



Hydrogeological Mapping in Saskatchewan

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Summary

The Water Security Agency (WSA) initiated the current hydrogeological mapping program to provide the basic tools for use by the public, government and private industry to understand and manage groundwater resources in Saskatchewan. The mapping program has provided a necessary update to the base understanding of the groundwater resources in the Regina and Saskatoon areas, including identifying areas more susceptible to groundwater contamination, aquifer availability, and chemistry. This has allowed the WSA to better develop allocation of water resources. SNC-Lavalin completed the hydrogeological and hydrostratigraphic mapping of the Saskatoon 73B and Regina 72I 1:250,000 scale NTS map sheets areas by interpreting over three thousand geophysical and lithological logs in each area, with consideration of historic reports, chemistry and hydraulic relationships. The area covering Saskatoon 73B map sheet was never mapped before due its stratigraphic complexity and the amount of data available for this area.

Hydrogeological mapping in Saskatchewan is complicated by the fact that over the past two million years, Saskatchewan has undergone at least six periods (and possibly up to ten) of significant glacial advance. Glaciation resulted in a complex arrangement of proglacial and glacial sediments interbedded with non-glacial stratified sediments (fluvial, lacustrine, etc.) deposited between glaciations and during interstadial deglaciation. Erosional valleys produced during interglacial periods were intermixed with preglacial valleys forming complex stratigraphic arrangements. The alluvial and colluvial deposits that were laid during preglacial and interglacial periods in the valleys, were covered by tills during the final stages of glaciation, forming deep buried valley aquifer systems, often flanked by more regionally extensive blanket aquifer systems. These systems are now buried with deposits from subsequent glacial and non-glacial periods, often with limited surface indication of their presence at depth. These deposits form the most significant “fresh water” aquifers in the province. The complex stratigraphic arrangements of the Tertiary and Quaternary deposits are often further complicated by extensive faulting due to either the dissolution of the deep (midDevonian) Prairie Evaporite deposits beneath the area, and subsequent collapse of near surface sediments, or by continental tectonic extension in the Cenozoic possibly combined with melting of gas hydrates during glacial retreat. These depressions were infilled (generally with till) during subsequent glaciations, often resulting in discontinuous and hydraulically isolated accumulations of valley infill deposits. Delineation of these collapse structures is important as they are often significant enough to displace aquifer units, resulting in lateral connectivity disruptions and significant aquifer boundary effects during water production.

This was the first phase of a multi-year project to map all of the Upper Cretaceous and Quaternary aquifers in Saskatchewan. The interpreted hydrostratigraphy, hydraulic relationships, water chemistry, water availability and aquifer vulnerability were assessed and presented on a regional scale using a series of databases that were designed and developed to map sediments that could exist between the base of the Cretaceous and ground surface. SNC-Lavalin and the WSA have continually enhanced the hydrostratigraphic mapping standards and GIS mapping system through the course of these two projects.