

What is land use planning?

Land Use Planning (LUP) can be defined as « *the process by which a society, through its institutions, decides where, within its territory, different socioeconomic activities such as agriculture, housing, industry, recreation, and commerce should take place*¹. »

It is mainly based on zoning that divides the land into zones to guide development.

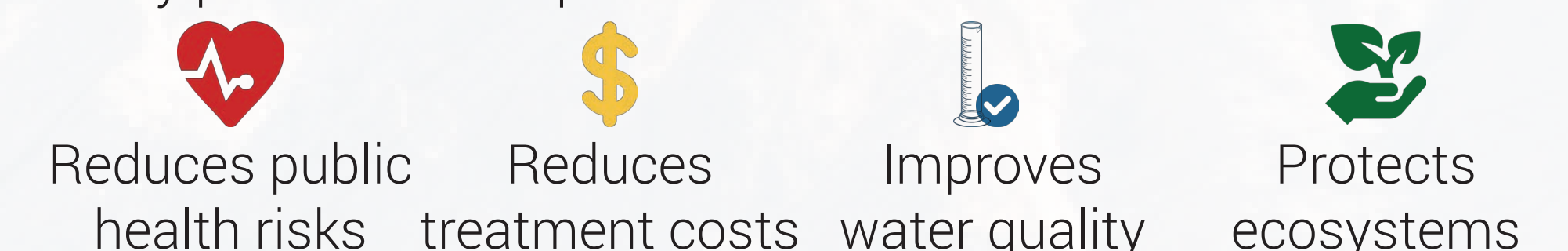


What is a source water?

Source water can be defined as the water that serves as supply for drinking water².

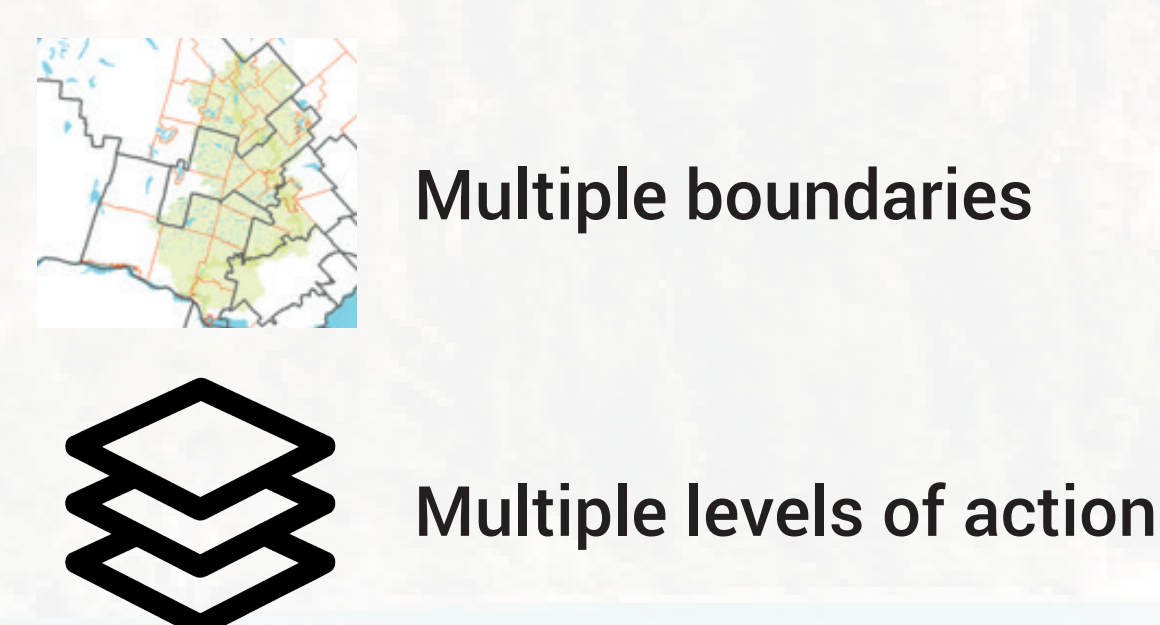


Source water protection (SWP) consists of a set of tools and strategies aimed at reducing source water contamination. It has many positive consequences such as³:



Context

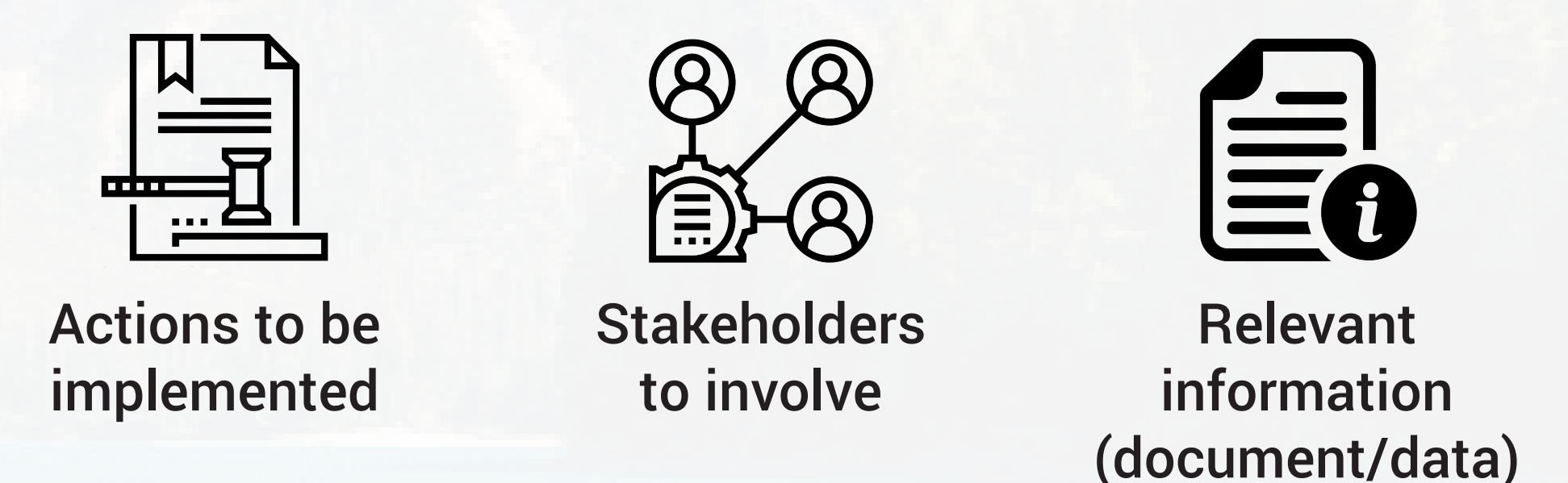
Maintaining a high-water quality is one of the main challenges of the 21st century⁴ and SWP is one way to ensure it. SWP is used in a LUP context to reduce negative impacts of anthropogenic activities on water. However, implementing SWP in LUP implies acting on a regional scale and faces several challenges such as:



Objective

The objective of this project is to design and implement a knowledge-based decision support system for source water protection in a land use planning context.

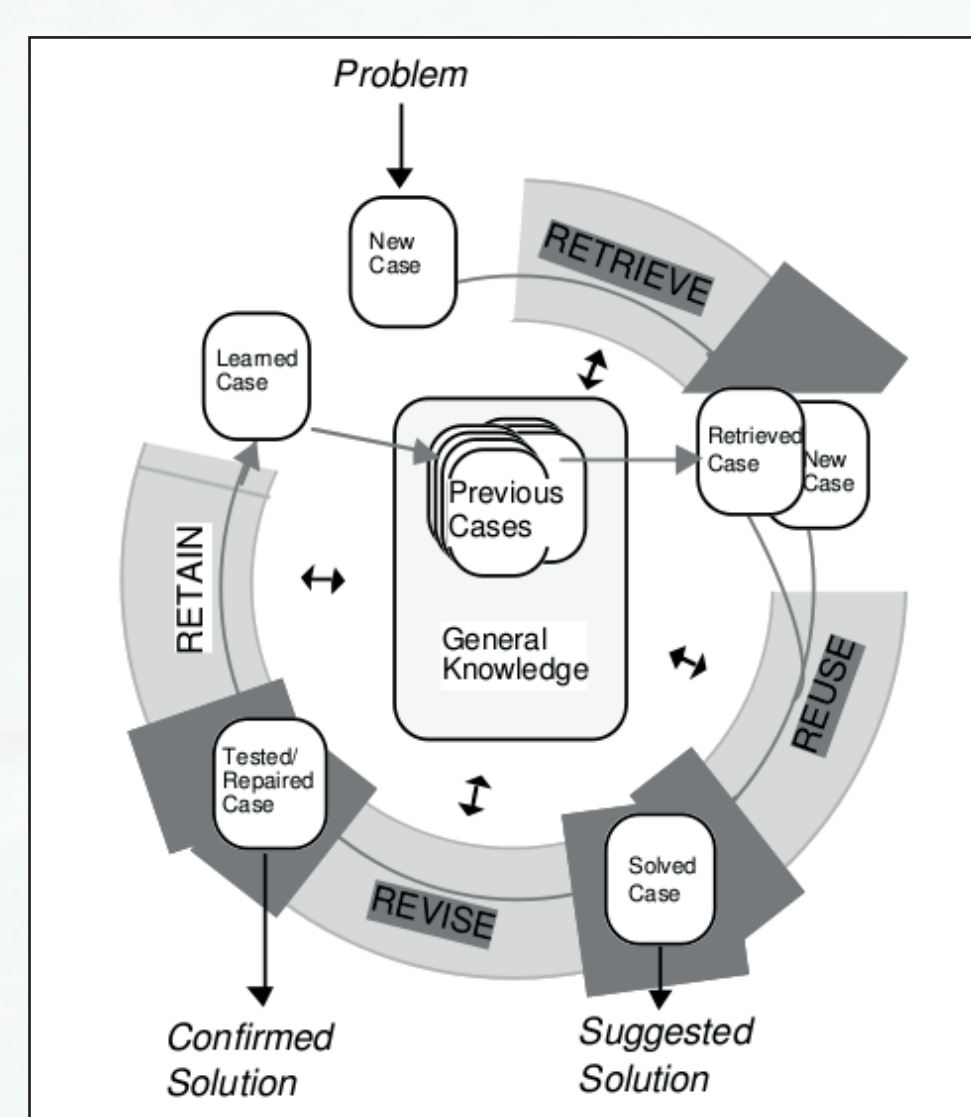
The project results should provide recommendations for land use planners on:



A CBR application for Source water protection

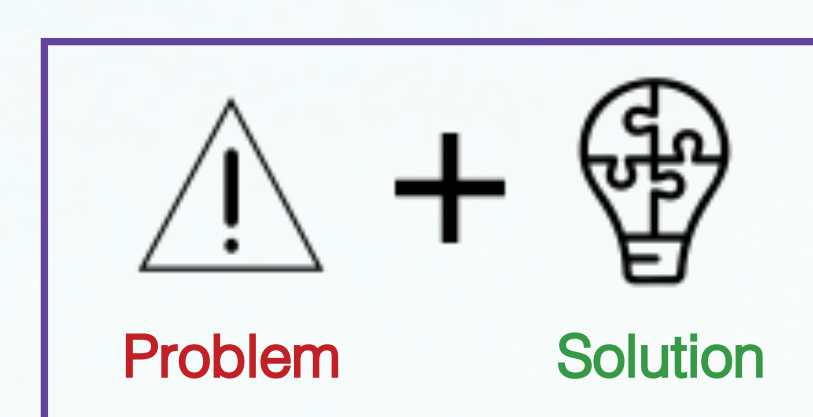
What is a CBR?

Case-Based Reasoning (CBR) is an artificial intelligence approach for problem solving inspired by human's natural process to solve a problem⁵. It consists of a four-step cycle defined by Aamodt and Plaza⁶.



The knowledge is represented as cases. The cases (problem-solution) are used for reasoning. CBR draws conclusions based on previous cases in order to solve a problem. The first phase consists in retrieving a previous case based on the similarities between the actual problem and old ones. The second phase allows reusing the most similar case. The third consists in adjusting the previous solution in order to solve the actual problem. The last phase allows retaining the adapted solution and saving it in the case base.

What is a case?



A case can be described as :

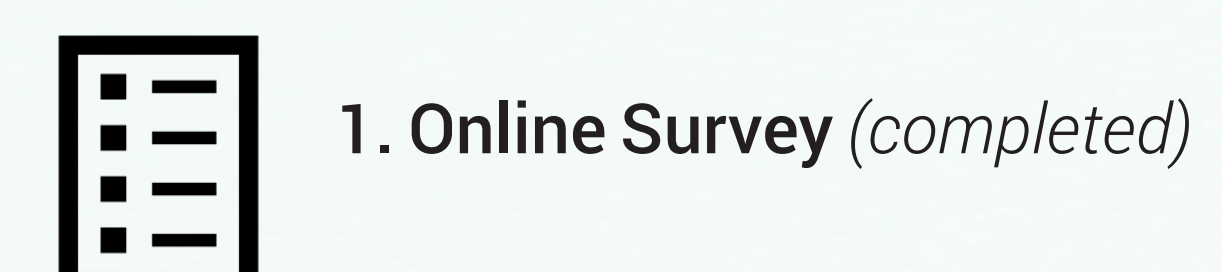
A problem related to the quality of a drinking water source, for which an action (solution) has been identified and implemented in a regional planning context

Based on a similarity score on several attributes (such as geographic context, socio-political environment, financial aspects, etc.), CBR can propose one or many solutions to a current problem similar to one or many similar problems in the case base.



Methodology

The methodology relies on a sequential mixed-method approach (quantitative and qualitative), that is well suited for complex and interdisciplinary problems⁷.

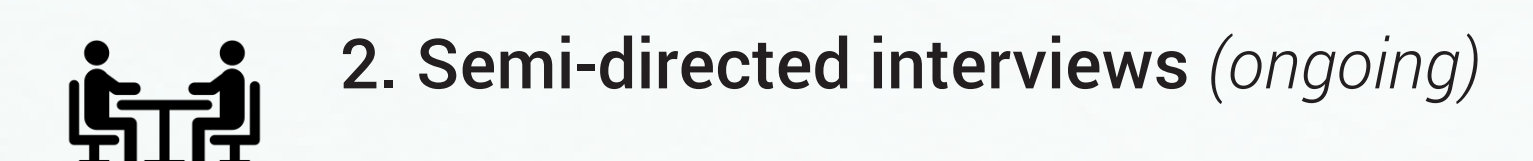


208 Validated questionnaires

103 Experts recruited

28 Municipal employees recruited

The online survey was used to identify the stakeholders involved in SWP in the Province of Quebec (CANADA).



- Identify problems encountered by source water protection stakeholders
- Identify solutions to solve a water-related problem
- Identify stakeholders who participated in the past experience (previous case)
- Identify the information used to solve the problem

References

- World Bank Group (2012). GETTING TO GREEN. A Sourcebook of Pollution Management. Policy Tools for Growth and Competitiveness
- US EPA, O. (2015, mars 27). Basic information about source water protection [Overviews and Factsheets]. Consulté 14 septembre 2019, à l'adresse US EPA website: <https://www.epa.gov/sourcewaterprotection/basic-information-about-source-water-protection>
- Communauté métropolitaine de Québec [CMQ]. (2016). Résumé de la démarche de protection des sources d'eau de la CMQ (p. 7) [Résumé]. Retrieved from Communauté métropolitaine de Québec website: http://www.cmquebec.qc.ca/gpc/_media/Document/cahier-protection-eau-vf.pdf
- UNESCO - IIWQ. (2016, March 29). The global water quality challenge & SDGs. Retrieved June 30, 2019, from UNESCO website: <https://en.unesco.org/waterquality-iiwq/wq-challenge>
- Richter, M. M. (2013). Case-based reasoning: A textbook (1st edition). New York: Springer.
- Aamodt, A., & Plaza, E. (1994). Case-Based Reasoning: Foundational Issues, Methodological Variations, and System Approaches. 27.
- Padgett, D. K. (2016). Qualitative Methods in Social Work Research. SAGE Publications.

Background picture by Pietro De Grandi⁸