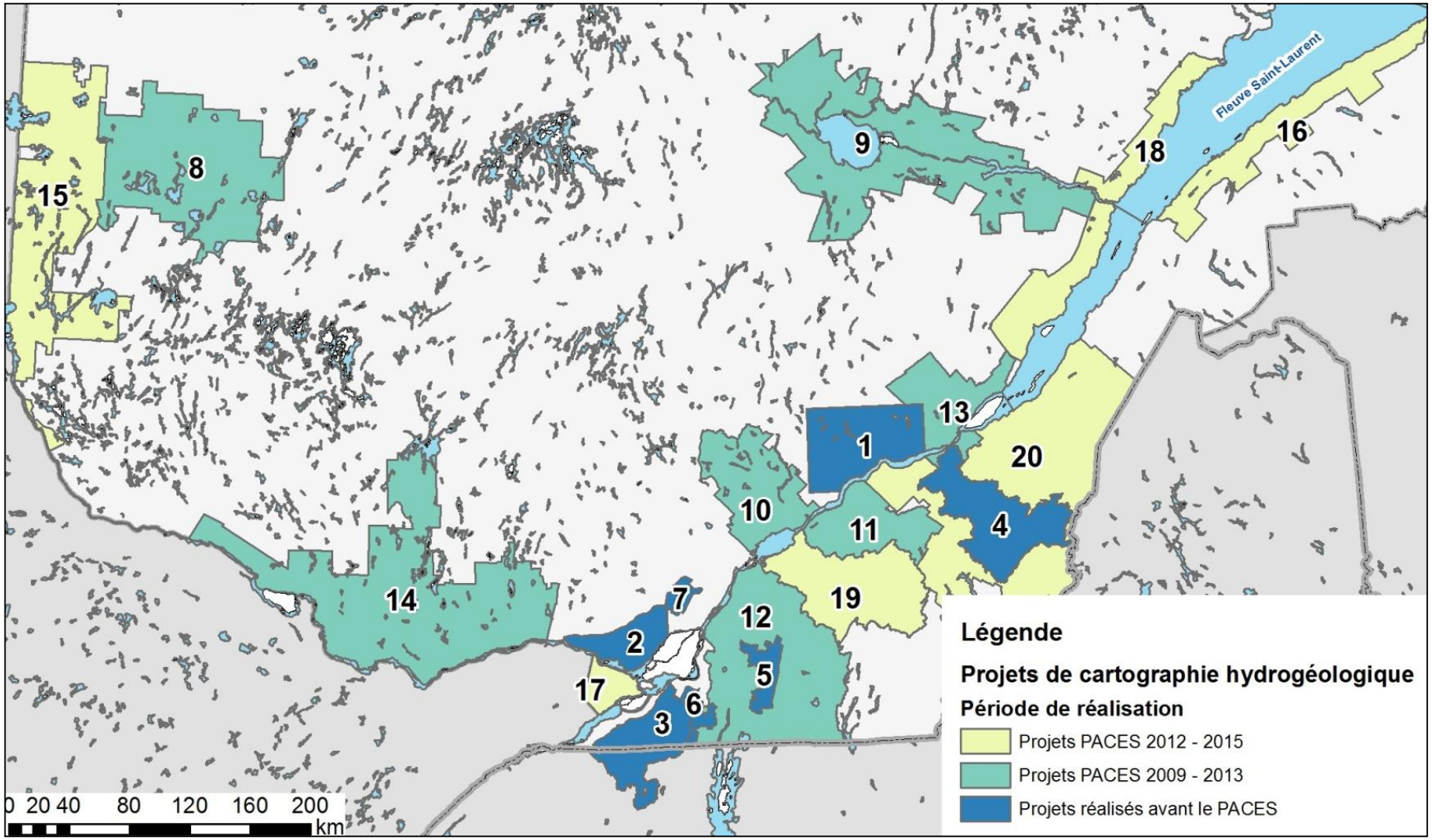
- Lack of resources (people, $)
- Lack of data
- Lack of management

Role of aquifer assessment programs

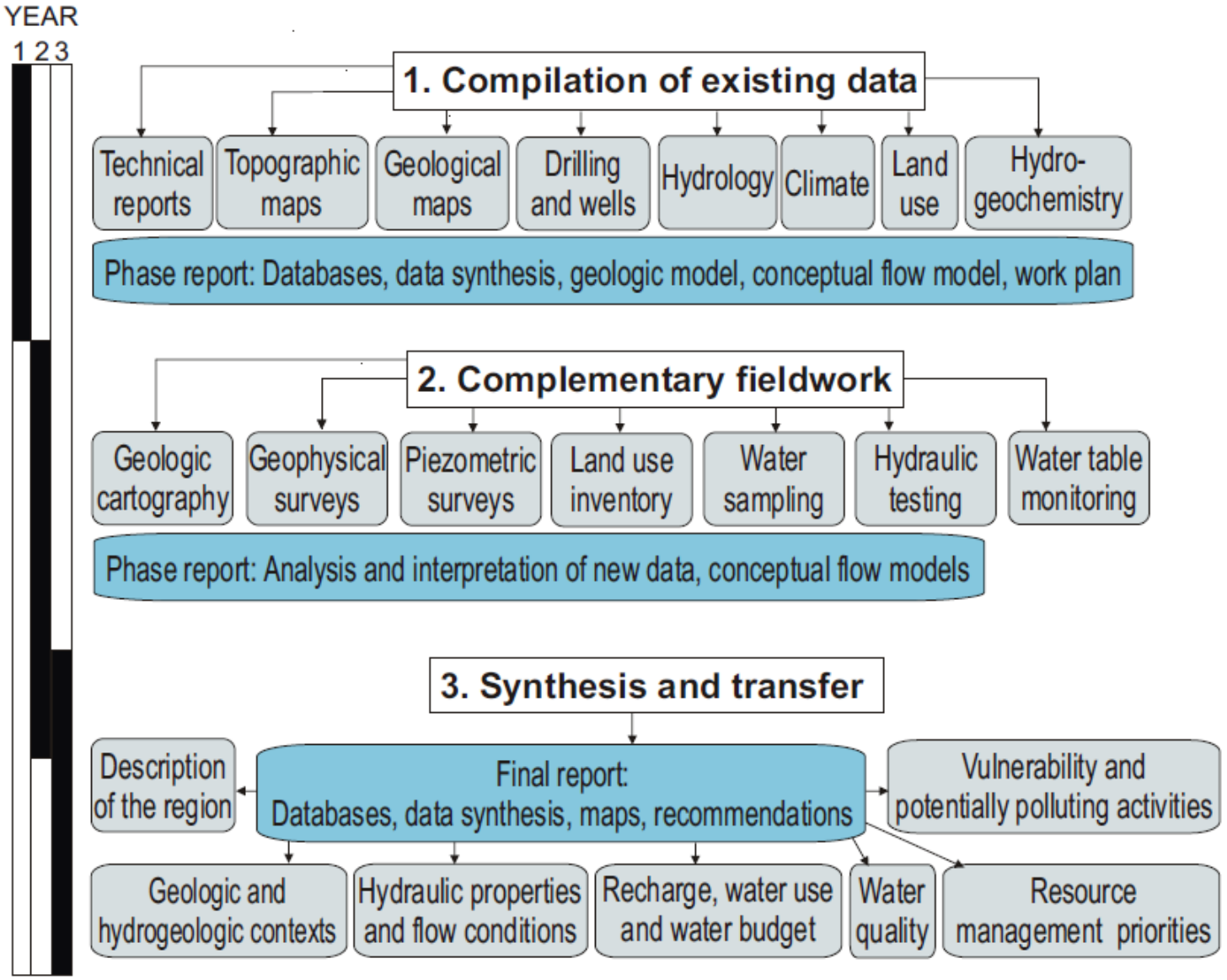
Morris et al. 2003 – UN Environment Programme

Regional Aquifer Assessment in Quebec

PACES aims to support informed GW management



PACES Projects Phases and Timeline

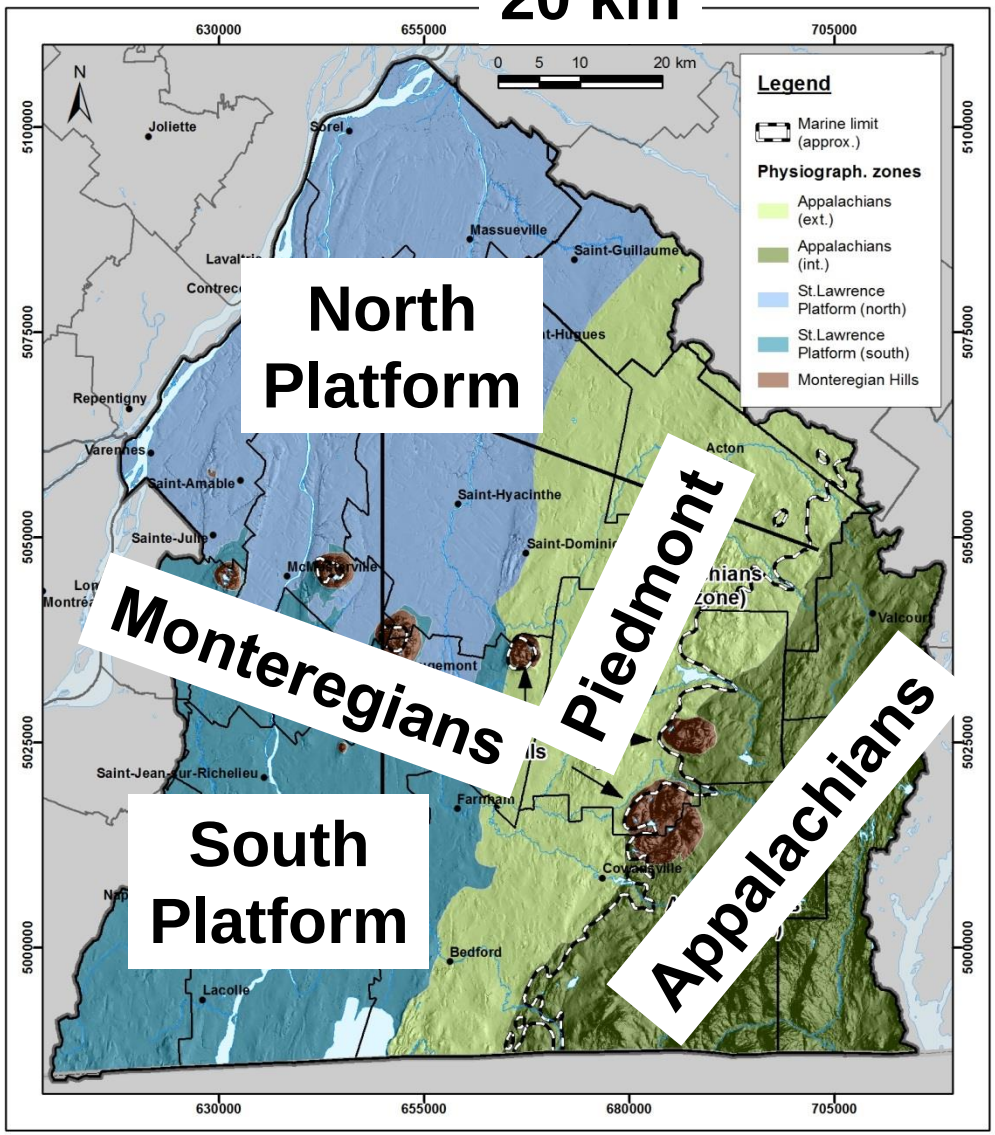


Information Transfer is Key to Management

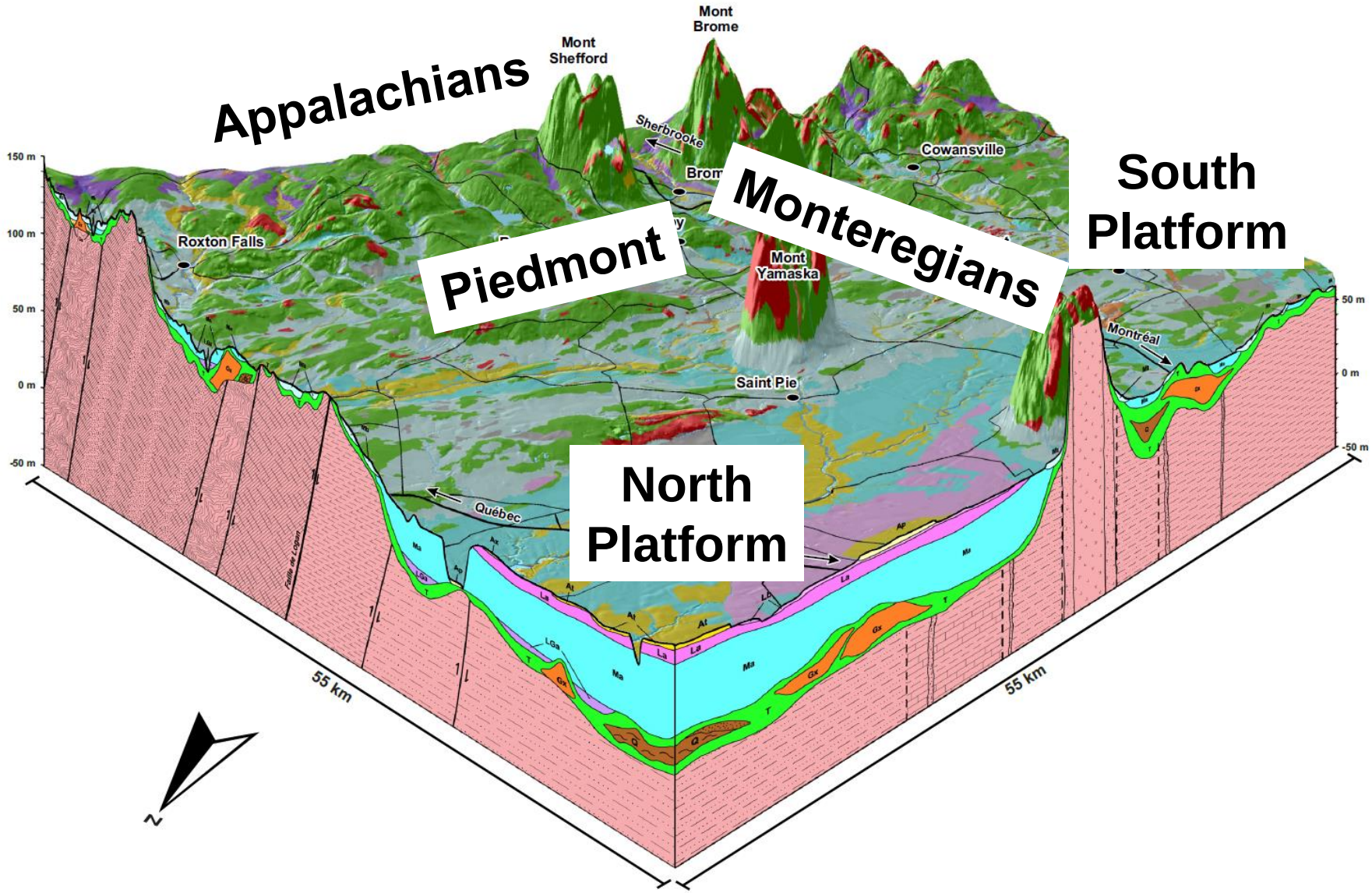
- Information (not only data) transfer to regional stakeholders is needed to ensure management
- The form of information has to allow the empowerment of stakeholders (they can understand and use the information)
- Hydrogeological maps and data have to be "translated" to allow transfer to stakeholders
- The form of the information transferred has to allow the identification of key issues and priority areas where to take actions

Montérégie Est Region – Models & Indicators

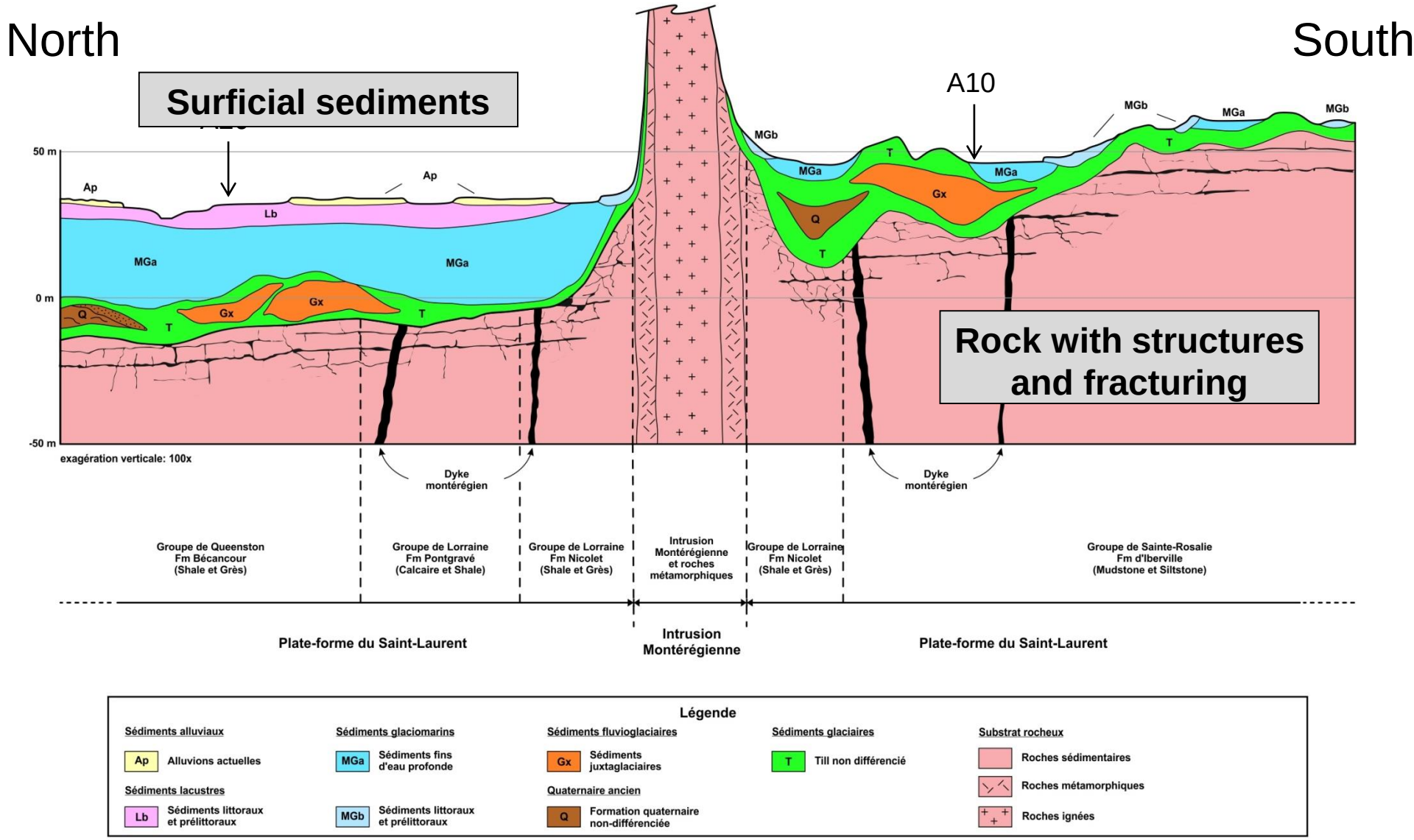
9000 km² study area



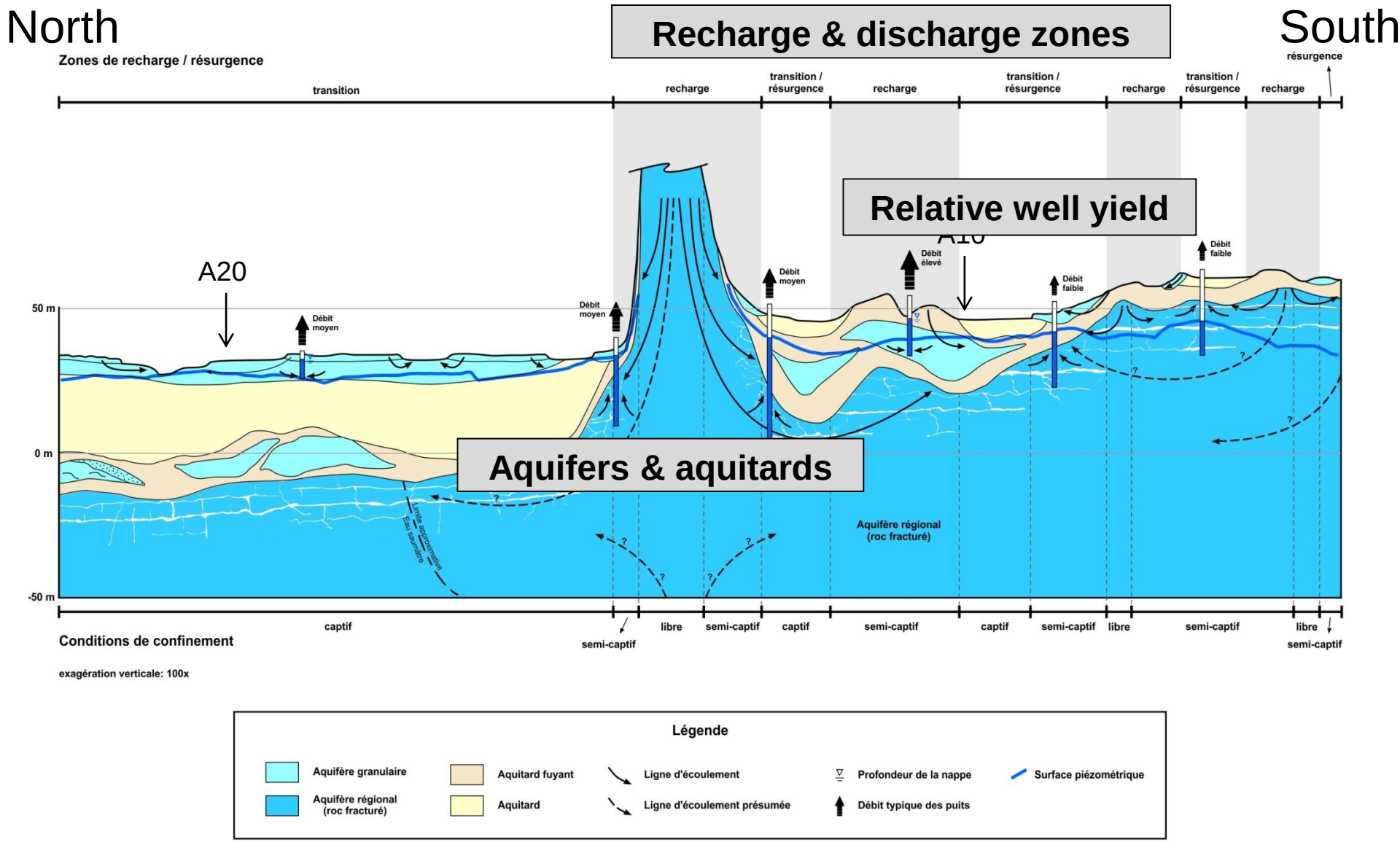
Montérégie Est Conceptual Models



Conceptual Model - Geology



Conceptual Model – Groundwater Quantity

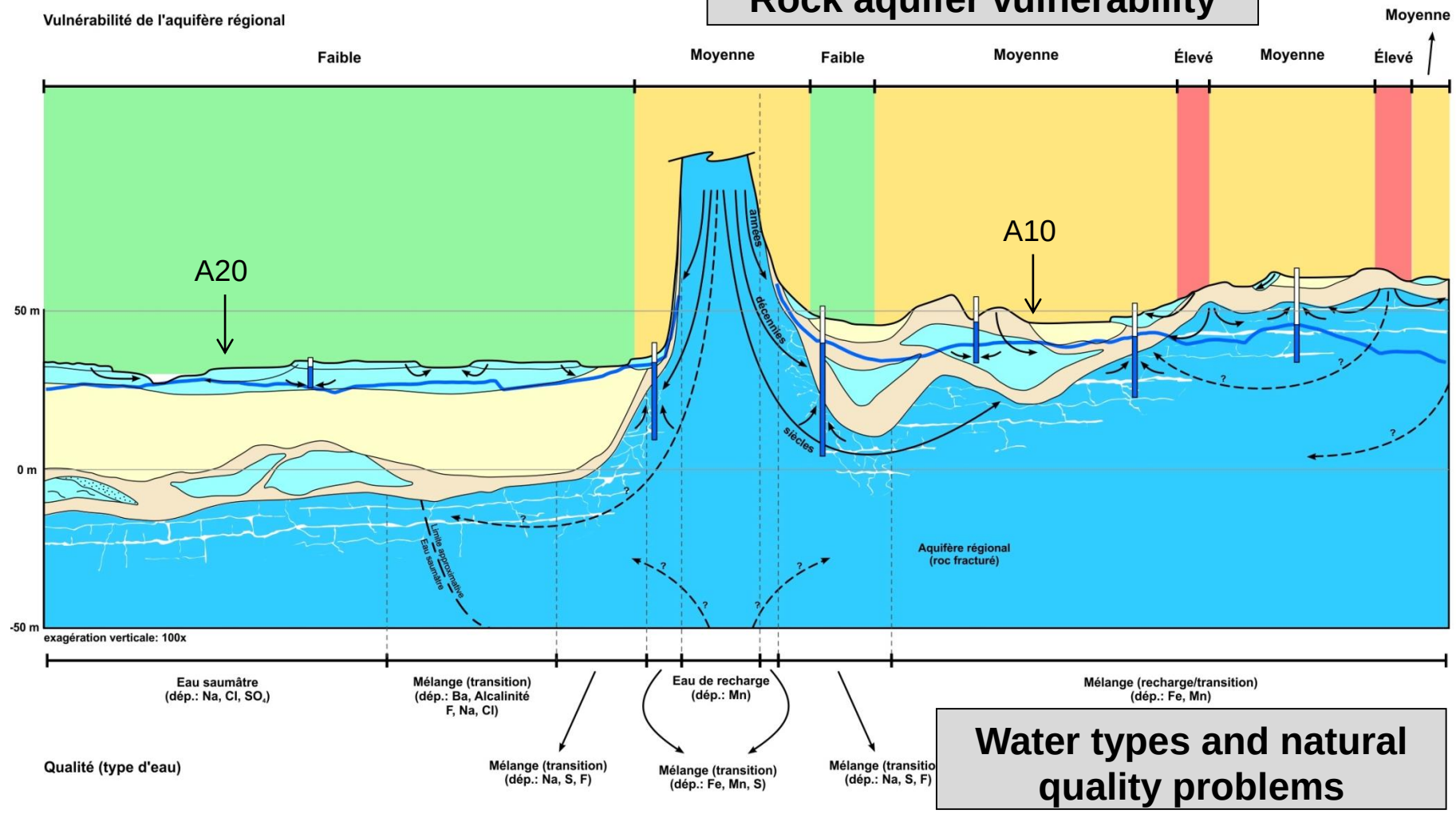


Conceptual Model – Groundwater Quality

North

South

Rock aquifer vulnerability



Water types and natural quality problems

CCME Initiative on Indicators

- Canadian Council of the Ministry of Environment (CCME):
  - As a follow up on the CCA (2009) report, develop a method to assess sustainable GW management
  - Development of sustainable management indicators
  - Pilot projects to assess the relevance of indicators and the feasibility to derive such indicators
  - Provinces have supported a range of projects at different scales and regional contexts to test the 12 suggested indicators for the 5 sustainable management objectives

Production and Use of Indicators

Sustainable Management Objectives:

Quantity

Quality

Well-being

Ecosystems

Governance

PACES Data & Maps

Sustainable Management Indicators

State of Groundwater Resources

Priority Issues and Areas

Identification of Corrective Actions

Issues Considered for Indicators

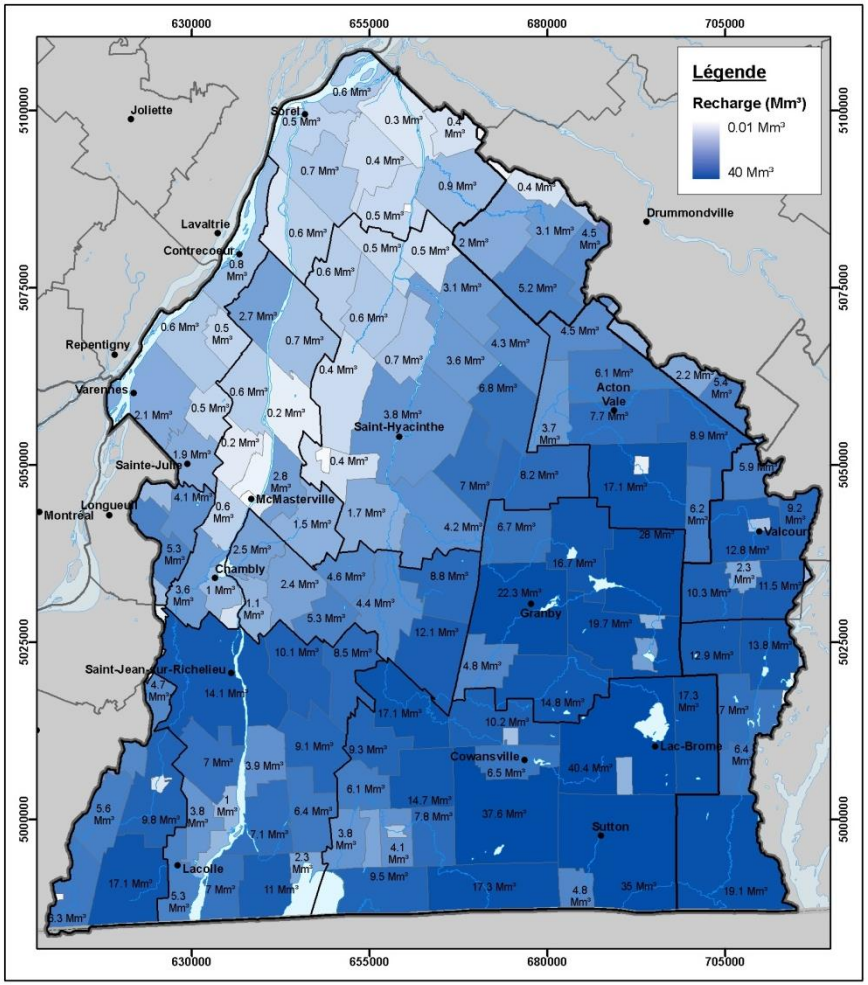
Sustainable GW Management Objectives

Management Objectives	Quantity	Quality	Ecosystems	Well-being
Issues	- GW use - GW availability and access	- Natural quality - Potential degradation - Actual degradation	- Stream flow requirements - Link between surface water and GW	- Maintain residential use - Maintain agricultural use - Maintain industrial use

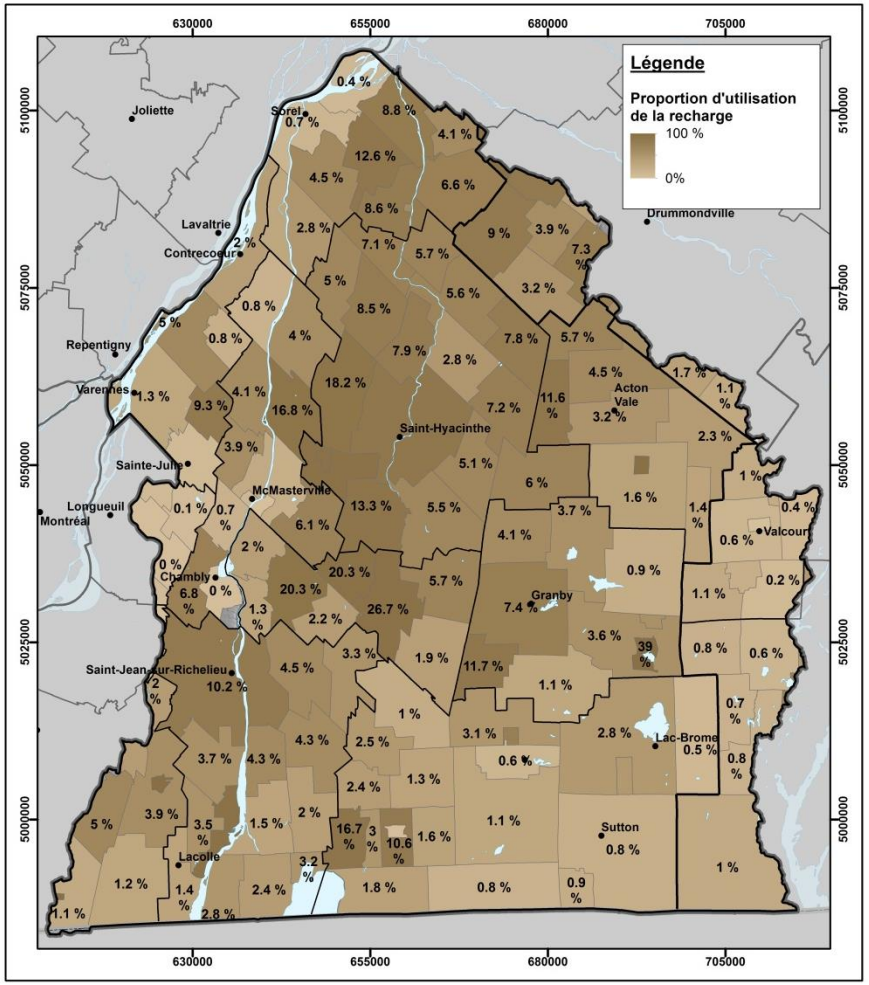
“Good Governance” is difficult to assess

GW Availability and Use Indicators

Recharge (Mm³ / municipality) (0.01 to 40 Mm³/y; 13-265 mm/y)

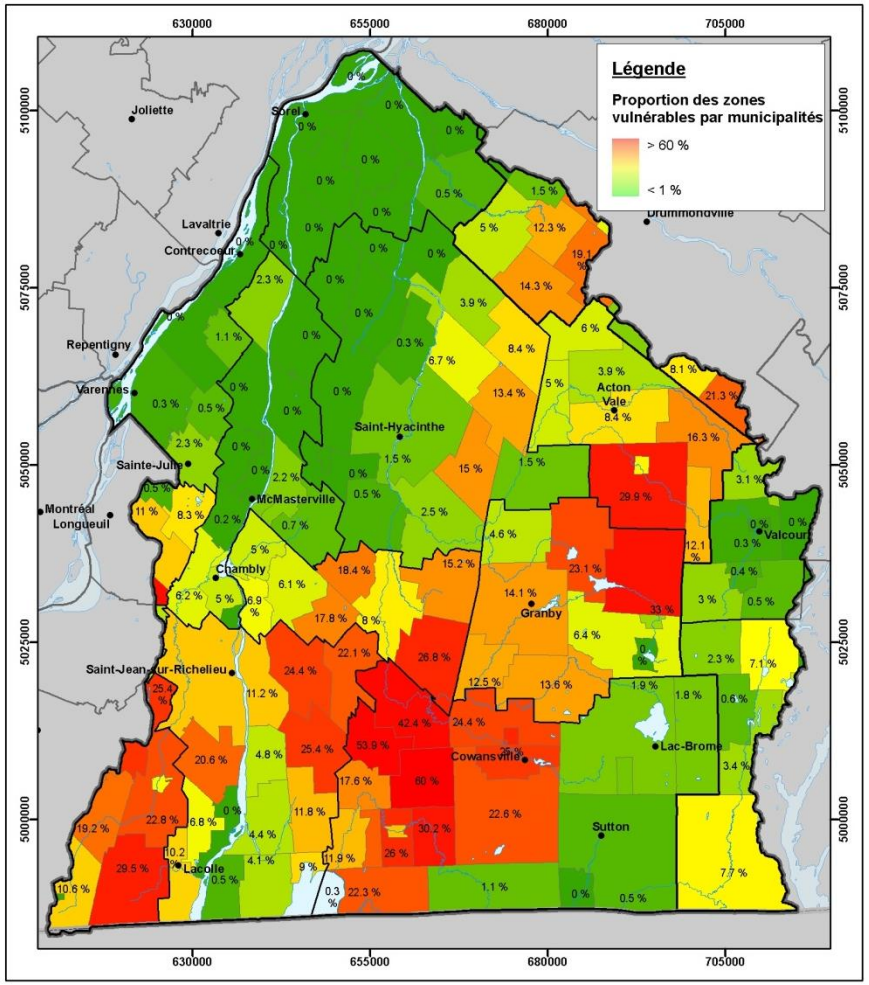


% Recharge Used (<1 to 20%)

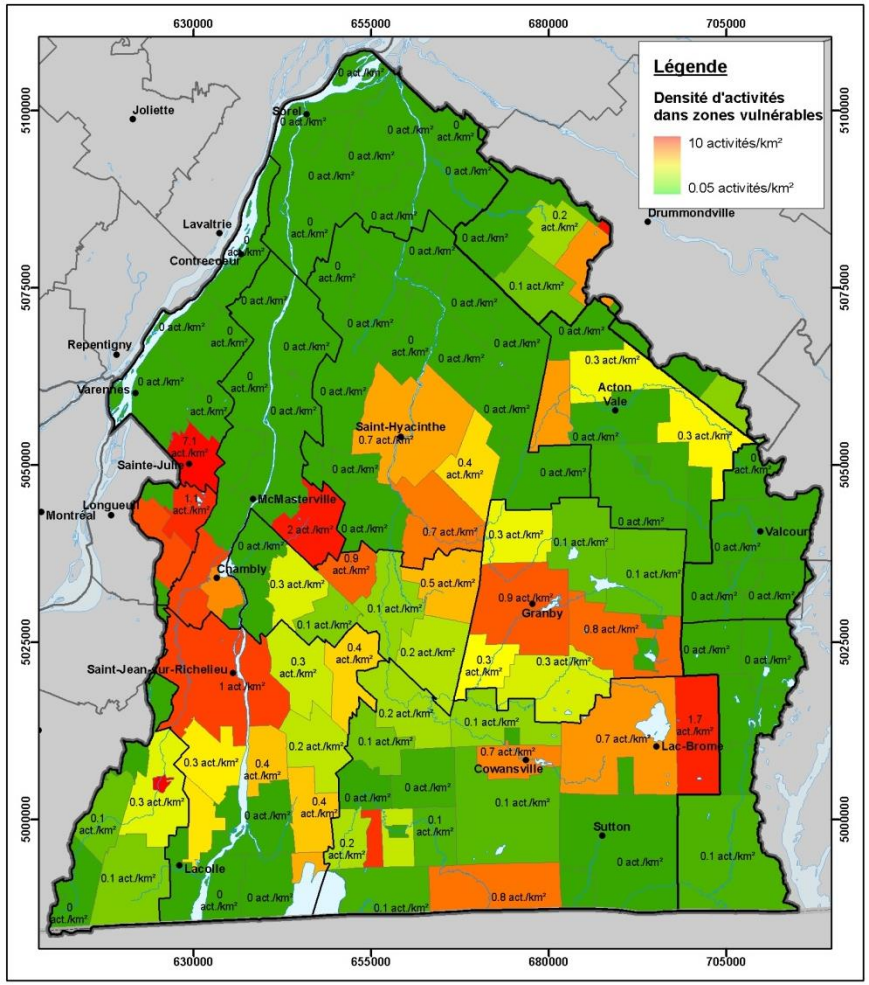


Potential GW Degradability Indicators

% Vulnerable Areas (<1 to >60%; DRASTIC)



"Risk": Anthropic Activities in Vulnerable Zones (nb/km²)



RQES Information Transfer Workshops

- The RQES developed a groundwater knowledge transfer program for regional water stakeholders
- The program is based on three workshops:
  - Workshop A: basic understanding of groundwater
  - Workshop B: use of data from PACES projects
  - Workshop C: issues related to governance and management - understand responsibilities, know implementation tools and identify water issues

Challenges Facing Aquifer Management

- Awareness about the importance of management
- Knowledge about groundwater and PACES data
- Responsibilities and interactions are not clear:
  - OBV: governance
  - MRC: land-use planning
  - Municipalities: source water protection
- No mechanism to develop management plans
- Implementation tools are lacking

Towards Aquifer Management

- A regional research program aims to build on RQES knowledge transfer workshops to progress towards regional aquifer management plans:
  - Workshop with stakeholders to recognize specific conditions and identify key issues of their area
  - Relational database to identify potential tools and actions for water protection

Activities → Contaminants → Consequences → Actions

- Use of a collaborative approach to develop regional groundwater management plans

Conclusions

- Aquifer regional assessments provide the knowledge needed for sustainable groundwater management
- Conceptual models and indicators allow the "translation" of this knowledge and facilitate its use
- Still, a structured knowledge transfer program is needed to empower regional water stakeholders
- Stakeholders have to be supported to develop regional management plans that orient decisions on the basis of identified key issues and priority areas
- Mechanisms and decision-making tools have to be developed to support planning and corrective actions

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