

Consolidating 25 years of GSC groundwater studies in glaciated terrain

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Introduction

Glacial sedimentary aquifers are the most commonly exploited groundwater resource in Canada. Rapid changes in the depositional processes and environments can results in rapid lateral changes, extremes in aquifer heterogeneity, abrupt aquifer boundaries, and large variability in aquifer yields. To better understand regional groundwater supply issues the Geological Survey of Canada (GSC) has been carrying out groundwater studies on 30 key Canadian aquifers (Table 1) over the past 25 years (e.g., Rivera 2014). To-date the GSC has relied for classification of aquifers on sediment-landform terminology for surficial aquifers and geological formation names for bedrock aquifers, with little regard for confining units and hydraulics. Thus there is a need to consolidate and synthesis knowledge from numerous case studies and the broader literature. This paper reviews plans for the consolidation of the past quarter century of work on surficial aquifers and how case studies may be consolidated within a classification of archetypal aquifers.

Table 1. Key Canadian aquifers grouped according to hydrogeological regions. Letters in parentheses refer to principal aquifer geology, namely bedrock (br), bedrock and sediment (brs), or sediment (s). Numbers refer to map location in Russell et al. (2011).

Cordillera	llera Western Canada Sedimentary Basin		Southern	St Lawrence	Appalachians
			Ontario	Platform	
1. Gulf Islands (br) 2. Nanaimo Lowland (br-s) 3. Fraser Lowland (s) 4. Okanagan Valley (s) 5. Shushwap Highlands (br)	6. Paskapoo (br) 7. Buried Valleys (s) 8. Upper Cretaceous Sand (br) 9. Milk River (br) 10. Judith River (br) 11. Eastend – Ravenscra g (br)	12. Intertill (s) 13. Manitoba Carbonate Rock (br) 14. Manitoba Basal Clastic unit (br) 15 Odanah Shale (br) 16. Sandilands (s) 17. Assiniboine Delta (s)	18. Oak Ridges Moraine (s) 19. Grand River Basin (br-s) 20. Credit River (br-s) 21. Waterloo Moraine (s) 22. Upper Thames River (br-s)	25. Mirabel (br-s) 26. Châteauguay (br-s) 27 Richelieu (br-s) 28 Chaudière (br-s) 29. Maurice (s) 30 Portneuf (s)	23. Annapolis – Cornwallis (br-s) Maritimes Basin 24. Carboniferous Basin (br)

Approach

A five step approach is being adopted to advance the study objectives. The approach is asynchronous, with parallel activities advancing the project objectives. The first step is an aquifer classification scheme, ideally moving beyond geological parameters to include aquifer hydraulics (recharge, storativity, etc) and confining units (Fig. 1). A case has been made for the need to describe both the container (sediment) and contents (fluid) in the general case of water

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bodies (e.g., Brodaric et al. 2019). The petroleum industry *Play* concept is one example of a unstructured application of this concept, which has been adapted for groundwater (e.g., Russell et al. 2011). To support the development of a classification, scheme a process of literature review and data consolidation is required. At the same time ongoing case study development will continue as existing work at the GSC is published in collaboration with provincial geological surveys and academia (e.g., Russell et al. 2018). New work will be completed where necessary to add information on underrepresented aquifer types. These steps will ideally result in the development of archetypal aquifer summaries within an aquifer classification scheme. It is hoped that it may be possible to develop the archetypal aquifer concept in a similar fashion as the classic facies model concept by Walker (1976). Work will also advance development of synoptic national scale maps of potential aquifers (Rivera personal com), potentially along the lines of Miller (1999) for the USA.

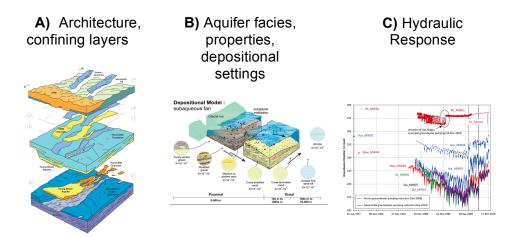


Figure 1. Possible elements that can be captured from case study reports to support characterization of archetypal aquifer in surficial sediment. Graphics from Gerber et al. 2018.

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